No. 1

JAPAN INTERNATIONAL COOPERATION AGENCY
THE MINISTRY OF TRADE AND INDUSTRY
THE MINISTRY OF FOOD AND AGRICULTURE
MONGOLIA

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR CONSTRUCTION OF GRAIN STORAGE IN MONGOLIA

MARCH 1995

OVERSEAS MERCHANDISE INSPECTION CO.,LTD.
(OMIC)

Basic Design Study Report
on
The Project for Construction of Grain Storage
in
Mongolia

March 1995

Overseas Merchandise Inspection Co., Ltd.
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PREFACE

In response to a request from the Government of Mongolia, the Government of Japan decided to conduct a basic design study on The Project for Construction of Grain Storage in Mongolia and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Mongolia a study team headed by Mr. Hideo Miyamoto, Deputy Director, First Basic Design Study Division, Grant Aid Study & Design Department, JICA and constituted by members of Overseas Merchandise Inspection Co., Ltd. from September 29 to October 22, 1994.

The team held discussions with the officials concerned of the Government of Mongolia, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then a mission was sent to Mongolia in order to discuss a draft report, and as this result, the present report was finalized.

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

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

March 1995

Kimio Fujita
President
Japan International Cooperation Agency

March 1995

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Construction of Grain Storage in Mongolia.

This study was conducted by Overseas Merchandise Inspection Co., Ltd., under a contract to JICA, during the period September 8, 1994 to March 31, 1995. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Mongolia and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fishery. We would also like to express our gratitude to the officials concerned of the Ministry of Food and Agriculture, the Ministry of Trade and Industry, the Flour Mills, the Embassy of Japan, the Ulaanbaatar office of a representative of JOCV for their cooperation and assistance throughout our field survey.

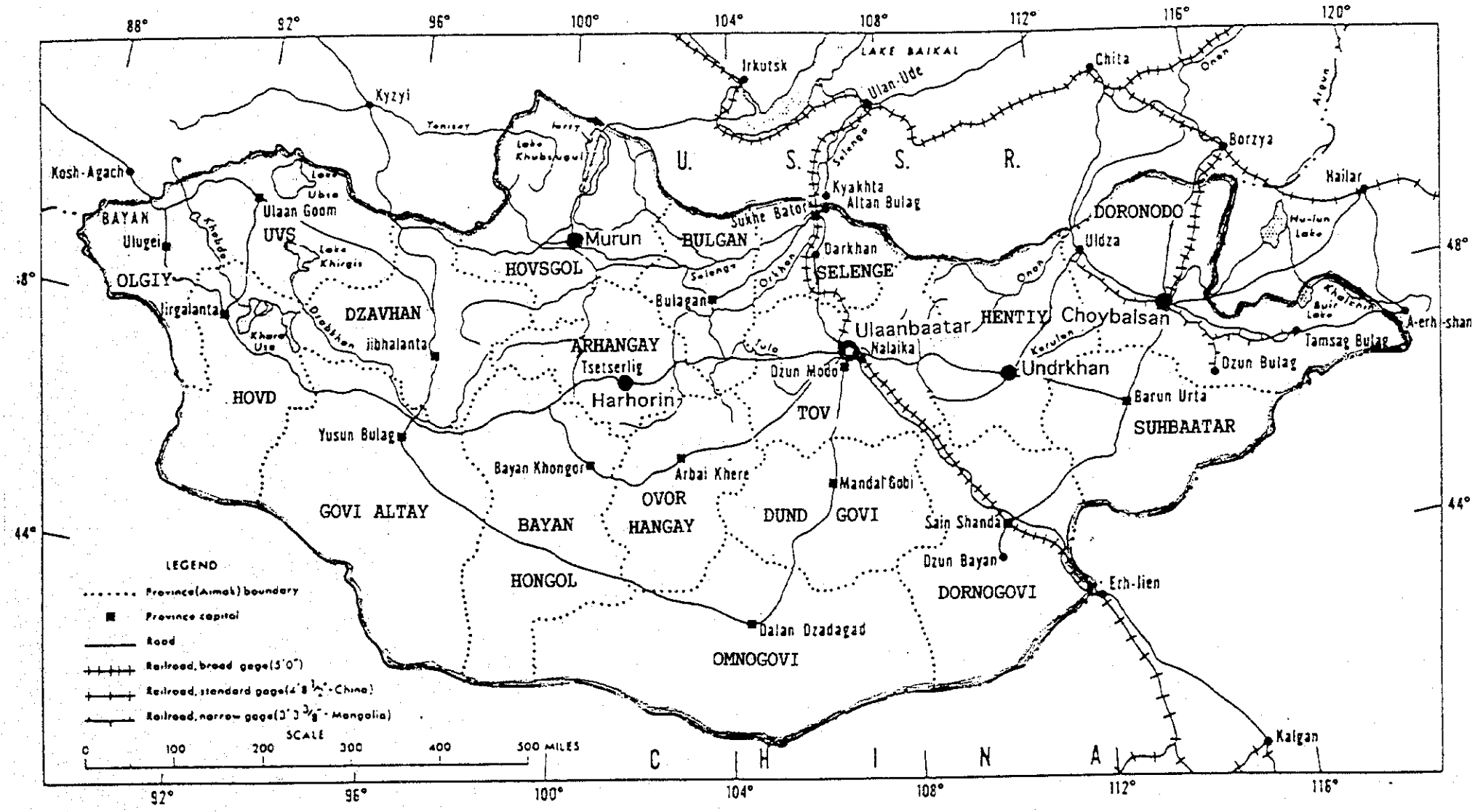
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

山崎 勇

Isamu Yamazaki
Project Manager
Basic design study team on The Project
for Construction of Grain Storage
in Mongolia
Overseas Merchandise Inspection Co., Ltd.

The Map of Mongolia



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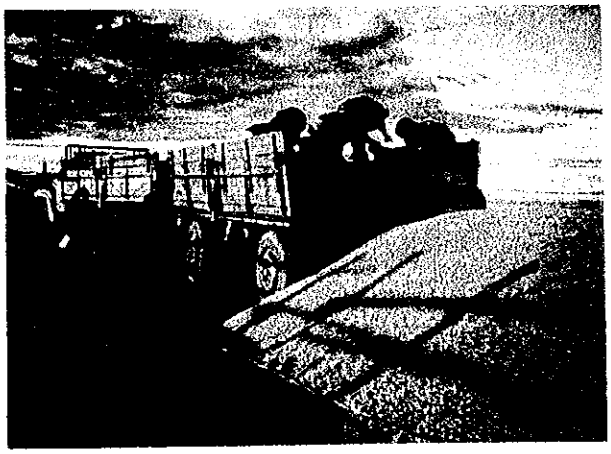
<Actual Conditions of Wheat Storage in Mongolia>



Unloading from 10 ton trailer truck on the line marked ground for open yard storage (Undrkhan)

Wheat mountains. The parts contact with ground often contaminated and damaged by moisture (Undrkhan)

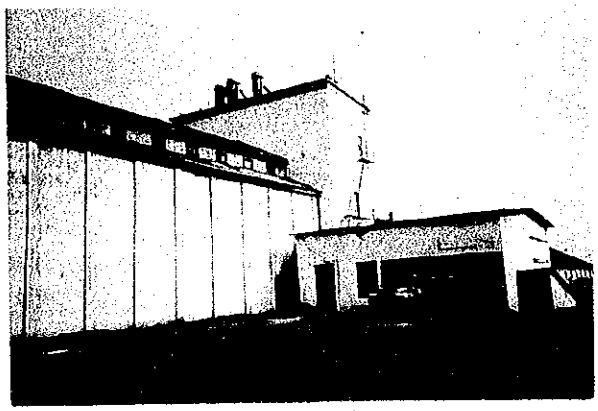
Wheat covered with snow. Due to severe cold climate and long winter, snow does not melt until spring. (Harhorin)

Wheat piled in open yard rottened by thawing of snow. (Harhorin)

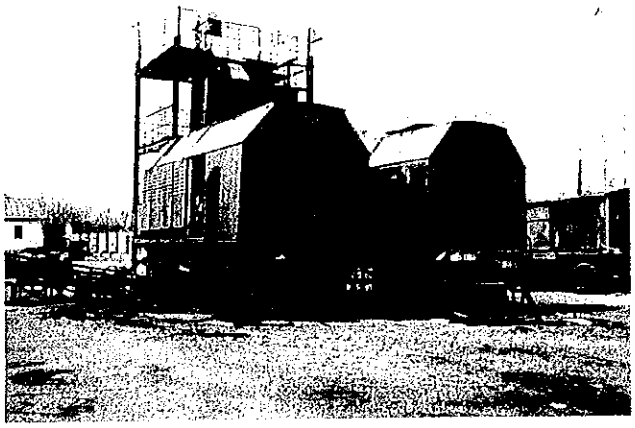
Wheat piled in open yard becomes bait for wild birds (Choybalsan)

<Existing Facilities in the Flour Mills>

A truck scale house is in front and a high building in the back is a feed mill. Access road to front gate is well maintained. (Harhorin)



Square buffer bins for material wheat (Left). In the back is a flour mill building, front is a feeding pit. (Undrkhan)

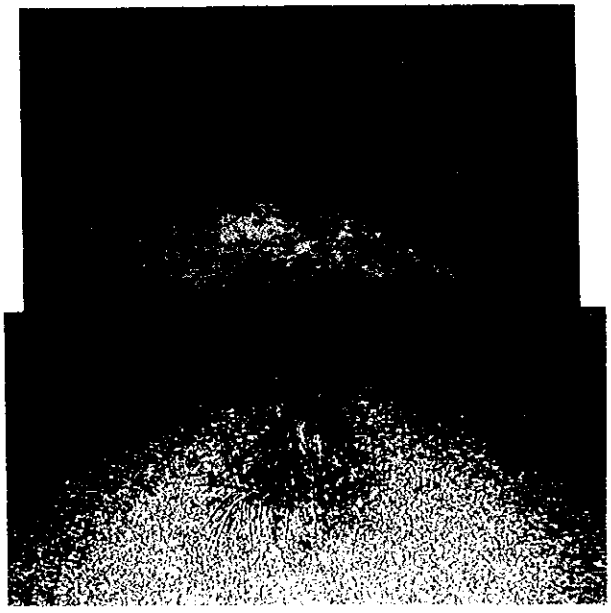


Semi-stationary grain dryer made in Russia (8 ton/hr/unit), imported diesel oil is used as fuel, posing problems in the maintenance due to its high cost and difficulty in procurement. (Undrkhan)

Surface water inroad to semi-underground mechanized warehouse (capacity 11,000 ton). 30 years old and badly worn out. (Harhorin)

Low eave height and not mechanized stone made flat warehouse, inconvenient to use. Numerous pigeons pecking wheat. (Choybalsan)

Flour milling facility building uneven subsidence cause cracks in the wall (Undrkhan)

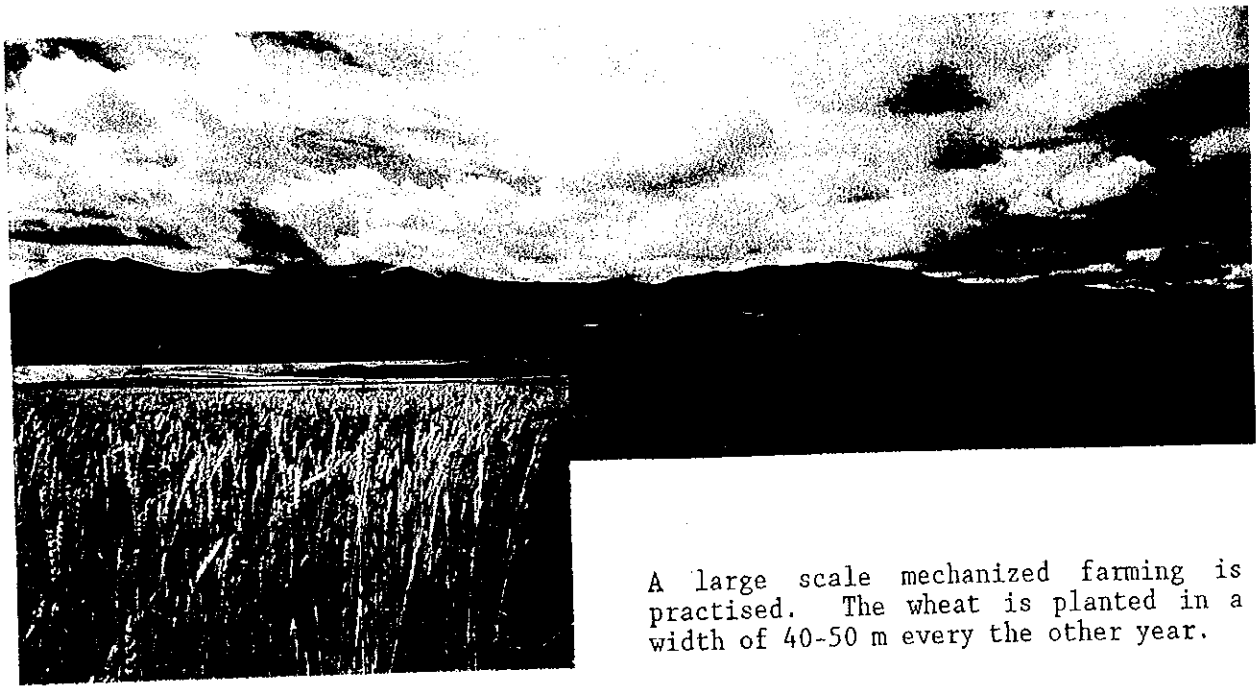


Wheat in the warehouse germinated with the water leaked from the roof (Murun)

The site reserved for construction of grain storage facility at Harhorin. Presently used for open yard piling of the wheat that could not be stored in existing warehouse.

The site reserved for construction of grain storage facility at Undrkhan. The site was planned for silo construction before.

<Vast Wheat Field>

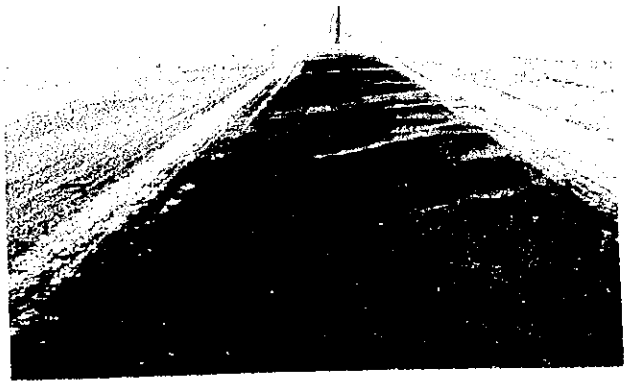


A large scale mechanized farming is practised. The wheat is planted in a width of 40-50 m every the other year.

<Access from Ulaanbaater>

(Upper) Natural road from Ulaanbaatar to Undrkhan. If service wires were not there, one may lost his way as the scenery is same all the way.

(Right) A paved way from Ulaanbaatar to Harhorin. Snow does not stay on the road by the wind.



Summary

Summary

The Mongolia is a vast inland country with an area of four times that of Japan located between Russia and China. Her main industry is mining and stock-farming. Winter is long, and besides the severe cold, rain is scarce. Therefore, the climate is not suitable for crop cultivation for food production. However, since 1960 production increase of mainly spring wheat was planned with the assistance from the former Soviet Union. Large scale mechanized farming was introduced to cultivate the land and the agricultural facilities were erected and improved. As a result of this, the production was increased to a degree where she could export to the former Soviet Union small quantities in the middle of 1980's.

Since 1989, the assistance from former Soviet Union and East European countries ceased and, as a consequence, the supply of agricultural input material decreased, resulting in reduced agricultural production. With the transition from a centrally controlled economy to market economy, the procurement function has been weakened but the agricultural production is gradually on a upward trend along with the settlement of market economy.

The material to be stored in the grain storage facility under this project, wheat is a staple food of the people of Mongolia together with meat. The existing storage facility for wheat are the material warehouses attached to former state owned flour mills. They are collecting the wheat from the producing farms in or out of the prefectures. There are nine flour mills located in the cities of wheat producing areas including Ulaanbaatar and Darkhan. These flour mills were built in the 1960's with the assistance of the former Soviet Union, under the above mentioned wheat production increase policy.

Attached storage facilities were also built at around the same time, however not only is the system old but 30 years have since past and they are no longer functional. The capacity of all the existing storage facility in the nation is matched with the present quantity handled by flour mills. However, their dilapidated conditions and shortage of capacity depending on the mills are of major concern.

Each flour mill store holds about 5,000 to 10,000 tonnes of wheat located outdoors at the peak of harvesting season, due to shortage of storage capacity and inadequate warehouses. Rotting by rains and snow, loss by birds and rats, scattering by wind cause about 5% loss. The quantity of wheat piled outdoors becomes maximum in severe cold season of winter and it is the time when manual labour for outdoor work become

necessary. Its rigorous work is posing problems.

The government of Mongolia has planned to improve the storage facilities at four places: Harhorin, Undrkhan, Murun and Choybalsan, where shortage of storage capacity is conspicuous in order to reduce the loss caused by open piling of wheat and to contribute to a stable supply of food through improvement of marketing facilities. They requested Grant Aid Assistance from the Japanese government for its implementation.

In response to the request made by the Mongolian government, the government of Japan decided to conduct a basic design study and the JICA sent to Mongolia a basic design study team for the period from September 28 to October 22, 1994. The team upon returning to Japan compiled a draft report after some review works. The government of Japan sent the draft explanation mission to Mongolia from February 27, 1995 to March 11. And through discussion with the executing organisation of the government of Mongolia, this report was completed.

The management conditions, the degree of inadequacies of the storage facility, together with condition of the open yard piling of wheat, etc. were studied at the four flour mills, for which the government of Mongolia requested the cooperation of the Japanese government to improve the storage facility. As a result of the study, it was confirmed that all four mills had a shortage of storage capacity. However, due to the nature of the grant aid assistance program of the Japanese government and some problems in infrastructure such as transportation and electric supply conditions in Mongolia, the propriety of constructing only two storage facilities at Harhorin and Undrkhan in this project was confirmed. In setting the proper scale of storage facility for this project, the main aim was placed with the solution of the present problem of open piling of wheat. The difference in the amount of wheat coming in and going out was calculated for every month for the past five years and they were taken as the stock amount at the end of every month; The yearly maximum stock was taken as the necessary storage capacity of that year, then, the average of this necessary storage capacity in five years was calculated, and the effective capacity of existing storage facility was deducted from the above average necessary storage capacity.

As a result of this calculation, construction of the storage facilities of 10,000 ton capacity for Harhorin and 8,000 ton for Undrkhan was confirmed. The conditions of the existing storage facilities at Murun and Choybalsan are more than just to repair from the viewpoint of design work and the degree of wear. In view of the fact that any quality control of the wheat is not sufficiently practiced at both sites

due to the lack of quality inspection equipment, equipment and tools for quality inspection shall be procured and supplied to these two sites. It is planned that the same equipment and tools shall be supplied to Harhorin and Undrkhan sites also.

Important points to be considered in the basic design of wheat storage facility in this project are as follows:

- From the harvest at farms to the milling process at flour mills, handling of wheat grain is done in bulk, not in a bagged condition.

- There are no special specifications necessary in the design of facility such as heat insulation, etc. because the wheat does not deteriorate in quality due to the low temperature of the cold season in Mongolia.

- It is necessary to reduce the amount of outdoor work for the safety of workers as the collection of wheat is done in severe cold season.

As the storage facility for this project, a systematized conveying among each equipment, centering upon corrugated steel silos to be assembled at site shall be designed. A storage facility does not function only by the main body of silos which is just a container. It is necessary to equip with facilities for wheat cleaning, drying, weighing, etc.

In this project, the fuel for grain dryers is not imported oil, but the coal mined locally is used.

The above mentioned contents of the basic design for this storage facility construction project are ranged in the table below.

Place	Facility		Relative Equipment
Machine building	Harhorin:	560 m²	
	Undrkhan:	555 m²	
	Dumping・receiving space	160 m²	Truck dumping equipment Receiving hopper Tanks for shipment
	Machine installation space	160 m²	Separators (Rotating, oscillating, specific gravity type) Weigher
	Main control room	25 m²	Main control panel
	Inspection room for received grains	25 m²	Inspection equipment
	Outfits and rest room	25 m²	
	Spare parts room	20 m²	Spare parts
	Power receiving, transforming and distribution room	30 m²	Cubicle Cyclone
	Dust collection room	50 m²	Air valve for cyclone Fan for cyclone Magnet separator Bucket elevator Chain conveyor
Outdoor installation	Silo main body, 1,000 ton/unit Harhorin: 10 units, Undrkhan: 8 units		Grain temperature Measuring equipment Screw conveyor Tempering tank Dryer Bucket elevator Chain conveyor
Boiler house		100 m²	Steam boiler

The local construction method of prefabricated concrete slabs was considered in the basic design study for the machine building and the boiler house in the above list. However, it was noted that there are some problems as columns and beams will be long

and heavy and tend to crack during transportation by trucks, joints are susceptible to break in the case of earthquakes and it takes time from the start of manufacturing to the completion of construction, etc. The steel frame prefabricated construction method which does not cause such problems was finally adopted.

The two construction sites of storage facilities in this project are located more than 350 km away from the capital Ulaanbaatar, one is in the east and the other in the west. Both are hard to access and communicate with and considering the procurement of equipment and materials, availability of labour and transportation means, it is difficult to start the construction works both at the same time.

Therefore, construction of storage facility in this project should be undertaken for Harhorin in the first phase and for Undrkhan in the second. The inspection equipment for emergency measures shall be procured for 3 sites, Harhorin, Undrkhan and Murun in the first phase, and for Choybalsan site in the second phase. The periods necessary for the procurement and construction, 12 months for the first phase and 11.7 months for the second phase.

The degree of mechanisation of the facility in this project is improvement of the existing storage facility. It has been confirmed by the study mission that the corresponding flour mills can manage, operate and maintain the new facility with the present staff members, technology and experiences.

With the implementation of this project, existing storage capacity of 11,000 ton will increase to 21,000 ton at Harhorin and at Undrkhan 3,800 ton will increase to 11,800 ton. The problem of open-piling will be solved, the loss of wheat will be reduced and the quality will be improved. The improvement of storage facility at the two sites located at the key points of marketing in those areas shall contribute to and its stable supply in the seven prefectures, about 24% of the total population.

In the implementation of this project, a responsible organization in the government of Mongolia is the Ministry of Trade and Industry and the Ministry of Food and Agriculture. However, actual site of construction shall be in the flour mills, separate organizations. Therefore, Mongolian party is expected to prepare well the executing system in order to adjust, give proper advises and coordinate on the works of each party.

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Chapter 1 Background of the Request

Chapter 1 Background of the Request

1-1 Background of the Request

Mongolia is situated in the eastern part of central Asia. Its area is 1,565,000 km² and the population 2.367 million(1993). Average population increment rate is 2.62% (1993) and the per capita(GNP) is about US$140(1992 estimate). Since 1960, she has received assistance from the former Soviet Union and East European countries. She has set the promotion of industry around Ulaanbaatar and Darkhan as the mainstay of national development policy.

New political power born by free election in 1990 changed its reliance upon the Soviet Union and east European countries and promoted a series of democratised economic reform policies including the introduction of closer relations with western countries.

The essential part of their 3-year plan,1993-1995 is the (1)Establishment of an economically independent system (2)Average 5% economic growth rate (3)Promotion of export. The agriculture and the stock-farming which are supply source of material for light industry and self-sufficiency in food are cited as one of the most important areas of improvement.

The agriculture and stock-raising are key industry of Mongolia. It occupies 30.7%(1992) of her GDP and about 40% of her total export is by the agricultural and stock-farming product. In 1980's stock-farming was about 70% of the total production and agricultural production was 30%. However agricultural production increased more than that of stock-farming since then. Recently, however, grain production's increment rate showed a decreasing trend due to a lack of foreign currency which resulted in the poor maintenance work of agricultural equipment and materials, food processing facilities and storage equipment.

In order to cope with the situation, the government of Mongolia is making efforts to increase the production and improve the quality of its food processing industries. It regards the increased stable supply of food to the people of Mongolia as their most important policy.

Main food is wheat(bread), meat and diary products. Wheat production was 506,000 ton yearly average in 1981-85 period, 687,000 ton in 1989, 453,000 ton

in 1992, 447,000 ton in 1993. Recently wheat production has fallen due to the lack of agricultural material and equipment. Mongolia has had to receive emergency assistance from Japan and U.S.A. Wheat is collected and stored at flour mills(11 in all)in each area. Flour mill's storage capacity in whole Mongolia is 347,900 ton. Study conducted this time on flour mills revealed that actual figure should be considerably lower due to deterioration. On the other hand, yearly quantity handled by wheat flour mills is 286,000 ton average of five years 1989-1993. Aside from the quality, as far as storage capacity concerns, it is more than enough. However four flour mills visited by the study mission this time, namely Harhorin, Undrkhan, Murun and Choybalsan, stored about 5,000 ~ 10,000 ton each of wheat for milling, piled outdoor due to lack of storage capacity. It had deteriorated due to rain and snow, scattered by birds, rodents and wind.

A large loss was generated in these conditions under these circumstances, and in order to improve grain storage facility, the Mongolian government made a plan of building new grain storage facility at these four flour mills where storage capacity is in shortage. They requested grant aid assistance from Japan.

1-2 Outline of the Requested Main Component

1-2-1 Outline of the Request

Under the above mentioned background, the government of Mongolia requested the government of Japan the grant aid assistance for the procurement of equipment and materials necessary for the project. Outline of the request is as follows.

Project name:	Plan to fit out a facility for Grain Storage in Mongolia
Executing agency:	Crop, Machinery and Irrigation Dept., Ministry of Food and Agriculture, Government of Mongolia assumes external responsibility. Actual implementation works will be entrusted to the four flour mills, object of the project.
Project site:	Four places of Harhorin, Undrkhan, Murun and Choybalsan. All within the premises of existing flour mills.

Content of request: Construction of storage facility including the ancillary equipment for the wheat to be milled and under the control of existing flour mills. In the request, the project is divided into two phases. 1st phase is for the two sites. 7,000 ton at each site and in total 14,000 ton, 2nd phase is the same. Capacity per site of 7,000 ton is for the realization of this project and for the installation of the similar facilities at as many places as possible.

Each site still has to suffer shortage of capacity even after realization of this project. It does not mention the names of places covered by each phases.

Amount requested: According to the estimate by the government of Mongolia, the amount requested to the Japanese government is 1,600 million yen in total.

1-2-2 Main Component of Request

During the field study of the mission and the scrutinizing of the request, the following were made clear:-

(1) This project covers not only the equipment and material but also civil work and construction work.

(2) Grain handling method in the storage facility must be mechanized because in the coldest season, manual works will be impossible.

(3) Coal mined in Mongolia is used as fuel for grain dryer. It is low cost and a stable supply.

(4) Collected wheat contains a lot of impurities which means a cleaning process must include stoners.

(5) Storage facility to be built under this project must be connected to the existing facility, and must function as a part of total system.

(6) Inspection apparatus is necessary in all sites so that quality of collected wheat can be inspected during the receiving stage.

(7) 2 dump trucks (8 ton) mentioned in the request have been deleted from the list through discussions within the Mongolian government.

(8) Main component in the request is same for all four sites. It is as shown in Table 1-01.

Table 1-01 Main Component in the Request

Facility/Equipment	Quality
Facility 1,600 m²	
Receiving/ Drying room	400 m²
Dust collection room	125 m²
Control room	40 m²
Feeding/distribution room	405 m²
Silo (1,200 ton/unit)	115 m² x 6 units
Machinery/Equipment	
Receiving hopper	2 ton x 2 sets
Belt conveyor (for receiving)	2 lines
Precleaner	10 ton x 2 lines
Receiving weigher	10 ton x 2 lines
Bucket elevator (for weighing)	2 lines
Rotary dryer	20 ton x 2 lines
Bucket elevator (for dryer)	1 set
Belt conveyor(Recirculation)	1 set
Aspirator	1 set
Bucket elevator (for silos)	1 set
Chain conveyor	1 set
Chain conveyor (for discharging)	1 set
Bucket elevator (for discharging)	1 set
Control box	1 set
Dust collection system	1 set
Inspection equipment	1 lot

Chapter 2 Outline of the Study

Chapter 2 Outline of the Study

The government of Japan, complying with the request from the government of Mongolia as mentioned in Chapter-1 instructed Japan International Cooperation Agency(JICA) to conduct a study and dispatched the Basic Design Study Mission headed by Mr. Hideo Miyamoto, Deputy Director, First Basic Design Study Division, Grant Aid Study & Design Department, JICA to Mongolia from September 28, 1994 to October 22.

The study mission discussed the project with the officials of the government of Mongolia, namely the Ministry of Food and Agriculture and other related authorities, conducted a field survey at four places of Harhorin, Undrkhan, Murun, Choybalsan, all are the object of this project, and on October 14 signed the Minutes of Discussions together Mr. Gochoo Davandorj, General Director, Crop, Machinery and Irrigation Dept., Ministry of Food and Agriculture and also Mr. CH. Enebish, Deputy Director, Economy & Foreign Trade Dept., Ministry of Trade and Industry.

On October 15, two members from the government side returned to Japan and four consultant members continued the study. They made an additional study at Undrkhan and collected some information, laws and regulations and standards at governmental organizations in the field of construction. They also visited private construction companies and made investigations in the construction works and collected data for cost calculations. They explained the Japanese Grant Aid System described in the inception report to the Mongolian party. Specially, as a study policy of Japanese team, they explained that they will visit all four sites. Harhorin or Undrkhan whichever is of higher priority should be selected as the project site and for remaining three sites. The necessity of urgent assistance shall be studied and discussed. The study team explained the above, and Mongolian party understood and gave consent.

Field investigation at the object of study took more time than expected because of the difficult traffic conditions and it was hard to conduct the investigations as initially planned because of the limited time of stay. However, in order to prevent the leakage of study item and to conduct the study efficiently, the mission employed a slip reminder system. Consequently the mission could achieve the expected results in a short time with the cooperation extended by the Mongolian representatives. The mission would observe the open yard piling of wheat as the study time coincided with the wheat collecting time after harvest.

On the other hand, as Mongolia has been under socialistic administration system for a long time, technical matters in all fields were taken from the former Soviet Union. As a result, technical standards are different from those in Japan. So it took time to investigate matters related to construction engineering.

The mission compiled the report upon returning to Japan by scrutinizing the collected information and data and the answers to the questionnaire. After this, JICA sent a draft report explanation team headed by Ms. Fujiko Yoshida, Assistant Director, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs. Members of the mission, itinerary, name list of persons interviewed at Mongolia, Minutes of Discussions are shown in Appendix.

Chapter 3 Circumstances Around the Project

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3-1 Socio-economic Condition

For the latest information on the socio-economic conditions of Mongolia, please refer to Appendix 5.

3-2 Development Program for Agriculture and Stock Farming

Main industry in Mongolia is mining, agriculture and stock-farming. Proportion of agriculture and stock-farming in the national economy is 16.5% of GDP in 1985, 20% in 1990, 19.5% in 1991, 30.7% in 1992 and 36.2%(estimate) in 1994. In 1990, it occupied about 30% of all working population, about 40% of all export. On the other hand, manufacturing industry occupied about 35% of GDP in the same year. It is chiefly processing industry using material made by stock-farming such as wool, cashmere, meat, etc. Therefore, agriculture and stock-farming can be said a mainstay of the Mongolian economy.

History of farming in Mongolia is relatively short. After 1950, under the guidance of the former Soviet Union, its planting area has been enlarged chiefly for wheat with the introduction of large scale mechanised farming. However since 1990, enlargement of the cultivating unit area is not progressing because state farms were divided and privatised. Also, production level is decreasing year by year. It is for the following reasons:

Confused socio-economic system due to abrupt privatisation, discontinued assistance from the former Soviet Union and east European countries, shortage of agricultural equipment & materials, inadequate irrigation system, insufficient distribution and processing facilities, lack of operational funds, etc. Especially, shortage of agricultural input such as fertilizer, agricultural chemicals, seeds, spare parts, fuel, etc. for agricultural machinery as a result of lowered function of government procurement organisations.

Production unit of former state-farms and NEKDELS(agricultural and stock farming cooperatives) were divided into enterprises and privatised. Large scale agricultural machinery were also divided and owned by each enterprise. Therefore, the conventional efficient agricultural production system by mechanized and coherent processes does not function any more.

Soil utilisation rate against total area of 1,565,000 km² is only 0.8%(1.37 million ha) which is cultivated in 1991. 90% is natural field and desert, forest is 9%. Out of 1.37 million ha of agricultural land every year about 0.7 million ha is planted. Out of planted 0.7 million ha land,90% of which is wheat cultivation. Grain planted area reached maximum 0.67 million ha in 1989. It decreased afterwards and in 1993, 0.55 million ha was planted for grain (wheat was planted on 0.45 million ha). Grain production in 1989 was 0.84 million ton but it decreased since then to 0.48 million ton (wheat was 0.45 million ton)in 1993. With regard to flour, she attained about 90% self-sufficiency.

The government of Mongolia tried to increase food production as it is the base for stable life of Mongolian people, named the year 1993 as "Food year" (resolution Dec. 25, 1992). However, it ended in a miserable condition. Production of main food such as grains, potato, etc. except vegetables was lower than expected. Planted area and production of main crops are shown in Table 3-01 and 3-02.

Table 3-01 Production of main crop

unit : 1,000 ton

Year	Total grain	(Wheat)	Potato	Vegetable	Crop for feed
1983	812.8	(647.6)	97.5	34.3	(n.a.)
1984	586.2	(458.7)	122.9	34.2	(n.a.)
1985	886.0	(688.5)	113.9	41.2	1,060.0
1986	869.4	(663.7)	132.8	46.4	1,091.8
1987	689.3	(543.0)	147.6	48.0	1,145.8
1988	814.3	(672.2)	103.2	56.3	1,035.7
1989	839.1	(686.9)	155.5	59.5	1,027.3
1990	718.3	(596.2)	131.1	41.7	696.4
1991	595.0	(538.2)	97.5	23.3	562.1
1992	493.9	(453.2)	78.5	16.4	405.7
1993	480.0	(447.0)	60.0	22.6	(n.a.)

Source: Mongolian economic and social statistics, 1992

Note: 1993 figures are by prompt report announced by Statistics Bureau

Table 3-02 Planted Area

(1,000 ha)

Year	Total Area	Grain	Potato	Vegetable	Crop for Feed
1985	789.6	636.2	10.3	3.3	139.7
1986	803.7	629.7	11.2	3.8	159.0
1987	800.1	622.9	12.4	4.0	160.8
1988	828.4	641.6	13.1	4.1	169.5
1989	837.9	673.4	12.6	4.2	147.7
1990	787.7	654.1	12.2	3.6	117.8
1991	708.1	615.3	10.1	2.8	79.9
1992	657.7	592.6	8.7	2.2	52.9
1993	580.2	546.0	8.5	3.0	22.7

Source: Mongolian Economic and Social Statistics, 1992

Note: 1993 figures are prompt report announced by Statistics Bureau

Under these circumstances, the Government of Mongolia cited achievement of self-sufficiency in food for stabilization of people's life as most important national policy. However, budget under the Ministry of Food and Agriculture is only 1,423,663,000 TG (about 335 million yen) in 1994, and is increasing to 2,670,757,300 TG (629 million yen) in 1995. Affected by stiffened financial conditions, it is rather a small amount for a total budget under one ministry. Therefore, governmental organizations started profit earning businesses to earn some of their operational fund, not relying only on national budget.

The Ministry of Food and Agriculture named a mid-term plan as "Basic Policy for Agricultural Field" and is now carrying on the policies. Some of the items related to this project of grain storage improvement are extracted as follows:

(1) To promote privatisation and free competition

(2) To establish semi-governmental Grain Farming Enterprises of 60,000 - 100,000 ha scale.

(3) To plan establishment of small to medium scale processing factories of private enterprises and give financial assistance to develop processing

factories of agricultural produce.

(4) To produce 185,000-190,000 tons of wheat flour about 71-73% of total demand of Mongolia. In order to operate food processing factories constantly and to increase production, install new two processing lines each in Alto company and Talfochihill company, both bread factories. One line each in Darkhan and Erdenet food processing factories.

(5) Let each bakery self-supply his own needs of material wheat, thereby reduce the import of material(wheat).

Following is a part extracted from Minister of Food and Agriculture Mr. Tseveenjaviin UULD's recent speech on his administrative policies, which related to this project.

(1) From the standpoint of improving food situation of the people of Mongolia, chalked out "Food of Mongol" plan. Subordinate plans about meat, milk and grains(wheat) are now being carried out.

(2) Although agricultural cultivation in Mongolia has only 30 years history, one million ha of farming land produce 540,000 tons of grains, 70,000 tons of potato and 30,000 tons of vegetables. The degree of agricultural mechanization is about 80%. Thus, it has developed in a short period. However, due to lack of capital, improvements in agricultural technology such as fertilisation, irrigation work, etc. have not been carried out. As a result soils have become impoverished and the productivity has been lowered.

(3) Privatisation is actively progressing, now 90% of all livestock is owned privately and many companies limited are born in agricultural cultivation.

(4) Scale of management unit of farms is 6,000 ha in the grain production, 50-300 ha for growing vegetables. It varies by crops.

(5) Make plans to integrate the investment and technical innovation by establishing organizations like cooperative in which the flour mills are incorporated into grain producing farms so that the farms can enlarge production and can be independent enterprises.

(6) Establishing advanced agricultural and stock-farming cooperatives by organising material production and food processing complex relating to agriculture and stock farming.

The Ministry of Food and Agriculture is now making a long-term plan up to year 2000.

3-3 Project by Japan, Other Countries and International Organisations Relating to This Project.

3-3-1 Meeting of Association for Mongolia Assisting Countries

Western countries expressed further assistance in chairman's declaration at London Summit, July 1991 to Mongolia who tackles reform works in the economic difficulties.

Various assistance centering upon emergency assistance for the economic crisis then were expressed by the participating countries and international organization in the 1st and the 2nd meeting of Mongolia Assisting Countries held in September 1991 and May 1992 under the joint chairmanship of Japan and the world bank. In the 3rd meeting of Mongolia Assisting Countries, assistance for mid-term and long-term development were discussed and new assistance was expressed by the participating countries. Further, at the 4th meeting of Mongolia Assisting Countries, held in Tokyo in November 1994, measures for a poverty alleviating plan were discussed.

3-3-2 Project by Other Countries and International Organizations

A seminar on assisting programs concerning food, agriculture and stock-farming by each country and international organizations was held in September 1994 at Ulaanbaatar. According to the seminar, among many projects followings are the projects relative to this project.

- Agricultural Management / Policy Financing

  MON/92/007-FAO Executed Agricultural Management Development

  Agricultural Sector Program Loan-ADB

MON/92/010 - Management Development Assistance for Specific Key Economic Sectors, 1992-95, US$ 874,000

- Vegetable, Fodder and Fertilizer

TCP/MON/4451-Weed and Rodent Control, FAO, 1994-1995, US$ 140,000

FADINAP program jointly implemented by FAO, ESCAP and UNIDO

Improvement of Vegetable Production, Israel, 1994

Nuclear Techniques in Agriculture, IAEA, 1993-95

4 MNG/P005 - World Bank Project on Improving the Crop Production, 1994-97, soft loan

- Food

FAO/ADB Agricultural Processing, Storage and Distribution Project, 1993-94

TCP/MON/2354 - Food Quality Control, FAO,TA US$ 190,000.

- Agricultural Information / Marketing System

TCP/MON/2252 - Strengthening the National Information Center for Agricultural Sciences and Techniques, FAO, TA US$ 126,000

TCP,RAS/2362 - Strengthening Food and Agricultural Marketing Reform in Asian Centrally Planned Economies, FAO, 1993-95, US$270,000

TCP/RAS/2353 - Agricultural Statistics, FAO, 1993-94, US$308,000

There are no overlapping project with this project. However, FAO/ADB Agricultural Processing, Storage and Distribution Project,1993-1994 is to select and strengthen the model private enterprises in the field of food processing. It may help strengthen effect of this project in the future.

3-3-3 Assistance from Japan

Executing agency of this project is the Ministry of Food and Agriculture and they are now implementing Project for Improvement of Darkhan Meat Plant and Project for Rehabilitation of Refrigerating System of Ulaanbaatar Milk Plant. Further, they are studying and making "Master Plan for Integrated Agriculture and Rural Development of Central Region of Mongolia" for aimags of Selenge, Tov, Overhangay, Darkhan, Bulgan and Erdenet. One of the site for this project, Harhorin is also the object of their study.

Project for Improvement of Transshipment Facilities at Zamin-Uud Station, a project for strengthening railway transportation, which is located at Mongolian side near Mongolia/China border will relate with this project during the implementation period. The transshipment facility improvement work is now under construction and will be completed by September 1995.

Besides the above-mentioned projects under the Grant Aid Assistance program of the Japanese Government, assistance of food or assistance for increasing food production are being extended to Mongolia by the government of Japan.

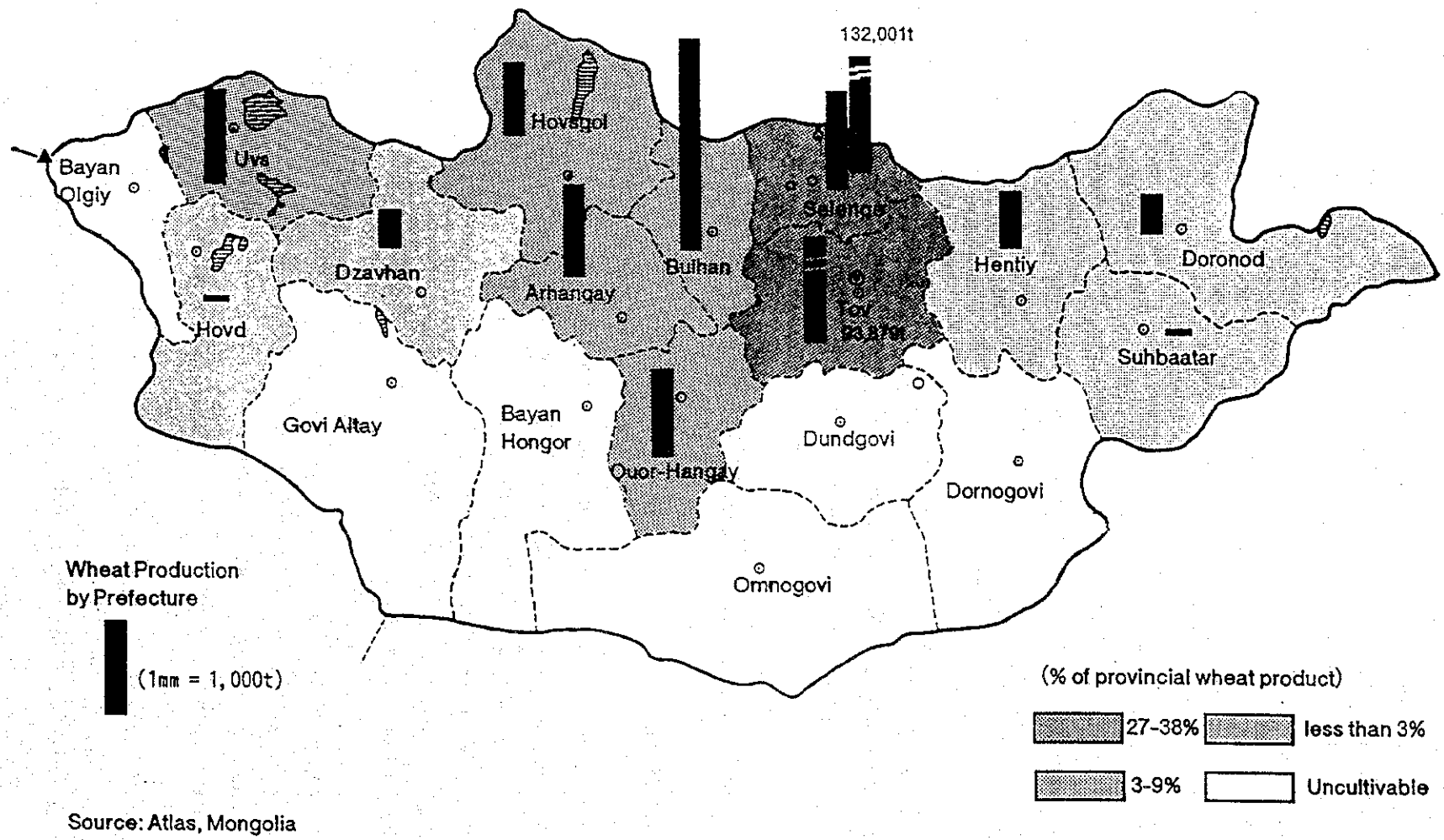
3-4 Present Condition of Agriculture and Stock Farming

3-4-1 Wheat Production

Growing period of agricultural crops in Mongolia is only for about 100 days in a year. Long winter and insufficient temperature and sunshine often causes quality problems such as immature grains. The crops are easily subject to the influence of weather. Main crops are spring wheat grown by a rotation system on an every other year basis. Normally sowing is done in early May and harvested in early September.

Agricultural works are done by large scale mechanised farming system imported from former Soviet Union. Plowing, leveling and planting are done by large tractors and harvesting by large combines. Handling is not done in a bagged condition but in bulk grain.

Main producing areas are northern central regions as shown in Figure 3-01. Prefectural base productions are shown in Table 3-03. Areas covered by this project are also main producing and supply bases in each area.



Source: Atlas, Mongolia

Figure 3-01

Wheat Production by Prefecture and
% of Provincial Wheat product to Total Product in Whole Land

Table 3-03 Prefectural Base Wheat Production

(unit : ton)

Prefecture	1986	1987	1988	1989	1990	1991	1992	1993
Arhangay	22,656	25,843	18,706	31,398	34,845	25,600	17,061	23,443
Bayan Olgiy	-	-	-	-	-	2	61	197
Bayan Hongor	-	-	-	-	-	-	-	22
Bulgan	74,721	59,604	76,808	95,739	77,930	71,679	65,587	54,911
Govi Altai	-	-	-	-	-	-	245	519
Dornogovi	-	-	-	-	-	-	-	-
Dornodo	9,056	9,176	29,458	53,161	28,794	30,132	18,923	13,761
Dundgovi	-	-	-	-	-	-	0	40
Dzavhan	10,322	8,334	4,888	3,852	3,078	6,608	2,851	2,950
Ovor-Hangay	19,861	26,347	13,411	20,957	23,682	20,661	11,699	13,994
Omnogovi	-	-	-	-	-	-	-	-
Suhbaatar	2,885	2,427	2,738	5,173	8,634	12,673	7,781	12,633
Selenge	289,863	220,178	337,935	190,014	187,357	170,986	155,383	144,801
Tov	139,144	120,469	96,945	148,881	115,423	105,580	120,563	95,226
Uvs	32,814	24,427	24,864	33,918	19,473	17,684	6,461	31,508
Hovd	478	142	-	-	36	100	415	489
Hovsgol	25,883	15,935	29,427	29,067	22,122	18,710	13,648	15,435
Hentiy	36,184	30,764	36,825	52,513	44,868	29,327	10,158	16,255
Darkhan	-	-	-	19,629	27,638	26,154	20,228	21,767
Ulaanbaatar	-	-	-	-	-	250	100	-
Erdenet	-	-	-	2,548	2,326	2,190	2,021	2,268
Total	663,867	543,646	672,005	686,850	596,206	538,336	453,185	450,219

Source: Ministry of Food and Agriculture

Before economic reform took place, state farms(41 farms out of 73) and NEKDELS(Agricultural cooperative) had produced wheat. State farms however were divided and privatized by 1993 and agricultural machines and other equipment were also divided and due to lack of these equipment, productivity is rather lowered recently. It is lower than self sufficiency level. It is obvious by Table 3-01 and 3-02, which show lowered planting areas and

decreased production.

Former state-farms owned grain storage facilities of 1,000-4,000 tons size. It is principally for seeds. They did not function as storage for distribution purpose. Small scale farms of about 1,000 ha was the model for privatisation. However, it had a bad effect of reducing utilization efficiency of the facilities and agricultural machines by smaller scale management. It is being reviewed and sometimes the farms are reunited again.

In the case of Hentiy prefecture(Undrkhan site), there were three state-farms and six to seven NEKDELS. But after privatization, they were divided into 30 smaller units. Afterwards, it was reviewed and many are reunited and now 12 farms are operating. Actual state of privatisation in Hentiy prefecture is not a complete privatisation but as Hentiy prefectural governor expressed that in future also prefectural government will own over 51% of the share and will keep control of the farms. Other prefectures also following the similar movement.

Generally, wheat for human consumption is classified into two types, soft wheat and hard wheat, depending on its usage. Under the Mongolian standard, wheat is classified into following three classes based on its colour, hardness and viscosity, and the first class has five ranks in quality, the second has two ranks and the third has two ranks.

- The first class Varieties of Red spring wheat; Saratav -29, -36, Skala, Buriatskiy -34 and others
- The second class Varieties of Hard spring wheat; Harkovskiy -46, Almaz and others
- The third class Varieties of White spring wheat; Albidium -43, Orhon and others

Quality standards for soft wheat (as target) are (apparent) specific gravity over 740 g/ℓ, moisture content below 19% w.b. and impurity content below 5.0% in weight. And lowest quality standards when they are received are (apparent) specific gravity over 700 g/ℓ, moisture content below 19% w.b. and impurity content below 5%. Additionally soft wheat is classified into 6 grads based on wet gluten quality and content (over 18%).

Quality of hard wheat must be apparent specific gravity over 745 g/ℓ and wet gluten content over 22%. Hard wheat is classified into 3 grads.

3-4-2 Marketing of Wheat

Under planned economy, wheat produced in state-farms was bought by certain flour mills at fixed price. Flour mills distributed the products, the flour according to the government directions. Therefore, distribution channel from production to consumption is extremely simple and uniform.

Table 3-04 shows production and shipment in 1990.

Table 3-04 Grain production and where shipped (1990)

Unit : 1,000 ton

	Wheat	Barley	Oat	Bean	Rye	Total
Farmer's own consumption	58.1	14.6	3.2	0.5	0.6	77.0
Seeds	95.8	23.0	14.6	0.2	0.9	134.5
Sales to state	372.1	41.7	9.7	0	0.7	424.2
Production	526.0	79.3	27.5	0.7	2.2	635.7
Amount sold to state was shipped to :						
Flour mills	262.1					262.1
Feed mills	75.9	28.3	4.9			109.1
Seed use	3.8		1.3			5.1
Food industry	9.8	3.3				13.1
Feed for pig	3.0	1.2				4.2
Feed for poultry	1.0	2.5				9.5
Bio-kombinat	0.1	0.7				0.8
Other farms	2.4	1.0	1.1		0.7	5.3
Other feeds	8.0	5.4	1.6			15.0
Total	372.1	41.7	9.7	0	0.7	424.2

Source: Ministry of Food and Agriculture

In the past, under planned economy, production, collection, processing (milling), sales were done according to government plans and directions. After introduction of market economy, marketing of food is institutionally liberalized but the conventional distribution channels that were directly connecting producing farms to flour mills are still followed by both sides. This is because distance between producing farms and flour mills is far and these distribution channels established under planned economy are still the most economical channels even after market-economy is introduced.

Figure 3-02 shows positions of existing flour mills and relation with former state farms who used to supply wheat to the mills. In the Appendix 8, you will find names of farms who are supplying wheat to the flour mills in the objects site of this project and their distances. They are mostly for away from 100 to 300 km.

Material storage facilities at flour mills sometimes function as producing site warehouse if they are located near the producing areas. However, they are generally located far away from producing areas. Marketing system is not well developed and there are no intermediary warehouse in the way of marketing.

Even after market economy was introduced, the market mechanism was not established. There were some confusions in the distribution system because the goods were not transported to the necessary areas when needed. Consequently, local government made some adjustment. Yet, the market mechanism did not function sufficiently. As a result, a rationing system was employed after January 1992 temporarily.

Presently, marketing of agricultural produce including wheat is liberalised. Producers can decide where to sell and the price they sell. Actual conditions after liberalization are as follows.

- ☐ Low priced wheat is imported from China affecting the sales of former state-owned flour mills.

- ☐ Marketing channels and buyers of domestically produced wheat are basically the same as before planned economy was enforced. Marketing was liberalized but not well developed, and if they were to sell to another company of a long distance away, transportation would cost more. As a result, wheat is actually sold to same flour mills as before. However, gradually there appeared local price differences in the price of wheat flour (110-120 TG/kg).

- ☐ Small scale flour mills are being opened locally using small milling machines made in China but there are some problems like lower milling yield and the final product containing some impurities as there is no cleaners. The Ministry of Food and Agriculture is urgently required to take actions to cope with the situation.

As mentioned so far, the flour mills have function of storage and milling who also collect the wheat from farms. Their position in the marketing of wheat from production to consuming stage is very important. This is even more true considering the simple marketing process.

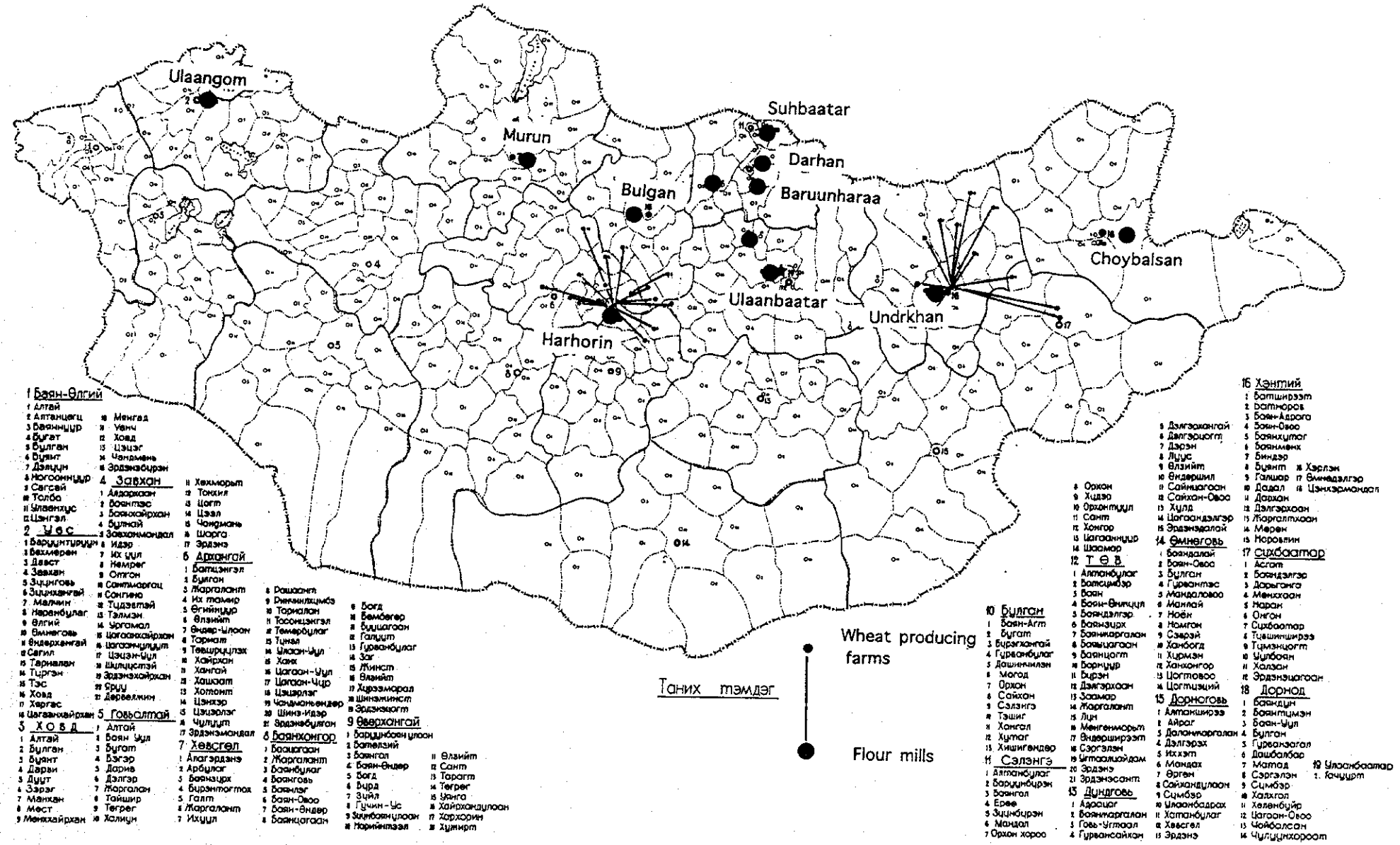


Figure 3-02 Location of Flour Mills and State Farms Producing Wheat

3-4-3 Present Condition of Existing Flour Mills & Storage Facilities

(1) Flour Mills

Most of formerly state owned flour mills and their ancillary equipment in Mongolia were built from late 1950's to early 1960's with the assistance of the former Soviet Union. They produced wheat flour, by-product of milling operation and feed from off-grade wheat exclusively in the past. At that time, flour mills are built strategically at the key points throughout the country along with the increase in cultivated land. They are located in between the consuming areas (Ulaanbaatar, and Darkhan) and producing areas or local areas (where wheat is not grown). It is assumed that the number of flour mills are decided by the minimum economic capacity and the location were planned by the distribution program from the fact that the wheat producing farms are only a small portion of vast land and they are not only scattered but total wheat production is rather small. Presently, ownership and management style of those flour mills are privatised due to the reform in social system and introduction of market economy. The government equally issued shares to the people of Mongolia when privatisation took place. Mainly employees and their families own these coupons(stock). Actually stock-owners are not many and are of a unspecified number of persons.

In the near future, the 2nd stage of the privatisation will be announced by the government. However, since milling industry plays an important role of supplying staple food to the people of Mongolia, the government will not only keep present level of ownership for stabilising people's life but also the Ministry of Food and Agriculture expressed their idea that the government control over the milling industry is basically necessary in future also.

Annual milling capacity of each flour mill is expressed by the quantity of product, flour. Necessary quantity of wheat material is calculated on the basis of milling yield 67%, from material to product. The outline of former state owned flour mills are shown in Table 3-05.

Table 3-05 Outline of Flour Mills

No	Name of flour mill	Established	Capital (mil. tg)	Form of ownership(%)		No. of employee	Annual flour milling capacity(1,000 ton)	
				Government	Private		Flour	Material wheat
1	Ulaanbaatar	1959	622.3	51	49	285	42.0	63.0
2	Suhbaatar	1961	99.1	51	49	454	41.0	61.2
3	Harhorin	1962	30.3	60	40	219	16.0	23.9
4	Bulgan	1958	52.5	-	100	180	11.5	17.2
5	Ulaangom	1959	21.8	51	49	155	9.0	13.4
6	Choybalsan	1959	11.6	51	49	133	9.0	13.4
7	Murun	1962	13.8	51	49	178	9.0	13.4
8	Undrkhan	1961	14.2	51	49	176	9.0	13.4
9	Darkhan	1963	42.3	51	49	350	44.0	65.6
10	Baruunharaa	1963	77.9	-	100	100	-	-
11	Khutul	1989	30.0	100	-	80	-	-
	Total		1,015.8	-	-	2,310	190.5	284.2

Source: Ministry of Food & Agriculture and the Study Mission

Quantity of wheat collected and quantity milled by each flour mill are as shown in Table 3-06 and Table 3-07.
Actual record of milling against capacity of machines is 94.4%. Operation rate is considerably high for its degree of worn-out condition.

There has been a downward tendency for product amount of wheat flour in Mongolia since 1990 because of conveying cheap one from China.

Table 3-06 Wheat Collected by Each Flour Mill

Unit: 1,000 ton

No	Name of flour mill	Collected quantity							
		1987	1988	1989	1990	1991	1992	1993	Ave.
1	Ulaanbaatar	72.9	47.5	115.1	67.4	58.4	57.5	54.4	67.6
2	Suhbaatar	57.3	109.4	58.4	50.4	27.5	38.5	35.0	53.8
3	Harhorin	29.2	23.0	35.8	32.6	20.2	15.2	20.0	25.1
4	Bulgan	24.2	27.0	28.1	25.5	22.5	20.8	20.8	24.1
5	Ulaangom	11.5	14.5	17.5	8.1	8.5	2.4	18.6	11.6
6	Choybalsan	3.0	19.5	38.9	14.4	13.5	6.3	8.0	14.8
7	Murun	8.5	15.2	14.8	18.2	12.6	8.5	11.0	12.7
8	Undrkhan	17.2	21.6	24.2	22.8	20.0	6.3	14.0	18.0
9	Darkhan	86.0	153.4	79.1	62.8	51.9	54.2	47.8	76.5
10	Baruunharaa	16.7	11.4	14.8	10.3	-	0.6	-	7.7
11	Khutul	-	-	-	-	7.1	8.1	-	2.2
	Total	326.5	442.5	426.7	312.5	242.2	218.4	229.6	314.1

Table 3-07 Flour Produced by Each Flour Mill

Unit: 1,000 ton

No	Name of flour mill	Flour production							
		1987	1988	1989	1990	1991	1992	1993	Ave.
1	Ulaanbaatar	n.a.	47.0	47.5	47.4	45.9	47.2	40.3	45.9
2	Suhbaatar	n.a.	40.3	42.5	32.6	30.9	34.6	24.4	32.6
3	Harhorin	n.a.	12.3	14.1	13.5	16.2	15.0	8.2	13.2
4	Bulgan	n.a.	9.9	10.7	11.0	11.6	12.4	10.4	11.0
5	Ulaangom	n.a.	10.4	10.2	10.2	10.1	9.9	6.0	9.5
6	Choybalsan	n.a.	8.1	8.4	9.2	9.3	10.1	5.0	8.4
7	Murun	n.a.	10.2	10.2	10.6	10.5	11.6	6.9	10.0
8	Undrkhan	n.a.	8.2	8.2	9.1	9.9	11.8	8.0	9.2
9	Darkhan	n.a.	50.0	47.9	43.7	30.2	29.3	29.7	38.3
10	Baruunharaa	n.a.	-	-	-	-	-	-	-
11	Khutul	n.a.	-	-	-	-	-	-	-
	Total	n.a.	196.4	199.7	187.3	174.6	181.9	138.9	179.8

Collected amount is about 10% more than the milling capacity of the mill. This is presumably because feed mill is installed side by side with the flour mill and lower grade wheat is used as material for feed. Generally, the quantity of wheat traded by each mill is balanced with the capacity of the mill. Milling facilities of the flour mills are judged as fully utilized.

After introduction of a market economy, small scale flour mills using Chinese small milling equipment are being established by private enterprises. However, there are some problems of lower milling yield, impurities mixed in with the flour(no cleaner), etc. and it is necessary for the Ministry of Food and Agriculture to take some control measures.

(2) Wheat Storage Facility

Wheat storage facility in Mongolia is only the material storage facility attached to flour mills except the one for seed purpose at producing farms. According to the Ministry of Food and Agriculture, total capacity of the material storage attached to the flour mills is 347,900 ton as shown in table 3-08.

Table 3-08 Capacity of Storage and Milling Facility at Each Mill

(1,000 ton)

No.	Name of flour mill	Storage facility	Annual milling capacity	
			Wheat flour	Material wheat
1	Ulaanbaatar	64.0	42.0	63.0
2	Suhbaatar	82.0	41.0	61.2
3	Harhorin	10.0	16.0	23.9
4	Bulgan	38.7	11.5	17.2
5	Ulaangom	4.0	9.0	13.4
6	Choybalsan	10.0	9.0	13.4
7	Murun	7.2	9.0	13.4
8	Undrkhan	4.0	9.0	13.4
9	Darkhan	82.0	44.0	65.6
10	Baruunharaa	12.0	-	-
11	Khutul	34.0	-	-
Total		347.9	190.5	284.2

Source: Ministry of Food & Agriculture

If we compare the necessary quantity of wheat from the Table 3-08 flour milling capacity and the total capacity of storage facility, the storage capacity is 120% of the necessary quantity of material wheat. But each flour mill has also feed mill and the low grade wheat would be a material for feed. Therefore these storage facilities partially store the material for feed. It is also 110% of the average quantity collected(314,000 tons).

Aside from the quality of storage facility, capacity of total nation can be said sufficient. However, in the flour mills under this project, quantity of necessary material(wheat) is far more than the storage capacity. Since there is a considerable difference in the storage capacity in the data of the Ministry of Food and Agriculture and the result of survey made this time by the study mission, storage capacity in the above-mentioned table must be corrected. The result of site survey in the object area of this project are as mentioned later.

In Mongolia, all grains are handled and marketed in bulk. Therefore storage facilities must also handle bulk grains. As mentioned before, present wheat storage facilities are attached to the flour mills and their necessary functions are a safe storage and a stable supply to its milling operation. Therefore, consistent flow for whole mill, from the storage to milling is required. It can be expressed as follows.

Example 1

(Loaded truck arrival) ↓		(Loaded truck arrival) ↓				
open piling	→	Mechanized flat warehouse Flat warehouse	→	Buffer bins	→	Milling process

Example 2

(Railway cart/ Truck arrival)	→	Silo	→	Buffer bins	→	Milling process

Types of storage practiced in present Mongolia are divided as follows : open piling is just a place to put and it is not a storage facility. Open shed can be said as simple storage facility.

- Open piling : Piles grain on ground or concrete floor(hard-standing) and piled in triangle form with a base 4-7 m. 5,000-6,000 ton/ha.

- Open shed : Flat warehouse without walls. To store grains for feed. 500-1,000 ton/unit

- Flat warehouse : Piles bulk grains on flat floor warehouse. Feeding and discharging are done by combination of manpower and truck.

- Mechanized flat warehouse : Semi under-ground. Feeding and discharging by upper and lower conveyors. 5,000-10,000 ton/unit

- Silo : Flour mills at Ulaanbaatar and Darkhan are equipped with modern concrete silos

Each flour mill when they receive grains must conduct inspection of moisture content and specific gravity according to the quality standard, complete drying according to its moisture content, and must store the grains until it is milled to flour.

3-5 Project Site

3-5-1 Storage Facility

(1) Result of Field Survey on Each Site

Result of study on the storage facilities of material wheat, receiving, drying, cleaning and warehouse are stated as below;

1) Harhorin Site

a) Storage of Material Wheat

Although there are two warehouses for wheat (total capacity 16,600 tons), one house(capacity 11,000 ton) is worn out and was ordered to repair by National Building Inspection Bureau. Further, Labour Security Board prohibited the use of this warehouse due to some problems in the safety of labour conditions. Repair works (including reduction in capacity) and

its necessary budgetary measures are now planned. Work is now scheduled to take place in 1994-1995.

The use of the other warehouse (capacity 5,600 ton) is not prohibited, but it can not be used for grain storage due to inundation, rain leaks from walls and roofs, broken conveyors, etc.

They have to pile up all the wheat collected this year on open yard.

b) Receiving, Drying and Cleaning Equipment

As a part of the grain storage facility, there is a receiving facility, a drying facility and a precleaning facility. All of the equipment are operating, but their functions and capacities are significantly reduced due to their poor condition. The dryer is a kerosene burner type and is situated in, one of the rooms in the machine building. It would need complete modification if it were to operate at the rated capacity of (48 ton/day) and to keep economical operation, raising the heat efficiency. However, under the present circumstance, they will have to make a partial and temporary repair in spite of its low investment efficiency due to a lack of fund and a problem in procurement. They are having a hard time in the procurement of kerosene fuel as it is quite expensive.

The dust collection, common for receiving, conveyors and precleaning processes, employs cyclone type but it is not in operation due to the breakage of its duct and fan.

For this reason, the floor and machines in the machine building are all covered with flour/dust. This powdery dust is contaminating the working environment and it may cause fire and a dust explosion by short circuits of electricity or friction heat.

2) Undrkhan Site

a) Storage of Material Wheat

There is only one semi-underground warehouse in the flour mill site. About 11 km away from the mill site is an open yard for 16,000-18,000 tons grain pile up. The material wheat procured from farms is weighed by truck scale in the flour mill and then transported to the open yard for piling.

Unloading from the truck is done manually (about 30 workers). Emptied trucks will go back to the flour mills for weighing. At this time the grain quantity transported by and received from this truck is known and recorded. The material wheat is piled up until the time the flour mill needs it (maximum about six months). Although there are watchman at grain pile-up ground, losses by birds, winds and rains are considerable.

For transportation into the flour mill, the grain are again loaded onto the truck manually. Then the grains are reweighed at the flour mill site, received, pre-cleaned and through dryers, etc. finally being fed to milling process.

b) Receiving, Drying, Precleaning Equipment

All equipment is badly maintained similar to that of Harhorin. Especially, base part of material feeding bucket elevator connected to receiving hopper and/or semi-underground warehouse is submerged in underground water.
It is kept operating while water is removed by pumps. The dryer they have is movable for open yard pile-up grains. They are having a hard time in procurement of fuel oil.

3) Murun Site

a) Storage of material wheat

There are two semi-underground warehouses (capacity 3,200 tons and 2,400 tons; total 5,600 tons capacity). Rain water leaked in smaller one of 2,400 ton capacity and germinated grains were

observed. Breakage of roofs,deformation of pillars and beams were seen and in general the warehouse is badly worn-out.

In the flour mill site, there are precleaner, weigher, semi-stationary dryer all placed outdoors and on open yard for grain pile up storage ground. Material wheat whose moisture content is higher than a certain level (majority of wheat received by the flour mills) is dried by this dryer and through semi-underground warehouse of 3,200 ton conveyed to the flour mill.

b) Receiving, Drying, Precleaning Equipment

Very bad condition, same as other flour mills

4) Choybalsan Site

a) Storage of material wheat

There are four stone-built warehouses for material wheat (total capacity 6,000 tons). These stone warehouses are of poor layout, not mechanized, low eave height (2.5-3.0 m), small doors and not functional.

The majority of material wheat is stored on the open yard ground adjacent to the flour mill. Unloading from and loading onto trucks is manual work similar to Undrkhan. A side track railway exists but because of poor connection with the farms, almost all of procured wheat is carried in by trucks.

b) Receiving, Drying, Precleaning Equipment

Very badly maintained same as other flour mills.

5) Present Quality Inspection

The material wheat procured from farms by the flour mill is undried, uncleaned wheat just after harvesting by combine harvesters and transported straight from farms to flour mills. At flour mills, samples are taken from unprocessed grain for quality inspection. Moisture meter, specific gravity tester, separator, etc. are used for

quality inspections. The results of inspections are referred to grade standards and the grades and buying prices are decided. Therefore quality inspection when received is extremely important.

Equipment used in each flour mill for quality inspections is as old as the flour mill itself, about 30 years. Measuring accuracy and speed are low. There are insufficient number and kinds of equipment. Consequently, necessary inspections are not made at the right times.

6) Simple Storage (Open shed)

Actual grain storage methods practiced in Mongolia are divided into open yard piling, open shed, flat warehouse, mechanised flat warehouse and silo. Among these 'Open shed' may correspond to simple storage. The open shed is used in Murun site for storage of wheat for feed use. This method is effective in reducing the effect of direct sun shine and rainfall. But it is not so effective in reducing the damage by birds and rodents, scattering by winds, inundation to floor area. Therefore newly use of open shed for storage of material wheat is not recommended in Mongolia.

(2) Capacity, Year Constructed, Worn-out Degree

Present storage capacity of the four sites studied are as follows:

Table 3-09 Present Condition of Storage Facility

Site	Existing storage facility (ton)			
	Mechanized flat warehouse	Flat warehouse	Open shed	Open yard piling
Harhorin	• 11,000 ton (constructed '62 Prohibited to use.) To be repaired	5,600 ton (constructed '60) unusable		7,000 ~ 8,000 ton
Undrkhan	• 3,800 ton (constructed '60) (Reroofed)			16,000 ~ 18,000 ton
Murun	• 3,200 ton (constructed '67) • 2,400 ton (constructed '67)		400 ton x 3 Material for feed	
Choybalsan		6,000 ton/4 houses unusable		3,500 ton

Source: Study mission

Existing storage facilities were built in the 1960's. Deterioration proceeded, rain water leaks, inroads of birds and rodents, danger of collapse(Harhorin), etc. are there. In the case of Harhorin, there are two flat warehouses. One is mechanised flat warehouse (designed capacity 11,000 ton), and the other is flat warehouse (designed capacity 5,600 ton). Under present conditions, they can not be used for grain storage as mentioned before. The flour mill plans to repair as follows: The mechanised warehouse is equipped with a discharging conveyor that runs through underground passage of about 80m in length. Out of total 80m, 24m needs repair. They plan to replace pillars for 12m length and repair side wall for the rest of 12m. According to an estimate made by a constructor in Hojirt city, it costs 2-3 million TG. The repair works are scheduled to be made after spring of 1995.

For flat warehouse, they have no plan of repair since it is not a mechanized warehouse.

(3) Collection of Materials Wheat

In object areas of this project, same as other areas, wheat produced in farms is transferred to the project site, flour mills by trucks directly. In principle, it is a direct transaction between farms and flour mills. There is no third party like brokers. Appendix 8 shows from which farms each flour mill procures wheat. The names of farms, the distance from the flour mill and actual quantity procured are shown.

Farms are not equipped with storage facilities for long period. Therefore, they ship to flour mills within 2-3 months after harvest (usually from October to December). There is no basic difference in the relation between each flour mill and farm even after liberalization of marketing. Conventional distribution channel existed under the planned economy is still operating now.

Transportation is entrusted to transportation companies either by farms or flour mills. Usually trailer type trucks are used. In most cases, trucks and trailers are both 5 ton capacity type. Bulk grains are directly loaded onto cargo bed. Therefore, considerable quantity is split and lost during transportation. Because payment is based on the weight when the grains are received at flour mills, the loss is borne by farms. Table 3-10 shows number of farms from which each flour mill

collected wheat for the past 5 years. And weighted average distance from farms to flour mills obtained by total weight of the grain collected in 5 years and total distance carried, also ratio of transportation cost (from farms to flour mills) in the procurement price of wheat.

Table 3-10 Number of Farms, its distance to flour mills and Transportation Cost.

Site	Harhorin	Undrkhan	Murun	Choybalsan
No. of farms 1989	17	11	7	15
1990	11	8	9	30
1991	11	8	9	22
1992	16	17	8	25
1993	30	19	10	22
Total No. of farms 1989-1993	42	30	10	38
Weighted average distance from farms to flour mills (km)	68.6	170.1	209.2	295.8
Ratio of transportation cost in procurement price of wheat (%)	5.1	10.9	12.9	18.9

Transportation distance is generally long. The difference among each site and yearly difference are both large. Harhorin site is nearest to the farms and Choybalsan site is about 295 km away from farms, equal to 4.3 times the distance of Harhorin. The ratio of the transportation cost in the procurement price of wheat is lowest in Harhorin 5.1%, Undrkhan 10.8%, Murun 12.9% and Choybalsan 18.9%.

Even after the liberalization, there is no basic difference in the relation between the farms and the flour mills. The marketing channels established under the planned economy remain unchanged. Paying method is all by cash because the interest rate is extremely high about 10% per month. The transportation is entrusted to transportation company either by farms or flour mills. Trucks used are mostly trailer type, 5 ton capacity of truck and trailer are used. Because bulk wheat is directly loaded on the platform, a considerable spilling loss occurs during

transportation. This loss by spilling is all for the account of farms because the weighing shall be made when the trucks arrive at the flour mills.

(4) Storage Loss

1) Outline

Measurements of storage loss are difficult. There is no study report on the grain storage loss in Mongolia. However, at each site, storage losses are recognised as average several percent in open yard piling and 0.5 % in the case of storage facility.

In existing storage facilities, one division is quite large 3,000-5,000 ton, and it is difficult to control the quantity and quality of the stock. Weighing is made by truck scale only at the time of receiving and by hopper scale at the time of feeding into milling process.

Weighing instrument for stock control is not equipped. It is hard to notice the reduced quantity except at the time of measurement when it is fed to milling machines.

2) Loss in Open Piling

Among open piling losses, there are quantity and quality losses of wheat and management cost (transportation cost, labor cost, etc.) that incurs because there is no storage facility.

Quality and Quantity losses are caused by wild birds (doves) and rodents (rats), wetting by rain or snow or from ground (1 - 2 cm that contact with ground will be lost) and scattering by strong winds. Especially after April, the loss will increase by temperature rise and rains. Besides losses in storage, bulk transportation by trucks yields a lot of spillage loss. There is a much loss also by the grain quality deterioration caused by the poor condition of the existing storage facilities (rain water leaks and high moisture content). It is a loss by heating and germination. Especially, infiltration of underground water, rain water leaks from roofs or walls are causing germination and rotten grain. Impurity mixed high

moisture grains are stored and heating generated resulting grains suitable for feed purpose only.

Table 3-11 shows yearly quantity loss and the prices of materials wheat, feed, flour at the Harhorin site.

Table 3-11 Yearly quality and quantity loss by open piling and prices of materials wheat, feed and flour (Harhorin)

Year		1990	1991	1992	1993
Quality loss (Use as feed material)	(ton)	151.0	442.0	164.0	153.0
Quantity loss (Damage by birds, rodents, cast aside)	(ton)	603.3	768.9	607.8	513.0
Procurement price of wheat	(TG/kg)	0.63	1.20	1.20	38.00
Price of feed	(TG/kg)	0.30	0.60	0.60	14.00
Price of wheat	(TG/kg)	1.00	2.00	2.00	46.00
Amount of work	(Man/month)	About 100 man/month is necessary every year			
Average unit	(TG/man/month)	2,700	2,820	4,140	5,400
Price of fuel for wheat transportation	(TG/ℓ)	1.10	2.20	28.00	100.00
Consumption quantity within yard	(ℓ)	4,480	2,736	1,367	2,280
Consumption quantity outside to throw away	(ℓ)	458	584	462	390
Electricity	(TG)	2,000	5,000	26,000	56,000

a) Loss at Harhorin Site

In 1993, 19,025 tons wheat was collected(procured). 10,000 ton was piled outdoors within a yard. Weight loss ratio is quality loss 1.06% and quantity loss 5.13%. Quality and quantity loss by open yard piling result in following overall economic loss.

- Quality loss (wheat changed to feed use due to quality deterioration) was 153 ton. Commercial value was lowered from flour 46,000 TG/ton to feed 14,000 TG/ton. Therefore, total economic loss is : 153 x (46,000-14,000) = 4,896,000 TG

- Quantity loss (loss by birds and rodents, scattering by wind and rain : 513 ton) is the procured material wheat(38,000 TG/ton) which was lost before milling process. Therefore, 513 x 38,000 = 19,494,000 TG

- Management cost is as follows :

Personal cost	100 x 5,400 =	540,000 TG
Fuel (within yard)	100 x 2,280 =	228,000 TG
Fuel (outside yard)	100 x 390 =	39,000 TG
Electricity		56,000 TG
Depreciation cost for cars, etc.		60,000 TG
	Total:	923,000 TG

Therefore, total economic loss by open yard piling is as follows:

Quality loss	4,896,000 TG
Quantity loss	19,494,000 TG
Management cost	923,000 TG
	25,313,000 TG

b) Loss at Undrkhan Site

At this site, economical loss by the open yard piling was calculated by the management before. We could obtain the amount per each unit weight.

In average about 8,000 ton of material wheat is piled in open yard about 12km away from the site. Weight loss rate at Undrkhan is about 4 %. Economic total loss is as follows:

Total weight of quality and quantity loss	:	8,000 x 0.04 = 320 ton
Amount of quality and quantity loss per unit weight	:	35,000 TG/ton
Personal cost	:	22 TG/ton
Transportation	:	990 TG/ton
Electricity	:	48 TG/ton
Depreciation cost	:	6 TG/ton

Therefore total loss is 35,000 x 320 + (22+990+48+6) x 8,000 = 19,728,000 TG.

c) Loss at Murun Site

Same as the Harhorin site, the wheat that could not be stored in existing warehouse shall be piled in open yard of flour mill.

Average quantity of wheat piled in open yard	:	4,500 ton
Quality loss ratio	:	1.6%
Quantity loss ratio	:	5.6%
Price of flour	:	46,000 TG/ton
Price of feed	:	14,000 TG/ton
Procurement price of material wheat	:	38,000 TG/ton

Similar to the calculation made for Harhorin site, economic loss was estimated as follows:

Quality loss: 4,500x0.016x(46,000-14,000)	= 2,304,000 TG
Quantity loss: 4,500x0.056x38,000	= 9,576,000 TG
Management cost: 4,500/10,000x923,000	= 415,350 TG
Total:	12,295,350 TG

d) Loss at Choybalsan Site

Same as Undrkhan site, the wheat that could not be stored in the existing storage facility shall be piled in open yard adjacent to the flour mill.

Average quantity of wheat piled in open yard	:	8,000 ton
Quality and quantity loss	:	6.5%
Price of quality and quantity loss	:	35,000 TG/ton
Personnel cost	:	22 TG/ton
Transportation/Electricity	:	90 TG/ton
Depreciation cost	:	6 TG/ton

Therefore, economic loss is estimated as follows:

Amount of quality and quantity loss	:	(8,000x0.0065x35,000 =	18,200,000 TG
Management cost	:	8,000 x (22+90+6) =	944,000 TG
		Total:	19,144,000 TG

The economic losses at four sites were tabulated in Table 3-12. All flour mills are suffering large losses, showing that the good storage is urgently needed.

Table 3-12 Economic Loss by open Yard Piling at Each Site

Site	Harhorin	Undrkhan	Murun	Choybalsan
Quantity of Wheat Piled ton	10,000	8,000	4,500	8,000
Amount of Economic Loss TG	25,313,000	19,728,000	12,295,350	19,144,000
(Equivalent to J. Yen)	Abt. 5.96 million	Abt. 4.64 million	Abt. 2.90 million	Abt. 4.50 million

(1TG=J¥0.236)

3) Loss by Existing Storage Facilities

There are losses by grain quality deterioration, germination and heating due to the worn out conditions of existing storage facilities (rain water leak and wet grains). Especially, rainwater leakage through roof and walls and inroads of ground surface water are causing grains to germinate and rotten while being in storage facility.

Sometimes, grains of very high impurity content ratio are stored with high moisture content resulting in heat damage and quality deterioration. These grains are not suitable for human consumption so they will be used for feed use.

3-5-2 Present Conditions of Infrastructure

All four project sites proposed for the grain storage facilities construction project are located in the range of about 340km (nearest site Undrkhan) to

about 650km(farthest site Choybalsan).

Better infrastructure means less risks in construction works, and sites where adjustments and operational problems after completion would be few are desirable. They are important factors to decide the priority of site selection.

The result of survey on the access and present conditions of each site are as follows:

(1) Harhorin Site

This site is located 360 km west of Ulaanbaatar. About 84% of a trunk road is asphalt paved. About 60 km near Harhorin, the road is not paved and deteriorates towards the end of Winter. The Government of Mongolia is hastening the paving work. It is scheduled to be completed by the time the construction work for this project starts (1995).

The project site is at the center of Harhorin city. The front gate at the west side faces an open square. The south side faces a road of 40 m width. There is a down grade of 1.5 in 100 from north to south. It has an area of 17,560 m², existing facilities such as offices and warehouses of 26,382 m² and a space for open-pile grain storage.

There are two gateways and two 25 ton and one 30 ton, in total three truck scales near the gates.

(2) Undrkhan Site

This site is located at 340 km east of Ulaanbaatar and at the center of Hentiy prefecture. To about 60 km from the capital, the road is paved but the rest is not paved. The project site is near the center of Undrkhan city. North side of the site faces a road of 12 m width. Incoming and outgoing trucks pass through this road. Construction site of this project is overlapping with the area where a warehouse once stood. It is a flat land, an area of 47,600 m² including the existing facility of 8,786 m² and a truck scale of 30 ton capacity.