JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

MONGOLIA
MINISTRY OF FOOD AND AGRICULTURE

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT
OF
ULAANBAATAR DAIRY PLANT
IN
MONGOLIA

NOVEMBER 1993

SYSTEM SCIENCE CONSULTANTS INC.

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PREFACE

In response to a request from the Government of Mongolia, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Ulaanbaatar Dairy Plant in Mongolia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Mongolia a study team headed by Takuo Kidokoro, Director, First Project Management Division, Grant Aid Project Management Department, JICA, and constituted by members of System Science Consultants, Inc. from July 1 to July 21, 1993.

The team held discussions with the officials concerned of the Government of Mongolia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Mongolia headed by Hisashi Ohno, Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs in order to discuss a draft report from October 1 to October 9, 1993, and as this result the present report was finalized.

I hope that this report will contribute to the promotion of the Project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Mongolia for their close cooperation extended to the teams.

November, 1993

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

November 1993

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

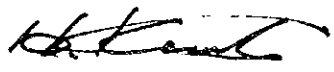
We are pleased to submit to you the basic design study report on the Project for Improvement of Ulaanbaatar Dairy Plant in Mongolia.

This study was conducted by System Science Consultants Inc., under a contract to JICA, during the period June 24, 1993 to November 30, 1993. In conducting the study, we have examined the feasibility and rational of the project with due consideration to the present situation of Mongolia and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries. We would also like to express our gratitude to the officials concerned of the Ministry of Trade and Industry, the Ministry of Food and Agriculture, and the Embassy of Japan in Mongolia for their cooperation and assistance throughout our field survey.

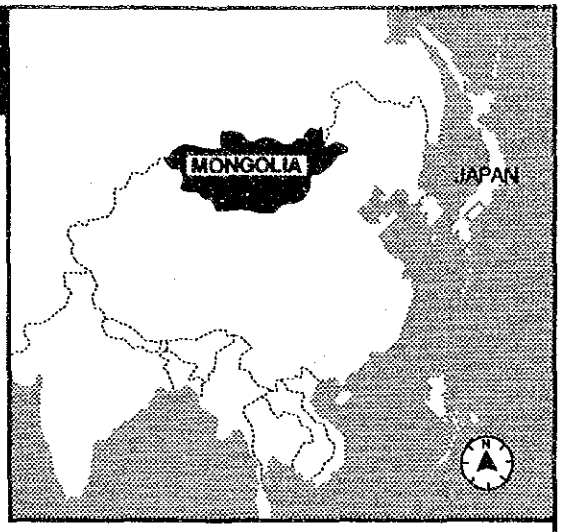
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



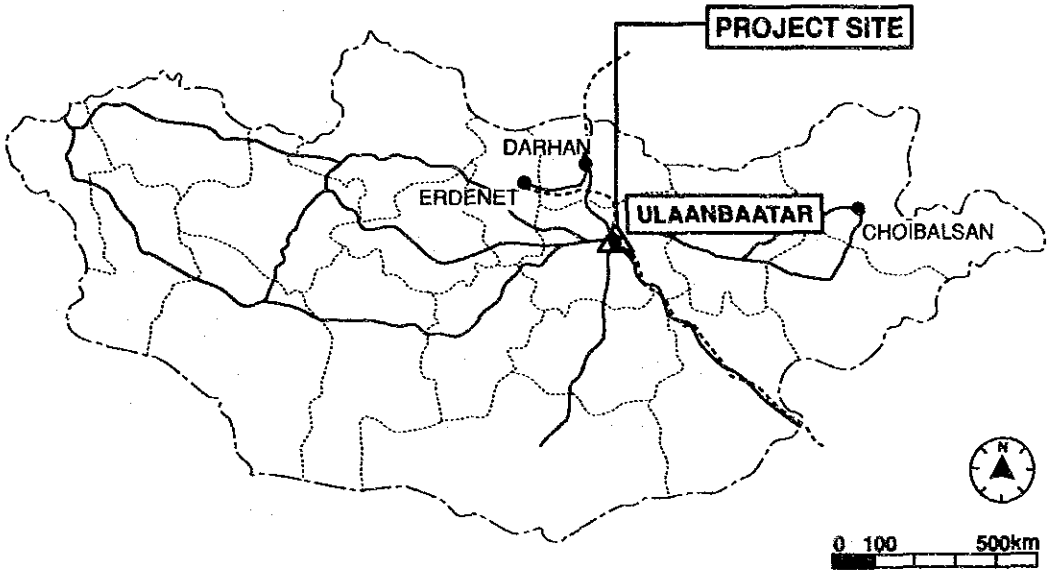
Hiroshi Kishimoto
Project Manager
Basic design study team on the
Project for Improvement of
Ulaanbaatar Dairy Plant in
Mongolia
System Science Consultants Inc.

PROJECT SITE



LEGEND

- MAIN ROAD
- RAILWAY
- DOMESTIC BOUNDARY
- INTERNATIONAL BOUNDARY
- NATIONAL CAPITAL
- DAIRY PLANT

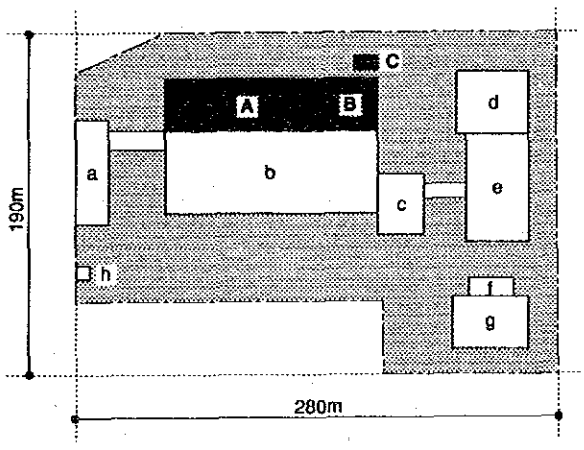


ULAANBAATAR DAIRY PLANT

LEGEND

OBJECTIVE FACILITIES

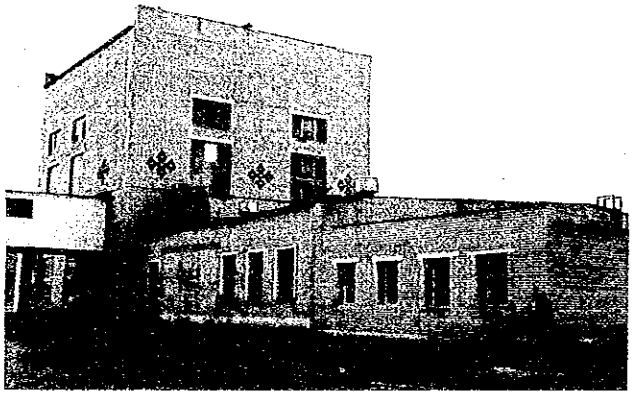
A	**COLD STORAGE**
B	**REFRIGERATION MACHINE ROOM**
C	**CONDENSER**
a	OFFICE
b	DAIRY PLANT ROOM
c	RAW MILK RECEIVING ROOM
d	WORK SHOP
e	POWDERED MILK PROCESSING ROOM
f	PUMP ROOM
g	WATER TREATMENT
h	GUARD ROOM



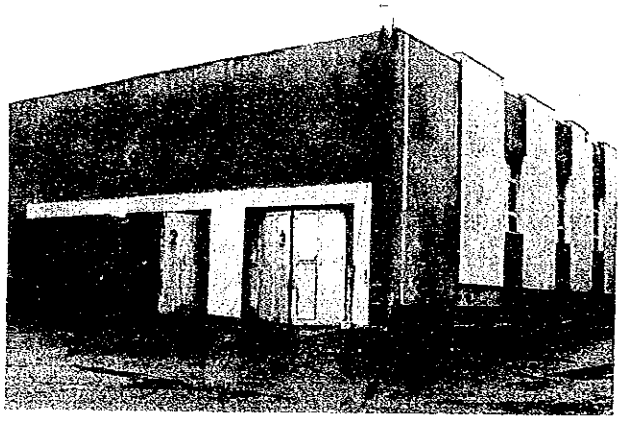
PROJECT SITE

Signing of the Minutes (Basic Design Study)

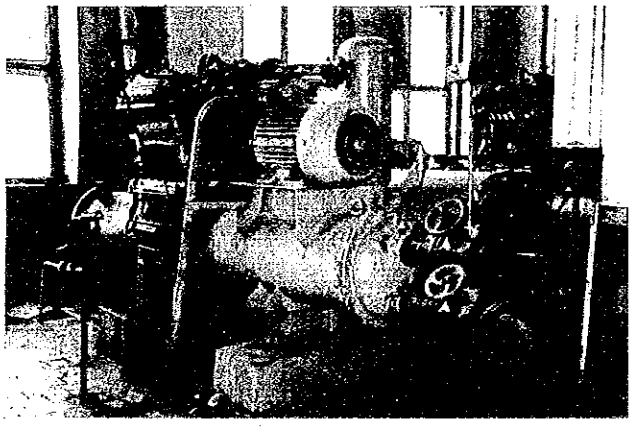
Signing of the Minutes (Draft Report Explanation)



External of the Plant



External of the Milk Receiving Room



Existing Refrigerating Facilities

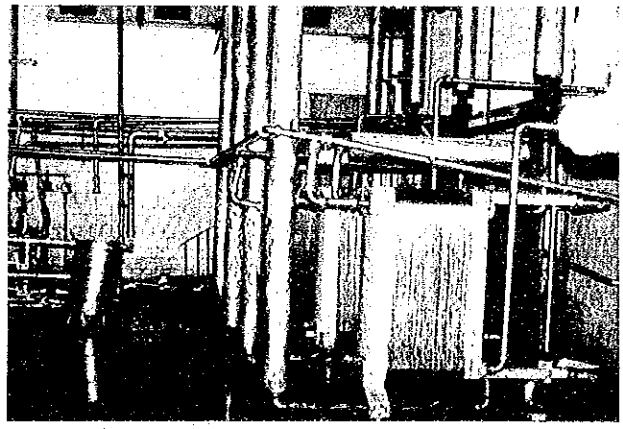
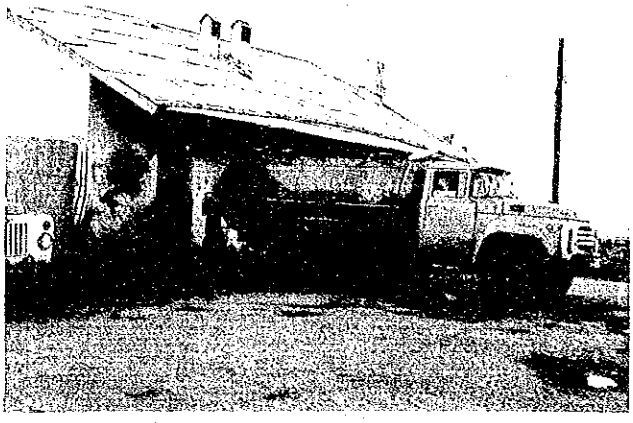
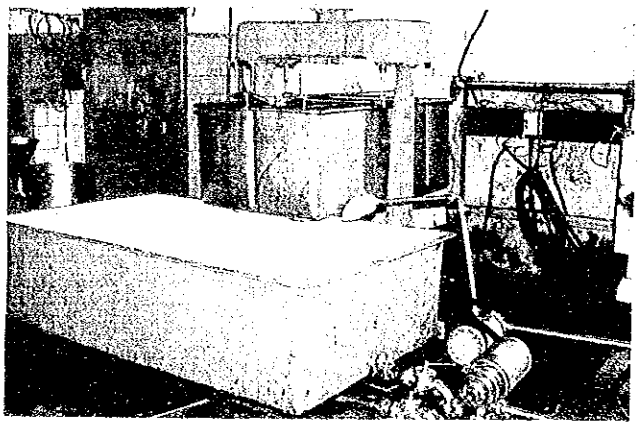


Plate Cooler

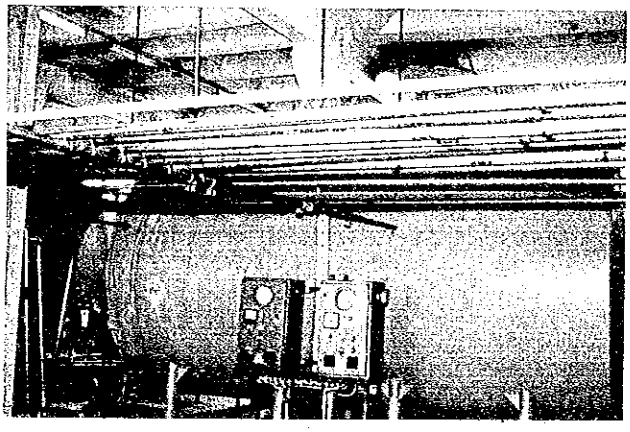


Milk Collecting Center

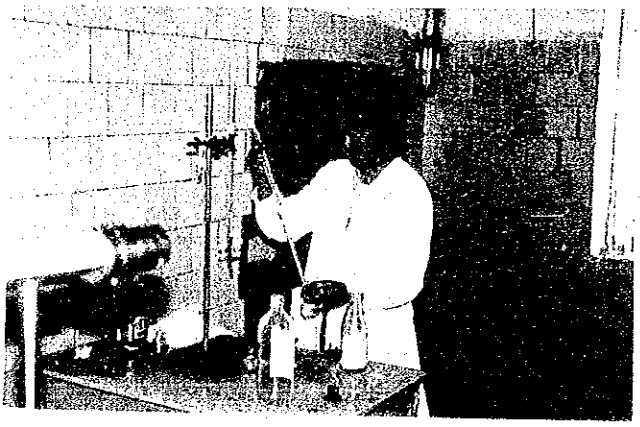
Receiving the Milk Transport Vehicle



Weighting Tank



Pasteurized Milk Tank



Quality Test

Sample of Milk Products

SUMMARY

SUMMARY

Mongolia is located in the northeast part of Central Asia between 41 degrees and 52 degrees North and between 88 degrees and 120 degrees East. It is a landlocked country that shares a border with the Russian Federation in the north and with China in the south. The total area is 1,566,000km^2 and though it is roughly divided into a mountainous region in the northwest and the steppes in the southeast, more than 80 percent of the country is composed of the steppes 1,000 to 1,500 meters above sea level. The country is divided into eighteen prefectures and three self-governing cities (Ulaanbaatar, Darhan, Erdenet) in terms of administration. 700,000 which is one third of the entire population of 2,200,000 (1992) live in these three cities, and one fourth of the total population, namely 600,000 is concentrated in the capital, Ulaanbaatar. Mongolia's main industries are agriculture, livestock farming based on the traditional nomadism, mining and other industries. Agricultural livestock sector plays significant economic and social roles in the nation by supplying its staple foods of meat and dairy products, making up 20 percent (1991) of the gross domestic product (GDP) and 50 percent of all the exports including processed goods, and employing about 30 percent of the entire work force.

Mongolia had been expanding its domestic economy with supports from the Russian Federation and East European countries ever since it became independent in 1924. However, confused domestic affairs in these nations concerned since the latter half of 1980s have considerably affected production activities in Mongolia. Especially, a rapid decline in imports from the Russian Federation which used to make up 80 percent of the entire amount has caused a shortage in fuels, raw materials and spare parts which are indispensable for production activities, and conspicuously curtailed the operational ratio in every major industry. Such decline in the operational ratio in food processing plants has reduced a supply volume of basic foods including meat and dairy products which are major staple commodities in the nation. It is concerned that the dietary needs of the city inhabitants have been greatly affected by reducing calorie volume required for good health.

Ulaanbaatar Dairy Plant (hereinafter called as "the Plant") which is located in the capital Ulaanbaatar is the largest dairy plant in the country established in 1985 with an assistance of the former Soviet Union, aiming at a stable supply of dairy products which are basic sources of nutrition for 600,000 citizens in Ulaanbaatar. The output of dairy products in the Plant which reached 45,000 tons in 1989 has been decreasing down to 18,000 tons in 1992 which is about 40 percent of the highest record. As a result, the government started to ration dairy products in order to cope with a shortage of supply volume which meets only 27 percent of the annual demand per capita in the city. It is pointed out that major causes of this output decline in the Plant are the reduced cooling capacity due to a functional deterioration of the cooling equipment and an incomplete system of milk collection due to frequent breakdowns of transport

vehicles. Therefore, it is essential to recover the supply capacity, and the improvement of facilities and equipment is an urgent issue to be conducted.

Under such circumstances, the Government of Mongolia requested grant aid assistance from the Government of Japan for the renovation of refrigeration facilities of the Plant and providing new transport vehicles through a study team of project formulation conducted by Japan International Cooperation Agency (JICA) in 1992. In the project formulation study, it was proposed to conduct a basic design study on the Project for Improvement of Ulaanbaatar Dairy Plant in Mongolia (hereinafter called as "the Project"). In response to the request, the Government of Japan decided to implement a basic design study on the Project, and JICA dispatched a basic design study team (hereinafter called as "the Team") to Mongolia from July 1, 1993 to July 21, 1993. The team held discussion with the officials concerned of the Ministry of Trade and Industry, the Ministry of Food and Agriculture and the Plant, studied the appropriateness of the Project and the content and scale of requested facilities, and dispatched a study team to explain the draft final report to Mongolia from October 1, 1993 to October 9, 1993, then formulated the final report.

The objective of the Project is to promote a stable supply of dairy products to the inhabitants in Ulaanbaatar by renovating the following facilities and equipment of the plant.

(i) Refrigerating equipment
(ii) Transport vehicles
(iii) Weighing equipment

A description of these facilities and equipment is given in the table below.

Description of Facilities and Equipment

Name of Equipment	Quantity	Major Use & Content
Refrigeration equipment		
Brine cooler unit	1unit	Brine cooling
Two stage refrigerator unit for low temperature	4units	Freezed storage
Single stage refrigerator unit for high temperature	7units	Refrigerating & Freezing
Evaporator (Unit cooler)	34units	Cold storage & chilling
Ammonia liquid pump	6units	Refrigerant circulation
Evaporative condenser	10units	Freezed storage & cold storage
Brine pump	3units	Brine circulation
Oil pump	2units	Refrigerating oil supply
Chilled water pump	6units	Chilled water supply
Cooling water pump for evaporative condenser	5units	Cooling water circulation
Cooling water pump for jacket	2units	Head and oil cooler cooling
Control panel for refrigerator unit	1unit	System control
Control panel for unit cooler	2units	System control
Auxiliary equipment (pressure vessels, valves)	1set	Refrigerant system control
Vehicles		
Milk transport and delivery vehicles (2tons)	10units	Insulated tank lorry
Milk product delivery vehicles (2tons)	10units	Refrigerated vehicles
Weighing equipment		
For receiving (15tons/hr)	1unit	Flow meter system
For delivery (15tons/hr)	1unit	Flow meter system

Costs which should be paid by the Mongolia side such as infrastructure and other expenses are not borne since the Project aims at renovating existing facilities and equipment and providing new vehicles. The responsible agency for the Project is the Ministry of Food and Agriculture, and the executing agency is Ulaanbaatar Dairy Plant which is operated under the jurisdiction of the ministry.

The Project will be implemented after the Exchange of Notes is signed between the Governments of Japan and Mongolia. A Japanese consultant will make a contract with the Government of Mongolia, and prepare documents on design and tender after conducting a field survey for a detailed design. Then, a pre-qualification study, a tender, an assessment of bids, and a contract with vendors will be conducted. The period of execution work is scheduled to be 10 months.

The implementation of the Project will improve the capacity of production and storage of dairy products by renovating refrigeration facilities, consolidate a milk collection system by providing milk transport vehicles and weighing equipment, and secure a stable supply of raw milk. As a result, it is expected that a supply volume of dairy products per capita in Ulaanbaatar will be three times as much as the current volume, and fill 80 percent of the demand. It is also expected that the implementation of the Project will recover production capacity of the Plant to expand the supply volume of dairy products, and thereby enhance self-sufficiency in food supply in the nation. The Government of Mongolia has been implementing the Ninth Economic and Social Development Plan with a focus on a policy of domestic economic reforms and expansion of food supply as they revise the former socialistic planned strategy and strengthen relationships with western countries.

The implementation of the Project is expected to support the current national development plan as well as to expand a supply volume of foods which comprise staple commodities for the nation. Thus, the appropriateness of the Project under grant aid from the Government of Japan is confirmed.

The Team would like to make the following suggestions to the Government of Mongolia in order to facilitate the implementation and conduct the operation properly.

(1) To conduct adequate operation and maintenance of the equipment to be provided in the Project.
(2) To provide sufficient personnel training in order to conduct efficient and stable operation of the equipment.
(3) To obtain enough budget to cover required operation and maintenance costs promptly.

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ABBREVIATION

B/A : Banking Arrangement

E/N : Exchenge of Notes

TUG : Tugrugs

1. INTRODUCTION

1. INTRODUCTION

Mongolia had been expanding its domestic economy with a support from the Russian Federation and East European countries ever since it became independent in 1924. However, confused domestic affairs in these nations since the latter half of 1980s have considerably affected production activities in the nation's main industries of foods and textiles, and caused a shortage in fuels, raw materials and spare parts which are indispensable for production activities. Especially, a curtailed production in food processing plants has reduced a supply volume of basic foods including meat, dairy products and grains which comprise major staple foods in the nation. Subsequently, the Government of Mongolia decided to introduce a market economy in 1991 with a main focus on the expansion of food supply and storage in its national development plan, and has been promoting economic reforms in the nation which had been ruled under a socialistic planned economy for more than seventy years, trying to strengthen the relationships with Western countries.

Ulaanbaatar Dairy Plant which is located in the capital Ulaanbaatar is the largest dairy plant in the country established in 1985, aiming at a stable supply of dairy products which are basic staple foods for the city inhabitants. For these several years, however, the operational ratio of the Plant has been decreasing as a result of a reduced cooling capacity due to a functional deterioration of the cooling equipment and an incomplete system of milk collection due to frequent breakdowns of transport vehicles. This decline has lowered the intake volume of dairy products per capita, and greatly affected the dietary needs of the city inhabitants.

Under such circumstance, the Government of Mongolia requested grant aid assistance from the Government of Japan for the renovation of the Dairy Plant located in the capital Ulaanbaatar with the objectives of improving a supply volume of dairy products which comprise staple foods in the nation.

In response to the request, the Government of Japan decided to implement a basic design study on the Project for Improvement of Ulaanbaatar Dairy Plant (hereinafter called as "the Project"), and Japan International Cooperation Agency (JICA) dispatched a basic design study team (hereinafter called as "the Team") headed by Takuo Kidokoro, Director, First Project Management Division, Grant Aid Project Management Department, JICA, to Mongolia from July 1, 1992 to July 21, 1993. The team held discussions with the officials concerned of the Ministry of Trade and Industry, the Ministry of Food and Agriculture and the Plant, and conducted a field survey to confirm the background and content of the request, and study the content and scale of the requested facilities and equipment.

After the Team returned to Japan, the survey materials were examined and analyzed, appropriate facilities and equipment were selected, the project costs were estimated, operation and maintenance as well as execution plans were formulated, and a draft final report was prepared.

JICA dispatched a study team to explain the draft final report headed by Hisashi Ohno, Grant Aid Division, Economic Cooperation Bureau of the Ministry of Foreign Affairs to Mongolia from October 1, 1993 to October 9, 1993 to discuss and confirm the content of the basic design study of the Project.

This report is a summation of results obtained from the aforementioned survey including basic design of equipment which is most appropriate for the impletentation of the Project, execution system, project evaluation, recommendations, etc. The member of the study team, field survey schedule, list of members contacted and minutes of discussions are included in the Appendixes.

2. BACKGROUND OF THE PROJECT

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2.1 Conditions of Mongolia and Its Agricultural and Livestock Sector

2.1.1 General Description

Mongolia is located in the northeast part of Central Asia between 41 degrees and 52 degrees North and between 88 degrees and 120 degrees East. It is a landlocked country that shares a border with the Russian Federation in the north and with China in the south. The total area is 1,566,000km^2, and though it is roughly divided into a mountainous region in the northwest and the steppes in the southeast, more than 80 percent of the country is composed of the steppes 1,000 to 1,500 meters above sea level.

Mongolia has a typical continental climate with little precipitation throughout the year (the average annual precipitation is 200 to 250mm), and constant dry seasons. The range of temperature is very wide from 12 to 20°C in summer to minus 25 to 45°C in the middle of winter.

The country is divided into eighteen prefectures and three self-governing cities (Ulaanbaatar, Darhan, Erdenet) in terms of administration. One third of the entire population of 2,200,000 (1992) live in these three cities, and one fourth of the total population, namely 600,000 is concentrated in the capital, Ulaanbaatar. The population of urban and rural areas has been kept in balance because a distribution of population in the cities has been planned under the socialistic policy. But with a recent progress in the economic reform, a migration from farming villages into these major cities is on the increase. Since the latter half of the 1970s, the nation has been promoting a policy to increase its population, and an annual average rate of increase in population in recent ten years was at a high level of 2.6 percent. Transitions in population increase and increase rate are shown in the Appendix 2.1 and 2.2.

Mongolia's main industries are agriculture, livestock farming based on the traditional nomadism, mining and other industries. Among them agricultural and livestock sector plays important roles as a source of supply for basic foods which include mainly meat and dairy products, and also as a supplier of raw materials to industries.

2.1.2 Roles of Agricultural and Livestock Sector in Domestic Economy

Agricultural and livestock sector which is mainly engaged in the livestock production play significant economic and social roles in the nation by supplying its staple foods of meat and dairy products, making up 20 percent (1991) of the gross

domestic product (GDP) and 50 percent of all the exports including processed goods, and employing about 30 percent of the entire work force. Furthermore, these sectors supply raw materials to industry sectors which share the majority of the GDP, and 24 percent of industrial products are produced by the processing of foods including meat and dairy products. The GDP, growth rate and composition ratio of employees by sector are described in the Appendix 2.3 and 2.4.

Agricultural and livestock sector in Mongolia has been developed from livestock farming based on the traditional nomadism, being engaged in the production of livestock products composed mainly of meat and dairy products. Although the production of grains and vegetables such as corn and potatoes has been increasing in recent years, livestock products comprise about 80 percent of the entire agricultural production in Mongolia.

Table 2.1 Total Output and Ratio of Agricultural Products

(Unit: 1,000TUG)

	1980	1985	1989	1990	1991
1) Livestock Products	1,747	1,648	1,848	1,852	1,843
Ratio (%)	85	67	69	73	78
2) Grains	320	816	802	700	520
Ratio (%)	15	33	31	27	22
Total	2,067	2,464	2,650	2,552	2,363
Ratio	100	100	100	100	100

Source: Annual Statistical Yearbook, 1992

2.1.3 Conditions of Farm Milk Supply and Consumption of Dairy Products

(1) Consumption of Dairy Products as Staple Foods

The staple foods in Mongolia are meat and dairy products. The average yearly intake of dairy products per capita is 118.5kg which is 1.24 times as much as the intake of meat. Especially in summer when meat is in shortage, the consumption of dairy products tend to increase to supplement nutrition source. The Ministry of Food and Agriculture estimates that the latent demand of dairy products per capita is 300kg in rural areas and 200kg in urban areas, and points out a shortage in supply in urban areas. A comparison of meat and dairy products is shown in the following table.

Table 2.2 Annual Intake per Capita of Meat and Dairy Products

(Unit: kg)

	1985	1986	1987	1988	1989	1990	1991	Average
1) Meat	92	93	90	90	93	97	116	95.8
2) Dairy Products	110	119	121	119	121	118	122	118.5
3) 2)/1)	1.19	1.27	1.34	1.32	1.30	1.21	1.05	1.24

Source : Annual Statistical Yearbook, 1992

Rural and urban areas show a basic difference in ways of processing and supplying dairy products as well as consumption volume. In rural areas dairy products are produced by individual farmers and farmers' organizations to be supplied for their own family and community. Meanwhile, residents in major cities in Mongolia depend on dairy plants located in their own cities for the supply of dairy products, and the annual supply is determined by the amount of farm milk collected and operational conditions of each dairy plant.

(2) Conditions of Farm Milk Supply

The total domestic production volume of farm milk which is raw material of dairy products has increased from 100 million liters in 1960 to 310 million liters in 1990 in response to an increase in demand. Principal sources of farm milk are cows, mares and goats, and 85 percent of the entire farm milk is produced by cows. About 48,000,000 liters which is equivalent to 15 percent of the total amount is supplied to dairy plants located in the major cities of Ulaanbaatar, Darhan, Erdenet and Choibalsan. About 80 percent of the total amount of farm milk is collected in the dairy plant in Ulaanbaatar, the largest plant in Mongolia. The volume of farm milk collected in each city is shown below.

Volume of Farm Milk Supply : 48,000,000 liters

City	Ulaanbatar	Darhan	Erdenet	Choibalsan
Comsuption Population	600,000	86,000	50,000	55,000
Collected Milk	3,820 mil.L.	558mil.L.	221 mil.L.	202 mil. L.
Collected Ratio	79.6%	11.6%	4.6%	4.2%
Consumption Volume Per Capita	64 L/person	65 L/person	44 L/person	37 L/person

2.2 Outline of Ulaanbaatar Dairy Plant

2.2.1 General Description of the Project Site, Ulaanbaatar

General description of Ulaanbaatar where the Plant is located is given below.

(1) Location and Natural Conditions of the Project Site

The capital Ulaanbaatar is a long narrow city located from east to west along the right bank of the Tuul River which flows from the Hentii Mountains (2,000 to 2,800m above sea level). The total area of the city is 1,350km^2, and the whole city and its surrounding areas are situated on alluvial fans and floodplains of the river which are 1,350m above sea level on the average formed by branches of the Tuul River. The maximum amount of flowing water of the River is 47 m^3/s, the minimum is 2m^3/s, and the average is 15 m^3/s. However, the water level falls considerably in winter because it freezes entirely between December and March. The ground water distributed along the river is generally used for drinking water and industrial purposes.

The city has a typical continental climate with a wide range of annual amount of precipitation and temperature. The average annual precipitation of the city is between 250 and 300mm, and 80 percent of the total precipitation is concentrated in summer between May and October. Monthly average temperature is below zero in winter between October and March, and goes down to minus 49°C in the middle of winter. Meanwhile, monthly average temperature ranges from 0.1 to 17°C between April and September, and the maximum difference in monthly average reaches 42°C. Relative humidity ranges from 50 to 78 percent on the annual average, and it tends to be high in winter and low in summer. Climate conditions in the city such as monthly precipitation and temperature are given in the Appendix 2.5.

(2) Socio-economic conditions in the Project Site

Administrative areas in Ulaanbaatar are composed of four special wards (Sukhubator, Oktyabri, Ajilchi, Nayiramdal) and two satellite cities (Nalaikh and Baganuur). The total population of these cities combined is 580,000 (1991) which makes up one quarter of the total population of Mongolia. Transitions in population in Ulaanbaatar during the past six years (1986-1991) is indicated in the table below. The average annual rate of population increase during the same period of time is 2.4 percent and the population is estimated to reach 700,000 in the year of 2000.

Table 2.3 Transitions in Population in Ulaanbaatar

year	1986	1987	1988	1989	1990	1991
Population (1,000)	520.4	535.5	548.4	575.0	575.0	578.9
Average Annual Increase Rate (%)	3.4	2.9	2.4	2.2	2.6	0.7
Ratio to Total Population (%)	26.6	26.8	26.8	26.8	26.8	26.7

Source: Annual Statistical Yearbook, 1992

The largest industry in the city is the production industry which is mainly engaged in processing of foods such as meat, dairy products and flour, and the largest industrial complex in Mongolia is formed in the entire southeast part of the city. Industry sectors play important social and economic roles in sharing production output which reaches 50 percent of the total amount in Mongolia, and employing 220,000 people which is 35 percent of the entire work force (660,000) in the nation.

The industry sector in the city, which has been largely dependent on the Russian Federation and East European countries for the majority of production activities such as construction of factories and purchasing spare parts, is forced to discontinue production. The economical confusion of these nations caused a suspension of assistance and cutbacks in imports of machinery components, related equipment and materials, and lowered the operation ratio of processing factories and plants. As a result, supply capacities of meat and dairy products which comprise staple foods in the nation have been reduced. The rate of self-sustaining supply of basic foods is less than 50 percent, and a ration system has been conducted by the government. The lowered operation ratio has also increased the number of unemployment, and the city produces 25 percent of the total number of unemployment that reached 55,000 in 1991.

(3) Conditions of Infrastructure in the Project Site

1) Electric Power

The total amount of power supply in Mongolia is 3,228,000Mwh, 85 percent of which is supplied by the Central Electric Service (CES). Conditions in power plants of CES in Ulaanbaatar are described as follows.

Power Plant	Plant Output	Rated Output
Ulaanbaatar Second Power Plant	24 MW	14 MW
Ulaanbaatar Third Power Plant	148 MW	110 MW
Ulaanbaatar Fourth Power Plan	540 MW	480 MW

※ $MW=10^6W$

Power plants in CES supply power only by coal thermal generation through 220kv power lines connected to Irkutsk in the Russian Federation. In terms of power consumption by sector in CES network, industry sector comprises 89 percent of the total amount, and in terms of consumption by district Ulaanbaatar makes up 40 percent as the largest consumer city in the country. Power supply and demand in CES shows a 9.2 percent annual increase from 1980 to 1988, but indicates a 6.3 percent decrease from 1988 to 1991. Due to a decrease in power supply, a planned suspension of power supply has been put into effect. But the facilities of major industry sectors like food processing plants including dairy plants located in the industry complex are given priorities in receiving power supply.

2) Water Supply and Its Source

The source of water supply in Ulaanbaatar is groundwater. After water is pumped up from wells and collected in reservoirs, it is sterilized by chlorine (0.3ppm residual chlorine with 1ppm injection), and distributed all over the city through distribution reservoirs. Underground sources which consist of a) Central Source, b) Factory Source, and c) Meat Industrial Complex Source are all located along the Tuul River. Among these sources, Factory and Meat Industrial Complex Sources are located downstream from the Central Source. 35,000 to 40,000m^3 a day is pumped up from 16 wells at the Factory Source, and 24,000 to 28,000 m^3 a day is pumped up from 9 wells at the Meat Industrial Complex Source. At present water supply of 50,000m^3 is in shortage in winter. In order to remedy this situation, a new source (Naraiha Source) is under construction. The criteria for drinking water and water quality of each source are indicated in the Appendix 2.6. There has been no report of problems with water quality owing to the underground location of water source.

(3) Roads

National roads connecting cities and prefectures have a length of 9,700km, but only 11 percent of the total length, namely 1,100km is paved, and a pavement ratio of local roads is 0.3 percent. Such unfavorable conditions in access roads have greatly affected economic activities by lowering product quality and increasing product cost because it takes a great amount of time to transport materials from rural areas. Conditions of roads connecting each city and prefecture are described in the Appendix 2.7.

2.2.2 Supply and Demand of Dairy Products

(1) Supply and Demand of Dairy Products in Ulaanbaatar

The Ulaanbaatar Dairy Plant produces dairy products composed mainly of pasteurized milk (cow's milk), yogurt and powdered milk to be supplied for the market in Ulaanbaatar. Pasteurized milk comprises more than 65 percent of the total output. Transitions in the output of major dairy products and total amount are shown in the table below. Since the output achieved 34,000 tons when the operation started in 1985, it has been growing steadily to reach 44,000 tons in 1989. However, it has been on a gradual decrease since 1991 down to 18,000 tons last year (1992).

Table 2.4 Transitions in Output of Dairy Products

(Unit: 1,000 ton)

		1989	(%)	1990	(%)	1991	(%)	1992	(%)
(i)	Major Dairy Products								
	Pasteurized Milk	30.3	69.0	29.4	69.3	21.0	64.6	11.9	64.8
	Yogurt	1.5	3.4	1.6	3.8	0.8	2.5	0.5	2.7
	Ice Cream	1.2	2.6	1.4	3.3	1.0	3.1	0.6	2.8
	Sour Cream	0.6	1.4	0.7	1.7	0.4	1.3	0.1	0.6
	Powdered Milk	0.2	0.5	0.1	0.2	0.4	1.3	0.1	0.6
	Curds	0.8	1.8	0.7	1.7	0.5	1.5	0.3	1.7
	Butter	0.1	0.3	0.1	0.2	0.1	0.3	0.1	0.6
	Others	9.3	21.0	8.4	19.8	8.3	25.5	4.8	26.2
(ii)	Total Output	44.0	100	42.4	100	32.5	100	18.4	100

Source: General Information of Milk Ltd., Trade Company, 1993

Notes: Unit of output is calculated into tons based on the above data.

The supply volume of dairy products per capita in Ulaanbaatar estimated from above-mentioned output is indicated below.

Table 2.5 Transitions in Supply of Dairy Products Per Capita by the Plant

Year	1985	1986	1987	1988	1989	1990	1991	1992
Amount per capita Capacity (kg)	67.3	69.2	71.2	76.6	78.6	73.0	55.7	31.1

Source: Annual Statistical yearbook, 1992

The supply volume per capita was about 78kg in 1989, but it went down to 32kg last year (1992) which is less than a half the amount in 1989. This figure is only 26 percent of 118.5kg, the annual intake volume per capita which is indicated earlier in the section 2.1.3 Conditions of Farm Milk Supply and Consumption of Dairy Products.

Transitions in the demand for dairy products in Ulaanbaatar and supply capacity of the Plant calculated based on the annual intake and latent demand for dairy products

per capita are illustrated in the following Figure 2.1. The demand for dairy products in the city shows an upward trend corresponding to an increase in population, but there is a substantial shortage in supply of dairy products to meet the demand.

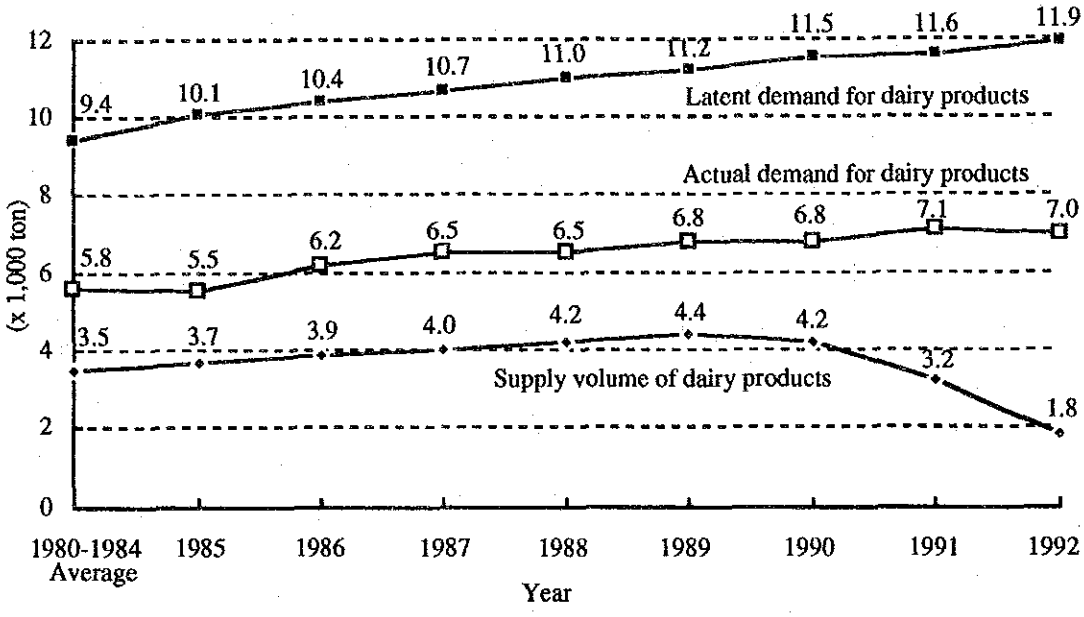


Figure 2.1 Transitions in Demand and Supply of Dairy Products

(2) System of Production and Milk Collection

In the Plant milk is transported from milk stations composed of thirty-six government-run farms and 6 cooperatives located in the three prefectures of Tuv, Hentii and Selenge to the Plant thorough eight Milk Collecting Centers (MCC) fully equipped with cooling device. The locations of milk stations and MCC as well as milk collection range (distance) are illustrated in the following figure 2.2. Milk collection range reaches a radius of 260km where milk is collected twice a day on the average. But due to unfavorable road conditions, it requires more than six hours to make one collection in some areas.

Conditions in raw milk production at milk stations and an outline of the Milk Collection Center are described as follows.

1) Milk Stations

The milk stations are managed by the government-run farms and agricultural cooperatives, and the total number of milk cows in forty-two milk stations is about 22,000. The annual milk volume (300 days) per head is from 2,000 to 2,500 liters,

and the average of 37 to 40 million liters of law milk is collected yearly. The amount of milk has been increasing due to a recent improvement in feeds and breeding skills with the highest record of 4,000 liters per head. Therefore, it is estimated that more than 660 million liters of raw milk can be supplied yearly by the milk stations in the area. Since the milk stations are not equipped with refrigerators, raw milk is cooled to 18°C by using underground or river water after being milked. Then, it is weighed before being delivered. The milk transport vehicles (3.0 to 3.5 tons) owned by the Plant collect raw milk twice a day on the average.

2) Milk Collecting Center

Milk Collecting Centers (MCC) which are located in eight places along main roads are operated under the direct management of the Plant. After raw milk is collected from milk stations, it is cooled to 12°C by a panel cooler. Quality tests are conducted on acidity, temperature, specific gravity and fat rate, but raw milk is not weighed because the center is not equipped with measurement devices. After being cooled, raw milk is transported to the Plant twice a day on average by milk transport vehicles (3.5 to 5.0 tons).

3) Dairy Plant

Raw milk is weighed and its quality is examined when it arrives from MCC. Details of transport and delivery vehicles owned by the Plant are as follows.

a) For collection and transport	: 60 (net working rate 70 %)
b) For delivery of pasteurized milk	: 20 (net working rate 80 %)
c) For delivery of dairy products	: 40 (net working rate 90 %)
Total	: 120 (average annual net working rate 80 %)

The following problems with the transport vehicles owned by the Plant have been affecting the collection and procurement of raw milk.

a) Frequent breakdown due to deterioration.
b) Difficulty in repairing vehicles due to a shortage of spare parts.
c) Fuel inefficiency due to the fact that many of the vehicles are three to five ton trucks though raw milk collected per day from milk stations amounts to 1.5 to 2.2 tons.
d) Difficulty in collecting raw milk from farms with poor access roads due to low mobility (2x4 drive) of the vehicles.

In addition, collecting milk requires a great amount of time due to unfavorable conditions of the access roads connecting milk stations and MCC, and as a result, the temperature of raw milk sometimes goes so high that it must be discarded.

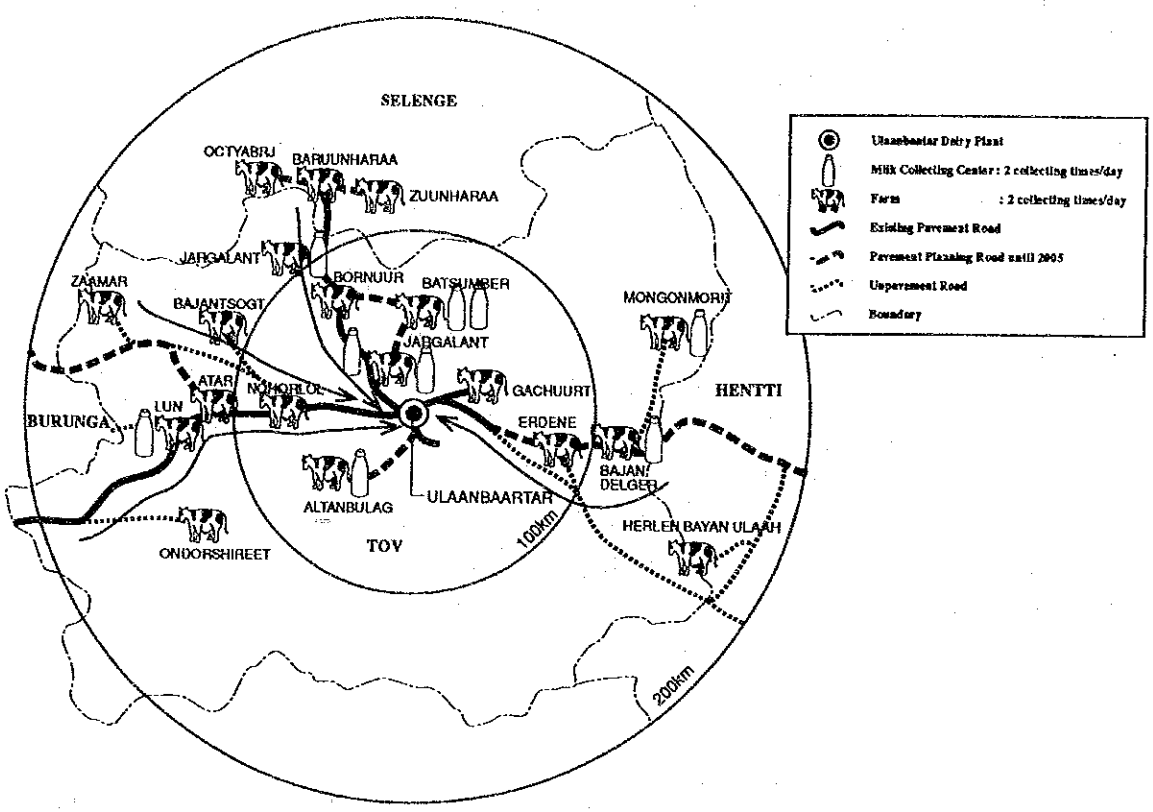


Figure 2.2 Locations and Areas of Milk Stations and MCC

(3) Manufacturing Process of Dairy Products

1) Receiving Process of Raw Milk

When raw milk arrives at the Plant by a transport vehicle, a test sample is taken, sent to a weighing device by a milk pump to be weighed. Then it is cooled by a plate type cooler and sent to a storage tank. Raw milk is received from 1:00 to 6:00 and from 12:00 to 3:00 p.m. The receiving process tends to be delayed because the capacity of a transport vehicle is 3.5 to 5.0 tons which is larger than the capacity of a weighing device which is 500kg/batch. The delay at the receiving process has caused lowering milk quality.

Basically, a plate type cooler cools milk down to 5°C, but actually it can cool it down to 8 to 10°C, because the refrigerator is out of order.

The process of receiving raw milk and manufacturing pasteurized milk is illustrated below.

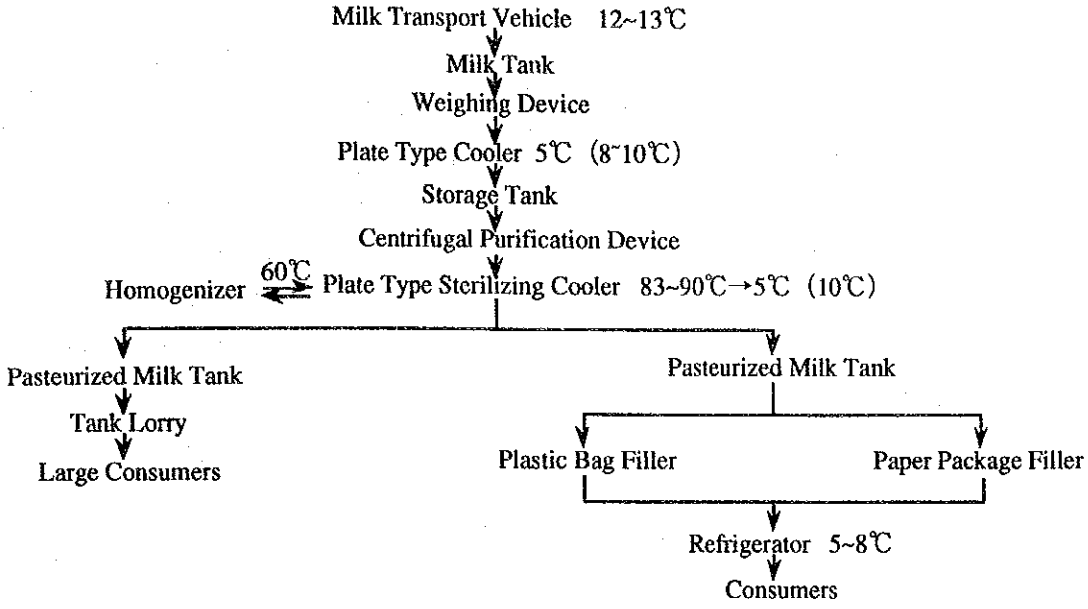
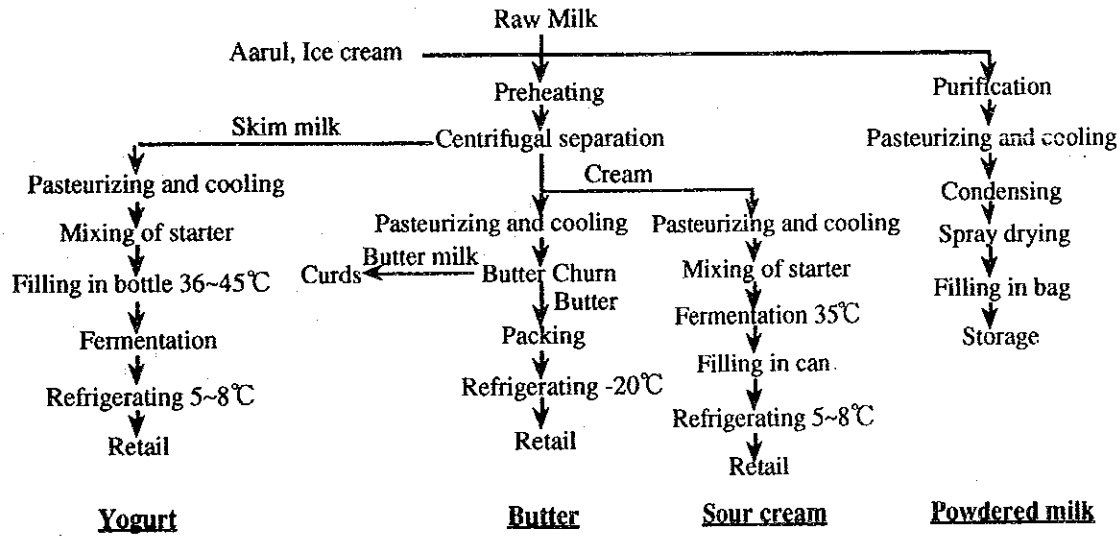


Figure 2.3 Process of Receiving Raw Milk and Manufacturing Pasteurized Milk

2) Manufacturing Process of Major Dairy Products

Currently, manufacturing process of dairy products is conducted at the Plant in almost the same system as in Japan, including pasteurization, cooling and fermentation. Manufacturing process of major dairy products except pasteurized milk is illustrated below.



* Aarul is a special dairy product which is made by compressing curdled protein and separating curd after lactic acid fermentation.

Figure 2.4 Manufacturing Process of Major Dairy Products

3) Quality Standard and Test of Dairy Products

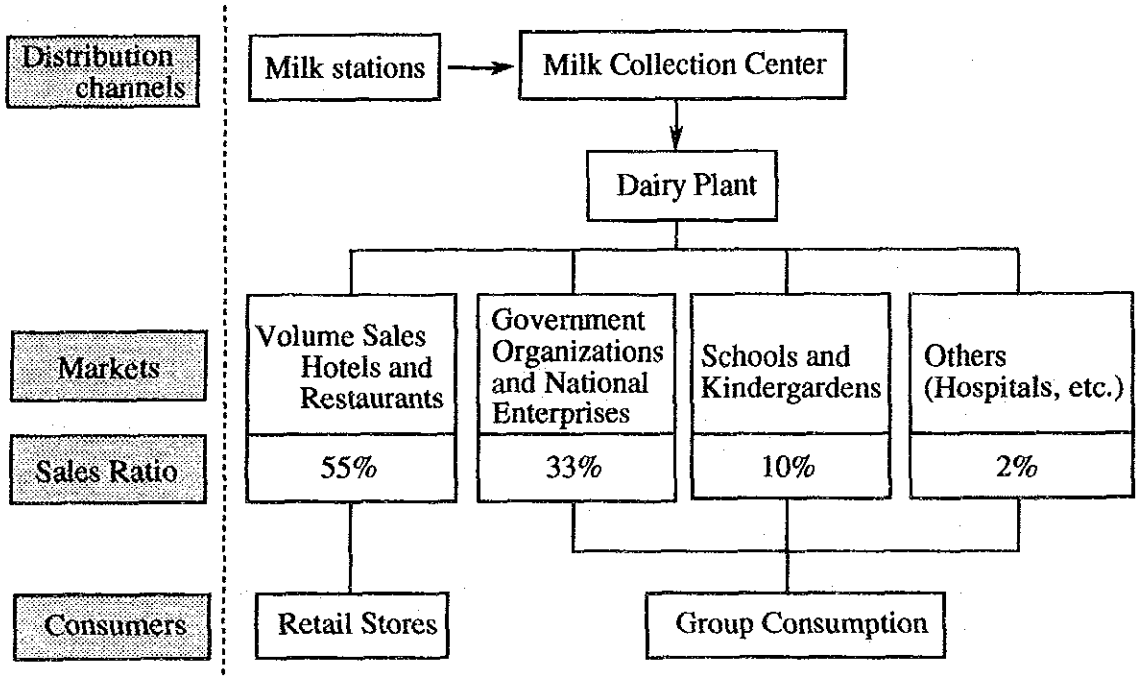
A public organization in charge of formulating quality standard and conducting a quality test is the National Standard and Measurement Center. The quality standard of raw milk adopted by the Center is shown below. The Dairy Plant is conducting tests on four items of gravity, temperature, fat rate, and acidity to check raw milk and dairy products.

Table 2.6 Quality Standard of Raw Milk

Item	Unit	Standard Value
Gravity	g/cm^3	1.028 - 1.032
Temperature	°C	+3 - +10
Fat Rate	%	Above 3.2
Acidity	%	0.17 - 0.20
Number of Germs	In 20ml	Less than 4 million

(4) Distribution and Sales of Dairy Products

Distribution channels and major markets of dairy products are illustrated below.



Markets of the dairy plant include volume sales stores (department stores and supermarkets: 136) and government related companies (92 companies) located in about 280 places. Basically, all the products are delivered immediately after being manufactured since it is difficult to secure storage and stock due to insufficient refrigeration equipment.

2.2.3 Current Equipment in Dairy Plant and Its Problems

The total site area of the Plant is 53,200m^2 (280m x 190m) where (1) processing building, (2) powdered milk manufacturing building, (3) workshop, (4) reservoir, and (5) vehicle repair shop. Processing room of dairy products, freezers and refrigerators, raw milk receiving room and electric machine room are located in the processing building. Refrigeration equipment, processing equipment and transport vehicles in the Plant are described as follows.

(1) Refrigeration Equipment

The refrigeration equipment in the dairy plant has a freezing capacity of 2,640,000kcal/hr (795.1 JRT/Japanese Refrigerating Ton), and it consists of three systems of a low temperature range (-30~ -40°C), a middle temperature range (-15°C) and a high temperature range (+5~-10°C). An ammonia liquid circulation system which is generally used for such large scale freezing equipment is used for a cooling system. A refrigeration equipment is used for manufacturing cooling brine and chilled water, cooling a plate cooler, and so on as well as for freezed and cold storage and freezing. Description of major refrigeration equipment and its operating conditions are shown below.

Table 2.7 Description of Major Freezing Equipment and Working Rate (July, 1993)

Equipment Name	Q'ty	Type	Capacity	Q'ty of Operating
Brine cooler unit	2	Semi-hermetic condensing unit	110,000kcal/h	1
Refrigerator unit for low temperature	2	Single stage open type	95,000kcal/h	1
Refrigerator unit for low temperature	2	Single stage open type	56,000kcal/hr	1
Refrigerator unit for high temperature	5	Single stage open type	306,000kcal/h	2
Refrigerator unit for high temperature	2	Single stage open type	292,700kcal/h	1
Evaporator(Unit cooler)	4	Ceiling Hanger unit type	150m^2	1
Evaporator(Unit cooler)	27	Ceiling Hanger unit type	100m^2	10
Evaporator(Unit cooler)	4	Unit type	230m^2	2
Refrigerant circulation pump	6	End suction volute type	10m^3/h	2
Condenser	10	Water cooling evaporation type	400m^2	8
Cooling tower	3	Counter flow forced ventilation	586,000kcal/h	2
Brine pump	3	End suction volute type	45m^3/h	1
Oil pump	2	Gear pump	3m^3/h	1
Chilled water pump	4	End suction volute type	90m^3/h	2
Chilled water pump	5	End suction volute type	385m^3/h	3
Chilled water pump (for cooling tower)	2	End suction volute type	85m^3/h	1

Notes: Manufactured all by the Russian Federation, Operation started in 1985.

As described in the above table, the average operation ratio of major equipment including compresors and condensing units is merely 50 percent. The cooling equipment plays such an important role in a dairy plant that a suspension of operation affects production capacity and quality considerably.

Major problems which the Plant has faced are described below.

1) The number of defective equipment due to failures has increased for the following reasons.

a) Over load due to long continuous operation.
b) Large load shift to refrigerator.
c) Insufficient condensing especially in winter.
d) Worn-out parts and shortage of spare parts.
e) Inadequate maintenance and operation.

In addition, some of the equipment in operation has been lacking capacity due to lowered functioning caused by worn-out parts. Another problem is a difficulty in coping with a sudden failure because there is no spare equipment.

2) Absolute Shortage of Repair Parts

In general, a compressor of a high speed multi-cylinder type used at the existing plants requires an overhaul and parts should be replaced when it is operated in 5000 to 10000 hours. In case a continuous operation of 24 hours is required as in this plant, more frequent overhauls and replacements of parts are required. It is considered that the main unit of a compressor has been rapidly deteriorated by being forced to be operated without replacing parts and proper oiling.

The majority of the existing equipment was made in 1981, but the operation started actually in 1985.

The production of the same type of equipment has been discontinued since 1986 in the Russian Federation where it was manufactured. Furthermore, it has become difficult to obtain parts since 1987 when the Russian Federation was collapsed, and now it is almost impossible to procure spare parts from the country.

Subsequently, the number of new spare parts owned by the plant has been decreasing since 1990 when the procurement stopped to zero at present. Under such circumstances, used parts taken from those in a similar plant in the Russian Federation are brought in to be utilized.

3) Lowered Production Activities

Since 1990 a lowered capacity due to a failure of the refrigeration equipment has affected the production of dairy products and reduced the production activities of the plant as a whole. In 1992 raw milk as much as eight tons a day was discarded due to a failure of a refrigeration equipment. The influence on the production activities due to detective equipment is described earlier in the section 2.2.3

4) Lowered Product Quality

Basically, raw milk after being received and pasteurized is to be cooled down to 5°C, but it can be cooled only down to 10°C due to an inadequate function of the freezing equipment, and thereby lowered the quality and affected the products to be stored.

(3) Processing Equipment

Major processing equipment in the dairy plant were imported from the Russian Federation and East Germany, Finland, England and Denmark. Description of the processing equipment is given in the following table.

Table 2.8 Processing Equipment (July, 1993)

Name	Q'ty	Capacity	Production Country	Operation Start Year
1. Centrifugal type purification device	2	15,000L/h	Russian Federation	1985
2. Plate type pasteurizing cooler	1	10,000L/h	Russian Federation	1985
3. Plate type pasteurizing cooler	2	15,000L/h	Russian Federation	1985
4. Centrifugal separator	2	15,000L/h	Russian Federation	1985
5. Tube type heater	1	5,000L/h	Russian Federation	1985
6. Storage tank	6	25,000L	Russian Federation	1985
7. yogurt automatic bottle filler	4	6,000bot/h	Russian Federation	1985
8. Plastic container filler	1	2,400con/h	Former East Germany	1985
9. Paper container	1	1,000con/h	Finland	1989
10 Butter churn	2	1,000L	Russian Federation	1985
11.Powdered milk condenser	1	Powdered milk 500 kg/h	England	1991
12.Centrifugal spray dryer	1	Powdered milk 500 kg/h	Denmark	1991
13.Weighing vat	1	500 kg/batch	Russian Federation	1985
14.Flow meter system weighing device	6	-	Former Czechoslovakia	1985

These processing equipment is in a fairly good condition without an urgent need of a repair or a renewal. However, weighing equipment has the following problems.

1) The weighing equipment installed for receiving raw milk and delivery of pasteurized milk is not used at all now due to a big error and a lack of precision. Subsequently, a weighing vat with a capacity of 500kg/batch is used, but it takes too much time to weigh milk and proceed receiving work smoothly.
2) There is no equipment to weigh a delivery amount of the pasteurized milk 90 percent of which is delivered by a tank lorry for bulk sales. Currently, a scale is marked on a tank to indicate the delivery amount, but such inadequate weighing method has caused a problem with dealers concerning quantity.

(4) Transport Vehicles

At present the dairy plant owns 120 transport vehicles which are all made in the Russian Federation, and they are operating at vehicle station department of the Plant, milk stations and MCC. A description of the vehicles and the number of vehicles in operation are shown below.

Table 2.9 Number of Transport Vehicles (July, 1993)

Name	Number	Capacity	Number of Vehicles in Operation
Milk transport vehicles	60	Insulated tank lorry, 3.5-5 tons	42
Pasteurized Milk delivery vehicles	20	Insulated tank lorry, 3.5-5 tons	16
Dairy product delivery vehicles	40	Insulated vehicles, 3.5-5 tons	36
Total	120	Total	94

All of these vehicles are made in 1978 to 1987, and since then they have not been replaced. Since 1990 a large scale repair including overhauling has not been conducted due to shortage of repair parts. The number of these vehicles has been decreasing year after year. About 200 vehicles were owned in 1992, but 40 percent has been reduced for only one year. This is not only because old vehicles were given to employees when the plant became a private enterprise but also because new vehicles were not provided to replace deteriorated ones due to a sluggish economy.

Current situation and problems of transport vehicles are described as follows.

1) Influence on Transport Amount and delivery

The shortage of milk transport and delivery vehicles has caused a problem in securing raw milk. Especially in summer the quality of raw milk is lowered due to

failures of vehicles during transport, defective insulation of tanks and inadequate refrigeration equipment.

2) Shortage of Spare Parts

It is extremely difficult to obtain spare parts of the vehicles owned by the plant which are all made in the Russian Federation as with refrigeration equipment.

3) Shortage of Fuels

Fuels for vehicles are all provided by the government, and now 3,000 liters/day in summer from July to August and 1,500 liters/day in winter from September of gasoline and light oil is allotted to the plant. However, this amount is not sufficient to facilitate transport work. Therefore, the Ministry of Trade and Industry which is in charge of providing fuels are planning to put a priority on the plant in providing fuels as required in accordance with the implementation of the Project.

2.2.4 Operation and Maintenance System of the Plant and Related Organizations

(1) Operation and Maintenance system of the Plant

The organization of the Plant is illustrated in the following Figure 2.5. The council committee which consists of Plant General Director, Deputy Plant General Director and managers of each facility is the highest decision making organization. Currently, the operation and maintenance are conducted by the total number of 64 engineers in charge of refrigeration and processing equipment and facilities under the deputy plant general director who is responsible for the technical aspects of the Plant. In each department operation is conducted on four shifts a day except in workshop and weighing department. The Plant has a workshop equipped with a considerable amount of machine tools such as lathes, vertical type drilling machine, etc. where most of repair work including a small scale construction work is conducted.

The operation and maintenance of transport vehicles are conducted by the Transport Station Department of the Plant. The Repair Workshop owned by the department is equipped with sufficient scale and facilities to overhaul all vehicles as well as an indoor parking space with air-conditioning facility and capacity of about forty vehicles. The Repair Workshop has ten engineers under the supervision of a chief manager who are engaged in repair works of the vehicles. Many of the engineers have an experience for more than ten years, but they have dealt only with vehicles made in the Russian Federation. However, it is planned that experienced engineers will be invited from outside, training plan will be prepared, and new vehicles will be provided and operated.

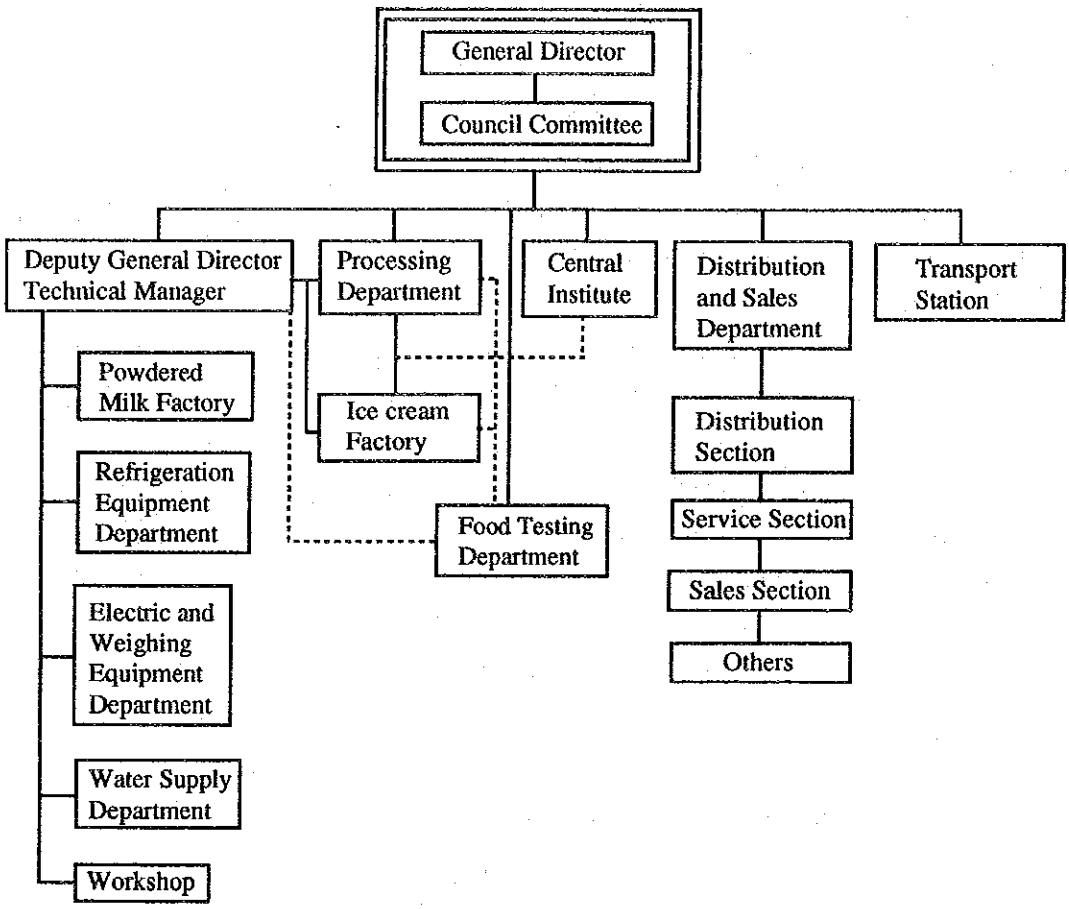


Figure 2.5 Organization of the Executing Agency

(2) Related Organizations

The organizations related to the Plant are the Ministry of Food and Agriculture and the Ulaanbaatar City Hall. As more than 51 percent of the stocks issued by the Plant are owned by the government, these organizations are major public superintendent agencies. The relationships with the two organizations are described below.

1) Ministry of Food and Agriculture

The Plant is under the supervision of the Food Department of the Ministry which has the main duties as follows.

a) To decide a policy on the production of pasteurized milk and dairy products.

b) To provide guidance to milk product organizations such as national and agricultural livestock cooperatives.

c) To provide guidance on the determination of producer price of raw milk.

d) To send personnel for operation and maintenance.

2) Ulaanbaatar City Hall

The Plant is under the supervision of the Agriculture and Food Department which has the main duties as follows.

a) To approve a supply volume of dairy products.

b) To approve a retail sales price of dairy products.

c) To send a plant general director.

In addition, an organizational chart of the Ministry of Food and Agriculture and Ulaanbaatar City, and relationships with the Plant are shown in the Appendix Fig. 2.1 and Fig. 2.2.

2.3 Outline of Related Projects

2.3.1 Current Situation of Economic Reform

Mongolia had been expanding its domestic economy with a support from the Russian Federation and East European countries ever since it became independent in 1924. However, confused domestic affairs in these nations since the latter half of 1980s have affected production activities in the nation and caused a difficulty in supplying daily commodities. Especially, a rapid decline in imports from the Russian Federation which used to make up 80 percent of the total volume caused a shortage of fuels, raw materials and spare parts which are indispensable for production activities, and lowered the growth rate of the gross domestic product (GDP) into the negative. Under such circumstance, the government decided to introduce a market economy system at free economy in place of the former socialistic planned economy, and anticipate that a strengthened relationships with western countries will bring about an expansion in technical and economic cooperation.

The economic reforms which have been implemented mainly include a liberalization of price and distribution and a privatization of government-run companies, and it has been decided to implement them on a short and middle term basis. However, public services in energy, communication and water supply are excluded from the privatization, and a food production sector is privileged to receive financial assistance from government offices.

Major economic reforms which have been implemented until 1991 include the followings.

Implementation year	Contents of Reforms
1987	-.Streamlining of government offices
1988	-.Lowering of official exchange rate
1989	-.Partial liberalization of livestock ownership
	-.Partial increase in retail prices
1990	-.Complete liberalization of livestock ownership
	-.Partial liberalization of retail prices
	-.Rationalization of government offices
	-.Introduction of foreign currency bid system
1991	-.Increase of retail prices of all products
	-.Drastic cutback of financial assistance for imports and businesses in the red
	-.Lowering of official exchange rate (1 US$=40 TUG)
	-.Approval of a privatization law and inauguration of small scale privatization programs
	-.Approval of a bank law and establishment of a central bank

2.3.2 National Development Plan

Mongolia has been implementing the Ninth Five-Year Economic and Social Development Plan (1991~1995) with a focus on the issues of (1) economic reforms, (2) development of livestock industry, and (3) increase of industry output. In the operation of the plan policies are determined based on the Action Program formulated each year. Priority items in the program policies include the followings. The present government is aiming at achieving the goals of this development plan, trying to revise its old social structure dependent on the Russian Federation and Eastern Europe, strengthen the relationships with Western countries, and promote a series of economic policies including an introduction of a market economy.

a) Improvement of an energy supply system.
b) Improvement of foods problems by promoting an agricultural livestock sector.
c) Improvement of infrastructures such as roads, communication, transportation, etc.
d) Improvement of social welfare by providing medical goods, foods, and housing to low income earners.
e) Improvement of an educational system.

2.3.3 Agricultural Livestock Policies

Major policy issues in the agricultural livestock sector in the aforementioned plan include the followings.

a) Improvement of agricultural livestock production which has been decreasing.
b) Expansion of a supply volume of meats and dairy products which comprise staple foods.
c) Enhancement of productivity of food processing plants.

As to the enhancement of productivity in food processing plants, a program is being formulated for the improvement of product quality as a basic strategy to achieve an expansion of food supply volume to the nation. In 1985 Agricultural Livestock Food Supply Plan was formulated to start a structural reform toward a market economy which has been implemented in a full-scale by privatizing national farms and cooperatives since around 1989. In 1989 the number of cattle owned by farmers for their own use was raised from 50 to 70, and at present more than 50 percent of the cattle are owned by individual farmers. Such promotion of private ownership aims at a productivity enhancement in the livestock sector. Since the price of raw materials has been controlled under a planned economy so far, a supply volume of raw materials of meat and farm milk for food processing has been limited by farmers. Therefore, it is expected that an expansion of a supply volume of these raw materials in urban areas will resolve the problem of a shortage in raw materials.

2.4 Background and Content of the Request

2.4.1 Background of the Request

Ulaanbaatar Dairy Plant which is located in the capital Ulaanbaatar is the largest dairy plant in the country established in 1985 with an assistance of the Russian Federation, aiming at a stable supply of dairy products which are basic sources of nutrition for 600,000 citizens in Ulaanbaatar. The output of dairy products in the Plant which reached 45,000 tons in 1989 has been decreasing down to 18,000tons in 1992 which is about 40 percent of the highest record. This decline in the production volume has reduced the supply volume of dairy products, and it is concerned that the dietary needs of the city inhabitants have been greatly affected by reducing calorie volume required for good health.

It is pointed out that a major cause of this output decline in the Plant is a reduced operational ratio due to a shortage and functional deterioration of the following facilities and equipment.

a) Reduced cooling capacity due to frequent failure of the existing refrigerating facilities and equipment.
b) Reduced storage capacity of deteriorated quality of raw milk and dairy products due to a reduced cooling capacity.
c) Reduced milk collection capacity due to a shortage of transport vehicles.

It is necessary to recover the reduced supply capacity in the Plant in order to expand a supply volume of dairy products. Therefore, it is urgently required to take adequate measures to solve the aforementioned problems to improve the operational ratio of the Plant.

Under such circumstances, the Government of Mongolia requested grant aid assistance from the Government of Japan for the renovation of refrigeration facilities of the Plant and providing new transport vehicles through a study team of project formulation conducted by JICA in 1992. In the project formation study, it was proposed to conduct a basic design study on the Project for Improvement of Ulaanbaatar Dairy Plant in Mongolia

2.4.2 Content of the Request

The contents of the request for grant aid made by the Government of Mongolia to the aforementioned project formation study team are as follows.

1) To renovate refrigeration facilities.
2) To provide milk transport vehicles.

3. CONTENT OF THE PROJECT

3. CONTENT OF THE PROJECT

3.1 Objective of the Project

The objective of the Project is to improve the refrigeration facilities and their related facilities and equipment of Ulaanbaatar Dairy Plant to recover its reduced processing and storage capacity, and thereby provide a stable supply of dairy products to the city inhabitants.

3.2 Study and Examination on the Content of the Request

3.2.1 Study and Examination on Appropriateness and Necessity of the Project

The appropriateness and necessity of the Project is evaluated in view of the following major respects.

(1) Enhancement of Self-sustaining food supply rate and contribution to the national development plan.

In Mongolia a rapid decline in imports and assistance from the Russian Federation and East European countries which used to make up 80 percent of the entire amount of imports has caused a shortage in fuels, raw materials and spare parts which are indispensable for production activities, and conspicuously curtailed the operational ratio in food processing plants in the food industry sector, one of major industries in the nation. Such decline has considerably reduced a supply volume of basic foods including meat and dairy products which are main staple commodities in the nation. Currently, the self-sustaining supply rate of these basic foods is as low as 50 percent so that the government has started a ration system. Under such circumstances, the agriculture and livestock policies in the Ninth Five-Year Economic and Social Development Plan which is being implemented now put a priority on the establishment of a stable supply system by expanding production of dairy products which are staple foods in the nation.

The recipient of the Project is Ulaanbaatar, which is the largest city where one-fourth of the entire population is concentrated. It is expected that a supply capacity of dairy products to the city inhabitants will expand about three times and a half as much as the current volume, and this expansion of dairy products which are staple foods in the country will not only improve the self-sustaining food supply rate but also support the national development plan.

(2) Salvation of low income earners.

In Mongolia dairy products, being an important source of nutrition, are one of the staple foods like meats with an annual intake per capita which is 1.24 times as much as that of meats. The annual income per capita is estimated to be less than US$ 100 (1992), and an increase in food price due to a recent shortage of food has been a big burden on low income earners. The government has started rationing dairy products and provided a financial assistance to save the poor and low income earners, but the absolute shortage volume has made it difficult to save them. Thus, an expansion of supply of dairy products will stabilize a supply of low priced products and contribute to the relief of the low income earners.

In this way, the Project will meet the goals of the national development plan, and satisfy needs for basic staple commodities of the nation. Thus, the implementation of the Project under the Japanese grant aid is considered to be appropriate.

3.2.2 Study and Examination on Plan of Operation

(1) Personnel Plan

As shown in the Organization Chart of Operation and Maintenance in the section 3.3.5 Operation and Maintenance Plan, 75 operation staff members of the equipment departments comprising mainly of the existing refrigeration and processing equipment departments will be in charge of the operation of the Project. These personnel are employed to comply with the maximum design capacity of the Plant. It is considered that there would be no problem with operation and maintenance of the facilities and equipment after the implementation of the Project in consideration that the number of equipment to be provided will not exceed the scale of the existing facilities since the Project puts a focus on replacement and renovation of the existing refrigeration equipment.

(2) Budget Plan

Operation budget for the Plant stems from the sales profit of dairy products. It covers electricity and heating expenses, purchasing costs of materials and equipment, etc. as well as personnel costs. Transitions in sales amount, personnel costs, and operation budget over these five years are shown below. Although a production output of dairy products has been decreasing since 1990, sales amount has been increasing due to raised sales prices of the products.

Table 3.1 Transitions in Operation Budget

(Unit: 1,000 TUG)

Item	1988	1989	1990	1991	1992	1994
1) Sales Amount	63,877	66,797	63,106	117,932	250,793	1,003,172
2) Personnel Cost	8,053	9,789	11,551	13,575	16,915	67,660
3) Operation Budget Total 1)-2)	55,824	57,008	51,555	104,357	233,878	935,512

Source: Data of Processing Facilities of Dairy Products, 1993

Notes: Figures in 1994 are planed amount.

Expenses required after the Project starts are estimated to be approximately 118.5 million TUG, as is shown later in the section 3.3.5 Operation and Maintenance Plan, which is within the range of operation budget in view of the past actual record. The Plant has a privilege of being given a low interest loans of 6 to 10 percent/year (normally 20 to 30 percent) based on a loan warranty provided by the government and the municipal office. Therefore, it is planned that operation and maintenance expenses will be appropriated in a special budget based on the aforementioned loan, and it is considered that there would be no problems with the operation budget for the Plant.

3.2.3 Study and Examination on Relationship and Duplication with Similar Projects and Grant Aids of International Organizations

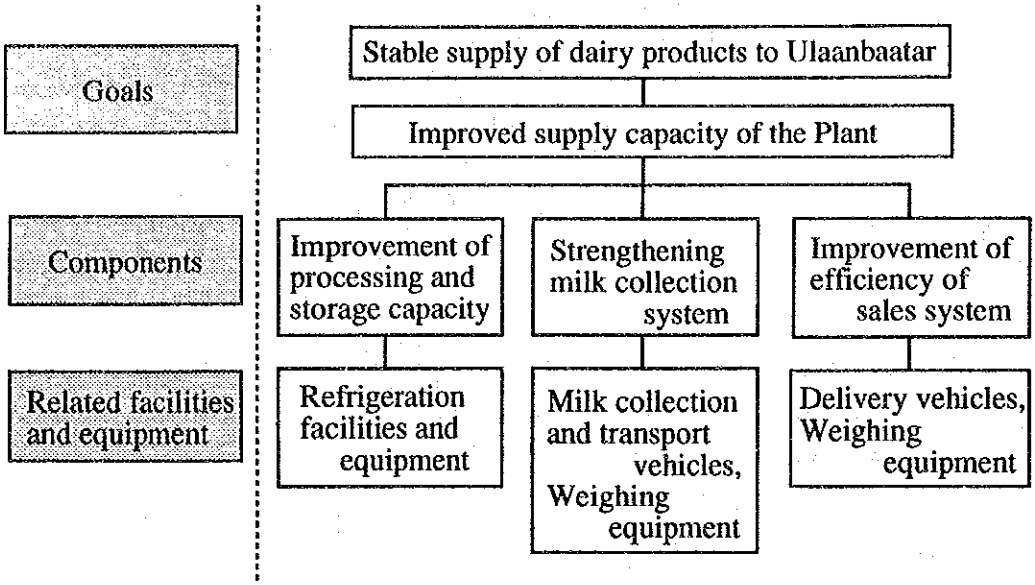
The Plant was designed under an aid from the Russian Federation, and construction started in 1975. Due to a shortage in fund for construction, a full scale operation started in 1985. However, with a collapse of the Russian Federation, a supply of spare parts and financial assistance from the Russian Federation has been discontinued since 1987. No other foreign countries and international organizations have provided assistance or aid to the Plant, and there is no duplication with other similar projects.

3.2.4 Study and Examination on Components of the Project

The Project aims at establishing a stable supply of dairy products by expanding production. In order to achieve that goal, it is necessary to establish a consistent production system of improved processing and storage capacities, and efficient sales and delivery work.

The relationship between components of the facilities and equipment in the Plant to be improved in the Project is illustrated below. The improvement of these

related facilities and equipment is considered to be essential in establishing a production system.



3.2.5 Study and Examination on Content of Requested Equipment

The content of the request confirmed on the field survey is described below.

a) Replacement of refrigeration equipment
b) Providing transport vehicles.
c) Replacement of weighing equipment for pasteurized milk.

The largest goal pursued by the Government of Mongolia is to recover reduced refrigeration capacities by replacement and renovation of refrigeration equipment, and a request was given at the field survey to recover the functions as much as possible. As to transport vehicles, a request was made to provide two kinds of vehicles including tank lorries used for milk collection and transport of pasteurized milk to retailers, and insulated vehicles used for delivery of dairy products. A request was also made to provide weighing equipment used for receiving raw milk and transport of pasteurized milk due to inaccuracy and insufficiency of the existing equipment.

The result of the analysis of the requested equipment is described below.

(1) Refrigeration Equipment

Although the Plant is the only processing plant of dairy products in Ulaanbaatar, its entire production capacity has fallen to about 30 percent of the original maximum

capacity largely due to a functional deterioration of refrigeration equipment. Therefore, it is necessary to recover its functions promptly. It is impossible to repair defective refrigeration equipment currently out of operation because there is no possibility of obtaining repair parts. It is also expected that existing refrigerator units in operation now will be defective in a year or two because maintenance work such as regular overhaulings has not been provided due to a shortage in spare parts. Thus, it is considered to be appropriate to replace all the major equipment including refrigerator units, evaporators, consensers, etc. As to magnetic valves, however, only spare parts will be provided to be replaced by the Mongolia side in future becuase some of them seems to be durable for several years, and it is possible to replace parts. As to pipings of refrigerants, chilled water, brine, cooling water, etc., they are relatively in good condition, and it is considered to be unnecessary to replace them except some pipes around the equipment.

(2) Transport Vehicles

The number of vehicles used for milk collection and transport and delivery of dairy products currently owened by the Plant is 120, but only 94 vehicles are in operation now due to breakdowns with an average operation ratio is 80 percent (as of July, 1993). As they have been deteriorated without being supplemented by new ones since 1990, it is expected that the average operation ratio will fall down to 60 percent in 1994. The number of delivery vehicles for dairy products is 40, and the average operation ratio is 90 percent, but they have been also deteriorated with lower transport capacity like milk collection and transport vehicles . It is necessary to replace them as they are essential factors in the Plant. It is anticipated that renovation of refrigeration facilities and equipment conducted under the Project will recover production capacity of the Plant and considerably increase transport volume.

However, it is considered to be appropriate to provide only a minimum number of vehicles which are urgently required because it is desirable to obtain vehicles which do not require special technology or installation work like refrigeration equipment through self-sustaining efforts by the Government of Mongolia.

(3) Weighing Equipment

The existing weighing equipment of a flow meter type is out of order, and the weighing vat of a batch type temporarily used takes too much time for weighing to proceed the receiving work of raw milk. As there is no accurate weighing equipment for delivery, delivered amount is not weighed precisely. As these weighing equipment is also an essential part of the Plant, it is necessary to provide equipment with sufficent capacity. The location of these equipment in the Plant is shown in the following figure.

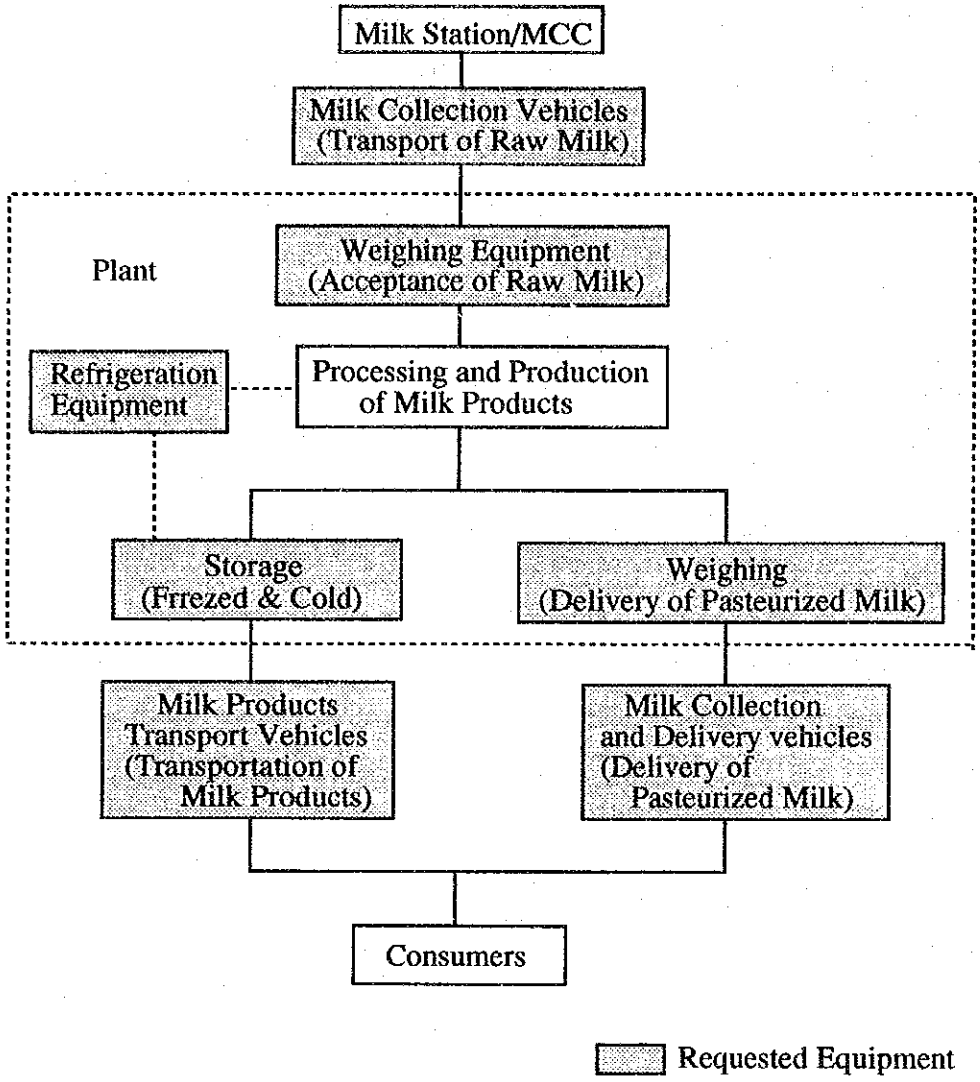


Figure 3.1 Flow Chart of Production and Distribution of Milk Products

3.2.6 Study and Examination on Necessity of Technical Assistance

Management staff of the facilities and equipment in the Plant have received training on technology as well as operation and maintenance by engineers of the Russian Federation who were in charge of the construction of the Plant. The chief engineer of the refrigeration facility seems to have a high level of technical skills as they received special training on refrigeration technology in the former Soveit Union. However, as the equipment to be provided in the Project requires different knowledge and skills on power and refrigerant control, and technical skills on repair and overhaul of the main unit, it is necessary to carry out sufficient in-house and on-the-job trainings.

3.2.7 Basic Policy of Implementation of the Grant Aid

As it was confirmed that the implementation of the Project is effective and realistic, the operation capability of the implementation organization in Mongolia is feasible, and the effects of the Project correspond to the system of Japanese grant aid, it was considered to be appropriate to implement the Project under Japanese grant aid. Therefore, an outline of the Project will be discussed in the following sections to conduct a basign design on the premise that Japanese grant aid will be provided.

3.3 Outline of the Project

3.3.1 Executing Agency and Operational Structure

The executing agency of the Project is Ulaanbaatar Dairy Plant. The current operation organization is shown earlier in the section 2.2.5 Operation and Maintenance System of the Plant. The council committee which consists of Plant General Director, Deputy Plant General Director and managers of each facility is the highest decision making organization. Under the Deputy Plant General Director who is responsible for technical aspects of the facilities, an operation and maintenance system is organized which mainly comprises refrigeration and processing equipment facilities. It is necessary to utilize the existing system and taff members effectively in order to conduct and operate the Project smoothly. The executing agency and its staff members are illustrated below. This organization is to continue operation after the completion of the improvement work and until the operation of the Project is put on track.

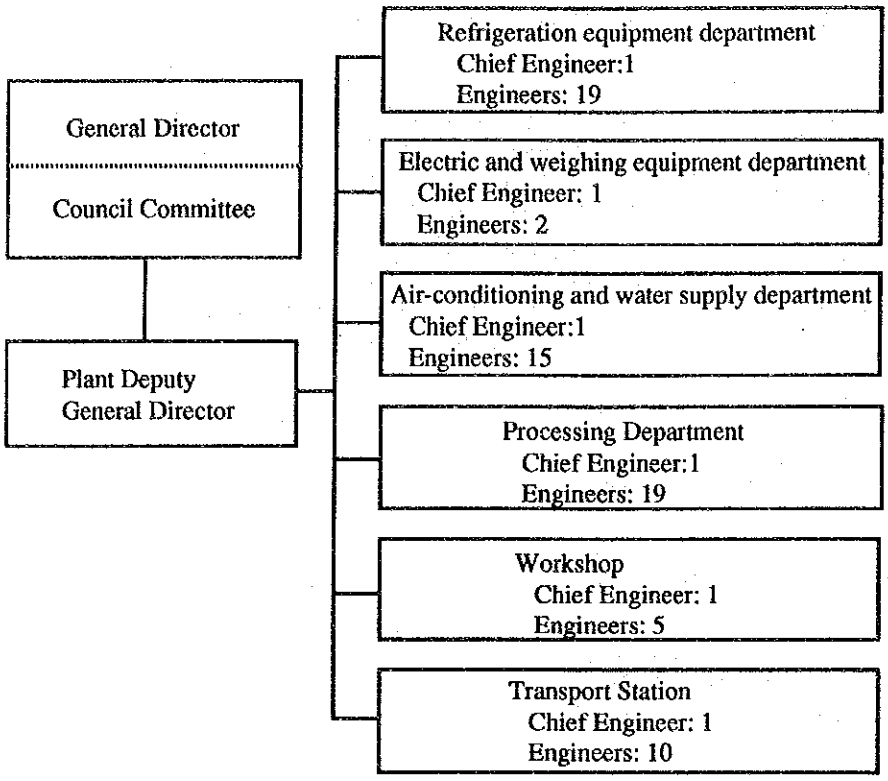


Figure 3.2 Operation and Maintenance Organization

3.3.2 Plan of Operation

(1) Equipment Improvement Plan

The object of the Project is to expand and stabilize a production and a supply volume of dairy products by renovating and enhancing reduced capacities of refrigeration, processing and storage in Ulaanbaatar Dairy Plant. In order to achieve the goal, the following equipment required for expanding production will be provided based on the understanding of the current situation and problems in the Plant as stated in the precious chapter 2.2 Outline of Ulaanbaatar Dairy Plant. Details and scale of the plan will be discussed in Chapter 4 Basic Design.

1) Refrigeration Equipment

a) Brine cooler unit	1 unit	b) Refrigerator unit for low temperature	4 units
c) Refrigerator unit for high temperature	7 units	d) Evaporator	34 units
e) Ammonia liquid pump	6 units	f) Evaporative condenser	10 units
g) Brine pump	3 unuts	h) Oil pump	2 units
i) Chilled water pump	6 units	j) Cooling water pump for evaporative condenser	5 units
k) Cooling water pump for jacket	2 units	l) Control panel for refrigerator unit	1 unit
m) Auxiliary equipment	1 lot	n) Control panel for Evaporator unit	2 units

2) Vehicles

a) Milk transport and delivery vehicles (2 tons)	10 units
b) Milk product delivery vehicles (2 tons)	10 units

3) Weighing equipment

a) For receiving (15tons/hr)	1 unit
b) For delivery (15tons/hr)	1 unit

(2) Production Plan of Dairy Products

The following table shows an estimation of supply and demand volume of dairy products in 2000, comparing when the improvement is conducted and not conducted.

The demand volume in the city was about 70,000 tons in 1992, 26 percent of which was met by the supply volume. The processing capacity of dairy products in the Plant will be able to restore the maximum capacity which is originally designed by renovating aforementioned equipment. As a result, the production output estimated from annual acceptable volume of 60,000 tons will be 66,000 tons which is about 3.5 times as much as the current volume (1992). This figure shows that about 80 percent of the estimated demand of 83,000 tons will be met in 2000.

Raw milk required for expanding production of dairy products is secured to be supplied from national farms under the direct control of the Plant, milk stations of agricultural cooperatives, and individual farmers. Average milk volume per head supplied from these sources is 2,500 L/year with the highest record of 4,000 L/year.

At present 22,000 cows are raised in national farms and a supply system of raw milk has been established to cope with the maximum production capacity of 60,000 tons of the Plant.

Table 3.2 Estimated Demand and supply of Dairy Products

	1992	2000		Fluctuation	
	(A)	(B1)	(B2)	B1/A	B2/A
1) Demand (1,000 ton)	70.0	83.3	83.3	1.19	1.19
2) Supply (1,000 ton)	18.5	18.5	66.0	1.00	3.56
3) Required collected milk (1,000 ton)	16.8	16.8	60.0	1.00	3.57
4) Percentage (%)	26.4	22.2	79.2	0.84	3.00
5) Intake volume per capita (kg)	118.5	118.5		1.00	
6) Supply volume per capita (kg)	31.4	26.4	94.3	0.84	3.00
7) Percentage (%)	26.7	22.1	79.2	0.82	2.97
8) Number of cattle (1,000)	22.0	22.0		1.00	
9) Supply volume of raw milk(1,000 ton)	55.0	66.0		1.20	
10) Consumption population (10,000)	58.9	70.0		1.19	

Notes:

1) Demand volume = Average consumption volume per capita x Consumption population

2) Supply volume = Production output of dairy products in the Plant

3) Intake per capita is the average over the past 7 years. (See the previous table 2.2)

B1 in 2000: Estimated volume based on the supply volume in 1992 without improvement of equipment.

B2 in 2000: Estimated volume based on the maximum production volume when equipment is improved.

9) Raw milk supply volume = number of cows at milk stations x milk volume per head

(1992: 22,000 x 2,500 L/average milk volume per head,

2000: 22,000 x 3,000 L/average milk volume per head)

10) Consumption population is replaced by total population.

3.3.3 Location and Condition of the Project Site

Ulaanbaatar Dairy Plant is located in the industrial complex surrounded by bread and sugar factories in a trade union district which is about 15km away from the center of the city. The area of the Plant is approximately 8,000m^2, and a total area including adjacent vehicle stations (about 2,000m^2) is 10,000m^2. The basic infrastructure condition is described as follows.

1) Access Road

A road network has been well developed in the city. The width of roads is large and most of them are paved. As the road in front of the Plant has a width of about 20m, there is no access problems.

2) Electric Power

Since June, 1992, electric power has been rather in shortage due to frequent breakdowns, but the condition has been improved. Power is supplied to the Plant as well as other factories in the industrial complex under the direction of the Ministry of Energy prior to other sectors. Standard power is 380 V (three-phased), 220 V (single-phased), 50 Hz.

The total volume of power received is 6,000 kVA and 2,000 kVA is secured for a refrigeration system. Power required for refrigeration and weighing equipment to be improved in the Project is expected to be about 1,500 kVA, and there is no problem in the Project implementation. As the existing primary trunk lines can be used to supply power to each equipment, a new construction work will not be required.

3) Water Supply and Sewer System

In the Plant site there are two water tanks with a capacity of 1,000 tons connecting with public water supply and sewer pipes, and water is pumped up from the pump room and sent to each factory and adjacent bread factories. The sewer pipes are connected with public sewer pipes. The water supply related to the Project is the one for condensers for which the existing supply pipes can be used.

4) Equipment Installation Place

As the object of the Project is a replacement of existing equipment, there are no particular problems in installation. Refrigeration equipment will be installed in the refrigeration machine room, freezers and refrigerators in the Processing Building. Weighing equipment will be installed in raw milk receiving room.

3.3.4 Outline of Equipment

The equipment to be provided in the Project includes refrigeration equipment and transport vehicles. These are all to be replaced for existing equipment and vehicles not newly provided. Refrigeration equipment has a cooling function required for receiving, delivery and processing of dairy products. Transport vehicles are used for transportation of raw milk from milk stations or collection stations to the Plant and delivery of dairy products from the Plant to retailers. Weighing equipment is used for weighing raw milk received and processed milk delivered in bulk. An outline of the equipment is shown below.

Table 3.3 Outline of Equipment

Name of Equipment	Quantity	Major Use & Content
Refrigeration equipment		
Brine cooler unit	1unit	Brine cooling
Two stage refrigerator unit for low temperature	4units	Cold storage & Freezing
Single stage refrigerator unit for high temperature	7units	Refrigerating & Freezing
Evaporator (Unit cooler)	34units	Cold storage & chilling
Ammonia liquid pump	6units	Refrigerant circulation
Evaporative condenser	10units	Freezed strage & cold strage
Brine pump	3unuts	Brine circulation
Oil pump	2units	Refrigerating oil supply
Chilled water pump	6units	Chilled water supply
Cooling water pump for evaporative condenser	5units	Cooling water circulation
Cooling water pump for jacket	2units	Head and oil cooler cooling
Control panel for refrigerator unit	1unit	System control
Control panel for unit cooler	2units	System control
Auxiliary equipment (pressure vessels, valves)	1set	Refrigerant system control
Vehicles		
Milk transport and delivery vehicles (2tons)	10units	Insulated tank lorry
Milk product delivery vehicles (2tons)	10units	Refrigerated vehicles
Weighing equipment		
For receiving (15tons/hr)	1unit	Flow meter system
For delivery (15tons/hr)	1unit	Flow meter system

3.3.5 Operation and Maintenance Plan

(1) Operation and Maintenance System

The object of the Project is to replace existing facilities and equipment in the Plant, and the operation and maintenance is conducted in accordance with the existing organization and system. Among the recipient equipment, refrigeration equipment will be in charge of Refrigeration Equipment Department, as shown in the section 2.2.4 Operation and Maintenance System of the Plant Related Organization. Weighing equipment will be operated and maintained by Processing Department, and transport vehicles will be by Transport Stations. The Plant has an operation and maintenance system similar to those of other factories in which operation and maintenance is conducted with their own personnel and facilities since there are very few private repair shops in Mongolia. When the Project is implemented, the whole system of refrigeration equipment will not be changed, but special skills and knowledge will be required for a single unit. Therefore, it is necessary to involve operation staff members from an installation stage and provide further training on operation and maintenance to facilitate technology transfer.

(2) Personnel Plan

Operation and maintenance staff members in the Plant include, as shown in the organization chart (Figure 3.1), twenty engineers in Refrigeration Equipment Department, three in Processing Department and eleven in Workshop in Transport Station.

These personnel will be retained as they are, and it seems that they are sufficient to meet the needs, but it is desirable to provide training on equipment and vehicles for acquiring more knowledge and skills. Currently at the Plant, technical training is given according to programs prepared by Chief Engineers during winter when operation ratio falls down. Those who have reached a certain level of skills will be assigned to actual work, but capacities of each individual varies, and the management admits that all the engineers have not reached a desired level. It is necessary to establish an in-house training system in order to improve the technical level for the implementation of the Project.

(3) Operation and Maintenance Costs

Operation and maintenance costs of the equipment to be provided in the Project is outlined below.

Table 3.4 Annual Operation and Maintenance Costs

(Unit: TUG)

Item	Costs		
1. Electricity	8,660,720 kwh x 6.75 TUG/kwh	=	58,459,860
2. Water Supply	401 ton x 10 TUG	=	4,015
3. Refrigeration Equipment Expendables			5,100,001
- Refrigerant (Ammonia)			(1,166,667)
- Secondary Refrigerant (calcium chloride)			(333,334)
- Oil and Fats (Refrigerator oil supply)			(3,600,000)
4. Refrigeration Equipment Spare Parts			27,821,327
5. Weighing Equipment Spare Parts			1,146,667
6. Fuels for Vehicles			9,000,000
7. Vehicles Spare Parts			17,019,000
Total			118,550,870

Operation and maintenance costs for the Project is disbursed from sales profits of dairy products.

The expenses for maintenance and operation of the Plant are provided by the sales profits of milk products. According to the budget plan for 1994 of the Plant, the total amount of operation budget with the deduction of 67 million TUG of personnel expenses from the annual sales of 10.03 billion TUG will be 936 million TUG. 177 million TUG has been appropriated for the maintenance and operation expenses of the

refrigeration and vehicle station departments covered by the Project. This budget is to be provided for facilities and equipment which are currently operating with low ratio. Meanwhile, it is planned to start operation of the equipment to be provided in the Project in 1995, and it is not necessary to replace spare parts for about three years as they are included in the Project. Furthermore, it is possible to secure budget larger than the current scale since sales are estimated to be increased due to considerable expansion of production volume brought forth by renovation and upgrading of the equipment. Thus, it is considered that sufficient budget will be obtained to cover maintenance and operation expenses.

The life of refrigeration facilities and equipment is largely affected by the condition of operation and maintenance, but when it is conducted properly, the life of refrigeration and weighing equipment is approximately twenty years, and transport vehicles need to be replaced every ten years.