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Mongolia
Prospects for Wheat Production

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CURRENCY EQUIVALENTS

(as of October 15, 1994)

Currency Unit	=	Tugrik (Tg)
$1.00	=	Tg 400
Tg 1.00	=	$0.0025

FISCAL YEAR

January 1 - December 31

CROP YEAR

May 1 - April 30

WEIGHTS AND MEASURES

Metric System

ACRONYMS AND ABBREVIATIONS

ASS	-	Agricultural Supply Service
CIMMYT	-	Centro Internacional de Mejoramiento de Maize y Trigo
CMEA	-	Council for Mutual Economic Assistance
FSU	-	Former Soviet Union
hp	-	horsepower
ICARDA	-	International Center for Agricultural Research in Dry Areas
K	-	Potassium
MOA	-	Ministry of Agriculture
MOFA	-	Ministry of Food and Agriculture
N	-	Nitrogen
P	-	Phosphorus
PSARI	-	Plant Science and Agricultural Research Institute
SEFF	-	State Emergency Feed Fund
t/ha	-	tons per hectare

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This report is based on the findings of a World Bank mission that visited Mongolia in October 1994. Mission members were Albert Nyberg (EA2AG, mission leader), John Stemp (EA2AG, agronomist), and Neil Chalmers (Consultant, agricultural economist). Many other individuals contributed, directly or indirectly, to the report, particularly Dennis Sheehy (Consultant, range ecologist) and Alvin Ulrich (Consultant, agronomist) who participated in previous World Bank missions. Report peer reviewers, Jitendra Srivastava (AGRTN, agronomist), Marjory-Anne Bromhead (EC1AE, economist), and Kutlu Somel (MN1AG, agricultural economist) as well as other reviewers provided useful comments and suggestions for improving the report.

The mission worked closely with counterpart staff of the Ministry of Food and Agriculture, who assisted the mission enormously. Mr. G. Davaadorj, General Director—Crop, Machinery and Irrigation Department, was particularly helpful in numerous discussions, providing information during both this and previous missions. Also, Mr. D. Dorligsuren and Ms. Ts. Enkh-Amgalan, of the Economics and International Cooperation Department, assisted the mission in locating data and by discussing various issues. Similarly, Director J. Mijiddorj and other staff of the Plant Science and Agricultural Research Institute provided considerable information and several days of discussions. Mr. J. Byambadorj, Agronomist and Manager Agriculture Division of Mongolian Consulting Services Company, provided invaluable advice and assistance over a continuing period. Mr. P. Chambers, FAO Agricultural Management Development Project, contributed considerable time and farm management information during several discussions.

EXECUTIVE SUMMARY

i. Under the command economy Mongolia achieved full self-sufficiency in wheat and annual flour consumption levels exceeded 100 kg per capita. This achievement was supported by the provision of subsidized investments (machinery and equipment) and seasonal inputs. However, as Mongolia transformed to a market economy, these subsidies were terminated along with livestock feed subsidies that provided a market for substandard quality wheat. Consequently, wheat production has declined dramatically; imported flour assisted in maintaining consumption.

ii. A major issue arising from this situation is whether a wheat self-sufficiency objective remains viable in a market economy framework. This report examines the potential for efficient wheat and flour production, specifically whether (a) wheat production and flour processing are economically efficient and financially profitable; if not, (b) can they be made efficient and profitable through improved technology and management; and (c) what will be the impact of improved technology on wheat area and yield.

iii. **Wheat requirements** are derived from three principal components: the annual flour requirement is about 240,000 tons, equivalent to 300,000-340,000 tons of wheat (depending upon the milling rate), 80,000 to 100,000 tons have been used for seed, but improved seed selection and reduced areas should reduce future requirements to 35,000-60,000 tons, and industry uses 15,000-16,000 tons. Thus, total requirements for ***high-quality wheat*** are about 350,000-400,000 tons. About 60 percent of current wheat production meets high-quality requirements; the balance is used for feed. However, the demand for feed-quality wheat declined precipitously following termination of subsidized feed programs and the decline of the intensive livestock industry.

Wheat Production

iv. The harsh climate and uncertain rainfall make crop (wheat) production risky. Much of the crop development of the past three decades involved increasingly marginal lands that have proved to be unsustainable in a market environment and the previous production increases have reversed. Further production declines are likely as wheat production is abandoned and more marginal cropland reverts to rangeland.

v. Several factors influence the location and amount of domestically produced wheat. As transportation infrastructure is underdeveloped in the remote areas of eastern and western Mongolia, local production and consumption will likely coincide. In the more heavily populated grain belt of north-central Mongolia, potential yield will be the primary determinant of where production will be efficient. Over 70 percent of production costs are either fixed or are incurred in planting, at which time the balance of the production, harvest, and storage costs have been substantially determined. Given the cost structure and input:output price ratio (based on a border price of Tg 58,000), the profitability threshold wheat yield is 1.16 tons per hectare (t/ha), but profitability is unstable; to absorb shocks caused by small quality and cost variances and provide adequate incentives to manage risk, *an average yield of 1.4 t/ha is required.* This yield level cannot be achieved in all locations, and farms that are unable to achieve it will abandon wheat production in the long run.

vi. Some 450,000 ha of wheat were planted in 1994, but due to inclement harvest weather, less than 400,000 tons (all qualities) were harvested. Future production, under improved management and technology, will be substantially determined by farmers' risk threshold prices and minimum profit incentive. The estimation of best and worst case scenarios suggest that future wheat areas and production ranges might be 225,000-344,300 ha and 370,000-537,700 tons, respectively; and *require 30,000 to 90,000 tons of flour imports to meet domestic consumption needs.*

vii. Assuming a 20 percent profit is required to provide sufficient incentive to cover production risks, small increases in farm-gate prices beyond the estimated economic border price would yield relatively larger output responses as the estimated supply elasticity near the border price, is highly elastic (reflecting the discontinuance of production over large areas that could be returned to production with relatively small cost). However, the supply function becomes relatively inelastic at price and production levels above Tg 64,000/t and 450,000 tons, respectively.

viii. There are two necessary conditions to improving wheat yields: (a) a rationalized wheat price ensuring producers receive a price similar to a border price; and (b) rapid implementation of adaptive research results on economically efficient domestic and imported technology including, seed, tillage and husbandry practices, fertilizer and agrochemical use, and machinery and equipment.

Policy Issues

ix. Flour mills procure wheat from farms and prices are paid on a farm-gate basis. Prices are no longer set by government, but are "negotiated" between the nine flour mills and farm managers. "Agreed" prices apply pan-territorially and are far below a border price equivalent, implying that government implicitly taxes farmers and subsidizes flour mills. The estimated farm-gate border price equivalent is Tg 58,000 per ton of flour-quality wheat, whereas the current financial price is Tg 35,000 per ton. [Note: the border price is based upon the least expensive way Mongolia can obtain externally produced flour (or wheat), and will vary seasonally and annually. This calculation was based on procuring flour ex-Beijing.] Alternatively, the estimated border price of flour is similar to current retail prices. Under the prevailing price regime, wheat production incurs large losses that are currently financed by the government treasury, the banking system and by farm asset depletion. *Without a farm-gate price approximating the Tg 58,000 per ton border price, wheat production is not and cannot become profitable at yield levels achievable in Mongolia.*

x. Although many factors influence profitability, four have major impacts, namely, price, yield, grain quality, and investment costs. A four-dimensional sensitivity analysis based on these factors was undertaken and clearly demonstrated that if the wheat grain price was near the border price and yields were minimally 1.4 t/ha, large investment costs could be absorbed and profitability retained over a range of grain qualities.

xi. Agricultural privatization has focused on broadening ownership of farm assets by forming joint stock companies that employees and other citizens could purchase with privatization coupons. However, the State has retained 51 percent majority ownership in both the former state farms and in the former state flour mills and thus has conflicting vested interests as a wheat buyer and seller. Full privatization of farms and flour mills would permit fully independent management decisions and commercialization.

xii. In the transition from a command to a market economy, land rights remain uncertain. The lack of an appropriate land law detailing land rights and security will continue to deter investment/reinvestment. In the absence of a land law permitting private land ownership, other options such as long-term leasing should be explored. Land has heretofore been considered a free input and its cost was not considered in management decisions; a leasing mechanism also would introduce a needed land charge.

xiii. Under the command economy, investments and seasonal inputs were centrally determined and a financial/credit market was unnecessary. Farmers are now responsible for these activities and rely upon a still-immature banking system for credit services, which does not have the skills to evaluate investment proposals. Also, inflation has led to nominal and real interest rates that are beyond the repayment capacity of low margin activities such as agriculture. Without inflation control and reduced real interest rates, many farms and agro-industrial enterprises will doubtlessly go bankrupt.

xiv. **Role of Government**. As the economy is transformed into a market economy, the Government *should not* totally disengage itself from the agricultural sector as there are critical roles for the State. These include the establishment/maintenance of policy guidelines, including taxes, land policy, quality-safety-hygienic standards, protection from market exploitation and market failure. Also, agricultural research, which has high social returns, remains a role of the State, and should be strongly supported (see para. xvii).

Technology and Management

xv. Within the harsh agroclimatic environment, limited soil moisture is the most constraining factor and improving soil moisture conservation and seed quality offer the greatest potential for increasing wheat yields. Employing minimum tillage practices, using equipment specifically designed for that purpose, offers the best means of improving soil moisture conservation. This should be coupled with improved fallow land management incorporating increased use of rapidly degradable herbicides for weed control.

xvi. Seed quality could be improved in the short run by giving more attention to seed selection and seed cleaning equipment and operation. Also, improved drying and storage would improve germination and vigor. Long-run improvement should be addressed through the incorporation of new genetic materials into the breeding research program.

xvii. If crop agriculture becomes a declining sector, the role and size of the research establishment requires careful evaluation. Research must be adaptive and oriented toward optimization and sustainability. This would require some retraining of research staff and the introduction of farm management economics into research programs. An outreach program of adaptive research on commercial farms would be an important component of extension and training for farm managers and staff. Fertilizer application rates should be reassessed and the potential of nitrogen fixing and phosphorus-releasing bacteria should be further investigated as a possible substitute for chemical fertilizer. New varieties of wheat, barley and rapeseed should be introduced for trial and possible multiplication for commercial distribution.

xviii. The decline of wheat production raises the issue of possible alternatives. The harsh environment limits the potential alternatives; unfortunately, there is essentially no demand for many of the agronomically suitable crops. Following the collapse of the intensive livestock industry, feed grains, silage, and fodder crops are required in very small quantities. One possible alternative is oilseed rape, which should be included in research and on-farm testing.

Flour Processing

xix. To permit consumers to pay and farmers to receive border price equivalents for flour and wheat, respectively, *flour milling efficiency must be improved to approach international norms. This would include, among other initiatives, increasing the milling rate to 78-80 percent, which would be consistent with European norms.* It seems improbable that the Mongolian market is sufficiently discriminating to demand flour milled at a 71 percent rate. Also, the milling of lower-quality grain should be considered.

xx. Flour mill management has demonstrated limited flexibility when faced with external competition. With the recent importation of low-cost, lower-quality flour, many mills reduced output and gave up market share without efforts to produce a competing quality or provide a competitive price. Managers should be provided incentives to minimize losses (as well as maximize profits) when exogenous events shock the market.

Conclusions

xxi. Wheat production is *not* profitable at current farmgate wheat prices, and can become profitable only at prices approximating the import border price (about Tg 58,000/ton. However, even at border prices profitability is marginal unless yields can be increased above prevailing levels. Fortunately, there is reason to believe the low wheat yields, in some locations, can be increased efficiently with improved management and technology. Yield levels of 1.4+ t/ha are attained in the drier areas of Saskatchewan, Canada and similar yields appear feasible in north central Mongolia which has a similar agro-climatic environment. However, the wide variation in yields suggests *full domestic* *wheat self-sufficiency is unsustainable in the long-run, and continued flour imports will be required to supplement domestic wheat production.*

xxii. The high cost of transporting wheat/flour (by road) creates high import, but low export, border prices in the production areas distant from a rail head. Thus, localized wheat self-sufficiency in distant production/consumption areas likely would be economically efficient, with possibly modest surpluses for *nearby* deficit areas. Alternatively, *the area planted to wheat in the north central region would likely decline by 25 to 50 percent. However, due to yield and quality increases, production of high quality grain could remain near current (1991-1993) levels or decline marginally.*

1. INTRODUCTION

1.1 Crop agriculture assumed importance only during the last five decades. Much of the development derived from directed investments and subsidized inputs to meet politically motivated grain production targets. The historical development of extensive livestock indicates Mongolia's resource base supports such systems, but there is little evidence that it will equally support efficient wheat production on a scale that would yield full self-sufficiency. The rapid decline in grain output, following discontinuance of the command economy, appears to confirm that much of the previous production was inefficient. However, an economy does not transform instantaneously to competitive market structures and efficient price transmissions, and imperfections remain in the grain market. This report examines the potential for efficient wheat and flour production and discusses the potential for alternative crops.

A. BACKGROUND

1.2 Historically, Mongolia was an agrarian economy characterized by nomadic and seminomadic extensive livestock production systems and modest barley cultivation on the periphery of settlements. Following 1940, the economy rapidly became more diversified; between 1940 and 1960 the contribution of agriculture to the Gross Social Product declined from 60 to 20 percent. Concurrently, the crop component's contribution to gross agricultural output increased from less than 0.5 percent to 15 percent, and 447,000 ha had been brought under cultivation, with wheat as the principal crop.

1.3 A large-scale conversion of grazing land to cultivated land was initiated in 1959/60 under the Virgin Lands program. Technical and financial assistance from the Council for Mutual Economic Assistance (CMEA) countries contributed to the development of mechanized irrigation schemes and large-scale, mechanized state farms producing intensive livestock, cereals, and livestock fodder. By 1990 cereals occupied 654,000 ha, or 83 percent of the planted area and the contribution of crops to the gross agricultural output increased to about 30 percent.

1.4 Over the same period, investments were also made in large-scale agroprocessing facilities. Nine flour and feed mills were established in the principal grain-producing areas. Processing equipment, of CMEA origin, was generally reliable but lacked the sophistication of more modern facilities available elsewhere. These facilities were largely protected by centralized planning; alternative flour sources were unavailable and alternative markets for grain were limited to small export quantities provided to the Russian province of Buriat.

B. Resource Base

1.5 Mongolia is located in the Central Asian plateau lying between 41° and 52°N latitude, bordered by Russia to the north and the People's Republic of China to the east, west and south. The country is large, 1.57 million km^2, but sparsely populated with an average density of 1.5 persons per km^2. The average elevation is 1,580 m above sea level, with about 80 percent of the territory above 1,000 m. The principal mountain ranges are the Mongolian Altai in the west, and the Hovsgol, Hangai and Hentii ranges in the north and center. The arid Gobi region of southern Mongolia covers over one third of the total land area.

1.6 The extreme continental *climate*, with long cold winters and low precipitation, is a serious constraint to agricultural production. The average number of frost-free days varies between 60 days, at higher elevations in the north and west, and 140 days in parts of the central and eastern steppe and the Gobi desert. The mean monthly temperature is below 0°C throughout the entire country between November and March. Frost is possible at any time of the year, and frequent unseasonal frost in late spring and early autumn can adversely affect both quality and yield of crop output. Although snow occurs in all regions except the Gobi desert, its contribution to total precipitation is minimal, with snow depth averaging only 5 to 15 mm annually. Average annual precipitation is between 450 mm in the high mountain Altai region in the west and <100 mm in the southern Gobi region. Rainfall is concentrated in the summer period with 65-75 percent of rainfall occurring between June and August. The dry weather conditions prevalent in the planting season in May make successful crop establishment difficult. Strong spring winds precede the onset of the summer rains, causing high evaporation and soil erosion in cultivated areas.

1.7 The arable *soils* of Mongolia comprise dark chestnut and chestnut soils, which are classified as Mollisols and are typical of soils that evolved with steppe vegetation. Similar soils are found in the Great Plains of North America, parts of South America, and a large part of Central Asia. Covering about 40 percent of the country, these are inherently fertile but shallow soils, with an average depth of 30 cm. These soils have an organic matter content of 3-4 percent and are slightly acid to neutral with a pH of 6.0 to 7.0. Because of their light texture, moisture retention is low and the soils are susceptible to erosion.

1.8 **Agricultural Land**. Some 80 percent of the total land area can be used for pastoral activities but only about 1 percent is suitable for cultivation, and 1993 statistics indicate a total cultivated area of 1.35 million ha, including cropped land and bare fallow. Land suitability for crop agriculture is determined by combinations of climatic and physical factors including precipitation, elevation, temperature, frost-free days, soils and topography. The principal crop-growing areas are in the central-northern part of the country and include portions of Selenge, Tuv and Bulgan aimags, which account for about 67 percent of total cultivated land. These areas comprise a broad basin draining to the north. Only valley bottomland and the lower slopes of hills with sufficiently deep soils are cultivated. The growing season is 100 to 120 days in duration and annual precipitation ranges from 250 to 350 mm. Smaller cultivated areas are widely distributed in the Hangai-Hovsgol Region in the northwest, and the Central and Eastern Steppe Region. Cultivated land is primarily devoted to rainfed cereal grains, mostly wheat. Only about 3 percent of the cultivated area is irrigated. The irrigation systems comprise numerous small schemes totaling 57,000 ha located primarily in the north-central and western parts of the country. However, many schemes are no longer operational due to inadequate maintenance, and only about 35,000 ha are currently being irrigated. Crops grown under irrigation include cereals, fodder, potatoes, vegetables and fruit.

2. ECONOMY IN TRANSITION

A. Objectives and Issues

2.1 Under the command economy, Mongolia achieved its wheat self-sufficiency objective and it is now faced with the issue of whether full self-sufficiency should be maintained. Resource transfers are no longer available from former CMEA countries, and in their absence the self-sufficiency objective appears increasingly unsustainable. The fundamental questions to be resolved are: (a) is wheat production (and flour processing) economically efficient and financially profitable; if not, (b) can they become efficient and profitable through improved technology and management; and (c) what will be the impact of improved technology on wheat area and yield?

B. Policy Environment

2.2 Although asset privatization, and price and market liberalization have been at the center of reform since 1990, the transition to a market economy remains only partial. The demise of the CMEA removed investment subsidies, but some input subsidies have been maintained through government-directed credit. The removal of several subsidies and high inflation have led to rapid increases in wheat production costs, but farm-gate output prices have increased less due to government interest in maintaining low urban flour prices, low-cost flour imports, and reduced demand for nonflour-quality wheat. As the command economy disappeared, cross-border trade developed and less costly flour from China began to find its way into the domestic market. Also, farms and Soums began to import small flour mills to add value to farm production and meet the flour requirements of local population centers. A large portion of wheat production is below flour quality, which heretofore had found a ready market as a feed grain ingredient for concentrates. But with the termination of feed support programs to large-scale intensive livestock enterprises and for supplementary winter feed for extensive livestock production, the market for feed grain was drastically reduced.

2.3 The privatization of agricultural production and processing assets (excluding agricultural land) was initiated following passage of the *1991 Privatization Law*. Ownership transfer was facilitated by the issuance of "coupons" that citizens could use to purchase state-owned assets. Joint stock companies were formed from the former state farms and state-owned agroprocessing facilities, including flour mills, with employees purchasing shares with coupons and forming a major share of the *private* owners. However, the state typically retained 51 percent of the ownership and continues to strongly influence decisions. The state's retention of 51 percent ownership of both farms and flour mills indicates a continued vested and conflicting interest in wheat production and milling.

2.4 **Agricultural Land Policy**. The Land Utilization Law of 1971 continues to apply to agricultural land pending Government implementation of a revised law incorporating private acquisition of agricultural land. Current law provides for allocating land for cultivated agriculture; allocation authority rests with the Ministry of Nature and Environment. Government imposes neither land taxes nor leasing fees, nor does it provide for secure land rights. The absence of such security contributes to farm managers' reluctance to undertake farm investments.

2.5 **Marketing and Pricing Policy**. State market orders were the primary market transaction mechanism during the planned economy period. These centrally defined market channels have been discontinued and farm managers now contract with flour mills for specified quantities, and prices are nominally negotiated. Although Government has discontinued setting farm-gate prices, it retains a strong interest in wheat prices and the "negotiated" farm-gate price applies nationwide and remains far below an equivalent border price. Thus, in a practical sense, farmers continue to face a monopsony market as higher prices are not available at other more distant mills. Alternative sales options are limited to recently established small local mills and export—either direct or via new export traders. Retail flour prices are set by the flour mills to cover costs and include a 10 percent trade tax, which also applies to imported flour. Also, farmers face a monopoly market for machinery and equipment as the relatively small demand and external sourcing characteristics do not stimulate competition.

2.6 An "Agricultural Commodity Exchange" was established in 1991 as a stage in the market transformation process. This facility permitted buying and selling, through the use of brokers, of agricultural inputs (both equipment and seasonal inputs) and livestock commodities; imported flour was often traded on the exchange, but not domestic wheat.

2.7 **Trade Policy**. International trade policies were liberalized in parallel with domestic market liberalization, but as applied to crop agriculture, liberalization impacts more on imports than exports. Import duties were standardized at 15 percent for all equipment, spare parts, and other production inputs. The same duty applied to major food commodities such as wheat flour, rice, and sugar but was exempted when food shortages occurred in late 1992. In February 1994, the exemption was partially lifted with a 7.5 percent duty applying and in July 1994, the exemption was fully lifted with the full 15 percent duty applying. Exports of wheat, either food or feed quality, requires Ministry of Food and Agriculture (MOFA) *authorization*; export authorization is contingent upon adequate domestic supplies. However, some barter trade for domestically unavailable spare parts and equipment by-passed the licensing requirement.

2.8 **Agricultural Credit Policy**. During the centrally planned period, credit was not an issue. Investment resources, both financial and physical, were largely allocated by MOA, to whom the state farms reported. Seasonal needs for fertilizer, fuel, etc. also were allocated centrally and at harvest time, the ministry mobilized manpower and transportation facilities to ensure maximum grain was harvested; the costs of these activities and/or their repayment were of little concern to farm managers, any deficits that accrued were financed from the treasury. As farm ownership structures were transferred to shareholding arrangements, farm managers assumed responsibility for financing both investments and seasonal inputs.

2.9 Conceptually, banks are permitted to set lending rates at levels they deem appropriate and that competition permits. High inflation has kept short-term lending rates at 10-12 percent per month (about 120-144 percent annualized; the interest is not compounded monthly). Rapid inflation, combined with a changed agricultural financing environment, including the removal of direct farm subsidies, has left farms in serious financial difficulty. Government has attempted to alleviate these difficulties with indirect subsidies through directed credit. In 1993, Government provided the banking system with Tg 7.7 billion at 7 percent interest per month, and directed them to onlend at a below-market rate of 8 percent (per month) to flour mills. The flour mills advanced these funds to farmers as prepayment for wheat delivery at harvest time (with the flour mills bearing the interest charge). The subsequent inability of the flour mills to repay the loans, with interest, resulted in Government assuming Tg 7.4 billion of the debt. Similar, but lower-volume, initiatives were undertaken in 1994. Farmers occasionally finance and import their own equipment and spares through barter trade.

2.10 The **State Emergency Feed Fund (SEFF)** was established to provide emergency feed supplies to herders during periods of natural disaster or calamity. It procured and distributed hay and concentrates, recovering only the cost of the feeds; government subsidized the transportation. Annual procurement resulted in accumulated stock in years of mild winter or otherwise without calamities, which required recycling to avoid deterioration in storage. This recycling need altered the emergency nature of the facility as it evolved into an annual supplier of feeds, primarily to the feed-deficit western and southern regions. Thus, de facto policy resulted in state-financed procurement of feedstuffs, creating an additional market for producers of hay—indeed, State Fodder Farms were established largely to service SEFF—and concentrates, which contained 50 percent grain. With the move toward private markets, SEFF's role as a regular feed procurer-supplier has diminished; no feedstuffs were procured in 1994.

2.11 **Role of Government**. The transition from a centrally planned to a market economy requires that Government disassociate itself from production and marketing initiatives and discontinue private sector interventions. However, it is important that the State not disengage totally from the sector but actively promote an environment that balances efficiency and welfare; this includes establishing policy guidelines (including taxes-tariffs, land policy, quality-safety-hygienic standards, and protection from market exploitation where monopoly-monopsony or oligopoly-oligopsony situations prevail) and engage in those activities, such as research and technology transfer, which are beyond the scope of the private sector. While basic agricultural research is sometimes undertaken by the private sector in mature market economies, Mongolia's immature private sector and scattered farms preclude them from undertaking agricultural research. Agricultural research has had high rates of return in other countries and, given Mongolia's lack of exposure to international research, would likely yield high social benefits. Further research on nutrient fixing bacteria and adaptive research should be of first priority, testing new cultivation/tillage practices, new machinery, and new genetic materials, and adapting them to the Mongolian agroclimatic environment should be the priorities. Mongolia should seek a sister relationship with an agricultural research agency/unit located in a similar environment such as the Canadian Plains.

C. CROPPING TRENDS

2.12 Only a small portion of Mongolia's land area is suitable for cultivation. The Virgin Lands programs rapidly expanded arable land, but increasingly marginal land was brought under cultivation. Growth in total sown area reached its zenith in 1989, then declined rapidly. Similarly, the maximum area sown to individual crops peaked in 1988-90, and also subsequently declined. However, commodity production declined even more rapidly. The area sown to wheat doubled between 1960 and 1990, then declined by 20 percent by 1994. Also over the 1960-90 period, production more than tripled, but by 1994 production (preliminary) had declined by 50 percent. Increases, and subsequent decreases, in potato and vegetable areas and production were more striking. But the most remarkable changes were recorded by fodder crops, which first increased about twelvefold, then declined by two-thirds. Fodder crop production paralleled the development and subsequent demise of the intensive livestock industry and SEFF. Detailed area and production statistics are contained in Annex Tables A1.1 to A1.5, and are summarized below (Table 2.1).

2.13 Yields increased over these decades, reaching their peak during the 1980s, probably due to fertilizer applications in increasingly liberal quantities (average per hectare applications increased from 59 kg to 229 kg between 1971-75 and 1986-90) in efforts to meet production targets. The high yields also reflect rainfall patterns, which were generally favorable in the 1980s, except for 1981 and 1984.

2.14 With the elimination of direct price subsidies, large areas of the less productive land have been withdrawn from cultivation. Abandoned land refers to land no longer cropped because the costs of crop production exceed the financial benefits attainable, but the soil remains capable of reestablishing perennial plant cover capable of providing livestock forage/fodder. An estimated 151,000 and 300,000 ha of land were abandoned by 1992 and 1994, respectively, reflecting the removal from cultivation of much of the marginal land brought under cultivation in the 1980s. Not surprisingly, more land has been abandoned in the Selenge-Onon agroecological zone, which comprises the principal cropped agricultural area (See Annex Table A3.1 for distribution of abandoned land).

Table 2.1: CROP AREA AND PRODUCTION TRENDS

	1960	1970	1980	1989	1990	1991	1992	1993
Crop Area				('000 ha)				
Sown Area	265.5	454.8	704.0	837.9	787.7	708.1	657.7	
Cereals	246.7	419.5	575.5	673.4	654.1	615.3	562.6	504.2/c
of which Wheat	*266.7/a*	*348.0*	*423.9*	*530.2*	*532.6*	*534.2*	*525.0*	*466.8/c*
Potatoes	2.2	2.9	7.4	12.6	12.2	10.1	8.7	8.5
Vegetables	0.8	1.4	2.4	4.2	3.6	2.8	2.2	2.9
Fodder Crops/b	15.8	30.8	136.7	147.7	117.8	79.9	52.9	N.A.
Production				('000 tons)				
Cereals	227.4	284.8	259.1	839.0	721.5	596.8	493.8	480.1
of which Wheat	*195.4*	*250.2*	*207.2*	*686.7*	*598.9*	*539.1*	*450.9*	*448.7*
Potatoes	18.5	20.8	37.9	148.0	129.2	95.1	76.9	58.4
Vegetables	6.8	11.2	26.3	54.5	46.2	22.4	21.7	23.0
Fodder Crops/b	37.4	34.2	105.1	513.6	497.8	199.0	191.7	N.A.

/a 1961.
/b Hay and silage.
/c Harvested area.

Source: Ministry of Food and Agriculture.

3. WHEAT AND FLOUR PRODUCTION

A. Production Systems and Agronomic Practices

3.1 The development of large-scale wheat growing in Mongolia was modeled on the Soviet Virgin and Idle Lands program in Western Siberia. These production systems were highly mechanized to cope with time-critical operations, especially planting and harvesting, in a harsh and risky physical environment with a short growing season of typically around 100 days. Virtually all farm machinery, fuel, fertilizers and agrochemicals were imported from the Soviet Union and provided to farms at highly subsidized prices. In an effort to become self-sufficient, the area under wheat increased from 200,000 ha in 1960 to 533,000 ha in 1990 and, in the process, significant areas of marginal land were brought under cultivation. Output targets for each farm were determined centrally and administered globally by the Ministry of Agriculture.

3.2 A wheat/fallow rotation was practiced with either wheat for two years followed by bare fallow in the third year, or wheat and fallow in alternate years: the choice depending primarily on annual precipitation and secondarily on the moisture retention capacity of the soil. In general, this meant a three-year rotation in much of the wheat-growing areas in the north-central region, and a two-year rotation in drier eastern areas of the country. However, following the withdrawal of Soviet support and the subsequent scarcity and higher cost of inputs, the two-year rotation, with 50 percent of cultivable land in fallow every year, is becoming standard practice in all wheat-growing areas.

3.3 Due to severe winters and minimal snow cover, it is not possible to grow winter wheat varieties, leaving early-maturing spring wheat varieties as the only option. Sowing occurs in May and the crop is harvested in September. The sowing date is a major factor influencing grain yield and quality, with May 1 to May 10 as the optimal period. Both yield and quality are likely to be seriously affected in crops sown later than May 20. National yield levels, which averaged 1.2 t/ha in the 1980s, have fallen to less than 1 t/ha, largely because of the greatly reduced availability (fuel) and use (fertilizer and agrochemicals) of inputs and the resultant negative effect on timely field operations.

3.4 **Tillage and Seeding**. Prior to planting, land is plowed and/or cultivated one or more times to a depth of 15-20 cm, followed by a further one or more cultivations to firm the seedbed before sowing at a depth of 7-10 cm. Seeding rates are between 180 and 200 kg/ha in contrast with rates of 50 to 70 kg/ha used in similar agroclimatic regions in North America. Relatively deep cultivation of the seedbed has been advocated to allow rainfall and plant roots to easily penetrate the soil. Unfortunately, such deep cultivation depletes soil moisture reserves and leads to soil erosion by strong spring winds. The loss of soil moisture requires deeper planting to ensure seeds are placed in contact with moist soil; but deep planting results in poor emergence and less vigorous seedlings. However, with the current shortage of fuel and machinery spare parts, many farms are now reducing the number of field operations and carrying out shallower cultivation. These changes may actually increase soil moisture conservation during preplanting tillage operations; but the shortage of fuel and spares has had a concurrent adverse effect on weed control on fallowed land where mechanical weed control has been severely curtailed, and in some cases discontinued. The main purpose of fallowing is to conserve moisture and build up fertility, which requires effective control of weeds that would otherwise deplete available moisture and nutrients.

3.5 There is scope for improving tillage practices both in seedbed preparation as well as in maintenance of bare fallow. Virtually all agricultural machinery and equipment used in Mongolia was imported from the Former Soviet Union (FSU) or eastern Europe. This equipment was inexpensive but spare parts were often difficult to obtain, and it was often more cost-effective to purchase new equipment rather than try to obtain parts for old machines. However, imports of new equipment have declined significantly since 1990. Tractors range in size from 55 to 150 hp and larger tractors are often teamed with implements with narrow working widths, which results in inefficient and costly operations.

3.6 Minimum tillage systems involving fewer and shallower cultivations to conserve soil moisture and reduce the risk of wind erosion offer the greatest potential for raising yields and improving cost-effectiveness. MOFA staff claim that such methods have been tried without success, but this may well reflect inexperience with appropriate techniques, too short a period of experimentation, and inadequate resources. Furthermore, the range of equipment specially developed for minimum tillage, such as rod weeders and tine harrows, is virtually unknown in Mongolia and should be performance tested under Mongolian conditions.

3.7 **Fertilizer and Agrochemicals.** Prior to 1990 Mongolia imported chemical fertilizers from the FSU at prices below international levels. The rate of application was quite high and fertilizer use more than doubled between 1978 and 1988. Recommended application rates for wheat are 60 kg/ha nitrogen (N), 60 kg/ha phosphorus (P), and 40 kg/ha potassium (K) (in practice, rates applied were often lower depending on availability). These recommendations are based on field trials conducted in the 1970s and are designed to give maximum rather than optimal output. Since 1990 fertilizer prices have been more closely related to world prices. With limited access to credit and foreign exchange, fertilizer imports and use have been reduced to a few tons obtained through concessional lending or by barter for use on vegetables or potatoes; virtually no fertilizer has been applied to the wheat crop since 1991.

3.8 Further work is needed to revise recommendations on fertilizer rates in the light of prevailing economic conditions. Determination of optimal application rates is made difficult by the variability of summer rainfall since yield response to fertilizer is largely dependent on the availability of soil moisture. This will require trials over a number of years in order to acquire reliable data and incorporate economic analyses. In the short term, based on current practice under similar environmental conditions in North America, application rates on the order of 30 kg/ha N, 15 kg/ha P, and 7.5 kg/ha K are likely to be closer to optimal than the existing recommendations, with perhaps even lower applications of nitrogen in the drier areas.

3.9 The use of agrochemicals has declined for the same reasons as fertilizer. Until 1990 agrochemicals were readily available and inexpensive, but subsequently have become costly and difficult to obtain. The main use of agrochemicals in wheat-growing has been in seed dressing for the control of seed-borne diseases, and herbicide (2,4-D) for control of broad-leaved weeds. Chemicals for seed treatment are required in quite small quantities and are still widely used, but chemical weed control has been largely abandoned. Without herbicides, and with fuel and spares in short supply, farmers are unable to effectively control weeds in the growing crop or summer fallow. The consequent loss of soil moisture and nutrients to increasing weed competition is an important factor contributing to declining wheat yields.

3.10 Replacing tillage with chemical weed control would conserve soil moisture and minimize erosion and is an important component of minimum tillage systems. Most of the herbicides used in such systems elsewhere have not been used in Mongolia and work should be undertaken to test a range of chemicals and spraying regimes for their applicability under Mongolian conditions.

3.11 **Harvest**. Aging equipment fleets (more than half of all tractors, combines and trucks are more than eight years old) and the scarcity of inputs is resulting in more frequent bottlenecks at harvest time. Harvesting needs to be completed as quickly as possible (ideally within two weeks) to minimize the risk of damage by frost or wet weather, which adversely affects grain quality. Serious delays can lead to abandonment of the crop and over the last five years only 89 percent (on average) of the sown area has been harvested.

3.12 Harvesting is carried out using combines that usually make two passes. The crop is first cut and swathed and left to wilt in the field for about five days, after which it is threshed and transported by truck or tractor and trailer to grain-dressing centers at the farm main complex. After the initial wilting, the grain has a moisture content of 20 to 25 percent. Further drying of the grain takes place while the grain is heaped on the floor of the dressing center. The grain is then processed up to three times using mobile grain cleaners that both clean and aerate the grain, further reducing the moisture content to about 16 to 20 percent, prior to sale. (The flour mills reduce the moisture content to 14 percent for long-term storage.)

3.13 Losses incurred between harvest and delivery to the mill are estimated at between 10 and 15 percent. Specific causes of losses include inadequate operation and maintenance of machinery and equipment, inadequate operator training coupled with poor motivation and a lack of incentive, and poor control of grazing animals.

3.14 **Seed Quality**. Existing problems of poor seed quality are mostly due to frost damage and the high moisture content of stored seed, resulting in poor germination, lack of vigor, and susceptibility to root rot infections. Quality is further lowered by contamination with weed seed. Modest investments in repair and/or replacement of screens for grain cleaners and closer attention to correct setting and operation of the equipment would improve seed cleaning operations and eliminate most weed seed. Avoidance of frost-damaged grain earmarked for seed, and aeration and drying of stored seed to reduce moisture content to 14 percent would significantly improve germination and vigor and allow a significant reduction in seed rates.

B. Agricultural Services

3.15 **Input Supply**. Until very recently the supply of all agricultural inputs was under the sole control of MOFA where the allocation of inputs was centrally planned in accordance with production targets set for each farm. A parastatal, the Agriculture Supply Service (ASS), was responsible for importing agricultural machinery, fertilizers and chemicals, and some seeds, most of which came from the FSU. Imports of all goods have fallen drastically in recent years. No fertilizer has been imported since 1991, apart from small quantities provided under foreign-financed projects. The total value of sales in 1993 was Tg 890 million, most of which was machinery. The FSU remains the principal source of machinery and spare parts, with small quantities from China. In 1994 ASS was notionally privatized and renamed the AgriTechImpex Co. with government retaining a majority shareholding. The company continues to operate under the direction of MOFA and remains a virtual monopoly.

3.16 **Seed Supply**. The production of quality wheat seed until 1990 was undertaken on selected research stations and state farms. Breeder seed of cultivars developed in the FSU and Mongolia were grown on the research stations and this seed was then multiplied on selected farms for commercial distribution. Seed crops were sampled and tested for germination at local seed control laboratories. Since 1990, this seed production system has largely collapsed. Research stations have suffered increasingly from inadequate funding and the seed farms have been partially privatized. Faced with rapidly increasing production costs, most farms now prefer to save their own seed rather than purchase it from seed farms.

3.17 **Research and Extension**. Responsibility for the administration and control of agricultural research, formerly under MOFA, was transferred to the Ministry of Science and Education in 1992, with MOFA retaining responsibility for technical oversight. In 1993 the agricultural research institutes were merged with the Agricultural University and the agricultural vocational and secondary schools. The Plant Science and Agricultural Research Institute (PSARI) at Darhan is the principal agricultural research center in Mongolia and foremost research center for wheat. The agricultural research institutes in Dornod in eastern Mongolia and Hovd in the west are also involved in wheat research. Agricultural research budgets have been increasingly constrained over the past five years, total staff employed have declined by 40 percent and research stations have directed most of their efforts into commercial crop production to generate income to cover routine recurrent expenditures.

3.18 The research methodologies and techniques adopted in Mongolia are based on scientific practice developed in the FSU and efforts have focused on maximizing output, regardless of the real costs of production. With the economy in transition, there is now a need to develop adaptive research geared to optimization and sustainability and this will require, in addition to increased funding, the integration of agronomic research with agricultural economics.

3.19 Mongolia does not have a conventional agricultural extension service. Under the state farm system, each farm had a team of specialists in agronomy, mechanization, plant protection, veterinary science and animal husbandry, and together with the farm manager, these specialists formed the management team. Periodic training for technical specialists was provided by the Agricultural Institute (now the Agricultural University).

3.20 **Credit.** The evolving banking system, which includes an agricultural bank with 360 rural branches, has insufficient capacity to evaluate either investment proposals or long-term lending. The new commercial banks are geared solely to short-term lending which, with high inflation rates, charge high interest rates that can only be used efficiently in short-term trading activities. Farmers have borrowed short-term to meet some of their seasonal requirements, but poor cash flows have resulted in poor debt repayment. Several farmers were unable to repay their loans to banks when flour mills declined to accept 1993 wheat deliveries as the domestic flour market declined due to large flour imports. The government has since provided funds to the flour mills to repay their loans. However, the banks still have a large portfolio of nonperforming loans and are reluctant to provide further credit. They now provide only selective seasonal lending at rates of 10 to 12 percent per month or onlend directed government funds at a below-market rate of 8 percent per month. Consequently, farmers' limited investment in equipment and procurement of spares is often financed through barter trade.

C. Wheat Production Costs and Efficiency

Current Technology and Management

3.21 Under current production technology and management, there is minimal scope for reducing the financial costs of producing wheat. Machinery operations, fuel, and seed are necessary in relatively constant amounts, except there is some scope for cost savings by reducing the number of operations. Although distance from Aimag center impacts on transportation costs, most farms, regardless of location, incur similar production costs. Farm/crop budgets and cost accounts typically understate actual costs and instead more closely represent cash flow statements. Depreciation costs are underestimated as they are based on historical costs and often the equipment in use has exceeded its economic life. Also, interest costs are often understated, including only actual interest payments made and excludes unpaid accrued interest. Thus, available accounting information inadequately reflects the production costs, and provides neither opportunity cost nor management information.

3.22 To more accurately reflect real costs, a wheat budget was developed, based on currently used physical inputs and contemporary prices, and both financial and economic costs of production were developed. Rather than applying existing depreciation coefficients or values, replacement costs of a full machinery complement were established based on current costs; and straightline depreciation costs were calculated based on standard working life coefficients. To avoid distortions created by the high rate of inflation and high nominal interest rate, *real* interest rates of 10 and 8 percent per year were applied to seasonal inputs and capital investments, respectively. Yields were assumed to average 1.0 t/ha of grain at 19 percent moisture and 10 percent on-farm losses, 40 percent of the saleable yield was assumed to be of nonflour quality (consistent with historical averages). Financial and economic costs of production, under current technology and management are indicated in Table 3.1. The full set of assumptions applied to the cost estimates are contained in Annex 2.

3.23 Under these assumptions, the major cost items are seed, machinery depreciation and repairs, and interest. The seed cost of Tg 7,400 may not be a cash cost as it is typically retained from the previous harvest, thus representing forgone revenue from that harvest. Depreciation is the largest single cost item and represents a very real long-run production cost, although many farms currently use fully depreciated equipment.

3.24 Inflation-induced high interest rates have a particularly severe impact on production costs and makes production unprofitable under all conceivable yield and price scenarios. If the directed credit interest rate of 8 percent per month applied to equipment/ machinery and seasonal inputs, break-even profitability at current yield levels would require a tenfold increase in the farm-gate price of wheat—clearly an untenable situation. Applying an 8 percent per month interest rate to only the seasonal inputs would require a price of Tg 85,000 per ton to break even, tenable only in the short run as equipment replacement and reinvestment would be precluded. Hence, *real* annualized interest rates of 8 to 10 percent rather than the prevailing nominal rates of 96 to 144 percent were assumed, although this understates actual interest costs. The interest on durable capital is the average amount paid over the length of life of the equipment.

Improved Technology and Management

3.25 Under improved technology seasonal production costs per hectare would increase as fertilizers and sprays would be employed, seed value would increase (higher seed costs would more than offset the decline in seeding rate), and additional equipment would be employed, thereby increasing depreciation and interest charges. Labor use and cost would decline about 60 percent (by comparison, North American labor use is very much less but substantially higher wage rates creates higher costs). The net impact of improved technology and management would be a per-hectare cost increase of about Tg 13,000; *but it is expected that these added inputs would reduce yield variations,*

Table 3.1: FINANCIAL AND ECONOMIC COSTS OF WHEAT PRODUCTION (CURRENT TECHNOLOGY AND MANAGEMENT)

			Financial		Economic	
	Unit	Units/ha/a	Tg/unit	Tg/ha & Tg/t	Tg/unit	Tg/ha & Tg/t
Traded Inputs				**19,094**		**21,078**
Seed	kg	200	37	7,432	62	11,636
Diesel	lt	33	104	3,479	76	2,539
Gasoline	lt	6	104	622	78	469
Electricity	kWh	12	46	552	69	828
Seed treat.	lt	0.3	4,504	1,351	3,776	1,133
Repairs	Tg			5,658		4,473
Depreciation				**12,670**		**10,078**
Machinery	Tg			11,888		9,398
Buildings	Tg			782		680
Domestic costs				**10,721**		**9,548**
Crop Insurance	Tg			1,600		1,600
Management	staff-mo.	0.024	12,000	288	12,000	288
Labor						
Full time	staff-mo.	0.240	10,000	2,400	10,000	2,400
Part time	staff-day	0.200	400	80	400	80
Interest on:						
working cap.	Tg			603		527
durable cap.	Tg			5,750		4,653
TOTAL COST				**42,485**		**40,703**

/a Unit requirements were derived from 1,000 ha budgets and are rounded to the nearest whole unit. But, cost per ha calculations include the hidden digits to the right of the decimal.

improve wheat quality and increase average yields by about 40 percent, resulting in a 30 percent decline in cost per ton. Table 3.2 contains wheat production cost estimates using improved technology.

3.26 The formerly *recommended* fertilization levels (para. 3.8) were designed to maximize, not optimize, yields in an otherwise optimum production environment (i.e., optimum, rather than average, rainfall distribution was assumed). Rather than applying 60, 60, and 40 kg/ha of the respective N, P, K nutrients, a much lower rate and ratio (30: 15:7.5) is proposed. An important component of the improved technology is specialized equipment to specifically reduce the number of field operations, which would improve weed control and moisture conservation and reduce labor costs.

3.27 There is **potential** for reduced cost under improved technologies *that have yet to be adequately tested* in Mongolia. These include further reduction in seed use through better selection, treatment, and storage; increased chemical weed control and minimum tillage operations. Also, there may be potential for replacing *some* chemical fertilizer with organic fertilizer utilizing nutrient-fixing bacteria. Conceptually, these technologies would further reduce costs but without testing under Mongolian conditions, the net impact on cost, yield and quality is uncertain (Table 3.2).

D. FLOUR PROCESSING COSTS

3.28 There are nine flour mills with a combined flour production capacity of 200,000 tons, with over two thirds of that capacity residing in three major mills located in the North-Central region. Mills located outside the North-Central region are typically of 9,000 tons capacity. By contrast, the average size North American mill would be about 125,000 tons. Most of the flour milling equipment has been in use about 20 years and is in serious need of renovation; an exception is the Darhan flour mill, which was rehabilitated 10 years ago.

3.29 Evaluating processing costs is hindered by both the lack of data and inconsistency in the available data. The mission obtained cost of production data on all of the mills (except Hovsgol) from MOFA and additional (but still incomplete) data directly from four mills—but procurement and production cost data from the two sources were inconsistent.

3.30 Flour mills procure wheat on an ex-farm-gate basis and assume responsibility for raw material transport, whereas in North America and Europe mills procure on a c.i.f. mill basis. Thus, Mongolian mills have an important transportation cost element that makes evaluation and comparison of the cost structures more difficult. Also, in the absence of farm grain storage and wholesalers to assume the storage function, Mongolian flour mills must procure their annual raw material requirement in a brief period following harvest. This adds a financial burden not incurred by North American and European mills that procure raw material on a year-round basis. Production cost details for 1992 and 1993 applying to the mills can be found in Annex Table A2.9, and are summarized below:

Table 3.2: POTENTIAL FINANCIAL AND ECONOMIC COSTS OF WHEAT PRODUCTION (IMPROVED TECHNOLOGY AND MANAGEMENT)

			Financial			Economic		
	Unit	Units/ha/a	Tg/unit	Tg/ha	Tg/t	Tg/unit	Tg/ha	Tg/t
Traded Inputs				**32,332**	**23,094**		**27,912**	**19,937**
Seed	kg	150	71	9,903	7,074	62	8,727	6,233
Fertilizer	kg							
NH_4NO_3		88	59	5,206	3,716	50	4,454	3,181
TSP		32	69	2,202	1,573	60	1,905	1,361
KCl		13	54	720	514	50	673	481
Fuel	lt							
Diesel		33	104	3,479	2,485	76	2,539	1,813
Gasoline		6	104	622	444	78	469	335
Electricity	kWh	17	46	773	524	69	1,159	828
Sprays	lt	1.4	2,004	2,756	1,968	1,936	2,663	1,902
Seed treatment	lt	0.2	4,504	1,013	724	3,776	850	607
Repairs	Tg			5,658	4,041		4,473	3,195
Depreciation				**13,172**	**9,408**		**10,475**	**7,482**
Machinery	Tg			12,390	8,850		9,795	6,996
Buildings	Tg			782	558		680	486
Domestic Costs				**10,333**	**7,381**		**9,153**	**6,538**
Crop Insurance	Tg			1,600	1,143		1,600	1,143
Management	staff-mo.	0.018	12,000	216	154	12,000	216	154
Labor								
Full time	staff-mo.	0.096	10,000	960	686	10,000	960	686
Part time	staff-day	0.120	400	48	34	400	48	34
Interest on								
working cap.	Tg			1,022	730		697	498
durable cap.	Tg			6,487	4,634		5,632	4,023
TOTAL COST				**55,837**	**39,883**		**47,540**	**33,957**

/a Unit requirements were derived from 1,000 ha budgets and are rounded to the nearest whole unit. However, cost per ha and per ton calculations include the hidden digits to the right of the decimal point.

PRODUCTION COST DISTRIBUTION

Category	Percent	Revised /a
Raw Material	63	71
Labor	3	3
Utilities	11	10
Spare Parts	3	3
Transport	7	0
Miscellaneous	13	13
Total	100	100

/a Transport costs were added to raw material costs to permit international comparisons.

3.31 Raw material costs as presented, are a particularly low proportion of total costs, but reestimating raw material costs on a c.i.f. mill basis, by including transport and gasoline/diesel costs as part of the raw material costs, increases raw material cost to 71 percent of total cost. North American norms for raw material cost are 75-80 percent of total cost. (Data obtained directly from the flour mills often contained substantially different cost coefficients, but the aggregate percentages were similar to the above.) The composition of the second-largest category, miscellaneous, is unknown and should be decomposed to determine the importance of the components. The minimal depreciation and lack of finance charges are important anomalies in the cost structure. A depreciation component was included but comprised less than 0.5 percent—perhaps because they are nearly fully depreciated. Other data indicate large interest costs; their exclusion from the processing cost statement is surprising—unless they were neither paid nor expected to be paid. While the consolidated 1992 and 1993 production cost statements indicate the milling industry was financially healthy, making a Tg 0.9 billion profit on sales of Tg 7.9 billion (excluding 1993 Hovsgol data), if interest charges of Tg 1.2 billion were included, the industry incurred a serious loss.

3.32 Estimates for rehabilitating a 40,000 tons per annum (tpa) flour mill with new equipment and civil works (exclusive of silo structures) range from $3.0 million (US estimate) to $10 million (Mongolian estimate). Assuming the lower investment cost, the annual interest and depreciation charges combined, based on a real interest rate of 8 percent and a 20-year life, would be $305,500 (Tg 122.2 million). This cost should be added to accurately reflect the cost of flour milling. If included in the production cost statement of the major mills, and other costs remained constant, a flour sale price increase of Tg 3 per kg would cover the incremental cost.

3.33 Most mills claim a milling rate of 73 percent, but the computed national average rate for 1992 and 1993 was 71 percent. This is a low rate given the relatively undiscriminating market where flour is primarily used for bread. North American and European extraction rates average 75 and 80-82 percent, respectively. Increasing the national average extraction rate from 71 to 80 percent would yield an additional 9,000 tons of flour from each 100,000 tons of wheat and would increase the flour industry's gross returns by about Tg 800 million (at current prices).

3.34 The lack of more complete accounting information prevents identification of flour milling inefficiencies. However, full privatization of the flour mills should be a high priority objective. Mill privatization coupled with imported flour (or potential imports) would increase incentives for improving flour milling and marketing efficiency.

3.35 Market initiatives are generally lacking. During the period when low-priced Chinese flour was abundant, mill managers apparently did not undertake initiatives to generate sales and improve cash flow. As this was a period when interest was accruing at the rate of 8 percent *per month* on borrowed funds, virtually any initiative (reduced prices or increased milling rates) to increase sales would have improved cash flow and profitability.

E. Wheat Alternatives

3.36 Alternatives to large-scale wheat cultivation are severely limited by the harsh climate and lack of markets. Fodder crops, which were previously grown in rotation with wheat, are in very limited demand following the abolition of subsidized livestock feed. Vegetables, which are consumed mostly by the urban population, are grown almost exclusively under irrigation and relatively small areas are needed to satisfy the demand. MOFA has shown interest in sugar beet and trial plantings have been undertaken by PSARI in Selenge aimag. Yields of up to 24 t/ha have been recorded in trials but commercial plantings are likely to yield much less. The growing season is too short and rainfall inadequate, and there is a high risk of frost damage, which can seriously reduce root yield and sugar content. Climatic variability between seasons is such that there is considerable risk of crop failure.

3.37 **Barley**, the second most important cereal in Mongolia, is quite well adapted to cool weather and a short growing season, has similar agronomic and equipment needs to those of wheat and is potentially more productive. However, the shortage of inputs and the collapse of the feed grain market has had a dramatic effect on cropped area and yield. The planted area has declined from about 120,000 ha in 1990 to 19,000 ha in 1994 and average grain yield, which reached about 1.2-1.3 t/ha in the mid-1980s, has fallen to about 0.6 t/ha. Improvements in crop husbandry and post-harvest grain handling and storage, similar to those described for wheat in paras. 3.4-3.14 are required in order to raise productivity and grain quality. In addition, new varieties are needed to replace the current variety "Winner," which was originally released in the Soviet Union in the 1920s.

3.38 **Rapeseed (Canola)** may have potential as an alternative to wheat although little agronomic work has been done on this crop in Mongolia to date. Early maturing (85-day) varieties are available and could be imported and multiplied quite rapidly with sowing rates of only 2-15 kg/ha. Most of the improved technology recommendations for wheat are equally applicable to rapeseed. However, successful seedbed preparation and crop establishment is more demanding than for wheat. Because of its small seed size, rapeseed requires a shallow planting depth (not more than 5 cm) and given the dry weather prevalent in Spring, minimum tillage is highly desirable to conserve moisture in the seedbed. Equipment requirements are similar to wheat with some (inexpensive) adaptation necessary for combine harvesters and seed processing equipment. Under good management average yields of 1 t/ha should be achievable.

4. MARKETING AND PRICING

A. Wheat Market Structure and Prices

4.1 There are four important uses for wheat: flour milling, industrial uses (distilling), seed, and feed milling. All of these uses, except feed milling, require high-quality grain. There are nine major flour mills, the three largest are located in the North-Central region, the remaining six are distributed throughout the population and production areas. Only two distilleries exist, a large one located in the center of the North-Central wheat-producing region and a smaller one located on the periphery. Wheat seed is typically selected from the better grain harvested and does not enter the market, but does require a significant quantity of grain, frequently as much as 20 percent of the quantity harvested.

4.2 *Flour Milling.* There is essentially a single short channel for marketing flour-quality wheat. There are no wholesalers and most farms sell directly to one of the nine large flour mills, although small amounts of wheat are sold via middlemen. The spatial distribution of these mills results in most farmers depending upon a single buyer for their wheat. Commercialization of the flour mills has been complicated by (a) state retention of 51 percent ownership, which limits the scope of entrepreneurial decisions flour mill managers are permitted, and (b) milling concentration that, even if fully privatized, would leave the mills in a monopsony structure. This sole market has been eroded slightly during the last two years as a small amount of wheat is required by the Soums and farms that have procured small flour mills (primarily of Chinese origin). There are 72 known rural mills that have an estimated combined capacity of 10,000 tons of flour or approximately 14,000 tons of wheat. Thus, the market size outside of the monopsony structure is rather small.

4.3 **Price.** Flour mills purchase standard grade II wheat at "negotiated" prices ex-farm-gate, which are uniform nationwide. The fivefold increase in farm-gate wheat prices over the past five years is modest compared to the twentyfold increase in the urban retail price of flour. Recent farm-gate wheat prices are:

	1990	1991	1992	1993	1994
Tg.	6,200	8,000	11,000	41,700	35,000

The marketing margin enjoyed by middlemen is unknown (US farmers receive an average of 83 percent of the central market—Kansas City, Minneapolis, etc.—prices). Considerable quantities of wheat were not procured in 1993, as imports of low-priced, low-quality flour caused domestic flour sales to decline. For inexplicable reasons, flour mill managers simply stopped milling and forewent sales rather than renegotiating procurement prices or increasing milling rates to produce import-competitive flour.

4.4 *Industrial use* of grain is predominately alcohol manufacture, in turn used to produce potable and medicinal spirits. The two Mongolian alcohol factories have had an annual average output of about 3.2 million liters, but output declined precipitously in 1993 and 1994 (Table 4.1). A major use of alcohol is the manufacture of vodka, one unit of alcohol is diluted to make about three units of vodka. There are numerous registered and unregistered vodka blenders.

Table 4.1: PRODUCTION OF ALCOHOL AND POTABLE SPIRITS
(Million liters)

	1989	1990	1991	1992	1993	1994
Alcohol	3.15	3.47	3.21	3.21	2.22	1.77/a
Vodka	4.92	6.44	6.77	6.68	5.25	1.91/b

/a January through November.
/b January through June.

Source: Mongolia; State Statistical Office.

4.5 Although alcohol production requires only a small quantity of wheat, it is a premium market as the quality requirements are very high. Consequently, prices paid by distilleries are about 20 percent higher than standard milling quality. Doubtlessly, some farmers benefit from this premium market, but it is a small niche market that should not dictate the market standard for the wheat sector. Alcohol manufacturers could use potatoes as an alternative raw material.

4.6 The principal market for *feed milling* quality wheat has been the eight flour/feed mills plus stand-alone feed mills. In turn, the market for the feed mills was the intensive livestock industry and SEFF, both of which have downsized since 1990. In addition, there was a small domestic market outside the feed mills and an external market in Russia. The latter market remains, albeit reduced in size. Bran, the by-product of flour milling, also competes for the reduced feed market. Feed-quality wheat and bran currently sell for about Tg 17,000 ($42.50) and Tg 9,400 ($23.50) per ton, respectively. These prices are exceptionally low by international comparison, but appear to be competitively determined and reflect the low demand for feed.

4.7 The three large **flour mills** in the North-Central region mill and sell flour (in three grades), other wheat products and by-products, and account for 67 percent of the national flour output capacity. Flour is sold in consumer and institutional-size bags and also is provided in bulk to large bakeries with bulk-handling facilities. These mills are large by domestic standards (40,000 tons annual capacity), but are relatively small by international norms. Flour mills located in other regions are considerably smaller, typically of 9,000 tons capacity and manufacture/sell only two grades of flour. There are two major and one minor groups of flour buyers, bakeries and wholesale trading agencies, and rural Soums, respectively. Also, imported flour provides some competition that, to date, has comprised lower-quality and priced flour.

4.8 Wholesale **prices of flour**, ex-mill are determined primarily on a cost-plus basis and vary by mill. October prices for the two largest mills are indicated below (Table 4.2). Acknowledging that Mongolian flour mills encounter transportation costs that elsewhere are incorporated into the purchase price, the farm-gate wheat price:ex-mill flour price ratio in Mongolia is very low, currently about 0.38. In North America, this coefficient is 0.80 (however, if the bran by-product had no value, the ratio would decline to 0.67); the China coefficient is 0.56.

Table 4.2: Ex-Mill Flour Prices /a
(Tg/ton)

	Ulaan Baatar	Darhan
Flour - Super	117,700	125,000
- Grade I	102,300	93,000
- Grade II	81,400	79,000
By-product		
- Bran	10,670	8,200

/a Includes 10 percent trade tax.

4.9 Retail prices of domestically produced Grades I and II flour are collected and published monthly as components of urban and rural consumer price lists. Retail prices are typically 7-10 percent above wholesale prices. Lower-priced imported flour (Chinese origin), exempted from customs duty, was widely available in 1993 and early 1994; these prices were not systematically collected; however, anecdotal reports indicate that the imported flour was discount priced about 10 percent below domestic Grade II (10 percent trade tax included). This represents an apparently anomalous situation as a retail price of Tg 70-80 per kg is significantly below a border price. Possible explanation of such a low price include (a) low-quality flour milled from grain stocks whose quality had deteriorated in storage and was unsalable in China but could be exported at discount prices; (b) localized wheat surpluses near the Mongolian border that, due to transport constraints, either could not be transported or was more costly to transport to deficit Chinese areas than to Mongolia; (c) flour was procured using undervalued barter commodities, such as wool or cashmere, because export prohibitions prevent reference prices in Ulaanbaatar from reflecting market values; and (d) wheat (flour) was adulterated with lower-value grains.

4.10 Data from Ulaanbaatar and Darhan flour mills indicate the average ex-mill flour price is similar to the ex-rail flour border price, but the farm-gate price for wheat is considerably below its estimated border price. This suggests the mills are either making abnormally high profits or are inefficient. High profits are not an issue as it was indicated earlier that, collectively, the mills would be incurring a loss if interest costs were included. Therefore, the border price anomaly must result from internal mill inefficiency. Unfortunately, inconsistent and insufficiently detailed accounting information prevent the identification of centers of inefficiency. Improved accounting based on accepted international standards, followed by identification and resolution of inefficiencies, should be a priority on the mill reform agenda.

B. Border Prices

4.11 Computing the *wheat border price* applicable to Mongolia is complicated by the landlocked nature of the country, the relatively small demand, and the limited handling and storage capacity. The importation of wheat from a major exporting country would require transiting either Russia or China, entering via either Vladivostok or Tianjin ports. Tianjin is used in the following analyses as the Russian route is longer and considered less secure.

4.12 International wheat prices were quoted at about $150 per ton in October 1994. China procures wheat in large volume and at discounted prices; therefore, China's prices c.i.f. Tianjin are typically near or below the internationally quoted f.o.b. Gulf Ports price. However, this discounted price option generally is unavailable to Mongolia; if Mongolia imported one third of its requirements, imports would be about 125,000 tons and would require throughout-the-year scheduling, given the limited storage and handling capacity. Thus, Mongolia would be deprived not only of lower prices available on large-volume purchases, it also would be deprived of using large bulk vessels (80,000 tons) and would incur greater shipping charges.

4.13 For analytical purposes, it was assumed that Mongolia could obtain wheat c.i.f. Tianjin at $150 per ton in bulk carriers (perhaps by "piggybacking" on Chinese procurement). However, Mongolia has no bulk-handling capacity and imported grain would require either containerization or bagging at Tianjin port. The handling and transportation charges indicated below (Table 4.3) suggest container shipping would be more efficient; but, unless nonreturnable containers were used, the transport cost would be doubled to reflect the return charge.

4.14 Also, China has discriminatory rail freight tariffs with relatively low rates applicable to local shippers and considerably higher rates applying to non-Chinese shippers. Therefore, the above handling charges would be effective only if a Chinese (e.g., Tianjin Grain Bureau) agency would claim ownership or origin. Otherwise, the Tianjin-Ulaanbaatar forwarding cost would be $90.00 per ton. Applying these transport/handling tariffs to the Tianjin c.i.f. price of $150/t, the minimum and maximum Ulaanbaatar border prices would be $188 and $240, respectively.

Table 4.3: HANDLING AND TRANSPORTATION COSTS OF IMPORTING WHEAT VIA TIANJIN
($ per ton basis)

	Bulk to Bag	Containers
Port Charges	7.40	2.40
Rail to Erenhot /a	4.70	8.00
Border Transfer/customs charge	4.00	4.00
Erlian /a to Ulaan Baatar	20.00	22.70
Off-loading/loading in U.B.	4.00	1.35
Total	**40.10**	**38.45**

/a Border transfer occurs at Erenhot, China/Erlian, Mongolia.

4.15 Adding a transport charge of $12.20 per ton (farm-gate to Ulaanbaatar) to the current farm-gate price of $87.50 per ton results in an Ulaanbaatar price/cost of about $100 per ton. This cost is considerably below the international price of $150 per ton and very substantially below the minimum border price of $188, indicating that a severe implicit tax is levied on Mongolian wheat producers. However, a border price for wheat is slightly misleading as the limited market and low prices for milling by-products indicates that **if imports are needed, flour not wheat should be the imported item.**

4.16 **Flour Border Prices**. Given the relatively small international trade in flour, it is inappropriate to determine its *world* price. However, flour could be sourced from China. Although China is one of the world's largest wheat importers, the relatively small volumes required by Mongolia would not overburden China's milling capacity. Thus, a border price for Mongolia was computed using ex-mill Beijing prices as the basis. These prices are about $247 and $223, equivalent for Grade 1 and Standard Grade, respectively.1/ Equating the respective Chinese grades with Mongolian Grades 1 and 2 and weighing the respective prices by the proportion of production of each grade, the border price in Ulaanbaatar would be about $275 per ton (including $32.70 handling and transport charges and excluding port charges, as per Table 4.3).

4.17 Imported Chinese flour prices were only Tg 70-80 per kg in mid-1994. Excluding the 10 percent trade tax and assuming a retail margin of 10 percent would reduce the wholesale (ex-rail equivalent) price to about $167 per ton. The very substantial difference between $167 and the computed border price of $275 per ton suggests imports of "cheap" Chinese flour is unsustainable unless one or more of the conditions noted in para. 4.9 is maintained.

1/ October quotation from the Beijing Grain Bureau.

4.18 Raw materials typically comprise 63 percent of the production costs incurred by Mongolian flour mills. But, internationally, raw material cost norms are about 80 percent of total production costs. Assuming improvements in processing consistent with international norms, *no change* in milling efficiency (73 percent), and applying a flour border price of $275.06 per ton, the border price of wheat at mill-gate and farm-gate would be $165.64 per ton and $154.43 (Tg 62,117) per ton, respectively. Further allowance for the higher moisture in Mongolian-traded grain (19 percent), would reduce the *economic* farm-gate border price to $145.45 (Tg 58,180) per ton. The 15 percent import tariff on flour would increase the *financial* farm-gate border price to about Tg 66,000 per ton (see Annex 3 for detailed calculations).

C. PROFITABILITY AND POTENTIAL PROFITABILITY

4.19 The following table (Table 4.4) indicates expected net returns of wheat production under the prevailing farm-gate price, yield, and quality. Also, it indicates expected profitability if farm-gate border prices are applied under improved technology and management.

Table 4.4: PROFITABILITY OF WHEAT PRODUCTION
(Tg/ha)

	Financial	Economic
Current Technology and Management		
Total Revenue (Annex 2) /a	25,200/b	39,453
Total Cost (Table 3.1)	42,485	40,703
Profitability	-17,285	-1,250
Improved Technology and Management		
Total Revenue (Annex 2) /a	75,053/c	66,136
Total Cost (Table 3.2)	55,837	47,538
Profitability	19,216	18,598

/a Feed-quality wheat is priced at 50 percent of grade 2 flour-quality wheat price.
/b Current price.
/c Border price.

4.20 As is readily apparent, current per hectare revenue of Tg 25,200 is far below the total costs incurred of Tg 42,485, resulting in losses of Tg 17,285. These losses have heretofore been financed by intergovernment subsidies, the national treasury, the banking system, and the mining of farm assets. Even if a border price of Tg 58,180 is applied at the farm-gate, a loss of Tg 1,250 would still be incurred. Applying farm-gate border prices and employing improved technology and management, the increased production costs would be more than compensated with higher yields and improved quality, and financial profits of about Tg 19,200/ha would accrue. Social profitability would be about Tg 18,600/ha (the impact of excluding taxes and tariffs on imported inputs would be more than offset by excluding the duty from the flour price). **The conclusion is that wheat production is *not* profitable under prevailing farm-gate prices; furthermore it is unlikely to become profitable at, or near, the prevailing price regardless of yield and quality conditions.** ***Wheat can be profitable only if the farm-gate price is near the border price and improved yield and grain quality are achieved.***

Sensitivity

4.21 There are four *major* factors that influence wheat profitability: price, yield, quality, and investment (depreciation) costs. Future profitability will substantially depend upon the level of these factors. The prevailing low prices of Russian-sourced machinery and equipment are unlikely to remain substantially below international competitors; thus, machinery and equipment investment costs add another uncertainty factor. To evaluate these uncertainties, a four-dimensional sensitivity analysis was undertaken by computing profitability over a range of prices, yields, qualities, and investment costs (Annex 4) and is summarized below (Table 4.5).

Table 4.5: WHEAT FINANCIAL PROFITABILITY BREAK-EVEN POINTS

		Current Mgmt	Improved Management				
Investment Costs Seasonal Costs		A A	A A	B A	B B	C A	C C
Yield Req'd if price is Tg 35,000/ton	(t/ha)	1.70	1.80	2.01	2.17	2.22	2.53
Yield Req'd if price is Tg 58,000/ton	(t/ha)	1.14	1.16	1.28	1.37	1.41	1.59
Price Req'd if yield is 1.0 t/ha	(Tg/t)	69,508	69,064	77,868	84,163	86,672	99,262
Price Req'd if yield is 1.2 t/ha	(Tg/t)	54,165	55,519	62,579	67,660	69,638	79,801

A = Current cost level.
B = 25 percent increase above current cost level.
C = 50 percent increase above current cost level.

4.22 It is not possible to achieve the 1.7 t/ha yield required to break even under the prevailing price of Tg 35,000 per ton of wheat. Further, if current investment and seasonal costs remained unchanged and the border farm-gate wheat price (Tg 58,000/t) was paid to farmers, gross returns and costs would be equated at a yield of 1.16 t/ha—an average yield level achieved only twice in the past eight years in Selenge and Tuv Aimags (the major wheat area). Most equipment and seasonal inputs are Russian-sourced at prices below international levels. An increase of 25 percent in factor prices, indicated in the

"B/B" column of Table 4.5 (considered quite probable), would require a yield of 1.37 t/ha to break even financially. Alternatively, if yields of 1.2 t/ha were obtained, a price of Tg 67,660 per ton would be required to break even. (Economic break-even points are about 15 percent below the financial break-even point, consistent with 15 percent import duties.)

4.23 The sensitivity analysis clearly indicates the nonrobust nature of profitability; modest changes in any of the four major influencing factors necessitates a substantial compensating change in another factor to maintain profitability. *Therefore, if economic border prices apply at the farm-gate, an average yield of about 1.4 t/ha is required to ensure financial profitability under a range of grain qualities and cost adjustments; if yields are below that level, an above-border price would be necessary.*

D. Impact on Wheat Production and Flour Mills

4.24 The dynamics of time, production technology, location, and price make it difficult to evaluate future wheat production. Crop models used by PSARI have assumed profit margins of 30 percent are required to provide an adequate incentive for wheat production; but this analysis assumes the "improved" wheat production model would reduce risk by reducing annual yield fluctuations and an adequate production incentive would be provided with 20 percent average profit (achievable at a border price of Tg 58,000 and an average yield of 1.4 t/ha). Import border prices in North-Central locations beyond Ulaanbaatar, which are rail accessible, would be marginally higher—$2.00 to $3.00 (Tg 800 to Tg 1,200) per ton. But in the more distant wheat areas, high transport costs create high import, but low export, parity prices. Thus, localized wheat self-sufficiency in the distant production areas likely would be economically efficient (high prices would stimulate production and discourage consumption), with modest surpluses for nearby deficit areas. (For example: the *financial* import parity price for a location 600 km distant from Ulaanbaatar would be Tg 95,500 per ton, which if paid to local farmers would permit 20 percent profitability to be obtained at yield levels of only 0.93 t/ha.) Furthermore, within the North-Central region, if farm-gate prices of wheat increased to Tg 64,000 per ton, the 20 percent profit incentive could be achieved with an average yield of 1.28 t/ha. Based on several assumptions 2/ and uncertain statistics, the production model indicates that total wheat area, total output, and output of high quality wheat would be about 225,000 ha, 370,000 tons, and 225,000 tons, respectively (see Annex 2). However, the model further suggests that the supply price elasticity is very high in this range and relatively large output increases could be achieved with relatively small price increases (e.g., increasing the price to Tg 68,000 would increase total output to 464,000 tons, an increase of about 100,000 tons).

4.25 In reality, some producers will be prepared to grow wheat at a profit margin below 20 percent (and perhaps others would require an average return greater than 20 percent), because alternative activities (shepherding) would earn less, or because their

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2/ The basic assumption relies on a normal distribution of yields with a mean yield of 1.4 t/ha and standard deviation of 0.333 t/ha.

risk threshold was lower. However, in the long run, no farmer would be prepared to produce wheat at a loss (i.e., average yield of less than 1.16 t/ha at Tg 58,000/ton). Assuming farmers were prepared to accept zero profit, 23.5 percent 3/ of the land currently planted to wheat would go out of production (at the Tg 58,000/ton border price). Alternatively, if all producers required 20 percent profits to manage risk and otherwise provide sufficient production incentives, some 50 percent of the wheat land would be abandoned. The actual situation would likely lie within that range; that is, the area planted to wheat in the North-Central region would be reduced between 25 and 50 percent (Annex 2).

4.26 The rated milling capacity of the various flour mills was often exceeded individually and collectively in the late 1980s-early 1990s. Thus, depending upon farmers' future responses to price incentives, there may or may not be excess milling capacity. Under the best-case scenario, *523,700 tons of wheat would be produced, of which 287,700 tons would be available for milling and would require the current milling capacity*. In the worst-case scenario, with 90,000 tons of flour imports, there would be about 25 percent overcapacity in the industry.

3/ 1.16 t/ha is -0.72 standard deviation units from the mean of 1.4 t/ha, and 23.5 percent of the area under a normal curve lies below -0.72 standard deviation units (i.e., yields less than 1.16 t/ha) and would incur losses, and thus go out of production in the long run.

5. DEMAND

A. FLOUR

5.1 In the latter half of the 1980s flour consumption was 105-110 kg per capita (data on rural-urban consumption distribution are unavailable). However, this level declined in the early 1990s (77 kg/cap in 1992) and meat consumption increased. Although the government "plans" for a 110 kg per capita consumption level, recent trends suggest consumption levels under prevailing price ratios may be less. This analysis assumes flour consumption of 100 kg per capita or total consumption of 240,000 tons, reflecting estimated population levels of 1997.

5.2 Once the decision is reached that 240,000 tons of flour is needed, the wheat requirements follow from the flour milling rate. Mongolia's milling standard is 73 percent; however, higher milling rates could be applied with only marginal quality impacts (ironically, higher milling rates would produce nutritionally superior flour, but is perceived as lower quality). A milling rate of 98 percent is achieved in some countries for whole wheat flour. Although 98 percent whole wheat flour would be an extreme, it illustrates the potential wheat savings (efficiency) as the 240,000 tons of flour could be met from 245,000 tons of milling quality wheat rather than the 329,000 tons required using the standard 73 percent milling rate. ***An increased milling rate would be an important contributing factor to improving the wheat self-sufficiency ratio.***

B. OTHER WHEAT PRODUCTS

5.3 **Seed** requirements are a function of seeding rate and planted area. If seed selection and processing are appropriately pursued, substantial seed savings should be effected. This analysis assumes a conservative decline in the seeding rate under improved management from 200 kg/ha to 150 kg/ha. It is more difficult to assess future planted areas; the 1994 sown area was 430,000 ha; however, further reductions are probable on the more marginal areas. For these purposes, it is assumed that planted areas would be between 225,000 and 345,000 ha. Thus, a possible range of seed requirement would be between 35,000 and 60,000 tons.

5.4 **Industrial Demand.** Alcohol production has declined by about 30 percent since 1990, amounting to only 2.2 million liters in 1993. Since alcohol production requires very high-quality grain, the decline likely results from the lack of available raw materials. It is assumed that a production level of 3.2 million liters (the 1990 production level) would be produced if raw materials were available. On this basis, and a conversion of 5 kg of wheat per liter of alcohol, distilling requirements would be 16,000 tons.

Although the raw material requirements could be met from potatoes, the wheat "savings" would be very modest.

5.5 **Feed Quality Grain and Flour By-Products.** Although several studies of the livestock sector, both intensive and extensive, have been undertaken over the past two years, little attention has been devoted to analyzing feed grain/manufactured feed requirements. However, recent declines in price for bran and feed quality wheat suggest that the demand has declined significantly (with reduced supplies and prices, demand must have declined even more). At the beginning of the 1994 harvest, 70,000 tons of feed-quality wheat remained in storage.

5.6 In the past, SEFF procured and distributed both hay and feed concentrate and was the major customer of State Fodder Farms and the feed mills. In the late 1980s, SEFF annual procurements averaged about 250,000 tons of hay and 125,000 tons of concentrates. Cracked grain comprises 50 percent of concentrates; thus, some 60,000 tons of wheat and barley were required to meet this need. However, this demand rapidly declined, depriving producers of an important market outlet for substandard-quality grain. Recent procurement is indicated below (Table 5.1).

Table 5.1: SEFF Procurement of Hay and Concentrates

	1989	1990	1991	1992	1993	1994
			(thousand tons)			
Hay	263.5	155.1	158.1	87.0	18.0	0
Concentrate	105.0	57.5/a	23.6/a	23.0	4.0	0
Transport subsidy (million Tg)	140	179	158	208	254	300/b

/a Derived from secondary sources.
/b IMF estimate.

Source: SEFF; Director.

5.7 Under prevailing average qualities and milling rates, some 60 percent of wheat production is available as feed (40 percent of wheat production is of feed quality and 20 percent of flour-quality wheat is bran by-product); thus, the demand for feed-quality wheat and bran will likely be met from normal wheat production. With improved technology and management the proportion of feed quality produced is expected to decline to 20 percent, but feed requirements would still be met from domestic production.

C. Demand and Supply Balance

5.8 As indicated elsewhere, an average yield of 1.4 t/ha is assumed necessary to meet minimum production incentives and manage year-to-year risks at a wheat border price of Tg 58,000. This would translate into 1.0 t/ha of flour-quality wheat at the internationally traded standard of 14 percent moisture content, and 0.25 t/ha of feed-quality wheat (the 0.15 t residual represents harvest, post-harvest and moisture losses). At the prevailing milling rate of 73 percent, flour requirements could be met from 328,750 tons of high-quality wheat. (With increased milling rates less wheat would be required.) Assuming 16,000 tons of wheat were required for industrial uses and seeding rates were reduced to 150 kg/ha, under improved management, the total domestic requirement for high-quality wheat would be 395,000 tons which, after considering proportions of substandard wheat, post-harvesting and moisture losses, is equivalent to about 584,000 tons of harvested wheat (maximum). Wheat production will be inadequate to meet this demand, but depending upon farmers' perception of risk and incentives under improved management and technology, wheat flour imports may be as small as 30,000 tons or as much as 90,000 tons (37 percent of requirements). At prevailing prices, the foreign exchange cost of importing 90,000 tons would add about $22.5 million to the import bill—an increase of about 6.5 percent (average of the last three years).

5.9 With milling efficiency improvements and import competition, consumer welfare should not be affected by higher farm-gate prices as the retail flour price currently approximates its border price.

D. Wheat Alternatives

5.10 The small, widely dispersed Mongolian population and low population density, coupled with poorly developed transport infrastructure, exacerbates marketing difficulties. The domestic market is small, with high distribution costs. If food processing facilities are centralized to benefit from processing scale economies, distribution costs are high; alternatively, if such facilities are established locally, they will be of suboptimal size and unable to enjoy potential scale economies. These factors combine with the harsh agroclimatic environment to limit the food items that can be met from domestic production. These same factors limit export potential.

5.11 **Vegetable Oilseeds.** The demand for vegetable oils is very limited; to date, the maximum annual import of vegetable oils was 2,700 tons and the maximum annual consumption has been slightly over 1 kg per capita. Vegetable oils must compete with animal fats, which are in abundant supply as a by-product of the meat industry. While there is modest potential demand for vegetable oil based on historical imports, about 7,000 ha would produce sufficient tonnage to meet this demand. Furthermore, investing in processing facilities for such a small output would be highly inefficient (international oilseed crushing mills are based on throughputs of 200,000 to 500,000 tons annually, and China has based its industry on small-scale plants that utilize throughputs of 15,000 to 20,000 tons of oilseed). However, China is a major importer of vegetable oils, including rapeseed oil; thus, a nearby potential export market exists if the oil quality is sufficiently high and prices are competitive.

5.12 **Malting Barley**. The consumption of beer in Mongolia is relatively modest by European standards; however, recent increases in beer imports suggests consumption may have been constrained by availability. Domestic production has been declining due to limited availability of both raw materials and containers. Beer quality is very poor, in part because nonmalting barley varieties are used, and has an exceedingly short shelf life. Recent annual production and import statistics are indicated below (Table 5.2):

Table 5.2: BEER PRODUCTION AND IMPORTS
(Thousand liters)

	1990	1991	1992	1993	1994/a
Production	6,254.2	2,761.2	3,043.8	2,287.2	752.7
Imports			176.6	2,075.3	10,700.5

/a First six months for production, first eight months for imports.

5.13 One ton of malting barley is used to produce 5 tons of beer; consequently, malting barley requirements would amount to only 2,500 to 3,000 tons, even if all beer consumed was domestically produced. Malting barley would be a *potential* export commodity; China imports several hundred thousand tons of malting barley annually. China produces barley but to produce the premium-quality beer Chinese consumers prefer, she imports higher-quality Canadian and Australian barley. A priori, it seems improbable Mongolian farmers would be more skilled and the climate more conducive to high-quality malting barley production than they are in China.

6. SUMMARY AND RECOMMENDATIONS

6.1 The low level of current wheat yields can be economically increased with improved technology and management. The technology and management employed in the drier regions of Saskatchewan and Alberta, Canada have facilitated 10-year average yields of 1.48 t/ha (Saskatchewan's four driest districts with <250 mm of rainfall). This yield level indicates an economically efficient yield, is consistent with the analyses in Chapter 3, and represents an acceptable yield level in Mongolia. Based on this comparison and Mongolia's historical record of input usage and yields, ***full*** domestic wheat *self-sufficiency* appears unsustainable in the long run.

6.2 A number of factors will determine where and how much wheat will be domestically produced. The remoteness and underdeveloped transportation infrastructure of many areas in both eastern and western Mongolia will impede any substantive wheat movement and local production and consumption will likely coincide. In the North-Central area, the wheat yield must average about 1.4 t/ha to be profitable. Farms unable to achieve this yield will discontinue wheat production in the long run.

6.3 The vagaries of Mongolia's climate will continue to make crop production risky. Much of the crop and wheat development of the past three decades has been reversed as production proved to be unsustainable. The limited areas with agroclimatic environments suitable to wheat production and the "reverse season" suboptimal rainfall pattern will result in further production declines as the more marginal lands brought under cultivation revert to rangeland.

6.4 There are two important preconditions to improving wheat yields: (a) rationalized wheat and flour prices to provide producers a price similar to a border price; and (b) rapid implementation of adaptive research, including economic evaluation, on domestic and imported technology including (i) seed, (ii) tillage and husbandry practices, (iii) fertilizer and agrochemical use, and (iv) machinery and equipment.

6.5 The annual consolidated demand for **superior quality wheat** is about 350,000-400,000 tons and contains three components: the primary demand for about 240,000 tons of wheat flour, equivalent to 300,000-340,000 tons of wheat (depending upon the milling rate), 35,000-60,000 tons of wheat for seed and about 15,000 tons of wheat for industrial uses. With the termination of most subsidized livestock support programs, there is virtually no demand for feed-quality grains. Thus, the technical focus and policy support must be on the production of high-quality flour grains.

A. THE POLICY FRAMEWORK

6.6 A discussion of inflation is beyond the scope of this paper. But, inflation's impact on investment, credit and prices is so severe it must be noted. Bringing inflation under control must be a high priority of government; without inflationary control, implementing supportive policies will remain very difficult.

6.7 **Privatization/commercialization** efforts have successfully broadened ownership of agricultural assets through transforming the state farms into joint stock companies. But as the state has retained 51 percent of the ownership of these enterprises, privatization of assets and management are, at best, only partial. By retaining majority ownership in both farms and flour mills, the state has conflicting production and processing interests as buyer and seller in the same market. To date, government's interests have favored processing. *Full privatization of both production and processing assets, permitting fully independent management decisions, should be a high government priority.*

6.8 **Taxation Policy**. Crop farms have enjoyed a partial exemption of the 43 percent income tax. However, the meager equipment depreciation allowance permitted in the tax code is a more serious disincentive to invest, particularly in periods of high inflation. A revised accounting methodology incorporating modern depreciation principles should be high on the reform agenda.

6.9 **Tariff Policy**. A flat 15 percent import tariff applies to agricultural inputs and commodities.1/ However, given the large inflow of low-cost Chinese flour, it may be appropriate to consider a selective tariff increase or define the import price basis as equivalent to ex-mill (Beijing) prices.

6.10 **Pricing Policy**. Previous subsidies to farmers in the form of financially subsidized investment infrastructure (machinery and equipment) and seasonal inputs (fertilizer and fuel) have been eliminated and full financial prices are now paid. But, prices of inputs of Russian origin remain below international prices, and very probably will increase, consistent with international levels and qualities. The farm-gate price for wheat remains grossly below border price equivalents, levying a large implicit tax on farmers.

6.11 Consumer and producer prices should be free of government intervention, and must adjust to border equivalent prices with marketing margins determined by competitive market forces. Government's marketing role should be limited to efficiency issues, ensuring market mechanisms effectively transmit a "near" border price to farmers—*this is the most important policy issue. Without a farm-gate price close to the economic border price (approximately Tg 58,000 per ton), wheat production is not and cannot become profitable at yield levels achievable in Mongolia.*

6.12 **Land Policy**. The draft land law has been under discussion for about three years, without developing a parliamentary consensus. Doubtlessly, several contentious issues remain to be resolved. However, *it is crucial that farmers acquire security of*

1/ Imported wheat flour remains exempted from one third of the duty; i.e., the duty levied is only 10 percent.

tenure, which might be achieved by some interim measure. It is not necessary to authorize private landownership; security through long-term leases would be sufficient to promote reinvestment and prevent asset stripping. Another important aspect of leasing would be the introduction of a land charge; heretofore, land has been a free input and its price or value was not a factor in production decisions.

6.13 **Credit Policy.** Inflation has had a serious impact on financial policies and interest rates. The rapid inflation Mongolia is currently experiencing has brought about interest rates of 100-144 percent (annualized). Government has provided directed credit to agriculture to assist in meeting seasonal input needs and to partially compensate for high commercial interest rates. While it is appropriate to have positive real interest rates, ***real rates*** have been highly positive and at levels incompatible with low-margin agricultural production. At current rates it not possible to reinvest in production infrastructure and without such reinvestment, production capital will soon become depleted and output will further suffer. Also, seasonal credit is required to cover cash costs of production and harvest, but current interest rates may increase the loan repayment by 50 percent within six months.

6.14 The recently privatized banking sector remains immature and has not developed the capacity to evaluate investment proposals and support long-term lending. Investment lending is crucial to development of the agricultural sector; government support and training is needed to ensure the banking sector acquires these evaluation skills.

B. Technology and Management

6.15 In the agroclimatic environment of Mongolia, *soil moisture is the most limiting constraint to crop production*. Spring rains are late and light, contributing to poor seed germination and limited fertilizer impact, and heavy autumn rains at harvest contribute to reduced yield and poor quality. Given this constraint, initiatives to improve soil moisture should be a high priority.

6.16 Reduced tillage, including the use of equipment specifically designed for that purpose, offers the best means of conserving soil moisture and reducing wind erosion. Such systems should be coupled with improved chemical weed control on summer fallow and widely tested on commercial wheat farms. Also, minimum tillage would reduce production costs and permit more timely planting.

6.17 There are several other technical and managerial initiatives that would contribute to improved yields; one of the more important is *improved seed* quality. In the longer term, this should include the introduction of new cultivars (varieties) but in the near term improved selection, closer attention to operation and maintenance of seed-dressing equipment and treatment, and better storage would improve seed quality and yields.

6.18 Recommended fertilizer rates should be reassessed in terms of optimal rather than maximal output and taking into account available moisture. The potential of nitrogen-fixing and phosphorus-releasing bacteria, currently under small-scale production, should be further investigated as a possible substitute for chemical fertilizer.

6.19 Research personnel devote considerable efforts to commercial activities to supplement research budgets. Thus, increased research funding and training/retraining is imperative to address the numerous adaptive and basic research issues facing modernization of the wheat industry. The traditional approach to research needs to be reoriented toward optimization and sustainability. This will require the introduction of farm management economics into research programs. Agricultural extension was not a support service under the command economy, but will become necessary as research activities are revived.

Production Alternatives

6.20 The harsh climatic conditions limit the crop alternatives available to Mongolian producers. While barley (for grain), silage and forage crops were once important crops, the termination of feed subsidy programs and decline of the intensive livestock industry have virtually eliminated the demand for these crops. Low-quality wheat and flour milling by-products are adequate to meet the feed demand. Sugar beets have been experimentally grown, with unsatisfactory results as the extreme continental climate exceeds the limits of efficient sugar beet production.

6.21 The domestic malting barley market is very small but there is a *potential* export market in China, provided the requisite quality could be attained. However, this does not appear to be a very promising alternative since China cannot produce malting barley under a more favorable environment and relies on Canadian and Australian supplies. Oilseed rape (canola) may have potential as a wheat alternative but, due to its small seed size, it has more demanding seedbed preparation requirements. *Rapeseed trials should be included in future research programs, but feasible processing plant sizes also should be examined.* With efficient rapeseed production and processing, domestic demand could be readily met from a very small planted area; however, China imports several hundred thousand tons of vegetable oil, including rapeseed oil, and represents a *potential* market.

Flour Milling

6.22 The average flour milling rate of 71 percent, either by design or default, is exceptionally low. Achieving a target rate of 80 percent would make Mongolia's mills comparable to design efficiencies of larger European mills. Also, this would reduce the bran by-product, for which there is minimal demand and would increase the nutritional content of the flour.

6.23 Flour mill management has displayed minimal capacity to address market anomalies. The reaction to imported low-cost flour in 1993 was to reduce, and in some cases defer, flour production. As a result, domestic mills operated at only 65 percent of capacity (in previous years, production was often over 100 percent of capacity). In a market economy, such situations will occur and managers must have incentives that will guide them in loss-minimizing, as well as profit-maximizing, decisions.

C. Next Steps

Government

6.24 It must be accepted that considerable marginal land has been brought under cultivation that cannot sustain wheat production. The amount of marginal wheat land that should revert to rangeland depends substantially upon the long-run border price and farmers' reaction to price incentives, but probably comprises 25 to 50 percent of the currently planted wheat areas. However, higher yields and improved quality will partially compensate for the reduced area. *But, the impact of wheat area reduction on rural labor requirements and alternative employment opportunities must be considered.*

6.25 A series of activities is needed to improve both short- and long-term efficiency in the wheat subsector. One of the most pressing issues is the control of inflation. Recent inflation has impacted asymmetrically on the wheat subsector. A stable exchange rate, coupled with flour imports and declining demand for feed, has caused output prices to decline, while the prices of imported factors of production have remained relatively stable. But inflation has made interest rates prohibitively high, precluding investment borrowing, leading to asset degradation and limiting use of seasonal inputs to unsustainably low levels. *Regardless of improvements made in other areas, if high real interest rates are prolonged, the agricultural sector will be decimated by farm and agro-industrial enterprise bankruptcies.*

6.26 Farm and wheat milling assets have been nominally privatized, but the State has retained majority share ownership in many of these facilities which has deferred the more important commercialization objective. Ownership divestiture, which would eliminate government's implicit roles in both price determination and management decisions, should be an immediate priority of government. *Without full government disengagement it is unlikely that needed wheat production and flour milling efficiencies will be achieved and that the farm-gate price for wheat will approximate a border price.*

6.27 For long-term sustainability of the wheat industry, an effective national research program is necessary. Given Mongolia's relatively small wheat subsector, it would be prohibitively costly to address the entire research spectrum domestically. Thus, research activities should focus on selective adaptation of research results from International Centers (CIMMYT, ICRISAT, etc.) and other National Centers (Canada) that have similar agroclimatic environments; *close working relationships should be developed with such centers. An effective research program is necessary for long-term sustainability of the wheat sector.*

World Bank

6.28 Following discussions of the report with government, the Bank should be prepared to assist Government in either of the following ways: (a) work with government in further identifying and budgeting priority agricultural research activities and, if research financing, onlending and ownership/pricing/marketing policies can be agreed, resume preparation of a wheat rehabilitation project; or (b) assist in identifying/locating grant funds that could be accessed to reestablish an effective crop research program.

AGROECOLOGICAL REGIONS OF MONGOLIA

A. VEGETATION ZONES

The combination of altitude, rainfall distribution and soil type has produced six definable vegetation zones or natural regions in Mongolia. These are alpine tundra, mountain taiga, mountain steppe and forest, steppe, desert steppe, and desert. These are outlined in Map 2. The principal agricultural areas are the mountain steppe and forest, steppe and desert steppe. Land distribution by zone is indicated in Table 1.

Table 1: LAND DISTRIBUTION BY ZONE

Zone	Area (percent)
Alpine tundra	4.5
Mountain taiga	3.8
Mountain steppe and forest	23.3
Steppe	25.9
Desert steppe	21.5
Desert	15.4
Interzonal vegetation and lakes	5.1

B. NATURAL REGIONS FOR AGRICULTURE

To more readily represent the different combinations of altitude, rainfall and soil type, Mongolia can be divided into five natural regions and 18 subregions. The five regions are Hangai-Khuvsgul, Selenge-Onon, Mongolian Altai, Central and Eastern Steppe and the Gobi Desert. The regions and subregions are shown in Map 3 and a brief description of each is set out below.

Hangai-Khuvsgul Region

The Hangai-Khuvsgul region is situated in the northwest of the country. It is a high-altitude forest area with deep valleys and many lakes. The northerly location and altitude make this a permafrost area and there is no underground water. It can be divided into five subregions.

1. The meadows and valleys of central Hangai where the major activities are yaks, cattle and sheep.

2. The Bulnai forest-steppe and arid steppe areas. Most suitable activities are sheep, cattle and fodder production.

3. The Khuvsgul mountain, taiga, forest and steppe regions. Major activities are production of yaks, cattle, reindeer.

4. Western Hangai steppe and arid steppe areas. Sheep, early-ripening cereals and fodder production are the most suitable agricultural activities.

5. Southern Hangai steppe and arid-steppe and semidesert areas are suitable for sheep and cattle activities, early-ripening grain and fodder crops.

The principal climatic details of the Hangai-Khuvsgul region are given in Table 2.

Table 2: Climatic Information Hangai-Khuvsgul Region

Zone	Av Elev ('000m asl)	Mean Annual (°C)	Temp Jan (°C)	Temp Jul (°C)	Heat sum (>10°C)	No. of days	Frost free days	Precipi-tation (mm)	Snow Cover (mm)	Wind Speed (m/sec)
1	3.0	-2.5:5.0	-20:-24	8.15	400:1400	70:90	60:80	>400	>15	2:4
2	2.5:3.0	-5.0:7.5	-20:-24	6:13	400:1400	70:90	60:80	300:400	>15	2:4
3	2.2:3.0	-5.0:7.5	-24:-30	15:19	1400:2000	90:110	90:110	200:250	>15	2:4
4	2.0:2.5	0.0:2.5	-16:-20	15:19	1400:2000	80:100	80:100	200:250	>15	2:4
5	2.0:2.3	0.0:2.5	-16:-20	15:19	1400:2000	80:100	80:100	200:250	>15	2:4

Selenge-Onon Region

This region is located in the north-central area of the country. It is a broad flat-floored basin draining to the north and is the principal cropping area. The Selenge-Onon region can be divided into four subregions.

6. Selenge forest and steppe subregion is suitable for cattle and sheep activities and rainfed crop production. The Selenge valley is the largest cropping area in the country.

7. Onon low mountains arid steppe subregion is suitable for rainfed crop production and cattle and sheep activities.

8. Khentei mountain forest and steppe subregion is suitable for cattle production and rainfed cropping.

9. Ulz-Tuul steppe and arid steppe subregions are suitable for sheep, cattle, early-ripening grain and fodder production.

Principal climatic details of the Selenge-Onon region are given in Table 3.

Table 3: CLIMATIC INFORMATION SELENGE-ONON REGION

Zone	Av Elev ('000m asl)	Mean Annual (°C)	Temp Jan (°C)	Temp Jul (°C)	Heat sum (>10°C)	No. of days	Frost free days	Precipi-tation (mm)	Snow Cover (mm)	Wind Speed (m/sec)
6	1.5:2.0	2.5:5.0	-20:-24	15:19	1000:2000	80:100	100:120	300:400	5:10	4:6
7	1.5:2.2	0.0:2.5	-16:-19	15:19	1400:2000	70:90	80:100	250:400	5:10	4:6
8	1.5:2.2	2.5:5.0	-20:-24	13:15	1000:2000	70:90	100:120	300:400	5:10	4:6
9	1.5:2.2	2.5:5.0	-20:-24	13:15	1000:2000	80:100	100:120	300:400	5:10	4:6

Mongolian Altai Region

This is the high mountain region at the far western end of the country. It is divided into three subregions.

10. Harhira and Turgen mountains arid steppe areas are suitable for sheep and goats and cattle.

11. Central altai meadow and steppe subregion is suitable for yaks, which are the prevailing class of cattle, also sheep and goats. The season is so short that only early-ripening fodder crops can be produced.

12. Southern Altai steppe subregion is suitable for livestock production, irrigated fruit and berry, melons and fodder production.

Principal climatic details of the Altai region are given in Table 4.

Table 4: CLIMATIC INFORMATION ALTAI REGION

Zone	Av Elev ('000m asl)	Mean Annual (°C)	Temp Jan (°C)	Temp Jul (°C)	Heat sum (>10°C)	No. of days	Frost free days	Precipi-tation (mm)	Snow Cover (mm)	Wind Speed (m/sec)
10	3.5:4.0	-2.5:5.0	-20:-24	8:13	400:1000	<70	60:80	400:500	>15	2:6
11	1.5:2.0	0.0:2.5	-16:-20	19:22	2000:2600	100:120	120:140	400:500	>15	4:6
12	2.5:3.0	0.0:2.5	-16:-20	15:19	1400:2000	80:120	80:1200	400:500	5:10	2:6

Central and Eastern Steppe Region

This region covers the broad, flat, treeless plains of eastern Mongolia. The area is divided into three subregions.

13. Southern part of Central Halha is suitable for sheep, goat and cattle production.

14. Kherlen-Khukh-Nuur in the north is suitable for sheep and cattle production. Rainfed crops can be produced in good years.

15. Menen-Dari'ganga arid steppe region is suitable for sheep and goat raising and rainfed cereal and fodder crop production.

Principal climatic details of the Central and Eastern Steppe region are given in Table 5.

Table 5: CLIMATIC INFORMATION CENTRAL AND EASTERN REGION

Zone	Av Elev ('000m asl)	Mean Annual (°C)	Temp Jan (°C)	Temp Jul (°C)	Heat sum (>10°C)	No. of days	Frost free days	Precipi-tation (mm)	Snow Cover (mm)	Wind Speed (m/sec)
13	0.9:1.5	0.0:2.5	-20:-24	15:20	1400:2000	100:130	110:140	150:250	5:10	4:6
14	0.5:1.1	0.0:2.5	-20:-24	19:22	2000:2600	90:110	120:140	150:250	5:10	4:6
15	0.9:2.0	0.0:2.5	-20:-24	19:22	2000:2600	>130	120:140	150:250	>5	6:8

Gobi Desert Region

The Gobi desert region covers the whole southern section of the country. It is divided into three subregions.

16. Great Lakes lowland semidesert and arid steppe subregions are suitable for sheep, goat and camel production, fruit and berries with melons on irrigated fields.

17. Gobi-Altai mountain-steppe, semidesert subregion is suitable for goat, sheep, camel and irrigated crop production in oases.

18. Galbyn Gobi semidesert, desert areas are suitable for camel, sheep, goat, irrigated vegetable, and melon activities.

Principal climatic details of the Gobi Desert region are given in Table 6.

Table 6: Climatic Information Gobi Desert Region

Zone	Av Elev ('000m asl)	Mean Annual (°C)	Temp Jan (°C)	Temp Jul (°C)	Heat sum (>10°C)	No. of days	Frost free days	Precipi-tation (mm)	Snow Cover (mm)	Wind Speed (m/sec)
16	0.7:1.3	0.0:2.5	-20:-24	19:22	2000:2600	90:110	120:140			2:4
17	0.8:1.4	>2.5	>16	>23	3000	>130	>140			6:8
18	0.7:1.0	>2.5	-16:-20	20:23	2600:3000	>130	>140			4:8

WHEAT PRODUCTION AND SUPPLY MODELS

Wheat Production Function

1. Theoretical supply functions are derived from marginal cost of production functions and indicate the incremental cost associated with changing output. In practice, the inability to accurately assess *all* production costs, and the frequent necessity to rely on time series data, often leads to the estimation of supply functions under **pure competition**, by including the output price variable 2/ as one of the factors affecting output.

2. Where input resources and output products have been **centrally allocated**, as in Mongolia, the price variables used in pure competition models are inappropriate as estimated coefficients would have no particular meaning. But, to assist in understanding which factors most influenced past production, wheat output was regressed against total fertilizer use, current and previous season rainfall and total arable area. The fertilizer and rainfall variables were expected to impact on the yield component of production. Total fertilizer use is a proxy for fertilizer applied to wheat, which in fact receives the bulk of the fertilizer applied (although fertilizer application rates are high for vegetables, total application is modest as the vegetable area is relatively small). An average rainfall variable was constructed by averaging data from seven meteorological stations located in the North-Central region. Rainfall in both current and previous seasons were included to capture the impact of soil moisture conservation in crop-fallow rotations. Also, current season rainfall typically occurs late in the season; seed germination and crop establishment rely on residual soil moisture, represented by the previous season's rainfall. The total arable area was expected to reflect central authority's intentions and explain the area component of production.

3. The model is indicated in the following equation:

$$Y_t = \beta_o X_{1t}^{\beta_1} X_{2t}^{\beta_2} X_{3t}^{\beta_3} X_{3t-1}^{\beta_4} \epsilon_t$$

2/ **Multiple variants are used depending upon the sophistication of the estimates, including lagged price variables and simultaneous systems.**

where:

Y	=	Wheat Production in thousand tons
X_1	=	Fertilizer use in tons
X_2	=	Average rainfall in mm
X_3	=	Arable area in thousand hectares
ϵ	=	error term
t	=	time period
β_i	=	estimated coefficient.

4. Data could be obtained only for the 1980-90 period. Consequently, only 11 observations were used in the analysis, which was reduced to 10 when a lagged rainfall variable was introduced and as coefficients for four variables were estimated the degrees of freedom were reduced to five. The estimated coefficients, in logarithms, and their "t" statistics (in brackets) are indicated below:

$$\log Y_t = -10.9334 + \underset{(0.73)}{0.9395 \log X_{1t}} + \underset{(0.81)}{0.1706 \log X_{2t}} + \underset{(4.29)}{1.0301 \log X_{2t-1}} + \underset{(1.03)}{0.9395 \log X_{3t}}$$

Coefficient of Determination = 0.95
Standard Error of Estimate = 0.0821

5. Despite the high coefficient of determination and low (8.2 percent) standard error of estimate, only the lagged rainfall variable was significant, perhaps reflecting the limited data and low degrees of freedom in the estimates. Nevertheless, all coefficients (elasticities) are of the expected sign and only the magnitude of current season rainfall (X_t) is unexpectedly low. The elasticity of arable area is high, as expected—given that wheat is overwhelmingly the major cultivated crop. Similarly, the fertilizer elasticity coefficient is high, reflecting the relatively low average use per hectare and the high marginal productivity.

6. Given the lack of significant coefficients, the function was reestimated, excluding the arable land variable. The reestimated coefficient of determination and standard error of estimate were only fractionally different from the earlier estimate, implying the arable land variable contributed little in the explanation of changes in output. The reestimated coefficients, in logarithms, and their "t" statistics are indicated below:

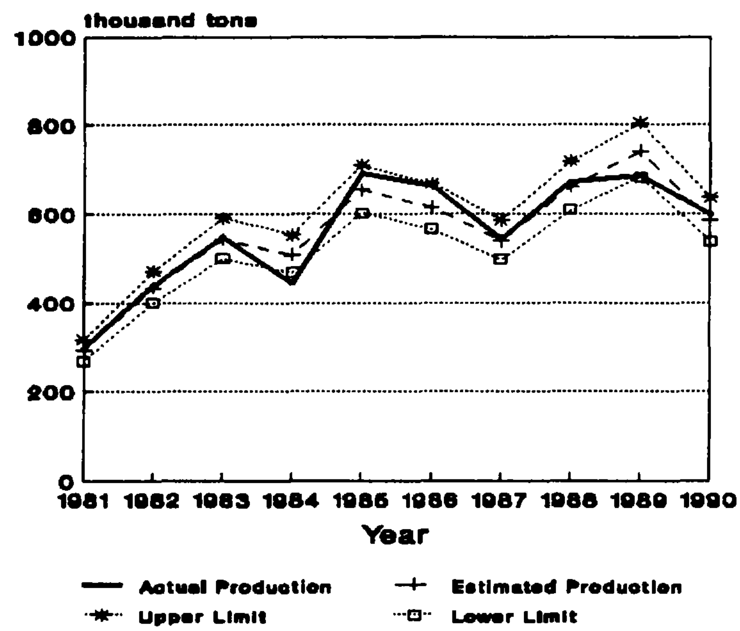
$$\log Y_t = -10.3188 + \underset{(4.33)}{0.7953 \log X_{1t}} + \underset{(1.00)}{0.2078 \log X_{2t}} + \underset{(9.01)}{1.1753 \log X_{2t-1}}$$

Coefficient of Determination = 0.94
Standard Error of Estimate = 0.0825

7. There was a slight difference in the magnitude of the rainfall coefficients in the latter equation, but the coefficient for rainfall in the current season remained nonsignificant. The fertilizer coefficient in the latter equation was smaller and significant. The actual and estimated production statistics for 1981-90 are indicated in the following

graph along with a band representing $\pm$ one standard error of the estimate and within which the actual production would be expected to fall 68 percent of the time.

Figure 1: Wheat Production



Wheat Supply Function

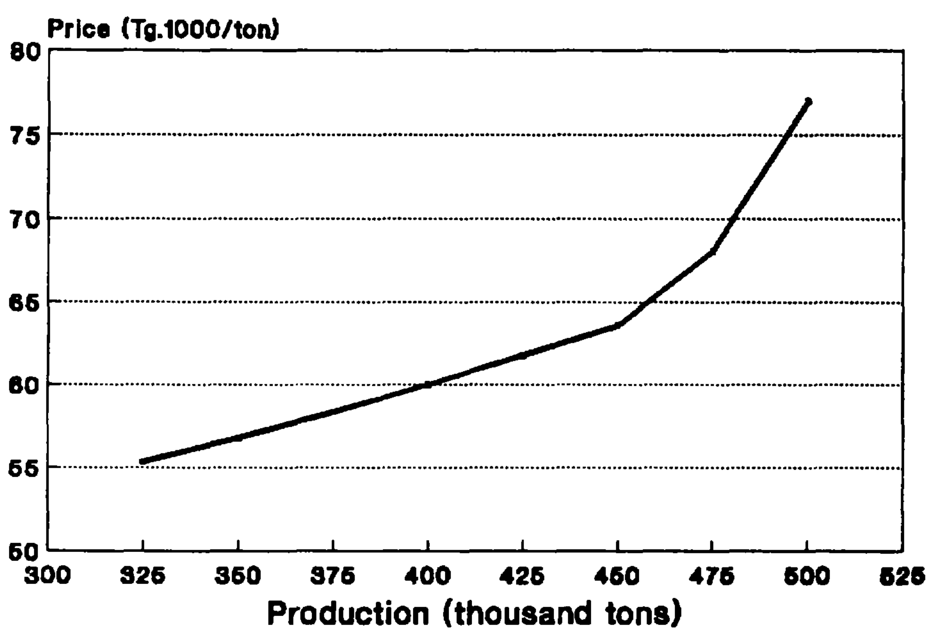
8. Wheat production has been discontinued on large areas that have proven to be marginal for cultivation, a trend that will likely continue. In an effort to examine the future wheat land loss and future wheat production, a simple yield-area-production model was developed based on the crop model, other historical empirical data, and several assumptions. National and Aimag annual yields with annual and spatial variations were determined from disaggregated data, available for the years 1987-93. It was assumed that these yields were normally distributed, and the yield standard deviation of 0.333 tons was derived for the 10 major wheat-producing Aimags. Improved management and technology are expected to increase the average yield to 1.4 t/ha and *should* reduce variation, but in the absence of any estimate of the variance under improved management, the variance under current management was applied to the improved model.

9. From the crop model, it can be determined that a yield of 1.16 t/ha (and price of Tg 58,000/t) results in zero profit—a minimum production situation. A yield of 1.16 t/ha lies 0.72 standard deviation units from the mean of 1.4 t/ha, and from normal curve tables it can be determined that 23.5 percent of the yield levels would be less that 1.16 tons; therefore, a minimum of 23.5 percent of the wheat land would revert to rangeland (or other crops). Deriving an estimate of the maximum amount of wheat land loss is more difficult and depends substantially upon farmers' response to price incentives. *If* all farmers required 20 percent average profit to manage risk and otherwise provide

sufficient incentives, 50 percent of the wheat land would revert to alternative use. Applying these land loss estimates to the current base of 450,000 ha of wheat land suggests the future wheat area may lie between 225,00 and 345,000 ha. Reality would likely lie between these points as some farmers would be prepared to grow wheat with more than zero but less than 20 percent profit because of a lower risk threshold or because alternative activities would earn less. As wheat production was abandoned on more marginal land, the average yield would increase; thus, estimates of minimum and maximum production falls within a narrower (proportional) range, 370,000 to 525,000 tons. Allowing for harvesting/post-harvesting losses and considering the proportion of poor-quality grain, seed, industrial use, and flour consumption requirements estimated **total harvested wheat** range from 557,500 to 584,000 tons. Therefore, an estimated 30,000 to 90,000 tons of imported flour would be required to meet aggregate wheat/flour needs.

10. Using the assumption that 20 percent profit would be required to provide an adequate production incentive the price required to generate additional production was estimated. Estimates also could be derived for other levels of profit incentive considered appropriate, but would have the same general shape. The resulting supply function is illustrated in the graph below. The elasticity is quite high in the lower portions of the curve, consistent with the fact that large areas of land have gone out of wheat production and could readily be brought back into production if prices increased, however, the curve becomes inelastic as prices increase.

Figure 2: SUPPLY RESPONSE



Instructions for the MONWHEAT spreadsheet model

Overview

The MONWHEAT spreadsheet has been designed to facilitate an understanding of Mongolian wheat production. The worksheet requires Microsoft Excel 5 and will give best results with a fast CPU (486 or Pentium) with a math co-processor, particularly if the sensitivity analysis options are to be used.

The format of the model is that of an annual budget for one hectare of wheat production under normalized, steady-state conditions. The capital expenditure associated with this activity is therefore amortized and included as an annual depreciation and interest charge. The approach is designed to allow financial and social profitability to be investigated and is broadly based on the Policy Analysis Matrix[1].

This approach requires the that prices be estimated on both a private and social basis. Two parallel accounting identities are then constructed and the degree of policy induced divergences can be measured. The model is highly disaggregated so that the policy analyst has a large measure of control over the assumptions made.

To permit a comparative approach it is possible to enter technical coefficients to reflect *current* and *improved* technology and management.

Because wheat production has been concentrated on large state farms the scale of operation has also been large. For this reason it was found easiest to consider the machinery requirements in relation to 1000 ha of wheat production with the associated fallow land. It should be emphasised that it is up to the user to specify the appropriate numbers of each type of machine. Machinery costs are of course lumpy in their nature and the ownership of 2.5 tractors is impossible in the case of an individual farm. This model is based on *average* production data and so fractional numbers of machines are entirely acceptable. The model is not designed to estimate marginal costs in any given situation.

Although the model is designed to test a wide range of assumptions and each of the modules can be changed, there are four main areas that would be altered when testing various assumptions.

These are:

- crop input output data
- general assumptions
- machinery inventory

[1] See Monke, E A and Pearson, S R (1989) *The Policy Analysis Matrix for Agricultural Development*, Ithaca, NY: Cornell University Press

- machinery operations

These modules, along the others that comprise the model, are described in detail in the remainder of this document.

Menu system

Because the worksheet is quite large, a menu system has been added to permit rapid movement from one module to another. The menu is activated by pressing Ctrl-G at any time. The options in the menu are described in detail in this document. There are two sub-menus as part of the menu structure accessing the results tables and the machinery data. The format of these instructions is geared to the menu structure in the worksheet. Please note that ***only items shown in blue should be changed*** in the worksheet. If protection is enabled only these cells can be changed

Modular layout

The modules are laid out in a diagonal manner to facilitate insertion and deletion of rows and columns in one module without affecting any others. The data required for each of these section are described in the relevant sections below.

General assumptions

These are data about the economic environment and the location of the farm. Two exchange rates are required, the ***official exchange rate*** and the ***shadow exchange rate.***

The model also requires data on rates of interest and inflation. The cost of working capital is calculated using a real rather than nominal interest. The real interest rate is worked out from the ***interest rate*** and the ***inflation rate***, which must be supplied. In practice the actual interest payment will be based on the nominal interest rate but theoretically the general level of prices will have risen by the rate of inflation over this period as well. The problem with the usual measure of inflation is that it is based on a retail price index and does not reflect the costs that the farmers are facing. In the year to harvest time 1994 the price of wheat has actually fallen by around 15% whereas inflation was 68%. The cost of working capital is also dependent on the duration of the production period. Credit is assumed to be taken in two tranches for which the user must supply the ***number of days*** and the ***proportion of the total*** in each tranche.

The ***social rate*** of interest is used for the calculation of the interest on working capital in the social costs budget. It is also used for both the private and social interest rate for the calculation of interest on durable capital. This is based on the assumption that in the long-term there would be a convergence between the private and social rates.

Labour costs are also entered in this section. Three categories of labour are used viz. ***management, crop workers*** and ***casual labour.*** For the first two the wage rate is entered as a monthly payment. The casual labour rate is expressed as a daily rate. For all labour classes the user can enter the private and social costs. Private labour costs are based on actual wage rates. Social costs of labour are more difficult to calculate and depend on a number of assumptions and factors beyond the scope of this document.

Provision is also made for a ***land rent*** for both private and social schedules. This is in units of Tg per ha.

The ***farm variables*** are simply a set of ***distances*** which are used to estimate the *farm-gate* prices of inputs and outputs. Remote farms are likely to have a locational disadvantage compared to those nearer to centres of consumption. To this end transfer costs are built in the model. This reflects the current requirement for farms to arrange the transport of inputs to the farm. The transport costs for grain are borne by the mills and so the quoted price is a farm gate price.

Crop input output data

This section contains the physical input output data on both the current and improved wheat models. For each the following data must be provided

The ***area of fallow*** associated with 1 ha of wheat. If recrop wheat is part of the system then this would be 0.5. For alternate wheat:fallow a value of 1 should be entered. The ***harvested yield*** is the grain harvested at the ***moisture content*** specified. The ***moisture content of imported grain*** is required so that the prices of domestic and imported grain can be adjusted to the same moisture content. An estimate of ***post-harvest losses*** is needed to calculate the amount of grain available for sale.

The ***grain quality*** is divided into three classes, Class I, Class II and Sub-standard

These are based on the following criteria:

	Class I	Class II	Animal Feed
Wet Gluten (%)	> 28	18-28	< 18
Screenings (%)	< 2	2-15	> 15
Rubble (%)	< 2	2-5	> 5
Moisture (%)	<= 17	17-19	> 19
1 litre wt (g)	> 740	700-740	< 700

The ***proportion of the saleable yield in each class*** is entered in this module. The wheat price is assumed to be that of class II wheat. A ***premium*** for class I and ***discount*** for sub-standard is also required in this module. This is expressed as a percentage of the class II price to be added or subtracted.

The crop inputs are also entered in this module.

The ***seed rate*** is expressed as kg per ha and the price will be based on the value of class II grain. This reflects the usual practice of using farm-saved seed. If seed is purchased then the ***premium*** can be altered to allow for the higher price.

Three types of ***fertilizer*** are assumed to be used. These are ammonium nitrate, triple superphosphate and potassium chloride. For each the ***application rate*** and the ***percentage active substance*** should be entered.

Similarly, data on the use of agro-chemicals is entered in this module. At present only a herbicide, 2,4-D is used along with a seed treatment. Provision is made for the ***application rates of herbicide*** on both the crop and the fallow land. These are expressed as litres per ha. The ***seed treatment*** is entered as litres per tonne.

Crop insurance is a payment per ha and is required for both private and social values.

There are three types of labour in the model. ***Management*** and ***crop workers*** are assumed to be full-time workers. Because the farms tend to be monoculture in nature it is assumed that the entire costs of the full time staff are charged to the production of wheat. In reality, because of the seasonal highly peaked labour demand, there is spare capacity and it is likely that many farm workers have additional sources of income, through other farming and non-farming activities. These are ignored in this analysis, although this can be incorporated by reducing the amount of labour devoted to the production of wheat. ***Casual labour*** is entered as man-days required per 1000 ha.

Output prices

The ***domestic price for wheat*** is assumed to be class II quality with the moisture content entered in the *crop input-output data* module. Transport costs from the farm to the flour mill are borne by the flour milling company and so the farm-gate price is the same as the domestic price. Rates for ***import duties*** and ***sales tax*** can also be entered.

A number of variables in order to calculate the import parity (social) price for wheat. The starting place is the ***fob price in the port of an exporting country***. This is assumed to be the west coast of the USA. ***Freight and insurance*** from here to Tianjin (in China) are added followed by the ***unloading*** and ***onward shipping costs*** from Tianjin to Ulaanbaatar. Strictly this should be split to reflect the Chinese and Mongolian components of this transfer cost (including the unloading and loading at the border).

Input prices

The input price schedule is the module in which price data for inputs are estimated. Private prices are based on observation of actual prices with an adjustment for the transport element. Normal practice in Mongolia has been for the farms to arrange for the inputs to be collected from the supplier. It is assumed that the supplier is based in Ulaanbaatar and the quoted price is *ex-supplier*. This is the ***domestic price*** which is entered. From this the farm-gate price is estimated by adding a transport cost.

Rates for ***import duties*** and ***sales tax*** are also entered in this module.

The calculation of social prices is made from first principles. Each input in this schedule is assumed to be an imported tradable input. The ***fob price in the exporting country*** is required. This is followed by the ***freight and insurance costs*** necessary to reach the Mongolian border. In the case of items sourced in the CIS this value is difficult to determine and so it has been entered as zero and the fob price is therefore taken as being the border price. Additional costs for ***unloading*** and ***freight and insurance to Ulaanbaatar*** are also entered to estimate the ***c.i.f.*** price in Ulaanbaatar. All of the above are in US$.

A mark-up for the ***importer/distributor*** can be added at the foot of the table. This applies to all inputs except fuel. After adding this element the price for the input in Ulaanbaatar is calculated. The social farm-gate price is estimated by converting this price to Tugrigs at the shadow exchange rate and adding the transport costs from ULN to the farm.

The estimated social price is based on the observed domestic price less transfer payments and adjusted for exchange rate divergences. This can be compared with the social price calculated by the method described above.

The domestic ***electricity price*** is entered below the main table together with a private-to-social ***conversion factor.***

Transport data

The internal transport costs are estimated explicitly given the importance of this element in costing inputs and outputs. The basis of these transport costs is the costs and owning and operating a truck. To this end the data below must be supplied.

For the calculation of private farm-gate prices a standard charge for transportation, in units of Tg per tonne-km, is required.

The estimation of social prices requires a different approach to transfer costs. This is done using the same approach as that used with inputs, to build up a price from first principles.

Because of their widespread use, the transport costs are based on the use of a ZIL truck. The ***capacity*** and ***purchase price*** of this truck are needed. In addition the following must also be supplied:

Servicing & repair cost as % of initial cost, working life (in years), fuel consumption (litres/km), utilisation - proportion of time with load (%), annual distance covered (kms), annual wage for truck driver and a ***required profit margin.*** From these the cost per tonne-km is calculated and this is used in the calculation of farm-gate social prices.

Machinery prices

Each item of machinery requires a unique alpha-numeric code to identify it. A description of the machine is also required. The code is important because it is used as a means of referencing the machine in other modules.

The basic price is the termed the border price, or more accurately the price c.i.f. Mongolia, probably Ulaanbaatar. This is the price in US$ that the importer would pay before any duties. The price paid by the farm is determined by the ***border price***, the ***import duty***, the ***distributor's margin*** and the ***sales tax*** . All of these can be readily altered. The price paid by the farm is calculated using these data and is shown in Tugrigs.

If necessary, additional rows can be inserted to allow more machines to be added. If this is done then the formulas will also need to be copied into the new rows. The diagonal layout of the worksheet means that rows (and columns) can be added to one module without affecting any others.

Other data required for this table are the ***depreciation rate*** which is used along with the ***working life*** to estimate the salvage value of the machine. Depreciation is calculated on a diminishing balance basis for the number of years of life. This is discounted to a present value and subtracted from the purchase cost to estimate the net initial cost of the machine. This value is used in subsequent calculations of ownership costs. The annual ***repair costs*** are expressed as a percentage of the initial purchase price, and do not take into account the annual usage of the machine.

The annual ownership cost of each machine is a combination of capital (depreciation) and interest. This is calculated using the annuity factor method which provides a constant annual payment.

A ***scale factor*** for machinery costs is provided to facilitate sensitivity analysis. The default is 1 which is no scaling. 1.5 would mean a price of machinery 50% higher than the base figures. It is suspected that, despite the quality deficiencies, Russian machinery is undervalued and may well increase in price soon.

Machinery inventory

The machinery inventory is based on the needs for 1000 ha of grain production with the associated fallow land. In practice the machinery complement will be determined by work rates of key tractor-implement combinations and the weather windows available to complete the these tasks. The critical operations are land preparations and sowing and harvest. Prior to 1990 there was significant nominal over-capacity of machinery.

In this section the number of machines per 1000 ha should be entered alongside the relevant code and description. It is entirely up to the user to ensure that the machinery complement is adequate to cover the requirements

Work rates and fuel use

The work rate and fuel use for any operation is determined, in this model, by the machine and power unit. The coefficients for ***work rate*** (ha/hour) and ***fuel consumption*** (litres of diesel per ha) for each implement/tractor combination are entered into this table, which is referenced as a look-up table by another module. The figures are based on standard data from Mongolian State farms.

The amount of labour required is also included in this table. This is usually one man (denoted by 1) but in some cases supplementary labour is required (denoted by 2 for a two man operation and so on).

The machine codes must be consistent with those used elsewhere because of look-up nature of this table.

Machinery operations

The machinery operations module draws upon the work rate and fuel use data to estimate the fuel used in growing 1 ha of wheat and managing the associated fallow. Two separate modules are provided - one for the current wheat and one for the improved system. In each there is provision to enter the crop and fallow operations. For each field operation the following data are entered.

Description and ***timing*** (optional). ***Implement*** and ***power unit*** which are used to reference the fuel use table. The user must ensure that each of the machines is available in the inventory as no cross-checking is built into the worksheet. The ***number of passes*** is used to actually enter an operation into the model. This will usually be 1 but 2 (or 3) can be used to denote multiple passes. Alongside these values are displayed the fuel per ha and hours per 1000 ha.

From this table the total (diesel) fuel usage is estimated. The labour use data and work rate are not used in the budget but are provided for completeness.

Some other data are entered in this module. The ***scale factor for repairs*** is provided to allow for the situation of a farm with a large number of machines which are under-utilised. It is assumed that repair costs are likely to be lower in this case. The ***efficiency loss factor*** is used to increase the fuel use. This is provided to allow for the fact that tractors are not employed in field operations all the time and that actual fuel consumption may be poorer than the standard figures. Entering 20 would increase the fuel used by 20%.

Petrol use is the amount of petrol used per ha. The trucks used for on-farm transport run on petrol rather than diesel and so this figure must be entered separately. Similarly ***electricity use*** should be entered in this section. Strictly, this more closely related to the harvested yield than the area but for convenience it is entered as kW hrs per ha.

Buildings schedule

The buildings schedule requires similar data to that of the machinery price module. In this case there is no salvage value assumed. The data required are the ***initial cost, working life*** and the ***repair costs*** (as a percentage of the new value). Because the model attempts to separate domestic factors of production from those which are imported, a ***coefficient denoting the proportion*** of the building's cost which is represented by domestic costs is also required.

Results section

The results are presented in the format of a profit statement with both private and social prices. Two similar results tables are included: one for the current wheat system and one for improved wheat. In both cases are summary of the physical and monetary data are included. Full explanation of the ratios can be found in the text by Monke & Pearson.

Sensitivity analysis

For both current and improved wheat a simple, two-way sensitivity analysis table is included. This allows the private profit to be calculated over a range of yields and wheat prices. The Excel calculation mode is set to semi-automatic which means that changes in the cells force a recalculation for all cells except tables. Function key F9 must be pressed to ensure that the table displays the correct values following any changes to other cells.

4 way sensitivity analysis

The four way sensitivity analysis calculates the private profitability of improved wheat at different values of four key parameters. These are price, yield, percentage class II quality and a scale factor for the cost of machinery. Because these results cannot be readily displayed in a single table they are written to a separate file with five values on each line, as shown below.

Yield	Price	Class II	Mach cost	Profit
t/ha	Tg/t	%	Scale	Tg/ha

The analysis is implemented by means of a macro which substitutes the values into each of the four cells, recalculates and writes the four values plus the profit to a comma-separated-value ASCII file. When this is finished the file (called SENSDATA.CSV) is loaded into Excel and formatted. The program needs to be able to write to the default working directory during this time.

Because the sheet must be recalculated every iteration, this procedure may take some time to run. It can be interrupted at any time by pressing Ctrl-Break or the Escape key.

GENERAL ASSUMPTIONS

ECONOMIC VARIABLES

Exchange rate	Official	Tg/US$	400	
	Shadow	Tg/US$	400	
Exchange premium			0	
Interest rate - private short term		%	85	
Inflation rate		%	68	
Real rate of interest		%	10	
Social cost of capital		%	8	
(Private interest on long-term capital uses the social cost)				
				%age
Number of days credit required		tranche 1	150	70
		tranche 2	30	30
Labour costs			Private	Social
	Management	Tg/month	12000	12000
	Full time crop workers	Tg/month	10000	10000
	Casual labour (man-days)	Tg/day	400	400
Land	Rent	Tg/ha	0	0

FARM VARIABLES

Distance of farm from processing site	kms	80
Distance of farm from Ulaan Baatar	kms	100
Distance of processing site from Ulaan Baatar	kms	60

Crop input-output data

			Units	Current Wheat	Improved Wheat
Area of fallow associated with 1 ha wheat			ha	1.00	0.75
Harvested yield			t/ha	1.00	1.40
Moisture content of harvested grain			%	19	19
Moisture content of imported grain			%	14	14
Yield at	14 % moisture		t/ha	0.94	1.32
Post harvest losses			%	10	5
Saleable yield			t/ha	0.85	1.25
Grain quality	Price Premia/Discount (%)				
Class I		**15**	Prop (%)	0	5
Class II		**0**	Prop (%)	60	75
Sub-standard		**-50**	Prop (%)	40	20
INPUTS					
	Seed rate		kg/ha	200	150
				Nutrient rate	Nutrient rate
Fertilizer	N = Ammonium Nitrate		kg/ha	0	30
	P = Triple Superphosphate		kg/ha	0	15
	K = Potassium Chloride		kg/ha	0	8
Sprays	2,4-D on crop		litres/ha	0	1
	2,4-D on fallow		litres/ha	0	0.5
	Seed treatment		litres/t	1.5	1.5
	Crop insurance - private		Tg/ha	1600	1600
	Crop insurance - social		Tg/ha	1600	1600
Labour	Management		per 1000 ha	2	1.5
	Full time crop workers		per 1000 ha	20	8
	Casual labour (man-days)		per 1000 ha	200	120

Domestic price adjusted to moisture of imported grain 37,160

Input prices

Item Units	Amm Nitr tonnes	TSP tonnes	KCl tonnes	Diesel tonnes	Petrol tonnes	Sprays litres	Seed Tr litres
Domestic price (Tg) (a)	65,000	65,000	50,000	120,000	140,000	2,000	4,500
Domestic farm-gate price (Tg) (b)	69,000	69,000	54,000	124,000	144,000	2,004	4,504
Import duty (%)	15	15	15	15	15	15	15
Sales tax (%)	10	10	10	10	10	10	10
International prices (US $)							
fob at ..	CIS	CIS	CIS	CIS	CIS	CIS	CIS
Fob price at above	90	110	90	205	250	4	8
Freight & Insurance	0	0	0	0	0	0	0
cif at ..	Irkutsk	Irkutsk	Irkutsk	Irkutsk	Irkutsk	Irkutsk	Irkutsk
Unloading	0	0	0	0	0	0	0
Freight & insurance overland to ULN	10	10	10	10	10	0.2	0.2
Wholesale price at ULN (cif)	100	120	100	215	260	4.20	8.20
Price including distributor's margin (c)	115	138	115	215	260	4.83	9.43
Transport costs							
ULN -> farm	11.2	11.2	11.2	11.2	11.2	0.0	0.0
Farm gate price (social) (Tg) (d)	50,482	59,682	50,482	90,482	108,482	1,936	3,776
Social price estimated (Tg) (e)	46,640	54,545	42,688	98,024	113,834	1,584	3,560
Density (kg/l)				0.84	0.72		
Disributor's margin for inputs	15% not fuel						
price per litre (Tg)				101	101		
Electricity price (Tg/KWhr)	46						
Conv Fact	1.5						

a) The domestic price is based on those observed in Mongolia. For inputs these are the prices quoted by the suppliers

b) Because farms usually have to provide their own transport to collect inputs a transport charge has been added, based on the distance from UL

c) This price (in $) is the Price in Mongolia based on the international price of the item, plus freight etc and a dealers margin.

d) The price in (c) is adjusted for transport costs and converted to Tugrigs at the shadow exchange rate.

e) The estimated social price is based on the observed domestic price less transfer payments and adjusted for exchange rate divergences

Output prices

Item Units	Wheat ton	Flour ton	Flour ton
		economic	financial
Domestic price (Tg) (a)	36,000		
Domestic farm-gate price (Tg) (b)	35,000		
Import duty (%)	0		
Sales tax (%)	0		
International prices (US $)			
fob at ..	WC-USA	Ex-Beijing	
Fob price at above	160	237.66	237.65
Freight & Insurance	27		
cif at ..	Tianjin		
Unloading	3		
Customs tariff @ 15%			273.30
Freight & insurance overland to ULN	90	37.40	37.40
Wholesale price at ULN (cif)	270	275.05	310.70
Raw Material Cost @ 80%		220.04	248.56
Milling Rate 73%		160.63	181.45
Bran value (20% at $25/t)		5.00	5.00
Transport costs			
Farm -> mill	9.0	11.21	11.21
Mill -> ULN	6.7		
Farmgate price (social) (Tg) (d)	101,725	61,769	70,097
Farmgate border price adjusted to 19% moisture*	95,811	58,178	66,021

Machinery prices

Source of data: MoA standard publication on Machinery norms

WORLD PRICES as at Oct 94

Import duty (%)	15	
Sales tax (%)	10	
Distributor's margin (%)	25	
Conversion factor	0.79	Private-> social by removing taxes, duties
Scaling factor for imported machinery	1	1=price in list, 2=double etc.

Machinery Inventory

Machine code	Description	Border price ($) current	Border price ($) scaled	Farm price ($)	Mean depn rate % per annum	Working life (years)	Repairs % new Value
CK-5	combine	16,000	16,000	25,300	20	7	10
DT-75	100hp crawler tractor	11,400	11,400	18,026	20	8	14
MTZ-50	55 hp wheeled tractor	6,000	6,000	9,488	20	8	16
MTZ-80	80 hp wheeled tractor	8,000	8,000	12,650	20	8	16
T-150	150hp 4wd wheeled tractor	22,000	22,000	34,788	20	8	16
K-700	250hp 4wd wheeled tractor	38,000	38,000	60,088	20	8	16
UMZ-6	tractor	7,000	7,000	11,069	20	8	16
ZIL-130	truck	10,000	10,000	15,813	15	10	10
BIG-3	diamond harrow	1,250	1,250	1,977	12	7	6
KPS3.8	cultivator - deep tillage	1,600	1,600	2,530	12	7	6
KPS-5	cultivator	1,500	1,500	2,372	12	7	6
LDG-15	one way disk	3,000	3,000	4,744	12	7	6
BNR-3	rotary harrow	1,300	1,300	2,056	12	7	6
OVT-1A	sprayer	2,800	2,800	4,428	18	6	8
VNB-3	straw loader	1,200	1,200	1,898	12	7	7
2PTS-4	trailer	2,000	2,000	3,163	12	7	5
CBY-2.6	snow sweeper	1,000	1,000	1,581	12	7	5
SZP-3.6	drill	2,100	2,100	3,321	15	7	9
CZC-2.1	drill (combine)	2,500	2,500	3,953	15	7	9
PSB-1.6	baler	2,000	2,000	3,163	18	6	9
ZKK-6A	roller	1,700	1,700	2,688	12	7	6
OVS-25	cleaner	4,500	4,500	7,116	12	7	9
ZPS-100	loader	3,000	3,000	4,744	12	7	9
CM-4	gravity separator	3,500	3,500	5,534	12	7	9
RW-1	rod weeder (10.9m)	10,500	10,500	16,603	8	15	2.5
MDC-1	medium duty cultivator (10.3)	17,500	17,500	27,672	8	15	6
HDH-1	harrow drawbar + harrows	7,100	7,100	11,227	6	17	2.7
CODE	--new machine--		0	0	12	7	9
CODE	--new machine--		0	0	12	7	9
CODE	--new machine--		0	0	12	7	9
CODE	--new machine--		0	0	12	7	9
BOG	caravan	3,000	3,000	4,744	12	10	3

Calculated Machinery Costs - Annual Capital Charge and Repairs

Machine code	Description	Salvage Value ($)	PV of Salvage ($)	Net Initial Cost ($)	Capital Recovery Factor	Annual Capital Charge ($)	Repair Cost $/year	Average Ann depn
CK-5	combine	5,306	3,096	22,204	0.192	4,265	2,530	3,172
DT-75	100hp crawler tractor	3,024	1,634	16,392	0.174	2,853	2,524	2,049
MTZ-50	55 hp wheeled tractor	1,592	860	8,628	0.174	1,501	1,518	1,078
MTZ-80	80 hp wheeled tractor	2,122	1,147	11,503	0.174	2,002	2,024	1,438
T-150	150hp 4wd wheeled tractor	5,836	3,153	31,634	0.174	5,505	5,566	3,954
K-700	250hp 4wd wheeled tractor	10,081	5,446	54,641	0.174	9,508	9,614	6,830
UMZ-6	tractor	1,857	1,003	10,065	0.174	1,752	1,771	1,258
ZIL-130	truck	3,113	1,442	14,371	0.149	2,142	1,581	1,437
BIG-3	diamond harrow	808	471	1,505	0.192	289	119	215
KPS3.8	cultivator - deep tillage	1,034	603	1,927	0.192	370	152	275
KPS-5	cultivator	969	566	1,806	0.192	347	142	258
LDG-15	one way disk	1,939	1,131	3,613	0.192	694	285	516
BNR-3	rotary harrow	840	490	1,565	0.192	301	123	224
OVT-1A	sprayer	1,346	848	3,579	0.216	774	354	597
VNB-3	straw loader	775	452	1,445	0.192	278	133	206
2PTS-4	trailer	1,292	754	2,408	0.192	463	158	344
CBY-2.6	snow sweeper	646	377	1,204	0.192	231	79	172
SZP-3.6	drill	1,065	621	2,699	0.192	518	299	386
CZC-2.1	drill (combine)	1,267	739	3,214	0.192	617	356	459
PSB-1.6	baler	961	606	2,557	0.216	553	285	426
ZKK-6A	roller	1,099	641	2,047	0.192	393	161	292
OVS-25	cleaner	2,908	1,697	5,419	0.192	1,041	640	774
ZPS-100	loader	1,939	1,131	3,613	0.192	694	427	516
CM-4	gravity separator	2,262	1,320	4,215	0.192	810	498	602
RW-1	rod weeder (10.9m)	4,753	1,498	15,105	0.117	1,765	415	1,007
MDC-1	medium duty cultivator (10.3)	7,922	2,497	25,174	0.117	2,941	1,660	1,678
HDH-1	harrow drawbar + harrows	3,921	1,060	10,167	0.110	1,115	303	598
CODE	--new machine--	0	0	0	0.192	0	0	0
CODE	--new machine--	0	0	0	0.192	0	0	0
CODE	--new machine--	0	0	0	0.192	0	0	0
CODE	--new machine--	0	0	0	0.192	0	0	0
BOG	caravan	1,321	612	4,132	0.149	616	142	413

Capital Recovery Factor is based on an interest rate of 8 %

Machinery inventory

Machine code	Description	Number per 1000 ha: Current Wheat	Number per 1000 ha: Improved Wheat	Annual Capital Cost ($)*: Current Wheat	Annual Capital Cost ($)*: Improved Wheat	Annual repair cost ($): Current Wheat	Annual repair cost ($): Improved Wheat	Annual depreciation ($): Current Wheat	Annual depreciation ($): Improved Wheat
CK-5	combine	2.8	2.5	11,941	10,662	4,480	4,000	8,882	7,930
DT-75	100hp crawler tractor	1.3	1.5	3,708	4,279	2,075	2,394	2,664	3,074
MTZ-50	55 hp wheeled tractor	1.8	1.8	2,702	2,702	1,728	1,728	1,941	1,941
MTZ-80	80 hp wheeled tractor	1.0	1.1	2,002	2,202	1,280	1,408	1,438	1,582
T-150	150hp 4wd wheeled tractor	1.0	1.0	5,505	5,505	3,520	3,520	3,954	3,954
K-700	250hp 4wd wheeled tractor			0	0	0	0	0	0
UMZ-6	tractor			0	0	0	0	0	0
ZIL-130	truck	1.2	1.0	2,570	2,142	1,200	1,000	1,724	1,437
BIG-3	diamond harrow	3.0	3.0	867	867	225	225	645	645
KPS3.8	cultivator - deep tillage			0	0	0	0	0	0
KPS-5	cultivator	3.0	3.0	1,041	1,041	270	270	774	774
LDG-15	one way disk			0	0	0	0	0	0
BNR-3	rotary harrow			0	0	0	0	0	0
OVT-1A	sprayer	1.0	1.0	774	774	224	224	597	597
VNB-3	straw loader	2.5		694	0	210	0	516	0
2PTS-4	trailer	1.5	1.5	694	694	150	150	516	516
CBY-2.6	snow sweeper	1.0		231	0	50	0	172	0
SZP-3.6	drill			0	0	0	0	0	0
CZC-2.1	drill (combine)	3.0	2.5	1,852	1,543	675	563	1,377	1,148
PSB-1.6	baler	1.0		553	0	180	0	426	0
ZKK-6A	roller	2.0	2.0	786	786	204	204	585	585
OVS-25	cleaner	2.0	2.0	2,082	2,082	810	810	1,548	1,548
ZPS-100	loader	3.0	3.0	2,082	2,082	810	810	1,548	1,548
CM-4	gravity separator			0	0	0	0	0	0
RW-1	rod weeder (10.9m)		1.0	0	1,765	0	263	0	1,007
MDC-1	medium duty cultivator (10.3)		1.0	0	2,941	0	1,050	0	1,678
HDH-1	harrow drawbar + harrows		1.0	0	1,115	0	192	0	598
CODE	--new machine--			0	0	0	0	0	0
CODE	--new machine--			0	0	0	0	0	0
CODE	--new machine--			0	0	0	0	0	0
CODE	--new machine--			0	0	0	0	0	0
BOG	caravan	1.0	1.0	616	616	90	90	413	413
				40,700	43,797	18,181	18,900	29,721	30,975
Per 1 ha of crop				40.70	43.80	18.18	18.90	29.72	30.98

*Depreciation and interest

Machinery work rates and fuel consumption

Implement Code	Power Unit ->	Work rate (ha/hr) DT-75	T-150	MTZ-50	MTZ-80	CK-5	Fuel cons (litres/ha) DT-75	T-150	MTZ-50	MTZ-80	CK-5	Supplementary Labour DT-75	T-150	MTZ-50	MTZ-80	CK-5
CK-5	Combine (windrowing)					1.9					5.2					1
NIVA	Combine (threshing)					2.1					7.5					1
BIG-3	Harrow	5.0	8.6	3.3			2.1	2.5				1.0	1.0			
KPS-5	Cultivator	2.1	4.2				6.0	5.4				1.0	1.0			
KPS-3.8	Cultivator-deep tillage	2.1					4.8					1.0				
LDG-15	One way disk	4.4	8.6				2.9	2.6				1.0	1.0			
BNR-3	Rotary harrow	5.8					2.1									
OVT-1A	Sprayer			6.5	6.5				0.9	1.1				2.0		
VNB-3	Straw loader			3.2					1.3					2.0		
2PTS-4	Trailer								0.8					1.0		
CBY-2.6	Snow sweeper	5.1	5.9				2.5					1.0				
CZC-2.1	Drill (combine)	2.2	2.5				5.2	6.9				2.0	2.0			
PSB-1.6	Baler			1.8					3.5					2.0		
RW-1	Rod weeder		6.5					2.8					1.0			
MDC-1	MD cultivating		6.1					2.6					1.0			
HDH-1	Harrow drawbar	7.2	7.2				2.3					1.0				
ZKK-6A	Roller			6.2	6.2				2.0	2.1				1.0		

Use same codes as for machinery inventory

Enter 1 if one man job (ie driver only)
Enter 2 if assistant required full-time

Current Wheat machinery operations

Machinery Operations (Implement and power unit codes should match those in the machinery tables above)

Wheat growing	Timing	Implement	Power unit	No of passes	Fuel/ha	Hrs/1000 ha	Supp hrs	Days/ha	Days reqd
Snow sweeping	**Feb**	**CBY-2.6**	**DT-75**		0.0	0	0	0	0.0
Harrowing	**Apr**	**BIG-3**	**DT-75**	**1**	2.1	200	0	25	19.2
Cultivation - first	**May**	**KPS-5**	**DT-75**	**1**	6.0	476	0	60	45.8
Cultivation - second	**May**	**KPS-5**	**T-150**	**1**	5.4	238	0	30	#DIV/0!
Rolling	**May**	**ZKK-6A**	**MTZ-50**	**1**	2.0	161	0	20	11.2
Sowing	**May**	**CZC-2.1**	**DT-75**	**1**	5.2	455	455	57	43.7
Spraying	**Jun**	**OVT-1A**	**MTZ-50**		0.0	0	0	0	0.0
Windrowing	**Sep**	**CK-5**	**CK-5**	**1**	5.2	526	0	66	23.5
Threshing	**Sep**	**NIVA**	**CK-5**	**1**	7.5	476	0	60	21.3
Baling	**Oct**	**PSB-1.6**	**MTZ-50**		0.0	0	0	0	0.0
Bale loading	**Oct**	**VNB-3**	**MTZ-50**		0.0	0	0	0	0.0
Total					33.4	2533	455	317	165

Fallow management	Timing	Implement	Power unit	No of passes	Fuel/ha	Hrs/1000 ha	Supp hrs	Days/ha	Days reqd
Cultivation	**Jun**	**KPS-5**	**DT-75**		0.0	0	0	0	0.0
Spraying	**Jun**	**OVT-1A**	**MTZ-50**		0.0	0	0	0	0.0
Cultivation	**Jul**	**KPS-5**	**DT-75**		0.0	0	0	0	0.0
Cultivation	**Jul**	**KPS-5**	**DT-75**		0.0	0	0	0	0.0
Harrowing	**Aug**	**BIG-3**	**DT-75**		0.0	0	0	0	0.0
Total					0.0	0	0	0	0

Scale factor for repairs	**-25** %	use this to reduce repair costs which are based on a percentage of the new price. Should be used when usage of machines is low
Efficiency loss factor	**0** %	
Petrol use (ON FARM)	**6** litres per ha	
Electricity use	**12** KWHrs per tonne of grain	

Diesel fuel required (litres)

Wheat growing (1 ha)	33.4
Fallow management (1 ha)	0.0

Improved wheat machinery operations

Machinery Operations (Implement and power unit codes should match those in the machinery tables above)

Wheat growing	Timing	Implement	Power unit	No of passes	Fuel/ha	Hrs/1000 ha	Supp hrs	Days/ha	Days reqd
Snow sweeping	Feb	CBY-2.6	DT-75		0.0	0	0	0	0.0
Harrowing	Apr	BIG-3	DT-75	1	2.1	200	0	25	19.2
Cultivation - first	May	KPS-5	DT-75	1	6.0	476	0	60	45.8
Cultivation - second	May	KPS-5	T-150	1	5.4	238	0	30	#DIV/0!
Rolling	May	ZKK-6A	MTZ-50	1	2.0	161	0	20	11.2
Sowing	May	CZC-2.1	DT-75	1	5.2	455	455	57	43.7
Spraying	Jun	OVT-1A	MTZ-50		0.0	0	0	0	0.0
Windrowing	Sep	CK-5	CK-5	1	5.2	526	0	66	23.5
Threshing	Sep	NIVA	CK-5	1	7.5	476	0	60	21.3
Baling	Oct	PSB-1.6	MTZ-50		0.0	0	0	0	0.0
Bale loading	Oct	VNB-3	MTZ-50		0.0	0	0	0	0.0
--new operation-	month	imp	power		#N/A	#N/A	#N/A	#N/A	#N/A
--new operation-	month	imp	power		#N/A	#N/A	#N/A	#N/A	#N/A
--new operation-	month	imp	power		#N/A	#N/A	#N/A	#N/A	#N/A
--new operation-	month	imp	power		#N/A	#N/A	#N/A	#N/A	#N/A
Total					33	2533	455	317	165

Fallow management	Timing	Implement	Power unit	No of passes	Fuel/ha	Hrs/1000 ha	Supp hrs	Days/ha	Days reqd
Cultivation	Jun	LDG-15	DT-75	1	2.9	227	0	28	21.9
Spraying	Jun	OVT-1A	MTZ-50		0.0	0	0	0	0.0
Cultivation	Jul	KPS-5	DT-75		0.0	0	0	0	0.0
Harrowing	Aug	BIG-3	DT-75		0.0	0	0	0	0.0
Rod weeder	July	RW-1	T-150	1	2.5	154	0	19	#DIV/0!
Cultivation		MDC-1	T-150	1	2.6	164	0	20	#DIV/0!
Harrowing		HDH-1	DT-75		0.0	0	0	0	0.0
--new operation-		imp	power		#N/A	#N/A	#N/A	#N/A	#N/A
Total					8	545	0	68	22

Scale factor for repairs	-20 %	use this to reduce repair costs which are based on a percentage of the new price. Should be used when usage of machines is low
Efficiency loss factor	0	
Petrol use (ON FARM)	6 litres per ha	
Electricity use	12 KWHrs per tonne of grain	

Diesel fuel required (litres)

Wheat growing (1 ha)	33.4
Fallow management (1 ha)	8.0

Buildings

Description	Intial Cost ($)	Working life (years)	Repair % new Value	roportio Domesti	Capital Recovery Factor	Annual Capital Cost ($)	Repair Cost $/year	Ave Dep	Domestic Deprec
Grain storage for 200 tonnes	**14000**	**20**	**2**	**0.7**	0.102	1426	280	700	490
Machinery garaging	**20000**	**20**	**2**	**0.7**	0.102	2037	400	1000	700
Total						3463	680	1700	1190
Total for 1 ha						3.46	0.68	1.70	1.19
Import duty on buildings materials	**15**	**%**	rate						

Summary of machinery and buildings costs

Farm Machinery

		Current wheat		Improved wheat	
		Private	*Social*	*Private*	*Social*
Machinery ACC (Tg/ha)	DEPRECIATION	11888	9398	12390	9795
	INTEREST	4392	3472	5129	4451
Buildings ACC (Tg/ha)	IMPORTED DEPN	235	204	235	204
	DOMESTIC DEPN	547	476	547	476
	INTEREST	1358	1181	1358	1181
Repair costs (Tg/ha)		5658	4473	5874	4643

TRANSPORT COSTS

Five tonne Russian truck	
Domestic haulage charge (Tg per t per km)	40
Truck capacity (tonnes)	5
Initial cost of truck ($)	16000
Scale factor for truck cost	1
Servicing & Repair cost as % of initial cost	10
Life (years)	10
Fuel consumption (litres/km)	0.37
Utilisation - proportion of time with load (%)	80
Annual distance covered (kms)	20000
Annual cost ($)	2384
Summary of non-domestic costs (US cents per tonne per km)	
Amortization	2.38
Repairs	1.60
Fuel	1.39
Total	5.37

Non-domestic costs (Tg/tonne-km)	21
Annual wage for driver (Tg)	180,000
Labour cost per km (Tg)	9
Truck company profit (% of turnover)	15%
Cost per tonne-km (Tg) at 100% loading	36
Cost per tonne-km (Tg) at reduced loading	45

Current Wheat results

					Private		Social	
OUTPUT			units	units/ha	Tg/unit	Tg/ha	Tg/unit	Tg/ha
	Saleable yield (@14%mc)		t	0.85				
Grain	Class I		t	0.00	42,735	0	66,904	0
	Class II		t	0.51	37,160	18,900	58,178	29,589
	Sub-standard		t	0.34	18,580	6,300	29,089	9,863
Straw			t					
Total						25,200		39,453
TRADED INPUTS			units	units/ha	Tg/unit	Tg/ha	Tg/unit	Tg/ha
	Seed		kg	200	37	7,432	58	11,636
	Fertiliser	Amm N	kg	0	59	0	50	0
		SP	kg	0	69	0	60	0
		KCl	kg	0	54	0	50	0
	Diesel		litres	33	104	3,479	76	2,539
	Petrol		litres	6	104	622	78	469
	Electricity		KWhr	12	46	552	69	828
	Sprays		litres	0.0	2,004	0	1,936	0
	Seed treatment		litres	0.3	4,504	1,351	3,776	1,133
	Repairs		Tg			5,658		4,473
DEPRECIATION			units	units/ha				
	Machinery		Tg			11,888		9,398
	Buildings		Tg			235		204
Total traded						31,218		30,679
Value Added						-6,018		8,774
DOMESTIC FACTORS			units	units/ha	Tg/unit	Tg/ha	Tg/unit	Tg/ha
	Crop insurance		Tg			1,600		1,600
Labour								
	Managers		man-months	0.024	12,000	288	12,000	288
	Full-time workers		man-months	0.240	10,000	2,400	10,000	2,400
	Seed dressing		man-days	0.200	400	80	400	80
Depreciation								
	Buildings		Tg			547		476
Capital								
	Interest on working capital					603		527
	Interest on durable capital					5,750		4,653
Land	Rent					0		0
Profit						-17,287		-1,250

Improved Wheat Results

					Private		Social	
OUTPUT			units	units/ha	Tg/unit	Tg/ha	Tg/unit	Tg/ha
	Saleable yield (@14%mc)		t	1.25				
Grain	Class I		t	0.06	75,925	4,755	66,904	4,190
	Class II		t	0.94	66,021	62,027	58,178	54,658
	Sub-standard		t	0.25	33,011	8,270	29,089	7,288
Straw			t					
Total						75,053		66,136
TRADED INPUTS			units	units/ha	Tg/unit	Tg/ha	Tg/unit	Tg/ha
	Seed		kg	150	66	9,903	58	8,727
	Fertiliser	Amm N	kg	88	59	5,206	50	4,454
		SP	kg	32	69	2,202	60	1,905
		KCl	kg	13	54	720	50	673
	Diesel		litres	33	104	3,479	76	2,539
	Petrol		litres	6	104	622	78	469
	Electricity		KWhr	17	46	773	69	1,159
	Sprays		litres	1.4	2,004	2,756	1,936	2,663
	Seed treatment		litres	0.2	4,504	1,013	3,776	850
	Repairs		Tg			5,658		4,473
DEPRECIATION			units	units/ha				
	Machinery		Tg			12,390		9,795
	Buildings		Tg			235		204
Total traded						44,957		37,909
Value Added						30,096		28,227
DOMESTIC FACTORS			units	units/ha	Tg/unit	Tg/ha	Tg/unit	Tg/ha
	Crop insurance		Tg			1,600		1,600
Labour								
	Managers		man-month	0.018	12,000	216	12,000	216
	Full-time workers		man-month	0.096	10,000	960	10,000	960
	Seed dressing		man-days	0.120	400	48	400	48
Depreciation								
	Buildings		Tg			547		476
Capital								
	Interest on working capital					1,022		697
	Interest on durable capital					6,487		5,632
Land	Rent					0		0
Profit						19,216		18,598

Economic Border Price Computations

Border prices can be computed on the basis of either international procurement of wheat or flour procurement from China. The two bases yield substantially different results.

October 1994 international wheat prices (f.o.b. basis) were about US$105 per ton. However, the physical process of transporting wheat from international ports into Mongolia is complex and costly. If Mongolia imported 50 percent of its wheat requirement, 200,000 tons, the limited domestic storage and handling capacity dictates that deliveries would require throughout the year scheduling. Such a relatively small volume may incur a price surcharge above international price quotations thereby increasing the base cost. Bi-monthly or quarterly scheduling would require 40,000 - 50,000 ton shipments depriving Mongolia of preferred shipment rates available on 80,000 - 100,000 ton unit shipments. Furthermore, Mongolia's inability to handle bulk grain would require either, (a) shipment in bags and/or containers, or (b) bagging at the Asian entry port (Vladivostok, Russia or Tianjin, China) - either option would involve substantial incremental costs. Additionally, trans-China rail charges are discriminatory, with high rates applying to commodities of non-Chinese shippers (the Russian route is less costly, but is longer and considered less secure). Recent, Tianjin - UlaanBaatar rail shipments have incurred all-inclusive costs of US$90 per ton. The net cost of wheat delivered to UlaanBaatar would be about US$285 per ton. Even if Mongolia could "piggyback" its requirements on Chinese orders (China's c.i.f. costs of wheat is about US$150 per ton) would still be about US$240 per ton. This high cost, coupled with the limited market for flour by-products (bran) suggests that flour, not wheat, should be imported.

Although China is one of the World's largest wheat importers, it is also a minor exporter of wheat flour, primarily to Mongolia and Korea. Even if Mongolia imported 200,000 tons of flour from China, China's milling capacity would not be overburdened. In October 1994, the Beijing Grain Bureau (GB) quoted ex-mill prices for two grades of flour; Grade 1 (the normal export grade) and Standard at Y2,100 and Y1,900 per ton, respectively. Over the past 10 years Mongolia has produced Grade 1 and Grade 2 wheat in a ratio of 60:40; and equating these grades with Chinese Grade 1 (and above) and Standard, respectively a weighted average flour price of Y2020 per ton was derived. Chinese costs for handling and transport would include Y40 per ton for rail car loading and Y40 per ton transport charges from Beijing to the China/Mongolia border and a further US$28 per ton charge for border transfer, Mongolia transport, and off-loading at UlaanBaatar. This would yield a wholesale (c.i.f. UlaanBaatar) price of about US$275 per ton of flour.

Internationally, 80 percent of the cost of producing flour is raw material cost; Applying that statistic to imported Mongolian flour, accepting the 73 percent milling rate of Mongolian flour mills, and allocating US$25 value per ton to bran, the UlaanBaatar wheat border price equivalent would be about $165 per ton. Deducting farm to mill transport costs and adjusting for moisture content would yield a farmgate border price of about US$145.45. The following table contains the border price derivation. (Also, see page 10 of Annnex 2).

Wheat and Flour Border Prices	
Weighted flour price, ex-mill Beijing, Yuan/ton	2020
Rail loading charges	40
Rail transport charges to Mongolian border	40
Total value at Mongolian border	Y 2100
Value in US$ @ Y8.50 = $1.00	247.06
China/Mongolia border transfer, rail transport to UlaanBaatar and off-loading	28.00
Flour border price - UlaanBaatar	$ 275.06
Raw material cost @ 80% of total production cost	220.05
Equivalent cost per ton of wheat at 73% milling rate	160.64
Add bran value at 20% recovery @ $25 per ton	5.00
Value of wheat at mill gate	165.64
Transport cost farmgate to mill gate (100 km @ Tg45/km) = Tg4500 or	11.21*
Farmgate border price of wheat @ 14 percent moisture#	$ 154.43
Farmgate border price of wheat @ 19 percent moisture#	$ 145.45

* cost per km is not precisely Tg45, actual values were computer generated and contain the influence of hidden digits to the right of the decimal.

\# wheat is internationally traded, and milled, at 14 % moisture, but 19 % is the standard moisture content for domestically traded wheat.

The farmgate value of approximately US$145 is equal to Tg58,000, which should be the basis on which Mongolian farmers are paid.

FOUR-DIMENSIONAL WHEAT PROFITABILITY SENSITIVITY ANALYSIS

A four-way sensitivity analysis was undertaken to evaluate the impact of changes in yield, output price, grain quality, and equipment investment cost variables on wheat profitability. The analysis indicates the minimum values of these variables which permits positive profitability and illustrates increasing profitability for an array of alternative values of the variables.

From this array of data a profitability function was estimated by regressing the four variables against profitability. [This implicitly assumes that other costs remain fixed.] The coefficients derived from the regression are highly significant and indicate the impact changes in these variables would have on profitability:

Profit = -124.6 + 57.17 (Yield) + 0.948 (Price) + 0.379 (Quality) - 0.231 (Mach. Cost)
"t" values (201) (117) (51) (138)

$R^2 = .995$ and $s_{y \cdot x_i} = .0437$

where,

where,	Profit	=	Tg1000/ha
	Yield	=	t/ha
	Price	=	Tg1000/ton
	Quality	=	percentage of grade 2 wheat produced
	Mach. Cost	=	Cost index (October 1994 = 100)

Thus, a yield increase of 100 kg/ha would increase profits by Tg5,717; a price increase of Tg1,000/t would increase profits by Tg948/ha; an increase of 10 percentage points in the proportion of grade 2 wheat produced would increase profit by Tg3,790 /ha, and a 10 percent increase in the cost of machinery would reduce profit by Tg2,310/ha.

Profitability Sensitivity to Prices, Yield, Quality, and Investment Costs

Profit	Yield	Price	Class 2	Mach Cos
Tg/ha	t/ha	Tg/t	%	Scale
25	1.1	58000	75	1
129	1.3	58000	80	1.5
252	1.3	60000	75	1.5
357	1.2	66000	75	1.5
410	1.2	62000	85	1.5
441	1.2	64000	80	1.5
470	0.9	70000	85	1
511	1.1	66000	75	1.25
614	1.1	62000	85	1.25
614	1.1	64000	80	1.25
664	1	66000	75	1
788	1	64000	80	1
817	1	62000	85	1
835	1.2	58000	80	1.25
922	1.2	60000	75	1.25
994	1	70000	85	1.25
1518	1.1	70000	85	1.5
1540	1.1	58000	80	1
1593	1.1	60000	75	1
1920	1.3	58000	85	1.5
2059	1	68000	75	1
2079	1.1	68000	75	1.25
2098	1.2	68000	75	1.5
2104	1.3	60000	80	1.5
2165	1.3	62000	75	1.5
2231	1	66000	80	1
2235	1.1	66000	80	1.25
2238	1.2	66000	80	1.5
2265	1.2	64000	85	1.5
2286	1.1	64000	85	1.25
2308	1	64000	85	1
2488	1.2	58000	85	1.25
2632	1.2	60000	80	1.25
2663	1.2	62000	75	1.25
3055	1.1	58000	85	1
3160	1.1	60000	80	1
3161	1.1	62000	75	1
3282	1.4	58000	75	1.5
3455	1	70000	75	1
3647	1.1	70000	75	1.25
3674	1	68000	80	1
3799	1	66000	85	1
3838	1.2	70000	75	1.5
3855	1.1	68000	80	1.25
3957	1.3	60000	85	1.5

Profitability Sensitivity to Prices, Yield, Quality, and Investment Costs

Profit	Yield	Price	Class 2	Mach Cos
Tg/ha	t/ha	Tg/t	%	Scale
3959	1.1	66000	85	1.25
4036	1.2	68000	80	1.5
4077	1.3	64000	75	1.5
4079	1.3	62000	80	1.5
4119	1.2	66000	85	1.5
4125	1.3	58000	75	1.25
4342	1.2	60000	85	1.25
4403	1.2	64000	75	1.25
4430	1.2	62000	80	1.25
4728	1.1	60000	85	1
4729	1.1	64000	75	1
4780	1.1	62000	80	1
4968	1.2	58000	75	1
5118	1	70000	80	1
5211	1.4	58000	80	1.5
5289	1	68000	85	1
5367	1.4	60000	75	1.5
5475	1.1	70000	80	1.25
5632	1.1	68000	85	1.25
5833	1.2	70000	80	1.5
5916	1.3	58000	80	1.25
5974	1.2	68000	85	1.5
5990	1.3	66000	75	1.5
5993	1.3	62000	85	1.5
6038	1.3	60000	75	1.25
6053	1.3	64000	80	1.5
6144	1.2	66000	75	1.25
6197	1.2	62000	85	1.25
6227	1.2	64000	80	1.25
6297	1.1	66000	75	1
6400	1.1	62000	85	1
6401	1.1	64000	80	1
6621	1.2	58000	80	1
6708	1.2	60000	75	1
6780	1	70000	85	1
7139	1.4	58000	85	1.5
7304	1.1	70000	85	1.25
7362	1.4	60000	80	1.5
7453	1.4	62000	75	1.5
7706	1.3	58000	85	1.25
7828	1.2	70000	85	1.5
7865	1.1	68000	75	1
7884	1.2	68000	75	1.25
7890	1.3	60000	80	1.25
7903	1.3	68000	75	1.5

Profitability Sensitivity to Prices, Yield, Quality, and Investment Costs

Profit	Yield	Price	Class 2	Mach Cos
Tg/ha	t/ha	Tg/t	%	Scale
7951	1.3	62000	75	1.25
8021	1.1	66000	80	1
8025	1.2	66000	80	1.25
8028	1.3	66000	80	1.5
8029	1.3	64000	85	1.5
8051	1.2	64000	85	1.25
8073	1.1	64000	85	1
8274	1.2	58000	85	1
8418	1.2	60000	80	1
8449	1.2	62000	75	1
9068	1.4	58000	75	1.25
9357	1.4	60000	85	1.5
9433	1.1	70000	75	1
9514	1.4	62000	80	1.5
9538	1.4	64000	75	1.5
9625	1.2	70000	75	1.25
9641	1.1	68000	80	1
9743	1.3	60000	85	1.25
9745	1.1	66000	85	1
9816	1.3	70000	75	1.5
9822	1.2	68000	80	1.25
9864	1.3	64000	75	1.25
9865	1.3	62000	80	1.25
9906	1.2	66000	85	1.25
9911	1.3	58000	75	1
10003	1.3	68000	80	1.5
10066	1.3	66000	85	1.5
10128	1.2	60000	85	1
10189	1.2	64000	75	1
10216	1.2	62000	80	1
10997	1.4	58000	80	1.25
11154	1.4	60000	75	1.25
11262	1.1	70000	80	1
11418	1.1	68000	85	1
11576	1.4	62000	85	1.5
11620	1.2	70000	80	1.25
11623	1.4	66000	75	1.5
11666	1.4	64000	80	1.5
11702	1.3	58000	80	1
11760	1.2	68000	85	1.25
11777	1.3	66000	75	1.25
11779	1.3	62000	85	1.25
11824	1.3	60000	75	1
11840	1.3	64000	80	1.25
11930	1.2	66000	75	1

Profitability Sensitivity to Prices, Yield, Quality, and Investment Costs

Profit	Yield	Price	Class 2	Mach Cos
Tg/ha	t/ha	Tg/t	%	Scale
11978	1.3	70000	80	1.5
11983	1.2	62000	85	1
12013	1.2	64000	80	1
12102	1.3	68000	85	1.5
12925	1.4	58000	85	1.25
13091	1.1	70000	85	1
13149	1.4	60000	80	1.25
13239	1.4	62000	75	1.25
13493	1.3	58000	85	1
13615	1.2	70000	85	1.25
13670	1.2	68000	75	1
13677	1.3	60000	80	1
13690	1.3	68000	75	1.25
13709	1.4	68000	75	1.5
13737	1.3	62000	75	1
13794	1.4	64000	85	1.5
13811	1.2	66000	80	1
13814	1.3	66000	80	1.25
13816	1.3	64000	85	1.25
13818	1.4	66000	80	1.5
13837	1.2	64000	85	1
14139	1.3	70000	85	1.5
14855	1.4	58000	75	1
15144	1.4	60000	85	1.25
15301	1.4	62000	80	1.25
15324	1.4	64000	75	1.25
15411	1.2	70000	75	1
15529	1.3	60000	85	1
15603	1.3	70000	75	1.25
15608	1.2	68000	80	1
15650	1.3	64000	75	1
15651	1.3	62000	80	1
15692	1.2	66000	85	1
15789	1.3	68000	80	1.25
15794	1.4	70000	75	1.5
15852	1.3	66000	85	1.25
15970	1.4	68000	80	1.5
16012	1.4	66000	85	1.5
16783	1.4	58000	80	1
16940	1.4	60000	75	1
17362	1.4	62000	85	1.25
17406	1.2	70000	80	1
17410	1.4	66000	75	1.25
17452	1.4	64000	80	1.25
17546	1.2	68000	85	1

Profitability Sensitivity to Prices, Yield, Quality, and Investment Costs

Profit	Yield	Price	Class 2	Mach Cos
Tg/ha	t/ha	Tg/t	%	Scale
17563	1.3	66000	75	1
17566	1.3	62000	85	1
17626	1.3	64000	80	1
17764	1.3	70000	80	1.25
17889	1.3	68000	85	1.25
18122	1.4	70000	80	1.5
18231	1.4	68000	85	1.5
18712	1.4	58000	85	1
18935	1.4	60000	80	1
19025	1.4	62000	75	1
19401	1.2	70000	85	1
19476	1.3	68000	75	1
19495	1.4	68000	75	1.25
19580	1.4	64000	85	1.25
19601	1.3	66000	80	1
19602	1.3	64000	85	1
19604	1.4	66000	80	1.25
19925	1.3	70000	85	1.25
20449	1.4	70000	85	1.5
20930	1.4	60000	85	1
21087	1.4	62000	80	1
21111	1.4	64000	75	1
21389	1.3	70000	75	1
21575	1.3	68000	80	1
21581	1.4	70000	75	1.25
21639	1.3	66000	85	1
21756	1.4	68000	80	1.25
21799	1.4	66000	85	1.25
23148	1.4	62000	85	1
23196	1.4	66000	75	1
23239	1.4	64000	80	1
23550	1.3	70000	80	1
23675	1.3	68000	85	1
23908	1.4	70000	80	1.25
24017	1.4	68000	85	1.25

Statistical Annex

Statistical Annex

List of Tables

Table A1.1

Crop Area Production and Yield

	Area (1000 ha)						Production (1000 tons)						Yield (quintals)					
	Grain	Wheat	Potato	Veg.	Fodder	Silage	Grain	Wheat	Potato	Veg.	Fodder	Silage	Grain	Wheat	Potato	Veg.	Fodder	Silage
			(1000 ha)						(1000 tons)						(quintals)			
1955	59.0	20.0	1.1	0.7	1.9		47.0	14.0	7.1	2.9	12.8		8.0	7.0	64.5	41.4	67.4	
1960	246.7		2.2	0.8	15.8		227.4	195.4	18.5	6.8	37.4		9.2		84.1	85.0	23.7	
1961	334.0	266.7	2.3	1.0	33.4	8.2	120.6	93.3	16.0	9.2	82.3	18.0	3.6	3.5	69.6	92.0	24.6	22.0
1962	380.1	321.1	2.1	1.3	41.9	9.8	315.7	288.4	22.3	10.0	109.5	25.0	8.3	9.0	106.2	76.9	26.1	25.5
1963	402.6	347.8	2.7	1.4	37.8	10.1	305.1	290.9	19.7	12.9	88.8	3.0	7.6	8.4	73.0	92.1	23.5	3.0
1964	409.0	356.4	2.7	1.5	31.4	8.7	366.6	335.2	24.0	15.7	58.1	39.6	9.0	9.4	88.9	104.7	18.5	45.5
1965	419.9	362.2	2.7	1.3	50.6	5.4	322.0	291.2	24.4	10.6	44.6	12.8	7.7	8.0	90.4	81.5	8.8	23.7
1966	405.5	342.6	2.9	1.3	62.8	4.3	266.5	252.9	20.1	10.4	87.5	8.8	6.6	7.4	69.3	80.0	13.9	20.5
1967	415.9	346.0	3.2	1.4	71.4	4.4	331.3	289.2	19.8	11.2	61.9	9.0	8.0	8.4	61.9	80.0	8.7	20.5
1968	413.2	346.3	3.1	1.4	65.4	2.5	215.7	188.0	25.4	11.3	46.0	9.9	5.2	5.4	81.9	80.7	7.0	39.6
1969	417.7	347.1	2.7	1.5	26.0	1.8	132.1	114.2	14.5	11.2	60.6	5.6	3.2	3.3	53.7	74.7	21.6	31.1
1970	419.6	348.0	2.9	1.4	37.1	2.4	184.8	250.2	20.8	11.7	27.6	6.6	4.4	7.2	71.7	83.6	7.4	27.5
1971	418.6	332.7	3.3	1.5	37.1	4.2	372.9	316.4	18.6	14.2	57.2	17.3	8.9	9.5	56.4	94.7	15.4	41.2
1972	420.3	314.4	2.8	1.6	46.5	1.9	205.0	169.7	10.2	10.9	40.9	10.0	4.9	5.4	36.4	68.1	8.8	52.6
1973	428.2	307.2	3.4	1.7	46.3	8.0	455.4	339.6	35.3	22.4	58.9	56.5	10.6	11.1	103.8	131.8	12.7	70.6
1974	429.4	305.2	4.0	1.9	48.5	9.3	315.8	250.2	22.8	21.2	55.3	80.6	7.4	8.2	57.0	111.6	11.4	86.7
1975	437.1	315.6	4.3	2.0	53.1	10.1	482.5	365.7	40.7	21.2	70.2	95.8	11.0	11.6	94.7	106.0	13.2	94.9
1976	450.1	324.3	4.7	2.0	62.2	11.1	376.3	280.3	36.0	25.1	105.1	70.2	8.4	8.6	76.6	125.5	16.9	63.2
1977	487.6	351.3	5.7	2.0	79.1	13.7	414.4	318.0	44.6	16.8	113.9	43.1	8.5	9.1	78.2	84.0	14.4	31.5
1978	569.9	414.9	6.5	2.3	83.9	13.5	354.9	279.3	48.5	24.6	79.2	49.6	6.2	6.7	74.6	107.0	9.4	36.7
1979	585.5	422.5	7.3	2.4	89.6	10.4	330.7	239.7	72.4	23.5	119.2	67.2	5.6	5.7	99.2	97.9	13.3	64.6
1980	575.6	423.9	7.5	2.4	108.5	10.2	259.1	207.2	37.9	26.3	65.5	39.6	4.5	4.9	50.5	109.6	6.0	38.8
1981	542.4	409.7	4.7	2.5	119.8	14.0	343.8	295.5	40.4	29.1	136.2	114.9	6.3	7.2	86.0	116.4	11.4	82.1
1982	529.1	430.9	7.1	2.8	88.4	14.1	551.3	439.6	75.1	36.1	160.8	146.1	10.4	10.2	105.8	128.9	18.2	103.6
1983	586.5	444.2	9.5	2.8	107.2	14.8	812.8	547.6	97.5	34.3	351.2	354.4	13.9	12.3	102.6	122.5	32.8	239.5
1984	619.6	460.7	9.7	2.9	124.7	14.5	586.2	446.0	112.0	34.2	159.1	195.6	9.5	9.7	115.5	117.9	12.8	134.9
1985	634.6	460.7	9.0	3.0	115.2	18.2	890.2	692.3	106.3	36.7	278.5	313.1	14.0	15.0	118.1	122.3	24.2	172.0
1986	631.5	466.2	9.8	3.5	133.5	21.3	869.6	663.8	123.9	43.8	294.2	248.1	13.8	14.2	126.4	125.1	22.0	116.5
1987	523.0	467.8	11.1	3.6	127.4	27.3	689.7	543.8	138.0	45.7	316.3	276.1	13.2	11.6	124.3	126.9	24.8	101.1
1988	641.0	491.0	11.8	3.6	134.0	27.6	814.4	672.0	97.9	51.2	220.7	290.8	12.7	13.7	83.0	142.2	16.5	105.4
1989	673.9	530.2	11.5	3.7	109.8	28.5	839.0	686.7	148.0	54.9	225.5	288.1	12.4	13.0	128.7	148.4	20.5	101.1
1990	653.9	532.6	11.8	3.3	81.9	26.5	721.5	598.9	129.2	35.4	223.9	273.9	11.0	11.2	109.5	107.3	27.3	103.4
1991	617.5	534.2	9.3	2.3	65.0	15.0	596.2	539.1	95.1	22.4	83.0	116.0	9.7	10.1	102.3	97.4	12.8	77.3
1992	592.8	525.0	8.2	1.9	44.4	14.0	493.8	450.9	76.9	14.6	107.1	84.6	8.3	8.6	93.8	76.8	24.1	60.4
1993	504.2	466.8	8.5	2.9			480.1	448.7	58.4	23.0			9.5	9.6	68.7	79.3		
*1994	390.9	377.7	7.4	2.5			330.8	321.8	55.0	23.0			8.5	8.5	74.3	92.0		

* Preliminary

Source: Ministry of Food and Agriculture

Table A1.2 **Cereal Area Planted by Aimag and Year**

(hectares)

	1987	1988	1989	1990	1991	1992	1993	1994
Arhangai	34,400	37,600	37,000	38,200	34,900	28,800	25,100	21,763
Bayan Ulgiy	800	900	900	700	500	775	780	20
Bayanhongor	200	270	160	30	0	17	700	53
Bulgan	76,800	71,500	72,200	70,800	64,100	62,480	60,700	53,941
Govi Altai	600	600	600	700	800	1,430	1,700	904
Domogovi	0	0	0	0	0	0	0	0
Domod	36,400	38,300	40,000	40,900	38,300	33,230	23,600	13,214
Dundgovi	0	0	0	0	0	0	0	0
Dzavhan	23,600	23,000	21,800	26,300	20,400	22,068	12,500	6,284
Ovorhangai	19,100	19,000	20,100	19,900	20,000	18,122	16,200	15,452
Omnogovi	0	0	0	0	0	0	0	0
Sukhbaatar	13,600	13,700	15,100	14,100	13,700	13,660	12,700	11,271
Selenge	165,600	177,100	180,700	172,400	170,000	166,318	167,200	140,994
Tuv	133,200	141,300	161,800	152,400	143,200	137,770	130,700	107,259
Uvs	32,500	32,000	33,700	27,700	29,800	28,374	27,500	23,982
Hovd	3,300	3,300	3,000	2,000	1,300	1,892	1,500	969
Khuvsgul	23,000	22,300	22,700	23,200	20,400	20,578	18,700	15,622
Hentii	38,900	39,700	42,900	41,600	37,700	36,427	28,600	18,486
Darhan City	17,700	20,000	18,100	19,400	18,300	18,261	16,900	16,799
UlaanBaatar City	0	0	0	0	0	0	0	104
Erdenet City	2,500	2,500	2,600	2,700	2,300	1,820	1,700	1,730
Mongolia	622,200	643,070	673,360	653,030	615,700	592,022	546,780	448,848
Index (1990=100)	95	98	103	100	94	91	84	69

Source: Ministry of Food and Agriculture and State Statistical Office

Table A1.3

Cereal Production by Aimag and Year
(thou tons)

	1987	1988	1989	1990	1991	1992	1993
Arhangai	39.7	28.5	46.7	46.3	29.9	18.2	23.7
Bayan Ulgiy	0.7	0.8	0.8	0.5	0.4	0.3	0.2
Bayanhongor	0.1		0.1	0.1			0.1
Bulgan	72.9	88.2	112.4	89.8	80.0	70.6	59.1
Govi Altai	1.0	0.7	0.8	0.8	0.6	0.9	1.5
Dornogovi							
Dornod	15.4	45.2	65.6	35.4	33.5	19.4	13.8
Dundgovi							0.1
Dzavhan	18.2	11.6	6.0	17.3	12.4	6.6	8.4
Ovorhangai	29.9	15.7	25.2	27.0	21.8	13.0	15.3
Omnogovi							
Sukhbaatar	11.6	13.4	17.9	19.5	14.9	8.2	12.6
Selenge	211.3	323.4	199.3	192.0	172.4	155.9	145.2
Tuv	177.7	139.6	206.9	161.3	129.9	145.1	108.9
Uvs	26.7	27.2	36.1	20.2	17.9	6.7	32.0
Hovd	3.7	2.1	3.2	1.6	0.6	0.7	1.0
Khuvsgul	20.1	36.2	35.9	27.7	22.2	15.8	16.8
Hentii	34.4	42.2	57.9	49.6	30.4	10.3	16.6
Darhan City	22.4	35.8	20.3	28.0	26.2	20.3	21.8
UlaanBaatar City					0.3	0.1	0.1
Erdenet City	3.8	3.5	3.8	2.6	2.2	2.1	2.3
Mongolia	689.6	814.1	838.9	719.7	595.2	493.9	479.4
Index (1990=100)	96	113	117	100	83	69	67

Source: Ministry of Food and Agriculture and State Statistical Office

Table A1.4 **Wheat Area Planted by Aimag and Year**

	1987	1988	1989	1990	1991	1992	1993	1994
Arhangai	22,904	22,606	25,636	27,667	28,072	26,274	23,687	21,053
Bayan Olgiy						225	330	3
Bayanhongor							49	49
Bulgan	58,291	58,972	61,397	60,140	56,565	55,928	56,064	51,582
Govi Altai						685	673	594
Dornogovi								
Dornod	25,449	23,559	30,199	34,538	33,119	31,285	23,362	13,214
Dundgovi							50	
Dzavhan	10,072	11,415	10,074	12,327	11,350	11,331	4,530	4,937
Ovorhangai	16,431	16,406	17,430	17,381	18,442	16,895	14,650	14,599
Omnogovi								
Sukhbaatar	2,370	2,500	3,750	6,161	11,534	12,495	12,212	11,271
Selenge	151,448	163,956	170,758	167,192	165,352	164,718	165,754	140,889
Tuv	82,618	91,344	105,108	104,554	106,357	106,847	106,448	95,292
Uvs	29,173	29,387	31,752	26,239	29,422	27,714	26,111	23,528
Hovd	49	40			147	725	801	569
Khuvsgul	17,564	16,791	17,514	17,548	16,405	17,278	16,907	15,622
Hentii	35,276	35,290	37,837	37,627	35,020	34,067	27,865	17,886
Darhan City	15,550	17,511	17,395	19,450	18,312	18,261	16,909	16,799
UlaanBaatar City					250			
Erdenet City	600	661	1,263	2,118	2,257	1,670	1,680	1,650
Mongolia	467,795	490,438	530,113	532,942	532,604	526,398	498,082	429,537
Index (1990=100)	88	92	99	100	100	99	93	81

Sources: Ministry of Food and Agriculture and State Statistical Office

Table A1.5 **Wheat Production by Aimag and Year**

(thou tons)

	1987	1988	1989	1990	1991	1992	1993
Arhangai	25.84	18.70	31.40	34.80	25.60	17.06	23.44
Bayan Olgiy						0.06	0.22
Bayanhongor							0.00
Bulgan	59.40	76.80	95.70	78.00	71.60	65.59	54.78
Govi Altai						0.25	0.52
Domogovi							
Dornod	9.10	29.40	53.40	29.50	30.40	18.92	13.76
Dundgovi							0.04
Dzavhan	8.30	11.80	3.80	3.10	6.60	2.85	2.95
Ovorhangai	26.30	13.40	20.90	23.80	20.60	11.70	13.99
Omnogovi							
Sukhbaatar	2.40	2.70	5.10	8.60	12.60	7.78	17.53
Selenge	199.60	304.40	190.00	187.70	171.30	155.38	145.24
Tuv	120.60	96.90	148.90	115.90	105.60	120.56	95.17
Uvs	24.40	24.80	33.90	19.40	17.70	6.41	31.54
Hovd	0.14				0.10	0.42	0.52
Khuvsgul	15.90	29.40	28.80	22.10	18.70	13.64	15.44
Hentii	30.70	36.80	52.50	45.70	29.20	10.16	15.26
Darhan City	19.30	32.10	19.60	27.60	26.20	20.23	22.03
UlaanBaatar City					0.15	0.10	
Erdenet City	1.10	1.30	2.50	2.30	2.20	2.02	2.29
Mongolia	543.08	678.50	686.50	598.50	538.55	453.13	454.72
Index (1990=10	91	113	115	100	90	76	76

Source: Ministry of Food and Agriculture and State Statistical Office

Table A1.6 **Wheat Yield by Aimag and Year**

(ton/ha)

	1987	1988	1989	1990	1991	1992	1993
Arhangai	1.13	0.83	1.22	1.26	0.91	0.65	0.99
Bayan Olgiy						0.27	0.68
Bayanhongor							0.04
Bulgan	1.02	1.30	1.56	1.30	1.27	1.17	0.98
Govi Altai						0.36	0.77
Dornogovi							
Dornod	0.36	1.25	1.77	0.85	0.92	0.60	0.59
Dundgovi							0.80
Dzavhan	0.82	1.03	0.38	0.25	0.58	0.25	0.65
Ovorhangai	1.60	0.82	1.20	1.37	1.12	0.69	0.96
Omnogovi							
Sukhbaatar	1.01	1.08	1.36	1.40	1.09	0.62	1.44
Selenge	1.32	1.86	1.11	1.12	1.04	0.94	0.88
Tuv	1.46	1.06	1.42	1.11	0.99	1.13	0.89
Uvs	0.84	0.84	1.07	0.74	0.60	0.23	1.21
Hovd	2.86				0.68	0.57	0.65
Khuvsgul	0.91	1.75	1.64	1.26	1.14	0.79	0.91
Hentii	0.87	1.04	1.39	1.21	0.83	0.30	0.55
Darhan City	1.24	1.83	1.13	1.42	1.43	1.11	1.30
UlaanBaatar City					0.60		
Erdenet City	1.83	1.97	1.98	1.09	0.97	1.21	1.36
Mongolia	1.16	1.38	1.30	1.12	1.01	0.86	0.91

Table A2.1 **Volume and Quality of Wheat Procured, by Flour Mill**

Mill	Ulaanbaatar				Sukhbaatar				Kharkhorin				Bulgan				Ulaangom			
Quality	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total
1982	0.0	20.3	28.5	48.8	0.2	9.4	22.8	32.4	0.0	3.7	15.5	19.2	0.0	21.3	0.0	21.3	0.0	7.4	10.3	17.7
1983	0.6	57.7	13.5	71.8	0.0	51.5	31.3	82.8	0.0	5.8	20.5	26.3	0.0	21.7	0.0	21.7	0.0	10.5	12.5	23.0
1984	0.0	39.0	15.2	54.3	0.1	14.5	19.6	34.2	0.0	6.8	12.5	19.3	0.0	4.2	7.1	11.3	0.0	1.1	3.3	5.1
1985	0.0	16.3	40.4	57.2	7.0	59.9	12.4	79.3	0.0	3.3	7.2	10.5	0.0	0.0	8.9	8.9	0.2	7.5	11.8	19.5
1986	0.0	66.2	16.7	82.9	0.7	58.2	9.7	69.6	0.0	19.3	3.0	22.3	0.0	13.3	2.5	15.8	1.4	15.7	2.4	19.5
1987	0.0	31.9	15.7	47.6	0.0	15.7	29.1	44.8	0.1	14.2	11.9	26.2	0.0	5.9	9.4	15.3	0.6	8.3	2.0	10.9
1988	0.0	21.6	9.3	31.3	0.2	88.3	5.1	93.6	0.0	16.9	3.2	20.1	0.0	20.0	1.8	21.5	6.5	7.2	0.2	13.9
1989	0.0	88.1	18.5	106.6	0.0	17.3	28.6	45.9	0.0	11.5	22.0	33.5	0.0	0.0	19.1	19.1	1.5	11.3	3.4	16.2
1990	0.0	17.5	17.3	34.8	0.0	21.8	5.6	27.4	0.0	9.4	18.7	28.1	0.0	16.5	0.0	16.5	0.6	5.6	3.9	10.1
1991		52.3	6.1	58.4		23.9	3.1	27.0		20.0	0.2	20.2		19.2	0.3	19.5		7.2	0.3	7.5
1992		47.5	10.0	57.5		37.0	1.5	38.5		14.7	0.5	15.2		17.8	1.2	19.0		2.4		2.4
1993		77.0	8.0	85.0		51.9	2.0	53.9		15.9	0.9	16.8		16.2	2.6	18.8		13.1		13.1

	Dornod				Moron				Onderkhaan				Darhan				TOTAL			
	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total	Flour 1	Flour 2	Feed	Total
1982	0.0	2.5	3.6	6.1	0.0	6.9	7.1	14.0	0.0	0.1	2.5	2.6	0.1	1.5	38.8	43.4	0.3	73.1	129.1	205.5
1983					0.0	1.3	13.6	14.9	0.0	0.0	5.8	5.8	2.2	84.1	22.2	108.5	2.8	232.6	119.4	354.8
1984	0.0	0.5	5.7	6.1	0.0	0.7	0.0	0.7	0.0	9.1	3.2	12.5	0.3	25.8	14.0	41.0	0.4	101.7	80.6	184.5
1985	0.0	0.9	5.2	6.1	0.0	5.9	5.6	11.6	0.0	6.3	22.4	28.7	0.0	56.2	40.2	96.4	7.2	156.3	154.1	318.2
1986	0.0	2.1	2.5	4.6	2.1	13.1	2.0	17.2	0.0	12.8	6.7	19.5	0.1	65.7	53.2	119.0	4.3	267.4	98.7	370.4
1987	0.0	1.5	0.0	1.5	0.3	4.3	1.5	6.1	0.0	4.6	10.4	15.0	0.0	14.2	59.4	73.6	1.0	100.6	139.4	241.0
1988	0.0	7.7	2.9	10.6	4.9	3.8	2.0	10.7	0.0	18.0	0.6	18.6	2.0	73.3	31.8	107.1	13.6	257.0	56.9	327.4
1989	0.0	15.4	18.7	34.1	0.3	7.0	3.2	10.5	0.0	10.0	8.8	19.4	0.0	37.8	26.2	63.5	1.8	198.4	148.5	348.8
1990	0.0	9.0	5.0	14.0	0.6	12.5	0.6	13.7	0.0	2.7	8.4	11.1	0.1	25.3	16.1	41.5	1.3	120.3	75.6	197.2
1991		12.7	0.6	13.3		8.5	2.8	11.3		18.8		18.8		42.2	7.8	50.0	0.0	204.8	21.2	226.0
1992		5.6	0.7	6.3		8.0	0.5	8.5		6.0		6.0		50.6	3.6	54.2	0.0	189.6	18.0	207.6
1993		5.0	2.0	7.0		9.5	2.0	11.5		12.5	0.7	13.2		41.9	6.0	47.9	0.0	243.0	24.2	267.2

Source: Corporation of Flour and Feed Milling Enterprises, (MOFA for 1991-93)

Table A2.2a **Grain Supplies to Flour and Feed Mills**

Combinant	1986	1987	1988	1989	1990	1991	1992	1993
				(1000 tons)				
Ulaanbaatar	110.8	72.9	47.5	115.1	67.4	58.4	57.5	85.5
Suhbaatar	74.4	57.3	109.4	58.4	50.4	27.5	38.5	53.9
Kharkhorin	28.7	29.2	23.0	35.8	32.6	20.2	15.2	16.8
Bulgan	26.6	24.2	27.0	28.1	25.5	22.6	20.8	21.0
Ulaangom	20.3	11.5	14.5	17.5	8.1	8.5	2.4	13.7
Dornod	6.8	3.0	19.5	38.9	14.4	13.5	6.3	7.0
Moron	26.5	8.5	15.5	14.8	18.2	12.6	8.5	11.7
Ondorkhaan	23.2	17.2	21.6	24.2	22.8	20.0	6.3	22.2
Darhan	135.2	86.0	153.4	79.1	62.8	51.7	54.2	47.9
Barunhaara	28.5	16.7	11.4	14.8	10.3	7.1	8.1	2.0
TOTAL	481.0	326.5	442.8	426.7	312.5	242.1	217.8	281.7

Table A2.2b **Production of Flour by Mill (1989-94)**

	Capacity							
Combinant	Wheat Storage	Flour Productio	1989	1990	1991	1992	1993	1994*
					(thou tons)			
Ulaanbaatar	64.0	42.0	47.5	47.4	45.9	47.2	38.1	18.7
Suhbaatar	82.0	41.0	42.5	32.6	30.8	34.6	24.4	13.8
Kharkhorin	12.0	16.0	14.1	13.5	16.2	15.0	8.2	4.2
Bulgan	38.7	11.5	10.8	11.0	11.6	12.4	10.4	4.0
Ulaangom	4.0	9.0	10.2	10.2	10.1	9.9	6.6	3.5
Dornod	7.0	9.0	8.4	9.2	9.3	10.1	7.0	5.2
Moron	6.5	9.0	10.2	10.5	10.5	11.6	6.6	3.4
Ondorkhaan	4.0	9.0	8.2	9.1	10.0	11.8	6.0	5.6
Darhan	82.0	54.0	48.0	43.7	30.2	29.3	24.1	13.4
TOTAL	300.2	200.5	199.9	187.1	174.5	181.9	131.4	71.8

* thru 9/30

Source: State Statistical Office of Mongolia, MOFA for 1993 & 1994

Table A2.3 **Wheat Flour Production and Imports, by month, 1993-94**

1993	Altan Taria U.B.	Selenge	Khar Khorin	Bulgan	Dornod	Hovsgol	Hentii	Ovs	Darhan	TOTAL	IMPORTS	Total Supply	Bread Prod. (t)
						(1000 tons)							
Jan	3.9	2.3	1.3	1.1	1.6	1.0	0.9	0.5	2.2	14.8	3.8	18.6	4435.9
Feb	3.6	0.0	1.4	1.2	1.5	0.9	0.9	0.6	2.1	12.2	3.8	16.0	3258.8
Mar	3.9	4.8	1.0	1.1	0.7	0.9	0.9	0.3	2.9	16.5	5.7	22.2	3543.0
Apr	2.7	2.4	0.8	1.2	0.7	1.4	0.7	0.6	3.5	14.0	2.0	16.0	3999.5
May	4.1	2.2	0.9	1.1	0.8	0.4	0.8	0.7	3.3	14.3	7.0	21.3	5017.1
Jun	4.3	2.2	1.5	1.2	0.5	0.0	0.0	0.0	0.0	9.7	11.7	21.4	2882.8
Jul	4.3	0.0	0.0	0.9	0.0	0.0	0.7	0.0	1.7	7.6	11.8	19.4	4082.1
Aug	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.1	2.2	3.6	8.8	12.4	3785.5
Sep	0.0	3.3	0.0	0.7	0.0	0.8	0.0	0.4	2.5	7.7	0.8	8.5	3886.8
Oct	8.2	3.3	0.1	0.9	0.0	0.8	0.8	0.9	2.5	17.5	7.8	25.3	3715.9
Nov	3.1	2.6	0.4	1.0	0.7	0.7	0.7	1.0	1.1	11.3	13.3	24.6	
Dec	0.0	0.0	0.8	0.0	0.1	0.1	0.2	0.9	0.1	2.2	8.2	10.4	3388.4
Sum	38.1	24.4	8.2	10.4	6.6	7.0	6.6	6.0	24.1	131.4	84.7	216.1	

1994												
						(1000 tons)						
Jan	1.4	1.4	0.0	0.8	0.0	0.0	0.0	0.6	1.8	6.0	0.4	6.4
Feb	2.0	0.0	1.0	0.0	0.0	0.8	0.3	0.0	0.6	4.7	2.8	7.5
Mar	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5	4.0	4.5
Apr	3.0	2.2	0.5	0.2	0.3	0.7	0.4	1.1	0.0	8.4	0.3	8.7
May	2.1	1.8	0.8	0.1	0.9	0.8	0.5	1.0	3.9	11.9	1.7	13.6
Jun	1.6	3.3	0.4	0.8	1.1	0.0	1.1	1.2	1.7	11.2	0.8	12.0
Jul	2.5	1.8	1.5	0.4	0.1	0.7	0.3	0.2	1.7	9.2	0.3	9.5
Aug	0.0	1.2	0.0	0.5	0.6	0.6	0.3	0.8	2.1	6.1	1.2	7.3
Sep	6.1	2.1	0.0	0.7	0.5	1.6	0.5	0.7	1.6	13.8		
Oct												
Nov												
Dec												
Sum-9/30	18.7	13.8	4.2	4	3.5	5.2	3.4	5.6	13.4	71.8	11.5	

Source: Statistical Office of Mongolia

Table A2.4 **External Trade, Selected Commodities**

	1989		1990		1991		1992		1993		1994*	
	volume	value	volume	value	volume	value	volume	value	volume	value	volume	value
Export	(thou t)	(mil $)	(thou t)	(mil $)	(thou t)	(mil $)	(thou t)	(mil $)	(thou t)	(mil $)	(thou t)	(mil $)
Wheat			27.1									
Wheat Flour			5.0		39.0	9.6	1.4	0.2	5.4	0.5	10.7	0.8
Barley							3.3	0.2	6.7	0.6		
Import												
Wheat	2.3						21.0	2.1				
Wheat Flour			27.7				20.3	4.5	92.3	20.5	11.5	1.7
Rice	13.3		19.1		14.7	3.5	4.5				1.4	0.3
Vegetable Oil	2.7		2.1		1.1		0.8	1.0	1.0	0.8	0.4	0.3

* first eight months

Source: State Statistical Office

Table A2.5 **Retail Prices of Selected Commodities (Tg/kg)**

1992	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flour-1st Quality	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	18	18	18
Flour-2nd Quality	2	2	2	2	2	2	2	2	2	14	14	14
Bread (loaf)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	13	13	13
Rice												
1993	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Flour-1st Quality	27	27	50	50	50	50	50	80	86	120	120	110
Flour-2nd Quality	21	21	43	43	43	43	43	70	70	80	90	96
Bread	20	20	36	36	36	36	36	59	59	590	59	59
Rice												
1994	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Flour-1st Quality	112	112	115	110	110	112	112	112	112			
Flour-2nd Quality	88	890	88	88	88	98	98	98	98			
Bread	77	77	77	77	77	77	77	77	77			
Rice	80	84	80	85	83	85	85	95	100			

Source: State Statistical Office

Table A2.6 **Volume and Quality of Flour and By-Product Output, by Flour Mill (tons)**

Mill	Ulaanbaatar				Sukhbaatar				Kharkhorin				Bulgan				Ulaangom			
Output	Flour				Flour				Flour				Flour				Flour			
	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran
1992 actual					3862	17045	13687	11005		7574	7379	5977		7797	4879	3910		5956	4680	2099
1993 actual	9067	19833	13317	12183	800	15000	11500	8232		6412	5303	2987		6378	4064	3470		1750	1218	585
1994 planned	9387	20533	13767	12613	2500	17500	10000	8400		7003	6997	3150		6000	6000	3863		5300	4200	2600

	Dornod				Moron				Onderkhaan				Darhan				TOTAL			
	Flour				Flour				Flour				Flour				Flour			
	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran	Super	Grade 1	Grade 2	Bran
1992 actual		4440	3286	2813		8666	3083	3149		8184	3622	3514	6160	21280	14560	12040	10022	80942	55176	44507
1993 actual		3036	2597	1840		6048	1849	2557		5746	2704	2300	4610	17701	13302	14118	14477	81904	55854	48272
1994 planned						7671	2329	3082		7900	3700	3150	7280	21840	12880	12040	19167	93747	59893	48898

Source: Ministry of Food and Agriculture

Table A2.7 **Year-End Wheat Stocks and Product Inventory, by Flour Mill**

	Ulaanbaatar	Sukhbaatar	Kharkhorin	Bulgan	Ulaangom	Dornod	Moron	Onderkhaan	Darhan	TOTAL
					(tons)					
1992										
Flour Super	3.1									3.1
Grade 1	10.1	0.3	22.6	42.0	133.9	45.8		79.7	12.1	346.5
Grade 2	14.4	0.8	47.3	25.0	132.4	20.9		9.3	24.1	274.2
TOTAL FLOUR	27.6	1.1	69.9	77.0	266.3	66.7		89.0	36.2	633.8
Bran	81.5	598.0	1125.7		20.7	607.3	3200.0		132.2	5765.4
Wheat Grain	40781.8		8774.5	14490.3		6800.0	6272.1	2237.3	49424.9	128780.9
1993										
Flour Super	318.0	35.4							274.6	628.0
Grade 1	384.6	235.7	446.7	280.0	147.3	420.0	426.5	496.5	12.7	2850.0
Grade 2	887.6	601.9	491.5	459.6	73.1		186.5	253.9	226.9	3181.0
TOTAL FLOUR	1590.2	873.0	938.2	739.6	220.4	420.0	613.0	750.4	514.2	6659.0
Bran		407.8		290.0	5.7			670.2		1383.7
Wheat Grain	40377.3		8760.8	14665.0		10600.0	9448.7	12567.3	43000.0	139419.1

Source: Ministry of Food and Agriculture

Table A2.8

Balance Sheets of Major Flour Mills (Tg million)

	UlaanBaatar				Darhan				SuhkBaatar				Ulaangom			
	1991	1992	1993	1994	1991	1992	1993	1994	1991	1992	1993	1994	1991	1992	1993	1994
Assets																
Fixed Assets	44.0	46.2	54.2	69.2	56.2	38.4	56.0	58.6	76.6	79.5	97.8	99.1	7.8	10.2	2.1	2.2
Raw Material	53.5	270.9	1,343.8	625.2	54.8	301.1	1,659.0	1,064.0	39.1	161.5	1,794.2	1,219.5	8.5	5.8	394.9	2.3
Bags	1.5	6.8	27.7	29.3	0.0	2.2	20.7	58.1	0.4	6.5	36.6	66.5	0.3	3.3	6.4	36.9
Production Material	0.0	0.0	3.5	5.4	0.3	0.6	1.2	1.1	0.4	0.7	3.3	3.6	0.3	1.2	4.8	11.3
Other	0.3	3.2	0.0	0.0	0.4	1.1	1.4	1.2	0.1	0.0	9.2	27.0	0.1	0.6	36.4	17.7
Coal	0.0	0.1	0.7	0.7	0.0	0.0	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.1	0.3	0.9
Fuel	0.4	1.7	3.3	1.8	0.2	2.3	5.7	0.6	0.6	1.2	11.9	16.1	0.0	1.1	4.6	3.7
Other	0.0	0.1	0.1	0.1	1.0	2.1	0.0	0.0	0.0	3.2	1.8	4.7	0.0	0.1	0.0	0.0
Spare Parts	0.4	6.2	19.1	19.0	3.5	17.9	48.9	54.8	1.3	0.4	27.9	37.0	1.2	2.8	8.4	14.9
Equipment	2.5	1.2	11.5	6.9	3.8	3.8	3.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.4	3.3
Livestock	0.2	0.2	0.2	0.2	0.3	0.3	0.5	0.0	0.6	2.5	3.2	3.2	0.2	0.3	0.0	3.9
Production Assets - in use	0.8	3.6	8.6	9.8	7.9	3.1	8.4	10.5	0.3	0.4	0.5	2.8	0.2	0.7	3.8	0.5
- in storage	0.4	0.5	1.5	2.7	0.7	0.7	2.8	5.3	0.1	0.5	0.3	0.3	0.2	0.3	2.4	2.8
Cost of Prep. of Materials	4.6	24.8	191.3	40.0	3.0	17.2	131.5	98.2	3.0	10.9	148.0	138.3	1.4	0.0	60.6	3.4
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Advance payments	0.0	0.2	0.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.1
Repair costs	0.0	0.0	0.0	7.1	0.0	0.0	12.4	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			25.9	36.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
				0.0	9.4	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Final Products	1.8	19.1	14.2	21.9	1.4	1.5	41.7	0.0	1.3	5.4	71.7	41.7	0.0	1.7	11.9	5.8
?????	0.1	0.1	2.8	2.8	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Sold Products	1.3	4.8	21.2	6.4	12.1	46.7	112.2	213.2	0.0	6.5	38.3	0.0	0.3	3.9	42.3	1.1
Cash - local	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.4	0.0	0.0	0.0	0.0
- foreign	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Bank Acct. - local	0.0	0.7	41.9	136.1	0.4	1.4	0.9	3.1	0.0	0.1	0.1	0.9	0.0	0.0	0.1	1.5
- foreign	0.0	3.7	9.5	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Valuables - local	0.2	0.9	2.0	12.9	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
- foreign	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accounts Receivable	0.9	6.9	246.2	541.1	2.7	10.2	368.8	645.3	0.0	84.1	411.1	654.2	2.7	18.6	36.6	88.6
Assets Purchased	0.0	0.0	0.0	0.0	0.0	0.0	1.4	10.4	0.0	3.0	3.0	3.0	0.0	0.0	0.0	0.0
				0.8	0.0	0.0	0.0	0.0	4.5	0.1	0.1	1.9	0.0	0.0	0.0	5.8
Advances to Employees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Accts Receive -institution.	0.0	0.0	8.8	15.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	4.8	1.8
Accts Receive - individual	0.1	0.0	0.0	0.0	0.8	0.4	3.1	11.4	0.0	0.5	0.8	0.9	0.4	0.2	0.7	1.5
			0.4	0.4	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit Dist - tax	13.2	15.3	81.0	48.8	4.7	0.0	0.0	0.0	1.7	2.6	4.9	0.0	0.0	0.0	0.0	0.0
Econ. & Social Dev.	9.6	25.3		0.0	0.0	0.0	11.4	81.2	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0
Other	0.0			0.0	2.4	35.1	0.0	0.0	1.6	0.0	0.1	0.1	0.0	0.0	0.0	0.0
									0.0	0.0	0.0	95.9	0	0	0	
TOTAL	135.9	442.5	2,119.4	1,650.7	166.4	496.1	2,495.6	2,333.7	133.4	369.6	2,676.2	2,417.5	23.8	51.1	622.7	241.6

Table A2.8 (Continued) **Balance Sheets of Major Flour Mills (Tg million)**

	UlaanBaatar				Darhan				SuhkBaatar				Ulaangom			
	1991	1992	1993	1994	1991	1992	1993	1994	1991	1992	1993	1994	1991	1992	1993	1994
Liability																
liability	11.0	14.4	28.9	28.9	29.6	11.6	27.9	31.4	76.9	73.6	96.7	85.8	11.5	13.0	23.3	23.8
Depreciation	27.7	29.5	32.3	32.3	29.2	29.4	31.7	31.6		3.3	8.4	10.6		0.4	1.2	3.7
														1.4		
Accounts Payable	12.1	206.8	1,518.4	126.7	5.2	20.9	1,510.5	110.4	11.0	104.3	1,780.3	216.1	2.0	16.4	353.6	41.1
Sold Shares	0.0	0.0	0.0	0.0			61.1	61.1								
Purchased Assets	0.0	0.0	4.8	5.0			1.4	59.8								
										1.6	1.5	0.6				0.2
Income Paid in Advance	0.0	0.0	0.0	0.0		31.0	177.4	292.2								4.1
Payable to Soc. Services	0.1	0.1	0.5	0.0	0.2	0.4	2.2	2.1	0.0	0.1	2.9	1.2	0.0		0.1	0.1
	0.5	1.1	3.4	3.9				0.0		0.0	0.1	0.0				
Payable to Govt (tax/duty)	0.0	0.0	0.8	0.5		0.2	2.0	19.7	0.0	0.2	55.2	61.5	4.0	6.3	3.8	0.0
Payable to Individuals	0.1	0.2	0.4	1.5	1.0	0.1	2.4	6.0	0.0	0.2	58.6	57.5	0.5	0.2	1.2	7.5
Amortization Fund	0.3	0.0	0.0	0.0	1.0	3.3	2.6	3.9	0.3	0.6	0.0	2.3			0.5	0.8
Fund for Econ & Soc. Dev.	7.9	0.3	0.0	331.3	1.6	0.3	4.2	125.6	4.8	0.6	3.7	8.9	1.6	1.3	0.2	11.8
Reserve	0.2	0.2	0.8	0.8	0.1	0.1	0.1	0.1	0.0	0.1	0.8	1.3	0.1	0.1	0.1	1.7
Bank Credit	50.9	121.7	122.0	899.7	79.2	385.3	471.1	146.5	34.2	175.1	636.7	136.0	4.0	12.0	197.1	570.7
State Subsidy	0.0	0.0	0.0	0.0	4.4	22.0		1,506.6				1,835.8				
	0.0	0.0	0.0	0.0												
Profit	25.1	68.3	406.9	246.5	26.6	40.1	262.0	35.5		9.8	31.3				29.8	15.0
TOTAL	135.9	442.5	2,119.2	1,677.0	178.0	544.8	2,556.7	2,432.3	127.4	369.4	2,676.2	2,417.5	23.8	51.1	610.8	680.6

Table A2.9 **Flour Production Cost** (Tg million)

	UlaanBaatar			Darhan			SuhkBaatar			Ulaangom		
	1992	1993	1994	1992	1993	1994	1992	1993	1994	1992	1993	1994
Raw Material	236.2	918.8	580.6	170.8	531.8	582.1	180.7	609.1	640.1	52.4	207.6	199.1
Cost for Preparation	22.3	110.0	90.9	13.3	18.9	39.0	43.2	57.8	12.6	16.8	93.9	42.0
Salary/Wage/Bonus	3.6	25.9	18.9	4.4	16.0	15.9	9.9	12.1	10.0	3.8	12.1	5.4
Social Charges	0.5	3.5	2.5	0.6	2.2	2.2	1.3	1.6	1.3	0.5	1.6	0.7
Solid Fuel		31.6			19.5	0.3	2.4	16.9	1.5	0.1	0.5	
Liquid Fuel		2.2	2.6		0.8	2.1	5.6	50.0	24.8	0.5	5.5	0.2
Electricity	2.3	72.6	14.2	5.3	82.5	18.5	3.7	53.2	27.5	6.2	53.9	55.8
Gas, Steam	1.7	3.0	3.1	1.1	3.0		0.4	5.3	3.4			4.1
Heating		0.0	0.0	1.0	1.3	2.1	0.4	0.4	0.2	0.1	0.2	
Water		4.1	5.1	0.6	2.3	1.3	0.4	8.4	4.1		0.2	
Spare Parts					11.7	5.4	3.2	17.3	10.1	1.3	11.4	0.9
Transport												
Communication		0.2	0.6		0.1	0.7		0.0		0.0		
Interest	1.8	306.5	40.7		203.4	31.0		224.5	113.5			
Depreciation	1.7	8.3	1.5	1.1	2.2	1.2	3.2	0.9	0.5	0.4	0.8	1.5
???		0.9	0.5		0.3					0.3	0.1	
Other	4.3	8.6	19.0	8.6	0.1			34.2	1.0		0.1	5.3
Travel		0.1	0.0			0.1		0.1		0.0	0.0	
Other - 2			0.5		0.2			2.3	0.3	1.0		0.1
TOTAL	274.4	1,496.5	780.6	206.7	896.1	701.8	254.4	1,094.2	850.9	83.6	388.0	315.0

Table A2.10 **Flour Production Cost**

	Darhan		UlaanBaatar		Selenge		Ulaangom		Hovsgol
	1992	1993	1992	1993	1992	1993	1992	1993	1992
				(Tg 1000)					
TOTAL COST	**206,704.0**	**1,048,833.2**	**274,522.4**	**1,978,078.6**	**254,443.3**	**952,374.6**	**83,626.6**	**276,412.1**	**87,192.2**
MATERIAL COST	201,628.6	1,014,236.7	270,460.1	1,936,101.9	243,172.6	916,638.9	79,240.7	254,648.2	85,559.5
Raw Material	171,539.4	586,846.8	236,175.2	1,256,176.9	180,704.3	634,094.5	52,423.4	136,160.0	73,273.6
Labor									
- Salaries	4,395.7	25,176.7	3,571.4	36,913.0	9,930.2	30,054.7	3,839.2	18,900.0	1,438.5
- Social Charges	593.2	3,398.8	482.1	4,983.2	1,340.5	4,057.0	538.4	2,457.0	194.1
Utilities									
- Coal/Wood	0.0	13,838.0		69,108.0	2,356.1	2,840.0	135.2	7,200.0	
- Petroleum		5,323.9		4,114.7	5,642.9	62,400.0	547.7	3,069.6	20.7
- Electricity	5,304.2	54,349.7	2,343.5	109,618.9	3,732.2	28,951.0	6,239.4	29,158.9	9,078.4
- Gas, Steam	2,078.6	22,443.1	1,721.7	7,298.9	411.2	3,050.0			1,032.0
- Water	597.4	1,994.0		10,628.3	354.8	1,200.0			
Spare Parts		34,850.0		1,256.0	3,202.5	120,000.0	1,272.4	4,510.0	109.1
Transport	13,264.5	29,508.6	22,300.0	118,428.3	43,187.4	44,112.0	16,242.7	66,950.0	98.1
Communication		270.7	112.0	930.6					2.0
- Safety equip.		1,773.4	94.3	1,410.7			536.0	910.0	85.7
- paper		259.8		75.2			12.9	1,900.0	8.2
Finance Charges									
Depreciation	1,094.2	2,742.8	1,701.2	2,820.6	3,163.9	3,144.4	427.2	1,750.0	482.0
Miscellaneous									
- other material	7,750.3	260,035.9	6,012.2	354,234.8	417.3	16,847.0	1,403.8	3,039.7	1,369.8
- field trip	86.5	77.0	8.8	80.5		124.0	8.3	406.9	
- other (general)		5,944.0				1,500.0			
SALES INCOME	**230,217.6**	**1,022,473.3**	**334,095.5**	**2,674,647.2**	**268,292.2**	**957,174.6**	**88,107.4**	**286,460.0**	**98,802.1**
Profits	23,513.6	(26,359.9)	59,573.1	696,568.6	13,848.9	4,800.0	4,480.8	10,047.9	11,609.9
TOTAL CREDIT	400.4	2,465,000.0	121,691.0		175,059.8	175,059.8	-	-	
Interest Cost	15.4	175,900.0	25,299.7	350,000.0		399,420.0			

Table A2.10 (continued) **Flour Production Cost**

	Hentii		Overhangai		Bulgan		Dornod		Total
	1992	1993	1992	1993	1992	1993	1992	1993	
					(Tg 1000)				
TOTAL COST	**79,273.9**	**450,202.5**	**108,388.0**	**399,131.5**	**72,310.2**	**427,371.3**	**63,079.9**	**286,050.8**	**7,047,995.1**
MATERIAL COST	75,623.9	436,926.0	106,397.5	381,492.4	67,040.5	403,924.3	60,484.1	276,239.5	6,809,815.4
Raw Material	54,624.2	301,871.8	96,306.2	281,926.8	59,291.9	148,304.5	45,770.6	100,893.2	4,416,383.3
Labor									224,288.6
- Salaries	3,202.9	11,452.0	1,742.9	15,470.3	4,623.9	16,200.0	2,223.0	8,561.8	
- Social Charges	431.5	1,546.0	235.2	2,068.8	623.8	2,187.0	300.0	1,155.8	
Utilities									785,364.2
- Coal/Wood	143.0	1,855.4	918.1	8,160.0	1,033.5	10,221.1	707.2	83,900.0	
- Petroleum	2,214.1	12,990.0		3,000.0	1,302.8	6,195.0	141.3	2,600.0	
- Electricity	11,618.6	53,624.3	1,957.3	17,570.0	2,670.8	46,721.3	1,149.1	5,321.6	
- Gas, Steam			2,162.1	9,837.4		9,500.0	1,149.1	5,321.6	
- Water				162.6		40.3	682.5	2,311.1	
Spare Parts	1,641.4	8,276.3			605.1	30,600.6	1,622.0	10,000.0	217,945.4
Transport	4,654.0	54,516.0	684.7	55,390.3		5,904.0	8,219.1	63,701.0	475,240.6
Communication	64.8	198.0		87.0		480.0	22.8	40.0	
- Safety equip.	117.8	210.0	255.1	286.3	111.4	1,000.0	122.2	400.0	
- paper	44.5	84.2	48.4	40.0	98.6	80.0	24.5	30.0	
Finance Charges									
Depreciation	420.0	2,960.0	1,031.9	1,032.0	1,185.4	1,753.0	560.0	520.0	26,788.6
Miscellaneous									827,837.2
- other material	81.5	340.0	3,033.7	4,000.0	741.0	153,124.5	313.7	1,201.0	
- field trip	15.6	258.3	12.4	100.0	22.0	200.0	57.5	93.7	
- other (general)		20.20				4860.00	15.3		
SALES INCOME	**88,077.9**	**562,067.2**	**77,755.4**	**367,947.1**	**66,629.9**	**502,208.0**	**71,161.2**	**269,512.3**	**7,965,628.9**
Profits	8,804.0	111,864.7	(30,632.6)	(31,184.4)	(5,680.3)	74,836.7	8,081.3	(16,538.5)	917,633.8
TOTAL CREDIT	90,437.0	803,626.0	18,064.7	530.6	140,380.4	458,000.0			4,448,249.7
Interest Cost		78,423.0	4,119.1	70.5	1,649.4	152,584.5			1,187,481.6

Source: Ministry of Food and Agriculture

Table A2.11 **Flour Milling Rate Analysis**

	Darhan		UlaanBaatar		Selenge		Ulangom	
	1992	1993	1992	1993	1992	1993	1992	1993
WHEAT (tons)								
Opening Stocks	52,876.1	49,424.9	51,633.3	40,781.8	1,600.0	181.0	5,393.4	272.6
Purchases	59,542.8	65,000.0	74,371.3	76,502.2	48,000.0	27,000.0	8,692.2	8,250.0
Available Supply	112,418.9	114,424.9	126,004.6	117,284.0	49,600.0	39,181.0	14,085.6	8,522.6
Government supplied						12,000.0		
Used in Flour Prod.	48,510.7	47,482.1	61,371.2	56,666.7	49,419.0	39,000.0	13,798.0	8,522.6
Sold as Wheat	14,483.3	23,942.8	23,851.6	20,240.0			15.0	
Closing Stocks	49,424.9	43,000.0	40,781.8	40,377.3	181.0	181.0	272.6	0.0
FLOUR								
Opening Stocks	448.0	52.3	382.4	162.1	10.5	121.0	11.2	16.3
Production	29,315.6	35,613.0	47,218.6	42,217.0	34,593.3	27,300.0	9,925.0	6,069.0
Super	3,331.5	4,610.0		9,067.0	3,861.9	800.0		
Grade I	15,443.4	17,701.0		19,833.0	17,044.9	15,000.0	5,955.9	1,750.5
Grade II	10,540.7	13,302.0		13,317.0	13,686.5	11,500.0	4,679.8	12,218.6
(Bran)	13,042.0	14,118.0		12,183.0	11,004.7	8,232.0	2,098.8	584.6
Available Supply	29,763.6	35,665.3	47,601.0	42,379.1	34,603.8	27,421.0	9,936.2	6,085.3
Sold/Distributed	29,711.3	35,626.6	47,438.9	42,512.0	34,482.8	27,400.0	9,919.9	6,069.0
Closing Stocks	52.3	38.7	162.1	(132.9)	121.0	21.0	16.3	16.3
Mill Rate (all grades)	0.60	0.75	0.77	0.75	0.70	0.70	0.72	0.71

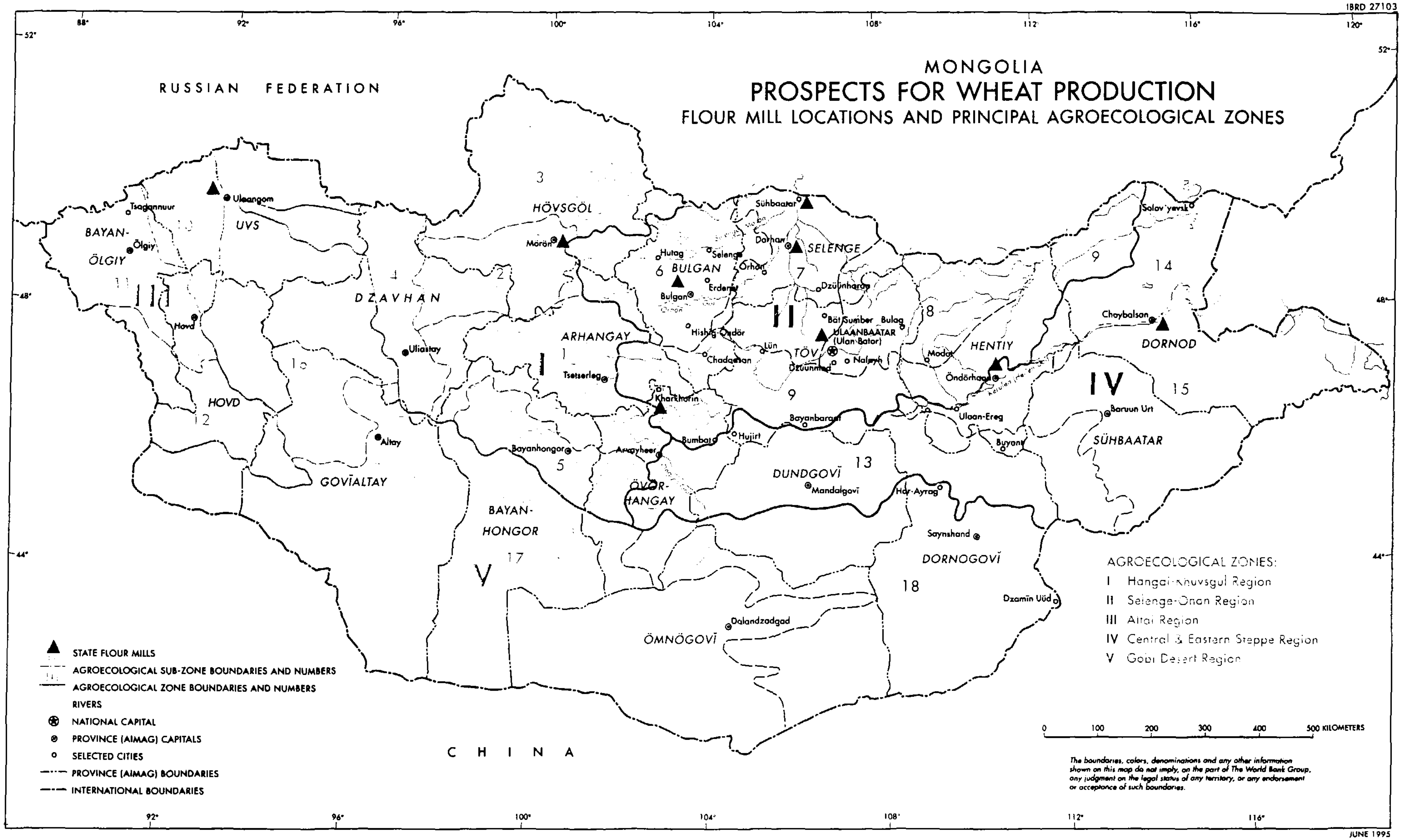
	Hentii		Hovsgol		Overhangai		Bulgan	
	1992	1993	1992	1993	1992	1993	1992	1993
WHEAT (tons)								
Opening Stocks	12,648.0	732.2	10,105.8	6,272.1	8,774.5	8,774.5	14,603.6	17,353.4
Purchases	6,959.5	22,400.0	13,580.6	17,776.6	19,050.0	16,700.0	19,696.1	16,000.0
Available Supply	19,607.5	23,132.2	25,686.4	27,548.7	27,824.5	25,474.5	34,299.7	33,353.4
Government supplied			2,000.0	3,500.0				
Used in Flour Prod.	17,608.3	12,070.0	19,282.7	18,000.0	19,050.0	16,713.0	16,946.3	16,000.0
Sold as Wheat	1,267.0		131.6	100.0				
Closing Stocks	732.2	11,062.2	6,272.1	9,448.7	8,774.5	8,761.5	17,353.4	17,353.4
FLOUR								
Opening Stocks	349.2	90.5	34.7	49.9	0.0			
Production	11,805.9	8,450.0	11,749.3	10,000.0	14,953.3	11,715.0		12,000.0
Super								
Grade I	8,183.8	5,746.0	8,665.8	6,048.0	7,573.9	6,412.0		6,000.0
Grade II	3,622.1	2,704.0	1,083.5	1,849.6	7,379.4	5,303.0		6,000.0
(Bran)		2,300.0	3,149.3	2,556.7	5,977.4	2,987.0		3,863.0
Available Supply	12,155.1	8,540.5	11,784.0	10,049.9	14,953.3	11,715.0	0.0	12,000.0
Sold/Distributed	12,064.6	8,450.0	11,734.1	10,049.9	14,953.3	11,715.0		11,900.0
Closing Stocks	90.5	90.5	49.9	0.0	0.0	0.0	0.0	100.0
Mill Rate (all grades)	0.67	0.70	0.61	0.56	0.78	0.70	0.00	0.75

Source: Ministry of Food and Agriculture

Annex Table: A3.1 Abandoned Land, by Aimags (1992)

Agro-econogical Zone	Aimag	Area (1,000 ha)
Hangai-Hovsgol	Arhangai	9.3
	Hovsgol	9.2
	Bulgan	9.1
	Dzavhan	8.4
	Sub-Total	36.0
Selenge-Onon	Tov	24.6
	Selenge	12.7
	Bulgan	9.1
	Arhangai	9.4
	Overhangai	4.0
	Sub-Total	59.8
Altai	Uvs	2.8
	Bayanolgiy	1.5
	Hovd	0.7
	Dzavhan	8.4
	Govi-Altai	0.8
	Sub-Total	14.2
Steppe	Dornod	5.6
	Hentii	21.0
	Sukhbaatar	8.2
	Dorngovi	0.1
	Dundgovi	0.3
	Sub-Total	35.2
Gobi	Omnogovi	0.4
	Govi-Altai	0.8
	Bayanhangor	0.3
	Overhangai	4.0
	Dundgovi	0.2
	Dorngovi	0.1
	Sub-Total	5.8
	TOTAL	151.0

MAP SECTION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MONGOLIA
PROSPECTS FOR WHEAT PRODUCTION
FLOUR MILL LOCATIONS AND PRINCIPAL AGROECOLOGICAL ZONES
RUSSIAN FEDERATION
CHINA
BAYAN-ÖLGIY
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DORNOD
SÜHBAATAR
DUNDGOVĬ
ÖVÖR-HANGAY
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ÖMNÖGOVĬ
DORNOGOVĬ
Tsagaannuur
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Hujirt
Hutag
Selenge
Bulgan
Erdenet
Orhon
Darhan
Sühbaatar
Dzüünharaa
Bat Sumber
Bulag
ULAANBAATAR (Ulan Bator)
Nalayh
Dzüünmod
Lün
Chadaagan
Hishig-Öndör
Bayanbaraat
Mandalgovĭ
Har-Ayrag
Saynshand
Dzamïn Üüd
Dalandzadgad
Modot
Öndörhaan
Ulaan-Ereg
Buyant
Baruun Urt
Choybalsan
Solov'yevsk
AGROECOLOGICAL ZONES:
I Hangai-Khuvsgul Region
II Selenge-Onon Region
III Altai Region
IV Central & Eastern Steppe Region
V Gobi Desert Region
STATE FLOUR MILLS
AGROECOLOGICAL SUB-ZONE BOUNDARIES AND NUMBERS
AGROECOLOGICAL ZONE BOUNDARIES AND NUMBERS
RIVERS
NATIONAL CAPITAL
PROVINCE (AIMAG) CAPITALS
SELECTED CITIES
PROVINCE (AIMAG) BOUNDARIES
INTERNATIONAL BOUNDARIES
0 100 200 300 400 500 KILOMETERS
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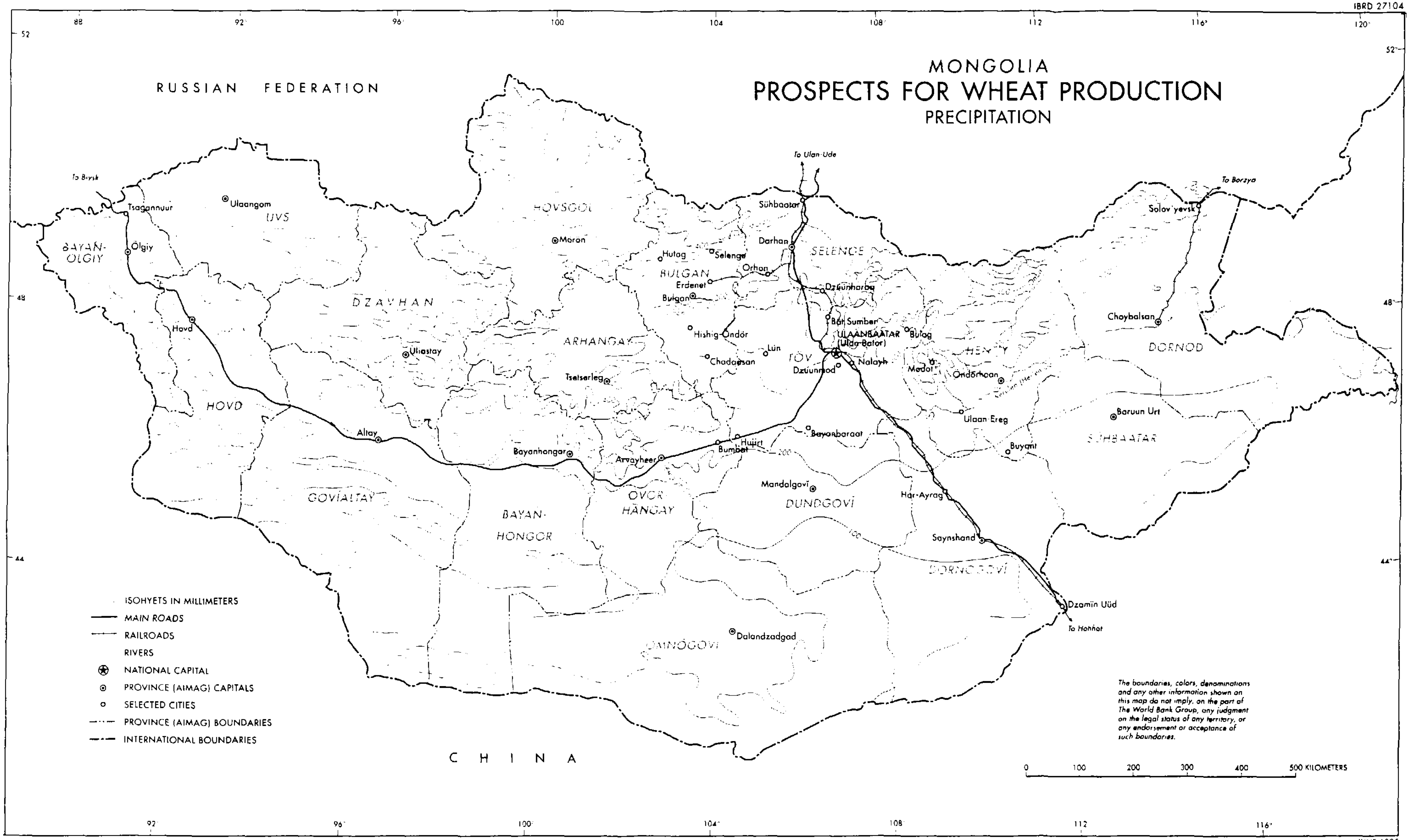

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