JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
MINISTRY OF TRADE AND INDUSTRY
MINISTRY OF FOOD AND AGRICULTURE
MONGOLIA

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR IMPROVEMENT OF DARKHAN MEAT PLANT IN MONGOLIA

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JULY, 1993

ZEN-NOH ARCHITECTS AND ENGINEERS INC.

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PREFACE

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

JICA sent to Mongolia a study team headed by Mr. Hiroshi Ito, director of the Ibaraki Station, National Livestock Breeding Center, Ministry of Agriculture, Forestry and Fisheries and constituted by members of Zen-noh Architects & Engineers Inc. from March 11 to April 8, 1993.

The team had a series of 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 in order to discuss a draft report and the present report was prepared.

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

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

July, 1993

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

July, 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 Darkhan Meat Plant in Mongolia.

This study has been made by Zen-noh Architects and Engineers Inc. based on a contract with JICA, from March 8 to July 30, 1993. Throughout the study, we have taken into full consideration the present situation in Mongolia, and have planned the most appropriate project in the scheme of Japan's grant aid.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, Ministry of Agriculture, Forestry and Fishery and Embassy of Mongolia in Japan. We also wish to express our deep gratitude to the officials concerned of Ministry of Trade and Industry, Ministry of Food and Agriculture, Darkhan Meat Plant, Embassy of Japan in Mongolia for their close cooperation and assistance throughout our study.

Finally, we hope that this report will contribute to the better implementation of the project.

Very truly yours,

Hidejiro Uchigasaki
Project Manager
Basic design study team on the Project for
Improvement of Darkhan Meat Plant in Mongolia
Zen-noh Architects and Engineers Inc.

SUMMARY

Mongolia is located in the central part of the Asian continent between 41°N and 51°N and is an inland country with an average elevation of 1,580m above sea level. It has a continental climate with minimal rainfall throughout the year. The mean temperature is below 0°C for a period of 6 - 7 months. Wheat is virtually the only staple crop which grows in Mongolia and the national diet is heavily dependent on traditional livestock products. While the relative shares of agricultural products and livestock products in terms of calorie intake are 84% and 16% of the world average respectively, the livestock share is as high as 35% in Mongolia. In the case of protein intake, livestock products account for 59% in Mongolia compared to the world average of 3%, clearly demonstrating the dominant status of livestock products in the national diet.

The rapid transformation of the economy to a market economy following the establishment of the democratic coalition government in 1990 and the adverse impacts of the deteriorating economic situation in the former Eastern Bloc have been causing much confusion as well as a crisis in the Mongolian economy. The meat production system which has so far been based on the traditional nomadic way of life and collectively-owned livestock producers' cooperatives and large combinats (production complexes), the creation of both of which was inspired by the socialistic planned economy of the former Soviet Union, have not escaped the crisis and require fundamental reform.

Mongolia is also characterised by a high population concentration in urban areas. Ulan Bator, the capital, has a population of some 0.6 million which accounts for one-quarter of Mongolia's total population. Together with other cities, the urban population accounts for one-third of the total population. The improvement and stabilisation of the meat supply system in these urban areas where there is much social confusion due to the rapid progress of democratisation has become an extremely important and urgent issue.

Meat production and distribution were controlled by the government upto 1990. Since then, the liberalisation of livestock prices due to the introduction of a market economy has caused profound changes in the livestock product distribution system. The collectively-owned Negdel (livestock producers' cooperative), a symbol of Mongolian socialism, was dismantled in 1991 to allow the private ownership of livestock. As a result, stock farmers are now free to breed and sell livestock while the sales prices to meat producers have been liberalised. The government liberalised the prices of all commodities except for 17 items, including meat in 1991. Regarding staple foods, i.e. wheat and meat, a rationing system was introduced and the prices were raised substantially several times, then price liberalization was implemented in November 1992. The ration system is still being used. The current state of meat distribution in Mongolia is very confused because of the unstable balance between supply and demand and also because of the

extremely high inflation rate which reached 383% in 1992, hitting the management of meat production companies and national life very hard.

There are 3 large abattoirs in Mongolia and 3 large meat plants (combinats) at Ulan Bator, Darkhan and Choybalsan which have a total annual production capacity of approximately 63,000 tons and a cold storage capacity of approximately 23,000 tons. These plants must meet the meat demand of 30,800 tons of the some 700,000 inhabitants of the main cities (Ulan Bator, Darkhan and Choybalsan). All the plants, however, are suffering from a deterioration of facilities and economic problems, such as an unreliable supply of meat, unstable purchase prices and inefficient operation, etc. The nomadic production of meat means the concentration of slaughter in a short period of time. Because of the cold storage capacity, believed to be at least 11,000 tons, and poor refrigeration, a loss of stored meat occurs in summer. While consumers prefer cut, boned meat, the abattoirs and meat plants do not generally produce boned cut meat and do not standardise their products because of the difficulty of procuring the necessary machinery and wrapping materials and also because of financial difficulties. As a result, meat joints are distributed to butchers who then cut the meat and sell it in 3 grades (3 different prices). Given these circumstances, improvement of the meat production facilities and strengthening of the operation system are believed to be essential for a stable supply of meat which is the main item in Mongolia's national diet.

The Darkhan Meat Plant (Combinat), which is the second largest plant of its kind in Mongolia, was established in 1974 with Hungarian assistance as a national enterprise to supply meat to such cities as Ulan Bator, Darkhan and Erdenet. It was operated by the national budget in accordance with the national plan until 1990 but became a limited enterprise with privatisation in 1991 with 51% of the shares owned by the Nation. It has an annual production capacity of 15,000 tons (body weight) and a cold storage capacity of 3,400 tons, the distribution ratios of meat produced by the plant are 40% for Ulan Bator (population of 580,000), 30% for Darkhan (population of 90,000), 20% for Erdenet (population of 60,000) and 10% for other nearby cities. The equipment in use is fairly deteriorated as the original equipment manufactured in the 1960's has never been replaced. The condition of the refrigeration facilities is particularly poor in that the leakage of ammonia gas, used as the refrigerant, prevents the efficient operation of the facilities, making it impossible to maintain proper meat quality. The privatisation of livestock ownership has caused the rush delivery of livestock in a short period of time, lengthening the idle time at the plant during which livestock is unavailable for slaughter. Conversely, the demand for slaughter increases by 50% in the busy season, creating a cold storage shortage of some 1,600 tons. In addition to the unstable delivery of livestock, the purchase price has become almost twice as expensive as the minimum standard price set by the government, therefore, the plant is facing operation difficulties.

The current situation described above makes improvement of the meat production facilities and strengthening of the operation system essential in order to secure a stable supply of meat. Against this background, the Government of Mongolia planned the project to repair the existing refrigeration facilities and to construct new production and storage facilities for cut meat, the demand of which is expected to steadily increase in the future and which could improve the storage efficiency, at the Darkhan Meat Plant. This particular plant has been given the highest improvement priority because of its poorer facility and operation conditions than the Ulan Bator Meat Plant on the grounds that the meat supply system for the highly populated Ulan Bator, Darkhan and nearby cities requires urgent improvement and consolidation.

The Government of Mongolia then made a request to the Government of Japan for the provision of official assistance for the project. In response to this request, the Government of Japan decided to conduct a project formulation survey relating to the project to improve the processing and storage facilities for Mongolia's main food products, such as meat, dairy products and agricultural products. Commissioned by the Government of Japan, the Japan International Cooperation Agency (JICA) sent the Project Formulation Survey Team to Mongolia in August, 1992. Based on the findings of this survey, it was decided to conduct the Basic Design Study for the Project to Improve the Darkhan Meat Plant in Mongolia to be implemented with Japanese grant aid and JICA sent the Basic Design Study Team to Mongolia for a period of 29 days, from March 14 to April 9, 1993. Through a series of consultations with the Mongolian counterparts, the Study Team examined the project contents, including the project implementation body, operation plan and outline of the required facilities and equipment, etc., and also examined the request in terms of the appropriateness and necessity of the Project, the project implementation and management plan and the project components, etc.

Upon its return to Japan, the Basic Design Study Team analysed the field survey findings and proceeded to conduct the basic design of the facilities, selection of the equipment and preparation of the maintenance plan. All the findings of this series of work were then compiled in the Basic Design Study Draft Report. The Draft Report Explanatory Team was sent to Mongolia for a period of 9 days, from July 2 to July 10, 1993 to explain the contents of the Basic Design Study Draft Report to the Mongolian counterparts. The Final Report incorporating changes to the Draft Final Report to reflect the opinions and comments of the Mongolian counterparts in regard to the Project will then be compiled and submitted to both the Mongolian and Japanese governments.

The prime objective of the Project is to stabilise the meat supply for Mongolia's urban population by means of expanding and improving the Darkhan Meat Plant, the deterioration of which is particularly noticeable. The project implementation body is the Darkhan Meat Plant which owns the subject facilities and the Project will be managed by the Ministry of Food and

Agriculture which plays a policy coordination role in regard to nationwide meat production activities. The Ministry of Trade and Industry, which is responsible for receiving Japanese grant aid, will have the overall responsibility for the implementation of the Project. It has been decided that the Project will have the following 4 components.

(1) Renewal of Existing Refrigeration Facilities

In order to minimise the leakage of ammonia, which comprises a health hazard for workers and which deteriorates the meat quality, and also to increase the cooling capacity, all the refrigerant pipes for cooling equipments (unit coolers), defrosting device and refrigerant circulation pumps and evaporater condensers of the existing refrigeration facilities will be renewed except those in the machine room.

(2) Establishment of Cut Meat Production Facility

In order to establish a production facility capable of producing 20 tons of boned cattle cut meat a day, the existing meat processing facility will be renewed through the installation of new equipment and improvement of the remaining facilities.

(3) Establishment of Rapid Freezing Facility for Beef Cut Meat and Internal Organs

The existing meat processing facility will also be replaced by a rapid freezing facility capable of rapidly freezing 30 tons of cut meat and internal organs a day.

(4) Expansion of Frozen Product Storehouse

A facility capable of storing 600 tons of frozen cut meat and internal organs and a refrigeration facility, inclusive of the facility described in (3) above, will be constructed. Loading/unloading equipment and transportation forklift(s) will be provided to facilitate efficient storage and loading/unloading work.

The original request for the renewal of the existing refrigeration facilities, confirmed at the project formulation survey stage, envisaged grant aid for replacement pipes and insulation materials, etc. while expecting the Government of Mongolia to conduct the actual renewal work. Renewal of the unit cooler(s) and defrosting device, etc. was then added because (a) it would be impossible to improve the refrigeration capacity by simply replacing pipes and insulation materials and (b) it would be impossible to prevent further leakage of ammonia gas from the deteriorated unit cooler(s) by the provision of new pipes and insulation materials. As ammonia is a toxic, inflammable gas, the planned renewal work would be risky and more complicated than the installation of completely new plant facilities. Accordingly, it has been

decided that the conducting of the work with Japanese grant aid is more appropriate so that advanced technologies are used under proper control.

The original request for the cut meat production facility ((2) above) envisaged a daily production of 30 tons of cut meat. In view of the fact that the proposed quantity is equivalent to the total weight of cattle to be slaughtered on a single day, it is thought to be unrealistic to assume that the entire quantity of carcass could be replaced by cut meat. As a result, the target cut meat production quantity has been downwardly revised to 20 tons/day.

With regard to the freezing facility for internal organs which would comprise part of the rapid freezing facility referred to in (3) above, a daily freezing capacity of 50 tons was requested at the time of the field survey. As the existing freezing and refrigeration facilities will be improved under the Project, the figure has been downwardly revised to 10 tons/day to make a total cut meat and internal organ freezing capacity of 30 tons/day on the grounds that the improved existing facilities will also be used for the freezing of cut meat.

The original request for the frozen product warehouse envisaged an additional storage capacity of 1,000 tons. As the storage of cut meat instead of carcass will reduce the storage space requirement by 1,000 tons, the remaining 600 tons will be catered for by the new facility.

The refrigerated vans included in the request at the project formulation stage have subsequently been ommitted from the Project as the transportation of meat products is not part of the operation of the Darkhan Meat Plant (project implementation body).

The contents of the basic design for the Project are outlined below.

[1]	Renewal of Existing Freezing and Refrigeration Facilities	
	[Phase 1 Work: Scope of Planned Renewal Work]	
	1) Renewal of all refrigeration pipes, valves with insulation materials from out of the existing machine room to each unit cooler	
	2) Renewal of all the unit coolers in the refrigeration room and the frozen product storage	
	3) Installation of a new defrosting device and a control unit as part of the drain system	
	4) Renewal of the evaporator-condensers and the refrigerant circulation pumps	
[2]	Cut Meat Production and Storage Facilities	
	[Phase 2 Work: Repair and Renovation of Existing Facilities and Construction of Freezing and Refrigeration Facilities].....	$1,350m^2 + 108m^2$
	Removal of existing meat processing facility (to be conducted by the Mongolian side).....	$1,350m^2$
	1) Refrigeration Facility	Changed purposed of the existing facility, partial repair of heat insulation doors and others..... $252m^2$
	2) Cut Meat Processing Room	Renovation of the existing facility, installation of new equipment..... $378m^2$
	3) Ante-Room and Material Storage	Renovation of the existing facility, installation of new equipment..... $78m^2$
	4) Internal Organ Packing Room	Renovation of the existing facility, installation of new equipment..... $48m^2$
	5) Cut Meat Forwarding Passage	Renovation of the existing facility..... $96m^2$
	6) Rapid Freezing Rooms	Renovation of the existing facility, 24 hours freezing, 10 tons x 4 rooms, use of trolley cars..... $144m^2$
	7) Loading Bay	Renovation of the existing facility, product transfer..... $168m^2$
	8) Substation	Renovation of the existing high voltage incoming panel, installation of new panels for the renovated facilities..... $60m^2$
	9) Existing Tie-Ins	Repair and renovation of the existing tie-in points..... $121m^2$
	10) Freezing and Refrigeration Machine Room	New, underground tank for defrosted water, outdoor evaporator-condensor..... $108m^2$
	[Phase 3 Work: Construction of Additional Facilities].....	$696m^2$
	11) Frozen Product Warehouse	New, storage capacity of 600 tons, 2 rooms, crawler pallet rack system..... $576m^2$
	12) Product Forwarding Passage	New, tie-in with the existing passage..... $120m^2$
[3]	Main Equipment to be Provided	
	[Phase 2 Work]	※ pallets : Phase 3 work
	1) Carcass Transportation Equipment:	Gambrel rails, carcass scales, dropper, trolley cars
	2) Meat Cutting Equipment:	Worktables, cut conveyor, chopping boards, knives, grinding bars, grinders, basin for disinfection
	3) Box Packing Equipment:	Turntables, packing tables, meat holders, weighing equipment, shelves, free roller conveyor
	4) Loading Equipment:	Trolley cars, manual lifts, forklifts
	[Phase 3 Work]	
	5) Storage Equipment:	Crawler pallet rack systems, pallets

As the work anticipated under the Project involves the repair and improvement of the existing facilities, it will be impossible to carry out all the planned work simultaneously. The 3 phases mentioned above will be necessary given the scope of work and the ongoing operation of the existing facilities. Each phase will require less than 12 months to complete, including preparatory work and removal work. The Mongolian side is required to conduct the work to remove the existing meat processing facility and to introduce intake wire (6kV) to the new substation at an estimated cost of 4,780,000 tugrugs (¥3,868,000).

The expected improvements of the existing freezing and refrigeration facilities of the Darkhan Meat Plant following implementation of the Project include:

① Improving the meat quality through an improved refigerating performance, thus resulting in reduced meat loss,
② Additional facilities to produce, freeze and store cut meat, alleviating the current storage shortage problem by 1,600 tons,
③ Contributing to increasing the supply of high quality, standardised cut meat to meet the growing demand of consumers for such meat,
③ Helping to secure a stable supply of meat, the principal food of the urban population, and for which demand is expected to steadily increase in the future, and
⑤ Reducing ammonia leakage which will improve the presently poor, even hazardous, work environxment.

The beneficiaries of the Project are some 100,000 people living in Darkhan and its vicinity, some 60,000 people in Erdenet and 20% of the some 600,000 people in Ulan Bator. In other words, the possible beneficiaries of the Project are some 13% of Mongolia's total population.

Implementation of the Project with Japanese Grant Aid is judged to be appropriate in view of the significant positive effects of the Project, including the improvement of urban life. Also, regarding operation and management of the Project, though the system on the Mongolian side is satisfactory in terms of personnel and funds, in order to fully recognize that the Project is intended to provide a stable supply of basic foods to the citizens of Mongolia during the transition to a market economy and to demonstrate the beneficial effects, it is essential to have a mutual cooperation system which includes not only the Darkhan Meat Plant (the project implementation body), but also the Ministry of Food and Agriculture (the administrative organization), and the Ministry of Trade and Industry (which hasa overall responsibility for the Project).

In addition, as liberalization of the meat place is a precondition, it is necessary to create a management and administrative system which can respond to the transition to a market

economy in order that a stable supply of meat is provided to the country. To meet this aim, it is important to educate personnel who possess management skills valuable in a market economy that the meat plant is able to supply high quality standardized meat, thus responding to the preferences of the Mongolian citizens of Mongolia. In this area, one idea is to employ Japan's technical trainees acceptance system.

In the future, using the Project as the base, it will be desirable to strengthen the ties between the Ministry of Food and Agriculture, the meat plants in each area and other concerned organizations, spreading the standardization of meat throughout the country and establishing a nationwide meat distribution channel.

БҮГД НАЙРАМДАХ МОНГОЛ АРД УЛС

Darkhan

Erdenet

Choybalsan

Ulan Bator

MAP OF MONGOLIA

CONTENTS

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

In response to a request for economic cooperation from the Government of Mongolia, the Government of Japan decided to conduct a project formation survey on a Project for Improvement of a Processing and Storage Facility for Meat, Dairy Products and Agricultural Products, the major food staples of Mongolia, commissioning the Japan International Cooperation Agency (JICA) to dispatch a study team to Mongolia from August 3 to August 27, 1992, headed by Mr. Takuo Kidokoro, Division Chief, Grant Aid Project Management Department. The study team had discussions with the concerned representatives from the Mongolian government and conducted a survey of the proposed site. The study team completed the survey results with the work they did after their return to Japan.

Based on this project formation survey and the Government of Mongolia's request for Grant Aid cooperation, the Government of Japan decided to conduct the basic design study for a "Project for Improvement of Mongolia's Darkhan Meat Plant" (hereinafter referred to as "the Project") and JICA dispatched a Basic Design Study Team to Mongolia, from March 11 to April 8, 1993, said group being headed by Mr. Hiroshi Ito, director of the Ibaraki Station, National Livestock Breeding Center, Ministry of Agriculture, Forestry and Fisheries. The team members, survey schedule and the list of members can be found in the appendix.

Based on the results of the project formation survey, the Basic Design Study Team held in-depth discussions with the concerned representatives from the Government of Mongolia, soliciting opinions in regard to the contents and scale of facilities and equipment. The group members explained the system of Japan's Grant Aid program and confirmed the contents of the Mongolian request, the details of the project and the operation and maintenance management plan, and collected related information and references, summarizing all of the above results in the Minutes of Discussions. The Minutes of Discussions can be found in the appendix.

Upon the return of the Basic Design Study Team, the basic design of the facility, equipment and maintenance management plan were decided on and a Draft Final Report was prepared based on analysis and study of the results of the above research. JICA dispatched another study team to Mongolia from July 2 to July 10 of this year, said team headed by Hiroshi Ito, to explain the Draft Final Report of the basic design and hold discussions with the concerned representatives from the Government of Mongolia and to finally obtain their agreement on the project contents.

Based on the above research, this basic design study report clarifies the objectives of the project and summarizes an optimum basic design proposal thereof.

CHAPTER 2

BACKGROUND OF THE PROJECT

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2-1 Outline of Mongolia

2-1-1 General information

Mongolia lies at the center of the Asian continent in an area defined by 41°35' ~ 52°09' N latitude and 87°44' ~ 119°56' E longitude. A landlocked country, it shares borders with the former Soviet Union to the north and China to the south, east and west. With a maximum length of as much as 2,392 km east to west and 1,259 km north to south, Mongolia has a land area of 1,566,500 km^2, well over four times that of Japan. The country can be roughly divided into two topographic zones; the northwest area, a mountainous region with an abundance of inland lakes and rivers, and the southeast area, an area of relatively low elevation consisting largely of regions of dried gravel called *govi* in the Mongolian language. Average elevation can reach as high as 1,580m above sea level and even in the lowest regions is 552m. Ulan-Bator, the capital, is situated at an elevation of 1,351m, while the highest site is found 4,374m above sea level, in the extreme west of the country, at the peak of Mönh Hayrahn Uul in the Mongol Altayn Nuruu (Mongolian Altai) range, which falls under the jurisdiction of Hovd Aymag (Hovd Province).

The climate is of the typical severe continental type. Located at the eastern end of the steppe climate extending from North Africa to Central Asia through the Near and Middle East, the climate is dry but cannot properly be called desert, and deep grassy plains called steppes extend across a wide range. The yearly precipitation is quite low at 100m to 350mm, however, the concentration of rain during the summer is an important factor in the creation of rich, deep, grassy plains. The period between summer and fall is the most comfortable season, and the Mongolian people especially prefer fall, referring to it as *altan namaru* (golden fall), though day-night temperature swings can be very large. In January, the coldest month, temperatures range from –15°C to as low as an extremely cold –33°C, while at the other end of the climatological pendulum, the month of July generally sees temperatures nationally in a range from around 14°C to 22°C. Air pressure is known to experience wild shifts in the spring, and gusty conditions and sandstorms are frequent occurrences.

2-1-2 Political situation

The supreme legislative body of the formerly socialist Mongolian nation was the Great People's Khural, or Parliament, and the executive body was the Council of Ministers, with each organization and the society being guided by the Mongolian People's Revolutionary Party (MPRP), the sole party in Mongolia's one-party political system. The party's guideline revised in 1966 states "the establishment of socialism has been completed and the nation has entered a period of transition to a Communist society" and expresses "cooperation with brother countries including the Soviet Union". Not only diplomatically but also economically the country strengthening their friendly relations with COMECON countries including Soviet Union.

However, since 1989, the repercussions of democratization of the former Soviet Union and other European countries have been felt throughout the country. In 1990, a multi-party system was introduced and renewal of domestic and international policies was actively promoted, thus Mongolia was reborn as a democratic country. The first free election was carried out in July 1990. As a result of this election, a new coalition government of the MPRP, Democratic Party and National Progressive Party was established. Assemblymen come from a multiple number of parties, with nine parties having registered to date. Under the new constitution, the country has a one-chamber system consisting of 76 members of a national assembly. This new constitution went into effect February 12, 1992 and is characterized by provisions describing the independence and democratization of Mongolia, the establishment of fundamental human rights, respect for freedom and diversification of the forms of ownership of property. Individuals are now permitted to own land, with the exception of pasture areas (nomadic lands) and certain other land areas.

2-1-3 Population

With a population calculated in 1991 at 2,187,200, the population density of 1.4 persons/km^2 is low. However, with an urban population of 1,236,000, accounting for 56% of the total population, the transition from rural to urban dwelling is underway. Moreover, since about 70% of the urban population is concentrated in major 3 cities—579,000 in the capital, Ulan-Bator, 88,000 in Darkhan (an industrial city), and 57,000 in Erdenet and its suburbs—the population density in areas other than in those areas is in fact less than 1 person/km^2. Annual population growth is relatively high, 2.68% in 1990 and 2.41% in 1991, because of an official policy encouraging population growth. Ulan-Bator, the capital, occupies an area of 2,000 km^2 and has about 600,000 people. Recently, the numbers of city dwellers have increased and become concentrated. However, this is not increase cannot necessarily be attributed to a natural phenomenon,

with it also being supposed that an increase in unemployment levels and a flow of people from other states are contributing factors.

2-1-4 Economic trends

Since 1987, importance has been placed on "achievement in profitability and quality improvements" for economic development. Policies to heighten independence and pursue profitability, and attempts to activate industries were carried out under the "Private Business Activation Law". Under the "Foreign Investment Law," adopted in 1990, capital investment and technical transfers from foreign countries have been actively promoted, with a special focus intended to welcome the expansion of exports, advanced technologies, resource utilization, maintenance of economic fundamentals and maintenance of tourist facilities.

Though many policies were carried out in an effort to break out of the economic doldrums, the effects of these policies were not immediately evident due to the rapidly changing political climate between 1989 and 1990 and the introduction of a market economy intended to end economic stagnation. During this important period in the development of Mongolia, various economic policies were imposed with the enactment of laws intended to facilitate the transition to a market economy. However, Mongolia, which relied heavily on the former Soviet Union, was severely affected by the collapse of the economies of the former Soviet Union and Eastern Europe which caused a sharp decrease in trade volume with the Soviet Union as well as the disappearance of COMECON. As a result, Mongolia is currently suffering from many problems such as the shutting down of factories due to the halting of the supply of various raw materials, a lack of fuel due to shortages in crude oil, shortages of electricity, decreases in facility function due to parts shortages, a halting of construction work due to a lack of construction materials and labor and a shortage of daily commodities. Major economic indices such as the income of production workers, industrial production volume, agricultural production volume, total investment value, total retail sales value, and trade balance figures showed increases over previous years until 1989, then dropped sharply in 1990, as did the ratio of project achievement. Also, the GNP in 1991 was 17,960 million Tugrug (fixed price equivalent to 8,345 million Trg in 1986 terms), $300 million ~ $400 million lower than the GNP of 9,545 million Trg in 1989 (fixed price equivalent to 9,361 million Trg in 1986 terms). The national debt in 1991 stood at 2,688 million Trg (about $477 million) and the inflation ratio in 1992 was 383%, with unemployment increasing to 55 thousand people.

The reasons for the current economic crisis are as follows:

① For 10 years to 1990, excessive levels of imports were covered by borrowing money from the Soviet Union but since 1991 it has become impossible to borrow money in this way,

② Settlement of trading accounts with the former Soviet Union and Eastern European countries now must be handled using convertible currency and at international exchange rates,

③ Transportation costs have risen sharply, and

④ Morale and organization in most of the production and service fields has deteriorated as the country has made the transition to a market economy.

2-1-5 Trends in industry

An 1991 analysis of major industry structure finds manufacturing accounting for 46.9% of the total, agriculture and livestock farming at 16.7%, commerce and supply 20.5%, transportation and communication 9.0%, and construction 6.9%. However, light industries such as food manufacturing and textiles which obtain materials from the agriculture and livestock farming industries account for a large portion of the industry. Also, since this industry supplies meat and dairy products which are staple foods of the Mongolian people, and occupies not an insignificant percentage of total exports, the agriculture and livestock industries are the key industries in Mongolia.

The agriculture and livestock industry used to operate under a socialistic production system consisting of a cooperative sector and a state-operated sector. However, with democratization accompanied by the introduction of a market economy, collective ownership *negdels* (cooperatives) — a symbol of Mongolia's socialism — were dissolved in 1991, thus individuals may now own livestock. With this, the livestock raising industry is still Mongolian's national industry, with 1992 livestock numbers estimated at 2,5660,000, about 11.7 head per person. However, in current years, livestock production volume has been slack. Sheep account for 60% of the livestock, with the remainder being made up of goat, cattle, horses and camels. The major agricultural products are grains such as wheat and feed such as potatoes, vegetables,, etc.

The mining and manufacturing industry expanded steadily until 1989 and manufacturing industry volume in 1989 has been estimated at 9,244 million Trg (fixed price equivalent to 9,182 million Trg in 1986 terms) but dropped to pre-1985 levels of 13,731 million Trg in 1991 (fixed price equivalent to 7,011 million Trg in 1986 terms). Fields having high production volume are food, textiles, leather, shoes, nonferrous metals (including mining of minerals), construction materials and electricity. Mongolia

is blessed with abundant mineral resources and has mineral deposits of copper, molybdenum, lead, zinc, tin, tungsten, gold, silver, fluorite, apatite, oil, coal and iron. Many areas are currently undeveloped. The most important mineral among the metal resources currently being mined is copper, accounting for 35% of total exports, and with deposits estimated to be among the top 5 countries worldwide.

2-1-6 Support from foreign countries and international organizations

According to the chairman's report of the London Summit held in 1991, advanced countries admitted the necessity of international cooperation to help alleviate Mongolia's economic crisis. Japan contributed ¥200 million in food support and ¥100 million in milk support. At the same time that Mongolia came to need international cooperation in terms of funding, a meeting of countries supporting Mongolia was held in Tokyo in September 1991, sponsored by Japan and the World Bank. At this meeting, loans of $153.6 million and donations of $48.8 million were pledged for funding Mongolia required by the end of 1991. Furthermore, a second meeting was held in May 1992 in Tokyo and at that time a total of $320 million in loans and cooperation within 18 months were declared to aid Mongolia in breaking through its economic crisis. Also, it was agreed to that about $70 million worth of supplies or funds would be provided in 1992. In addition to the 18-month aid program, the IMF, Denmark and China decided to provide grant aid, thus a total of $400 million in aid has been implemented from July 1992 to December 1993. An itemized statement is as follows:

[Unit : US$1,000,000]

Itemized statement of loans and aid to Mongolia (July 1992 ~ December 1993)	
International balance aid	138.0
Project fund aid	236.0
Technical cooperation	26.7
Food/product grants	7.4
Total	409.0

The concerned countries and organizations are as follows.

- Concerned countries : Japan, USA, German, Korea, China, Australia, New Zealand, Singapore, England, France, Italy, Holland, Kingdom of Brunei, Denmark, Russia, Sweden
- Concerned organizations : World Bank (WB), International Monetary Fund (IMF), Asian Development Bank (AsDB), United Nations Development Program (UNDP), European Community (EC)

Aid from countries and organizations other than Japan, including decisions made in the meetings of countries to support Mongolia, is as follows:

Country or organization	Type of aid	Value
US	Grant Food aid	US $10 million 30,000 tons of wheat flour
S. Korea	Loan Grant	US $10,000,000 US $1,000,000
France	Grant	Fr 1,000,000
Germany	Emer. aid Tech. aid	US $4,000,000 US $12,600,000
China	Loan	50,000,000 yuan
WB	Emer. loan	US $30,000,000
IMF	Emer. loan	US $30,000,000
AsDB	Emer. loan	US $30,500,000

The Mongolia aid committee has promoted the above aid and loans and priority in 1991 was given to raw materials, essential consumable goods, medical supplies and equipment and spare parts procurement necessary to such important sectors as fuel energy, agricultural products, transportation and export products. Detailed allocation was 21.2% for purchasing of equipment for medium and small size businesses, 11.2% for the food and energy sectors, 10.9% for the purchasing of food and commodities, and 20% or more for the transportation, light industry, construction and agricultural sectors, 6.2% for the social welfare sector and 15% for foreign currency reserves and training. The National Development Board, which is under direct control of the Prime Minister, was established in July 1992 as a window for economic support from foreign

countries. In October 1992, the second donor consultation conference was held in Ulan Bator with more than 20 countries participating.

2-2 Outline of National Development Plan

2-2-1 Past national development plans

During World War II the number of livestock head sharply decreased, thus the first 5-year plan (1948~1952) placed importance on agriculture and the livestock industry, then the second 5-year plan (1953 ~ 1957), 3-year plan (1958 ~ 1960) and the third 5-year plan (1961 ~ 1965) were carried out, striving to establish socialist agriculture and grouping of the agriculture and livestock industries. Following this, subsequent planning up until the eighth 5-year plan (1986 ~ 1990) were carried out with the main goals being industrial production development and agricultural development with support from the Soviet Union, China and Eastern European countries.

The major objective of the eighth 5-year plan was to improve the people's welfare by expanding production and improving its efficiency and satisfactory achievements were obtained in such fields as refining the energy foundation, developing resources, investigating mineral deposits, and improving technologies for processing agricultural and livestock products. However, there are an abundance of problems such as the low growth rate of national income, lack of employment against increased population, no achievement in the establishment of a high value-added type economic structure, an unequal economy, an imbalance between foreign trade prices and international market prices, increased production material costs and a shortage of commodities.

2-2-2 Current national development plan

Accompanying the establishment of the new government in 1990, in November 1990 a program was introduced through which the economy is to be changed to a market economy within 3 years, starting in 1991. However, because of the resultant confusion due to rapid democratization and the introduction of this market economy, the next 5-year plan has not yet been worked out.

The main points of the 3-year plan starting in 1991 are:

① Permit private ownership and distribute 2/3 of national property to all citizens equally, and promote privatization of companies, and

② Reform the foreign trade and monetary system and eventually plunge into a floating price system and establish the legal foundation for a free economy.

During the two years since 1991, the previous planned economy was abolished and the Mongolian economy experienced a revolution in its structure. The rebuilding process is still ongoing.

Since 1991, the Government of Mongolia has been taking appropriate measures aiming at privatization, market-driven pricing, a rebuilding of the financial services industry, a freeing of trade and opening up of the economy. Unfortunately, however, the economic level of Mongolia's citizens is still low and the country is facing difficulties in achieving economic rebuilding.

The objective of the Government of Mongolia's short term plan to overcome this crisis is to carry out a policy which can accelerate the transition to a market-driven economy. To achieve this goal, the government of Mongolia is taking the following measures.

- Completion of privatization within a minimum period of time.
- Liberalization of remaining government-controlled prices.
- Revision of existing laws to fit within a market economy framework.
- Establish appropriate measures to secure fuel and energy supplies for industry and exports.

The medium term policy is concentrated on the following:

- Securing of the financial stability of the economy.
- Establishment of a market economy and implementation of structural reform to strengthen private business.
- Establishment of a social welfare system to break down endemic poverty and support weaker social elements.
- Implementation of an open economic policy and promotion of foreign investment in Mongolia.

The aim of the above policies is to end the current economic crisis and establish a foundation for future economic growth. It is expected that a stable production environment will be created and improvement to the quality of life will begin within 2 years. The economy is expected to start growing again as of 1995.

2-3 Current Situation in Regard to the Food Supply System and Related Matters

2-3-1 Current food production condition

Mongolia has had an agriculture and livestock industry for centuries, chiefly due to conditions of nature such as geography and weather. Livestock raising, especially, is the main industry as most of the population used to be nomadic. Though it was initially small scale, grain production began in 1940 and the production volume increased steadily. Grains (mostly wheat) and potatoes are grown as food and others are mostly used as feed. For this reason, the people rely on livestock products such as meat and dairy products produced through traditional livestock farming for a large portion of

their food. According to statistics supplied by FAO in 1989, the calorie intake ratio per person in Mongolia is 35% from livestock products, while the world average is 84% from agricultural products and 16% from livestock products. Moreover, the Mongolian people take 59% of their total protein from livestock products compared to a world average of 3%. Therefore, livestock products are truly the staple of the Mongolian people.

Concerning grain production, accompanying the transition to a market economy in the 1991~1992 period, 70 government runs farms and 200 production cooperatives were resolved, being divided into approximately 1,000 companies to date, and the scale of farming has been reduced. As a result, during the period of the planned economy, tractors introduced by the former Soviet Union for use in large scale farming are no longer being used effectively. Moreover, on top of unstable weather conditions, to further add to Mongolia's problems the collapse of the economies of the former Soviet Union and Eastern Europe has resulted in the stagnation of imports of materials essential to Mongolia's cultivation agriculture, including spare parts, fuel, fertilizer, agricultural chemicals, etc. There has been a sharp drop in grain production, from a high of 835,500 tons in 1989 to 490,600 tons in 1992.

According to statistics available as of November 1992, the average per day calorie intake is 1,875 kcal in urban areas and 2,092 kcal in rural areas, a large decrease when compared to 1989 figures of 2,408 kcal in rural areas. It is expected that the population will come to even more heavily rely on livestock products as food sources in the future.

The number of livestock in Mongolia in 1991 was approximately 25.66 million head, with breeding livestock occupied 11.64 million head. However, recent slackening in the livestock industry is serious in that production of meats which are a staple cannot keep up with population growth. As a result, the amount of meat available per person has been declining consistently. Against the backdrop of a doubling of the Mongolia population over the past 30 years, the number of livestock has reached a ceiling level of between 23 million and 26 million head. Consequently, meat production per person has been decreasing every year, 193.7 kg in 1960, 144.1 kg in 1970, 136.4 kg in 1980, 123.9 kg in 1985 and 119.9 kg in 1990. This symbolizes the stagnation of Mongolia's economy. Currently, the average yearly meat consumption per person is supposed to be 88 kg in urban areas and 120 kg in rural areas and the average yearly demand for dairy products is thought to be 270 kg per person.

2-3-2 Current situation in regard to food distribution

Even though an open market economy has been officially announced, the Government of Mongolia is still having trouble controlling production of the basic agricultural

products and market sales in the current transition period. National production targets are currently assigned to meat and wheat. At the same time, the government assures farms of markets for their products under government instruction and sets the lower limits for prices paid to farms. However, as a result of implementation of market policies throughout the entire economy in January 1991, the prices for basic agricultural products have soared.

In the spring of 1991, laws were enacted providing for the private ownership of assets and livestock farmers and the prices were liberalized with farmers able to to freely increase production and sell livestock. In January 1991, the government implemented liberalization of prices except for 34 items including meat and by the middle of the year, the prices for all but except 17 items had been liberalized. Concerning major foods, i.e. wheat and meat, a ration system was introduced in February 1991 and following that prices were lowered substantially several times.

According to government resolution No. 20 decreed in January 1991, the lower limit purchase price of sheep and goat meat increased 65%, and the prices for horse meat tripled and cattle meat doubled. The agreed sales price of sheep meat in the summer of 1992 was 35 Trg per kilogram and in the winter was 120 Trg per kilogram. In November, 1992 the government implemented liberalization of prices of all products including wheat and meat, but the rationing system is still being used. Concerning energy resources such as electricity, the government still controls prices and it is planned that prices will be increased sharply in June this year, thus it is expected that the prices for wheat and meat will soar after July.

Concerning meat, an important staple of the Mongolian nation, meat plant production and market sales are still controlled using a rationing system. In 1991, annual national orders for meat totalled about 216,000 tons (measured by weight of livestock). However, since production costs exceeded the purchase prices, the corporate side took measures to decrease national order, thus production volume decreased to 181,000 tons. As a result, consumers obtained only 85% of the total demand at cheaper national price, and the remaining 15% had to be obtained on the open market. Since then, this tendency has been expanding, to the point where the amount of supply of rationed meat has decreased to half of production capability and meat prices on the open market have increased to 1.5 ~ 2 times that for rationed meat. Meat supply to the open market is limited to the slaughtering period during the fall to winter because of a lack of storage facilities, and from spring to winter, people depend on rationed meat supplied mainly from meat plants which have storage facilities.

There are three major slaughterhouses and three meat plants, with annual meat production totaling about 64,700 tons in 1987 and decreasing to 49,600 tons in 1991.

The total storage capacity of these plants is 19,500 tons. These plants have to respond to the demands of at least 700,000 people in urban areas and this amount is estimated at 61,600 tons of dressed meat. In addition to the economic reasons detailed above, since the amount of livestock received by slaughterhouses varies widely depending on the season, 11,000 tons of meat storage is in fact inadequate. Furthermore, sometimes stored meat spoils in the summer due to inadequate maintenance control that has its roots in the obsolescence of facilities and equipment and a lack of spare parts.

Generally, slaughterhouses and meat plants do not remove bone and classify meat, instead transferring meat as a form of carcass (slaughtered body) to the commerce (trading) system, then retailers cut carcasses and sell meat at 3 different pricing levels. On the other hand, though consumers prefer boneless and classified meat, supply of cut-meat has not spread, except in certain limited areas, because meat plants have difficulty in obtaining spare parts and equipment or packing materials. The sales price for rationed meat is determined by each meat plant under government instructions and the retailers specified by each meat plant sell at a common price to which expenses are added to the above price.

2-4 Current Situation Regarding Agriculture and Livestock Farming Industry Policy

The livestock industry developed considerably over the past 30 years under the planned economy system; however, the resources of the wide range of livestock fields have not been fully utilized. It has been pointed out that an inappropriate centralized power policy and sales system, improper agricultural price policies and insufficient veterinary work and bleeding work limited the development of the livestock industry and production growth and also caused a tailing off of producers' will to be independent and social problems having to do with depopulation and aging. To cope with this situation, the government has permitted private possession of livestock with the intention of increasing production enthusiasm and has promoted the rapid transition to a market economy. The country is still in a transition period; reform of the retail sales system has not yet reached a stable condition and pricing policies have not had a satisfactory effect.

In particular, the expansion of selective breeding and breeding work necessary to improve the quality and productivity of livestock production, and improvements in the veterinary industry which currently suffers from an acute shortage of medical supplies and equipment, are critical subjects for the Ministry of Food and Agriculture. Also, government-run farms and cooperative firms have lost the feed market and its production has decreased due to the collapse of the planned economy system. Assorted feed factories in urban areas have almost completely ceased operations because they

have become too old and parts are difficult to obtain, because there has been a sharp decrease in the production of feed corps (the 1992 harvest was about 40% of the average harvest over the 1986 to 1990 period), and also because production costs have increased due to soaring fuel costs. Thus, it is expected that for the time being there will be continuing shortages of feed in the winter months.

As explained above, there are many subjects remained in the livestock production, thus the role the Ministry of Food and Agriculture will assume is significant to the stabilization and expansion of production. On the other hand, for meat production, an priority urgent subject is to improve large scale facilities in city areas. It has been desired that policies are instituted which closely link production of livestock and livestock processing, that is promoting the building in each local area small scale slaughterhouses equipped with refrigeration facilities in order to decrease the distance between production, processing and consumption, thus increasing economic efficiency. Also, it is vital to activate local areas by elevating small scale industries such as processing of related by-products, etc. To implement these policies, it is necessary to have planning and implementation ability. Also technical guidance ability must be improved and investment funds must be secured. The Ministry of Food and Agriculture yields significant influence over the production of meat livestock and takes an important role in the improvement of the meat production system. At this time, the distribution system — from livestock raising to meat production to consumption — is in the process of being reformed. Providing market information to manufacturers and consumers, improving transportation, brokerage and wholesale systems and systematically improving and refining quality control and establishing standards are essential to improving the current condition. Therefore, in the future, to ensure a stable supply of meat, a very important food source among the basic Mongolian staple foods, it is important for the Ministry of Food and Agriculture and meat processing facilities to have close ties, clarifying and implement their roles efficiently based on national policies.

2-5 Current Condition of Meat Production and Outline of Meat Processing Facilities

2-5-1 Outline of meat processing facilities in Mongolia

Currently, the large scale meat plants (combinate) are in the three major cities (Ulan-Bator, Darkhan and Choybalsan) and major slaughterhouses are in three local cities (Uliastay, Saynshanod, and Olgiy). A medium scale meat plant currently under construction is planned to begin operations in 1993 in Barkhangay. Among these facilities, the Government of Mongolia owns more than half of the three large scale meat plants and they fall under the control of the Ministry of Food and Agriculture.

These plants are operated based on natural conditions and the nomadic system unique to Mongolia. They are currently being operated for about 130 days from the beginning of August to the middle of December and an average of more than 250 processes are not operated each year.

Location	Year began operation	1 process cycle capability				Freezing capability tons/day	Refrigeration capability (tons)
		Carcass (tons)	No. stocked				
			Large	Small	Pig		
1. Ulan-Bator	1968	120	400	4,000	100	240	16,000
2. Darkhan	1974	50	170	1,300	—	100	3,400
3. Choybalsan	1970	50	120	1,200	—	100	2,000
4. Uliastay	1984	5	40	300	—	10	450
5. Saynshanod	1986	5	40	300	—	10	450
6. Olgiy	1991	5	40	300	—	10	450

Province where found: 1. Seleng, 2. Dornod, 3. Zarkhan, 4. Dornogori, 5. Bayan 6. Ölgiy

*Source: The Ministry of Food and Agriculture

(1) Ulan-Bator meat plant

The Ulan-Bator meet plant (combinate), the largest plant, was built in 1964 with the economic support of the former Soviet Union. It was then expanded and its facilities were renovated through the technical and economical cooperation of what was then East Germany and renovated first term operations began starting in 1968 and second term operations began from 1971. Though the facilities are old and the processing technology is obsolete, maintenance control is relatively good and the networking rate is high, thus meat production was 26,000 tons in 1991 and was 18,000 tons in 1992 against a yearly production capability of 31,000 tons. This plant consists of four major facilities; the slaughtering and dismantling facility, freezing and storage facility, cut-meat processing and packing facility, and sausage and canning production facility. In addition to the four main facilities, there is also a casing production facility and meat laboratory under joint management with Germany. Besides carcass, 1,500 tons of cut-meat, 4,500 tons of sausage, 600 tons of cooking oil, 880 tons of bone meal and 420 tons of canned products are produced here.

(2) Choybalsan

The Choybalsan meat plant was built with the technical and economic assistance of Bulgaria and began operations in 1970. Against the yearly production capability of 13,000 tons, it produced 8,400 tons of meat in 1991 and 7,300 tons in 1992. Besides carcasses, this plant produces 480 tons of sausage, 360 tons of cooking

oil, 140 tons of bone meal, 210,000 casings and 22 tons of by-products from the primary processing of leather.

(3) Uliastay

The Uliastay slaughterhouse was built with the assistance of the former Soviet Union and began operations in 1984 and is intended to supply meat to the residents of Uliastay. In one process cycle, 40 large livestock and 300 small livestock can be slaughtered and dismantled and 5 tons of meat and 0.6 tons of sausage can be produced. The plant produces 1,500 tons of meat, 50 tons of sausage, 40 tons of cooking oil, 60 tons of soap oil and 60,000 casings for export. In addition to the above, this plant also has facilities for the production of bone meal and the primary processing of leather.

(4) Saynshanod

The Saynshanod slaughterhouse was built in 1986 through the cooperation of the former Soviet Union. One process cycle can produce 5 tons of meat and 0.6 tons of sausage and there are facilities for bone meal and cooking oil production, casing processing for export and the primary processing of leather.

(5) Barthangay

Currently, a medium-scale meat plant intended to export processed meat such as sausage is being constructed in Barthangay with a loan from Finland and it is planned that operations will be begin within this year. These Finnish-constructed facilities are designed to have an annual capability to slaughter and dismember 20,000 horses, 6,000 cattle, 20,000 sheep and goat and 6,000 pigs and has 800 tons of freezing storage capacity.

2-5-2 Positioning of the Darkhan Meat Plant in Mongolia's meat industry

Darkhan, situated 219 km north of Ulan-Bator, the capital, was built having functions as an industrial city supplementing the capital, thus paved roads and a railway link to the capital have been provided. The Darkhan Meat Plant (complex), the second largest in the country, was built in 1974 with the cooperation of Hungary as a government-run company intended to supply meat to cities such as Ulan-Bator, Darkhan and Erdenet. It had been operated under the national plan until 1990 with an annual budget of 20,000,000 Trg. However, with the privatization of companies, it has become a joint-stock corporation, 51% owned by the Nation. Government resolution No. 170 decreed in 1992 specifies all government run companies and companies which should be joint-stock corporations whose majority of stocks are owned by the government. The three meat plants including Darkhan Meat Plant are included. In order to change those

government run corporations and half-private, half-government corporations, a resolution is required by the privatization committee, which is an organization equivalent to the cabinet. The committee has expressed that they don't have a policy to privatize those meat plants because of food policy. Darkhan Meat Plant has 730 employees and can produce 15,000 tons (volume of living body) of carcass a year and also produces processed products such as sausage, animal oil, bone meal, and secondary products such as leather and casings for ham and sausage. 40% of these products are shipped to Ulan-Bator, 30% to Darkhan, 20% to Erdenet and 10% to other neighboring municipalities. However, the installed equipment was made in 1960s and mostly has not been renovated, thus is very old and decrepit. The condition of the refrigerating and freezing equipment is especially poor, and leakage of anmonia as refrigerant, corrosion of the metal part of piping and peeling of mortar in the finished walls can be seen here and there. Because of this, the storage condition is extremely bad, thus appropriate quality cannot be maintained in its present condition. Also, because of the influence of privatization of ownership of livestock, acceptance of meat livestock which used to begin in June is now started at the beginning of August, meaning that the period of time when slaughter processing is not carried out is increased, while, on the other hand, in some seasons the amount processed per day has been increased some 50%. For this reason, 5,000 tons of storage is necessary. With current capacity at 3,400 tons, storage capacity is 1,600 tons short of this goal.

On top of such unstable acceptance of meat livestock, the purchasing price has become twice the lowest standard price of the government, and moreover, government controls on prices have resulted in a further deterioration of the management situation.

Because of the above situation, the government of Mongolia believes that improvement of the structure the supply of meat to Ulan-Bator, Darkhan and neighboring towns where the population is most concentrated is a subject that urgently needs to be dealt with. Compared to the Ulan-Bator Meat Plant, improving the Darkhan Meat Plant, whose facilities and operation are in very poor condition, is of the highest priority, thus it is necessary to implement an improvement plan which has as its central aim the improvement of existing freezing system and cut-meat production and storage facilities which have high value-added potential and on which future demands will be large.

(1) Role and current condition of the Darkhan Meat Plant

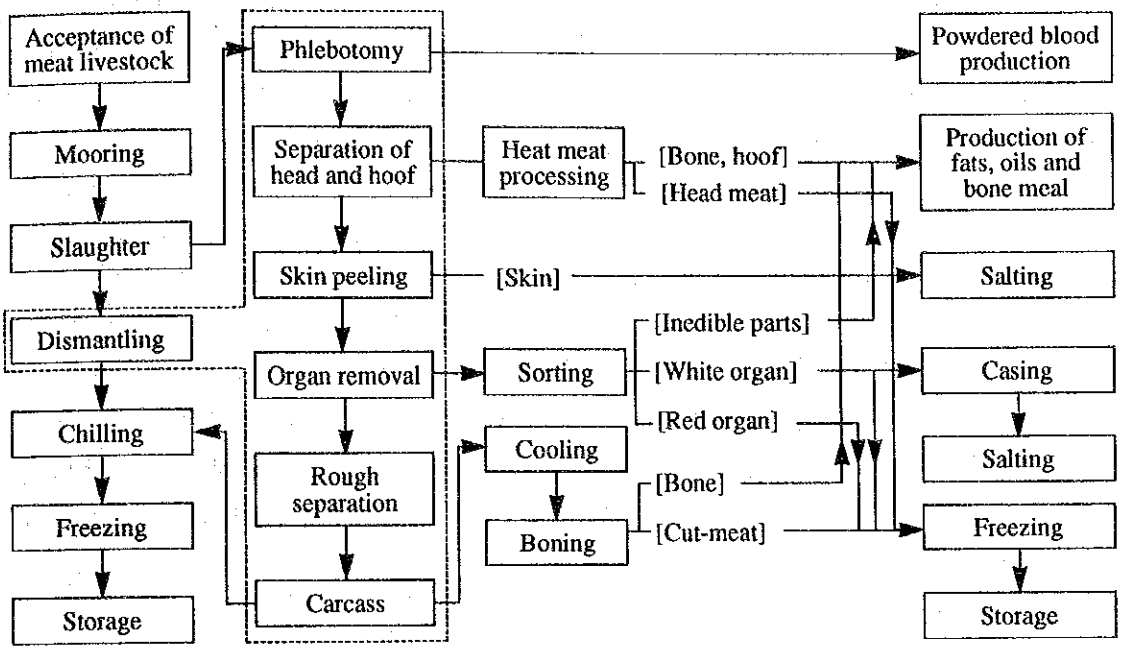
The role of a meat plant is to purchase meat livestock raised by livestock farmers and slaughter it, sanitarily processing it into meat products and then selling it. In order to ensure a stable supply of meat under the present condition wherein the period of acceptance of meat livestock is concentrated, it is necessary to store processed meat in a streamlined way and adjust delivery accordingly. To do this,

securing a constant storage capability is essential. Also, to stabilize the supply price, it is also necessary to promote the storage of boned cut-meat and suppress the storage cost by using efficient storage methods such as decreasing the relative freezing capacity. On the other hand, with the transition to a market economy, the volume of meat that stock farmers bring directly to the open market has been increasing, thus, the necessity of ensuring control of quality and sanitary conditions has increased. For this reason, the role of a meat plant is not simply of increasing production but also controlling sanitation and establishing standards to stabilize meat quality. It is necessary to establish standards for boned cut-meat based on a part classification scheme and to safely and sanitarily store and distribute them to consumers in a manner which is efficient and predictive of their needs.

Unfortunately, the Darkhan Meat Plant has currently exceeded its limits in terms of its slaughtering and dismantling capability due to the concentration of the livestock acceptance period which is has been exacerbated by the liberalization of meat livestock prices. In addition, meat storage capability has decreased due to decrepit facilities and equipment, and moreover, the quality of stored products has deteriorated. Measures to solve these problems include the repair and improvement of refrigeration facilities and an expansion and streamlining of production and distribution of cut-meat which enables the implementation of quality standardization.

The production and storage of cut-meat will not only secure stable quality but will also promote efficient storage and distribution and reduce relative operating costs, enabling increased income from value-added sales which respond to consumer requests. This provides not only a direct effect on improvements in the operation of meat plants but also indirectly affects the improvement of Mongolia's food distribution system.

[Meat production process]



1) Acceptance and queuing

Under the previous planned economy system, the Darkhan Meat Plant accepted meat livestock from June to December, however, with the implementation of private ownership of firms, it has become concentrated between the beginning of August and the middle of December during which time meat livestock grow the fattest. Since the scale of the existing livestock lot is estimated from its production capability, livestock transferred while grazing cannot be accommodated and a queue of such animals can be seen grazing in pasture lands around the plant during the peak of the season. This condition suppresses the operation of the meat plant in various ways as explained previously. This condition of concentration is expected to continue for the time being; however, it is also possible to predict that there will be a gradual stabilization of this situation as the brokerage system is improved and the spread of market information is promoted, resulting in the balancing of demand and the sale price. Therefore, the priority order for improvement of the livestock lot can be seen to be lower compared to the aspects explained below and improvement from an operations aspect, including in the relationship with other, related organizations, is rather necessary.

2) Slaughter and dismembering process

Slaughtered livestock are bled, skinned, disemboweled, washed, and then dismembered into carcass form. There are two existing slaughter lines, one for

large sized animals such as cattle and horses and the other for sheep and goats, a small sized animal. Since pigs, a medium sized animal, are slaughtered in a different season, they are processed in the same room as large sized animals and part of the equipment is shared. On those lines, the heads and hooves are cut off and large sized animals are quartered, medium sized animals are halved and small sized animals are dismembered in whole. The processing capability per day is 340 large sized animals, 30 medium sized animals and 2,600 small sized animals. However, during the peak season, it is necessary to process 400 large sized animals and 4,000 small sized animals per day, thus a rotating 16-hour shift system is used. Equipment such as the carcass hanging rail is obsolete and is not automated, thus a large portion of the work is performed manually. Though the facilities are old and there are problems with the heating and ventilation facilities, these conditions have not yet critically affect the work performed here.

Modifying the facilities and improving the equipment used there are effective in improving sanitary control and processing capacity. However, investment in facility and equipment and the maintenance control for this is too significant of a burden in present management circumstances. Also, since the operation time is limited, significant investment effect cannot be expected.

3) Refrigeration and freezing

Meat always goes bad and spoils when it is left raw. To store meat while preventing changes in quality and spoiling, simply preventing microbes from being generated is not enough. The metabolism must be weakened and maturation must be forcefully suppressed. Fresh meat is not preserved as is but also must be deformed and processed to preserve it more safely, and in fact the temperature of animals does not fall immediately after they are slaughtered. Rather, it rises for a time due to heat expended in rigor mortis, then falls. A temperature of 30° ~ 40°, which is a combination of slaughtered animal temperature and rigor mortis heat, provides conditions favorable to the action of enzymes and the generation of microbes, thus accelerating changes in quality of meat and meat spoilage. Therefore, it is necessary to cool animal bodies immediately after slaughtering. The internal temperature of the dead animal body is cooled to +3 ~ 5°C in a essential process called chilling. Animal bodies need to be refrigerated or frozen and this must be done after chilling. The main storage methods for raw meat are refrigeration and freezing. Generally, the freezing storage method is used in Mongolia because of its climate and transportation conditions.

In the existing facility, a carcass is chilled for about 8 ~ 10 hours in chilled carcass room, then is frozen in 12 ~ 24 hours in a rapid freeze room at a temperature of about -35°C. Frozen carcasses are stored in refrigerated storage. The chilled carcass and freeze rooms are tunnel-shaped and are equipped with a carcass hanging rail; a refrigeration unit which uses ammonia as a refrigerant is installed on the ceiling slab, said unit consisting of an air-blowing fan and coil evaporator equipped. The defroster on this evaporator does not work, thus there is conspicuous corrosion of the pipes and valves. Ammonia can be smelled in the room and leakage of the ammonia refrigerant has a damaging effect on meat quality and employee health. The causes of this leakage are supposed to be corrosion of pipes and valves due to condensation generated due to obsolete pipe heat insulating materials or obsolescence of gasket materials. Deterioration of the floor concrete and finished mortared walls is severe and the cooling capability has decreased. Refrigerated storage is a flat loading type with no carcass hanging rail and a wall-hanging type cooling units have been installed. The facility and equipment used for this aspect of refrigerated storage are also old and the smell of ammonia is noticeable, thus it is in bad condition as well. As explained above, it is absolutely essential that the conditions of the existing storage facility—which are the most critical factors in ensuring stable meat supply—be improved.

To solve the present problem, a lack of storage capacity, it is necessary to employ an efficient storage method which has less of an associated burden in terms of management costs. That is, it is necessary to expand processing and storage facility for cut-meat and ensure a stable supply of sanitary-controlled safe and standardized meat to consumers. This will increase the added value of meat and eventually help to increase sales income, thus management can be improved.

4) Cutting and processing

As explained before, aside from carcass processing, the existing plant produces 800 ~ 900 tons of processed meat products such as ham and sausage, 300 tons of animal oil, 300 tons of bone meal, 400,000 casings for ham and sausage using organs and 100 tons of the secondary products such as leather. Cut-meat is not processed. The Darkhan Meat Plant has a plan to separate the function of producing processed meats such as ham and sausage from other functions and expand them by themselves. This will enable the production of cut-meat by modifying existing functions to allow for cut-meat and utilizing and introducing necessary equipment. Cutting processing for cut-meat increases storage

efficiency as explained above and enables the production of animal oil or secondary products such as bone meal. Also, since the processing techniques employed are part of the steps already being employed in the processing of ham and sausage, the current workers are capable of performing the work.

5) Delivery

A railroad spur has been installed in the existing plant and most carcasses and processed products are delivered using the railroad; only a small amount of products are delivered by trucks to Darkhan City and neighboring towns outside the railroad line. Though a product transportation infrastructure does exist, there seems to be many problems in terms of efficient operation to catch up with the rapid transition to the market economy. For example, railroad freight is currently restricted in terms of volume and time in such a ways as to adjust shipments to meet demand trends necessary to stabilize the price. Therefore, the necessity for highly flexible truck transportation is inevitably expected to increase.

Currently, frozen carcasses are transported without being packed, however, cut-meat must be packed and transported for sanitary control. A recycling system using plastic containers is a good idea but using plastic film and cardboard boxes is sufficient. It is possible to obtain such packing materials because they are already used for processed meat or organs.

6) Refrigeration facility

The refrigeration facilities of the existing plant consist of a flooded system using ammonia as a refrigerant and it is operated from the machine room using a centralized system. In Japan, ammonia-based facilities used to be used for large sized refrigerators before the introduction of freon-based systems, but is not now widely used as a refrigerant. System temperature control is performed according to the following flow.

• Fresh body	38°C ~ 40°C
• Chilled carcass storage	0°C, carcass surface temperature 4°C / 8 ~ 10 hours
• Rapid freeze room	Carcass surface frozen at –35°C, core temperature 7 ~ 8°C / 16 ~ 24 hours
• Refrigerated storage	–18 ~ –20°C

Installed major equipment, refrigerant piping facilities and ammonia leakage condition are as follows.

① Compressor

The renovated compressors were constructed in Poland in 1984. Twelve freezers are operated in the following 3 systems. They employ open-type multicylinder compressors and are durable, thus there it seems there is no problem in that area for the time being.

–10°C system : 160 kW (4 units), 200 kW (1 unit)

–30°C system : 75 kW (1 unit), 200 kW (1 unit)

–45°C system : 200 kW (5 units)

② Evaporator condenser

A visual check has revealed problems such as considerable corrosion on the coil section because it is installed outside and damages caused during maintenance or cleaning at time of repairs. For this reason, there is a very high possibility of the occurrence of ammonia leakage. Furthermore, the surrounding valves and piping have aged and some of the chilled water circulation pumps have broken down, thus it will be necessary to renovate them.

③ Evaporator (unit cooler)

Each cooling room has this equipment and there are problems due to long term operation. For example, the fan has fallen off of the unit cooler installed in the passage, thus the cooler cannot fully perform up to its original power. Defrosting is a common problem. This plant uses the hot gas system (using compressed refrigerant gas as the heating source) for the cooling system. The drain pans of equipment in many of cooling rooms have fallen off and water generated as a result of defrosting is being discharged onto the floor. It is only conjecture to say so, but it seems that the operation of the system was not so good from the beginning. Drain pipes

are not being correctly used to accommodate the water spray defrosting system installed in the chilled carcass storage and rapid freeze rooms, and this defrosted water freezes, thus the system is not being fully utilized.

④ Auxiliary equipment

Auxiliary equipment, including the receiver tank, inter-cooler, and gas purger, are static, thus obsolescence is not a big problem. However, the condition of the heat insulation coating of parts of the equipment continuously exposed to low temperatures has deteriorated considerably and the part of the liquid pump used for refrigerant circulation, where there is constant icing and dewing, has suffered a great deal of external corrosion.

⑤ Piping facilities

Major pipes are heat insulation coated but have suffered severe damage due to deterioration caused by aging. Especially, the control valve around the evaporator is rusted due to metal corrosion and is not functioning. Concerning the piping for the ammonia refrigerant, the inside of the pipes is not corroded and there is only limited corrosion on the outside, however, the durability of heat insulation is a problem, thus periodic repair is definitely needed in the future.

⑥ Electricity and automatic control facility

Generally, control of each piece of equipment, setting of the room temperature, and warning of failures in the refrigeration facility is performed with electric signals. In this plant, a minimum scale electrical control system has been installed, but it is practically nonfunctional due to deterioration caused by aging, voltage fluctuations and frequently occurring electric failures, and also control is not reliable at all. Currently, the person in charge of this aspect of plant operations manually controls conditions by observing each pressure gauge and thermometer.

⑦ Ammonium leakage condition

During the field survey, ammonia leakage condition of the above existing refrigeration facility was measured using an ammonia detector (Riken portable NH_3 detector : model no. NH-275). The measured values are as follows. To date, considerable amount of ammonia has leaked, thus it is time to renovate all of the equipment. Also, according to the results of an investigation conducted through interviewing those concerned, the amount of ammonia replenished annually reaches 30 tons and 15 tons or more refrigerating machine oil is consumed. This means that the amount of

ammonia leakage is several times as much as normal based on the size of the whole facility.

Passage between chilled carcass storage and rapid freeze room	:	15 ppm
Inside storage area (during cooling)	:	25 ppm
Machine room	:	Could not be measured (more than 150 ppm)
	:	40 ppm (re-investigation the following day)
Ham and sausage processing room	:	20 ppm and 35 ppm

Reference : Standard to Measure Ammonia Density in Air
American Industrial Hygienic Committee (ACGIH)

5 ppm	:	Can smell
15 ppm	:	Feel unpleasant
30 ppm	:	Person in charge needs to go out for a breath of fresh air
50 ppm	:	Can't stay in the vicinity for more than 5 minutes
5,000 ppm	:	Life-threatening
150,000 ppm+	:	Combustion

ACGIH (workplace environmental tolerance):

25 ppm or less (Average density for 8 hours)
35 ppm or less (Average density for 15 minutes)

7) Maintenance control condition

It can be said that the major factors contributing to the obsolescence of the current facilities and equipment resides in maintenance control. However, it is not a matter of technology per se; the fact is that a large part of the problems are caused by operation management, that is, economical operation and structure such as procurement of spare parts or the arrangement of personnel.

2-6 Background and Contents of Application

2-6-1 Background of application

The Government of Mongolia is currently carrying out a 3-year plan that began in 1991 intended to introduce a market economy system. Importance is placed on economic reform, development of the livestock farming industry and increasing the volume of industrial production. However, due to market confusion resulting from a too-rapid introduction of free market principles, as well as to repercussions from the collapse of Communism in Eastern Europe and the disintegration of the Soviet Union, the Mongolian economy has fallen on hard times. Moreover, the country's food situation—meat, dairy products, wheat, etc.—has become more severe as each year passes. In part this situation is due to a drop in production stemming from unseasonable weather and the various circumstances in the agriculture and livestock farming industry. A greater cause, however, is the failure to use the country's produce efficiently: stored goods often end up rotting or deteriorating due to inadequate or superannuated storage facilities and distribution equipment. In order to ensure a stable supply of food products to the people of Mongolia, the Government believes improvement of processing and storage facilities for agricultural and livestock farming products are urgent subjects.

Currently, large scale meat processing plants at Ulan-Bator, Darkhan and Choybalsan and the local meat plants at three locations are being operated and operation of one more local meat plant is planned in 1993. The second largest city in the nation following Ulan-Bator, Darkhan City has a population of approximately 100,000, if the population from the surrounding suburbs are taken into account. The Darkhan Meat Plant provides meat to Erdenet and Ulan-Bator as well as Darkhan. However, the major facilities of this plant as a government-run company were built in 1974 with the assistance of Hungary and thus the major facilities and equipment currently being used were actually made in the 1960s. Therefore, the machines are extremely old and in need of repaired. Unfortunately, with the dissolution of COMECON it has become especially difficult to obtain spare parts. Furthermore, since the country's urban population has been increasing rapidly, it has become necessary to expand the capacity of the refrigeration facilities. Therefore, as a way to help stabilize the supply of meat to its people, the Government of Mongolia applied to Japan's Grant Aid program for the purpose of improving and expanding the refrigeration facilities at the meat plant in Darkhan City.

Based on the application from the Government of Mongolia for economic cooperation, the Government of Japan conducted a project formulation survey in August 1992 with respect to the improvement of the Mongolia's processing and storage facilities for agricultural and livestock farming products. The implementation of the basic design survey for the project was determined based on the results of the above survey.

2-6-2 Contents of the application

(1) Purpose

The purpose of the application is the stable supply of meat to the urban people of Mongolia by improving and expanding the Darkhan Meat Plant. The four requested items are mentioned at the end of this section.

(2) Project site

The project site is the Darkhan Meat Plant.

(3) Executing organization

In the initial application, the executing organization was the Food and Industry Corporation. However, because of privatization of the said corporation the Darkhan Meat Plant has come under the control of the Ministry of Food and Agriculture. As a result, the responsible, administrative and executing organizations are as follows.

Responsible organization	:	Ministry of Trade and Industry (This ministry is in charge of the application and acceptance activities of Japan's Grant Aid Program.)
Administrative organization	:	Ministry of Food and Agriculture (The food department of this ministry controls the three major meat plants.)
Executing organization	:	Darkhan Meat Plant (This is a joint-stock corporation in which the nation owns more than half of the stock.)

(4) Items requested by the Government of Mongolia

In the initial application, the Government of Mongolia requested renovation of all existing refrigeration facilities and piping and installation of a 30-ton a day capacity cut-meat freezing facility and 1,000 ton capacity storage. However, as a result of the project formulation survey, the components of the project have been decided as follows.

Requested contents on the original application	Results of project formulation survey
1) Repair of existing refrigeration facilities	
① Repair of compressor	Deferred (impossible to procure parts in Japan)
② Renewal of defrosting facility for compressor	Deferred (impossible to procure parts in Japan)
③ Renewal of refrigerant piping	Providing materials is possible, partial technical guidance is available
2) Construction of cut-meat processing room (converting the existing meat processing function is a precondition)	
① Construction of cut-meat processing room	Modification of existing meat processing room and providing of equipment are both possible
② Construction of organ processing room	Integration with cut-meat room is possible
3) Construction and expansion of storage	
① Construction of new chilled carcass storage	Construction of cut-meat freeze storage is possible
② Construction of new organ freezer storage	Integration with cut-meat freezer storage is possible
4) Transportation	
① Introduction of meat freezing transportation vehicle	Providing two large sized vehicles for frozen transport is possible

As the result of the confirmation of the above items during the field survey, the requested items have been modified as follows.

① Supply of pipes, accessories and technical guidance for the renovation of the existing refrigeration system.
② Converting the existing meat processing room into a cut-meat processing room including supply of necessary equipment.
③ Construction of rapid freezing facility for cattle cut-meat and internal organs.
④ Construction of frozen products storehouse.

CHAPTER 3

CONTENTS OF THE PROJECT

CHAPTER 3 CONTENTS OF THE PROJECT

3-1 Purpose

Though the Darkhan Meat Plant is the second largest in the country, its processing and storage capacity have deteriorated a tremendous amount due to obsolescence of the facilities. The objective of the Project is to implement plant improvements, with aim of supplying meat, the staple of the country and the supply of which is now insufficient, to the urban market.

3-2 Study on Requests

3-2-1 Validity and necessity of the Project

It is an important and urgent issue for the Government of Mongolia to implement improvements designed to secure a stable supply of meat to the approximately 600,000 residents living in the capital Ulan-Bator and neighboring areas, the most heavily populated area in Mongolia, and to the approximately 100,000 residents of Darkhan, the second largest city. Even though the Darkhan Meat Plant supplies 20% of the total amount of meat products reaching Ulan-Bator, in comparison, the facilities and management conditions are worse than those found at the Ulan-Bator meat plant. Therefore, the Government of Mongolia believes that top priority should be assigned to improvement of the Darkhan Meat Plant and is requesting the cooperation of the Government of Japan in an improvement project the aim of which is the renovation of existing refrigeration facilities and construction of production and storage facilities for cut-meat, for which there is the potential for high added value and for which large demand can be expected in the future.

This project will be important and effective in ensuring a stable supply of basic food needs for the urban people of Mongolia and it also will improve the basic field of supporting the development of the Mongolian economy. Therefore, it is supposed that the meaning of the implementation of the Project is significant. Also, the Project is reasonable as a means to solve problems in the course of establishing a stable food supply structure in Mongolia and in the context of defining a realistic target. Furthermore, the objective of the Project is very meaningful and reasonable as a subject case for Japan's Grant Aid program because it establishes a structure for food self-

sufficiency, meeting one of the basic targets of the Government of Mongolia's development plan.

However, in order for all urban-dwelling citizens to reap the rewards generated by this project, and whom account for 1/3 of the total population, it is necessary to not only effect a general improvement in the meat production situation but also to establish structures on a national scale for the production and distribution of meat products. The direct effect is to contribute to the improvement of the working environment and management condition of the superannuated Darkhan Meat Plant. Improvements can be expected both through providing a safe working environment and improving the amount and quality of the delivered meat. Moreover, the expansion of cut-meat supply will have a beneficial effect on improving the distribution system, responding to customer preferences and contributing to the standardization of meat. On the other hand, though production of cut-meat requires additional processing, boned meat simplifies storage needs and facilitates efficient distribution in addition to adding demand-based sales value where appropriate. Therefore, production of cut-meat can be expected to have a considerable effect on improving management of the Darkhan Meat Plant.

3-2-2 Study on implementation and operation plan

The contents of each of the Project's requested items, such as renovation of existing refrigeration facilities, cut-meat processing, and freezing and storage of cut-meat, were studied from their comprising elements. Also, study and evaluation was performed of various aspects of the Project in terms of both the validity and effectiveness of the Project as part of the Grant Aid program. The aspects evaluated include the feasibility of the operating structure, including the organization structure and arrangement of personnel after implementation of the Grant Aid Program, and the Project implementation structure on the Mongolian side, including a planned budget detailing maintenance control expenses.

(1) Role sharing among organizations and sections in regard to project implementation

The subject organization of the Project is the Darkhan Meat Plant which is under the control of the Food Department of the Ministry of Food and Agriculture. Under terms of ownership established in 1992, this organization became a joint-stock corporation 51% owned by the nation, with a basic policy of the government being that this control system will remain in this form in perpetuity. The business record of the past 3 years and the plan in 1993 for the organization are as follows.

[Business analysis of Darkhan Meat Plant]

Item	Unit	1991	1992	1993	1994
① Total asset	1,000 tgr	128,774.0	128,774.0	85,929.7	85,929.7
② Networking rate of facility	%	96.5	76.9	39.2	40.6
③ Personnel expenses	1,000 tgr	3,831.5	6,944.3	12,698.2	13,929.2
④ Sales amount	1,000 tgr	124,797.6	159,693.2	205,385.1	552,206.4
⑤ Cost	1,000 tgr	116,993.2	160,611.0	469,660.0	469,660.0
⑥ Net profit	1,000 tgr	7,804.4	44,744.1	82,546.4	82,546.4
⑦ Ratio of expenses to revenues	⑥ ÷ ④	0.063	0.067	0.218	0.149

The control organization for the Project, the Food Department of the Ministry of Food and Agriculture assumes the political functions related to adjustment of operation of meat plants nationwide with respect to the stocking and supply of meat on a national level, thus takes the role of building a structure of cooperation between the Project and each related organization. However, it does not have any say in the execution of the national budget. Until 1992, liberalization of prices for meat livestock and the government set price together had decided the fate of the management of meat plants. Since the meat price has been liberalized, the details of operation and the plan for the Darkhan Meat Plant must be adjusted according to future government food policies. For this reason, it is expected that the Ministry of Food and Agriculture and related organizations will promote the improvement of the management of meat plants and a stable supply of meat through the promotion of the setting and spread of standards for classes of meat quality used when purchasing livestock (the Meat Livestock Evaluation Standard), the standardization of the quality of price controlled meat, and expansion of the supply of value added products such as high quality cut-meat matched to consumer preference.

On the other hand, the Ministry of Trade and Industry, which is responsible for the organization and execution of the national budget, is also in charge of all aspects of economic cooperation with and from Japan. Therefore, it is quite reasonable that this organization has responsibility for the implementation of the Project.

In summary, the project implementation organization is the organization which directly operates the subject plant of the Project, the Ministry of Food and Agriculture is responsible for controlling the activities of the organization as a whole and, the Ministry of Trade and Industry, which adjusts the Grant Aid Program as a means of project implementation, and oversees the execution of the

budget, is responsible for the implementation of the Project in its entirety. This structure can be seen to be the most the effective way of implementing the Project.

(2) Operation structure and personnel arrangement of implementing organization

The Darkhan Meat Plant currently has 730 employees. The current level was reached in March 1993 as a result of 200 layoffs attributed to streamlining of the business. Among the current employees, 495 employees directly engage in meat processing work, and there are 76 technical workers and 419 seasonal workers. (Refer to the system diagram 3-3-1(2) in the attachment.) This structure does not need to be changed and is appropriate for the achievement of the Project.

Concerning the arrangement of personnel, special workers will be necessary to process carcasses into cut-meat. Also, for forklift or cart operations, laborers who are specifically assigned to the movement of freight (stock) will be necessary. Concerning the level of the technical workers, from an examination of the existing production record and considering that the referred-to workers are from a traditionally meat-oriented culture, no problems are found; however, the number of technical workers and other workers required is related to the issue of the streamlining of the management of the whole plant. As a result study of the relationship between the contents of the management improvement plan and this project, the working condition and technical level, the scale and contents of the plant and equipment, and the maintenance and management system, it was determined that it is not necessary to increase the number of personnel, instead accomplishing the goals of the Project through a reshuffling of existing personnel.

(3) Budget plan

The budget required by the Mongolian side to implement the Project is divided into two categories, one covering the construction required to implement and the other detailing the operation, maintenance and management cost required following the completion of the Project. Since the plant is a production facility, the cost of operation and maintenance control can be covered by profits generated through product sales. The feasibility of this was studied by analyzing and evaluating the basic economics of the Project. Since the construction cost borne by the Mongolian side is necessary upon implementation of the Grant Aid Program, it is essential to secure its budget. Therefore, the details of the budget plan were studied in the following way.

1) Construction cost borne by the Recipient

Removal construction of the meat processing function is a precondition of project implementation. Therefore, securing the budget for this aspect of construction is necessary. In addition to the above, it will be necessary to make arrangements concerning various expenses related to the procurement of consumables, expenses for the incoming electricity line, and for procedures related to duty-free entry of equipment and materials, as well as expenses incurred through banking agreements.

Concerning those expenses, though the Ministry of Trade and Industry and the Ministry of Food and Agriculture will provide some assistance, the cost will actually be borne by the Darkhan Meat Plant. Therefore, totaling the costs for the implementation plan and estimated construction costs for the removal construction of the meat processing facilities and intake of power in the basic design, a study was made of the feasibility of securing the budget for the management plan of the plant. As a result, since the estimated construction expense accounts for about 6% of the profit detailed in the 1993 business plan of the plant, it was determined that it is possible to secure the budget. For other necessary items, the contents, quantity and implementation structure were clarified to make firm the plan and its implementation. Upon explanation of the final draft of the Project to the Mongolian side, the contents of the construction covered by the Recipient were confirmed, including the contents of the above-mentioned removal construction and others, and it was made clear that the Mongolian side must surely secure the budget required for implementation of the Project. Furthermore, it was made certain that the Darkhan Meat Plant will include the above in their budget for the current fiscal year and that this part of the budget will definitely be implemented.

If the above cost cannot be covered in the plant's budget, a loan to cover any shortfall will be made by the National Bank. To obtain this loan, the application is first examined by the Ministry of Food and Agriculture and the National Development Board, then approval is made after the Ministry of Trade and Industry and the Ministry of Finance examines the approval on a priority of importance basis.

2) Study of operation and maintenance control expenses

These expenses can be divided into expenses for personnel engaging in operation, procurement of consumables and spare parts, lighting & heating and communications, maintenance control of facilities and equipment, and materials such as the raw material (carcasses) and packing materials. Of these, an

optimum figure for labor costs for personnel under the plant management improvement plan was estimated based on personnel records for the past three years of operation. Concerning the procurement of consumables and spare parts and maintenance and management expenses, from a long term point of view the basic policy was to suppress expenses as much as possible through proper selection of facilities and equipment. Specifically, depending on the method of processing and storage, expenses was estimated using references such as an estimation of standard light and heat expenses and the quantity of spare parts and their estimated cost. Material expenses were realistically estimated based on an analysis of purchase price records, taking fluctuations and market trends into account. From these estimates and the fixing of expenses, an appropriate facilities and equipment plan were decided on. At the same time, a realistic sales price was set which took into consideration added value and product demand trends, using fundamental economic analyses and evaluation, and a study of subject plant and the effects of improvement of plant management (refer to 3-3-4 (5)). Furthermore, we investigated the operation plan and budget plan of the whole plant and confirm that the budget plan is suitable for implementation over the long term.

It is expected that operation, and maintenance control expenses related to the improvement of the existing refrigeration facilities will be reduced through the implementation of the Project. However, since not all systems are the subject of improvement in the Project, a quantitative estimate is difficult. Therefore, investigation of past records indicates that one area where expenses can be reduced is in outlays for ammonia. It is possible to reduce current consumption, which stands at some 30 tons per year, by 50~70%.

3) Study of relationship with other similar projects and plans of other assisting counties and duplication of effort

Currently, the Asian Development Bank is planning a development project starting from 1993 to 1994 concerning the preservation and processing of agricultural and stock farming products as an activity of meat aid related to the Ministry of Food and Agriculture. The Ulan-Bator Meat Plant is proceeding with facility improvement of its own with the cooperation of Germany and Korea but the details are not known.

Besides this project, the Darkhan Meat Plant is requesting Germany to provide technical assistance and equipment for its sausage processing function and the installation of a slaughter and dismembering facility for pigs but this has not yet

been realized. Also, the plant is planning to introduce a bone meal production machinery from China and a casing equipment from Europe in 1994 in the way of renovation. None of the above projects are duplicated by this project.

4) Study of the comprising elements of the Project

The comprising elements of the Project can be roughly divided into four areas:

① Repair and renovation of refrigeration facilities,
② Converting the meat processing room to a cut-meat processing room and supply and installation of necessary equipment therein,
③ Installation of a cut-meat and organ rapid freeze facility, and
④ Expansion of refrigerated storage.

① Repair and renovation of refrigeration facilities

With respect to the repair of the refrigeration facilities, that is, the renovation of cooling machines, refrigerant pipes, valves and related equipment, stopping or minimizing the leakage of ammonia to as small an amount as possible and heightening the cooling ability are the objectives. However, renovation of all refrigeration facilities is impossible due to the fact that such a case would require the halting of plant operations for long period of time as well as other conditions such as the construction period and budget. Therefore, as a result of local discussions, the priorities of the study with respect to ammonia leakage was given to improvement of the chilled storage and storage room, both very important safety measures and which have a large effect on deterioration of the quality of stored meat quality. As a result, the implementation of renovation of the insulation coating of extremely old coolers, defrosters, refrigerant pipes and valves for each low-tension side system have become subjects of the Project. The evaporator condenser currently installed outside is very old and is in a decrepit state, thus its renovation is included in the Project. High-tension side refrigeration facilities such as equipment and compressors installed in the machine room shall be renovated by the implementation organization step-by-step under the terms of the Project. However, refrigeration ability is effective only when high-tension side machines and low-tension side coolers operate at their rated capacity, therefore, simply renovating pipes does not help in an evaluation of effectiveness. Furthermore, different from new construction, there are many tie-ins between the existing equipment and the plant, thus renovation becomes complicated. This means that renovation of low-tension side coolers and pipes is unavoidably accompanied by repair work on

sections that have plant tie-ins. However, with the exception of its superstructure, since the entire plant itself will because of its obsolescence need to be renovated, the renovation work needs to proceed with great care. In addition to this, ammonia used for the existing facilities as the refrigerant is a toxic combustible gas, thus the renovation process is accompanied by a high degree of risk. Advanced construction technology is therefore required. For the above reasons, concerning renovation of the existing refrigeration facilities it was judged that sufficient Project effect cannot be obtained through only the replacement of pipes servicing the existing refrigeration facilities, as was suggested in the project formulation survey result and also in requests from the Mongolian side. Therefore, in addition to pipes, providing equipment and materials including unit coolers and defroster and implementation of the requisite renovations work have been included in the range of Japan's Grant Aid Program.

② Converting the meat processing room to a cut-meat processing room and supply and installation of necessary equipment

Concerning converting the meat processing room to the cut-meat processing room including installation of necessary equipment, the transfer of the existing meat processing facility section is a precondition of the construction of frozen cut-meat storage, which is one target of the Project. Therefore, the removal of facility functions and equipment with respect to meat processing is within the range of the transfer plan, thus it shall be borne by the Mongolian side. Therefore, the subject items of the Project are facility renovation, installation of building facilities and supply and installation of necessary equipment required for cut-meat processing.

③ Installation of cut-meat and organ rapid freeze facility

A rapid freeze facility for cut-meat is indispensable to maintaining meat quality. After the meat processing function is replaced with the cut-meat processing function there is still a vacant area in the building, thus this facility will be provided using this area. With respect to freeze processing of organs, a minimum amount of the cut-meat rapid freeze facility will be shared in order to reduce sanity control problems resulting from the sharing of the existing carcass freeze facility.

④ Expansion of refrigerated storage

Though 1,000 tons of refrigerated storage has been requested, storage will be expanded by 600 tons, which is short even if existing storage is used efficiently, on the condition that priority of storage is given to high value

added cattle cut-meat. A method yielding the highest storage density and most efficient product (freight) handling and maintenance control will be used. In addition to expanding the facility, it is also necessary to introduce forklifts in order to improve freight-handling efficiency.

⑤ Other

In addition to the above comprising elements, the introduction of a vehicle for frozen transport was added to the items requested in the project formulation survey. This is effective in regard to improving distribution in terms of maintaining product quality and adjusting shipments. However, because transportation of products is handled by other organizations with the exception of transportation to direct sales stores in Darkhan city operated under the control of the project implementation organization, this item has been excluded from subjects for inclusion in the Project.

5) Study of requested facilities and equipment

① Improvement of existing refrigeration facilities

As explained in the comprising elements section, the objective is to prevent ammonia leakage and increase cooling efficiency with the intention of improving what is now a dangerous working environment and eliminating potentially damaging effects in the meat storage environment. Therefore, the contents of construction of facilities were studied as follows for those two items and the safety of removal and renovation construction.

a. Prevention of ammonia leakage

Measurements obtained at the site indicate ammonia leakage has occurred throughout the entire plant. The leakage from joints between pipes and around gland packing is especially severe, thus all piping needs to be replaced. Also, it is highly possible that ammonia has leaked from the welded joint sections of cooler coils themselves (for the evaporator and unit cooler, hereinafter referred to as the unit cooler) installed in each cooling room and in refrigerated storage. If this influence on the working environment and stored products is taken into consideration, simple replacement of pipes is not enough to prevent ammonia leakage and the unit coolers themselves must also be replaced.

b. Improvement of cooling efficiency

The performance of the compressor cannot be judged correctly as it was made in Poland and there is no performance table to refer to but it seems to satisfy the required capability. However, under current conditions it is

not possible for the machine to be fully utilized. That is, the accumulation of machine oil in the system as a result of deterioration due to aging when using an ammonia cooling system can be expected, and a decrease in the effective pipe diameter and a decrease in heat transfer efficiency due to oil adhering to the inside of the cooling coil of the unit cooler are also expected. Furthermore, there is the matter of the non operational status of the equipment which defrosts the frost stuck on the external surface of the cooling coil—equipment which essential to the operation of refrigeration units which handle temperatures below 0°C. This leads to a decrease in the cooling ability and also has become a big burden for maintenance control. Renewal of pipes, unit coolers and defrosters is very effective in regaining cooling ability, thus is absolutely essential to the proper operation of the system over the long term.

Let us now examine the defrosting system in more detail. As a unit cooler circulates and cools the air, frost sticks to the cooling coil. Defrosting is necessary since this frost makes it difficult to cool the air passing the cooling coil. This facility uses compressed-gas (hot gas) exhausted from the compressor for defrosting and this is performed by reversing the cooling cycle. Because the range which one defrost operation handles, that is, the number of unit coolers, is too great and the distribution of the compressed-gas for the same system is not equal, defrosting has not been operated correctly. To improve this, ① it is necessary to subdivide the range of the defrosting operation and increase the number of electromagnetic valves used for control, and ② subdivide the piping system according to the capacity of the defrosting system and partially change the system and ③ change the number of unit coolers and repair the electrical control method. The water spray defrosting system which has been partly adopted is a very simple and reliable system.

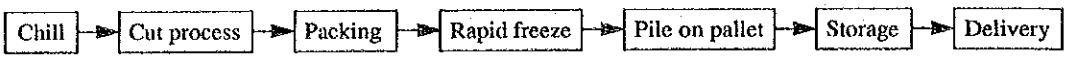
This is especially highly rated considering that the system is used in the chilled carcass storage and freeze room where humidity is high and that it was designed this way 20 years ago. However, from the point of view of water quality control, defrost water temperature control, prevention of drain piping from freezing and the progress of metal corrosion due to unit coolers water leakage, it is time to renovate them.

c. Study on safety of removal and renovation construction

Ammonia used as a refrigerant in the existing refrigeration facilities is designated as a combustible and toxic gas in Japan under the High Pressure Gas Control Law. Since cutting and welding are the main work in renovation and in the partial repair and construction of pipes for the existing refrigeration facilities, the use of fire sources is unavoidable, thus it is very dangerous. Furthermore, since the existing plant is a unified whole facility system and has become superannuated, depending on the reliability of valves which divide the work area, if an accident occurs the damage will probably extend to the whole plant. Therefore, construction needs to proceed with great care and a system to secure the safety of the work environment must be put into place. In addition to this, different from original construction, removal and installation are repeated in the narrow spaces available for renovation, therefore, an advanced construction plan and advanced control ability are necessary. Under these circumstances, the Darkhan Meat Plant expresses that they employ about 30 engineers and that it is possible for them to independently carry out pipe laying renovations of refrigeration facilities outside the range of Japan's Grant Aid Program. However, as far as the sphere of the field survey extends, there is no record that the same kind of or similar renovation work has been conducted in Mongolia itself. Newly installed refrigeration facilities have mostly been installed with cooperation of other countries, thus we cannot judge the extent of Mongolia's actual construction ability. Furthermore, the Darkhan Meat Plant itself has no experience in undertaking renovation projects similar to that called for by the Project, thus we cannot judge whether the technical level of their engineers and their construction management ability is sufficient. Therefore, considering the difficulty and the degree of danger in the said construction, we believe it must be implemented within the scope of Japan's Grant Aid Program.

② Study on cut-meat storage function

On the processes of cut-meat production in the Project, from acceptance of meat livestock to slaughtering, dismembering and carcass preparation, the same procedures are required for chilled carcass storage, thus the existing facilities can be shared. Therefore, study of the cut-meat processing and refrigerated storage function aims at the following steps after the carcass chilling process.



Concerning the organ process requested at the beginning, for processes up to chilling, the existing facilities will be used and the organ freeze process and refrigerated storage including part of the packing process have been determined to be subjects of the Project. However, except for the packing process, all facilities and equipment needed for cut-meat processing will be shared with the organ freezing and storage process.

a. Chilling

Among meat production processes, the process to chill carcasses is indispensable to preventing meat from spoiling. In Japan, the standard for carcass chilling prescribes that the internal temperature of the carcasses is 5°C or lower. At this temperature, meat becomes tight, facilitating cut-meat processing (bone elimination, cutting). However, the existing facility is 0°C ~ +2°C , and the internal temperature of carcasses is lowered to +8°C ~ +10°C in about 8 hours. At this temperature, the meat is rather tender, thus bone elimination and cutting are a little bit difficult. Therefore, a chilled carcass facility for cut-meat is necessary. Since the existing multi-purpose storage is equipped with a carcass hanging rail and satisfies the above condition, this will be used as the chilled carcass facility for cut-meat.

b. Cut-meat boning process

Dismembered and disemboweled carcasses without heads and hooves are chilled, then roughly divided and major bones such as the back and legs are separated from the whole and the remainder of the carcass is processed into boned pieces called cut-meat. In addition to the above processes, in Japan, the cut-meat transaction rule of the Ministry of Agriculture, Forestry and Fisheries prescribes processes such that extra fat and thin bones are eliminated and the meat is well formed, and that each half of the symmetrically bisected cattle carcass is separated into 13 parts and each half of the similarly bisected pig carcass is separated into 5 to 6 parts. Also, the standard for imported frozen beef purchased by the Livestock Industry Promotion Corporation prescribes 12-part separation. In this project, cattle cut-meat will be processed according to the standard conforming to cut-meat processing described above and processing of horses and pigs will conform to the standards established for processing of cattle meat.

For cut-meat processing, several workers dedicated to the processing of carcasses into cut-meat forms work as a group and carry out a series of work on an assembly line. Therefore, the amount of processing can be calculated using the time and number of lines required for a series of processing. The meat processing scale is calculated based on such conditions as the worker's technique, the number of people making up a group and time required for cut-meat processing for processed products being carried out in the existing plant. The requested processing amount, i.e. 30 tons per day, is equivalent to the slaughter and dismembering of 340 livestock which is not realistic, thus the cut-meat processing production scale has been established at 20 tons per day.

c. Packing

Classified cut-meat and organs are wrapped in a fixed amount of polyethylene film and packed in the cardboard box, then the item is weighed and the contained item and its weight are recorded. After that, a fixed amount of boxed and measured products are piled on a cart in order to move them to the next stage in freeze processing. Spaces is maintained between piled boxes to increase freezing efficiency. While packing of cut-meat takes place in the same room as cut-meat processing, for sanitary reasons packing of organs takes place in a room separated from the cut-meat processing room. Packing materials are stored in cardboard box storage room connected to the inner organ packing room and the cut-meat room. In addition, polyethylene film bags are used for the freezing of organs and cardboard box are used for packing fat, thus procurement of those materials is not a problem.

③ Study of rapid freeze facility

a. Freezing of cut-meat and organs

If meat is frozen at low temperatures and in a short period of time, moisture and restoration conditions such as elasticity are excellent when the meat is subsequently thawed, thus the quality of meat can be maintained at a higher level than is found with gradually frozen meat. Since it is effective to rapidly freeze cut-meat in a freeze room at –35°C ~ –40°C in 24 hours, this method is generally practiced in Japan. Since this freeze room needs high performance refrigeration facility and power consumption is very large, whether or not the system is adopted was decided by comparing and studying the realistically assumed price setting of products depending on quality and power consumption, maintenance

control expenses, procurement of replaced parts and operation maintenance and management expenses including freight movement personnel.

The refrigeration efficiency of the rapid freeze room is higher as the room area is smaller as measured against the total amount of accommodation. Therefore, the rapid freeze room will be divided into several rooms and boxed products loaded on carts will be more efficiently frozen.

The amount of processing per day has been decided is a total of 30 tons, 20 tons of cut-meat and 10 tons of organs. 50 tons of organs was requested during the field survey but only 10 tons has been accepted as a subject of the Project.

When 24 hours freeze time is taken into consideration, two or more freeze rooms are necessary because of the time required for stocking and withdrawal of the product from the rooms. The relationship between the amount of accommodation per room (t) and the number of rooms (N) is as follows.

Amount frozen per day $T = t (N - 1)$

According to the above formula, the amount of accommodation per room (t) is $T \div (N - 1)$, thus as the number of rooms increases, the total amount of accommodation (tN) and the amount frozen per day begin to merge on a secondary degree curve and as the amount of accommodation per room becomes smaller the accommodation efficiency of the facility becomes lower. The most effective number of rooms can be obtained based on an analysis of mutual relationships such as the amount of freeze time necessary each day and the fluctuations therein, freight movement efficiency, operation and maintenance control expenses, and facilities and equipment expenses; however, four or less rooms is appropriate for 30 tons of daily processing amount.

④ Refrigerated storage

Frozen and boxed cut-meat is stored in refrigerated storage at –18°C to –20°C and fixed amounts are delivered depending on demand. Storage refrigeration efficiency is also higher as the room area is smaller as measured against accommodation area. Therefore, to increase accommo-dation efficiency, it is effective to use a gravity-fed pallet rack system with which pallets are loaded with boxed products which can be delivered to several