The Mongolian Livestock Sector: Vital for the Economy and People, but Vulnerable to Natural Phenomena

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I Introduction

The agriculture sector is of great importance to the economy of Mongolia, and its share of the gross national product of the country exceeds 30%. In particular, the livestock sector produces more than 80% of gross agricultural product and is the only source of income for more than 34% of all households in Mongolia. However, the pastoral character of animal husbandry makes it extremely vulnerable to such natural phenomena as severe winters preceded or followed by droughts, known as *"dzud"*.

Livestock in Mongolia is considered to be part of the nation's wealth and is subject to state protection under the country's constitution. "Animal husbandry continues to be the dominant economic sector in Mongolia with daily impacts on virtually all persons in the country" (Batjargal, 2000, p.5). As a result of the large-scale privatization process that began in the early 1990s, almost all state-owned livestock has been transferred to herders, encouraging a rapid increase in the number of herds. In 1999, the number of livestock reached 33.6 million - the highest level for the past 80 years - 96.2% of which was privately owned. In 1990, privately-owned livestock accounted for only 31.9% of all livestock throughout the country (see Figure 3.1).

The initial development of the industrial sector in Mongolia began in 1934 with the establishment of processing industries, the main raw materials of which, such as meat, milk, hides and skin, wool and cashmere, originate from the livestock sector. In addition, the sector is one of the country's major sources of export earnings, in the form of raw materials, preliminary and semi-processed products, and finished goods.

The purpose of this paper is to provide the reader with information illustrating these specifics and characteristics of Mongolian animal husbandry and animal raw material-based industry.

II Livestock as the Source of the Livelihood of the Mongolian People

With an area of 1.5641 million km^2, and a population of 2.4 million, Mongolia is the most sparsely populated country in the world, having an average population density of 1.54 persons per km^2. In terms of land area, Mongolia is the 18^{th} largest country in the world and the 5^{th} largest in Asia. The climate of Mongolia is a harsh continental one with four clearly differentiated seasons.

The population of Mongolia has increased almost fourfold during the past eight decades and is now mostly young and economically active. The urban and rural populations account for 56.6% and 43.4% of the total respectively, with 55.4% of the urban population living in Ulaanbaatar in 2000 (NSO, 2001b). Data indicate that the share of urban population decreased by 0.5% in 2000 compared with 1989. This shift in the urban and rural population shares during this period was associated with the structural change of the country's economy from industry-dominated to being focused on agriculture, specifically livestock.

The population census of 2000 revealed that more than half of all families in Mongolia live in traditional housing in the form of gers. Although the number of households living in conventional housing increased by 9.5% in 2000 compared with 1989, gers are still a popular type of housing for rural households, 76.8% of which still live in them (Table 2.1).

Currently, herder households account for almost 35% of all Mongolian households for which livestock is the main source of income, which is a twofold increase on 1990 levels. This trend is related to the massive privatization of state-owned livestock (by distributing them among herders free of charge using a voucher system) and a sharp decline in industrial activity during that period, thus ending the domination of industry in the Mongolian economic structure and making agriculture more prominent.

In 2000, there were 421,400 herders, constituting almost half of the country's economically active population. This is defined as all employed and some unemployed persons of working age (women: 16-55, men: 16-60) who are registered at the Employment Regulation Office, but does not include the armed forces, prisoners, pupils and students of working age. Moreover, herders account for between 70-90% of the economically active population in almost all regions except a few industrialized regions.

Along with the privatization of livestock, the government adopted a policy aimed at avoiding placing an excessive tax burden on herders, which has encouraged

Table 2.1 **Selected Population Characteristics of Mongolia**

	1989	2000
Population, million	2.04	2.37
Average life expectancy at birth, years	62.6	65.1
Households living in conventional housing, % of total	39.6	49.1
Households living in gers, % of total	60.4	50.9

Source: NSO, 2001b

herders to increase the number of livestock they farm. Accordingly, while in 1990 most herder households had only up to 30 head of privately owned livestock, by 1995 this figure had doubled or tripled in most cases, and the number of herders with more than 100 head of livestock increased substantially during the 1990s. For example, the number of herder households that have more than 100 and fewer than 200 head of livestock increased from 10,700 to 59,000 in 1990 and 2000 respectively. Although there was a national average of 177 livestock per herder household in 1999, this decreased to 141 and 89 in 2000 and 2001 respectively, due to losses of livestock in consecutive *dzuds* in those years. Thus, most herder households (85.5% of the total, as of 2000) had fewer than 200 head of livestock, with the biggest share (45.7% of the total) held by households that have more than 50 but fewer than 200 head (Figure 2.1).

Based on the average productivity of a head of livestock in Mongolian conditions, a herder household with fewer than 200 head of livestock is considered poor, as this number only assures self-sufficiency. Therefore, 85.5% of Mongolian herder households are still trapped in poverty.

The main characteristics of herder households in Mongolia are presented in Table 2.2. Data indicate that only 13.4% of herder households had electricity sources (mainly in the form of low-capacity mobile generators and renewable energy sources, such as solar or wind power); and 15.7% had TV sets in 2001. In addition, 9.5% and 1.5% had automobiles and tractors respectively. Motorcycles are the most popular type of motorized transport among herders in Mongolia, with 18.3% of herders possessing such transport in 2001 (Table 2.2). A survey conducted in more than 58% of all rural areas in Mongolia in the early 1990s (after the privatization of livestock), revealed that more than 60% of households had the ability and willingness to purchase modern information technology and electrical appliances. It is believed that the infrastructure of herders in the 21st century will be compatible with that of American and Australian herders today. Using modern information and communications technology, as well as the internet, Mongolian herders will be able to make direct contact with customers, cooperatives and organizations via satellite systems. By expanding the use of new energy resources (renewable sources, biogas, etc.), herder households will have sufficient electricity to engage in small-scale production at their sites (Chadraa, 2000).

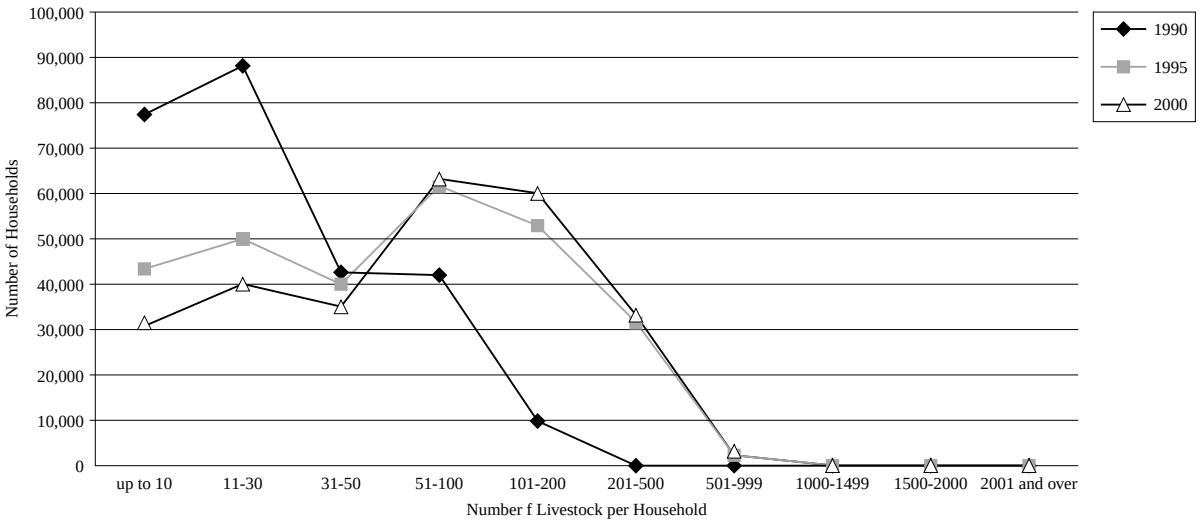
Therefore, in order to respond to the emerging need for the improvement of herders' living standards on the one hand, and to facilitate more proactive production practices at herder settlements on the other, the proper development of infrastructure in Mongolia's rural areas is required. In particular, a reliable supply of energy is indispensable. Given the pastoral character of animal husbandry in Mongolia, and its vast and scarcely populated areas, small-scale renewable energy sources are considered to be the most practical.

Table 2.2 **Selected Indicators of Herder Households in Mongolia**

Indicators	1990	1995	1999	2000	2001
Number of herders, thousand	147.5	390.5	417.7	421.4	407.0
Number of herder households, thousand	74.7	169.3	189.9	191.5	185.5
Share of herder households with electricity, %	15.0	11.3	13.5	10.6	13.4
Share of herder households with a TV set, %	NA	9.9	16.3	12.8	15.7
Share of herder households with an automobile, %	NA	2.9	6.7	8.7	9.5
Share of herder households with a motorcycle, %	NA	15.8	15.7	16.6	18.3
Share of herder households with a tractor, %	NA	NA	1.6	1.5	1.5

Sources: NSO, 2001a; NSO, 2002a.

Figure2.1 **Grouping of Herder Households by the Numbe of Livestock**



Sources: NSO, 2001a

III Livestock as the National Wealth of Mongolia

3.1. A Brief History of Animal Husbandry Development in Mongolia

The natural environmental conditions of Mongolia, which are suitable for rearing domestic livestock, were the major reason for the development of the livestock sector as the country's first productive sector, although, as in other countries across the globe, the first economic activity undertaken by early humans was hunting. The initial process of domesticating wild animals began in Mongolia between the 8th and 3rd centuries B.C. and they came to be the focus of productive activity after the latter half of the 2nd century B.C. Traditionally, five types of domestic livestock were commonly raised in Mongolia: sheep, goats, cattle, horses and camels, while pigs, hens and other birds were seldom reared. Horses were the first animal in Mongolia to be domesticated (Baasanjav et.al., 1999).

The harsh continental climate of Mongolia, which is characterized by significant changes in the weather during the four seasons, as well as differences in the grassland available in different areas, cause the Mongolian people to lead a nomadic lifestyle based on pastoral animal husbandry. Research suggests that this was economically more effective than conventional agriculture (i.e. planting). Therefore, the classic Mongolian type of animal husbandry is considered an efficient production activity in terms of labor, economic payoffs and ecological considerations. The term "classic" denotes the original pastoral animal husbandry methods that have developed over time during the course of the nomadic lifestyle, and which have been transferred from generation to generation.

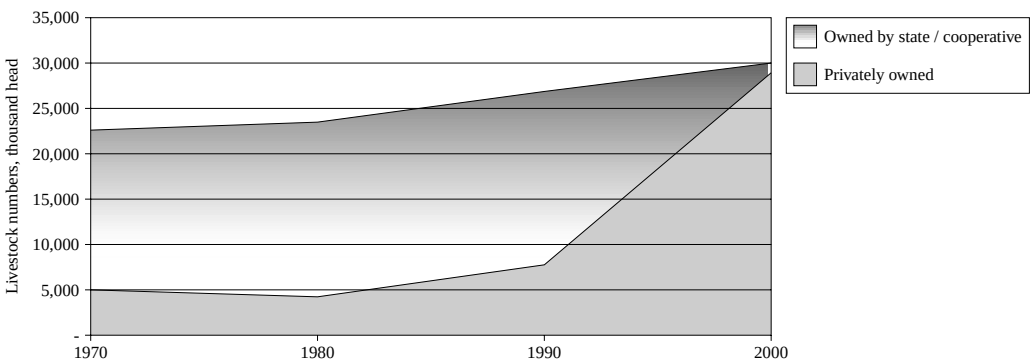
Between the 13th and 14th centuries, herder-settlements - groups of herder households forming small nomadic settlements - became the first major labor division of herders. Typically, every herder household raised a variety of livestock as the different species provided different services and products, such as food, clothing, transportation, housing and production devices. One herder-settlement typically consisted of 7-12 households. During the summers - the busiest season for herders - they settled in one place to engage in various collective animal husbandry activities; when the weather became harsher, they would move to their winter shelters.

However, after 1950, when the nationwide campaign for the establishment of cooperatives started, the herder-settlement system of labor division, which had been practiced for more than 700 years in Mongolia, was abandoned in favor of cooperatives. Thus, the majority of private livestock was transferred to the collective ownership of cooperatives. The management of the cooperatives was responsible for providing various services to herders, such as preparing livestock enclosures, constructing wells, and making hay to feed herds during the winter and early spring, etc. Furthermore, more advanced methods of animal husbandry were established, including livestock farms, sites for rearing young animals, and livestock complexes. However, herders who belonged to the cooperatives had to follow a strict plan for livestock production levels. In the 1970s and 1980s, interventions from the state became more intense, interfering with the cooperatives' property and controlling product prices, thus changing the function of cooperatives from that which was originally intended (Baasanjav et al, 1999).

Nevertheless, in 1991, with the beginning of the transition from a centrally-planned command economy to a market-oriented one, a massive privatization process got underway and livestock was transferred back to private ownership free of charge, mainly to the cooperatives' own members; all the cooperatives were thus dissolved. Consequently, the herder-settlement method of labor division has recently been regaining popularity among herders.

Before the formation of cooperatives, almost all livestock (e.g. 99.8% in 1940) was in private hands. During the collectivization period (1960-1990), the share of private livestock decreased to 17-30% of the total number of livestock, but due to the privatization process that began in the early 1990s, the share of privately-owned livestock increased again, with 96.7% of total livestock in private hands in 2000. It is evident that livestock numbers tend to increase by a greater degree when they are in private hands. From the 1950s to the beginning of the 1990s, when livestock was under cooperative/state ownership, the numbers remained steady or increased only slightly despite various efforts made under the centrally-planned command regime (Figure 3.1).

Figure3.1 **Livestock Numbers in 1970-2001(Composition of Ownership)**



Source: NSO, various issues.

3.2. Types of Livestock and Their Regional Distribution

Five types of livestock are raised in Mongolia: sheep, goats, cattle, horses, and camels. Conforming to the traditional pattern, sheep and goats comprise the majority of livestock and respectively accounted for 45.9% and 34.0% of the total number of livestock in 2000. Camels account for only 1.1% of total livestock and are mainly raised in the southern part of the country. In Asia, Mongolia ranks 2nd and 4th in terms of horses and camels, 6th and 7th in terms of sheep and goats respectively, and 15th in terms of cattle. Worldwide, Mongolia has the most horses and goats per capita and is 3rd in terms of camel and sheep per capita (NSO, 2002b).

The livestock numbers by type are shown in Table 3.1. As the data show, the fluctuation in the number of sheep in 1970-2000 was relatively steady, ranging between 12.0 and 16.0 million head, while the number of goats increased sharply (almost by twofold) during the last decade. This was associated with an increase in the market price of cashmere due to high demand for it in markets and strong competition for its procurement, both among domestic producers and foreign competitors.

Livestock products are supplied to processing industries for producing a variety of semi-finished and finished goods and products, as well as being exported. Since the various types of livestock were first domesticated in Mongolia, they have become adapted to Mongolia's climate by means of careful selection, breeding and cross-breeding, making them a uniquely reliable source of renewable resources for food and other products. For example, a special goat variety that produces the finest cashmere in the world is found only in Mongolia. The quality of cashmere - known as the "fiber of kings" - produced by Mongolian goats is superior to the cashmere produced in other countries and localities, as it is longer and finer than any other (Khishigjargal & Sedvanchig, 2000).

Although livestock is relatively uniformly distributed in comparison with the population size of each region, the forests and mountainous areas of northern and eastern Mongolia are most populous in terms of livestock. According to the livestock census of 2001, there was an average 61 sheep-equivalent head of livestock per 100 ha of pastureland in those regions, whereas it ranged from 30 to 34 in other regions. (For accounting purposes, livestock numbers are usually converted into sheep-equivalent or cattle-equivalent head using the relevant conversion coefficients).[1] The national average was estimated to be 39 sheep-equivalent head per 100 ha of pastureland in 2001, falling from 48 sheep-equivalent head in 2000 due to a decrease in the number of livestock. Overgrazing is becoming problematic in areas close to major markets. For example, livestock density measured in sheep-equivalent head per 100ha of pastureland in Orhon and Darhan-Uul provinces and Ulaanbaatar rose to 190-881 in 2001, which is 5 to 10 times higher than the figure in other regions (NSO, 2002b). Nevertheless, the appropriate number of livestock for Mongolia - taking into account the country's economic, social and environmental conditions - has yet to be clarified. Some researchers argue that it should be no more than 60 million sheep-head equivalent, i.e. the number of livestock in Mongolia at present.

IV Livestock Production and Livestock Raw Material Processing Industries in Mongolia

4.1 Livestock Output

As of 2000, livestock production accounted for 87.6% of Mongolia's gross agricultural product, whereas the agriculture sector accounted for 30% of the country's GDP. At the same time, the livestock sector directly employed almost half of the country's economically active population.

The usual livestock rearing method used in Mongolia involves the extensive grazing of various types of livestock at one herder household site (livestock farming). Although intensive livestock farming (i.e. housed dairy cattle, pigs and poultry) was practiced during the 1980s under state and cooperative ownership, such farms ceased to be appropriate after the livestock was transferred to private hands. Extensive livestock farming is important not only for providing different types of products, such as meat, milk and wool, but also for ensuring that fodder plant species are grazed in a balanced fashion (Batjargal, 2000).

Livestock production is entirely seasonal, taking place in harmony with the Mongolian climate. For example, wool and hair is collected in late spring and early summer, while most livestock is slaughtered in late autumn and early winter, at either meat factories, temporary slaughterhouses in rural areas, or herder household sites. Milk and dairy products are mainly produced during summer. Accordingly,

Table 3.1 **Mongolian Livestock by Type, thousand head**

Year	Total	of which, %				
		Camels	Horses	Cattle	Sheep	Goats
1970	22,574.9	2.8	10.3	9.3	59.0	18.6
1980	23,771.4	2.5	8.4	10.1	59.9	19.2
1990	25,856.9	2.1	8.7	11.0	58.3	19.8
2000	30,227.4	1.1	8.8	10.2	45.9	34.0
2001	26,075.2	1.1	8.4	7.9	45.8	36.8

Source: NSO, various issues.

[1] The coefficients used by the NSO (National Statistical Office of Mongolia) are as follows: The sheep-equivalent head coefficients for camels, horses, cattle, sheep and goats are 5.0, 7.0, 6.0, 1.0, and 0.9 respectively. The cattle-equivalent head coefficients for camels, horses, cattle, sheep and goats are 1.5, 1.0, 1.0, 6.0 and 8.0 respectively. The coefficients are not necessarily identical as they have been developed for tax purposes in different years.

industries that use raw materials of livestock origin have to cope with such specifics and usually have to maintain inefficiently high inventories of raw materials. The limited range of short-term, high interest rate loans available from commercial banks operating in Mongolia at present is not appropriate for financing such activities, as these loans do not take such operational realities into account. In fact, this was a major cause of the sharp decline in production and failure experienced by many such industries in Mongolia during the transition from a centrally-planned economy to a market-oriented one that started in the early 1990s. As a result, the majority of raw materials of livestock origin is exported without being processed, exports of finished and value-added products have decreased substantially and many finished products have actually disappeared from the export list. Despite this problem, proper schemes to deal with the situation do not seem likely to be devised in the near future.

As mentioned earlier, the Mongolian economy largely depends on livestock production. The country's gross agricultural output, evaluated at constant 1993 and 1995 prices, is shown in Table 4.1. The livestock sector has historically been the predominant sector in the Mongolian economy and accounted for more than 70% of gross agricultural output during the past 30 years. As shown in Table 4.1, the ratio of livestock and crop output in total agricultural output in 1990 was 73:27, becoming 85:15 in 2000. Despite a decline in crop production after 1995, increases in gross agricultural output have occurred owing to increases in livestock output arising from an increase in livestock numbers. Mechanized farming of croplands, which was no longer sustainable without massive subsidies from the state, declined by about 50% during the 1990s.

4.2 Major Livestock Products and Industries Processing Raw Materials of Livestock Origin

Mongolia's major livestock products are meat, meat by-products, and milk and dairy products, which provide staple foods for the population, as well as being inputs in many food industries. In addition, wool, hair, cashmere, hides and skins are key inputs for animal raw material processing industries within Mongolia. Due to a decline in production in these industries during the last decade, the majority of such raw materials are presently exported without being processed.

The initial development of this industry began with the establishment of industries processing the abundant raw materials produced by the livestock sector, including meat, milk, wool, cashmere, hides and skin. The development of this industry dates back to December 1933, when the first wool-washing factory in Hatgal town, Huvsgul province began operating, while an industrial complex consisting of a wool-washing factory, leather tannery, and shoe and felt factories, as well as a second electric power station, became operational in 1934 in Ulaanbaatar. Further expansion has taken place with the establishment of many other new enterprises, such as meat and dairy factories, textile industries, cashmere-processing plants, carpet and blanket factories, spinning and knitting enterprises, and fur-processing, leather garment and haberdashery factories; in addition, existing enterprises have undergone modernization and expansion.

A.Meat and Milk

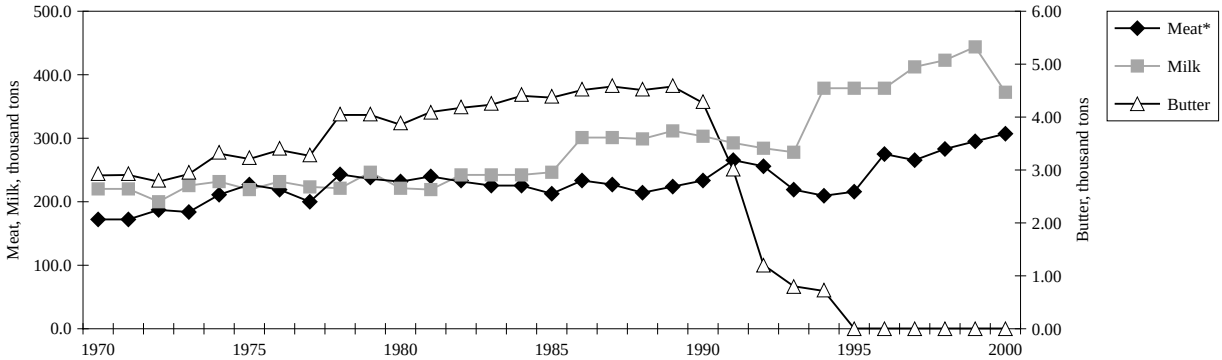
On average, 7.5 million head of livestock are slaughtered for consumption annually, accounting for about 25% of the total livestock herd counted at the beginning of each year. This equals 250,000-300,000 tons of meat

Table 4.1 **Gross Agricultural Output of Mongolia, 1970-2000**

	1970	1980	1990	1995	1999	2000
	At constant 1993 prices, billion MNT			At constant 1995 prices, billion MNT		
Total	69.5	74.8	109.3	102.8	321.2	256.3
Livestock	58.4	61.1	79.3	87.8	282.5	218.9
Crop	11.1	13.7	30.0	15.0	38.7	37.4
	Share (%)					
Livestock	84.0	81.7	72.9	85.2	89.8	85.4
Crop	16.0	18.3	27.1	14.8	10.2	14.6

Source: Mongolian Statistical Yearbook, various issues.

Figure4.3 **Meat and Milk Production Dynamics of Livestock in Mongolia, 1970-2000**



Note:*of slaughtered weight

(Table 4.2). Mutton and beef comprise the main share of total meat prepared, accounting for around 45% and 35% of the total quantity of meat respectively. Horse and camel meat is not so popular in Mongolia and these types of meat are usually consumed mostly during the winter. Because the air temperature in Mongolia drops to between -15 and -30^{O}C during winter, all herder households and most urban households put aside enough different types of meat to see them through the winter.

A special method of meat procurement for meat-processing factories and slaughterhouses was developed in Mongolia as an alternative to the conventional delivery modes for goods, which is still used today. The country's vast land area and the lack of a proper nationwide transportation network make the extensive use of different transportation modes in meat procurement for major meat-processing factories unfeasible. Therefore, factories usually buy livestock based on the live-weight rate in spring, when the price of livestock is lowest due to the livestock having lost weight during the winter, and herders bring them to the factory by autumn. This takes about 3-4 months, depending on the distance they must travel, and the livestock regain weight along the way during the summer. Each herd is accompanied by 3-5 herders depending on the type and size of the animals. The herders draw up contracts with the purchasing factories regarding the total weight that will be gained during the course of delivery and rates for excess weight gained. Depending on the type of livestock and the location of their usual meadows, slaughter weight as a percentage of live weight ranges from 42% to 50% (NSO, 2000). At present, 12 major meat-processing factories operate in Mongolia, with an annual supply capacity of 50,300 tons of live weight of various types of meat (TCI, 2001).

Obviously, Mongolia has never imported any type of fresh meat for consumption. Instead, it is a potential exporter of organic meat and dairy produce. Table 4.3 shows exports of Mongolian meat and meat by-products between 1970-2000. During the 1970s and 1980s, Mongolia exported up to 46,000 tons of meat in addition to exports of livestock; all of this was exported to the former Soviet Union. Until 1992, 20,000-50,000 tons of live weight of livestock was exported, including 20,000-76,000 head of horses, but exports of livestock later ceased due to strong pressure from domestic meat producers and reimbursement difficulties.

In 1995, only 2,200 tons of meat was exported, twenty times lower than the peak reached in 1980. However, after 1995, meat exports began to recover, reaching 16,700 tons in 2000, mostly to Russia and Kazakhstan. Meanwhile, exports of intestines experienced less dramatic declines (Table 4.3).

Currently, Mongolian meat-processing plants have an annual export capacity of 60,000 tons of meat (TCI, 2001). However, despite the hormone-free organic qualities of Mongolian meat, which is in high demand in international markets, the lack of domestic "infrastructure" to meet international standards and requirements for trade in such products still prevents the expansion of export markets. These obstacles include the lack of internationally accredited laboratories for the quality control and certification of products; insufficiently developed nationwide animal health services; the lack of refrigerated container transportation facilities; and the lack of bilateral and multilateral negotiations and agreements on animal health and food hygiene certification with major importing countries. Currently, Mongolia has agreements on the mutual acceptance of animal health and food hygiene certification with Russia and China.

As stated above, Mongolia needs to develop its proper "infrastructure" further in order to increase the quantity and variety of meat and dairy product exports, thus fully utilizing its competitive advantage in organic agricultural/livestock products. Since Mongolia joined the WTO in 1997, scant progress has been made in terms of capacity building, increasing the country's negotiating power with its trading partners, and building an adequate trade infrastructure. The WTO Sanitary and Phytosanitary (SPS) Committee's decision on equivalence in October 2001 was an important step forward in overcoming major trade barriers that face developing countries. The decision made it possible to implement the provisions of Article 4 of

Table 4.2 **Meat Production in Mongolia by Type (thousand tons of slaughtered weight)**

Years	Total	Of which				
		Camel meat	Horse Meat	Beef	Mutton	Goat Meat
1970	179.4	5.8	26.1	51.7	79.1	16.7
1980	225.6	9.7	29.5	70.6	94.3	21.5
1990	240.8	11.6	30.7	66.2	107.6	24.7
2000	310.6	NA	NA	113.4	120.0*	

Source: NSO, various issues. Note: * total for mutton and goat meat.

Table 4.3 **Exports of Meat and Meat By-Products from Mongolia, 1970-2000**

Main Items	1970	1975	1980	1985	1990	1995	2000
Meat, thousand tons	20.9	35.7	45.9	36.8	24.3	2.2	16.7
Intestines, thousand rolls	1,800.9	2,797.2	3,228.9	2,858.6	2,163.8	1,288.3	869.6
Bone dust, thousand tons	-	-	-	-	0.8	1.5	2.4
Livestock, thousand tons of live weight	51.0	50.2	36.1	24.7	20.8	0.0	0.0
Horses, thousand head	67.5	61.8	76.3	63.1	42.3	0.0	0.0

Sourse: NSO, Statistical Yearbook, various issues

the SPS Agreement on the Application of Sanitary and Phytosanitary Measures and affirms that equivalence can be applied between all members irrespective of their level of development. Moreover, appropriate technical assistance to facilitate the implementation of this article shall be provided, especially to a developing country if it requests it, thus enhancing its market access opportunities (WTO, 2001). Therefore, Mongolia needs to develop its trading infrastructure by extensively utilizing such opportunities, as well as other resources.

Another major livestock product is milk. Annually 250,000-350,000 tons of milk is produced in Mongolia. The majority of this is cow's milk, which accounts for more than 80% of the total quantity of milk produced, with sheep & goat milk and horse milk accounting for approximately 10% and 8% respectively. With regard to cow's milk, the yield and period of milking each year also differs depending on the breed and region. More than 90% of all cows is accounted for by native Mongolian cows, which have an average milk yield of 1.9 liters per day in the steppe region, and 1.3 liters in the Gobi region. Cows are milked for 8.4 months of each year in steppe and forest regions, and 5.3 months in the Gobi region. Because of the higher milk yield of cows in steppe regions, small livestock (i.e. sheep and goats) are not usually milked in those regions (NSO, 2000).

Milk is consumed by herder households and used to produce various dairy products for domestic consumption, as well as being supplied to manufacturers of dairy products, such as yogurt, butter, dried curds, cheese etc. These industries have established large manufacturing facilities in major cities. For example, the four factories in Ulaanbaatar, Darhan and Selenge process 573.1 million liters of milk per annum. However, some of them currently only utilize about 2-4% of installed capacity due to an insufficient supply of milk; this is as a result of the demolition of intensive cattle farms. As shown in Figure 4.3, butter production has been declining since the early 1990s and has almost ceased since 1995 due to a decline in production by these factories, with butter for the domestic market being almost entirely imported.

On the other hand, the previous centralized procurement and distribution system for the state-run industry became obsolete as a result of the country's transition from a centrally planned economy to a market-oriented one. Therefore, the capacities of such enterprises became too large and were inconsistent with market demand, given that they supplied only domestic markets. However, their share of the market has been taken over to some extent by a number of small companies, which produce a greater variety of milk and dairy products, as well as by direct supplies by herder households. Much of the space at large factories has been rented out to these small units. Milk and dairy products are sold entirely on the domestic market, but some companies are also seeking out export opportunities.

Most horse milk is used to produce a popular drink known as *airag*, a low-alcohol content drink that is similar to beer in, but is white in color, as it is milk. The Mongolian tradition of making *airag* dates back about 2300 years. Rich contents of amino acids, vitamins and sugar found in horse milk makes *airag* a nutritious and healthy drink, which is also low in fat. Therefore, it is used to treat many illnesses, including tuberculosis, diseases of digestive organs, pharmaceutical toxicity, and fatigue. Mongolia has several special sanatoria that use *airag* as the main form of treatment. Currently, *airag* is only consumed in Mongolia.

Milk from other livestock is used to produce a variety of milk and dairy products such as dried curd, yogurt, cheese, and butter in factories and also by herder households for their own consumption as well as for sale. During the summer, milk and dairy products provide the major sources of food for rural and herder households. It is said that because of their high intake of dairy products, especially dried curd, rural Mongolians have very strong white teeth and are rarely affected by dental diseases.

B. Wool, Hair and Cashmere

Wool, hair, and cashmere are other valuable resources originating from livestock. These are renewable resources with an annual cycle. The warm coats (hair, wool and down) of livestock in Mongolia developed naturally as a way to survive the country's harsh winters. When the air temperature starts to rise, the down on the animals' undercoats loosens naturally, making its collection and removal easier. Goat, cattle, and camel down and cashmere are gathered by combing, while sheep wool and hair is removed by shearing.

About 25,000 tons of wool, hair and cashmere is produced in Mongolia annually, more than 70% of which is accounted for by sheep wool. Mongolia is the second largest producer of raw cashmere in the world (after China); currently, 3300 tons of cashmere is produced annually, accounting for about 20% of the total global supply. Cashmere is one of Mongolia's main export commodities.

Processing industries based on these raw materials have developed significant capacity in Mongolia since the mid-1930s. They include wool-washing factories, felt and felt boot plants, carpet manufacturers, spinning and knitting factories, cashmere-processing plants and factories producing non-woven fabrics. However, other than in the cashmere industry, only a small proportion of installed capacity is being utilized currently.

Production of this industry's principal goods for the period 1970-2000 is shown in Table 4.4. Similarly to the meat and dairy industry, it experienced peak production levels during the 1970s and 1980s, but these declined sharply in the early 1990s. For example, the production of spun thread and woolen fabrics dropped almost 22-fold and 244-fold respectively in 1997 from their peak levels in 1989. Although a slight recovery was experienced in the production of scoured wool and woolen fabrics, real recovery is still far away.

Nevertheless, the cashmere sector was the only sector in this industry that was able to survive transitional difficulties, due to the increased demand for and high value of cashmere and cashmere products on the international market. The first experimental factory for cashmere processing was built using technical assistance provided by UNIDO in 1975 and a production complex covering all stages of production, from the processing of raw cashmere

Table 4.4 **Production of Major Items in the Mongolian Wool and Cashmere Industry, 1970-2000**

Main Items	1970	1980	1985	1990	1995	2000
Spun thread, tons	NA	NA	2,722.5	2,285.4	344.9	40.8
De-haired cashmere, tons	NA	NA	198.5	240.1	420.8	450.9
Camel wool blankets, thousand m	NA	NA	84.9	91.2	19.4	28.5
Scoured wool, thousand tons	9.8	11.8	11.3	9.7	1.2	1.4
Carpet, thousand sq.m	6.6	464.4	1,585.6	1,971.2	595.7	704.8
Knitted goods, thousand pcs	157.4	1,134.0	2,824.7	4,248.6	522.7	1,233.5
Felt, thousand m	550.2	614.6	623.9	745.1	76.5	113.9
Felt boots, thousand pairs	394.2	465.8	452.2	588.5	79.0	34.0
Woolen fabrics, thousand running m	623.7	963.5	1,432.5	1,111.3	71.1	21.0

Source: NSO, Statistical Yearbook, various issues.

and camel wool to the manufacturing of various finished products, went into operation in 1981 using technical and financial aid from Japan. During the 1990s this sector attracted foreign and domestic investors and, as of 2001, five domestic and 77 joint-venture entities were operating in this field, in which more than 50% of excess capacity (compared with the domestically available quantity of raw cashmere) has been installed for use in the scouring and de-hairing processes (MIT, 2002).

In order to facilitate closer interaction between herders, cashmere traders and manufacturers, cashmere exchanges and auctions were organized in two southern provinces last year as part of a USAID-funded collaborative project, with another four scheduled for this year. This initiative will serve as a good start in rebuilding the raw material collection system and transforming it into one appropriate to the new market economy. Moreover, price premiums and quality discounts in the negotiating process ensure herders have a true sense of and concern for the quality of their raw materials and act appropriately. Therefore, the current single-pricing practices with regard to bulk cashmere will eventually move to quality-based price quotations, which is essential to the industry's sustainability.

Exports of the major commodities of the Mongolian wool and cashmere industry for 1970-2000 are shown in Table 4.5. The values for cashmere and sheep wool include both raw and semi-processed items. Cashmere represents the main export commodity not only in this sector but also for the whole country, and Mongolia is the world's second largest supplier. A substantial part of the cashmere produced in Mongolia is supplied for export in its raw and semi-processed forms. Since the price fluctuation of such commodities on the world market is high compared with the prices of finished products using cashmere fibers, export earnings are highly vulnerable. In 2000, 1500 tons of cashmere was exported, valued at US$77 million. This accounted for 16.5% of the country's total exports. The main countries that import such products are Italy, the United Kingdom, China and Japan. Cashmere exports to Japan were worth about US$9 million in 2001, an increase of 2.3 times on the previous year (NSO, 2002a).

Other items included in this sector's exports were sheep wool, horse manes, knitted goods, woolen fabrics, woolen blankets and carpets. However, since the early 1990s, exports of most of these commodities have almost vanished as production declined due to the various reasons mentioned earlier. Moreover, as neighboring countries impose high import tariffs (more than 50%) on woolen products, exports of such commodities remain unchanged (GOM, 2000b). Only exports of sheep wool have displayed a relatively stable pattern over the period, with 5,200 tons of wool (both greasy and scoured) being exported in 2000 (Table 4.5).

C. Hides and Skin

Livestock hides and skin are also a valuable resource for producing luxury consumer goods, and are a by-product of livestock slaughtered for consumption.

About 6.5-8.5 million individual hides and skins are produced in Mongolia annually if counted on the basis of the number of livestock slaughtered for consumption. More than 80% of these are sheep- and goat-skins. Most of them are supplied to processing industries or exported, as well as being used by herder households. Traditionally, sheepskin was used for making warm winter coats and floor coverings, while various accessories for handling horses were made from cattle hides.

Table 4.5 **Exports of Major Mongolian Wool and Cashmere Industry Commodities, 1970-2000**

Main Items	1970	1980	1985	1990	1995	2000
Camel wool, thousand t	3.2	3.0	2.6	1.9	0.9	0.8
Cashmere, thousand t	0.9	1.2	0.6	0.4	0.6	1.5
Sheep wool, thousand t	10.1	10.8	7.7	3.3	14.9	5.2
Horse mane, thousand t	0.9	0.7	0.6	0.5	0.4	0.2
Knitted goods, thousand pcs	0.0	45.1	252.6	298.9	570.3	3,393.5
Carpets, million. sq.m	0.0	0.4	1.5	1.7	0.0	0.1
Woolen fabrics, thousand m	230.3	31.9	34.6	0.0	0.0	0.0
Woolen blankets, thousand pcs	37.6	330.8	313.9	336.4	20.5	4.5

Source: NSO, Statistical Yearbook, various issues.

Sufficient capacity to process hide and skin resources completely has been installed in the country over the course of the development of Mongolia's leather industry since the 1930s. The technical level of the leather industry is more-or-less comparable with the global average, owing to modernization and restructuring in recent years. Similarly to the wool and cashmere sector, the development of this sector is characterized by the horizontal integration of technology. An industrial complex comprising a preliminary processing plant for hides and skin, tanneries for shoe uppers, linings and soles, leather garment and leather haberdashery manufacturers, a shoe-making plant, and a fur and skin processing plant have been established in Ulaanbaatar. In addition, several auxiliary plants were established in order to utilize the waste materials and scraps generated during the production process, such as a sewing plant that uses leather scraps, a glue manufacturer, and a synthetic leather plant. A sheepskin goods manufacturing complex was opened in Darkhan city with the cooperation of Bulgaria, while another shoe-making plant was established in Dzavhan province.

The initial development of the leather production complex in Ulaanbaatar was carried out with technical assistance from the former Czechoslovakia. In 1988, a new plant for producing leather garments and leather haberdashery was put into operation in cooperation with the former Yugoslavia, with investment of more than US$11 million. As all the machinery and equipment installed at this plant was purchased from Western manufacturers and used the best technology available at the time, Mongolia was able to export more than 90% of the factory's products to a diverse range of markets, including the most sensitive western markets. Major markets included France, Germany, Switzerland and the former Yugoslavia, in addition to the ex-CMEA countries. Japan also accounted for some sales.

A production line using Italian technology was installed in a shoe factory, while major renovation work was carried out at a cow-hide tannery in Ulaanbaatar under a project developed in cooperation with Italy during the mid-1990s. Though all work was completed, the project was not as successful as originally intended. It cost the equivalent of US$17 million, 15% of which was directly invested by the Mongolian government, with the remaining balance provided by an Italian commercial bank supported by the government of Italy. However, the plant failed to repay its debts due to unstable production. The reasons for this failure are similar to those behind the failures of other industries described in this paper.

The production pattern of selected items in the Mongolian leather industry is illustrated in Table 4.6. Overall, the leather industry was the hardest hit by the transitional shocks of the 1990s and is still awaiting recovery. 4.2 million pairs of leather shoes and 300,200 leather garments were produced in 1990, but this figure dropped to 5,600 and 200 respectively in 2000. Accordingly, the production of tanned sheepskin and goatskin declined to 4,600 sq. m and 800 sq. m respectively in 2000 from record levels of 1.51 million sq. m and 418,400 sq. m respectively in 1990.

Similarly to other industrial sectors in Mongolia, the various transitional difficulties mentioned earlier conspired to bring about the failure of the country's leather industry. Moreover, apart from a few items subject to excise duties, such as alcohol, tobacco and passenger cars, Mongolia unilaterally reduced its general import tariffs to zero on May 1st, 1997. A uniform rate of 15% was imposed on all imported goods until this date. This measure was another major blow to domestic industries, because cheap - though not necessarily high-quality - imported goods swamped domestic markets. Consequently, exports of finished leather products have entirely been replaced by exports of raw hides and skins (Table 4.7). However, import duties were reintroduced in 1999 at lower rates than before (The rates are: 5% effective from July 1st, 1999; 7% effective from January 1st, 2001 and 5% effective from January 1st, 2002).

Table 4.6 **Production of Selected Items in the Mongolian Leather Industry, 1970-2000**

Main Items	1970	1980	1985	1990	1995	2000
Sole leather, tons	1,300.0	1,400.0	800.0	1,000.0	0.0	0.0
Tanned sheepskin, thousand sq. m	NA	1,209.5	1,491.6	1,510.5	193.5	4.6
Tanned goatskin, thousand sq. m	NA	178.0	331.1	418.4	35.9	0.8
Leather shoes, thousand pairs	1,621.5	2,104.9	2,883.4	4,222.5	245.5	5.6
Leather garments, thousand pcs	47.9	269.9	357.2	300.2	31.6	0.2
Sheepskin coats, thousand pcs	NA	83.0	135.2	138.1	16.8	1.0

Source: NSO, Statistical Yearbook, various issues.

Table 4.7 **Exports of Raw Hides and Skin and Selected Items from the Mongolian Leather Industry**

Main Items	1970	1980	1985	1990	1995	2000
Cattle hide, thousand pcs	NA	NA	NA	47.7	309.6	1,058.5
Horse hide, thousand pcs	12.1	65.0	58.0	105.2	70.0	276.3
Sheepskin, thousand pcs	5.1	261.0	280.2	130.0	2,004.3	2,640.0
Goatskin, thousand pcs	4.2	315.1	526.2	113.2	361.4	110.5
Tanned goatskin, thousand pcs	224.6	175.0	236.6	172.0	0.0	0.0
Tanned sheepskin, thousand pcs	394.6	123.1	411.0	24.1	0.0	0.0
Leather garments, thousand pcs	14.2	54.7	321.5	87.0	0.8	0.0

Source: NSO, Statistical Yearbook, various issues.

V Livestock and the Environment

5.1. Pastureland and Livestock

The vast, diverse pastureland of Mongolia is highly suitable for livestock production, with more than 600 of the 2,600 natural plant species found in pastureland palatable to livestock and providing its major source of feed (GOM, 2001). Pastureland in Mongolia occupied 129.4 million ha in 2000, an increase of 4.9% on 1980 levels, but a decrease of 8% in comparison with the level in 1950. A nationwide crop cultivation program started in Mongolia in 1959 and about 1.2 million ha of agricultural land was made available for this. However, with the beginning of economic transition, state subsidies were no longer allocated to this sector, and crop cultivation began to drop sharply. Currently only 20-30% of land is utilized for annual crop cultivation, a level four times lower than in the 1980s.

The total number of livestock was 30.2 million in 2000, an increase of 7.6 million head or 33.9% on the 1970 level. Levels reached a record high of 33.6 million head in 1999. As a result of a decrease in pastureland area and an increase in the number of livestock, it was estimated that pastureland available per head of livestock decreased from 6.2 ha in 1930 to 4.3 ha in 2000. However, due to huge losses of adult animals during the severe winters of 2000-2001, livestock numbers decreased further to 26.1 million head in 2001.

Mongolia's harsh continental climate and seasonal patterns, as well as the pastoral character of its extensive livestock farming mean that a wide area of pastureland is necessary for each herd. Sheep and goats are put out to pasture together, usually in the area closest to the herder settlement, while cattle, horse and camel herds are put out to pasture separately in areas further away. Areas surrounding the herder settlement are used for young livestock. In order to feed the livestock with a variety of natural plants, herder households have to move several times each year, depending on grass and water availability. Moreover, the same pastureland is shared or rotated daily between neighboring herder households. Academics describe this as follows: "The methodology of seasonal use and segmentation of pasture is the choice of the Mongols, arising from their traditions and experience shaped over centuries" (Adyasuren, 2000, p.4). Moreover, in an area such as Mongolia, where there are extreme fluctuations in air temperature both annually and diurnally, and which has a relatively short effective vegetation growth period (80 to 130 days, depending on altitude and location), the rotation system of land management is the only way to maximize outcomes while not exceeding the ecological capacity threshold of a given landscape (Batjargal, 2000).

Accordingly, each herder household usually has several sites that are used during winter, spring, and autumn, which are equipped with specific herd shelters, herd enclosures, hay and other facilities. Wood is the material most commonly used in building such facilities. Because they are usually used for several years, herders avoid using pastures surrounding these facilities during summer, thus facilitating the natural restoration of pastureland and ensuring that it will be available for use the following year. Although herder households change locations several times during the summer, no pre-prepared enclosures are needed. As a rule, areas used for herder settlements are supposed to be cleaned completely before moving to other places. Enclosures for summer use are far simpler in construction than those used in other seasons. As mentioned earlier, herders usually use the herder-settlements model of labor division during the summer.

Pastureland management is usually based on mutual understanding and agreements among the herders of a particular area within a region; however trans-regional movements are not an exception. There are warnings that areas close to major markets are tending to be over-exploited because of large concentrations of livestock, causing land degradation in those areas. However, the idea of privatizing pastureland areas for individual use by herders, as advised by some local and outside experts, seems a rather odd solution. The country's total area of pastureland would simply not be sufficient to meet the minimum required level of pastureland per herd if the current pastoral character of livestock rearing continues and the pasturelands are not shared. Others suggest shifting to a settled model of intensive livestock farming. Although such a transformation would be optimal for the more populated areas (i.e. near the largest cities), the complete shift of all livestock farming towards such methods would be impractical and unprofitable in Mongolia. Firstly, the infrastructure needed for intensive livestock farming, along with the initial investments and operating costs, may cost much more than that required for extensive pastoral livestock farming. Without certain subsidies, it would lead to an increase in the prices of all livestock products. Secondly, years of breeding and crossbreeding would be required in order to accustom Mongolia's existing livestock to a settled pattern of farming. In addition, animal psychology has to be dealt with adequately. This branch of animal sciences is still underdeveloped to a great extent in Mongolia, although experienced herders have acquired this knowledge through their own experiences and those of their ancestors. Thirdly, the most important aspect is that the ecological superiority of Mongolian livestock products would vanish, causing the industry to lose its competitive advantage. It is uncontested that Mongolia is the only country in the world where extensive pastoral livestock farming can be developed and sustained. Infrastructure development and the introduction of the latest small-scale production methods and technology in order to mechanize production activities at herder settlements, not to mention a proper policy on the balanced development of the regions, would offer much better solutions for most of these problems.

The pastoral character of Mongolian animal husbandry makes it extremely vulnerable to such natural phenomena as severe winters and droughts, especially severe winters preceded by droughts, which are known as "*dzud*". This is recognized as the prime disadvantage of pastoral animal husbandry. In this sense, the consequences of global warming and climate change have a strong direct impact on Mongolian animal husbandry.

The pastures that support livestock are strongly affected by weather conditions. The coldest period is January, when the air temperature drops to between -

31.1°C and -52°C, rising to between +28.5°C and 44°C in July. Precipitation is low, averaging 200-220 mm per annum. Droughts occur once every 2-3 years in the Gobi region and every 10 years in other regions (GOM & UNDP, 2000). Nationwide droughts occurred in 1944 and 1972 (MFA, 2001).

Livestock gain weight through taking in nutrients during the summer, reaching their maximum weight in autumn. From winter to early spring, they lose weight due to cold air temperatures, the unavailability of fresh grass, snow cover, snow and dust storms and strong winds, so their survival depends greatly on the weight and energy gained during summer and autumn. Mongolian livestock has become adapted to such conditions over the years through natural selection and selective breeding.

Data show that an average loss of 0.8-1.0 million adult livestock - 4% of the total number of livestock - occurs in Mongolia annually in normal years. A substantial part of this loss results from adverse weather conditions. Data show that the percentage of losses of different types of livestock exhibit very similar trends, although in extreme weather conditions, i.e. during *dzuds*, losses of cattle and horses in terms of the percentage of the total number of each tend to be higher than those of other livestock. In addition to losses of adult livestock, young animals also suffer greatly from the adverse effects of natural phenomena.

5.2. The Consequences of Recent Dzuds

As a result of climate change, such natural phenomena as *dzud*, droughts, strong winds and flooding have begun to occur frequently in Mongolia recently. Two consecutive *dzuds* occurred in 2000-2001; during the *dzud* of 2000, Mongolia lost 3.5 million adult animals, while in 2001, a further 4.8 million were lost. This means that the scale of losses in 2000 and 2001 was equal to 11.5 % and 18.2 % of the country's total livestock respectively. As a percentage of total livestock at the beginning of the respective years, the figures were 10.4% and 15.7% respectively (NSO, 2002b).

In autumn 2000, snow fell earlier than usual and more than 90% of Mongolia was covered with snow well before the usual period for this extent of snow cover. More than 70% of 158 *soums* in 13 provinces suffered *dzud*. About 2400 herder households lost all of their livestock and more than 10,000 herder households ended up with fewer than 100 head of surviving animals. The total value of lost livestock was 91.7 billion togrogs (MFA, 2001).

The *dzud* of 2001 was more severe than the previous one in terms of the area covered and the drop in air temperature. During this *dzud* 7400 herder households lost all of their livestock and another 13,300 households lost more than 50% of their total livestock. A survey revealed that 74.3% of these losses was attributed to a shortage of fodder. In terms of losses as a percentage of total herds, cattle and horses were the hardest hit, with 49.2% of adult cattle and 20.5% of adult horses lost in 2001, compared with 20.3% and 14.8% respectively in 2000 (MFA, 2001).

In addition to direct losses of adult and young animals, other adverse consequences, such as an increase in the number of barren female animals and miscarriages, also resulted in the reduction of total livestock numbers in 2000-2001. For example, there were 1.5 million and 1.4 million barren female animals in 2000 and 2001 respectively, as well as 1.2 million and 1 million miscarriages in those respective years (NSO, 2002b). All this contributed to an increase in rural poverty across the nation. Moreover, estimates show that, due to the reduction of agricultural, and thus livestock, production, the country's GDP grew only at 1.1% in 2001; had this drop in production not taken place, GDP growth could have attained 10.0% (BOM, 2002).

The abovementioned situation requires that the government of Mongolia actively undertake measures to prevent and minimize the consequences of *dzud*. Indeed, it is paying close attention to this problem, developing and implementing complex measures aimed at the protection of herds and the prevention of livestock losses due to such natural phenomena as *dzud*. Attention is also being focused on the rehabilitation of industries processing raw materials of livestock origin.

Accordingly, the government of Mongolia is undertaking a number of programs to support the country's livestock sector by diverting funds from state budgets, as well as actively mobilizing the financial and other resources allocated to the country by international organizations and donor-countries, including Japan. However, in view of the country's limited financial capacity, it is obviously not possible for Mongolia completely to solve this problem on its own. The situation is aggravated by economic stagnation arising from various internal and external factors, which relate to the period of transition from the planned economy to the market-oriented one.

Therefore, collaboration with international organizations, donor-countries and other concerned parties is needed in organizing joint initiatives aimed at developing and implementing complex measures to protect herds and prevent livestock losses as a result of such natural phenomena as *dzud*. Other goals of these initiatives could include supporting herder households and improving the nation's capacity to take preventive measures against problems caused by severe climate conditions, as well tackling those problems when they do arise.

VI Conclusion

Livestock plays a significant role in the Mongolian economy, providing renewable sources of food and consumer goods. It directly supports the livelihood of more than half of the country's population. Processing raw materials of livestock origin constitutes Mongolia's main manufacturing industry and is one of the country's major sources of export earnings. However, the pastoral character of animal husbandry makes it extremely vulnerable to natural phenomena.

In view of the importance of livestock, the government of Mongolia is paying close attention to this problem and taking every possible measure by developing and implementing complex measures aimed at the protection of herds and the prevention of livestock losses as a result of such natural phenomena as *dzud*. In order to facilitate the prevention of livestock losses arising from

dzud and other natural phenomena, the following measures could be developed and undertaken: (i) the improvement of forecasting and analysis, and the expansion of the information network in isolated areas; (ii) strengthening the capacity to respond to and take urgent measures to tackle naturally-occurring climatic phenomena; (iii) the revitalization and improvement of the work of forage production units; (iv) the supply of cattle-breeding farms in isolated areas with power from renewable energy sources; and (v) the improvement of pastureland management and veterinary assistance in preventing various animal parasites etc.

Fundamental reforms in livestock sector development in the 21st century constitute the main challenge for the country. However, simply favoring a more settled style of animal husbandry over the traditional pastoral one does not seem to be the best solution. Thanks to global economic development and technological advancement, especially in the field of information and communications technology, remote areas are no longer being left behind. Therefore, a proper policy and the active introduction of such technology, aimed at bringing new insights to pastoral animal husbandry, offer much better prospects.

The economic, environmental, and social changes and challenges of the next 50 years are likely to be fundamentally different from those of the past half-century. Therefore, there should be no doubt that Mongolia's economic development strategy must deal with these tendencies and be based upon a vision for sustainable development.

A development strategy must be aimed at facilitating the transformation of the Mongolian economy from its current "deadlocked" position towards a more advanced sustainable path, while identifying the barriers to, as well as potential catalysts for such change. A blueprint for the sustainable development of Mongolia in the 21st century, known as MAP-21 (Mongolian Action Program for the 21st Century), was released in 1999. Although it laid good foundations for the evolution of a development strategy in coming years, it needs to be revised and redefined, setting concrete goals for sustainable economic development in the present dynamic global environment.

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経済と人々の生活に欠かせないが、自然現象に弱いモンゴル畜産部門

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１．はじめに

モンゴル経済にとって、農業部門は非常に重要で、国民総生産の30%以上を占める。特に、畜産部門は農業粗収入の80%以上を占め、全世帯の34%以上が畜産を唯一の収入源としている。しかし、家畜の牧畜的性格は、干ばつの前後に厳しい冬がくる「ゾト」といわれるような自然現象に極端に弱い。

モンゴルの家畜は国の財産の一部として考えられ、憲法の上でも、国の保護下に置かれている。「家畜は依然モンゴルの主要な経済部門であり、全国民の日常に影響を与えていると言ってもよい」（Batjargal, 2000, p.5）。1990年代の初めに始まった大規模な民営化の過程で、国家が所有していた家畜の大部分は遊牧民の手に渡り、群れの数の急激な増加が奨励された。1999年にはその数は、過去80年間で最高の3,360万頭に上り、そのうちの96.2%が個人所有であった。1990年に個人で所有していた数は国内総数の31.9%に過ぎなかった（図３．１）。

モンゴルの産業部門の発展は、1934年に肉、乳、皮、ウール、カシミヤなど、畜産部門に由来する産品を主要な原材料とする加工産業の設立と共に始まった。さらに、この部門は輸出の大きな収入源で、原材料、一次加工ないしは半加工品、完成品などの形で輸出されている。

この論文は、モンゴルの家畜並びに家畜原材料を原料とする産業について、その詳細や特徴を提供することが目的である。

２．モンゴルの人々が生計の源とする家畜

国土156万4,100平方キロメートル、人口240万人のモンゴルは、人口密度が１平方キロメートル当り平均1.54人と、世界で最も人口密度が薄い国である。世界で18番目、アジアで５番目に広い国土をもつ。気候は厳しい大陸性気候ではっきりとした四季をもつ。

過去80年間で人口が約４倍に増え、現在は若年層が多く、経済状況は活発である。2000年現在では全人口の56.6%は都市に、43.4%は地方に住み、都市人口の55.4%がウランバートルに住んでいる（NSO、2001b）。統計によると、都市人口は1989年から2000年までの間に0.5%減少している。このように都市から地方へと人口が流れているのは、国の経済が工業主体から、農業、特に牧畜業に焦点を当てるという構造の変化と関係がある。

2000年の人口調査によると、モンゴルの全家庭の半数以上が、ゲルという伝統的な住居に住んでいる。通常の住居に住んでいる世帯数は、2000年には1989年に比べて9.5%増えているが、農村部の家庭ではまだゲルが一般的で、76.8%がゲルに住んでいる（表２．１）。

現在、家畜を主な収入源にする遊牧民家庭は全世帯の約35%にのぼり、1990年当時に比べて２倍に増えている。これは、この間に国家所有の家畜を大量に個人所有化し（バウチャー制度を使って、家畜を無料で分け与えた）、鉱工業活動が急激に低下したことに関係し、その結果、モンゴル経済構造における鉱工業の支配を終わらせ、農業部門をより目立たせた。

2000年の遊牧民の数は42.14万人で、国内の経済活動人口の約半分を占める。この数は、就業規定局に登録している就労年齢（女性：16－55歳、男性16－60歳）にあたる全ての就労者数と、いくらかの非就労者数と定義されているが、軍隊、囚人、就労年齢に達している学生は含まれていない。また、少数の鉱工業地帯を除くほとんど全ての地域で、遊牧民は経済活動人口の70－90%を占めている。

家畜の個人所有化に加えて、政府が過度の課税をしない方針を立てたことで、遊牧民は飼育する家畜数を増やした。これに伴って、1990年の個人所有家畜数は、せいぜい30頭ほどだったのが、1995年までに大半の遊牧民はその数を２～３倍に増やし、1990年代の間に100頭以上の家畜を所有する遊牧民の数は著しく増えた。例えば、所有家畜数100頭以上200頭未満の遊牧民は、1990年から2000年の間に、10,700人から59,000人に増えた。しかし、1999年、１遊牧民世帯の所有家畜数は、全国平均で177頭であったが、２年続いたゾトで家畜が死亡し、2000年には141頭、2001年には89頭に減少している。このように、家畜所有数200頭以下の遊牧民世帯が大半（2000年現在85.5%）で、大部分（全体の45.7%）は50頭以上200頭未満である（図２．１）。

表２．１　モンゴルの人口の特徴

	1989年	2000年
人口（百万）	2.04	2.37
平均寿命（歳）	62.6	65.1
通常の住居に住む世帯数（%）	39.6	49.1
ゲルに住む世帯数（%）	60.4	50.9

出典：NSO、2001b

モンゴルにおける１頭の家畜の平均的生産性に基づくと、200頭というのは自給自足ができるだけの数で、所有家畜数がそれ以下の遊牧民家庭は貧しいといえる。ゆえに、85.5%のモンゴル遊牧民は、未だに貧困層から抜け出せないでいる。

モンゴル遊牧民の主な特徴を表２．２にまとめた。2001年の統計によると、電力源（主に、低容量の移動式発電機や、太陽及び風力発電のような再生可能なエネルギー源）をもつ遊牧民はわずか13.4%、テレビは15.7%である。また、自動車の所有は9.5%、トラクターは1.5%である。動力付きの移動手段として遊牧民が最も多く利用するのがオートバイで、2001年では18.3%の遊牧民が所有している。1990年代初め（家畜の個人所有化以降）に国内の農村部の58%以上で行われた調査では、60%以上の家庭が最新情報技術や電気製品の購入ができる能力と希望を持っているという結果が出た。21世紀のモンゴル遊牧民を取り巻くインフラは、今日のアメリカやオーストラリアの遊牧民に匹敵するだろうと言われている。最新の情報・通信技術、インターネットの利用により、サテライトシステムを通じて、消費者、企業、組織と直接やりとりすることができるようになるだろう。新しいエネルギー源（再生可能なエネルギー源、バイオガス等）の利用を拡大することにより、遊牧民は自分の土地で小規模な生産活動を行うための効率の良い電力が得られるようになるだろう（Chadraa, 2000）。

従って、遊牧民の生活基準向上の必要性に応え、遊牧民の居住地での主体的な生産活動を促進するため、農村部のインフラ整備が求められている。とりわけ、確実なエネルギー供給が不可欠である。モンゴルの家畜業の牧畜的性格と、広大で人口の少ない地域を考え合わせると、規模の小さい再生可能なエネルギー源がもっとも実用的と思われる。

３．国家財産としての家畜

３－１　モンゴルの家畜飼育の発展の歴史

世界で人類によって最初に行われた経済活動は狩猟だったが、モンゴルでは家畜を育てるために適した自然条件が整っていたため、国の最初の生産部門として牧畜部門が発達した。紀元前８世紀から紀元前３世紀の間に、モンゴルでは野生動物が飼い慣らされ、紀元前２世紀の後半には家畜が生産活動の中心となった。伝統的に、５種類の家畜（羊、山羊、牛、馬、ラクダ）が一般的に飼育され、豚、鶏、その他の鳥類はほとんど飼育されなかった。馬はモンゴルで最初に飼いならされた動物である（Baasanjav et.al., 1999）。

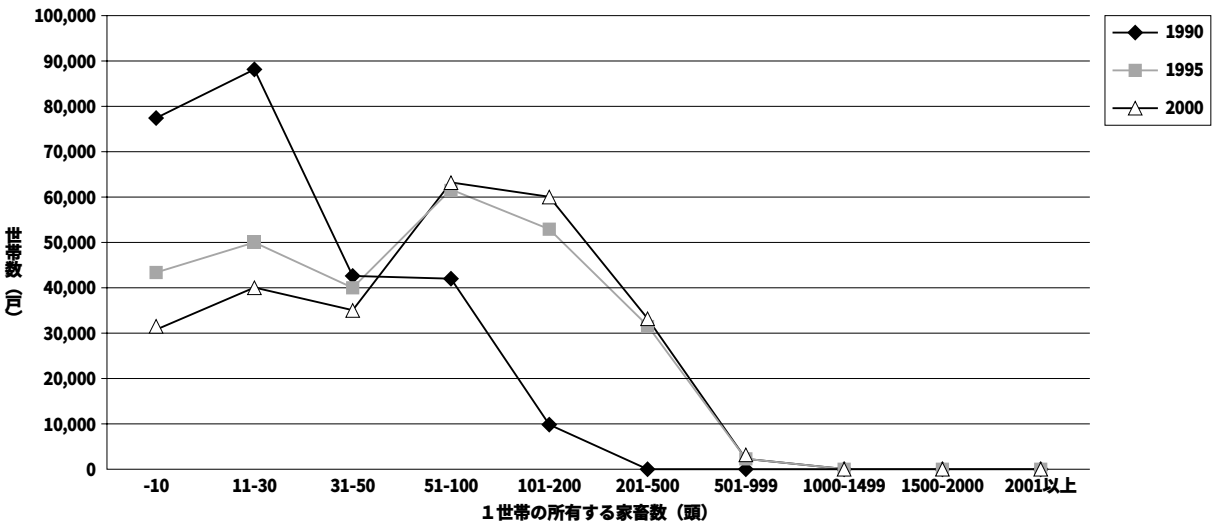
四季を通じて天候が大きく変化する厳しい大陸性気候

表２．２　モンゴルの遊牧民世帯の指標

指　標	1990年	1995年	1999年	2000年	2001年
遊牧民数（千人）	147.5	390.5	417.7	421.4	407.0
遊牧民世帯数（千人）	74.7	169.3	189.9	191.5	185.5
電気を所有する遊牧民世帯の割合（%）	15.0	11.3	13.5	10.6	13.4
テレビを所有する遊牧民世帯の割合（%）	NA	9.9	16.3	12.8	15.7
自動車を所有する遊牧民世帯の割合（%）	NA	2.9	6.7	8.7	9.5
オートバイを所有する遊牧民世帯の割合（%）	NA	15.8	15.7	16.6	18.3
トラクターを所有する遊牧民世帯の割合（%）	NA	NA	1.6	1.5	1.5

出典：NSO　2001a、NSO2002a

図２．１　所有家畜数による遊牧民の分類



出典：NSO、2001a

と、土地によって手に入る草が違うことから、モンゴルの人々は牧畜を基本にした移動型の生活を送るようになった。研究によれば、これは経済的に従来型の農業（すなわち農作）よりも効率的である。ゆえに、昔ながらのモンゴル型の牧畜は、労働、経済的収益、環境的配慮の面から、効率の良い生産活動と言える。「昔ながら」というのは、移動型生活を送ってきた長い間の過程で発展し、何世代にも渡って受け継がれてきた独特な牧畜方法である。

13～14世紀の間に、いくつかの遊牧民家庭が小さな遊牧民集落を形成し、遊牧民の主要な労働集団となった。種の違う家畜は、食料、衣類、交通、住居、生産手段などの面で、色々な役割と生産物を提供することから、一般に、遊牧民世帯は様々な種類の家畜を飼育した。ひとつの遊牧民集落は、たいてい７～12家庭で構成された。最も忙しい夏の間は一箇所に定住して色々な集団的牧畜活動を行い、気候が厳しくなると、冬の避難場所へ移動した。

しかし、1950年以降、国を挙げた協同組合の設立が始まると、700年以上続いた労働部門の遊牧民集落制度は、協同組合にとって代わられた。こうして、個人が所有していた家畜の大半は協同組合の共同所有となった。協同組合は家畜の囲いの準備、井戸の掘削、冬期や春の初めに与える干し草作りなど、遊牧民に様々なサービスを提供した。さらに、家畜農場、若い家畜の飼育場、家畜集合施設など、進歩した牧畜方法が考えられた。しかし、協同組合に所属する遊牧民は、厳しい家畜生産水準計画に従わなければならなかった。1970年代から1980年代にかけて、国の干渉が強まり、協同組合の所有権に干渉したり、生産価格をコントロールしたりしはじめたため、協同組合の機能は、最初に考えられたものと違っていった（Baasanjav et al, 1999）。

しかし、1991年、中央指令型経済から市場志向型経済への移行の始まりとともに、大規模な個人所有化が進められ、家畜は再び、協同組合の会員を中心に無料で引き渡された。こうして協同組合は全て解散させられた。結果的に、遊牧民の間では、再び労働部門における遊牧民集落の方法が一般的となった。

協同組合の形成前は、ほぼ全ての家畜（例えば1940年には99.8%）が個人所有であった。集団化の時代（1960-1990年）に、家畜の個人所有率は家畜総数の17－30%に減ったが、1990年代初期に始まった個人所有化の過程でその数は再び増加し、2000年には96.7%となった。個人で所有している時の方が家畜数が大幅に増える傾向にあることは明らかである。家畜が協同組合や国の所有であった1950年代から1990年代の初めまでは、中央計画指令体制のもとでどんなに努力が払われようと、その数は同じか、ごくわずかに増えただけであった（図３．１）。

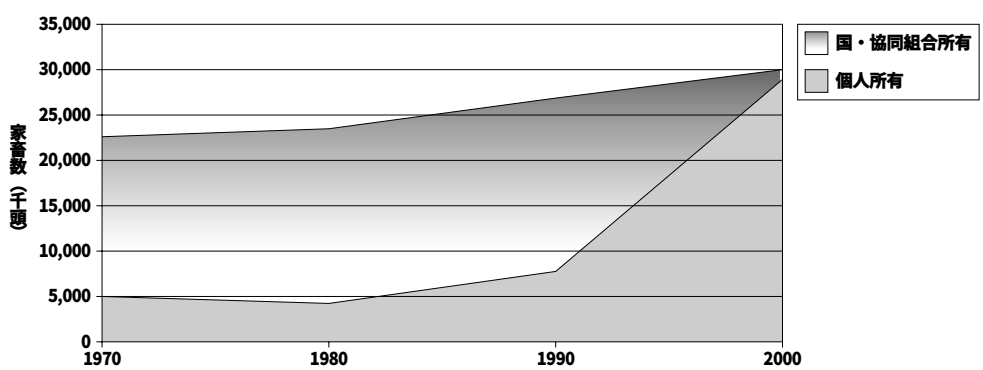
３－２　家畜の種類と地域的分布

モンゴルでは、羊、山羊、牛、馬、ラクダの５種類の家畜が飼育されている。従来のパターン通り、家畜の大多数は羊と山羊で、2000年ではそれぞれ家畜総数の45.9%と34.0%であった。ラクダは1.1%にしか過ぎず、主に南部で飼育されている。アジア全体でみると、モンゴルは馬の数が２位、ラクダ４位、羊６位、山羊７位、牛15位である。一人当りの馬と山羊の数では世界第１位、ラクダと羊が３位である（NSO、2002b）。

種類別の家畜数は表３．１の通りである。1970～2000年の羊の数は、1,200万～1,600万頭でほぼ一定しているのに対し、山羊の数は過去10年間でほぼ２倍と著しく増えている。これは、国内の生産者と海外の競争相手の間で、市場におけるカシミヤへの需要が高まり、獲得競争が激しくなったことに伴う市場価格の上昇と関係する。

家畜生産品は各種の半製品・完成品の生産、そして輸出向け加工産業に利用される。様々な種類の家畜がモンゴルで飼い慣らされはじめて以来、念入りな選定、交配、交雑育種を重ねてモンゴルの気候に適した家畜が生まれ、食料やその他の製品として、独特の信頼性のある再生可能な資

図３．１　所有者別にみた家畜数（1970－2001年）



出典：NSO　各種

源となった。例えば、世界でも最高品質のカシミヤを生み出す特別な山羊の種類は、モンゴルにしか生息しない。「繊維の王様」として知られるモンゴル山羊から作られるカシミヤの品質は、他の国々や地方で作られるカシミヤに比べて毛足が長くなめらかである（Khishigjargal & Sedvanchig, 2000）。

家畜は各地域の人口規模に照らしてほぼ均等に分配されているが、モンゴル北部や東部の森林・山岳地帯でその数が最も多い。2001年の家畜統計によると、森林・山岳地帯では、牧草地100ヘクタール当りの羊相当数で平均61頭、その他の地域では30～34頭である。（計算上、家畜の数は通例、適切な換算係数を用いて、羊相当数もしくは牛相当数に換算される）[1] 2001年の国の平均は牧草地100ヘクタール当り39羊相当数と推定され、家畜数は、2000年の48頭から減少した。また、主要市場に近い土地での過放牧が問題になっている。例えば、オルホン県、ダルハン－ウール県、ウランバートルにおける牧草地100ヘクタール当りの羊相当数で換算した家畜密度は、2001年で190～881頭で、これは他の地域の５倍から10倍に相当する（NSO、2002b）。それでもなお、国の経済、社会、環境的要素を考慮した適切な家畜数は、未だ確定されていない。羊相当数で6,000万頭（すなわち現在の家畜総数）を越えるべきでないという研究者の意見もある。

４．モンゴルにおける家畜生産及び畜産加工業

４－１　家畜生産高

2000年現在、畜産部門はモンゴルの農業粗収入の87.6%を占め、一方、農業部門はGDPの30%を占めている。同じく、畜産部門は、経済活動人口の約半分を直接雇用している。

通常、モンゴルでは、１つの遊牧民世帯（家畜飼育）で色々な種類の家畜を集約せずに放牧するという家畜飼育法をとっている。集約した家畜飼育（すなわち、放牧しない乳牛、豚、家禽類）も1980年代に国や協同組合の所有のもとで行われたが、家畜が個人所有に移ってからは、このような農場は適切ではなくなった。広域家畜飼育は、肉、乳、羊毛などの様々な種類の生産品を生み出すだけでなく、餌となる草の種をバランスよく食べさせるためにも大切である（Batjargal、2000）。

家畜生産は、モンゴルの気候と調和しながら完全に季節ごとに行われている。例えば、羊毛や毛は春の終わりから夏の初めにかけて刈りとられ、秋の終わりから冬の初めになると、家畜の大部分は食肉工場か地元の仮設屠殺場もしくは遊牧民世帯で屠殺される。乳・乳製品は主に夏の間に作られる。従って、家畜を元にした原材料を扱う産業は、家畜の種類毎に、通常は効率が悪いことに原材料の在庫を多く持たなければならない。現在、モンゴルで行われている商業銀行からの短期で金利の高い限られた種類の貸し付けは、経営上の現実を考慮していないため、このような活動に融資するのには適さない。実際、これが主な原因となって、1990年代初頭に始まった中央計画経済から市場経済への移行期に、モンゴルでは多くの産業が生産を著しく減少させ、失敗を招いた。結果として、家畜を元にした原材料のほとんどは、加工されないまま輸出され、完成品、付加価値品の輸出は実質的に減少し、事実、多くの完成品は輸出品目から消えている。このような問題にもかかわらず、この状況に対処する適切な基本構想が近い将来考え出されることはなさそうである。

これまでに述べたように、モンゴルの経済は家畜生産に大きく依存している。1993年と1995年の不変価格で評価した農業総産出額が、表４．１である。歴史的に畜産部門はモンゴル経済を支配し、過去30年間で農業総産出額の70%以上を占めてきた。表２．４に示されるように、農業総産出額における家畜と農作物の比率は、1990年で73対27、2000年では85対15である。1995年以後の農作物生産の減少にもかかわらず、家畜数が増加して家畜生産高が上がり、その結果、農業総産出額は増加している。農作物用の土地耕作の機械化は、国の多額な補助金なしではもはや存続できないこともあり、1990年代に約50%減少した。

表３．１　モンゴルの種類別家畜数（千頭）

年	総数	内　訳　(%)				
		ラクダ	馬	牛	羊	山羊
1970年	22,574.9	2.8	10.3	9.3	59.0	18.6
1980年	23,771.4	2.5	8.4	10.1	59.9	19.2
1990年	25,856.9	2.1	8.7	11.0	58.3	19.8
2000年	30,227.4	1.1	8.8	10.2	45.9	34.0
2001年	26,075.2	1.1	8.4	7.9	45.8	36.8

出典：NSO　各種

[1] NSOの定義によれば、ラクダ、馬、牛、羊、山羊の頭数の羊換算係数は、それぞれ5.0、7.0、6.0、1.0、0.9頭、牛換算係数では、1.5、1.0、1.0、6.0、8.0頭である。これらの係数は様々な年の税金を目的として作られているため、必ずしも一致していない。

４－２　主要な家畜製品及び畜産加工業

モンゴルの主要な家畜生産品は、肉、肉の副産物、乳、乳製品で、これらは人々の主食であるとともに、多くの食品産業へ回されている。また、ウール、毛、カシミヤ、皮は国内の畜産加工業へも多く出荷されている。これらの産業で過去10年間製造量が減っていることから、原材料の大部分は現在、加工されずに輸出されている。

この産業の発達は、肉、乳、羊毛、カシミヤ、皮など、畜産部門で作られる豊富な原材料加工産業の設立で始まった。フブスグル県ハトガル村に最初の洗毛工場ができた1933年12月に始まり、また、1934年には洗毛工場、皮なめし工場、靴・フェルト工場からなる工業団地や２基目の発電所がウランバートルに作られた。その他にも、肉・乳製品工場、繊維工業、カシミヤ加工工場、絨毯・毛布工場、紡績・ニット工場、皮加工・皮の服飾品・皮小物など、多くの新しい企業が作られて拡大し、加えて、既存の企業も近代化し拡張した。

A．肉類と乳

毎年、平均して年初の家畜数の約25%にあたる750万頭が消費用に屠殺される。これは、肉にして25万～30万トンである（表４．２）。羊肉が45%、牛肉が35%で全肉類の大部分を占める。馬やラクダの肉はモンゴルではあまり一般的でなく、食されるのはたいてい冬の間である。冬期は気温が－15℃～－30℃に下がるため、遊牧民世帯や都市の住民は、通常、冬の間の食料としていろいろな種類の肉を保存している。

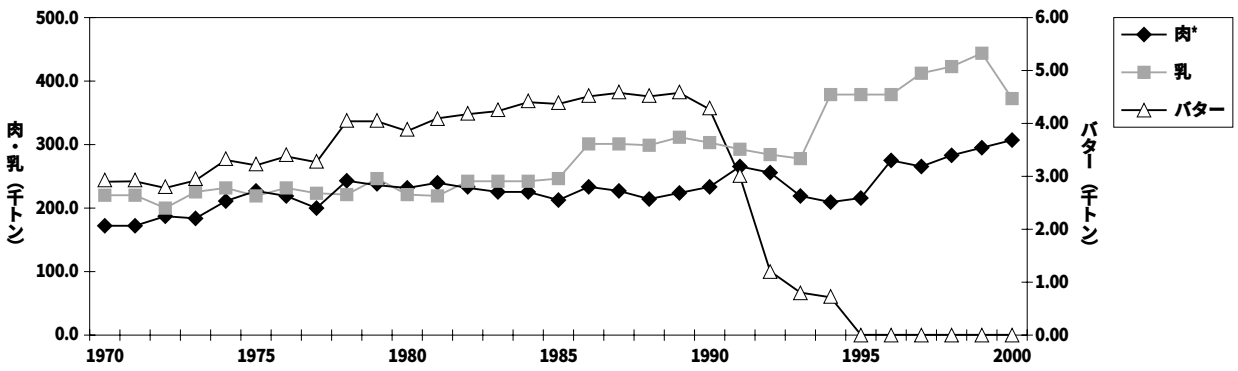
モンゴルでは、一般的な製品の配送方法と違った、加工工場や屠殺場への肉の調達方法が発達し、今も行われている。国土が広く、適切な輸送網が国内にないため、加工工場は、肉の調達のために色々な輸送手段を使うことができない。そこで、工場側は通常、冬の間に体重を減らして価格の最も落ちた春に、生きている家畜の重さを基準にして買い、家畜は秋に遊牧民によって工場に持ち込まれる。移動距離にもよるが、この間約３～４ヶ月かかり、家畜は夏の間に体重を増やす。群れは、家畜の種類と大きさによって、３～５人の遊牧民に伴われる。遊牧民は移動中に増えるであろう体重の総量と、余分に増した重さに対する率について、購入する工場と契約を交わす。家畜の種類と通常食べる草の場所によって、肉となった後の重さは、生きて

表４．１　モンゴルの農業総産出額　（1970－2000年）

	1970年	1980年	1990年	1995年	1999年	2000年
	1993年の不変価格（億トグリク）			1995年の不変価格（億トグリク）		
合　　計	695	748	1,093	1,028	3,212	2,563
家　　畜	584	611	793	878	2,825	2,189
農　作　物	111	137	300	150	387	374
			割	合（%）		
家　　畜	84.0	81.7	72.9	85.2	89.8	85.4
農　作　物	16.0	18.3	27.1	14.8	10.2	14.6

出典：「モンゴル統計年鑑」各年

図４．３　モンゴルの家畜の肉・乳製品生産の推移（1970－2000年）



*注：屠殺された後の重さ

表４．２　種類別肉製造（屠殺後の重さにして千トン）

年	合計	内　訳				
		ラクダの肉	馬肉	牛肉	羊肉	山羊肉
1970年	179.4	5.8	26.1	51.7	79.1	16.7
1980年	225.6	9.7	29.5	70.6	94.3	21.5
1990年	240.8	11.6	30.7	66.2	107.6	24.7
2000年	310.6	NA	NA	113.4	120.0*	

出典：NSO　各種
注*　羊肉と山羊肉の合計

いるときの42～50%となる（NSO、2000）。現在、モンゴルには主要な肉加工工場が12あり、様々な種類の肉を生体重にして年間50,300トンさばくことができる（TCI、2001）。

言うまでもなく、モンゴルではこれまでどんな種類の生肉も消費用には輸入されていない。その代わり、有機飼育の肉や乳製品を輸出できる可能性がある。表４．３に1970～2000年のモンゴルの肉及び肉の副産物の輸出を示した。1970年代から1980年代にかけて、モンゴルは生きた家畜に加えて、46,000トンの肉を輸出したが、全て旧ソビエト連邦への輸出であった。1992年までに、20,000～76,000頭の馬を含む、20,000～50,000トンの生きた家畜が輸出されたが、国内の肉生産者からの強い圧力や、支払いの問題などのため、生きた家畜の輸出は中断された。

1995年に輸出された肉は、わずか2,200トン、ピーク時の1980年に比べて20分の１である。しかし、その後、肉の輸出は回復し、2000年には16,700トンとなり、大部分がロシアやカザフスタンへ輸出された。その間、腸の輸出はあまり大きな変化をみせていない（表４．３）。

現在、モンゴルの肉加工工場の能力では、年間６万トンの肉を輸出できる（TCI、2001）。しかし、ホルモン剤を使用していないモンゴルの有機肉は国際市場で需要が高いにもかかわらず、生産物の貿易に必要な国際基準と条件に見合うようにするための国内の「インフラ」がないため、未だに輸出市場が拡大できない。障害になっているのは、品質管理と生産物の保証に関する国際的に認可された検査機関がないこと、国内の動物健康管理サービスが不十分であること、冷蔵コンテナ輸送施設がないこと、そして主たる輸入国との間に、動物の健康と食品衛生保証に関する二国間・多国間の話し合いと合意がないことなどである。現在、モンゴルが動物の健康と食品衛生保証に関してお互いに合意しているのは、ロシアと中国である。

上に述べたように、有機畜産品における有利な競争力を十分に利用して、肉の品質と種類、乳製品の輸出を増やすために、国内の適切な「インフラ」をもっと整備しなければならない。WTOに加盟した1997年以降も、能力の向上、貿易相手国との交渉力の向上、適切な貿易インフラ設立の面では、十分な進歩がされていない。2001年10月のWTOの衛生植物検疫措置（SPS）に関する委員会でなされた同等に関する決定は、発展途上国が直面する貿易の主要な障害を克服する重要な第一歩であった。この決定により、衛生植物検疫措置の適用に関する協定４条の条項を施行することができるようになり、国の発展レベルに関係なく全ての加盟国に同等の措置がとられることを確約した。さらには、この条項の施行を円滑にするための適切な技術支援が、特に発展途上国が要求した場合に行われるだろうから、市場アクセスの機会が増えるはずだ（WTO、2001年）。従って、モンゴルはこのような機会やその他の資源を最大限に利用して、貿易インフラを発展させる必要がある。

もうひとつの主要な畜産品は、乳である。年間25万～35万トンの乳がモンゴルで生産されている。主なものは牛の乳で、乳の全生産量の80%以上を占め、続いて羊・山羊の乳が約10%、馬の乳が８%である。牛乳についていえば、毎年の搾乳産出高と時期もまた、品種と地域により違う。90%はモンゴル牛で、ステップ地帯で１日に平均1.9リットル、ゴビ地帯で1.3リットルの乳を出す。牛の搾乳は、ステップや森林地帯で約8.4か月、ゴビ地帯で5.3か月である。ステップ地帯では牛が乳を多く出すので、小さな家畜（羊や山羊）の乳はあまり搾られない（NSO、2000）。

乳は遊牧民世帯で消費され、世帯内で様々な種類の乳製品が作られ、また、ヨーグルト、バター、乾燥凝乳、チーズその他の乳製品の生産会社へも出荷される。このような産業は主要な都市に大きな製造工場を作っている。例えば、ウランバートル、ダルハン、セレンゲにある４つの工場では、年間１億7,310万リットルの乳を加工する。しかし、そのいくつかは、集約的牛舎の破壊が原因で乳の供給が不十分になり、現在、設置された能力の２～４%ほどしか使われていない。図４．３が示すように、1990年初期からバターの生産は減少し、工場生産が少なくなって1995年以降はほぼ中止され、国内市場へ出されるバターはほとんど輸入されている。

他方、中央計画経済から市場経済へ移行した結果、以前のような国営産業の中央集中的調達・分配制は時代遅れとなった。その結果、国内市場にしか供給しない企業の受容能力は大きすぎて市場の需要と合わなくなった。しかし、その分の市場シェアは、多くの種類の乳・乳製品を生産する小企業や、遊牧民からの直接供給である程度引き受けら

表４．３　モンゴルの肉及び肉の副産物の輸出（1970－2000年）

主要品目	1970年	1975年	1980年	1985年	1990年	1995年	2000年
肉（千トン）	20.9	35.7	45.9	36.8	24.3	2.2	16.7
腸（千本）	1,800.9	2,797.2	3,228.9	2,858.6	2,163.8	1,288.3	869.6
骨紛（千トン）	NA	NA	NA	NA	0.8	1.5	2.4
家畜（生体重として千トン）	51.0	50.2	36.1	24.7	20.8	0.0	0.0
馬（千頭）	67.5	61.8	76.3	63.1	42.3	0.0	0.0

出典：NSO「モンゴル統計年鑑」　各種

れている。大工場のスペースのほとんどは、これらの小さな単位に賃貸されている。乳・乳製品は完全に国内市場で消費されているが、企業の中には輸出の機会を狙っているものもある。

馬の乳からは、馬乳酒というアルコール含有量が少なくてビールに近く、色がミルクのように白い飲み物が作られる。馬乳酒作りの伝統は2,300年前に遡る。馬の乳に含まれるアミノ酸、ビタミン、糖分の豊富な馬乳酒は、栄養価が高く健康によく、また脂肪分が少ない。そのため、結核、消化器系の病気、薬による毒、疲労など、多くの病気の治療に使われる。モンゴルには馬乳酒を使って治療を行っている特別療養所がいくつかある。馬乳酒は今のところモンゴルでしか消費されていない。

その他の家畜の乳からは、工場や、遊牧民家庭で家庭用と販売用に、乾燥凝乳、ヨーグルト、チーズ、バターなど、いろいろな種類の乳・乳製品が作られ、夏の間、乳・乳製品は農村部や遊牧民家庭で主要な食料となる。乳製品、特に乾燥凝乳を多く摂取するため、農村部のモンゴル人は、白くて強い歯をもち、歯の病気にほとんどかからないと言われている。

B．ウール、毛、カシミヤ

家畜からとれるその他の価値ある原料として、ウール、毛、カシミヤがある。これらは１年のサイクルで再生可能な資源である。モンゴルでは厳しい冬を乗り切る手段として、自然に家畜の暖かいコート（毛、ウール、ダウン）が発達した。気温が上がり始めると、動物の下毛のダウンは自然に緩くなり、集めたり取り除いたりするのが楽になる。山羊、牛、ラクダのダウンやカシミヤは櫛で梳いて集め、羊の毛は刈って集める。

年間25,000トンのウール、毛、カシミヤが作られるが、その70%以上が羊毛である。モンゴルは中国に次いで世界で２番目に大きいカシミヤ原料の生産国で、現在、世界の供給の約20%にあたる年間3,300トンのカシミヤが作られている。カシミヤはモンゴルの主要輸出品目の一つである。

モンゴルでは1930年代の半ばからこれらの原材料を元にした加工産業が大きく発展してきた。洗毛工場、フェルトやフェルトの靴工場、絨毯製造会社、紡織・ニット工場、カシミヤ加工工場、不織布工場である。しかし、カシミヤ産業を除くと、現在は設置された受容能力のうちのわずかしか使用されていない。

表４．４は、1970～2000年までのこの産業の主要な商品である。肉・乳製品産業と同じように、1970年代から1980年代に生産レベルのピークを迎え、1990年代の初めに大きく落ち込んだ。例えば、紡績糸と毛織物の生産は、1997年には1989年のピーク時に比べて、それぞれ22分の１、244分の１に落ちている。洗い上げ羊毛や毛織物の生産は多少持ち直したとはいえ、本当の回復にはまだ時間がかかる。

それでも、国際市場の中でのカシミヤやカシミヤ製品への需要は高く、品質が高いことから、カシミヤ部門はこの産業の中で唯一、移行期の困難を切り抜けることができた。1975年、UNIDO（国連工業開発機構）の技術支援を得て、最初の試験的カシミヤ加工工場が作られ、1981年には、日本の技術・資金援助で、カシミヤ原料やラクダの毛の加工から様々な完成品の製造まで、生産の全過程にわたる製造工業団地が操業を開始した。1990年代にはこの部門に国内・海外の投資家が集まり、2001年現在、国内から５つ、合弁で77の事業体が営まれ、そこでは50%以上の過剰設備（国内で使用される量と比較して）がカシミヤ原料の洗い上げ及び毛を梳く過程に利用された（MIT、2002）。

遊牧民、カシミヤ業者、製造者の間の連絡を密にするために、昨年、USAID（米国国際開発庁）基金による共同事業の一環として、カシミヤの取引と競売が南部の２つの県で行われたが、今年もさらに４回開催される予定である。この主導権は、原料集約システムを作り直し、適切で新しい市場経済へ移行させるよいスタートとなるだろう。さらに、交渉過程における価格プレミアムや品質による値引きなどで、遊牧民は扱う原料の品質に対して意識や関心を持ち、適切に取り扱うようになる。このようなことから、現行のカシミヤに対する単一価格方式は、次第にこの産業が持続するのに不可欠な品質基準に基づく相場に移行すると思われる。

表４．４　モンゴルのウール・カシミヤ産業における主要生産品目（1970－2000年）

主要品目	1970年	1980年	1985年	1990年	1995年	2000年
紡績糸（トン）	NA	NA	2,722.5	2,285.4	344.9	40.8
毛を除いたカシミヤ（トン）	NA	NA	198.5	240.1	420.8	450.9
ラクダの毛布（千メートル）	NA	NA	84.9	91.2	19.4	28.5
洗い上げ羊毛（千トン）	9.8	11.8	11.3	9.7	1.2	1.4
絨毯（千平方メートル）	6.6	464.4	1,585.6	1,971.2	595.7	704.8
ニット商品（千個）	157.4	1,134.0	2,824.7	4,248.6	522.7	1,233.5
フェルト（千メートル）	550.2	614.6	623.9	745.1	76.5	113.9
フェルトの靴（千足）	394.2	465.8	452.2	588.5	79.0	34.0
毛織物（千メートル）	623.7	963.5	1,432.5	1,111.3	71.1	21.0

出典：NSO「モンゴル統計年鑑」　各種

1970～2000年のモンゴルのウール・カシミヤ産業の主要な輸出品目が表4.5である。カシミヤと羊の毛は、原料と半加工品の両方を含む。カシミヤは、この部門だけでなく国の主要な輸出品目で、モンゴルは世界で２番目に多く輸出している。モンゴルで生産されるカシミヤの多くは原料及び半加工品の形で輸出されている。原料及び半加工品は、カシミヤの繊維を使った完成品の価格に比べて国際市場において価格の変動が大きいことから、輸出による収入は非常に不安定である。2000年には1,500トン、7,700万ドル相当のカシミヤが輸出された。これは国の総輸出額の16.5%に当たる。主な輸入国はイタリア、イギリス、中国、日本である。日本へのカシミヤ輸出は、2001年で約900万ドル、前年比2.3倍であった（NSO、2002b）。

この部門のその他の輸出品は、羊毛、馬のたてがみ、ニット製品、毛織物、ウールの毛布、絨毯である。けれども、これまで述べてきたような理由により、1990年代初めから、このような商品の製造は減少し、輸出はほとんどなくなった。加えて、近隣諸国がウール製品に高い輸入関税（50%以上）を課したことから、輸出高も変わっていない（GOM、2000b）。唯一、羊毛だけがこの間を通して比較的安定した傾向を示し、2000年には5,200トン（脂付及び洗い上げウール）が輸出された（表４．５）。

C．皮革

家畜の皮もまた、消費者向けの高級品を作る貴重な資源であり、消費のために屠殺される家畜からの副産物でもある。

消費用に屠殺される家畜数を元に計算すると、毎年約650万～850万頭分の皮がモンゴルで生産されている。このうちの80%以上が羊と山羊の皮である。ほとんどは加工産業または輸出に出され、遊牧民家庭でも使われる。昔から羊の皮は冬の暖かいコートや床の敷物に使われ、馬用の装飾品は牛の皮で作られる。

1930年代以降に皮革産業が発展する過程で、皮の材料を完全加工する十分な能力が国内に導入された。最近の近代化・改革のお陰で、皮革産業の技術レベルはおおよそ世界の平均に匹敵している。ウール・カシミヤ部門と同様、この部門の発展は技術の横のつながりを特徴としている。皮の準備加工工場、靴の上部・内張り・底のなめし皮工場、皮の服飾並びに皮小物類の製造会社、靴製造工場、毛皮と皮加工工場の入った工業団地が、ウランバートルに作られた。加えて、皮の断片を縫い合わせる縫製工場や膠製造会社、合成皮革工場など、製造過程で出される捨てる部分や断片を活用する付属工場も建てられた。ブルガリアの協力で羊の皮商品製造複合施設がダルハン市に作られ、他に靴製造工場がザブハン県に建てられた。

ウランバートルにある皮革製造複合施設の最初の発展は、旧チェコスロバキアの技術支援により行われた。旧ユーゴスラビアとの協力により1,100万ドル以上を投じて、1988年、皮の服飾品や小物類を作る新しい工場が操業を開始した。この工場に導入された設備機械は西欧の製造会社から仕入れ、当時の最新鋭技術が使われたため、工場から作られる製品の90%以上を、最も敏感な西側市場を含む、広い範囲に売り出すことに成功した。主な市場は、フランス、ドイツ、スイス、旧ユーゴスラビア、また旧欧州経済相互援助会議諸国である。日本へもまたいくらか輸出された。

イタリアの技術を受けた製造ラインが靴工場に導入され、一方、1990年代の半ばにイタリアと協力して進められた事業により、ウランバートルの牛皮なめし工場の大がかりな改築が行われた。工事は全て完了したが、事業は当初計画されたほどの成功を納めなかった。1,700万ドル相当の事業費が費やされたが、そのうちの15%はモンゴル政府からの直接投資、残りはイタリア政府に支援されたイタリア商業銀行からであった。しかし、製造が不安定だったため、工場は負債の返済ができなかった。この失敗の原因は、これまで述べてきた他の産業における失敗の背景となった原因と同じである。

モンゴルの皮革産業の製造パターンは表4.6の通りである。全体的に見て、皮革産業は1990年の移行期の打撃を最も受けており、今も回復が待たれる。1990年には420万足の革靴と30万着の皮の服飾品が作られたが、2000年にはそ

表４．５　モンゴルのウール・カシミヤ産業の主要な輸出品目（1970－2000年）

主要品目	1970年	1980年	1985年	1990年	1995年	2000年
ラクダの毛（千トン）	3.2	3.0	2.6	1.9	0.9	0.8
カシミヤ（千トン）	0.9	1.2	0.6	0.4	0.6	1.5
羊毛（千トン）	10.1	10.8	7.7	3.3	14.9	5.2
馬のたてがみ（千トン）	0.9	0.7	0.6	0.5	0.4	0.2
ニット製品（千枚）	0.0	45.1	252.6	298.9	570.3	3,393.5
絨毯（百万平方メートル）	0.0	0.4	1.5	1.7	0.0	0.1
毛織物（千メートル）	230.3	31.9	34.6	0.0	0.0	0.0
ウールの毛布（千枚）	37.6	330.8	313.9	336.4	20.5	4.5

出典：NSO「モンゴル統計年鑑」等

れぞれ5,600足、200着に減少した。それに応じて、1990年にはこれまで最高の151万㎡作られた羊のなめし皮は、2000年には4,600㎡に、山羊のなめし皮は41㎡から800㎡に減っている。

他の産業部門同様、これまで述べてきた様々な移行期の問題が、モンゴルの皮革産業の衰退を招いた。さらに、酒、タバコ、乗用車などの物品税の対象となるいくつかの品目を除き、1997年５月１日、モンゴルは一方的に一般輸入関税をゼロにした。それまでは、定率で15%が全輸入品目に課せられていた。この措置もまた国内産業に大きな打撃を与えた一因で、安価で必ずしも品質の高くない輸入品が国内市場を圧迫した。結果として、輸出において皮革完成品はすべて皮原料に代わった（表4.7）。けれども、輸入関税は以前よりも低率になって1999年に再導入された。（1999年７月１日から５%、2001年１月１から７%、2002年１月１日から５%で施行された）。

５．家畜と環境

５－１　牧草地と家畜

広大で種類の多いモンゴルの牧草地は、家畜の飼育に非常に適し、2,600ある植物種のうちの600種類以上が家畜の好む草として主な飼料源となっている（GOM、2001）。モンゴルの牧草地は1980年から2000年に4.9%広がって12,940万ヘクタールを占めたが、1950年のレベルからは８%減少している。国を挙げた農作物の耕作計画が1959年に始まり、120万ヘクタールの農作地が作られた。しかし、経済の移行が始まるとともに、この部門に対する国の助成金がなくなり、農作物の栽培は激減した。現在、年間の農作物栽培に利用されているのは、1980年代のレベルの４分の１、土地の20～30%にしかすぎない。

2000年の家畜総数は1970年から760万頭、33.9%増えて3,020万頭である。1999年の3,360万頭が過去最高である。牧草地帯が減少し、家畜の数が増加した結果、１頭あたりの家畜に与えられる牧草地の広さは、1930年の6.2ヘクタールから2000年の4.3ヘクタールに減少している。ただ、2000～2001年の厳冬期に膨大な数の成長した家畜が死んだことから、家畜数は2001年に2,610万頭にまで減っている。

モンゴルの過酷な大陸性気候と季節パターン、さらに広域家畜飼育経営の牧畜の性格上、各群れには広い牧草地が必要である。羊と山羊は、通常、遊牧民の住居に近くの牧草地に一緒に放され、一方、牛、馬、ラクダの群れは遠くの場所に別々に放牧される。遊牧民の住居の周辺では、子供の家畜が育てられる。家畜に幾種類もの天然の牧草を食べさせるために、遊牧民は草と水のある場所を求めて年に数回、移動しなければならない。さらに、近隣の遊牧民家族との間で、毎日、同じ牧草地を区分けしたり持ち回りで回転させたりしている。学者によれば、「季節ごとの利用と牧草地の区分けの方法論は、何世紀にも渡り形成されてきた伝統と経験からなるモンゴルの選択である」（Adyasuren、2000、p.4）。加えて、年間及び日中の気温の変動が著しく、植物がよく成長する時期が比較的短い（標高と位置により80～130日）モンゴルのような地域では、輪作制度という土地管理は、与えられた土地の生態学的能力値を超えずに最大の成果を得る唯一の方法である（Batjargal、2000）。

そのようなわけで、各遊牧民家庭は、通常、冬、春、秋に利用する場所をいくつか持ち、それぞれ保護施設、囲い、干し草やその他の施設を備えている。施設の建設には一般的に木が使われる。施設は数年にわたって利用されるため、遊牧民は夏の間、施設の周りの牧草地を使わないので、自然に牧草地が保護され、翌年、確実に利用できる。遊牧民家庭はひと夏に数回場所を変えるが、事前に場所を確保す

表４.６　モンゴルの皮革産業の品目別製造量の推移（1970－2000年）

主要品目	1970年	1980年	1985年	1990年	1995年	2000年
底革（トン）	1,300.0	1,400.0	800.0	1,000.0	0.0	0.0
羊のなめし皮（千平方メートル）	NA	1,209.5	1,491.6	1,510.5	193.5	4.6
山羊のなめし皮（千平方メートル）	NA	178.0	331.1	418.4	35.9	0.8
革靴（千足）	1,621.5	2,104.9	2,883.4	4,222.5	245.5	5.6
革服飾品（千着）	47.9	269.9	357.2	300.2	31.6	0.2
羊皮のコート（千着）	NA	83.0	135.2	138.1	16.8	1.0

出典：NSO「モンゴル統計年鑑」　各種

表４.７　モンゴル皮革産業における皮原料その他の品目別輸出量の推移

主要品目	1970年	1980年	1985年	1990年	1995年	2000年
牛皮（千着）	NA	NA	NA	47.7	309.6	1,058.5
馬皮（千着）	12.1	65.0	58.0	105.2	70.0	276.3
羊皮（千着）	5.1	261.0	280.2	130.0	2,004.3	2,640.0
山羊皮（千着）	4.2	315.1	526.2	113.2	361.4	110.5
山羊のなめし皮（千着）	224.6	175.0	236.6	172.0	0.0	0.0
羊のなめし皮（千着）	394.6	123.1	411.0	24.1	0.0	0.0
皮の服飾品（千着）	14.2	54.7	321.5	87.0	0.8	0.0

出典：NSO「モンゴル統計年鑑」　各種

ることはない。原則として、遊牧民の住居に使う場所は、次の場所へ移動する前に完全に取り払われる。夏の囲い込みの構造は、他の季節よりずっと簡素である。前に述べたように、通常、遊牧民は夏期にはいくつかの遊牧民家庭が小さな遊牧民集落を形成するという遊牧民集落型の労働配分を行う。

牧草地の管理は、通常、地域内の特定の場所にいる遊牧民の間でのお互いの理解と合意に基づいているが、地域を越えた移動も例外でない。大きな市場に近い地域は、家畜が集中して土地を荒廃させ、過剰利用の傾向にあるという警告がある。しかしながら、地元や海外の専門家が言うように、各遊牧民に牧草地を個人所有化させるという考えは、むしろ奇妙な解決策である。現状の牧畜形態が続きながら、牧草地が共有されなければ、国内の牧草地の総面積は、１つの群れに最低限必要な牧草地のレベルにさえ達しないだろう。その他に、定住型の集約的家畜農場経営への移行も提案されている。このような転換は過密地域（すなわち大都市の近く）には最適かもしれないが、全ての家畜農場をこういう方法に完全に移行することは、非現実的で採算が合わない。

まず、集約的家畜農場に必要なインフラや初期投資、運転費は、広域牧畜飼育にかかる費用よりもずっと多い。助成金がなければ、全ての家畜生産品の価格が上昇することになる。次に、今の家畜が定住スタイルの農場に慣れるには、品種改良と交配に長い年月を要する。また動物心理学も十分に扱われなければならない。モンゴルでは、この分野の動物科学はまだ立ち遅れているが、経験を積んだ遊牧民は自らや先祖からの経験で、そういう知識をもっている。三番目に、最も重要な側面は、モンゴルの畜産品がもつ生態学的優位性がなくなり、この産業が競争上の利点を失うことである。モンゴルは地球上で唯一、広域牧畜飼育が発展し持続可能な国であることに議論の余地はない。問題の大部分は、バランスの取れた地域開発に向けた適切な政策はもとより、遊牧民の居住地における生産活動を機械化するために、インフラを整備し、近代的な小規模生産方法と技術を導入することにより、より良い解決ができる。

モンゴルの畜産の牧畜的性格上、厳冬と干ばつ、特に「ゾト」と呼ばれる干ばつの後に続く厳しい冬のような自然現象に極端に弱い。これは牧畜業にとってもっとも大きい損害である。この意味から、地球温暖化や気候の変化に伴う因果関係は、モンゴルの牧畜業に大きく直接的な影響を与える。

家畜を支える牧草地は天候状態に大きく左右される。最も寒い時期は１月で気温は－31.1℃から－52℃まで下がり、７月には28.5℃から44℃まで上昇する。降水量は少なく、年平均で200～220ミリである。干ばつはゴビ地域で２～３年おき、その他の地域で10年に１度起きる（GOM ＆ UNDP、2000）。1944年と1972年には、全国的な干ばつに襲われている（MFA、2001）。

家畜は夏の間に栄養をとって太り、秋に最も体重が重くなる。冬から春の初めにかけて、気温の低下、新鮮な草の欠乏、雪、吹雪や風塵、強風のために体重を落とすため、生き残りは夏と秋の間に蓄える体重とエネルギーの量に大きく関係する。モンゴルの家畜は、長年の間に自然淘汰と品種改良によって、こういう気候条件に適応している。

データによれば、モンゴルでは普通の年で、年間、家畜総数の４％にあたる平均80万～100万頭の成畜が死亡している。このほとんどが悪天候が原因である。ゾトのような極端な天候状態では、総数の割合からみた牛と馬の死亡率は他の家畜よりも高いが、家畜の種類が違っても、死亡率は非常に似た傾向を示すというデータがある。成畜の死亡に加えて、子供の家畜もまた自然現象の悪影響を大きく受けている。

５－２　近年のゾトの影響

気候変動の結果、近年、モンゴルではゾト、干ばつ、強風、洪水などの自然現象が頻繁に起きるようになった。2000年から2001年にかけてゾトが２年連続で起き、2000年には350万頭、2001年にはさらに深刻な480万頭の成畜が死亡した。これは2000年の国内家畜総数の11.5%、2001年の18.2%に相当する。その年の初めの家畜総数を基準にすると、それぞれ10.4%、15.7%である（NSO、2002b）。

2000年の秋は、平年よりも早く雪が降り、国土の90%以上が例年の同時期よりも深く雪に覆われた。13県内の158ソム（村）の70％以上がゾトに見舞われた。遊牧民約2,400世帯が全ての家畜を失い、生き残った家畜の数が100頭以下になったのは１万世帯以上にも上った。失った家畜の被害額は917億トグリクである（MFA、2001）。

2001年のゾトは前年に比べて見舞われた範囲が広く、気温の低下も著しかった。このゾトで7,400世帯が家畜を全て失い、13,300世帯が所有する家畜の50%以上を失った。ある調査では、これらの損失の74.3%は飼料の不足が原因であるという。全損失数の割合は、牛と馬が最も大きく被害を受け、2001年には成育した牛の49.2%、馬の20.5%が死亡し、同じく2000年はそれぞれ20.3%、14.8%である（MFA、2001）。

成獣や子供の家畜の死亡に加え、その他にも子供を産まない雌や流産などのマイナス要因が2000～2001年の家畜総

数の減少を招いた。例えば、子供を産まない雌は、2000年に150万頭、2001年には140万頭、また流産はそれぞれの年で120万頭と100万頭である（NSO、2002b）。このようにして農村部に貧困が広がっていった。さらに、農業生産の減少、それによる家畜生産の減少により、2001年のGDP成長は1.1%で、この生産の減少がなければ、10.0%であったと推定される（BOM、2002）。

このような状況から、ゾトの影響を防ぎ最小限に抑えるためのモンゴル政府の積極的な対応が求められる。実際、政府は現在この問題に注目し、家畜の群れを保護し、ゾトのような自然現象からの損失を防ぐための総合的な対策を考え、投入している。また、家畜をもとにした原材料加工産業の回復にも焦点を合わせている。

それに応じて、モンゴル政府は国内予算を転用し、国際機関や日本などの援助国から割り当てられる資金その他の資源を積極的に活用するなど、数多くの畜産部門支援策を行っている。しかし、国の限られた財政力では、１国でこの問題を完全に解決することは明らかに不可能である。この状況は、計画経済から市場経済への移行期に関連する内外の要因から起きる経済不況により、一層追い討ちをかけられている。

そのために、家畜の群れを保護し、ゾトのような自然現象からの損失をなくすための総合的対策を打ち立て実行することを目的とした、共同の先導的取り組みを始めるにあたって、国際機関、援助国、その他関係団体との協力が必要である。こうした取り組みの目標としては、この他にも遊牧民家族を支援することや、厳しい気候条件によって起きる問題に対して防衛手段をとったり、また、このような問題が起きたときに対処したりするための国家の能力を向上させることがある。

６．結論

家畜は再生可能な食料と消費物資を供給し、モンゴルの経済に大きな役割を果たす。また、国内人口の半分以上の生活を直接支えている。家畜をもとにした原料加工はモンゴルの主要製造産業で、大きな輸出収入源の１つである。しかし、家畜の牧畜的性格は自然現象に極端に弱い。

家畜の重要性に鑑み、モンゴル政府はこの問題に大きく着目し、家畜の群れを保護し、ゾトのような自然現象からの損失をなくすための総合的対策を立てて実行するために可能な限りの方策をとっている。ゾトやその他の自然現象による家畜の死亡防止策を促進するため、次のような対策を立て、実行することが考えられる。

⑴　気象予報と分析の改善、孤立した地域での情報網の拡大
⑵　自然に起きる気象現象への対応に応え、緊急の対策を立てる能力の強化
⑶　飼料生産設備の働きを回復し向上させる
⑷　孤立した地域に、再生可能なエネルギー源を備えた牛の飼育農場を作る
⑸　牧草地管理と動物の寄生虫を予防する獣医による支援の向上

など。

21世紀の畜産部門発展の基本的な改革が、モンゴルの大きな課題である。しかし、単純に伝統的な家畜放牧の形態よりも、定住スタイルを勧めることは決して最良の解決法ではない。とりわけ情報通信技術の分野における世界的な経済発展と技術の向上のお陰で、遠隔地はもはや取り残された場所ではない。ゆえに、家畜の放牧に新しい見方をもたらすための適切な方針と積極的な技術の導入により、よりよい見通しが与えられる。

この先50年間の経済的、環境的、社会的変化とチャレンジは、これまでの50年とは全く違うものになるであろう。それゆえに、モンゴルの経済発展の戦略は、この傾向に合わせ、持続可能な発展へのビジョンを元にしなければならないことは疑いの余地がない。

発展の戦略は、モンゴルの経済を現在の「膠着」状態からより進んだ持続への道への移行を進めることを目標にし、同時にこのような変化に対する障害を明らかにし、きっかけの可能性を見つけなければならない。1999年に、MAP-21（21世紀に向けたアクションプログラム）といわれる21世紀におけるモンゴルの持続可能な発展への計画が発表された。これにより次世代の発展戦略の展開に大事な基礎を築かれたとはいえ、この先も、今のダイナミックな地球環境における持続可能な経済発展への具体的な目標を立てつつ、計画の修正や定義の見直しをすることが必要である。

Small-Scale Energy Development in Northeast Asia: Experience, Prospects and Social Implications of Solar PV in Mongolia

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The priority for small-energy development in many cases is economic growth and the alleviation of poverty. As of today, one-third of the world's population has no access to commercial energy. Many live in low-income developing countries, including some in Northeast Asia.

Small-scale energy development may play a key role in the eradication of disparities in standards of living, per capita electricity consumption, access to information and modern communications, and medical and educational services. On the other hand, it is necessary to develop renewable energy resources. The development of small-scale energy systems may play a part in increasing social stability. Government subsidies, incentives encouraging the utilization of renewable energy sources and the inclusion of these in the national energy policy portfolio are needed.

This paper looks at the utilization of solar PV (photovoltaics) in Mongolia as an example of small-scale clean energy.

1. Introduction

The priorities for small-scale energy development in many cases are the support of economic growth and alleviation of poverty. At present, such as the 40% or so of the Mongolian population that currently has no access to electricity.

Small-scale energy development may play a key role in the eradication of disparities in standards of living, per capita electricity consumption, access to information and modern communications, and medical and educational services. On the other hand, it is necessary to develop and use renewable energy resources, including solar energy.

2. Renewable energy sources

Wind energy: In Mongolia, the wind blows anywhere and at any time. The potential reserve of wind energy is 836.8 billion kilowatt hours (kWh), with an average possible utilization period of 3,500-4,600 hours each year. An average wind velocity of 4-5 m/s prevails in the southeastern part of the country, covering 60% of the territory with a wind energy reserve of over 100 Watts per square meter (W/sq. M).

There are 52 soums[1] in this part of the country, where 100-150 kW wind turbine generators could be installed. Some projects for evaluating wind generators operating in tandem with existing diesel generators or the grid network are under consideration.

Smaller 50W windmills manufactured by the domestic company Monmar Co., Ltd. are available for 167,000 togrog (MNT)[2], for use in pastoral livestock farming, but not in sufficient quantity. 3-5 kW windmills have been approved for use in activities involving greater consumption, such as water pumping and powering some facilities at summer settlements. Winter settlements are usually established on windless, sunny sites. The publication of the Wind Energy Atlas of Mongolia by the National Renewable Energy Laboratory (2001) of the U.S. Department of Energy will be very useful for designing wind power generators.

Solar energy: Mongolia, the "Land of Blue Sky", enjoys more than 260 sunny days a year, typically between 2,250 and 3,300 hours each year. There are no more than two consecutive days without sun. Its average altitude of about 1,600 meters above sea level provides comparatively favorable conditions for the utilization of solar energy (Tsegmid 1969). It is estimated that the southern part of the country receives on average between 4.3-4.7 kWh/sq. m of solar energy per day. Solar PV research work, which started at the beginning of the 1970s, showed that, compared with diesel/gasoline generators, PV modules are just as feasible for the purposes of powering radios, portable TV sets, lighting ger[3], meeting soum hospitals' needs, pumping water, and for radio relay transmission trunk lines. Currently about 3% of herder families use solar PV modules for lighting purposes.

Hydro-energy: In Mongolia, about 20 hydro sites have been identified, with installed capacities ranging from 5 Megawatts (MW) to 110MW. However, these are mainly situated in the mountainous western part of Mongolia, far from the central grid. Therefore, these resources would probably be expensive to develop. A couple of projects have been devised, which involve constructing hydroelectric power stations to be connected to the existing network in order to decrease the peak hour load and reduce imports of electricity from abroad. Some micro hydroelectric generators are in use at summer settlements.

Conventional ovens for cooking in and heating ger: For cooking purposes, the utilization of gas stoves with an appropriate scheme of gas provision could also be considered. Fuel (wood, coal, animal dust, etc.) fuller burning and smokeless ovens are chosen for local

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[1] Rural district in Mongolian prefectures
[2] Mongolian currency unit: MNT 1124 = US$1, as of late 2002
[3] Tent made from felt forming the traditional residence of herders

production and distribution to those living in ger. (Khuldorj 1999). On the other hand, recent proposals[4] for cooperation with Russia in the field of natural gas allow its practical use in households (cooking and heating).

Other sources of energy: Bioelectricity has been proven to be a feasible option for meeting the current and projected electricity needs of rural areas in many developing countries. There are about 50 remote villages in the northern part of Mongolia where biogasifiers could be feasible.

3. Solar PV cells and their utilization

PV systems can be installed in remote villages or homes. Solar PV cells are proven to be capable of converting 15% of incident solar energy into electricity. Their modularity enables them to deal with loads ranging from a few milliwatts to several megawatts. Solar PV could be the energy technology of choice for many households, hospitals, schools, farmers, and telecommunications companies. Home PV systems are most economical in remote locations and can be used to power lights or small appliances such as radios/TV sets. A 50W solar PV system provides approximately 10 to 15 kWh/month to a household.

PV systems can be used to power vaccine refrigerators, sterilization equipment, emergency radios and other critical loads, lighting and computers. The cost of PV modules per watt of generating capacity has decreased from $15 in the mid-1980s to around $4 today. There has been a rapid expansion in sales of household PV systems, with nearly a half a million installed in developing countries (World Bank 2002).

The use of PV systems results in improved quality of life through access to such services as education, medical care, and information to support small business development. The provision of lighting is the biggest incentive for rural households to introduce PV systems. A typical 50W solar PV system for household use offsets about 400 kg of CO2 emissions annually (World Bank 2002).

Larger PV systems are used in remote areas to supply power for telecommunications and decentralized drinking water supply systems. Water supply ranges from as little as 0.3 liters per day for drip irrigation to over one thousand liters per day for a village water supply. Both residential and community use of PV can be promoted by such mechanisms as government subsidies. One example of this is the special program implemented in Japan, which subsidized the installation of grid-connected 3.5 kW PV systems in homes. (NEF 2002)

4. Pastoral livestock farming in Mongolia

Animal husbandry based on natural pastureland plays an important role in the Mongolian economy. The problem of electricity supply is the main obstacle to operating wells and increasing water supply. The country's 26 million livestock are farmed in the traditional pastoral way. About a third of pastures (total 129 million hectares) are not being used because of a shortage of water, putting a pressure on the pastureland that is utilized. Of the 24,600 wells built in the period up to 1991, only 8,200 were in operation in 2001 (Table 1). In the husbandry sector, about 185,500 families were engaged in producing primary livestock products, of which, only about 13% had access to electricity in 2001.

Table 1. Some Social Indicators of Herders in Mongolia

	1991	2001
Number of herders	245,000	407,000
Number of herder households	114,900	185,500
Number of herder households with electricity	12,300	24,800
Number of wells	24,600	8,200

Source: National Statistical Office of Mongolia (2002) Mongolian Statistical Yearbook 2001. Ulaanbaatar: NSO.

As a result of the loss of herds during "zhud"[5], the number of these families decreased by 6,000 in 2001 on the previous year. The pasture around urbanized settlements such as district and province centers is practically exhausted, because herders try to keep their herds as close as possible to markets and public services. As a consequence, a large portion of the nation's livestock has been lost. Such a situation should be corrected by all possible means, including better energy provision.

Urban and rural household inequalities are also growing wider. Increased exports of livestock products and the high share of the labor force engaged in the agricultural sector (49%) mean that greater attention should be paid to the problem of supplying electricity to such families. Tables 2 and 3 demonstrate that electricity consumption in Mongolia is at about the same level as in some countries of Central Asia. However, electrical power consumption by households in rural areas is very low and they could be considered to suffer from "energy poverty". The lack of a reliable electricity supply to herder families causes problems. Many families are completely without information about weather forecasts, markets and news due to the lack of power supply. Access to clean water sources is also limited, while the health and education services in remote areas are inadequate.

1) Use of solar PV for pastoral livestock farming

Mongolia's geographical and meteorological characteristics ensure that PV is the first choice in terms of renewable energy sources for use in pastoral livestock farming. Tests of PV modules designed to ascertain herding families' minimum demand for electricity showed that a

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[4] Joint communique on the official visit of Prime Minister Mikhail Kasyanov of the Russian Federation to Mongolia, April, 2002, Ulaanbaatar, Mongolia, www.extmin.mn/kasianovCV.htm (30 May 2002).

[5] If the "zhud" natural disaster in 2000 resulted in a 10% loss from 33 million herds, then the one in 2001 will mean a 15% loss from 30 million herds. However, the reasons for these losses differ from one case to another. Herds die because of a shortage of feed or no access to dry grass, due to heavy snow fall on pastures covering large areas, or a lack of snow, which is a source of water (black zhud), and/or an extremely low temperature. Losses will also be incurred if there was a drought the previous summer.

Table 2. Electricity Production and Consumption in Mongolia

	1990	2001
Total resources, million kWh	3,576	3,213
Consumption, million kWh	2,719	1,948
-Agriculture, million kWh	116	17
-Communal housing, million kWh	349	476
Total population, million	2.0977	2.4425
-Urban population, million	1.1957	1.3971
-Rural population, million	0.902	1.0454
Electricity produced per capita, kWh	1,664.0	1,235.0
*Electricity consumed per capita, kWh	948.7	797.5
*Household electricity consumption per capita in urban areas, kWh	291.9	340.7
*Household electricity consumption per capita in rural areas, kWh	128.6	16.3

Source: National Statistical Office of Mongolia (2001), (2002) Mongolian Statistical Yearbook 2000 and 2001. Ulaanbaatar: NSO
* - derivative data

Table 3. Electricity Consumption in Some Countries (1999 data)

Country	Population, million	GDP, billion US dollars (1995)	Electricity consumption, kWh/capita
China	1,260.32	1,112.84	936
Mongolia	2.40	0.90	1,253
Kyrgyz	4.87	4.14	1,585
Turkmenistan	4.78	4.63	1,319

Source: International Energy Agency (2001). Key World Energy Statistics from the IEA 2001, Paris: OECD.

system of around 50W PV is economically feasible compared with gasoline generators. Feasibility analyses have also been carried out on other PV applications in pastoral livestock farming (Galbaatar and Nachin 1982).

The feasibility of PV use in ger has also been confirmed by research carried out by international organizations, including UNDP and NEDO (New Energy and Industrial Technology Development Organization), Japan. Based on the results of these tests, a project to construct a solar PV module assembly plant was drafted. This was later approved and 0.5MW PV modules can now be produced domestically. The products from this plant were primarily designed for installation on radio relay transmission trunk lines atop mountains. The government of Mongolia has announced the "100,000 solar ger" project (GOM 1999). Under the project's first stage, solar PV systems were installed in 826 herder homes, with 409 of those systems being capable of receiving TV broadcasts (GOM 2002).

2) PV modules for lighting ger

12W, 24W and 55W PV systems containing an automotive battery with a capacity of 30-70 Ampere hours (Ah), an electronic block to prevent overcharging /deep recharging, and a daylight tube have been designed for lighting ger. Installation costs range between 175,000-347,220 togrog or US$150-300. While 5,100 herder families are considered to have access to electricity, equipping the remaining 180,400 families would cost between US$27 million and US$54 million.

3) PV modules for soums

Currently there are about 200 soums that still have to use diesel generators because they are not yet connected to Mongolia's central electricity grid. Most of these diesel generators (each soum center has 2-3 diesel generator sets with a rating of 100-200 kW) run for a limited period of time, usually between 18:00-23:00, in order to save fuel. Annually, the central government provides about 5 billion togrog (US$5 million) of subsidies to run these generators. Since these diesel generators operate in the evenings, the installation of PV systems in high-priority public service facilities, including hospitals, schools, post and telecommunications offices, and water pumping units is needed.

4) PV modules for hospitals and schools

A 200W PV system, which is able to light 2-3 rooms and power a small refrigerator, is probably the smallest unit that could supply electricity to hospitals located in soum centers. For a school, a 250W PV system may be the smallest feasible size. However, installed capacity could be increased gradually according to the financial means and size of each hospital or school.

As mentioned earlier, because of interruptions to the electricity supply, the use of computers in schools and advanced medical equipment in hospitals is limited, so solar PV systems should be upgraded at least to 3 kW level (NEF 2002)[6]. At present, social services such as education and medical treatment are mainly under state control, so subsidies to purchase PV systems should be provided by the government.

5) New options for rural electric supply

The modularity of PV makes it ideal for use in remote locations, allowing upgrades or increases in installed capacity and circumventing the need for investment in extending the electricity grid.

A memorandum on building a solar power station in Mongolia has recently been signed between the Ministry of Infrastructure of Mongolia and NEDO of Japan. A group of Japanese and Mongolian experts is due to leave for Noyon soum[7] in Omnogov aimag, in order to start construction of this 200 kW solar PV station. The cost of the station, which will provide remote soums and settlements with electricity, is around US$3 million (BBC 2002).

It is estimated that the additional installation of PV systems in 200 soum centers in order to reduce the amount of diesel fuel used by electricity generators would cost US$200-400 million. The total cost of introducing the combined diesel generator and solar PV system for households is estimated at roughly US$250-450 million.

According to JICA's Master Plan Study for Rural Power Supply by Renewable Energy in Mongolia, the second stage (2010), which is aimed at improving the

[6] 3.5 kW PV modules are in use in some Japanese homes

[7] Rural district in the Gobi desert situated 240 km from Omnogobi aimag center (at a distance of about 600 km from Ulaanbaatar, the capital city)

power supply to every household in order to stabilize people's livelihoods in the 167 soums targeted, is expected to save about 5 million liters of fuel annually through the use of renewable energy sources (PV, wind and small hydropower) in combination with existing diesel stations and the realization of planned grid extension. The third stage (2015), which is aimed at achieving community development and a steady power supply to every household, would save 7 million liters of fuel, thereby reducing emissions (JICA, 2000b).

5. Economic and social implications

The alleviation of "energy poverty" in rural areas would have great social impact, such as improved access to information, medical treatment, schools, remote education, clean water, better management and use of pastures, and a decreased risk of mass loss of animals. In addition, for herder families, the introduction of PV would be at the lower end of investment risk, because it is modular and therefore can be installed and expanded step by step.

Animal husbandry accounts for one-third of Mongolia's GDP of US$1 billion and comprises three-quarters of its agricultural output. As of late 2001, the total size of the national herd was 26.1 million livestock, including 11.9 million sheep, 9.6 million goats, 2.1 million cattle, 2.2 million horses and 0.3 million camels. Mongolia produces around 25% of the worldwide output of cashmere, and also exports high-quality skins, hides, wool, meat and other products of animal origin. Cashmere, hides and meat products form the second largest source of hard currency revenue (around one-third of exports) after the export of copper concentrate.

Among herder families, ownership of 100-200 sheep is common. According to the 2001 census, 23.5% of herder families have 51-100 head, while 20% own 101-200 head. The average number of head per herder family is 99 (1 camel, 8 horses, 8 cattle, 45 sheep and 37 goats). Therefore, herd capitalization of 10-20% will give around US$200-800 per year per family. This data, the abovementioned importance of PV utilization in the agricultural sector and the estimated cost of PV implementation efforts would require significant capital investment, including financing from ODA sources and other mechanisms, such as the Clean Development Mechanism (CDM).

As a whole, the introduction of PV will provide socio-economic benefits not only for the rural population, but also for the entire country, and may also earn the public approval that is the raison d'être of policy-makers.

Regional governments recognize the need to balance energy use, economic growth, and environmental limitations and are attempting to realize it both domestically and internationally with varying degrees of success. Under these circumstances, the utilization of renewable sources of energy, especially solar PV, presents a means of supplying electricity to the 40% or so of the Mongolian population that currently has no access to electricity.

6. Conclusions and recommendations

Specific demand is essential to the development of renewable energy sources, which may play a part in increasing social stability.

A strategy for reducing greenhouse gas emissions, which focuses simultaneously on the short- and long-term might be realized, focusing on the development of small-scale energy systems based on renewable energy sources. Inclusion of the utilization of renewable energy sources into the national energy policy portfolio with government subsidies and incentives will be a significant issue.

International cooperation (realization of CDM, as well as governments of industrialized countries encouraging national companies to produce and export advanced technologies involving the utilization of renewable energy sources/natural gas) is important to promote cleaner fuel options such as natural gas and renewable energy, where cost-effective.

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