Ministry of Construction and Urban Development (MCUD)

National Development Agency (NDA)

Japan International Cooperation Agency (JICA)

Sector Report on Crop Farming, Livestock Farming, Mining, Manufacturing and Tourism for The Project for Formulation of National Comprehensive Development Plan

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ABBREVIATIONS

GENERAL

2D	Two Dimensions
3D	Three Dimensions
BCL	brown coal liquefaction
BFG	Blast Furnace Gas
BL	Backward Linkage
CAGR	Compound Annual Growth Rate
CBM	Coal Bed Methane
CBT	Community-Based Tourism
CCT	Clean Coal Technology
CCUS	Carbon Capture, Utilization, and Storage
CDQ	Coke Dry Quenching
CIP	Carriage and Insurance Paid
CIT	Corporate Income Tax
CMC	Coal Moisture Control
CMM	Coal Mine Methane
CNG	Compressed Natural Gas
COG	Coke Oven Gas
COI	Cost of Inaction
COP21	21th Conference of the Parties to the United Nations Convention on Climate Change
COVID-19	Coronavirus Disease 2019
CTL	Coal to Liquids
DF/R	Draft Final Report
DIIP	Development Initiative-Infrastructure Project
DME	Dimethyl Ether
EIA	Environmental Impact Assessment
EMP	Enterprise Mongolia Project
EV	Electric Vehicle
FDI	Foreign Direct Investment
FEZ	Free Economic Zone
FL	Forward Linkage
FSI	Free Swelling Index
FTZ	Free Trade Zone
FZ	Free Zone
GDP	Gross Domestic Product
GMP	Good Manufacturing Practice
GTI	Greater Tumen Initiative
GTR	Greater Tumen region
HACCP	Hazard Analysis Critical Control Point
HOB	Heat Only Boiler
HTML	Hyper Text Markup Language
IC	Integrated Circuit
ICT	Information and Communication Technology
IGCC	Integrated Gasification Combined Cycle
IP	Intellectual Property
ISIC	International Standard Industrial Classification
IT	Information Technology
IT/R	Interim Report
KLNP	Khuvsgul Lake National Park
LLC	Limited Liability Company
LLP	limited liable partnership
LPG	Liquefied Petroleum Gas
LTDP2050	Long Term Deployment Plan 2050
M/P	Master Plan
MICE	Meeting, Incentive Travel, Convention/Conference and Event/Exhibition
M-JEED	Mongolia-Japan Engineering Education Development Project
MNT	Mongolia Tughrik
MOU	Memorandum of Understanding
MSH	Multi-Stakeholder
MSIS	Mongolian Statistical Information Service
MW	Megawatt
N/A	Not Applicable
NCDP	National Comprehensive Development Plan
NCS	natural and cultural heritage site
NGO	Non-Governmental Organization
NIMP	National Irrigation Master Plan
NSO	National Statistical Office
NUBIA	New Ulaanbaatar International Airport
O&M	Operation and Maintenance
OBNP	Onon-Balj National Park
OSSC	One Stop Service Center
OVOP	One Village and One Product
PPP	Public-Private Partnership

R&D	Research and Development
RDP	Regional Development Policy
SCGP	Shell Coal Gas Process
SDF	Skills Development Fund
SDGs	Sustainable Development Goals
SDV 2030	Sustainable Development Vision 2030
SEZ	Special Economic Zone
SME	Small and Medium-sized Enterprises
SNG	Synthetic Natural Gas
SPA	Specially Protected Area
SSR	Self-Sufficiency Rate
T&T	travel and tourism
TBS	Teetered Bed Separator
TCP	Technical Cooperation Project
TDNP	Tourism Development National Program
TMR	Total Mixed Ration
TPDP	Three Pillar Development Policy
TSLP	Two-Step-Loan Project
TT	Tavan Tolgoi
TTCR	Travel and Tourism Competitiveness Report
TV	Television
TVET	Technical Vocational Education and Training
UBC	Upgrade Brown Coal
UBTZ	Ulaanbaatar Railway
UCG	Underground Coal Gasification
UHG	Ukuhaa Khudag
UK	United Kingdom
USA	United States of America
USC	Ultra Super Critical Power Plant
VAM	Ventilation Air Methane
VAT	Value Added Tax
VSP	Vertical Seismic Survey
WEF	World Economic Forum

ORGANIZATIONS

ADB	Asian Development Bank
ALAMGaC	Agency for Land Administration and Management, Geodesy and Cartography
AWRC	Argali Wildlife Research Center
CAREC	Central Asia Regional Economic Cooperation
CMREC	China-Mongolia-Russia Economic Corridor
DBM	Development Bank of Mongolia
FAO	Food and Agriculture Organization
GIZ	Deutsche Gesellschaft fur Internationale Zusammenarbeit
ISO	International Organization for Standardization
ITC	International Trade Center
ITU	International Telecommunication Union
JAICAF	Japan Association for International Collaboration of Agriculture and Forestry
JICA	Japan International Cooperation Agency
JOGMEC	Japan, Oil、Gas and Metals National Corporation
KOGAS	Korea Gas Corporation
MCUD	Ministry of Construction and Urban Development
MET	Ministry of Environment and Tourism
MFALI	Ministry of Forestry, Agriculture and Light Industry
MMHI	Ministry of Mining and Heavy Industry
MNCCI	Mongolian National Chamber of Commerce and Industry
MOA	Ministry of Agriculture
MOF	Ministry of Finance
MOFALI	Ministry of Food, Agriculture and Light Industry
MOI	Ministry of Infrastructure
MRPAM	Mineral Resources and Petroleum Authority of Mongolia
MRTD	Ministry of Road and Transportation Development
NDA	National Development Agency
NEDO	New Energy Development Organization
OECD	Organisation for Economic Co-operation and Development
PWG	Project Working Group
TICA	Thailand International Cooperation Agency
UN	United Nations
UNDP	United Nations Development Program
UNIDO	United Nation Industry Development Organization
UNWTO	United Nations World Tourism Organization
WTO	World Trade Organization

Chapter 1 Crop Farming

1.1 Policy for Crop Farming Sector

1.1.1 Mongolian sustainable development vision 2030

The Mongolian Sustainable Development Vision 2030 (SDV2030) has established the agriculture and livestock sector as one of priority sectors to realize economic diversity for sustainable development under sound macro-economic policies together with industry especially light and food industries, various processing industries, tourism, mining and extractive industries as well as energy and infrastructure sectors. Development goals related to the agriculture and livestock sector in the SDV2030 are enumerated in Table 1.1.1.

Table 1.1.1 Development Goals of SDV 2030 Related to Agriculture and Livestock Sector

Sector	Development goal
Agriculture and livestock	- Strengthening of competitiveness to adopt international standard - Reconstruction of supply network - Introduction of intensive agricultural technology - Support for small-scale agricultural enterprises
Industry	- Industrial development for processing of raw agricultural and livestock materials
Infrastructure	- Development of logistics network
Business environment	- Acceleration of the procedures for trading network

Source: SDV2030

The development goals related to agriculture and livestock involve not only agriculture and livestock activities, but also other sectors such as industrial and infrastructure sectors. For example, supports for enhancing raw materials availability and promotion of food processing to be pursued in the industrial sector constitutes important development objectives to increase value-added in agriculture and livestock products. It is essential for the development of agriculture and livestock sector to align with other sectors based on the long-term national development vision in Mongolia. The detailed development objectives related to the crop farming sector described in the SDV 2030 are summarized in Table 1.1.2.

Table 1.1.2 Development Objectives of SDV 2030 Related to Crop Farming Sector

Sector	SDV2030	Development objective
Agriculture and livestock	Objective 3	Increase the soil fertility, reduce land deterioration, adopt economical and efficient advanced agro-technical and irrigation technology to amend soil, and develop intensified farming in order to meet the domestic demand for grains, potatoes, and vegetables
	Objective 4	Support the business and economics of herders, herder groups, and small and medium sized farmers; provide modern techniques, technologies, and electricity; and create a financial, economic, and legal environment for sustainable production
Industry	Objective 1	Develop the industrial sector based on advanced methods, technology and innovations, and increase productivity
	Objective 2	Introduce advanced technology in the food industry, improve the competitiveness, increase domestic supply in main food products, and ensure that citizens are supplied with healthy and safe food products
Infrastructure	Objective 3	Expand and develop roads and transportation logistics network

		to enable economic growth
Business environment	Objective 1	Improve trade and services, develop transportation and logistics network of import and export goods, simplify the system for special license issuance, digitalize and improve tax payments and state registration systems, and establish a favorable business environment

Source: SDV 2030

1.1.2 State policies and programs related to crop farming sector

The Regional Development Policy (RDP) as part of the NCDP aims at strengthening the regional socio-economy by re-vitalizing economic and social activities for self-reliant development. This will contribute to the rectification of disparities between rural and urban areas through the optimum use of local resources including raw agricultural materials.

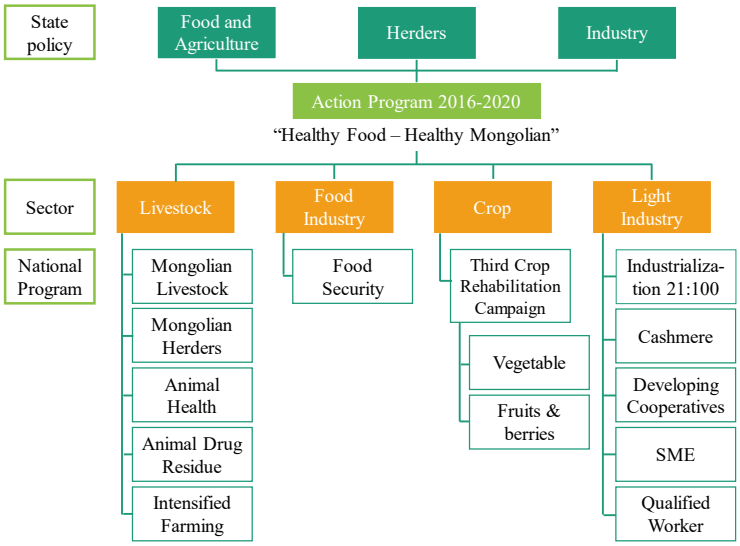
Furthermore, there are two major state policies related to crop farming sector as shown in Table 1.1.3. Based on the state policies, MOFALI implements various programs and campaigns. The relationship matrix of the implementations is illustrated in Figure 1.1.1. With regard to crop farming, national programs of vegetables, and fruits and berries were approved in 2017. An additional program related to green house is expected to be approved in 2020.

The Parliamentary resolution on food import duties was revised on May 1, 2020. Consequently, import duties on potato, onion, garlic, tomato, cabbage, carrot, turnip, cucumber, ware melon etc. has been raised from 15~20% to 30 %, and import duties on seed of fodder, grains, oil crops, potato and other vegetables have been reduced to zero as of August 1, 2020.

Table 1.1.3 Outline of State Policies Related to Crop Farming Sector

State policy	Outline
Food and agriculture	- Supply in nutritious and safe food evenly to the population - Sustainable human resource development - Production based on research and development - Guarantee and protection of investment - Product development through strengthening of value chain and competitiveness - Mitigation of risks
Industry	- Promotion of health and safety-oriented and environment-friendly industry - Development of the export-oriented and import-substitutive competitive products that assures the national and international standards - Promotion of economically efficient industry development based on the advanced techniques, high technology, and innovation - Establishment of effective collaboration among government organization, scientific institution, and private company - Promotion of fair competition - Formulation of a strategy for diversification of products through research on productivity and competitiveness

Source: MOFALI



Source: JICA Project Team based on the information from MOFALI

Figure 1.1.1 Relationships between Policies in Agriculture and Livestock Sector

1.1.3 Long-term development plan 2050

There is another important document newly established: the Long-Term Development Plan 2050 (LTDP 2050). The LTDP 2050 envisages the unique development with the slogan of "Energetic Mongolia". Out of nine development targets, crop farming is related to 2) human development, 6) green development, and 8) regional development. Hence, a set of projects to be proposed needs to coincide with the LTDP 2050 as well.

1.2 Current Conditions of Crop Farming Sector

1.2.1 Agricultural land

Agricultural land is composed of six categories: pasture, meadows, arable land, fallow, land for agricultural buildings, and others; pasture occupies 96.2% of the agricultural area of Mongolia and other categories are between 0.1 and 1.5% only (Table 1.2.1). Although the pasture area has decreased by approximately 15% from 2000 to 2005, areas in all the other categories generally tend to maintain the respective areas from 2005 onward.

Table 1.2.1 Agricultural Land Type and Area between 2000 and 2019, and Percentage Share in 2019

Unit: thousand ha

Type	2000	2005	2010	2015	2019	Share in 2019 (%)
Pasture	129,293.8	110,929.6	111,255.6	110,613.6	110,330.6	96.2
Meadows	0.0	1,822.8	1,714.9	1,717.7	1,709.1	1.5
Arable land	1,176.0	1,175.5	932.4	1,028.2	1,117.2	1.0
Fallow	0.0	478.4	306.6	305.0	216.6	0.2
Land for agricultural buildings	0.0	43.3	54.7	74.4	103.5	0.1
Others	71.3	1,261.4	1,261.6	1,259.7	1,259.7	1.1
Total agricultural area	130,541.1	115,711.0	115,525.8	114,998.6	114,736.7	100.0

Source: Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia. Share in 2019 was calculated by JICA Project Team.

1.2.2 Agricultural production

(1) Sown area

The sown area of the major agro-products tends to steadily increase year on year (Table 1.2.2). Among the edible products including cereals, potatoes and vegetables, the growth of the sown area of vegetables is comparatively low with a compound annual growth rate (CAGR) with 2.4%. The sown area of fodder crops and industrial crops such as oil seeds has rapidly expanded and achieved 23.5% and 15.6% of CAGR, respectively.

Table 1.2.2 Sown Area by Type and Compound Annual Growth Rate between 2000 and 2019

Unit: thousand ha

Type	2000	2005	2010	2015	2019	CAGR (%)
Cereals	194.7	159.1	259.2	390.7	369.4	3.4
Potatoes	7.9	9.8	13.8	12.8	14.9	3.4
Vegetables	5.4	5.9	7.0	7.7	8.4	2.4
Fodder crops	0.8	5.2	11.1	23.8	43.8	23.5
Industrial crops	-	-	23.3	84.5	86.2	15.6
Others	0.5	0.5	0.8	5.5	0.3	-2.7
Total	209.3	180.5	315.2	525.0	523.0	5.5

Source: Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia. CAGR was calculated by JICA Project Team.

(2) Yields

The yields of agricultural products between 2000 and 2019 showed contrasting results. The yields of grains, potatoes, and vegetables and industrial crops over two decades have increased 1.6 times, 1.7 times, 1.5 times, and 3.3 times respectively (Table 1.2.3). Although the yields have steadily increased, it is still unstable. For example, it was highly affected by droughts occurred in 2015 and 2017. This indicates that it is necessary for stable production to prepare favorable conditions and to realize its potential. In contrast, the yields of other crops including fodder and industrial crops showed decreasing trends with a negative CAGR.

Table 1.2.3 Yield by Type and Compound Annual Growth Rate between 2000 and 2019

Unit: ton/ha

Type	2000	2005	2010	2015	2019	CAGR (%)
Grains	0.7	0.5	1.4	0.6	1.2	2.5
Potatoes	7.5	8.5	12.2	12.8	12.9	2.9
Vegetables	8.1	10.9	11.8	9.4	11.8	2.0
Fodder crops	5.4	1.6	3.1	2.1	2.8	-3.5
Industrial crops	-	0.1	0.5	0.3	0.4	8.8

Source: Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia. CAGR was calculated by JICA Project Team.

(3) Production

As a whole, production of the major agro-products in Mongolia has steadily increased from the year 2000 onward, though some fluctuations are observed (Table 1.2.4). As for wheat and potatoes, both the cultivation area expansion and the yield increase contributed to production increase, resulting in improvement of self-sufficiency. For these crops, stability of production is required in the next phase. Although production of vegetables has also increased through the area expansion and the yield increase, the production has been overwhelmed by increased demand. Limited production period, low yield, and lack of storage facilities are some of the limiting factors for production. Increase in cropping

intensity during winter season, yield increase, prolongation of storage period, and establishment of supply chain hold the key for vegetable production. Regarding fodder crops and industrial crops, the production increase is totally attributed to the expansion of the sown area. It is important for them to select target crops with exploration of market channels and to identify suitable cultivation areas.

Table 1.2.4 Production by Type and Compound Annual Growth Rate between 2000 and 2019

Unit: thousand ton

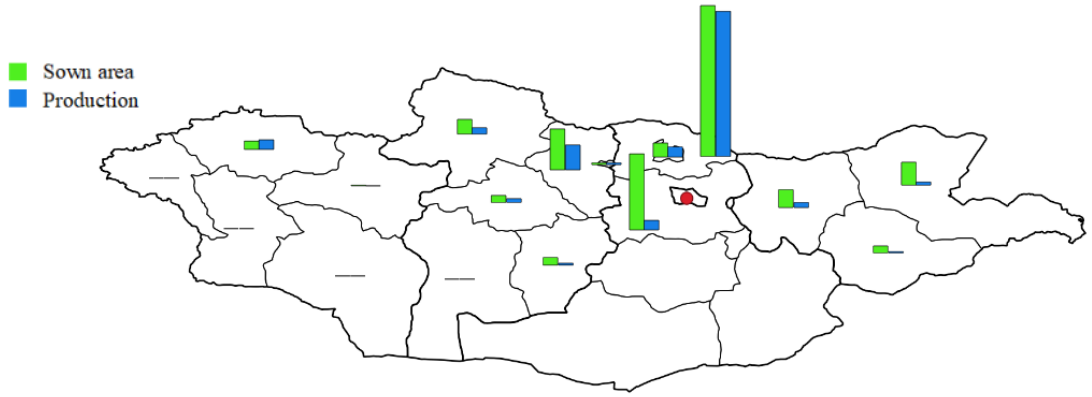
Type	2000	2005	2010	2015	2019	CAGR (%)
Wheat	138.7	73.5	345.5	203.9	411.4	5.9
Potatoes	58.9	82.8	168.0	163.8	192.2	6.4
Vegetables	44.0	64.2	82.3	72.3	99.5	4.4
Fodder crops	4.1	8.3	34.8	49.2	121.1	19.5
Industrial crops	0.3	1.2	11.1	23.1	34.0	28.3
Fruits and berries	0.2	0.2	0.6	1.4	1.8	12.2

Source: Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia. CAGR was calculated by the JICA Project Team.

(4) Production by Aimag

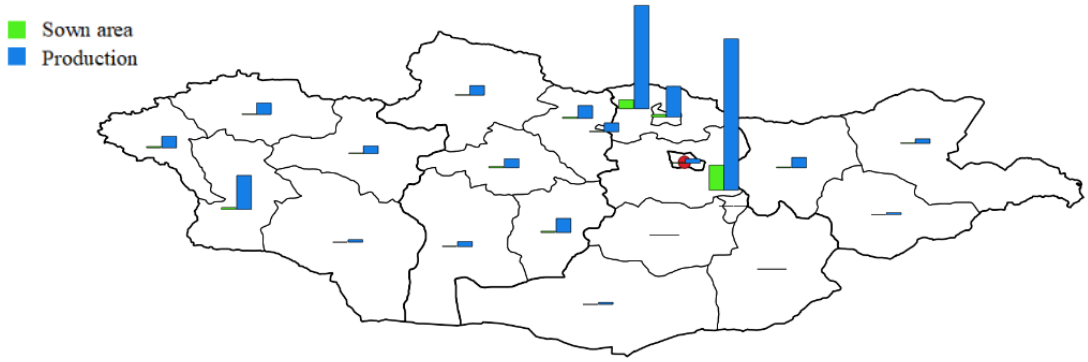
Characteristic production areas for major agro-products are illustrated in Figures 1.2.1 through 1.2.5 and summarized in Table 1.2.5. Production of many agro-products are predominant in the northern part of Central Region, i.e., Selenge, Tuv, and Darkhan-Uul. In many cases, they also exhibit surplus supply over demand as shown in Figures 1.2.6 through 1.2.8. However, some Aimags rank among the top five for the production: Uvs and Bulgan for wheat, Khovd and Uvurkhangai for potatoes, Khovd for vegetables, Uvs, Arkhangai, and Khentii for fodder crops. Production of fruits and berries are characteristics of Western Region.

In general, the size of the sown area does not always associate with production. It indicates that there is a large yield variation between Aimags. In order to promote and maintain the production, yield gaps between Aimgas should be reduced by support measures. In addition, location of production areas where supply exceeds demand is skewed, the way to improve the distribution of excess products to balance all the Aimags needs to be examined.



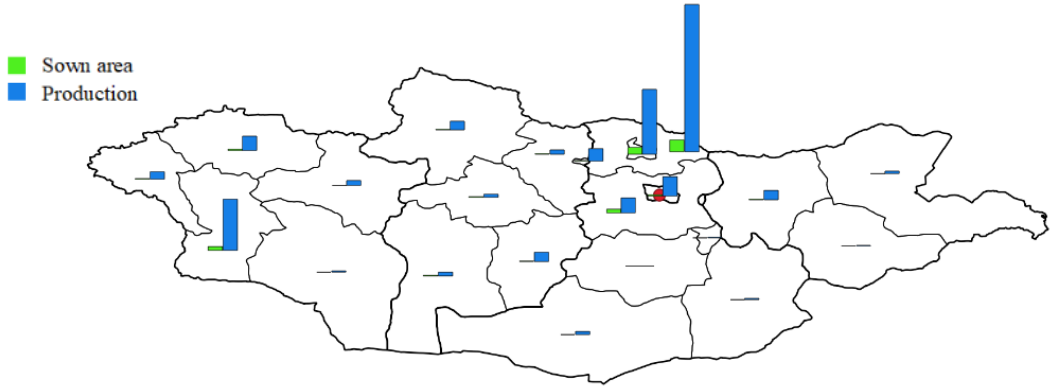
Source: JICA Project Team based on Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia

Figure 1.2.1 Sown Area and Production of Wheat by Aimag in 2019



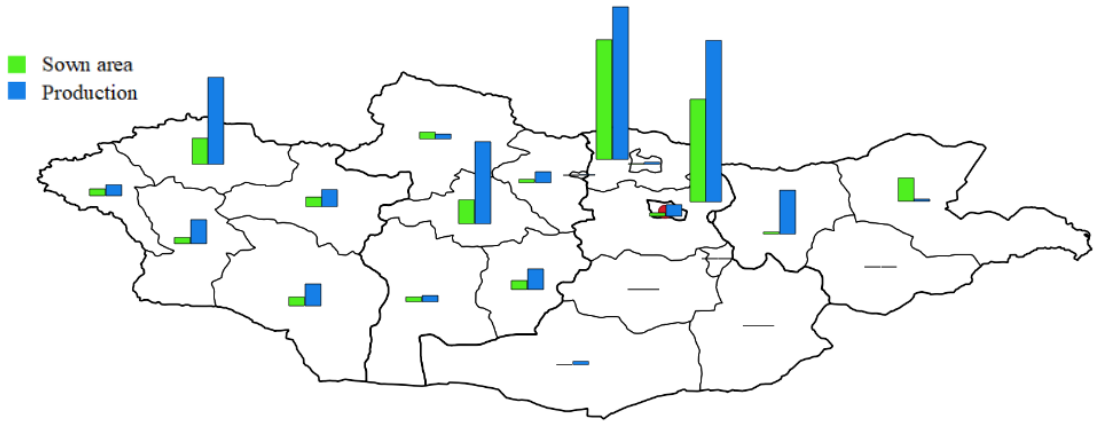
Source: JICA Project Team based on Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia

Figure 1.2.2 Sown Area and Production of Potatoes by Aimag in 2019



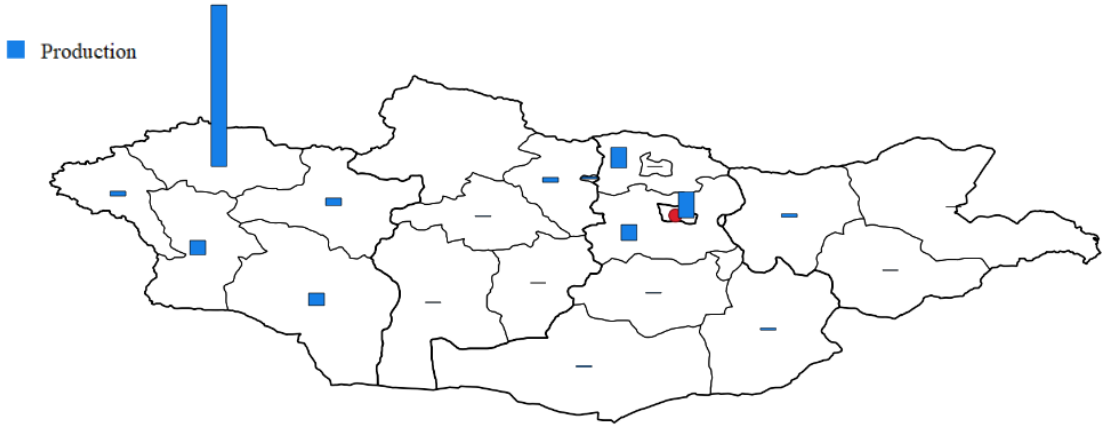
Source: JICA Project Team based on Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia

Figure 1.2.3 Sown Area and Production of Vegetables by Aimag in 2019



Source: JICA Project Team based on Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia

Figure 1.2.4 Sown Area and Production of Fodder Crops by Aimag in 2019



Source: JICA Project Team based on Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia

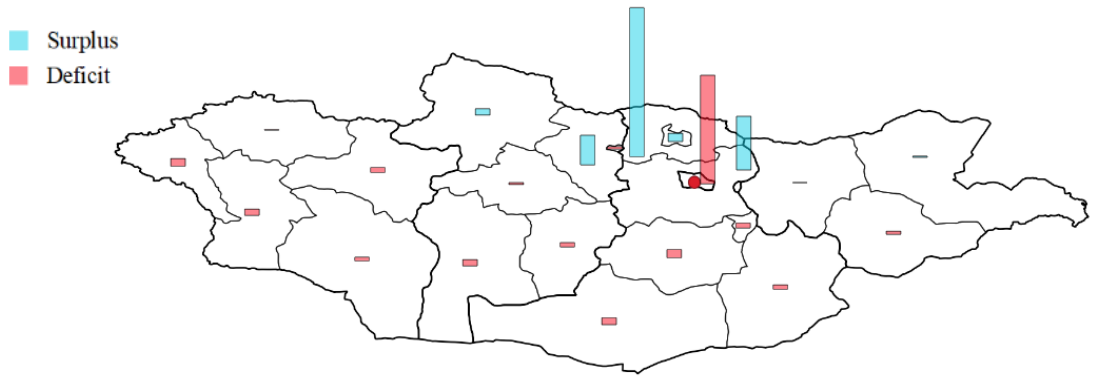
Figure 1.2.5 Production of Fruits and Berries by Aimag in 2019

Table 1.2.5 Top Five Aimags for Sown Area and Production by Type in 2019

Unit: ha for sown area, ton for production

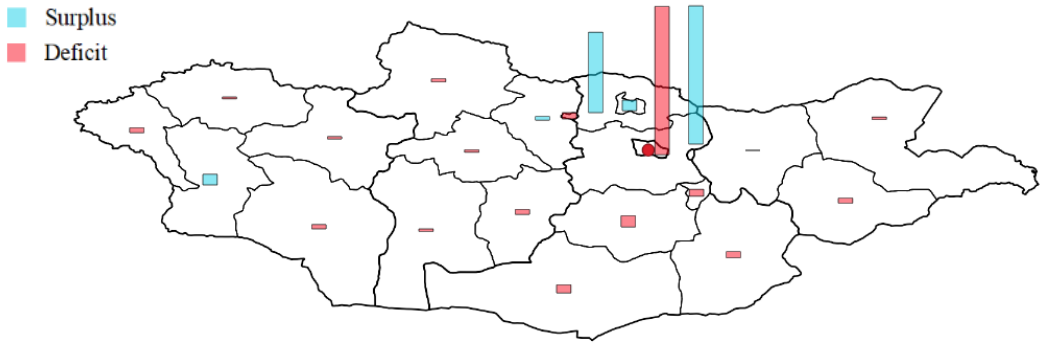
Type	Item	1st	2nd	3rd	4th	5th
Wheat	Sown area	Selenge 153,415	Tuv 69,802	Bulgan 40,914	Dornod 20,890	Khuvsgul 16,872
	Production	Selenge 159,269	Tuv 94,247	Bulgan 56,685	Uvs 26,463	Khuvsgul 26,343
Potatoes	Sown area	Tuv 7,892	Selenge 2,481	Khovd 669	Darkhan-Uul 585	Uvurkhangai 392
	Production	Tuv 105,114	Selenge 34,105	Khovd 9,465	Darkhan-Uul 7,286	Bulgan 5,356
Vegetables	Sown area	Selenge 2,513	Darkhan-Uul 1,365	Tuv 1,144	Khovd 965	Uvs 273
	Production	Selenge 32,557	Tuv 15,084	Darkhan-Uul 13,148	Khovd 12,603	Ulaanbaatar 4,548
Fodder crops	Sown area	Selenge 12,928	Tuv 10,950	Dornod 6,709	Uvs 2,908	Bulgan 1,500
	Production	Tuv 45,435	Selenge 32,732	Uvs 7,204	Bulgan 5,921	Dornod 4,692
Fruits and berries	Production	Uvs 945	Tuv 169	Selenge 151	Ulaanbaatar 144	Bayan-Ulgi 94

Source: Mongolian Statistical Yearbook 2019, National Statistics Office of Mongolia



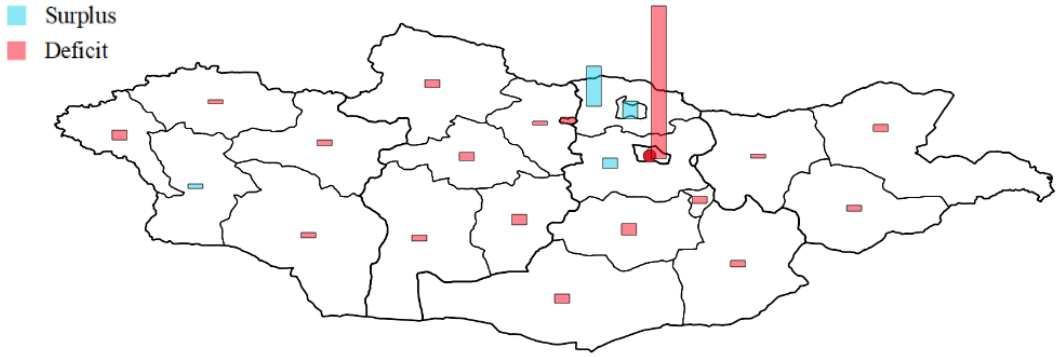
Source: JICA Project Team based on the information from Ministry of Forestry, Food, Agriculture and Light Industry (MOFALI)

Figure 1.2.6 Gaps between Supply and Demand of Wheat by Aimag in 2016



Source: JICA Project Team based on the information from MOFALI

Figure 1.2.7 Gaps between Supply and Demand of Potatoes by Aimag in 2016



Source: JICA Project Team based on the information from MOFALI

Figure 1.2.8 Between Supply and Demand of Vegetables by Aimag in 2016

(5) Trade and self-sufficiency of agro-products

Tables 1.2.6 through 1.2.8 show the trading trends and the self-sufficiency rates of the agro-products. Basically, major agro-products show negative balance of trade. As of 2019, import of agriculture and livestock products accounts for 10.6% of the total import value. However, the highest import amount of cereals and potatoes were recorded in 2005, and since then the import tended to decrease. The import amount of wheat and potatoes in 2018 was reduced to 24% and 7% of the import in 2005,

respectively.

Mongolia trades major agro-products with specific countries, mainly Russia and China. As of 2018, almost 100 % of wheat is imported from Russia and 69% and 27% of potatoes came from China and Russia, respectively. Vegetable came from various countries other than Russia and China such as Netherland, Korea, and Germany, although major trading country is still China. Import amount of vegetables and fodder crops have continued to increase. As compared to the year 2000, import amount of vegetables and fodder crops in 2018 reached 4 times and 6 times, respectively. Along with the trading trends, the self-sufficiency rates of cereals and potatoes increased to attain nearly 100%. On the other hand, self-sufficiency rates of vegetables in 2018 declined to around 50%.

Fodder crops are imported and exported simultaneously for the following reasons. Fodder crops are imported mainly from Russian Federation and their prices are normally cheaper than domestic products, e.g., average price of imported and domestic waste grain is MNT 289/kg and MNT 350/kg, respectively. Therefore, domestic products do not have enough competitiveness against imported products. On the other hand, almost all the fodder crops are exported to China to meet their demand for livestock feed as their livestock production has increased 1.7 times over the past 20 years.

In 2019, the volume of rail freight was approximately 10.2 million tons for export and 2.9 million tons for import, respectively (NSO, 2019). The volume of road freight by trade flow is unknown, however, if the same proportion for rail freight is applied, the total volume of carried freight by rail and road for export and import is estimated to 25.1 million tons and 7.0 million tons, respectively. According to these estimates, the volumes of carried freight for agro-products account for 0.7% for export and 0.4% for import of total carried freight, respectively.

There are three major transport routes for agro-products; i) Tianjin – Eren Hot – Zamin-Uud – Ulaanbaatar corridor, ii) Vladivostok – Ulan Ude – Kyahta – Altanbulag – Ulaanbaatar corridor, and iii) Moscow – Ulan Ude – Kyahta – Altanbulag – Ulaanbaatar corridor. Of these routes, transaction volume via Zamin-Uud is the largest. Agro-products from Europe are imported to Mongolia via Brest in Belarus. Border ports in Mongolia are equipped with quarantine stations operated by the General Agency Specialized Investigation.

Along with the trading trends, the self-sufficiency rates of cereals and potatoes increased to attain nearly 100%. On the other hand, self-sufficiency rates of vegetables in 2018 declined to around 50% as shown in Table 1.2.7.

Table 1.2.6 Trade of Agro-products between 2000 and 2018 and Detailed Trading Statistics in 2018

Unit: ton for amount, US$1,000 US$ for value

Type	2000		2005		2010		2015		2018	
	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
Wheat	92,235	0	97,475	0	56,152	0	21,071	0	23,200	0
Potatoes	13,163	0	40,986	0	15,485	0	17,059	0	2,892	0
Vegetables	8,597	6	23,685	7	46,230	0	60,352	756	97,203	36
Fodder crops	2,897	3,084	8,850	3,526	13,622	505	61,208	20,346	50,526	29,875
Wheat	Import amount: Russian 23,199, Canada 1									
	Import value: Russian 4,433, Canada 1									
Potatoes	Import amount: China 1,993, Russia 774, Germany 100, Kazakhstan 20, France 5									
	Import value: China 388, Russia 86, Germany 86, Kazakhstan 4, France 3									
Vegetables	Import value: China 15,636, Netherland 487, Russia 428, Korea 116, Germany 109									
	Export value: China 11									
Fodder crops	Import amount: Russia 45.115, China 4,414, Korea 816, Other countries 181									
	Import value: Russia 7,563, China 2,429, Korea 146, Other countries 342									
	Export amount: China 29,875									
	Export value: China 4,657									

Source: FAOSTAT and UN Comtrade

Table 1.2.7 Self-sufficiency Rates and Demand of Major Agro-products between 2000 and 2018

Unit: % for self-sufficiency rate, 1,000 tons for demand

Type	Parameter	2000	2005	2010	2015	2018
Wheat	Self-sufficiency rate	60.1	43.0	86.0	90.6	94.9
	Demand	292.4	310.4	335.9	372.0	394.0
Potatoes	Self-sufficiency rate	81.7	66.9	91.6	90.6	98.3
	Demand	122.8	130.4	141.1	156.3	165.5
Vegetables	Self-sufficiency rate	83.7	73.1	64.0	54.8	50.9
	Demand	175.4	186.2	201.6	223.2	236.4
Fodder crops	Self-sufficiency rate	100.0	60.9	72.6	54.6	82.9

Source: calculated by the JICA Project Team based on FAOSTAT

Among vegetables, cabbage shows the highest import value, followed by onion and garlic. The self-sufficiency rates of these crops were less than 40%, lower than that of vegetables as a whole. Carrot and other root vegetables shows 84% of self-sufficiency, but its import value remains as high as more than US$1.0 million. These vegetables may be the targets for further production. Various vegetables are still imported and diversification of crops should also be pursued.

As shown above in (3) Production, some of limiting factors are noted for vegetable production. Production, harvesting and post-harvest conditions specific to different vegetables may provide additional reasons for still low self-sufficiency rates of vegetables. The agricultural policy in Mongolia gives top priority to achievement of full self-sufficiency of staple foods, wheat and potatoes. Consequently, most subsidies have been provided to increase production of these crops. In addition, vegetables are more perishable than wheat and potatoes, and therefore increase in consumption of domestically-produced vegetable requires more cold storage to extend its life-span. Another possible reason is that it is not easy to apply machineries in vegetable cultivation as compared to wheat and potatoes cultivation. For example, harvesting process of cabbage is not fully mechanized and it still requires manual conditioning and sorting. Onion also requires several works in harvesting process such as topping and root cutting. As for garlic, its bulb is very vulnerable to sun exposure, and therefore after digging up, it should be topped and protected from the sun exposure immediately. These processes are difficult to be mechanized. These are additional reasons why production volume of these vegetables remains comparatively low.

Table 1.2.8 Production, Import Amount, Import Value, and Self-sufficiency Rate of Vegetables by Type in 2018

Type	Production (thousand ton)	Import (thousand ton)	Import value (thousand US$)	Self-sufficiency rate (%)
Cabbage	18.8	28.3	5,743	39.9
Carrot and other root vegetables	50.4	9.6	1,683	84.0
Cucumber	3.8	0.8	210	82.5
Onion and garlic	14.6	28.1	4,743	34.3
Tomatoes	1.9	0.8	230	70.6
Others	-	14.9	3,370	-
Cabbage	Import amount: China 27.9, Russia 0.4 Import value: China 5,334, Russia 78			
Carrot and other root vegetables	Import amount: China 8.9, Kyrgyzstan 0.4, Russia 0.3 Import value: China 1,559, Russia 60, Kyrgyzstan 41			
Cucumber	Import amount: China 0.76, Russia 0.07 Import value: China 186, Russia 23			

Onion and garlic	Import amount: China 26.8, Netherlands 0.5, Russia 0.4, Others 0.4 Import value: China 4,027, Netherlands 486, Russia 65, Others 165
Tomatoes	Import amount: China 0.75, Russia 0.05 Import value: China 195, Russia 22

Source: NSO website1. Self-sufficiency rate was calculated by the JICA Project Team based on NSO website

As seen in the SDV 2030, achievement of full self-sufficiency of cereals, potatoes, and vegetables is one of the development objectives, and therefore continuous activities to attain the target should be undertaken. Especially for vegetables, the official order of the Minister of Health was released in 2017 that the recommended average daily vegetable consumption per person should increase from 200 grams to 260 grams. Further efforts will be required for production increase in vegetables. As fodder supply is essential to support the livestock industry to ensure sufficient and stable production of meat and dairy products constituting important part of the traditional Mongolian diet, fodder production should be increased for import substitution.

1.3 Other Information Related to Crop Farming

(1) Land degradation

According to the statistical data, 1.4 million ha is classified as arable land of which 19% is recognized as fallow. Out of the arable land, approximately 1.0 million ha is identified as land suitable for farming and 10% of suitable land is regarded as the degraded land.

Currently, many of crop farm households and crop business entities express their concern about soil degradation as shown in Table 1.3.1. In total, 57% of crop farming households and 67% of business entities face the soil degradation to a greater or lesser extent, respectively. Business entities tend to face the situation more severely than crop farming households due to higher usage of chemical fertilizer. To mitigate the land degradation, proper fertilizer distribution and utilization, and soil conservation practices such as minimum- or zero-tillage cultivation and integrated crop-livestock farming are required. As of 2019, it is reported that soil conservation practices were applied in eight Aimags and total area with these practices was approximately 123,000 ha. Out of the eight Aimgas, Selenge showed the highest figure with 45,000 ha, followed by Bulgan with 20,000 ha and Tuv with 15,000 ha. Transformation of fallow land to pasture land through MOFALI programs such as fencing, and forestation between agriculture land and pasture land is also important.

Table 1.3.1 Severity of Soil Degradation

Unit: %

Degree	Total		Region									
			West		Khangai		Central		East		UB	
	(H)	(B)	(H)	(B)	(H)	(B)	(H)	(B)	(H)	(B)	(H)	(B)
None	42	34	36	31	41	32	40	32	44	46	54	48
Low	25	27	26	29	27	26	26	26	23	21	22	24
Medium	30	38	36	38	31	40	31	39	31	29	23	26
High	2	2	2	1	1	2	3	2	2	4	2	2

(H): Household farm, (B): Business entity
Source: Agricultural Census

(2) Irrigation

The irrigated area covers 57,000 ha before the transition from the planned economy to the market economy, then it dropped to 5,300 ha in 2000. This is because the water use fee collection system during the planned economy era collapsed, and irrigation schemes owned by the Government were not properly maintained and abandoned. Along with decrease in irrigation area, production of major crops decreased, and then, the importance of irrigation was recognized. Since then, the Government has

[1] http://1212.mn/Stat.aspx?LIST_ID=976_L10_2&type=tables, accessed on 1st April, 2019

promoted irrigation development through agricultural programs such as "Third Crop Rehabilitation Campaign" and offered cost sharing for rehabilitation of irrigation facilities done by the private sector. Developing partners have also supported irrigation development.

The irrigated area recovered to 44,798 ha in the first half of 2010. Table 1.3.2 shows irrigated area and proportion of the irrigation installation. Regarding irrigated area, Selenge is the highest with 11,166 ha, followed by Khovd with 5,335 ha, Govi-Altai with 5,152 ha, Uvs with 4,426 ha, and Tuv with 4,421 ha. According to the MOFALI's latest estimation, the total irrigated area has gradually increased and it is approximately 57,000 ha in 2019. Although more than 80% and 50% of areas at household farms and business entities are irrigated, crop farming in Mongolia is still susceptible to droughts. In addition, of those who did not install irrigation, 45% of household farms and 49.8% of business entities responded that the lack of water is the most severe constraint, followed by lack of financial resources. Effective irrigation technology to address these conditions should be investigated.

It should be noted that instalment ratio of irrigation facilities was calculated based on the information collected in 2010. Whereas household farm usually uses surface and flood irrigation that are easy to maintain, business entity uses highly mechanized irrigation that were devasted after transition. Therefore, instalment ratio of household farm was higher than that of business entity as of 2010. However, thanks to government effort and support from developing partners, the irrigation area has recovered and the latest instalment ratio of business entity could be higher than the figures mentioned in Table 1.3.2.

Table 1.3.2 Irrigated Area and Instalment Ratio

	Total		Region									
			West		Khangai		Central		East		Ulaanbaatar	
Area (ha)	44,798		20,313		5,407		16,969		1,644		465	
Instalment	(H)	(B)	(H)	(B)	(H)	(B)	(H)	(B)	(H)	(B)	(H)	(B)
ratio (%)	81	53	95	86	76	51	80	40	61	54	86	49

Note: (H): Household farm, (B): Business entity
Source: MOFALI and Agricultural Census

(3) Fertilizer usage

In regard to fertilizer usage, 22% of the total harvest area was fertilized in 2010, 16% for household farms and 23% for business entities. As seen in Table 1.3.3, household farms totally depended on the natural and other organic fertilizer and their usage accounts for almost 100%, irrespective of the regions. Even business entities, the proportion of fertilizer usage other than natural and organic fertilizer has been reduced to 6% on an average. To increase production and enhance productivity, manufacturing and proper distribution of fertilizer need to be promoted together with soil conservation techniques.

Table 1.3.3 Use of Fertilizer by Type

Unit: ton

Household farm	Total	West	Khangai	Central	East	Ulaanbaatar
Total	36.766.3	12,576.0	4,128.4	17,862.4	675.7	1,523.8
Natural fertilizer	23.863.0	3,574.5	3,523.9	15,248.3	558.8	957.5
Other organic	12,770.4	8,993.7	588.6	2,510.7	116.3	561.1
Mineral	66.5	3.9	8.0	51.7	0.3	2.6
Nitrate	42.8	3.2	3.2	34.2	0.1	2.1
Phosphorus	7.1	0.4	0.3	6.3	0.0	0.1
Potassium	1.0	0.1	0.5	0.3	0.0	0.1
Mixed fertilizer	15.5	0.2	3.9	10.9	0.2	0.3
Business entity	Total	West	Khangai	Central	East	Ulaanbaatar
Total	52,356.9	3,208.3	17,116.8	31,050.0	398.9	582.9
Natural fertilizer	38,009.6	1,327.8	14,506.8	21,582.9	216.5	375.6

Other organic	11,028.2	1,877.5	2,146.0	6,805.3	-	199.4
Mineral	1,659.5	1.5	232.0	1,330.9	91.2	3.9
Nitrate	915.5	0.3	113.3	777.3	21.0	3.6
Phosphorus	152.4	0.1	7.3	144.8	-	0.2
Potassium	88.2	0.1	12.0	76.0	-	0.1
Mixed fertilizer	503.5	1.0	99.4	332.8	70.2	0.1

Source: Agricultural Census

(4) Greenhouse production

Continuous efforts have been made by the Mongolian Government to establish greenhouses to meet the demand for vegetables. As of 2017, cultivation area under greenhouse was 75.9 ha, of which 19.3 ha was for winter and 56.8 ha for summer production (Table 1.3.4). The total production under greenhouse cultivation was 5,140 ton consisting of 3,405 ton in summer and 1,735 ton in winter. According to MOFALI, there is a plan to construct 50 ha of additional greenhouse capacity. As production per unit area of greenhouses is higher in winter season than in summer season, greenhouse cultivation should place more emphasis on winter, but major constraints for expansion is fuel costs. It is said that fuel costs comprise up to 40% of the production cost by greenhouses. Therefore, greenhouse technology with low-cost production system is required.

Table 1.3.4 Area and Production under Greenhouse Cultivation between 2014 and 2017

	2014	2015	2016	2017
Area (ha)	63.1	68.4	70.2	75.9
Production (ton)	3,878	4,538	4,990	5,140

Source: MOFALI

(5) Type of fodder crops

In Mongolia, there are several type of fodder crops as seen in Table 1.3.5, such as hay, straw, green fodder, and so on. Hay predominates more than 86% of the total amount, however, the price is generally low as compared to other fodders. In order to i) improve the quality of animal products, ii) promote intensive farming for environment conservation, iii) improve farmers' livelihood, it is reasonable to increase the supply of green fodder.

Table 1.3.5 Amount and Prices of Fodder in 2016

Type	Amount (ton)	Price range (MNT/kg)	Average price (MNT/kg)
Hay	1,100,000	100 - 350	200
Straw	35,700	80 - 150	100
Green fodder	34,400	200 - 400	250
Silage	7,900	200 - 400	250
Waste potatoes and vegetables	3,000	150 - 300	200
Waste grain	7,200	250 - 450	350
Bran	60,000	450 - 650	550
Compound feed	27,100	500 - 1,200	750 - 1,000

Source: Market Study on Livestock Fodder Production and Demand in Mongolia, 2017, German-Mongolian Cooperation Project Sustainable Agriculture

(6) Marketing

There are several actors in the value chain for crops such as producer, middleman, transporter, processor, retailer, and consumer. Among the actors, middlemen have appeared in the distribution system after the transition to the market economy and developed their own supply chains. Producers generally do not have a bargaining power for several reasons; the area where they produce agro-products is far from

consumption areas, they do not have transportation means nor storage facilities, they have limited access to market information, and so forth. As a result, producers have to accept the prices offered by middlemen, although they are often lower than the market prices. As seen from Table 1.3.6, the difference between producer prices and consumer prices ranges from 66% to 90%, except for onion. It is due to interventions by several actors.

As for distribution and storage of major crop farming products, i.e., wheat, potatoes, and vegetables, the current situation is described as follows. After harvesting, 51% of domestically produced wheat was sent to milling facilities for flour production as of 2017, and other destinations were crop support fund for flour production and seed (21%), farm-saved seed for the next cropping season (13%), feed production (10%), and so forth. Twenty-four mills were in operation nationwide and its total production capacity was 772,000 ton. The total capacity of grain elevators was 523,000,000 ton, of which crop support fund, milling facility, and individual farm manages 182,000 ton, 231,000 ton, and 110,000 ton, respectively. Facilities managed by crop support fund were located in Selenge, Darkhan-Uul, Tuv, Bulgan, and Uvurkhangai. In addition, there are grain storages managed by grain enterprises as shown in Table 1.3.7.

Of the total potato production, 50% was sold to intermediaries, followed by retailers (10%), wholesalers (10%). The rest were kept for sales in winter and spring. In most cases, the intermediaries provide transportation and storage when they purchase the agro-products from producers. Transportation costs are assumed to be MNT 76/kg when it is within 300 km from production site to market. According to MOFALI, number of storages for potatoes and vegetables was approximately 5,700 and their capacity was approximately 175,000 ton (Table 1.3.8). It covers approximately 80% of potatoes and 67% of vegetables in total production, respectively. Out of these storages, there are only 14 cold storages; 2 in Selenge and 12 in Ulaanbaatar. According to MOFALI, post-harvest loss reaches 35% during storage due to lack of storage quality. To resolve the issues mentioned above, increase in storage capacity and quality is required as well as provision of market information.

Table 1.3.6 Producer and Consumer Prices of Vegetables in 2017

Type	Producer price (MNT/kg)	Consumer price (MNT/kg)	Price difference (%)
Potatoes	500	895	79
Carrot	696	1,241	78
Rutabaga	708	1,320	86
Cabbage	900	1,496	66
Onion	1,500	1,608	7
Tomato	2,500	4,746	90

Source: Data Collection Survey for Master Plan Project for the Development of Agricultural Value Added Chain, 2019, ERI CO., LTD./JICA

Table 1.3.7 Number and Capacity of Wheat Storage Managed by Enterprise

Aimag	Number	Capacity (ton)	Aimag	Number	Capacity (ton)
Arkhangai	5	1,310	Sukhbaatar	6	12,000
Bulgan	42	28,370	Selenge	167	85,925
Darkhan-Uul	15	7,020	Tuv	45	42,290
Dornod	14	37,500	Khuvsgul	23	19,000
Orkhon	8	3,640	Khentii	30	20,220
Uvurkhangai	4	8,800	Ulaanbaatar	6	101,500

Source: MOFALI

Table 1.3.8 Number and Capacity of Potatoes and Vegetables Storage

Aimag	Potatoes	Vegetables

	Number	Capacity (ton)	Number	Capacity (ton)
Arkhangai	66	787	18	526
Bayankhongor	31	733	22	724
Bayan-Ulgii	47	1,014	0	0
Bulgan	103	3,400	0	0
Darkhan-Uul	144	2,904	88	7,987
Dornod	23	371	129	562
Dornogovi	2	150	7	240
Dundgovi	3	31	4	45
Govi-Altai	18	510	0	0
Govisumber	12	483	0	0
Khentii	38	670	17	310
Khovd	362	8,550	8	195
Khuvsgul	9	445	6	280
Orkhon	47	2,812	113	3,706
Selenge	246	8,868	66	24,604
Sukhbaatar	12	440	0	0
Tuv	3,473	65,645	0	0
Ulaanbaatar	25	16,640	81	15,000
Umnugovi	88	730	0	0
Uvs	66	1,040	104	1,235
Uvurkhangai	72	1,666	54	549
Zavkhan	86	1,354	5	32

Source: MOFALI

(7) Agricultural extension service

Major stakeholders of national extension system can be classified as shown in Table 1.3.9. The public extension service is provided by the Food and Agriculture, Light Industry, and Rural Development Center newly established based on the National Agricultural Extension Center (NAEC). NAEC was state-funded enterprise and its status was defined by governmental resolution No. 188 and Order No. A/186 of MOFALI. NEAC had a headquarter office in Ulaanbaatar and number of staff of NAEC was approximately 30. Most staff members (54%) worked in administration, management, accounting, general service, and maintenance, while the rest were agricultural specialist who provided extension and advisory services.

Each Aimag has an extension center located in the department of agriculture in the Aimag government. Only one focal person is dispatched to the center and their expertise is all related to agriculture such as agronomy, livestock, engineering. Their salary is paid by the Aimag government, and therefore the extension worker in Aimag tends to put more emphasis on the tasks prioritized by the Aimag government. All the centers were equipped with minimal facilities, but there is little knowledge exchange and sharing among extension workers in the different Aimags and Soums, and the NAEC at national level. In addition to Aimag centers, 180 Soums were equipped with advisory service centers by the international project. However, once the project ended, service centers in Soum were closed due to lack of fund. Public budget allocation for NAEC is limited, of which more than 80% of budget is spent for recurrent cost, while 2% is used for training and meeting.

Apart from the public extension services, private companies and civil society organizations work with farmers in Mongolia and provide various services, such as agricultural machinery and equipment, and agricultural input supply. For example, some LLC provides technical support and extension services including filed demonstrations, technical training, and advisory services to their clients, other LCC holds study tour, training session and demonstration on agricultural machinery to promote farmer to farmer extension. They often have more frequent contacts with farmers, but their services tend to exclude farmers who cannot afford to pay or are unable to invest in high cost technologies. In general, private sector services are quickly moving towards more modern technology and higher investment. However, there are few linkages between public institutions and private companies, and incentives to facilitate

such linkages are limited.

Table 1.3.9 Main Stakeholders and Main Objectives for Agricultural Extension Service

Stakeholder	Main activities
The government	- Developing agricultural production, extension and research policy, setting priorities of agricultural research and extension activities and partnering with external agricultural players/donors.
Public research institutions and agricultural universities	- Carrying out long- and short-term research projects, testing different varieties and technologies, and offering both undergraduate and graduate degrees in agriculture. Both research institute and universities have extension centers that offer some training sessions.
National Agriculture Extension Center (public)	- Organizing training and extension activities across the country through their Aimag and Soum branches. They often liaise with and provide international projects with training programs and other activities, rather than linking farmers with other stakeholders, including researchers based on their needs.
Private sector	- Providing goods and services to farmers for profit, mainly input suppliers and veterinary medicine services.
NGOs	- Implementing governmental and non-governmental programs and international projects, and bidding on tenders for input import
International projects	- Providing funding for inputs and equipment, and expertise and support for technology transfer
Farmer associations and commodity groups	- Often formed by politicians for lobbying purpose, involved in implementing international and national projects.
Farmers and agricultural producers	- Traditionally receiving research and extension services.

Source: A review of the agricultural research and extension system, FAO

(8) Cooperatives

There are 4,572 cooperatives as of 2019 and the total membership is 234,875 in Mongolia. Of cooperatives, 31% is agriculture-related (Table 1.3.10), while the proportion of the agriculture-related membership accounts for less than 15%. This indicates that agriculture-related cooperatives are rather small with 25 membership on average per cooperative as compared to other economic activities. Since the National Programme for Cooperative Development was conducted between 2009 and 2017, the number of cooperatives and the total membership between 2013 and 2019 increased 1.4 times and 2.1 times, respectively.

The programme was implemented through the National Cooperative Federation together with sector-specific associations such as National Association of Mongolian Agricultural Cooperatives (NAMAC). However, increase in the number of cooperatives and membership related to agriculture are comparatively low as compared to national statistics. It seems that those who are engaged in the agriculture sector are not convinced of the merit of participating in cooperatives. Nevertheless, some cooperatives such as NAMAC and Mongolian Female Farmers' Association are actively implementing their project, as they are not politically drive or external project driven, but self-funded through sales of several products, training and advisory service fees, and membership fees. Cooperatives need to be vitalized in considering financial aspect to facilitate introduction of better technologies and procurement of better input for production as well as marketing of products. Some major crop farming-related cooperatives are shown in Table 1.3.11.

Table 1.3.10 Number of Agriculture-related Cooperatives and Membership between 2013 and 2019

	2013	2014	2015	2016	2017	2018	2019
Cooperative	1,164	1,352	1,348	1,317	1,352	1,384	1,397
Membership	27,153	31,392	29,813	32,216	32,640	34,133	34,393

Source: NSO website

Table 1.3.11 List of Some of Major Crop Farming-related Cooperatives in Mongolia

Title	Main activity
National Association of Mongolian Agricultural Cooperatives	- Provides regular training, consulting and marketing services for member cooperatives, and different types and levels of training, regional meeting, policy making, lobbying, delivery of government policies to rural areas, etc.
National Association of Cooperatives	- Provides training, seminars and consulting services for members, connecting with different associations
Association for Sustainable Rural Development	- Provides professional consulting for agricultural businesses, rural small and medium enterprises and rural and community development programmes; researches rural and community development issues on international standards; implements or co-implements projects for sustainable rural development and poverty reduction
Mongolian National Association of Food and Agriculture	- Largest association in Mongolia representing smallholder and family farmers engaged in horticulture and small-scale livestock farming
Mongolian National Association of Sea Buckthorn Growers and Producers	- Provides training and consulting regarding sea buckthorn and other crops to members, individuals and farmers; carries out research and studies in the agricultural sector
Mongolian Association of Crop Producers	- Helps members produce higher-quality wheat; promotes their activities; provides training on implementing innovation in the sector
Mongolian Society of Agricultural and Rural Development	- Focuses on strengthening capacity building
Seed Breeders Association	- Provides training and consulting
Mongolian Women Farmers Association	- Supports potato planting, plantation selling, training, consulting and business development
Mongolian Beekeepers Association	- Provides training and consulting services for members and individual beekeepers; prints booklets and guidebooks
Mongolian Food and Agriculture Association	- Supports exhibitions, annual conferences, training, consulting, event organization and connecting partners

Source: A review of the agricultural research and extension system, FAO

(9) Agro industrial technology park/Agro supply chain

Agro industrial technology parks (Agro IT Parks) originally promoted under the initiative of the former Ministry of Industry were formally approved in 2016 and it is now under the control of National Development Agency (NDA). Initially 40 proposed sites were selected and eight out of 40 sites were designated as priority sites, but it is under a review process. NDA is also planning to realize the new project called "Agro supply chain". From the viewpoint of crop farming, the Government selected as priority seven Aimags of Selenge, Tuv, Darkhan-Uul, Khentii, Uvurkhangai, Bulgan, and Arkhangai. The action program 2016-20 for agriculture and livestock promotes, "Healthy food-healthy Mongolian" and all the programs are prepared under this slogan. Accordingly, diversification of crops including millet, beans, and oil seeds could contribute to all the policies and programs consistently.

1.4 Development Directions, Objectives, Strategies and Targets

1.4.1 Development directions

(1) Keywords for development of crop farming sector

Based on the information presented above, important keywords are extracted and summarized as shown in Table 1.4.1. Development approaches will also be established based on these keywords as shown.

Table 1.4.1 Keywords for Development for Crop Farming Sector

Keyword	Approach
Full self-sufficiency of grains, potatoes, and vegetables	- Efficient irrigation technology - Increase in fertilizer supply - Strengthening of winter production
Environment-friendly farming	- Soil conservation techniques
Improvement of market environment	- Demand and supply information exchange system - Distribution system including cold chains
Development of industrial cluster	- Healthy and safety food, and processing using diversified crops

Source: JICA Project Team

(2) Example technologies/crops to be introduced

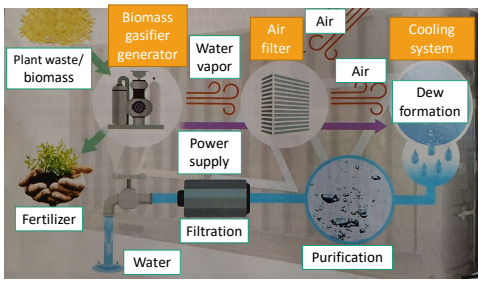
There are several example technologies and crops to be introduced based on the keywords presented above (Table 1.4.2). These technologies are outlined below with respective titles (Table 1.4.3). It is noteworthy that Japan International Cooperation Agency (JICA) has commenced in March 2020 the new technical cooperation project (TCP) " The project for formulation of master plan on the agriculture value chain in Mongolia". The new TCP is expected to implement several pilot projects relating to improvement of the agro-related value chain. Therefore, it is important to keep consistency between the crop farming sector in the National Comprehensive Development Plan (NCDP) and the new TCP.

Table 1.4.2 Example Technologies/Crops to be Introduced for Crop Farming Sector

No.	Approach	Example technology/crop to be introduced
1)-i)	Efficient irrigation technology	- Water forming from air using biomass gasifier generator - Water-saving cultivation
1)-ii)	Increase in fertilizer supply	- Compost making using food residues in Ulaanbaatar and its distribution to production areas - Small-scale nitrogen manufacturing plant
1)-iii)	Strengthening of winter production	- Greenhouse using geothermal heat exchange system
2)-i)	Soil conservation techniques	- Sowing machine for zero-tillage - Roll planter for soil surface coverage and root development
3)-i)	Demand and supply information exchange system	- Matching system with ICT (Information Communication Technology) between producers and buyers
3)-ii)	Distribution system including cold chains	- Ice shelter using natural ice
4)-i)	Healthy and safe cultivation and processing using diversified crops	- Use of ICT application and traceable cultivation

Source: JICA Project Team

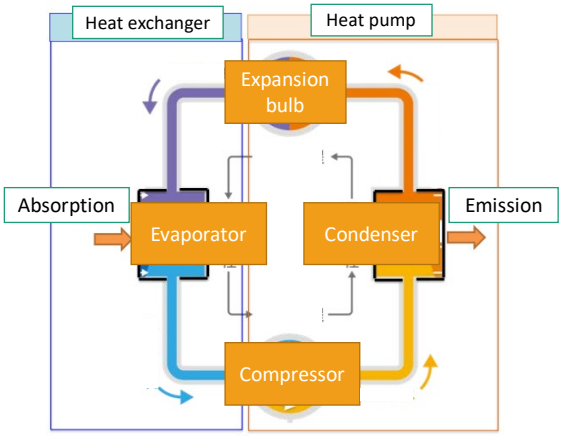
Table 1.4.3 Outline of Example Technologies/Crops to be Introduced

1)-i)	Title:	Water forming from air using biomass gasifier generator
	Outline:	In Mongolia, droughts pose one of the constraints to crop production causing fluctuations of the production. Although main water sources here continue to be surface water and/or groundwater, the latest technology allows to make water from air. Biomass gasifier generator running by plant wastes and/or other biomass can supply the power for air filter and cooling system and produce water vapor. Water vapor and air will be sent to air filter and cooling system for dew formation. Once dew is formed, purification and filtration will be done for the final product. It can produce 2,000 liter of water in 24-hour operation. By-product from the generator can be utilized as fertilizer.  Source: Skysource website modified by the JICA Project Team
	Title:	Water-saving cultivation
	Outline:	In Mongolia, groundwater is often used for vegetable cultivation. However, it is reported that the groundwater levels have been declining gradually, and the sustainable use of water resources is one of the concerns in LTDP 2050. To meet the increasing demand of vegetables in consideration of sustainable use of water resources, water-saving techniques should be introduced. There is a system which optimizes the farming environment through automatic irrigation control. The system collects necessary information, e.g., temperature, humidity, radiation, soil moisture, and then, its unique algorithm controls the irrigation through internet to optimize nutrition and moisture in the soil.  Source: Routrek Networks
1)-ii)	Title:	Compost making using food residues in Ulaanbaatar and distribution to production areas
	Outline:	Currently, the self-sufficiency rate of vegetables is around 55%. Consistently increasing production is needed to meet the growing urban demand especially in Ulaanbaatar. Fertilizer application is indispensable to increase production, but little amount of fertilizer is used at present. Introduction of waste disposal processors could provide one of the solutions. Using a waste disposal processor, the garbage is biologically decomposed and its volume reduced without odor.  Source: JICA Kyushu After putting garbage into the processor, decomposition starts with micro-organisms and garbage turns to fermenting bed. It will be taken out once in half a year. The fermented bed gets fully composed, and then, makes it compost and soil conditioner. They will be sent to production areas such as Selenge. This way, the urban residents of Ulaanbaatar could also contribute to farming.
	Title:	Small-scale nitrogen manufacturing plant
	Outline:	The Haber-Bosch process, which has been used up to now for the synthesis of ammonia, requires high-temperature, high-pressure reaction conditions, and therefore concentrated,

high-volume production must be undertaken at a single large-scale plant that consumes huge volumes of energy. This entails substantial capital investments. Prof. Hosono at the Tokyo Institute of Technology applied "Electrides" that use a component found in low-cost alumina cement as a raw material, which are stable even in the air at room temperature as a catalyst for ammonia synthesis, and discovered that highly efficient ammonia synthesis is possible even under low-temperature, low-pressure conditions. Using these Electrides as catalysts to synthesize ammonia under low-temperature, low-pressure reaction conditions makes it possible to produce ammonia even at small-scale plants, where production was considered difficult in the past. [2]

1)-iii) Title: Greenhouse using geothermal heat exchange system

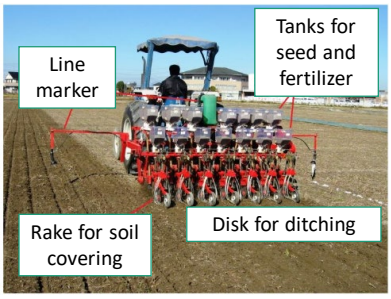
Outline: Demand for vegetables has grown year by year; however, there are still some constraints for year-round cultivation such as fuel costs. It is said that fuel costs comprise up to 40% of total production cost during winter. Greenhouse using geothermal heat exchange system could contribute to the issue.
In the system, geothermal heat absorbed by evaporator converts refrigerant to low-temperature and low-pressure gas. It will be transformed into high-temperature and high-pressure gas by compressor. The gas heats the water through condenser. Geothermal heat, one of natural energies, is stable for use throughout the year and this stable temperature can be utilized for geothermal heat exchange system.



Source: JICA report

2)-i) Title: Sowing machine for zero-tillage

Outline: More than 50% of crop farm households and business entities in Mongolia face soil degradation to greater or lesser extent. As soil conservation is one of the tasks in the policy for environment friendly farming, soil conservation techniques such as zero-tillage cultivation need to be introduced. Sowing machines for zero-tillage are equipped with all the necessary attachments.



Source: Saitama Prefecture

Title: Roll planter for soil surface coverage and root development

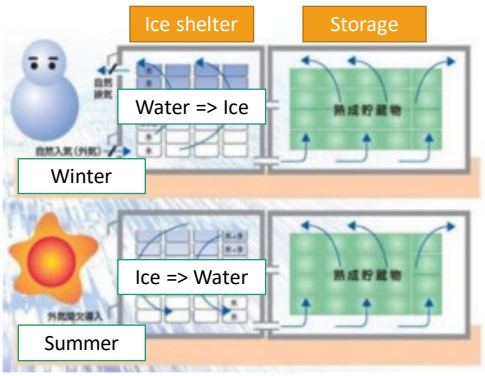
Outline: Polylactic acid roll planter is a bio-degradable material knit into a cylindrical shape, which is stuffed with soil and sand.
It could revive vegetation in degraded lands to allow harvesting agricultural products because it promotes root development under the optimum water retention, aeration, and nutrition supply. When it is combined with drip irrigation system, use of water and labor can be economized.


Source: JICA report

3)-i) Title: Matching system between producers and buyers

Outline: Producers generally do not have a bargaining power with middleman for several reasons; the production areas far from consumption areas, lack of transport means and storage facilities, limited access to market information among others.
To correct the information inequality, a matching system on the web server could be used.

[2] https://tsubame-bhb.co.jp/en/technologies/, accessed on 1st April, 2019

		Producers upload the information on their farming plans, expected harvest and price, and buyers share their sales plans. The information can be browsed from both sides and they can negotiate each other based on the shared information. One smartphone/tablet device will be given to a cooperative and all the information will be gathered through ICT application, e.g., production support system. Not only buyers, but also other stakeholders such as input suppliers and banks may be involved in the system. This will also lead to strengthening of cooperatives.
3)-ii)	Title:	Ice shelter using natural ice
	Outline:	Increment in storage capacity is the key for better distribution of agro-products. Ice shelter using natural ice is one of the solutions and it will also contribute to cold chains. Ice shelter is a kind of low-temperature storage facilities and it keeps room temperature around zero degree C throughout the year using latent heat effect of natural ice. During winter, in the course of transformation from water to ice, water release the heat and it act as warming effect and vice versa in summer.
		 Source: JICA report
4)-i)	Title:	Use of ICT application and traceable cultivation
	Outline:	Nowadays, producers need to produce safe and traceable agro-products as consumers are highly conscious of how and where food was produced. There are several approaches to ensure food safety such as Good Agriculture Practices (GAP) and laboratory analyses. Although keeping records and information management are major constraints for producers, ICT application could support them. One smartphone/tablet device will be given to a cooperative and all the information will be gathered through ICT application, e.g., production support system including type of crops, variety, location, field management, and so forth. From the viewpoint of diversification of crops, millet, beans, and perilla could be recommendable. They are generally known as high-nutrition foods. One of the millets variety "Quinoa" has a favorable balance in its amino acid contents compared to other plant foods. Also, international trade has shown an increase in its demand. Furthermore, when it is cultivated by organic farming and popped by high-temperature steamer, its value increases. Beans can be incorporated into crop rotation for soil conservation. Perilla belongs to mint family and its oil contains more than 60% of Omega-3 fatty acid which is one of the essential fatty acids and is prone to shortages in usual diet. Cultivation of these crops could contribute to healthy Mongolia.

Source: JICA Project Team

1.4.2 Development objectives, strategies and targets

(1) Development objectives

Through the discussions with stakeholders and literature review of policy documents, the vision of the crop farming in Mongolia to be pursued is summarized as follows:

(a) To become a country which secures self-sufficiency of basic food,
(b) To provide diversified agro-products as part of economic diversification,
(c) To pursue market-oriented agriculture for import substitution and export promotion, and
(d) To ensure environment-friendly agriculture as part of green development.

To achieve its vision, the following development objectives are proposed:

(i) Realization of 100% self-sufficiency of wheat, potatoes, and selected vegetables,
(ii) Introduction of diversified agro-products and integrated approaches,
(iii) Establishment of market-oriented agriculture for improvement of livelihood, and

(iv) Consideration of natural and social environment-friendly agriculture.

(2) Development strategies

In the light of the above objectives, the basic strategy for agricultural development in Mongolia is proposed with the following components:

(a) Introducing appropriate technologies which contribute to production and productivity increase,
(b) Promoting diversified crop production and integrated farming with livestock,
(c) Pursuing better market environment and customer satisfaction through value addition, and
(d) Ensuring environment-friendly cultivation practices for sustainable agriculture.

(3) Development targets

In order to realize the objectives, the development targets were estimated based on the following preconditions.

General conditions

- Population: 3,862,800 in 2030 and 4,495,000 in 2040
- Per capita annual consumption (kg/person/year)[3]: 121.7 for cereal, 51.1 for potatoes, 73.0 for vegetables, and 9.1 for industrial crops (oil seed crop).

Cereal

- Area (ha): area cultivated in 2018 will be maintained both in 2030 and 2040.
- Yield (ton/ha): productivity will gradually increase from 1.2 in 2018 to 1.3 in 2030 and 1.5 in 2040; the highest yield was 1.4 recorded in 2010.
- Total consumption (ton): 469,974 in 2030 and 546,891 in 2040.
- Self-Sufficiency Rate (SSR) target (%): 100% both in 2030 and 2040[4].
- Required production to meet SSR: 469,974 in 2030 and 546,891 in 2040.

Potatoes

- Area (ha): area cultivated in 2016 will be used both in 2030 and 2040; the highest cultivation area was recorded in 2016.
- Yield (ton/ha): productivity will gradually increase from 13.1 in 2018 to 13.5 in 2030 and 15.3 in 2040[5]
- Total consumption (ton): 197,389 in 2030 and 229,694 in 2040.
- SSR target (%): 100% both in 2030 and 2040[8].
- Required production to meet SSR: 197,389 in 2030 and 229,694 in 2040.

Vegetables

- Area (ha): area to be cultivated in 2030 will increase by 200% in priority Aimgas[6] and 80% in others compared to cultivation area in 2018. In 2040, area in priority Aimags will be maintained and area in other Aimag will increase by 100% from cultivation area in 2018.

[3] The unit for industrial crops is L/person/year
[4] The SSR targets were set in the SDV 2030
[5] The CAGR between 2000 and 2018 is 3.1% and expected yield will reach 18.9 in 2030 and 25.6 in 2040 reaches when it applies
[6] Arkhangai, Bulgan, Darkhan-Uul, Khentii, Selenge, Tuv, and Uvurkhangai

- Yield (ton/ha): productivity will gradually increase from 11.4 in 2018 to 12.4 in 2030 and 14.0 in 2040[7].
- Total consumption (ton): 281,985 in 2030 and 328,136 in 2040.
- SSR target (%): 100% for selected vegetables both in 2030 and 2040[8].
- Required production to meet SSR: 281,985 in 2030 and 328,136 in 2040.

Fodder crops

- Area (ha): area cultivated in 2018 will be maintained both in 2030 and 2040.
- Yield (ton/ha): productivity will gradually increase from 2.7 in 2018 to 3.0 in 2030 and 3.3 in 2040; the yield of 3.1 was recorded in 2010.
- Total consumption (ton): 136,224 in 2030 and 148,608 in 2040[8]; as of 2018, production was 123,840 and assuming that intensive livestock will increase by 10% in 2030 and 20% in 2040 from 2018.
- SSR target (%): 100% both in 2030 and 2040[9].
- Required production to meet SSR target: 135,165 in 2030 and 144,176 in 2040.

Industrial crops

- Area (ha): area to be cultivated in 2030 and 2040 will increase by 40% and 60% compared to cultivation area in 2018, respectively.
- Yield (ton/ha): productivity will gradually increase from 0.5 in 2018 to 0.6 in 2030 and 0.7 in 2040.
- Total consumption (ton): 129,713 in 2030 and 150,942 in 2040; consumption was calculated using the following formula. A x B / C, where A is population, B is per capita annual consumption, and C is oil extraction rate (0.25).
- SSR target (%): 35% in 2030 and 50% in 2040[10]; SSR in 2015 is 21%.
- Required production to meet SSR target: 58,371 in 2030 and 75,471 in 2040.

Fruits

- Area (ha): area to be cultivated in 2030 and 2040 will increase by 80% and 200% compared to cultivation area in 2018, respectively[10].
- Yield (ton/ha): N/A.
- Total consumption (ton): N/A.
- SSR target (%): N/A.
- Required production to meet SSR target: N/A.

Related information at national level in 2018, 2030, and 2040 is summarized in Table 1.4.4.

Table 1.4.4 Agricultural Statistics in 2018 and Estimation in 2030 and 2040

2018	Production (ton)	Area (ha)	Yield (ton/ha)	Per capita annual consumption (kg/person/year)*
Cereal	453,849	366,809	1.2	121.7
Potatoes	168,883	12,925	13.1	51.1

[7] The CAGR between 2000 and 2018 is 1.9% and expected yield will reach 14.3 in 2030 and 17.2 in 2040 when it applies
[8] Total consumption was set by JICA Project Team
[9] SSR target was set by JICA Project Team
[10] When the CAGR with 5% applies, area to be cultivated reaches given figures

Vegetables	100,732	8,866	11.4	73		
Fodder crops	123,840	46,309	2.7	-		
Industrial crops	34,581	69,161	0.5	9.1		
Fruits	1,692	3,873	0.4	-		
2030	Production (ton)	Area (ha)	Yield (ton/ha)	Population	Total consumption (ton)***	SSR target (%)**
Cereal	476,852	366,809	1.3	3,862,800	469,974	100 (469,974)
Potatoes	202,838	15,025	13.5	3,862,800	197,389	100 (197,389)
Vegetables	287,338	22,987	12.5	3,862,800	281,985	100 (281,985)
Fodder crops	138,927	46,309	3.0	-	136,224	100 (136,224)
Industrial crops	59,194	98,657	0.6	3,862,800	140,992	40 (56,397)
Fruits	-	6,983	-	-	-	-
2040	Production (ton)	Area (ha)	Yield (ton/ha)	Population	Total Consumption (ton)	SSR target (%)
Cereal	550,214	366,809	1.5	4,495,000	546,891	100 (546,891)
Potatoes	229,883	15,025	15.3	4,495,000	229,694	100 (229,694)
Vegetables	329,420	23,530	14.0	4,495,000	328,136	100 (328,136)
Fodder crops	152,820	46,309	3.3	-	148,608	100 (148,608)
Industrial crops	82,034	112,702	0.75	4,495,000	164,068	50 (82,034)
Fruits	-	11,638	-	-	-	-

* The unit for industrial crop is L/person/year.
** Figure in parenthesis shows necessary production amount to meet the target of self-sufficiency rate.
*** Total consumption for industrial crop is calculated using the following formula. A x B / C, where A is population, B is per capita annual consumption, and C is oil extraction rate (0.25).
Source: JICA Project Team

1.5 Projects for Crop Farming Development

A set of projects is proposed for crop farming sector as summarized in Table 1.5.1.

Table 1.5.1 Project List for Crop Farming Sector

No.	Theme	Main contents	Location	Relationship with LTDP 2050 (ID #)
1	Smart agriculture	ICT application, Unmanned aerial vehicle and precision farming	Ak, Bg, Bu, Du, Dg, Kt, Sl, Tv, Uk, and Uv	2.4
2	Greenhouse	ICT application and geothermal heat exchange system, and environmental education	Du, Kd, Sl, Tv, and UB	6.4.7
3	Irrigation	National Irrigation Master Plan, development of irrigation scheme, and O&M	Nationwide	8.1.4, 8.6.6
4	Fodder crop	Varietal selection, cultivation techniques, and logistics	Ak, Du, Dn, Kt, Sb, Sl, Tv, and Uv	8.1.4
5	Oil seed crop	Varietal selection, cultivation techniques, and market survey	Bg, Du, Dn, Kt, Sl, Sb, Tv, and Uk	8) Regional development, Development of eastern Mongolia,

				Stage 2
6	Integrated crop-livestock farming	ICT application, combination with crop, social welfare, medical, and education sector	Ak, Du, Dn, Kt, Sb, Sl, Tv, and Uv	8) Regional development, Development of eastern Mongolia, Stage 2
7	Sea buckthorn	Cultivation techniques, market-oriented processing	Bg, Sl, Tv. Ul, Uv, Uk, and Zh	8.4.6
8	Cold chain	Cold storage using techniques such as solar power, ice shelter, zeer pot, and radiation.	Du, Kt, Kd, Sl, Tv, Uv, and Uk	8.5.7
9	Market environment	ICT application for traceability and matching system	Du, Kt, Kd, Sl, Tv, Uv, and Uk	2.5.16, 8.1.6, 8.2.7, 8.3.3, 8.4.5, 8.5.8, 8.6.8
10	Land conservation	Sowing machine for zero-tillage and polylactic acid roll planter	Nationwide	6.2.7, 6.2.8, 6.2.8, 6.4.8
11	Recycle-based society	Survey on food loss, installation of recycle equipment, environmental education	Du, Sl, Tv, and Ub	2.5.10

Note: Ak: Arkhangai, Bu: Bayan-Ulgi, Bg: Bulgan, Du: Darkhan-Uul, Dn: Dornod, Dg: Dornogovi, Kt: Khentii, Kd: Khovd, Sl: Selenge, Sb: Sukhbaatar, Tv: Tuv, Ub: Ulaanbaatar, Uv: Uvs, Uk: Uvurkhangai, and Zh: Zavkhan
Source: JICA Project Team

1.5.1 Smart agriculture promotion

(1) Background

The SDV2030 mentions that 100% self-sufficiency of wheat, potatoes, and vegetables will be achieved by 2030. Currently, production of wheat and potatoes almost meet its demand. Contrary, self-sufficiency rate for vegetables in 2018 is 43%. It is expected that the population in Mongolia will reach 3.8 million in 2030 and 4.5 million in 2040, and therefore, production needs to be increased to meet the demand. One of the issues for crop farming is unstable production. Annual variation of productivity was too large and there is a wide yield variation between Aimags. In order to increase the production, productivity should be maintained at high level and yield gaps between Aimgas should be reduced by support measures. Another issue is that number of people who are engaged in agriculture has been decreasing, although the total labor force has been increasing year-on-year. To resolve these issues together, application of ICT is effective to realize smart agriculture.

(2) Project components

Installation of ICT application

The project will install 24/7 full operation meteorological sensor and soil sensor at the field. All the collected information together with weather forecast and cultivation record in the past year will be uploaded in the cloud system. Then, the system will provide the necessary information such as planting and harvesting time, fertilizer, chemical, and irrigation requirement, prevention measures from climatic damage, and so on. This allows producers to optimize the input and maximize the production with low cost and low input.

Utilization of unmanned vehicle

The use of drones performs the tasks such as sowing and fertilizer application. Moreover, the drone equipped with sensing devices can quickly and precisely monitor growth conditions and make pinpoint application based on the information collected. Unmanned machineries such as tractor and harvester using satellite positioning technology can work all day and all night, and allow producer to expand the area to be cultivated with less labor input.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where the system will be installed and deciding the size of operation, providing professional and methodological advice, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products, installation and maintenance of the system, and providing professional methodology and capital investment required.

1.5.2 Greenhouse agriculture promotion (* Anchor project)

(1) Background

The SDV2030 mentions that 100% self-sufficiency of wheat, potatoes, and vegetables will be achieved by 2030. Self-sufficiency rate for vegetables has gradually decreased and it is 43% in 2018. It is expected that the population in Mongolia will reach 3.8 million in 2030 and 4.5 million in 2040, and therefore, production needs to be increased to meet the demand. In Mongolia, cultivatable period is limited due to climate conditions in the winter. One of the options is to construct greenhouses which allow to cultivate vegetables in the winter. However, cultivation area and production under greenhouses in 2017 was still less than 1% of total area and production. As production per unit area of greenhouses is higher in winter season than in summer season, greenhouse cultivation should place more emphasis on winter, but major constraints for expansion is fuel costs. It is said that fuel costs comprise up to 40% of the production cost by greenhouses. In addition, sustainable use of water resources needs to be considered as it is reported that the ground water has been declining gradually. Therefore, greenhouse technology with eco-friendly and low-cost production system is required.

(2) Project components

Installation of environmental control system

The project will install 24/7 full operation environmental control system in the greenhouse. The system collects the required information and make all the information visible. Through the environmental monitoring, the system autonomously decides whether temperature and humidity are increased or decreased, and irrigation is applied or not to maintain the optimal environment for vegetables in the greenhouse. Timer-control is also available based on the designed schedule.

Utilization of geothermal heat exchange system

In the system, geothermal heat absorbed by evaporator converts refrigerant to low-temperature and low-pressure gas. It will be transformed into high-temperature and high-pressure gas by compressor. The gas heats the water through condenser. Geothermal heat, one of natural energies, is stable for use throughout the year and this stable temperature can be utilized for geothermal heat exchange system.

Education for younger generation

The environmental control system is composed of modern technologies and greenhouse with such a system may attract the interest of younger generation. A small model of greenhouse will be used for them to learn greenhouse horticulture and training course will be established including classroom lecture and on-farm training.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where the system will be installed and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products, installation and maintenance of the system, and providing professional methodology and capital investment required.

1.5.3 Irrigation development

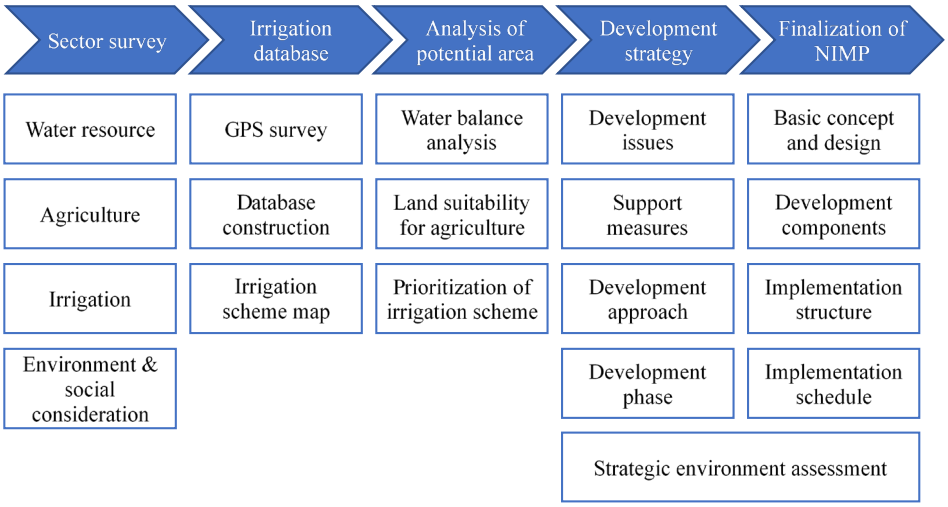
(1) Background

Drought and lack of irrigation facilities are reasons of a yield fluctuation of crops, and therefore target irrigation development area is set at 120,000 ha in the SDV2030. Although more than 80% and 50% of areas at household farms and business entities are irrigated respectively, crop farming in Mongolia is still susceptible to droughts. In addition, of those who did not install irrigation, 45% of household farms and 49.8% of business entities responded that the lack of water is the most severe constraint, followed by lack of financial resources. In order to promote the production, productivity should be maintained at high level and yield gaps between Aimags should be reduced by support measures such as irrigation.

(2) Project components

Preparation of the National Irrigation Master Plan (NIMP)

The project will prepare the NIMP to achieve 100% self-sufficiency of wheat, potatoes, and vegetables. Conceptual image of the preparation process is depicted in Figure 1.5.1. At the time of preparation, it is considered sustainable irrigation development, management at national level and communal level, contribution to poverty reduction and climate change, and the idea of watershed management.



Source: JICA Project Team

Figure 1.5.1 Process to Prepare National Irrigation Master Plan of Mongolia

Development of irrigation facilities

In the course of preparation of the NIMP, the existing irrigation area to be improved will be identified and a new irrigation development area will be prioritized. Irrigation schemes to be proposed in the NIMP include headwork and pump irrigation, dam and reservoir irrigation, lake irrigation, and groundwater irrigation. In development planning, it is important to incorporate the idea for multipurpose utilization; irrigation water could be utilized for domestic water and drinking water for livestock.

Reinforcement of the O&M system

Once facilities are developed, it is important to operate and maintain the facilities continuously in a proper manner. Guidelines and a manual for O&M are to be prepared and training is to be given to relevant stakeholders including government officers and members of the water user association in the rural area. Installation of ICT application for data collection, O&M, and monitoring to facilitate the capacity should also be considered.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where the irrigation schemed will be developed and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with a private entity or water users association for administering and managing the irrigation schemes.

1.5.4 Fodder crops development

(1) Background

Fodder crops in Mongolia are composed of four major categories: green fodder, perennial crops, silage crops, and other crops. Although hay is the most consumed fodder by livestock, green fodder contains much more minerals than hay. Self-sufficiency rate for fodder crops in 2015 is estimated at 55% and deficit amount is imported from abroad.

Number of livestock is more than 66 million in 2018, and central and northern parts of Mongolia where human population and livestock population are dense are considered as overgrazing areas. In order to improve quality of animal products and to promote intensive farming for environment conservation, it is reasonable to increase the supply of fodder crops. As the price of green fodder is higher than that of straw and hay, cultivation of green fodder also contributes to improvement of farmers' livelihood.

(2) Project components

Selection and multiplication of appropriate crops and varieties

The first step is to search for potential crops and varieties to be introduced that are fitted to Mongolian environment. Land suitability for fodder crops will be assessed and using such an information, crops and varieties to be employed will be selected. After tentative selection, a cultivation test is conducted on-site and varieties to be disseminated are selected. In the course of selection, performance of the varieties including productivity, growth duration, and nutritious aspect for livestock are evaluated. Seed multiplication also needs to be taken into account to promote cultivation.

Improvement of cultivation techniques

Cultivation techniques could be varied depending on the final form such as hay and silage. In the light of the expected output, sowing amount, fertilizer application rate, drainage measure, and harvesting time should be examined. For example, Italian ryegrass is recommended to harvesting at the time of heading stage to obtain the maximum total digestive nutrients. Therefore, a cultivation calendar with appropriate fodder crops with cultivation techniques should be prepared. The cultivation calendar should contain nursery preparations, a schedule for sowing, transplanting, irrigation, weeding, harvesting etc. The formation of cooperative society could contribute to information sharing.

Establishment of logistic system

Logistic hubs including processing factory, storage, and logistic services are necessary to distribute the product to constitute effectively as an industrial cluster. Logistic hubs may include roadside station and antenna shop to promote the products.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where fodder crops cultivation will be promoted and deciding the size of operation, providing professional and methodological advice, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products and providing professional methodology.

1.5.5 Oil seed crops development

(1) Background

Oil seeds such as rapeseed and sunflower are major industrial crop in Mongolia. Oil seed crops harvested by producers are transferred to a processing company, and final product is delivered to the customers. The processing steps of oil seed crops include (i) pressing, (ii) extraction of gum, (iii) bleaching, (iv) deodorant, and (v) packaging. According to a processing company, a ton of rapeseed purchased at approximately US$350 produces about 250 liter of soil and it is sold at US$1.5-2/liter. Self-sufficiency rate for oil seed crops in 2015 is estimated at 21% and deficit amount is imported from abroad. In order to improve food security, it is reasonable to promote oil seed crop cultivation as import substitution.

(2) Project components

Selection and multiplication of appropriate crops and varieties

The first step is to search for potential crops and varieties to be introduced that are fitted to Mongolian environment. There is land suitability map for oil seed crop, and therefore crops and varieties to be employed will be selected using such an information. After tentative selection, a cultivation test is conducted on-site and varieties to be disseminated are selected. In the course of selection, performance of the varieties including productivity, growth duration, and people's preference are evaluated.

In case of rapeseed, the varieties which do not contain erucic acid should be selected from the nutritional aspect. From the viewpoint of diversification of crops, perilla could be recommendable. Perilla belongs to mint family and its oil contains more than 60% of Omega-3 fatty acid which is one of the essential fatty acids and is prone to shortages in usual diet. Cultivation of these crops could contribute to healthy Mongolia. Seed multiplication also needs to be considered to promote cultivation.

Improvement of cultivation techniques

Oil seed crops, for example rapeseed, can be grown in many types of soil, though appropriate fertilizer application design depending on soil conditions is the key for better harvesting. Other points to be considered are protection from wet damage and injury by continuous cultivation. Therefore, a cultivation calendar with appropriate oil seed crops with cultivation techniques should be prepared. Moreover, it is reasonable to make the existing machineries used for other crops available for oil seed crop cultivation. For example, sowing machine for wheat can be used to sow rapeseed when sowing attachment is modified to recommended sowing rate and harvesting can also be done by general combine harvester using attachment for buckwheat. At the processing stage, drying and sorting can be done by the existing machineries if 1 mm metallic mesh is attached. The formation of cooperative society could contribute to information sharing.

Market-oriented processing

Information gathering is the first step for development of market-oriented processing. The information on oil seed crops also needs to be collected through a market survey. For example, mixing with vitamin extracted from sea buckthorn may add its value. By-products, i.e., oil cake, can also be used as animal feed and fertilizer.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where oil seed crops cultivation will be promoted and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organizations for administering and managing the project activities, including production of value-added products and providing professional methodology.

1.5.6 Integrated crop-livestock farming promotion

(1) Background

According to the statistical data, 1.4 million ha is classified as arable land. Out of the arable land, approximately 1.0 million ha is identified as land suitable for farming, and it is also the maximum crop farming area from the viewpoint of soil conservation. Currently, many of crop farm households and crop business entities express their concern about soil degradation. In total, 57% of crop farming households and 67% of business entities face the soil degradation to a greater or lesser extent, respectively. Business entities tend to face the situation more severely than crop farming households due to higher usage of chemical fertilizer.

Another issue is overgrazing. Number of livestock is more than 66 million in 2018 and the central and the northern parts of Mongolia where human population and livestock population are dense are assessed as overgrazing areas. To mitigate the land degradation, soil conservation practices through intensive livestock farming associated with crop farming is required.

(2) Project components

Installation of ICT application

The project will install 24/7 full operation environment control system in the animal stall. Various information such as temperature, humidity, and amount of feed is collected by sensor and the system makes all the information visible. Through the environmental monitoring, the system autonomously decides whether temperature and humidity are increased or decreased and feed is applied or not to maintain the optimal environment for livestock in the stall. Timer-control is also available based on the designed schedule.

All the environmental information is shared with a producer via a network. If the system detects an unfavorable event, it gives alert to a producer. The stall environment is also controlled remotely using digital devices connected with network. This also contributes to animal welfare.

Combination with other sectors

In order to make intensive livestock more effective, combination with other sectors is recommended. Intensive livestock will be established where crop cultivation is actively implemented or will be promoted. In doing so, by-products from crop cultivation such as bran from wheat, oil cake from rape seed will be utilized as a feed for livestock and by-product from livestock including animal dung will be applied to crop field as fertilizer. This will contribute to natural conservations. The integration with social welfare sector, medical sector, and education sector is another option by employment of disable people, rehabilitation through farming activities, and interaction between urban and rural areas. SDG 11 also aims at supporting positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where integrated farming will be promoted and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products and providing professional methodology.

1.5.7 Sea buckthorn production expansion

(1) Background

Sea buckthorn is one of the promising agro-products in Mongolia. It can survive below 40 °C and produce a wide range of processed products such as juice, jam, essential oils and cosmetics. Sea

buckthorn purchased at approximately MNT 4,000/kg is processed and sold at MNT 6,000/kg on average. Market price of 50 ml of sea buckthorn oil is around MNT 20,000 and 250 ml of juice is MNT 2,000. Currently, many parts of fruits are processed to juice and jam that are comparatively low value-added products, and therefore other products that offer more value addition needs to be explored.

(2) Project components

Improvement of cultivation environment

It is known that sea buckthorn can be grown at wide range of soils, even sandy and gravely soils. Although the fruit is drought tolerant, the fruits where water is sufficient exhibit higher and more stable production than the fruits at less water retention area. Hence, improvement of cultivation environment is indispensable for further production. There is land suitability map for sea buckthorn and suitable sites will be selected using such and information. Harvesting is normally done manually and thorn may cause injuries, but there are some thorn-free varieties and introduction of them facilitates the workability of producers. Countermeasures for bird attack during maturity period and post-harvest loss also need to be considered.

Market-oriented processing

Information gathering is the first step for development of market-oriented processing. Juice is the most common product as it contains a favorable balance in its protein, vitamins C and E, and organic acids. The leaves are also utilized as a nutritious tea and animal fodders. The oil extracted from fruit is rich in minerals and can be used for cosmetic and medicinal purposes. The information on sea buckthorn processing needs to be collected through formation of cooperative society.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where sea buckthorn cultivation will be promoted and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products and providing professional methodology.

1.5.8 Cold chain development

(1) Background

In Mongolia, cultivatable period is limited due to climate conditions in the winter. One of the options is to construct greenhouses which allow to cultivate vegetables in the winter. Even though production is increased, production itself does not contribute to improvement of self-sufficiency rate for vegetables without distribution to consumers. Hence, it is reasonable to promote cold chain development, mainly storage facilities.

(2) Project components

Selection of appropriate storage technologies

There are various options of cold storage. The basic cold storage is electrical operational one, but it requires a large investment and running cost. A solar power unit to operate cold storage is another option. The cost in Mongolia is estimated at approximately US$15,000 and this contributes to natural environmental protection. In case of a large-scale storage, hybrid power supply between solar and electricity is recommended as a solar power unit only may not supply sufficient power to maintain it.

An ice shelter using natural ice is also available and environment-friendly technique. An ice shelter is a kind of low-temperature storage facilities and it keeps room temperature around zero degree C throughout the year using latent heat effect of natural ice. During winter, in the course of transformation from water to ice, water release the heat and it act as warming effect and vice versa in

summer. An idea of zeer pot using evaporation from wet sand and the cooling system using emission of radiation may also be utilized as environment-friendly technologies.

Selection of appropriate locations

From the cold storage, products need to be distributed to specific destinations. Hence, there are possibility of establishment of logistic hubs including cold storage, processing factory, and logistic services, then it works effectively as an industrial cluster.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the location of the fields where cold storage will be established and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products and providing professional methodology.

1.5.9 Market environment improvement

(1) Background

There are several actors in the value chain for crops such as producer, middleman, transporter, processor, retailer, and consumer. Among the actors, middlemen have appeared in the distribution system after the transition to the market economy and developed their own supply chains. Producers generally do not have a bargaining power for several reasons; the area where they produce agro-products is far from consumption areas, they do not have transportation means nor storage facilities, they have limited access to market information, and so forth. As a result, producers have to accept the prices offered by middlemen, although they are often lower than the market prices. It is reported that the difference between producer prices and consumer prices ranges from 66% to 90%. It is due to interventions by several actors.

Regarding marketing, producers nowadays need to produce safe and traceable agro-products as consumers are highly conscious of how and where food was produced. Hence, improvement of market environment is required such as introduction of GAP for value addition and provision of market information.

(2) Project components

Installation of ICT application for traceability

There are several approaches to ensure food safety such as GAP and laboratory analyses. Although keeping records and information management are major constraints for producers, ICT application could support them. One smartphone/tablet device will be given to a cooperative and all the information will be gathered through ICT application, e.g., production support system including type of crops, variety, location, field management, and so forth.

The recorded information will also be utilized by financial institutes as a decision-making tool for loan disbursement and the wholesale market will be able to provide such an information to consumers to secure its quality. In the SDV2030, it is mentioned that 75% of producers will have access to new technologies and finance by 2030. In order to attract consumers' interest, semi-processed food such as pre-cut vegetables and meal kits may also be introduced.

Establishment of proper distribution system

To correct the information inequality, a matching system on the web server could be used. Producers upload the information on their farming plans, expected harvest and price, and buyers share their sales plans. The information can be browsed from both sides and they can negotiate each other based on the shared information. One smartphone/tablet device will be given to a cooperative and all the information will be gathered through ICT application, e.g., production support system. Not only

buyers, but also other stakeholders such as input suppliers and banks may be involved in the system. This will also lead to strengthening of cooperatives. Agro-products will be delivered to logistic hubs where storage, processing factory, and logistic services are available, for further distribution.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the pilot organization and location where the system will be installed and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products and providing professional methodology.

1.5.10 Land degradation prevention

(1) Background

Currently, many of crop farm households and crop business entities express their concern about soil degradation. In total, 57% of crop farming households and 67% of business entities face the soil degradation to a greater or lesser extent, respectively. Business entities tend to face the situation more severely than crop farming households due to higher usage of chemical fertilizer. To mitigate the land degradation, proper fertilizer distribution and utilization, and soil conservation practices such as minimum- or zero-tillage cultivation are required. The SDV2030 also mentions that minimum- or zero- tillage cultivation is applied in 90% of farm areas.

(2) Project components

As soil conservation is one of the tasks in the policy for environment-friendly farming, soil conservation techniques such as zero-tillage cultivation need to be introduced. Sowing machines for zero-tillage are equipped with all the necessary attachments.

Another example technology is polylactic acid roll planter. It is a bio-degradable material knit made into a cylindrical shape, which is stuffed with soil and sand. It could revive vegetation in degraded lands to allow harvesting agricultural products because it promotes root development under the optimum water retention, aeration and nutrition supply. When it is combined with drip irrigation system, use of water and labor can be economized. These technologies are defined as climate smart agriculture.

(3) Implementing arrangements

MOFALI is the government implementing agency responsible for finding the pilot organization and location where the land degradation measures system will be installed and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. MOFALI will contract with concerned organization for administering and managing the project activities, including production of value-added products and providing professional methodology.

1.5.11 Recycle-oriented society development

(1) Background

In regard to fertilizer usage, 22% of the total harvest area was fertilized in 2010, 16% for household farms and 23% for business entities. Household farms totally depended on the natural and other organic fertilizer and their usage accounts for almost 100%, irrespective of the regions. Even business entities, the proportion of fertilizer usage other than natural and organic fertilizer is 6% on an average. It is expected that the population in Mongolia will reach 3.8 million in 2030 and 4.5 million in 2040, and therefore consistently increasing production is needed to meet the urban demand especially in Ulaanbaatar. In order to increase production and enhance productivity, proper distribution of fertilizer needs to be promoted together with soil conservation techniques.

(2) Project components

Survey on food loss

The Food and Agriculture Organization of the United Nations (FAO) estimates that 32% of all food produced in the world was lost or wasted in 2009. This estimate is based on weight. When converted into calories, global food loss and waste amounts to approximately 24% of all food produced. Essentially, quarter of food calories intended for people is not ultimately consumed by them.

Food loss and waste have many negative economic and environmental impacts. Economically, they represent a wasted investment that can reduce farmers' incomes and increase consumers' expenses. Environmentally, food loss and waste inflict a host of impacts, including unnecessary greenhouse gas emissions and inefficiently used water and land, which in turn can lead to diminished natural ecosystems and the services they provide[11]. It is reported that there is a positive correlation between income and food loss. SDG 12 also aims at halving per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

Installation of recycling equipment

Using a waste disposal processor, the garbage is biologically decomposed and its volume reduced without odor. After putting garbage into the processor, decomposition starts with micro-organisms and garbage turns to fermenting bed. It will be taken out once in half a year. The fermented bed gets fully composed, and then, makes it compost and soil conditioner. They will be sent to production areas such as Darkhan-Uul, Selenge, and Tuv. This way, the urban residents of Ulaanbaatar could also contribute to farming. To promote recycle-based society, equipment will be installed at educational institute as a part of environmental education.

(3) Implementing arrangements

MOFALI and Ministry of Environment and Tourism (MET) are the government implementing agency responsible for finding the pilot organization and location where the recycling system will be installed and deciding the size of operation, providing professional and methodological advices, supporting fund sourcing for international grants and investment for infrastructure. Ulaanbaatar City will contract with concerned organization for administering and managing the project activities, including subsidy for purchase of recycling equipment and providing professional maintenance technology.

1.6 Institutional Measures

For crop farming to contribute to the attainment of the SDV2030 and further the realization of the new development paradigm of alternative socio-economy, technology development and adaptation are most important. Farming activities by private individual and cooperative farmers should be supported by the strong initiative of the Government to take appropriate institutional measures related to technology.

Technology development and adaptation for crop farming should aim at increasing productivity in view of currently low productivity of most crops and need to protect pastureland from further degradation. Specifically, irrigation development needs the government initiative for site selection, planning for water resources development and management and design of facilities. Greenhouse agriculture should be supported by subsidy schemes to encourage introduction of innovative facilities that would fit to local climatic and other conditions.

Other areas and aspects to be supported by the Government include farming technology such as zero-tillage farming, soil improvement measures and selection and development of crop varieties and quality seed. Specific technology and crops to be introduced and adapted are proposed in Table 3.1.20 and Table 3.1.21.

Another important aspect that would need the government initiative is marketing particularly to promote exports. Production of safe and traceable agro-products is increasingly demanded by the export market.

[11] World Resources Institutes, Reducing food loss and wastes

ICT application is indispensable to establish traceable production and marketing system, which should be established first as a pilot project by the government initiative.

The Government may take incentive measures to encourage production of strategic crops that can be processed for higher value added and export products. While an industrial cluster based on a strategic crop may develop by voluntary activities of individual farmers and investors, the Government may facilitate the cluster formation by linking prospective members of the cluster including farmers, processing industries, marketing agents, research institutes and other support service providers. Also, technology for product development and marketing support for export products may be the roles of the Government for some industrial clusters.

Chapter 2 Livestock Farming

2.1 Existing Conditions of Livestock Farming

2.1.1 Livestock sector in Mongolia

(1) Overview

The livestock sector is a key sector of Mongolian economy as it employs 25% of the total workforce, although the sector's activities are mostly seasonal. The livestock sector accounted for 13.6% of the GDP in 2018, slightly decreased from 13.9% in 2010. The livestock sectors' GDP share peak of the last decade was 16.1% in 2016.

The livestock sector of Mongolia is not just one of economic sectors but a totality of socio-cultural and economic activities complex constituting the backbone of the Mongolian tradition having millennia long history. The sector at present supports directly the livelihood of over 300,000 nomadic people engaging in traditional livestock farming, provides employment opportunities for much larger population by primary production, processing, input supply including fodders and veterinary services and related activities.

The livestock sector produces meats and dairy products as essential part of the Mongolian diet, important export goods represented by cashmere wool, hides and skins and leather products as well as meat and dairy products, contributing to foreign exchange earnings. Main products include: 25,800 ton of meat products, 8.66 million liter of processed milk, 1.10 million pieces of goat skins, 8.70 million pieces of sheep skins, 39.6 million pieces of cattle skins, 2.0 ton of wool and 137.9 ton of cashmere raw wool.

(2) Livestock farming systems

Livestock farming in Mongolia is broadly classified into two types: 1) traditional grazing system and 2) more intensive modern farming system. The traditional grazing system is undertaken by nomadic people, and most of them keep five main livestock: goat, sheep, cattle, horse and camel. They move from one place to another typically four to five times a year looking for grazing land most suitable for availability of land, water, fodders and other conditions depending on the season. They graze their animals usually in grassland at higher altitude during spring to summer and move down to lowland with most nutritious grasses during summer to autumn. During winter, they establish simple sheds to protect their animals from the harsh weather conditions.

Nomads produce meat and milk products for self-consumption. They keep livestock for meats represented by sheep for sale to obtain cash income. They also sell cashmere wool, sheep wool and hairs of camels and horses for additional cash income. Horse hairs have been used for string musical instruments for over a century throughout the world.

An increasing number of livestock farmers are undertaking more intensive modern livestock farming in recent years. They still undertake grazing during spring to summer, but they switch to settled farming to avoid reliance on grazing which is more vulnerable to harsh climatic conditions. The Mongolian Government has been promoting this system of livestock farming to ensure sufficient and stable supply of meat and dairy products for increasing urban residents. Especially in the suburbs around Ulaanbaatar, more intensive livestock farming is getting popular to supply livestock products to the city residents.

(3) Livestock population

The total livestock population reported for 2019 is 70,969,000 heads of livestock consisting of 4,214,800 horses, 4,753,200 cattle, 472,400 camels, 32,267,300 sheep and 29,261,700 goats. These are commonly called the five Mongolian livestock. In addition, there exist 20,892 swine and 898,700 poultry. The average population of each of the five livestock during 1926-92, changes in livestock

composition and the rates of population increase are summarized in Table 2.1.1.

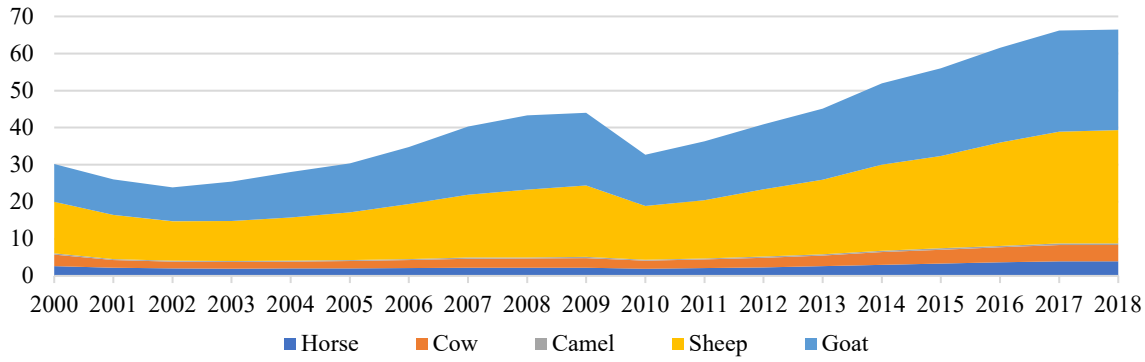
Table 2.1.1 Population of Five Livestock, Composition and Rates of Increase

	1926-92 Average	Share (%)	1993-2003 Average	Share (%)	2004-09 Average	Share (%)	2015	Share (%)	2019	Share (%)	Increase rate, % p.a. 2015-19
Total	22,961	100	28,476	100	36,801	100	55,977	100	70,969	100	6.1
Camel	648	3	331	1.2	261	0.7	367	0.7	472	0.7	6.5
Horse	2,147	9	2,540	8.9	2,133	5.8	3,295	5.9	4,215	5.9	6.3
Cattle	2,197	10	2,958	10.4	2,250	6.1	3,780	6.8	4,753	6.7	5.9
Sheep	13,392	58	13,282	46.6	15,669	42.6	24,943	44.5	32,267	45.5	6.6
Goat	4,577	20	9,365	32.9	16,488	44.8	23,592	42.1	27,125	38.2	3.6

Source: Mongolian Statistical Information Service

As seen from Table 2.1.1, goat population increased by more than six times from the average of 4.56 million during 1926-92 largely before the democratic reform to 27.13 million in 2019. The overall increase in livestock population is due primarily to the increases in goat and sheep population. Sheep population increased from the average 13.39 million during 1926-92 to 32.27 million in 2019. Population of the other three livestock increased only marginally during the same period.

In 2018, the total number of livestock increased to 71.0 million by 0.4% or 240,000 from 2017. The lower growth was attributed mainly to the number of full-grown livestock lost prematurely due to severe weather, disease, etc. The livestock population increased to 71.0 million by the end of 2019. Despite the increase in number of livestock, there has been a major change in the herd composition. As the average of several years, small cattle constitute 78.3% of the herd of pastoral animals. In recent years, the share has increased to 86.8%, consisting of 46% sheep and 40.8% goats. In winter 2010, the number of livestock decreased sharply due to severe weather conditions.



Source: NSO

Figure 2.1.1 Changes in Livestock Population and its Composition, million

It is said that from the management viewpoint of sheep-goat mixed herds, the sheep and goat population should be 3 to 1. This ratio was 2.93 during 1926-92, but consistently decreased to 1.42 during 1993-2003 and the goat population exceeded sheep population during 2004-09 to make the ratio 0.95. The ratios increased slightly to 1.06 in 2015 and 1.10 in 2019.

It can be generally said that the change in composition of livestock population after the democratic reform is a consequence of commercially oriented livestock farming responding to the market economy. Goats provide incentives for commercial farming as they produce high value leather and meat and milk products as well as cashmere wool. Sheep provide meat as the main stay of Mongolian diet traditionally and also raw materials for traditional handicrafts for felt and carpets.

Cattle population more than doubled from 2.20 million before the reform to 4.75 million in 2019 to meet the rapidly increasing domestic and export demand. Beef is an important export commodity for Mongolia. Intensive cattle farming has been increasing especially in the suburbs of Ulaanbaatar to supply meat and dairy products for the city residents. Horse population increased steadily from 2.15 million before the reform to 4.21 million in 2019. Camel used to provide traditional transport means for rural people including nomads, but its population has decreased as motorization has proceeded.

(4) Livestock production

Production

According to the NSO statistics, real production of livestock sector reached MNT2.5trillion in 2018, increased by 9.6% from previous year and 1.8 times more than that in 2010. From 2010 to 2018, the number of livestock has doubled. Meanwhile, the production of animal products and number of pasture animals have increased similarly. Main livestock commodities are meat, milk, cashmere, wool and animal skins leather.

Changes in production of meat and milk by kind of livestock are summarized in Table 2.1.2 and Table 2.1.3, respectively. Meat production has increased steadily in recent years except swine with cattle at 17.5% per annum, sheep at 8.7%, goat at 5.5%, poultry at 14.6% and horse at 14.3% during 2013-18. While goat population has expanded during this period to produce cashmere wool, goat meat production has not increased much. It is noted that poultry production has increased at a high rate, although the total production is still small.

Milk production has increased also during 2013-17 except goat milk for the same reason mentioned above. The increase in milk production is dominated by cattle at the average annual rate of 9.1% during 2013-17, while sheep milk and camel milk increased only at 2.9% and 2.4% during the same period. The total milk production was 919,500 tons in 2017, decreased to 902,400 tons in 2018 and increased to 1,074,200 tons in 2019. There exist two major manufacturers of dairy products in Mongolia, both of medium size. The raw milk they use is 20% Mongolian and 80% imported from New Zealand and Russia.

Production of leather products are limited due to low quality of raw leather with hardness and defects due to flaws and bugs. Export of leather products is decreasing except export to Turkey. Most leather products are directed to domestic market or otherwise wasted.

Table 2.1.2 Changes in Meat Production by Kind of Livestock

Unit: ton

Livestock	2013	2014	2015	2016	2017	2018	Increase rate 2013-18
Cattle	56,436	54,876	93,252	92,383	97,680	126,591	17.5%
Sheep	92,414	91,299	134,546	116,172	126,656	152,706	8.7%
Goat	64,134	60,548	86,356	76,903	80,813	83,623	5.5%
Camel	6,718	6,355	8,162	6,455	7,122	9,689	7.6%
Poultry	123	234	237	228	220	243	14.6%
Horse	29,283	29,535	50,642	41,734	41,787	57,193	14.3%
Swine	527	763	603	770	488	-	-1.9% (2013-17)

Source: FAOSTAT

Table 2.1.3 Changes in Milk Production by Kind of Livestock

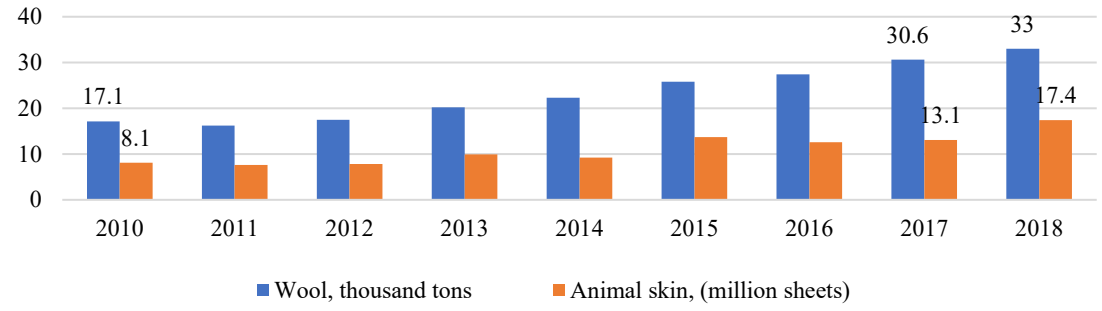
Unit: 1,000 liters

Livestock	2013	2014	2015	2016	2017	2019	Increase rate 2013−19
Cattle	380,830	440,371	512,442	522,388	539,926	668,800	9.8%
Sheep	41,226	39,115	38,790	43,400	46,300	123,600	20.1%
Goat	82,326	81,634	82,462	73,643	75,207	172,300	13.1%
Camel	5,364	5,463	5,925	5,900	5,900	19,230	23.7%

Source: FAOSTAT

The total meat production was 357,800 ton in 2017, led by sheep meat with a 35.7% share followed by cattle with 27.5%, goat with 22.8% and horse with 11.8%. The total meat production increased to 430,000 ton in 2018. Per capita availability of meat of all kinds is calculated to be 112.6 kg in 2017, which increased to 132.9 kg in 2018. Probably the self-sufficiency level of meat in Mongolia is close to these levels as meat export and import are comparatively small by order of magnitude. The total milk production was 661.9 million liter in 2017 and cattle milk accounts for 81.6%. However, production of processed milk is reported to be 86.6 million liters, corresponding to per capita availability of only 27 liter. Most milk produced is used for self-consumption by herders.

Production of wool was 30,600 tons in 2017, increased to 33,000 tons in 2018 and further to 33,700 tons in 2019. Production of hides and skins was 14,500 tons in 2017, increased to 19,300tons in 2018 and 19,600 tons in 2019. In 2019, production of cashmere increased 6.8% reaching 10,900 tons and about 1.7 times more than that in 2010.



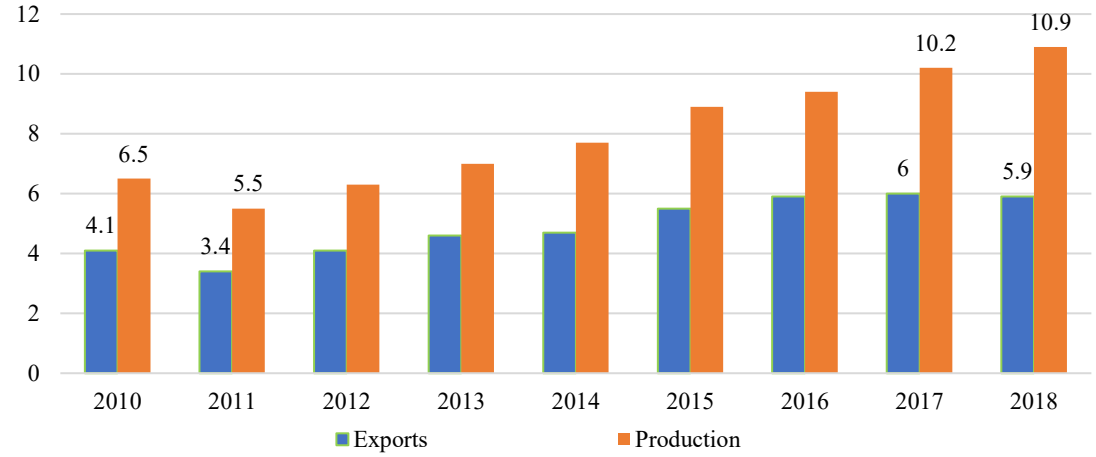
Source: NSO

Figure 2.1 2 Production of Wool and Animal Skin Leather

Export

Export and production of cashmere decreased sharply in 2011 caused by 29.4% decline of goat herd in 2010 due to severe weather condition. Still production of cashmere increased similarly to export between 2010 to 2016. Growth of cashmere export volume in recent years had been slowing down during 2016-18 to stay around 6 million ton but the export increased to 6,196,000 ton in 2019 (Figure 2.1.3).

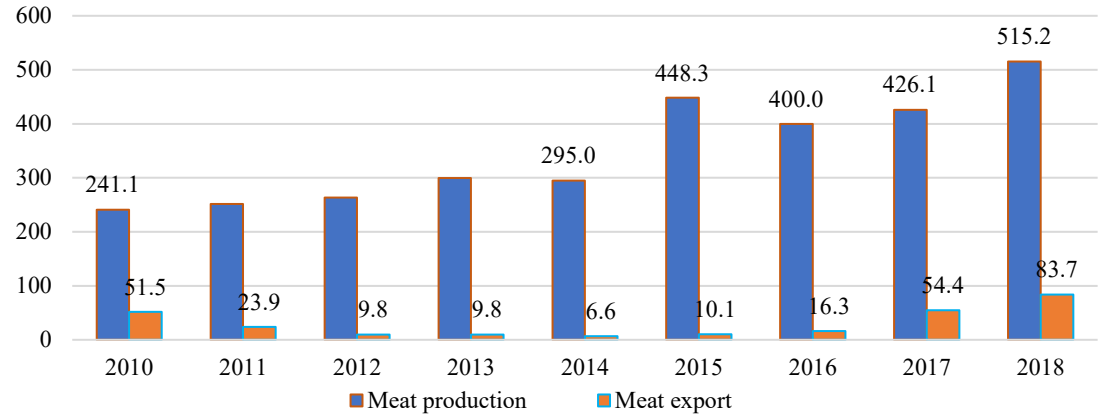
The balance between production and export is due to 1) informal export to avoid high export tax and cumbersome export procedure, 2) direct transactions with Russian and Chinese buyers at local market, and 3) increase in stock. Cashmere washing and dyeing plants exist along borders, from where the products are exported. Export to Russia takes the forms mainly of knitted cashmere, mufflers and coats and export to China is mainly cashmere raw materials. Cashmere products are exported also to EU, USA and Japan. Semi-finished cashmere products are exported to China, Italy, UK and Japan. Product standards are different for these countries, and it is desirable Mongolian product standards are established.



Source: NSO, Customs Office

Figure 2.1.3 Export and Production of Cashmere, 1,000 tons

In 2019, meat production reached 554,200 tons, 7.6% increase in comparison to 2018 and 2.3 times higher than 2010. Meat production increased dramatically in 2015 due to the herders' expectation of cold weather and heavy snowfall. In recent years, there was an increasing trend in meat production due to the increased meat export (Figure 2.1.4), but the export decreased to 50,800 ton in 2019. Export of meat products is mainly to China, where export of live animals is forbidden. China constructed abattoirs near the borders within Mongolia. Russia accepts live animal import, and there are seven abattoirs along the borders with Mongolia. Export of meat products to Vietnam and the Middle East has been conceived.

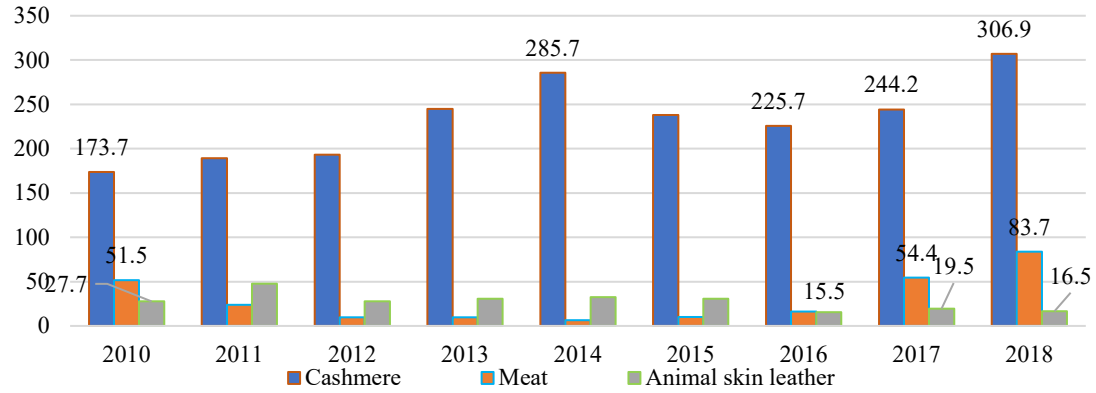


Source: NSO, Customs Office

Figure 2.1.4 Meat Exports and Production, 1,000 tons

According to the Customs Office, the total export of livestock products and commodities (cashmere, meat and leather skin) increased by US$89 million in 2018 or by 28% compared to the previous year reaching US$407 million. The total export further increased to US$452 million in 2019. In 2018, livestock sector's shares of GDP and export revenue were 13.6% and 5.8% respectively. Most of the livestock product export constituted cashmere. In 2018, 75.3% of livestock sector's export revenue is attributed to cashmere revenue, reached US$307 million (Figure 2.1.5). As the cashmere export increased to US$416 million in 2019, its share in the total export value of livestock products increased to 92.1%. The export value of cashmere products increased significantly by 30% on 2017 as a result of a new national program approved in 2018. Due to COVID-19, however, cashmere export has been facing difficulties as access to the Mongolian cashmere market by Chinese traders and European buyers

has significantly reduced.



Source: National Statistics Office, Customs office

Figure 2.1.5 Export of Meat, Cashmere and Animal Skin Leather, US$ million

As reported by the Customs Office, meat export has grown to 39,400 tons, by the end of the 2018 and revenue of meat export was US$83.7 million. In volume terms, the total meat export in 2018 was 1.5 times higher than the meat export in 2010. Out of total meat export, 32,000 tons was horse meat exported to China (91.4%), Kazakhstan (2.1%) and Russia (6.4%) in 2018. In September 2019, price index of meat and meat products was 137.2 in comparison to the same period of 2018 (NSO, 2019). Meanwhile, imports of meat and meat products have grown rapidly from US$40,900 in 2016. Imports of beef alone were US$80,500 in 2017 and 67,800 in 2018. In 2018, import of sheep and goat meats was US$423,100, which was presumably due to demand by foreign workers at mines. Detailed statistics on meat imports are not available.

2.1.2 Distribution of livestock activities and nomads

(1) Livestock activities

Spatial distribution of livestock activities as shown in Table 2.1.4 by Aimag reflects availability of grassland for grazing, water availability and climatic conditions and access to markets for livestock products. Livestock population is relatively large in Khangai Region, where rich grasslands spread on fertile soil surrounded by forests. Six Aimags of Khangai Region account for 36.9% of the total livestock population in 2017. Livestock population is particularly large in Arkhangai, Uvurkhangai and Khuvsgul Aimags. Other Aimags having relatively large livestock population are Tuv Aimag in Central Region and Khentii Aimag in Eastern Region. In these Aimags, livestock population increased significantly in recent years.

In Western Region, population of sheep and goats suited to dry climate and tolerable to thin vegetation and semi-desert conditions is comparatively large. Shares of livestock population in 2017 are 36.9% in Khangai Region, 24.5% in Western Region, 22.9% in Central Region and 15.1% in Eastern Region. With respect to per capita livestock population, four Aimags in Khangai Region, except Orkhon which is largely urban and Khuvsgul, exceed 50 animals per person. This level is attained only in Govi-Altai and Zavkhan in Western Region, Dundgovi and Tuv in Central Region, and Sukhbaatar and Khentii in Eastern Region.

Table 2.1.4 Distribution of Livestock Population by Aimag

Region/Aimag	Total Number of Animals (thousand heads)				Total Number of Animals per Person			
	2010		2019		2010		2019	
	No.	Rank	No.	Rank	No.	Rank	No.	Rank

Western Region	7,419	-	16,004	-	21	-	39	-
Bayan-Ulgii	1,127	14	2,193	17	13	17	20	18
Gove-Altai	1,316	12	3,598	11	25	10	62	3
Zavkhan	1,718	9	3,850	8	27	8	49	9
Uvs	1,619	11	3,280	12	22	11	39	13
Khovd	1,639	10	3,043	13	22	12	34	14
Khangai Region	12,217	-	26,257	-	24	-	43	-
Arkhangai	2,679	3	6,167	1	32	5	65	2
Bayankhongor	1,963	8	4,645	6	26	9	52	8
Bulgan	2,293	4	3,642	10	43	1	59	6
Orkhon	169	21	127	22	2	21	1	21
Uvurkhangai	2,011	6	5,626	3	20	13	48	10
Khuvsgul	3,101	1	6,040	2	27	7	45	11
Central Region	7,558	-	16,959	-	17	-	33	-
Govisumber	153	22	452	19	12	19	25	17
Darkhan-Uul	250	20	347	21	3	20	3	20
Dornogovi	1,057	17	2,404	15	18	14	34	15
Dundgovi	1,112	16	4,093	7	29	6	87	1
Umnugovi	1,010	18	3,000	14	17	15	43	12
Selenge	1,266	13	1,683	18	13	18	15	19
Tuv	2,711	2	4,979	4	32	4	53	7
Eastern Region	5,274	-	11,315	-	28	-	51	-
Dornod	1,113	15	2,630	15	16	16	32	16
Sukhbaatar	1,980	7	3,817	9	39	2	60	5
Khentii	2,181	5	4,868	5	33	3	62	4
Ulaanbaatar	263	19	445	20	0	22	0	22
Mongolia	32,730	-	70,969	-	12	-	21	-

Source: Mongolian Statistical Yearbook 2017 and 2019, National Statistics Office of Mongolia

(2) Nomadic people

While the livestock population has been increasing, population of nomadic people has been decreasing over years as a result of rural to urban migration (Table 2.1.5). The total nomadic population was 349,303 in 2009, corresponding to about 13% of the national population. It decreased further to become smaller than 300,000 by 2013 but has increased recently by 6.2% to reach 303,600 in 2017 accounting for 9.6% of the total population and decreased again to 8.7% in 2019.

Population of nomadic people decreased from 349,303 in 2009 to 285,482 in 2019 by 18.3%. Reduction rates vary between regions. It is smallest in Central Region reduced by 8.8%, followed by 9.2% in Eastern Region, 15.0% in Khangai Region, 27.9% in Western Region, and 41.6% in Ulaanbaatar.

The shares of nomadic people are 24.6% in Western Region, 41.7% in Khangai Region, 20.3% in Central Region and 12.0% in Eastern Region as of 2019. The shares of nomadic population in 2019 are larger than the shares of livestock population in Western and Khangai Regions and lower in Central and Eastern Regions. This implies that in Aimags closer to Ulaanbaatar, there exist comparatively more herders engaging in intensive or semi-intensive livestock farming and that in Aimags remote from Ulaanbaatar, traditional grazing by nomadic people is comparatively more popular. Despite this situation, per capita livestock population is larger in Aimags where nomads are more dominant.

Table 2.1.5 Population of Nomadic People by Region, Aimag and Capital

Region/Aimag /Capital	2000		2010		2015		2019		Share (%)	Rate of Increase 2000-19 (%)
	No.	Rank	No.	Rank	No.	Rank	No.	Rank		
Mongolia	421,392	-	327,154	-	297,828	-	285,482	-	-	-32.3
Western Region	126,114	-	88,171	-	79,200	-	70,478	-	24.7	-44.1
Bayan-Ulgii	23,310	8	18,685	7	18,398	6	13,746	4	4.8	-41.0
Gove-Altai	22,311	9	14,776	12	13,294	12	12,287	12	4.3	-44.9
Zavkhan	31,206	4	17,762	9	16,081	8	15,644	7	5.5	-49.9
Uvs	24,050	7	18,905	6	16,215	7	15,988	6	5.6	-33.5
Khovd	25,237	6	18,043	8	15,232	9	12,813	11	4.5	-49.2
Khangai Region	169,413	-	135,009	-	123,056	-	119,179	-	41.7	-29.7
Arkhangai	37,053	3	30,241	3	26,915	3	25,688	3	9.0	-30.7
Bayankhongor	29,730	5	22,340	4	21,062	4	21,771	4	7.6	-26.8
Bulgan	17,284	13	15,300	10	15,200	10	13,917	9	4.9	-19.5
Orkhon	3,365	20	2,397	21	1,364	21	1,299	21	0.5	-61.4
Uvurkhangai	40,119	2	30,771	2	28,446	2	27,101	2	9.5	-32.4
Khuvsgul	41,862	1	33,960	1	30,069	1	29,394	1	10.3	-29.8
Central Region	75,463	-	61,561	-	58,759	-	57,942	-	20.3	-23.2
Govisumber	1,228	22	936	22	1,160	22	1,097	22	0.4	-10.7
Darkhan-Uul	2,636	21	3,206	20	2,108	20	1,743	20	0.6	-33.9
Dornogovi	9,587	17	6,750	18	7,221	18	7,024	18	2.5	-26.7
Dundgovi	18,811	11	12,377	14	11,633	14	12,241	13	4.3	-34.9
Umnugovi	15,060	15	10,258	15	9,588	15	9,671	15	3.4	-35.8
Selenge	6,015	18	8,948	16	8,051	16	7,741	17	2.7	28.7
Tuv	22,126	10	19,086	5	18,998	5	18,425	5	6.5	-16.7
Eastern Region	45,196	-	37,109	-	34,483	-	34,313	-	12.0	-24.1
Dornod	10,589	16	8,302	17	7,681	17	7,983	16	2.8	-24.6
Sukhbaatar	17,796	12	15,142	11	14,288	11	14,496	8	5.1	-18.5
Khentii	16,811	14	13,665	13	12,514	13	11,834	14	4.1	-29.6
Ulaanbaatar	5,206	19	5,304	19	2,310	19	3,579	19	1.3	-31.3

Source: Mongolian Statistical Yearbook 2017 and 2019, National Statistics Office of Mongolia

(3) Recent changes

Recent changes in the distribution of livestock activities can be traced by a few indices as summarized in Table 2.1.6. Pastureland availability appears to have been improved in some Aimags between 2016 and 2017. These Aimags are Bulgan, Orkhan, Darkhan-Uul, Selenge and Tuv, which are locate close to Ulaanbaatar with high urbanization rates. This apparent improvement is due to decrease in livestock population.

Table 2.1.6 Changes in Distribution of Livestock Activities by Aimag

	No. of livestock per 100ha pasture land		Number of livestock per herder household		Share of herders in total employment (%)		Herder households with electric engines	
	2016	2017	2016	2019	2016	2019	2016	2019
Western region	-	-	-	-	-	-	-	-
Bayan-Ulgii	94	99	244	252	46.1	50.7	66.7	68.1
Govi-Altai	51	57	507	496	57.8	53.3	88.8	87.0
Zavkhan	76	82	387	432	57.1	53.5	89.7	88.4
Uvs	97	109	324	367	46.0	35.8	86.2	82.5
Khovd	95	102	443	414	55.8	49.1	91.4	80.8
Khangai region	-	-	-	-	-	-	-	-
Arkhangai	262	279	347	405	57.1	58.5	89.2	84.7
Bayankhongor	70	77	379	387	60.5	55.9	86.9	82.6
Bulgan	250	241	420	427	60.2	49.3	87.3	82.6
Orkhon	740	734	165	151	4.5	4.1	111.1	100.2
Uvurkhangai	146	163	338	343	55.0	65.2	82.7	82.8
Khuvsgul	190	200	333	357	57.1	55.5	85.6	77.5
Central region	-	-	-	-	-	-	-	-
Govisumber	120	133	552	646	57.7	55.5	85.9	87.3
Darkhan-Uul	353	351	272	267	42.3	47.1	97.4	84.5
Dornogovi	31	35	424	568	23.1	21.5	82.3	84.6
Dundgovi	59	69	464	565	24.1	15.1	82.3	78.9
Umnugovi	29	33	410	491	7.1	5.0	81.7	83.7
Selenge	185	180	361	346	40.5	31.7	94.7	88.1
Tuv	161	158	417	413	26.6	21.1	92.2	87.1
Eastern region	-	-	-	-	-	-	-	-
Dornod	41	48	392	495	30.7	30.1	82.8	82.0
Sukhbaatar	73	85	418	483	54.9	51.3	89.1	87.9
Khentii	129	145	536	611	46.6	37.0	86.3	79.2

Sources: Mongolia: Provincial Competitiveness Report 2018 and 2017

Livestock herd size per herder household decreased in Bayan-Ulgii, Khovd, Bulgan, Orkhan, Khuvsgul, Darkhan-Uul, Selenge and Tuv. Five of these Aimags are the same as the ones identified above as highly urbanized Aimags closer to Ulaanbaatar. The decrease in herd size is clearly due to population growth. Three others are all located in remote areas along the borders. Reasons for the decrease in herd size in these Aimags need to be looked into.

The shares of herders in total employment decreased between 2016 and 2017 in all the Aimags except Sukhbaatar. The degree of decrease is significant in three Aimags of Bayan-Ulgii, Govi-Altai and Zavkhan in Western Region, and Bulgan, Uvurkhangai and Govisumber. For the latter three Aimags, the decrease in shares of herders in total employment is probably due to generation of comparatively more employment opportunities in mining and/or urban sector.

The shares of herder household with electric engines increased between 2016 and 2017 only in three Aimags of Zavkhan, Govisumber and Dornogovi. Again in these Aimags, mining and urban development must have served as a trigger to expand the electricity supply. Conversely, expansion of electricity supply has not kept pace with population increase in other Aimags.

(4) Availability of pastureland and fodder production

Changes in availability of pastureland by Aimag in recent years are summarized in Table 2.1.7. The total availability of pastureland decreased from 129.3 million ha in 2000 to 110.9 million ha in 2005 but since then has been staying at the similar level. However, degradation of agricultural land has been reported by both household farmers and business entities, where pastureland occupies 96.1% of the agricultural area of Mongolia in 2017 as reported in Section 1.1. Central Region accounts for 31.9% of the total pastureland, Western Region 30.6%, Eastern region 19.4% and Khangai Region 18.0%. The distribution of pastureland between regions is quite different from the distribution of livestock population seen above. This implies that pastureland in Western Region and Central Region, particularly in those Aimags in the southern part is more degraded due to improper management and dry climate.

According to research and analysis of grazing condition in 2016, around 57% of Mongolia's pastureland has been degraded: 13% slightly, 21.1% moderately and 12.8% strongly degraded and 10.3% in danger of desertification. In 2016, the share of degraded pasture increased by 8 percentage point and the share of pasture in danger of desertification increased by 3.3 percentage point compared to base information of 2014. Main cause of degradation is overgrazing associated with sharply increasing livestock population. The number of livestock in 2017 exceeds Mongolian grazing capacity by over 25 million livestock estimated on sheep (Pastureland protection law).

Table 2.1.7 Changes in Pasture Land Availability by Aimag

Unit: 1,000 ha

Aimag	2005	2010	2015	2016	2017	2019
Arkhangai	3,740	3,739	3,738	3,738	3,738	3,738
Bayan-Ulgii	9,003	8,869	8,862	8,860	8,859	8,856
Bayankhongor	3,452	3,582	3,572	3,540	3,539	3,541
Bulgan	2,521	2,490	2,489	2,485	2,485	2,485
Govi-Altai	8,705	8,811	8,609	8,609	8,609	8,609
Govisumber	530	473	470	466	470	473
Darkhan-Uul	189	180	178	178	177	176
Dornogovi	8,872	8,744	9,236	9,229	9,158	9,114
Dornod	9,292	9,273	8,686	8,654	8,654	8,656
Dundgovi	7,171	7,165	7,152	7,151	7,149	7,148
Zavkhan	6,488	6,918	6,918	6,924	6,926	6,925
Orkhon	40	40	40	40	39	39
Uvurkhangai	5,741	5,695	5,695	5,693	5,690	5,689
Umnugovi	11,471	11,466	11,444	11,443	11,434	11,431
Sukhbaatar	7,501	7,639	7,639	7,636	7,671	7,668
Selenge	1,653	1,635	1,620	1,616	1,614	1,611
Tuv	5,387	5,313	5,224	5,210	5,197	5,177
Uvs	4,487	4,343	4,308	4,292	4,292	4,269
Khovd	5,198	5,180	5,066	5,064	5,063	5,059
Khuvsgul	4,141	4,380	4,377	4,380	4,380	4,386
Khentii	5,084	5,076	5,070	5,069	5,068	5,067

Ulaanbaatar	265	246	221	213	218	215
Total	110,930	111,256	110,614	110,490	110,429	110,331

Source: NSO database

Changes in fodder production in recent years are summarized by Aimag in Table 2.1.8. The increase in total fodder production in recent years is impressive. It increased at the average annual rate of 18.4% during 2005-16. The production decreased slightly in 2017 due to unfavorable weather conditions, but it jumped by 2.6 times in 2018. The distribution of fodder production is even more skewed in favor of Central Region having a share of 66.8%, followed by Khangai Region at 11.8%, Western Region at 10.5% and Eastern Region at 8.0%. Naturally, this reflects intensive and semi-intensive livestock farming dominantly located in Aimags closer to Ulaanbaatar. In particular, of the significant increase of fodder production by 75,745 ton in 2018, Central Region accounts for 59,742 ton or 78.9% of the increase. Nevertheless, feed shortages during winter season constrain livestock production with imported high productivity animals.

Table 2.1.8 Changes in Fodder Production by Aimag

Unit: Ton

Aimag	2005	2010	2015	2016	2017	2018	2019
Total	8,328	34,792	49,164	53,424	47,895	123,840	121,117
Western region	5,743	12,472	9,399	14,503	11,587	12,982	14,387
Bayan-Ulgii	481	4,824	1,069	1,402	792	779	1,330
Govi-Altai	729	1,528	1,159	1,555	1,577	1,693	1,839
Zavkhan	1,021	2,585	1,073	3,077	1,227	1,984	2,344
Uvs	2,388	2,413	3,975	6,516	6,241	6,801	7,204
Khovd	1,123	1,122	2,123	1,953	1,750	1,725	1,670
Khangai region	381	5,269	8,424	10,739	9,102	14,623	13,819
Arkhangai	198	3,396	4,533	4,661	5,893	5,817	2,814
Bayankhongor	37	359	1,111	1,552	470	421	895
Bulgan		480	363	572	797	3,513	5,920
Orkhon	34		178	368	80	315	511
Uvurkhangai	112	704	1,634	2,485	1,506	3,520	2,331
Khuvsgul		330	606	1,101	356	1,037	1,346
Central region	1,752	16,612	25,324	24,862	22,980	82,722	79,519
Govisumber	10	81	3	5	28	43	52
Darkhan-Uul		215	2,088	306	162	3,933	700
Dornogovi		0	55	23	8	43	13
Dundgovi	11	37	30	19	4	1	1
Umnugovi	86	267	317	215	276	19	584
Selenge	1,095	2,237	7,410	12,125	10,929	14,615	32,731
Tuv	550	13,775	15,421	12,170	11,573	63,882	45,434
Eastern region	0	14	1,394	1,621	3,364	9,891	9,406
Dornod			14	1,036	194	3,755	4,692
Sukhbaatar		14	221	0	0	893	2,660
Khentii			1,160	585	3,170	5,243	2,054
Ulaanbaatar	453	425	4,623	1,698	863	3,623	3,985

Source: NSO database

2.2 Issues and Policy Directions for Livestock Development

2.2.1 Issues for livestock development

Based on the review of existing study reports, discussions with stakeholders and limited field surveys, important issues for livestock development in Mongolia have been identified as listed below.

(a) Environmental preservation against aggravation of grazing land degradation
  (i) Advancement of desertification
    ✓ Degrading vegetation as observed by satellite imageries
    ✓ Reduction of biomass distribution
    ✓ Increasing dryness due to climate changes
    ✓ Increase in livestock population due to:
    ✓ Private ownership of livestock, and abolition of ceiling for livestock population and sales
    ✓ Disintegration of marketing system and responsibility to bear transport costs
    ✓ Reduced profits from livestock sales due to inflation
    ✓ Development of wells
    ✓ Lack of pricing systems for fodders and land
    ✓ Decline of cashmere prices

(b) Serious damages by Dzud
  (i) Increase in novice herder families
  (ii) Increase in cash income-oriented herders
  (iii) Disintegration of fodder distribution system by Negdel (kind of cooperative during the socialist regime similar to the Soviet's "kolkhoz" or collective farm)

(c) Safety and security related to communicable diseases, sanitation, quality control
  (i) High dissemination rate
  (ii) Economic losses
  (iii) Difficulty to deal with by individual farmers
  (iv) Foot-and-mouth disease as priority

(d) Processing industries
  (i) Logistics and marketing to strengthen competitiveness by:
    ✓ Concept of market-in
    ✓ Diversification of logistic functions including storage distribution and transport and alliance between them
  (ii) Processing mechanism to link producers and processors including:
    ✓ Expansion of domestic and export markets
    ✓ Improvement of food trade system by domestic retailers
    ✓ Improvement of milk transport, storage and processing
  (iii) Hygiene and quality control for total product management system
    ✓ Hygiene control for meat products production
    ✓ HACCP (Hazard Analysis Critical Control Point) certification
    ✓ ISO22000 (International Organization for Standardization) acquisition

(e) Price hike due to meat shortages caused by Dzud

Each issue is described below.

(1) Environmental preservation against aggravation of grazing land degradation

Many point out that degradation of grassland has been proceeding for some reasons. Specific causes suggested including macroscopic observations of advancement of desertification, degrading vegetation

as observed by satellite imageries, reduction of biomass distribution and increasing dryness as a result of climatic changes, and more tangible cause such as increase in livestock population, especially goats, increase in heavy traffic, and rapid urbanization.

It is important to note that rapid increase of livestock population has resulted from massive migration of nomadic people into urban areas seeking better livelihood and life. For some nomadic herders, this is a rational decision, and for others, this is inevitable. Even those forced to move to urban areas may decide to settle there and lose traditional capability for grazing. Also, their personal decisions have side effects to aggravate poverty and other problems in urban areas. To solve this complexity of problems, comprehensive measures need to be taken.

After the disintegration of Negdel, all the livestock owned by the State were transferred to their staff and nomads. That is, livestock ownership was privatized, and ceilings and quotas for livestock population and sales were abolished. Sales of livestock are conducted by individual decisions. Abolition of wholesale slaughter before winter conducted by Negdel reduced the total sale of livestock, resulting in increase in livestock population.

Under the socialistic regime, sale of livestock was undertaken by Negdel taking care of all the logistic arrangements. After the disintegration of Negdel, herders have to bear transport costs and profits from livestock sales reduced. The profits of those herders remote from main markets are more reduced. This encourages herders to move closer to urban markets, resulting in unbalanced geographic distribution of livestock in Mongolia.

High inflation rates during 1990's reduced sales prices of livestock, and many herders refrained from selling their livelihood. This caused livestock population to increase.

Availability of water is a critical condition for herders to determine grazing bases. After the disintegration of Negdel, many wells were degraded by lack of proper management. This resulted in concentration of nomads in the areas with functional wells. This was observed particularly in Central Region.

The logistic and marketing system managed by Negdel dealt with export of meat products and livestock. These quotas were reduced after Negdel was demolished resulting in increase in livestock population. Particularly reduced was export of sheep meat.

Cashmere prices declined heavily in 1993 from US$127/ton in early 1990's to US$37/ton. This forced herders to suppress shipping of goats, resulting in significant increase in goat population and reduction of slaughtering. Goat population has continued to increase since then. Some market mechanism is called for to allow herders to release goats.

Most unique characteristics of livestock farming in Mongolia, as compared to intensive livestock farming in other countries, is that herders do not bear costs of fodders and land. Costs of fodders and land are not usually included in cost calculation for investment decision. This also encourages herders to increase livestock population.

(2) Serious damages by Dzud

Most recent Dzud occurred from 2000 through 2002 and from 2009 through 2010 caused very serious effects as some 25% of the total livestock population died. Dzud is generally considered a natural phenomenon, but human factors seem to play important roles as well. It is reported that those herders practicing proper counter measures against Dzud receive little or no adverse effects. Serious Dzud damages arise due to increase in such herders that cannot prepare for Dzud properly. This has some aspects related to degradation of livestock as described below.

After Negdel was demolished, new herders, including former Negdel staff, started livestock farming with livestock transferred by Negdel. Some tried to avoid reduced income from livestock sales under high inflation rates, and some others considered herding as safety valve of life against other ways to earn living. Consequently, the number of herder families increased from about 75,000 during the socialistic regime to 200,000 by 2002. These new herders did not have proper herding technology but tried to increase the livestock heads to realize economic stability. They could not prepare for the harsh

winter season including selection of sheds location, production of hay and building of shelters against cold weather, causing high livestock death rates.

Another kind of new herders are those focusing on increasing livestock that can be converted to cash income. Increasing goat population is the case in point. This is natural as a decision in the market economy, but it has a side effect to aggravate Dzud effects. Goats for cashmere production tend to concentrate in areas for easy shipping near the market outlets. This increase the competition for securing grazing land, hay and fodder, and overall preparedness for winter is reduced. As commonly said, Dzud damages become more serious as livestock population increases.

Before the disintegration of Negdel, fodder for the winter season was produced according to its plan to produce fodder at 22 centers located at key places throughout the Country. Depending on the climatic and other conditions during a particular winter season, fodder was supplied to regions with fodder shortages on a priority basis. While fodder production is primarily the responsibility of herders, the storage and distribution system by Negdel worked to minimize the adverse effects of Dzud.

Degradation of the fodder storage and distribution system undertaken by Negdel is certainly at the bottom of aggravation of damages by Dzud. No comprehensive support system for fodder supply and related measures has been established since then. As clarified, the human factors are accountable for the aggravation of Dzud damages, which took effects through the rapid increase in livestock population causing in turn degradation of grazing land. This implies that both problems of the grazing land degradation and the serious Dzud damages may be overcome at the same time by taking proper comprehensive measures.

As the increasing number of new herders entered the livestock sector responding to the market economy, health conditions of livestock have been degraded. Costs of veterinary services to be borne by users have aggravated the situation. Also, as the availability of grazing land has been reduced by the increase in livestock population, particularly of goat, the average live weight has been reduced. This has resulted in not only reduction of tolerance by animals against Dzud but also lower quality of cashmere and other livestock products.

(3) Safety and security related to communicable diseases, sanitation, quality control

Many livestock diseases have been reported in Mongolia recently including brucellosis, glanders pneumonia and protozoan infection. Of these diseases, probably foot-and-mouth disease calls for priority attention by the Government due to 1) its high communicable power, 2) economic losses, and 3) difficulty to cope with by individual herders. Foot-and-mouth disease spreads to animals by virus, and all the livestock are susceptible to the virus except horses and donkeys. Once infected, the animals lose their economic utility and their sputum, excreta, hairs etc. become sources of propagation. As the propagation power of the virus is so high, damages spread and expand to make them difficult to control. The results are enormous economic losses as market value is completely lost and export opportunities totally denied.

After the disintegration of Negdel, veterinary services that had been free until then were mostly privatized. Charges for diagnosis and treatment and lack of training in veterinary on-site medical treatment techniques have led to the decline in quality and quantity of veterinary services. Also, increased livestock diseases such as foot-and-mouth disease and brucellosis have made the livestock industry vulnerable seriously. Therefore, veterinarian capacity development is essential to tackle the infectious diseases.

Image control to overcome negative rumors about livestock diseases in Mongolia is another important aspect of the problem to be overcome. According to hearings by the JICA Project Team, possibilities of foot-and-mouth diseases in Mongolia affect trade negotiations with buyers from outside. Staff of the Mongolia Wool Association and the Union of Leather Industries of Mongolia stated “We believe Mongolian wool after proper treatment cannot be a source of foot-and-mouth disease infection, but the perception that there exists this diseases in Mongolia affects the trade negotiations”. Leather products also receive similar negative effects on economic value.

Trade negotiations for any tradable commodities are subject to intentions of two concerned countries.

What is important is for Mongolia to apply international state-of-art measures against the disease and to negotiate with trade partners based on such facts. Large firms such as "Meatpackers" have started such practices with some successes. Benefits of the success cases have not reached nomadic herders supporting the livestock industry. Information dissemination is another important part of the measures against foot-and-mouth disease.

The Mongolian Government has made an effort to develop the proper implementation system on agricultural and pastoral administration and extension services in rural areas. As a result, three farming experts are assigned to each of 330 Soums respectively, of which two are livestock experts (total of 660 experts are assigned). However, due to the rapid increase in the number of the experts, those who have insufficient technical knowledge have been assigned. Therefore, improvement of the skills of these experts would be urgently needed in terms of specialized technical skills. The proper assignment of engineers for each Soum would also be an issue to be considered immediately.

(4) Processing industries

According to the Mongolian Food Industry Association, there are 280 manufacturing firms and related research institutes for beverages, liquors, bakery products, dairy products such as milk, cheese, yogurt etc., and meat products registered with the association. Of these, 80 are located in Ulaanbaatar.

Main issues for the agro-based food and beverage industries are as follows:

(a) Expansion of domestic and export markets,
(b) Improvement of food trade system for domestic retailors,
(c) Improvement of transport, storage and processing system of milk as only 71,000 ton of milk corresponding to 9% of the total milk production at 765,000 ton is used for processing, and
(d) Hygiene control at production of meat and other products to increase export, and strengthening of quality inspection system to promote acquisition of certification for good manufacturing practice (GMP), HACCP and ISO22000.

At present, processing technology is generally low and processing facilities are limited or inadequate so that meat products, textiles, leather and other livestock products are traded without processing or with only primary processing as low value-added commodities. As logistic infrastructure is not well developed, livestock products produced in rural areas cannot be effectively collected by processors and traders. No wholesale market exists for agro-products and food products so that most trades are conducted by direct transactions. This makes livestock farmers, especially unorganized nomadic herders, vulnerable to traders and proper prices may not be ensured.

Livestock farmers have been affected seriously by Dzud since they face significant reduction of livestock they own. To alleviate damages on livestock, procurement and storage of fodder for winter, organization of herders for the purposes, and improved veterinary services are necessary. On the part of processors, price hikes as a result of shortages of meat is a concern. Sometimes, meat prices decline heavily by large supply and stock of meat in anticipation of demand during winter. Effects of Dzud on milk production are less serious as milk is produced at well managed dairy farms close to urban markets.

Apiculture for production of honey etc. is part of livestock production in Mongolia. Currently, it suffers from low productivity. The average production of honey per bee hive is around 12kg, which is compared with 60kg in Japan. Factors for low productivity include low cultivation techniques of bees, and immature techniques for mediation of honey sources. Issues to promote export of honey and its derivatives include examination of possibilities to produce single source honey preferred in Japan and elsewhere, inspection of residual agro-chemicals and antibiotics, and methods to protect bees during winter by storage facilities and other preservation means.

2.2.2 Policy directions for livestock development

(1) Existing policies for livestock sector

The Mongolia Sustainable Development Vision 2030 (SDV2030) states the objectives and targets of

livestock development as follows.

(a) Create properly ratio of livestock's number by type that satisfy the grazing capacity and develop the livestock sector capable of competing in international market;
(b) Establish by 2030 appropriate proportion of livestock and increase share of pastureland suited to the requirements of world animal health organization to 60%, and create a national veterinary system that meets international standards;
(c) Develop intensive livestock farming and a system of supply, preservation and transportation of livestock related commodities and products; and
(d) Increase by 2030 the share of yield livestock production to 8% of total livestock, and develop supply, preservation, transportation of livestock related commodities and products at Soum and Aimag levels.

The Mongolian livestock national program has established the following policies:

(a) Develop livestock industry that is capable to risk and adapt to climate, nature and ecology, and provide quality raw materials to the processing industry and supply a healthy and safe food;
(b) Associate livestock numbers and types with the pastureland carrying capacity, establish the maximum number of animals to keep pasture in areas where pasture land is overloaded, and create economic incentives to avoid over-grazing; and
(c) Use legal environment for herders to pay for pasture use due to herd composition and regional characteristics, and use some of them to protect and improve pasture land.
(d) The National Biodiversity Program (2015-2025) has established the following policy:
(e) Establish legal and economic incentives for livestock numbers and types with pastureland carrying capacity to reduce and decrease pasture degradation of Mongolia up to 70%.

The Vision2050 emphasizes value-added processing of primary products. Related to livestock sector, the Vision2050 aims to increase export of wool and cashmere products, and also to make Mongolia an active player in organic food production. Hyde sans skins and leather products are also emphasized.

(2) Policy directions for livestock development

Although the Mongolian Government is promoting intensive or semi-intensive livestock farming to secure sufficient and stable supply of meat and dairy products as main stays of diet of Mongolian people for ever increasing population, this does not mean the Government neglects the nomadic people. First of all, intensive livestock in the Mongolian context does not mean a factory-type livestock rearing with very high density of livestock population observed in western countries where land resources are limited. More appropriate in Mongolia is rather semi-intensive livestock farming combining livestock shedding and seasonal grazing, which can be practiced by the nomads.

The SDV2030 has established as the objective for tourism sector stating: "Mongolia would become the international destination for nomadic culture and tourism". However, it should not mean the Mongolian nomadic way of life be preserves only in museums. To effectively promote the nomadic life for tourism or whatever, a prerequisite is to realize and maintain the viable socioeconomic activities based on the nomadic way of livestock farming.

The SDV2030/Vision2050 is basically economic growth-oriented vision document, but it pursues inclusive economic growth and sustainable social development as well. To realize the Vision2050, Mongolia should pursue such a development paradigm away from the 20th century development characterized by intensive use (abuse) of resources and economic efficiency-oriented development. This may be called alternative socio-economy as described in Main Report. The traditional livestock farming undertaken by nomadic people may offer lessons to be learned to realize the Mongolian model of alternative socio-economy.

The SDV2030 presents principles of environmental sustainability as follows:

- Promote participation of local residents and people at large to ensure environmental sustainability;
- Use resource efficiently and effectively;
- Support clean technology and encourage low-waste and sustainable production and consumption;
- Develop and enforce environmental rehabilitation at international standard level; and
- Encourage environment-friendly attitude and appropriate behavior.

These principles fit well to the nomadic way of livestock farming. The traditional livestock farming does not leave wastes and tries to utilize them as much as possible to produce useful products for efficient and effective resource use as declared by the SDV2030. Even land resource should not be disturbed by crop cultivation or extractive mining. In fact, traditional livestock farming preserves the sustainability of ecosystem as required by the SDV2030. For this system to survive in the global competitive economy, however, certain conditions would have to be satisfied.

The basic condition is to establish what is called "healthy livestock farming" based on the traditional and sustainable farming. The healthy farming is defined by 1) healthy animals, 2) healthy herds and herding, and 3) healthy management practices. Existing conditions of livestock farming, on the other hand, are characterized by i) aggravating grazing land degradation, ii) serious damages by Dzud and associated climatic conditions, and iii) inadequate measures to prevent communicable diseases. Integrated measures should be taken to overcome these conditions and realize healthy and sustainable livestock farming.

While the SDV2030/Vision2050 pursues intensive livestock farming as a matter of principle, specific measures to realize it are applicable to nomadic farming as well. Increasing processing of livestock products for high value meat and dairy products will develop domestic and export markets for livestock products, and improved access to the markets will help re-vitalize nomadic livestock farming as well. Development of transport network linking livestock areas and processing industries will facilitate marketing of raw materials and processed products. Nomadic farming should also benefit from advanced technologies for production, processing and marketing such as ICT and biotechnology to produce improved varieties. Linking these activities, livestock industrial clusters should be developed by organizing herders, processors and marketing agencies supported by local administrations under the proper livestock policy by the Mongolian Government.

Export demand for cashmere is expected to continue to increase especially if quality standards are established for branded Mongolian cashmere. Establishment of market for semi-finished cashmere products may be pursued strategically. Mongolian meat is considered organic and thus competitive in international markets. Additional value-added products may be developed by utilizing internal organs, blood and bones, which will reduce wastes. High quality pet food production is an immediate possibility. To increase export of livestock products significantly, establishment of value chains for safe and healthy products holds a key. These are consistent with the Vision2050 as well as the idea of alternative socio-economy pursued by the NCDP.

2.3 Development Objectives and Strategy for Livestock Development

2.3.1 Development objectives for livestock development

Through the discussions with stakeholders and literature review of policy documents, the objectives of the livestock farming in Mongolia to be pursued may be summarized as follows:

(a) To establish Mongolia as the leading livestock country in the world with respect to organic farming and total processing without wastes,
(b) To produce high quality livestock products such as meat and dairy products for domestic and export markets,
(c) To provide robust base for processing industries of variety of livestock products to contribute to high value-added and large employment opportunities, and

(d) To preserve lively and viable nomadic tradition as inherent culture of Mongolian society and attractive base for international tourism.

2.3.2 Strategy for livestock development

In line with the policy direction described in sub-section 2.2.2, development strategy for livestock farming to attain the development objectives proposed above is established with the following components:

(a) Promotion of more intensive or semi-intensive livestock farming following the Government policy to ensure sufficient and stable supply of meat and dairy products for growing urban population and export markets;
(b) Re-vitalization of herders' communities based on nomadic livestock farming and culture as the basis for cultural and heritage tourism and the Mongolian model of alternative socio-economy for preservation of ecosystem;
(c) Increasing processing of livestock products for higher value-added by zero-waste or total processing;
(d) Improvement of market access for livestock products as part of export diversification; and
(e) Application of advanced technology for production, processing and marketing of livestock products such as ICT and biotechnology.

2.4 Development Measures for Livestock Development

2.4.1 Proposed measures

Since the Mongolian Government is correctly promoting intensive or semi-intensive livestock farming, importance of traditional grazing system by nomadic people is emphasized here. While the SDV2030 pursues intensive livestock farming as a matter of principle, specific measures to realize it are applicable to nomadic farming as well. As a symbolic gesture for the Government to manifest their focus on the traditional livestock farming, it is proposed to earmark the nomadic population to be maintained as part of the SDV2030.

In pursuing the directions of livestock development proposed in sub-section 2.2.2, the following measures are effective:

(a) Livestock industrial cluster development,
(b) Cattle ranching system development,
(c) Integrated farming with fodder,
(d) Fodder production expansion,
(e) New generation herders upbringing,
(f) ICT oriented livestock support,
(g) Comprehensive nomad database development, and
(h) Spray dry powder milk technology.

(1) Livestock industrial cluster promotion

1) Concepts

The industrial cluster development strategy is proposed in Main Report. In particular, vertical industrial clusters based on primary products are highly applicable in developing countries relying mainly on primary products production for economic growth. This is exactly the case in Mongolia relying on primary products of mining, crop production and livestock. A vertical industrial cluster is composed of production of primary products, a series of processing industries to produce increasingly

higher value-added products, of which at least one should be exported. By promoting a set of livelihood and economic activities linked to the export market, the entire clusters of activities become viable in the global economy. Such industrial clusters, therefore, help to link livelihood activities by the poor, through indigenous industries to export industries, thus contributing to poverty alleviation and social stability as well.

High value-added livestock products having high potentials for domestic and export markets include leather products, organic cosmetics, wool insulation materials, apparel, pet food and halal meat (Data Collection Survey for Agriculture and Livestock Sector in Mongolia, Final Report, August 2017). They may be developed further as part of livestock industrial cluster. To collect raw materials for these high value-added products, livelihood activities by nomadic people have to be organized and collection systems established. Technology development may be necessary for products development. For some products, sanitation and quality control are prerequisites to develop particularly export markets.

The livestock industrial cluster will satisfy all these conditions effectively by cooperation of herders, processors, transporters and export agencies, supported by proper government policy. Establishment of processing plants in local towns close to production areas would provide marketing outlets for herders in rural areas and incentives for quality-oriented production. This would re-vitalize herders communities, which in turn attract more visitors for cultural and heritage tourism. As a prerequisite, monitoring and disease control should be undertaken on a priority basis in the areas to be covered by the industrial cluster.

2) Formulation

Scope of livestock industrial cluster

A full scope of possible economic activities that may be included in the livestock industrial cluster is shown in Table 2.4.1 encompassing primary livestock rearing, primary processing, advanced or value-added processing and marketing. Some value-added processing to produce export products is an essential condition for successful cluster development, although most products of the livestock industrial cluster may produce for domestic market.

Table 2.4.1 Possible Scope of Economic Activities Involved in Livestock Industrial Cluster

Primary production	Primary processing	Secondary and value-added processing	Main markets
Livestock rearing	Meat	Processed meat products	Domestic
	Milk	Various dairy products, Omega7	Domestic, Export
	Hides and skins	Leather products, clothing etc.	Domestic, Export
	Placenta	Medicines, cosmetics, health products	Export
	Intestines, blood & bones	Animal feed, sausage casing etc.	Domestic

Core facilities for the cluster

As the central facilities of the livestock industrial cluster, livestock complex facilities may be established at selected locations in or near livestock areas. Initially they may consist of ordinary warehouse, simple processing facilities and management office, but at ultimate stage of development, the following facilities may be included:

- - Warehouse including cold storage to store raw materials of livestock,
- - Slaughter houses for animals satisfying sanitation and other essential conditions,
- - Processing plants for various livestock products,
- - Marketing facilities for local marketing and shipping,
- - Inspection and testing facilities to ensure quality of primary and processed products,
- - Research facilities for new products development and product quality improvement, and
- - Management office with ancillary facilities for staff.

Stage-wise development

The initial development of the livestock industrial cluster is to be undertaken in stages as follows.

Stage 1:

1) Organizing/strengthening of association for livestock farmers and related associations,
2) Planning for the entire cluster development in stages and necessary infrastructure,
3) Stage 2:
4) Design of components for the first stage with specific contents of raw materials and products,
5) Establishment of management organization for the initial cluster development,
6) Training of staff in key positions of the management organization,

Stage 3:

1) Establishment of initial components of the complex facilities together with improvement of necessary infrastructure, and
2) Research for product development and market development.

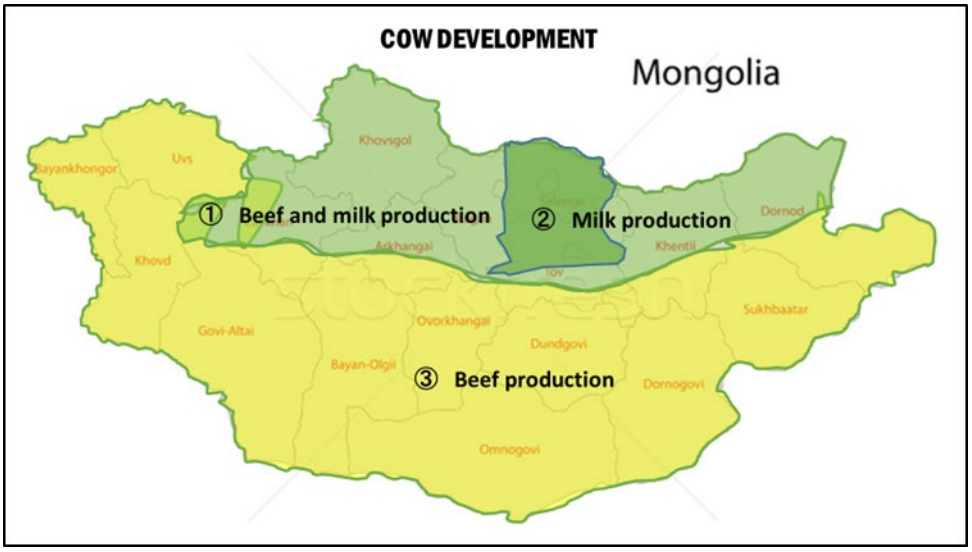
Implementing arrangements

The livestock industrial cluster development should be implemented by PPP with MOFALI as the lead agency on the public side in cooperation with the private sector. MOFALI may take the initiative for Stage 1 mustering related associations and private firms as well as livestock farmers, and local governments. The private sector will be the main players for Stage 2 supported by the Central Government for training. Stage 3 will be implemented by the private sector supported by infrastructure improvement by the Central Government and research by research institutes.

(2) Cattle ranching system development

Mongolia has a variety of resources in different regions that can be utilized for regional development. Some of these resources may be combined to establish high profit livestock clusters. In particular, a model may be developed for integrated cattle-based cluster by combining resources in four different types of areas: livestock farming and processing area, fodder production area, intensive livestock farming area and border trade area.

The territory of Mongolia is broadly divided into three zones with respect to livestock production: ①beef and milk production zone, ②milk production zone and ③beef production zone (Figure 2.4.1). Characteristics of these zones are summarized in Table 2.4.2. The idea of integrated cattle-based cluster is to combine areas in different zones for complementary use of their characteristics.



Source: TANA lab

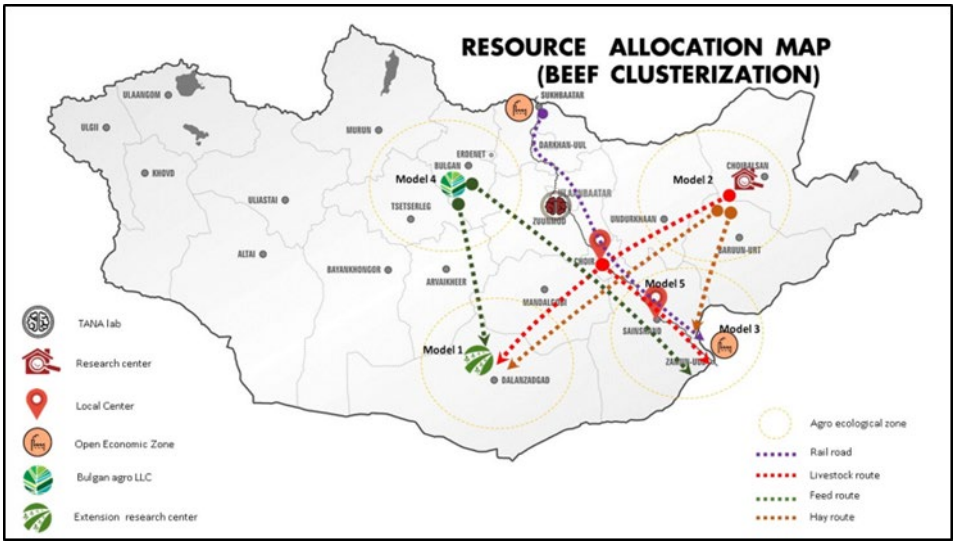
Figure 2.4.1 Three Zones for Beef and Milk Production in Mongolia

Table 2.4.2 Characteristics of Three Zones for Cattle Ranching

Zone	1	2	3
Methods of livestock farming	Grazing and cattle sheds	Cattle sheds	Grazing and pasture
Feed	Pasture, condensed feed	Condensed feed	Pasture
Feed self-sufficiency	Possible	Possible	May be difficult
Characteristics	Low costs by grazing during summer	Intensive farming with total mixed ration (TMC) etc.	Traditional low input farming

Source: TANA lab

Four areas are selected for model development: Bulgan and Choibalsan for fodder production, Dalanzadgad for processing and Zamin-Uud for border trade. In addition, an area in the suburbs of Ulaanbaatar is selected for intensive livestock farming. Flows of fodder, cattle and livestock products are illustrated in Figure 2.4.2.



Source: TANA lab

Figure 2.4.2 Flows of Fodder, Cattle and Livestock Products in Cattle Ranching System

(3) Integrated farming with fodder

Supply of sufficient and nutritious feed is a prerequisite for improving productivity and increasing production of livestock development. Production of fodder crops has been rapidly increasing particularly in Aimags located closer to Ulaanbaatar to support intensive or semi-intensive livestock farming. To ensure further expansion of fodder production and efficient transport of fodder, integrated farming combining livestock farming and fodder production may be promoted.

This form of integrated farming may be introduced also in rural areas to support nomadic livestock farming. Intensive or semi-intensive livestock farming is established in the vicinity of local towns, where cultivation of fodder crops may be encouraged. Farmers applying this model can benefit from nomadic communities as market outlets, and the traditional livestock farmers can be ensued with supplemental feed in face of harsh climatic conditions. Particular fodder crops suited to local conditions should be selected.

(4) Fodder production expansion

To support intensive and semi-intensive livestock farming, domestic production of fodder crops should

be much expanded. The project includes the following components: 1) corn production increase, 2) feed making contractors, 3) mechanized crop farming extension, and 4) Total Mixed Ration (TMR) promotion. Feed making contractors are individuals or enterprises specializing in collecting raw feed materials from the agricultural fields after harvest of grains by using machines. Total mixed ration is a kind of mixed feed to be produced from locally available feed materials for mixing to produce relatively low cost but nutritious feed.

(5) New generation herders upbringing

If the tradition of nomadic livestock farming is to be preserved with viable socioeconomic activities, new generations of herders would have to be continually generated. Bases for upbringing new generation herders may be established close to local towns of Aimags where livestock activities are dominant. Semi-intensive livestock farming may be promoted in combination with traditional grazing system by using these bases.

In each base, basic social facilities including primary education and health care and other public facilities for community activities should be provided. At a primary school, environmental education should be conducted so that environment-friendly practices of traditional livestock farming would be properly inherited. These bases would become host communities for alternative tourism including not only cultural and heritage tourism as expressed in the SDV2030 but also rural tourism. Then, training for tourism services may also be undertaken starting from primary education. This would diversify income opportunities and help to stabilize livelihood of nomadic herders as well. Home garden agriculture may also be introduced to supply to the tourism industry for additional income as well as to improve the traditional diet of nomadic people.

(6) ICT oriented support system for nomads

Implementation of the SDV2030 calls for monitoring and evaluation of its effects as it responds to the United Nation (UN) initiative of Sustainable Development Goals (SDGs). To evaluate the SDGs attainment, not only macro data but also micro data are necessary by income class, region, gender and social group. Collection of micro data at the Aimag and Soum levels would increase the administrative costs particularly at the local administration. Local communities and firms are expected to contribute voluntarily to collection of micro data necessary for SGDs monitoring and evaluation in order to reduce administrative costs at the local level.

This situation should be taken as an opportunity to establish better relationships between local administrations and local people including nomadic people. If composition, size and socio-economic characteristics of nomadic people, their migration routes, procurement of forage and water along the routes, and problems they face are known to administrations in real time, the administrations can take support measures in a timely manner. Conversely, if information on climate and other meteorological conditions, demand and prices of livestock products, availability of measures for livestock diseases and forage supply is provided to nomadic people at right time, livelihood of the nomadic people would be improved to contribute to attainment of SDGs.

An ICT oriented support system should be established first as a prototype of information exchange system by using smartphones, and pilot tested in a selected area. Micro data obtained by this will complement the statistical data and hearings and help to prepare more appropriate measures to be incorporated in development plans at the Aimag level. It may turn out to be the first step toward the realization of stronger relationships between the administrations and residents.

By linking local administrations with local residents and communities by ICT network, capacity on both sides of the network would be enhanced and mutual trust and sense of responsibility would be cultivated. This indeed is considered social innovation. For data collection, Mongolia has an advantage compared to other developing countries with respect to mobile phone service availability and Internet penetration rates covering both settlers and nomads. Therefore, Mongolia has a high potential for ICT application in this aspect.

(7) Comprehensive nomad database development

Official statistical data are very well collected and compiled in Mongolia covering many sectors and aspects. Despite this situation, data and information on nomadic people need to be further improved in a systematic way as a prerequisite to providing supports in proper and timely way. A comprehensive nomad database development project may be undertaken possibly starting with the ICT oriented support system proposed above. This, together with the earmarking of nomad population target as proposed above would convey correct messages to the Mongolian people about the government policy to respect the traditional culture of nomadic life as the basis of national development for decades to come.

(8) Spray dry power milk technology

Spray dry powder technology is a state-of art technology to produce powder products. It may be applied to producing dried camel and goat milk to facilitate transportation of the products and expand the market.

Proposed locations

Some of the projects and components proposed above may be located in selected Agro-IT parks. For the fodder production expansion, corn production increase may be located in Hutag-Undur district of Bulgan Aimag, feed making contractors may be established in Bayanchandmai district of Tuv, mechanized crop farming extension in Batsumber of Tuv, and TMR promotion project in Jargalant of Tuv. Processing facilities of cattle ranching project may be located in Erdenedalai of Dundgovi. Spray dry powder milk plant may be located in Umnugovi.

2.4.2 Strategic shift for post/with COVID-19

(1) Overview of cashmere production and sales under COVID-19

Livestock farming is the mainstay of Mongolian socioeconomy, and in particular about one-third of the Mongolian population is engaged in cashmere production. Proliferation of COVID-19 worldwide has reduced demand for cashmere significantly as access by Chinese buyers was constrained and sales in the European market declined. The Mongolian Government, facing the national election in June, introduced urgent measures to help herders overcome the difficulties such as subsidies and low interest loans conditional on purchase prices set by processors and other buyers. Cashmere producers continue to suffer from low market prices and low and unstable transactions.

Reduced income makes it difficult for herders to procure fodders and other input for livestock farming especially during the harsh winter season. This situation may have been partly alleviated by the urgent government subsidies, but sustainability of livestock farming should be ensured for the post/with COVID-19 era by expanding and stabilizing fodder production and construction of fodder treatment and storage facilities. As herders harvest goat hair in spring accumulated during winter for protection against cold weather to obtain more or less two-thirds of the annual income, expansion of trade during winter and early spring is critically important for their livelihood.

(2) Comprehensive measures for sustainability of cashmere production

To support the livelihood of herders by expanding cashmere trade at appropriate prices, a package of measures should be introduced. They should include not only such short term measures as subsidies and low interest loans already introduced by the Government, but also more structured measures to ensure sustainable development of livestock industry especially cashmere production and marketing. To formulate such comprehensive measures, the entire industry should be taken into account related to cashmere production, processing and marketing.

Cashmere industry at present encompasses the following procedure from production of cashmere hair to production of clean cashmere wool:

- Selection process: To remove greases, dusts and stains from raw cashmere hair,
- Sifting process: To sift out scurf and sand attached to the cashmere hair, and

- Washing process: To wash the raw cashmere hair with clean water to produce clean cashmere wool.

The raw cashmere wool after the washing is collected at collection points, where it is classified by color, quality and quantity in grades and buyers are selected by auction for cashmere wool of specific grade. Usually, processors in Mongolia and brokers representing processors in China participate in the auction.

In view of limited access by the Chinese buyers due to COVID-19, e-transactions should be introduced in steps. First, transactions at existing collection points may be conducted online, and for the purpose telecommunication facilities at the collection points should be upgraded. Related infrastructure for transport and storage of cashmere wool may also be improved as necessary.

As the e-transaction is established, introduction of livestock insurance should be promoted. Just like the livestock insurance system was introduced at the time of drought in Africa, the COVID-19 disaster should be taken as the opportunity to introduce the system in Mongolia as well.

As the means to transport cashmere wool, use of drones may be promoted as well. Many types of drones with different performance and capacity have been developed worldwide. Battery operated drones can transport cargo of 10kg weight for 20~30 minutes, or cargo of 40kg for 20 minutes. Hybrid drones under development can transport cargo of 40kg for one hour. It is feasible for such drones to transport cashmere wool of 45kg produced from 300 cashmere goats for 40 minutes or so.

As many herders face shortages of fodder during winter due to COVID-19, the Government should establish the system to ensure sustainable cashmere production by expanding fodder production and constructing facilities for drying and storage of fodder. Once the entire e-transaction system is established for cashmere, it can be applied also to transaction of fodder, hides and skins, meat products and other livestock products.

The COVID-19 disaster should be taken as the opportunity to upgrade the entire livestock sector by advanced technology rather than just restoration from the disaster. In fact, it is a blessing in disguise to attain the SDGs as pursued by Mongolia. As the first step, the following should be undertaken by the strong government initiative:

- Establishment of e-transaction system for cashmere wool,
- Introduction of livestock insurance system,
- Promotion of drone transport system for domestic transport of cashmere wool,
- Supply of high quality seed for fodder grasses and introduction of grass reaping machine, and
- Construction of fodder drying and storage facilities.

(3) E-transaction system for cashmere wool and other livestock products

The e-transaction system may be established for various livestock products in steps. It may be established first at selected collection points of cashmere wool already functioning. For the purpose, pilot Aimags may be designated. At any selected Aimag, existing conditions of livestock farming should be comprehensively examined focusing on cashmere production. The data to be collected and compiled include population and distribution of cashmere goats, production of raw cashmere hair, existing procedure of raw cashmere wool processing up to washing to produce cashmere wool, existing brokers and processors at the collection points and their transaction records as well as basic data and information on Aimag's socioeconomy and household economies of herders.

Based on the data and information collected, a few collection points may be selected to establish e-transaction systems by clarifying scale of transactions, facilities, operation and management entities and other specifics. At each collection point selected, conditions for e-transaction are determined including scope of cashmere wool collection service area, conditions for qualification of participating brokers and traders, procedure of bidding including e-settlement of accounts, establishment and management of database, and desirable supports by the Government.

For the pilot implementation of e-transaction, MOFALI is the government agency to supervise the implementation coordinating related organizations. The Aimag government of the pilot

implementation is the main implementation agency in cooperation with the Mongolian National University of Science and Technology, the Mongolian National Chamber of Commerce and Industry, associations of cashmere producers and processors and other entities. Mongolian ICT firms will be involved possibly in association with foreign firms, and technical cooperation of donor agencies may also be sought.

Chapter 3 Mining

3.1 Existing Conditions of Mining Sector

3.1.1 Overview of mining sector

Mongolia is rich in mineral resources, producing coal, copper, gold, uranium and rare metals, and recently oil as well. Of the export value in 2019, 90% is attributed to mineral resources represented by coal and copper. Therefore, in order to sustain economic growth, mineral resources are extremely important for Mongolia. The number of licenses issued by the end of August 2020 increased to 2,661 consisting of 1,681 mining licenses and 980 exploration licenses, of which 74% is granted to domestic companies. Licenses for three minerals, coal, gold and copper mining account for 50% of the total.

The coal has been used as a domestic energy source until now, but the development of the Tavan Tolgoi coal field in the South Gobi region, the world's largest undeveloped coal mine with a reserve of approximately 6.4 billion tons, has begun and it is now exporting the coking coal.

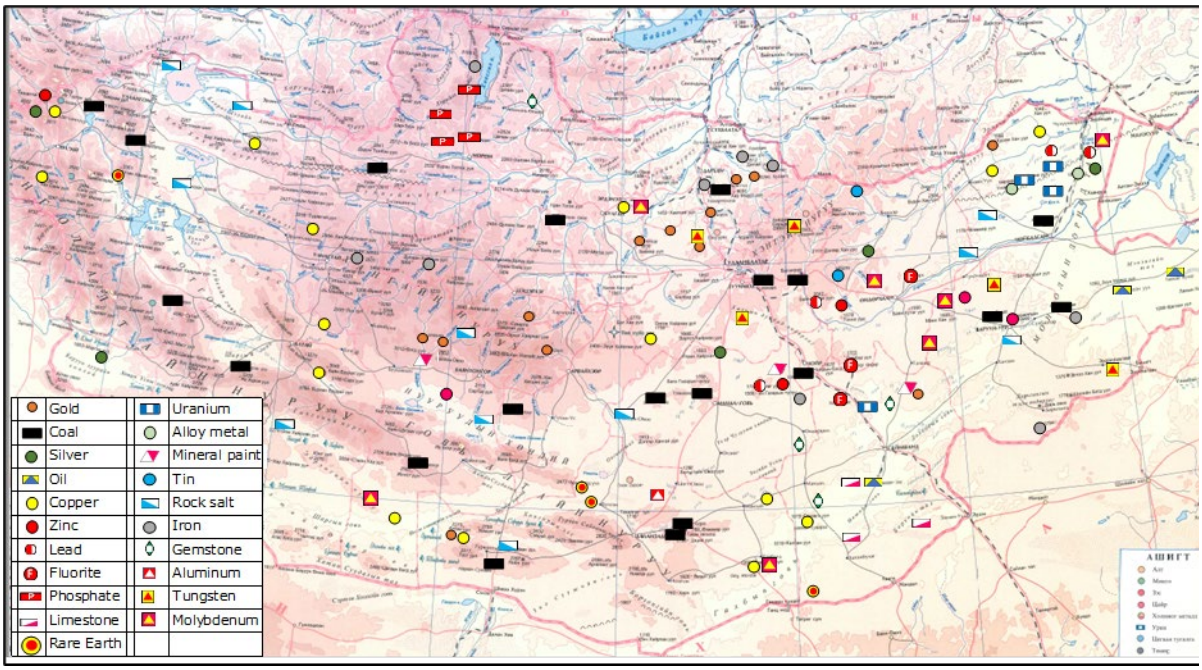
With regard to copper, the Erdenet mine started operation in 1975 as a joint venture with Soviet Union at that time, and the development of the Oyu Tolgoi mine in South Gobi, which has abundant reserves even on a global basis, started operation recently and copper concentrate has been exported since 2013. The high-grade ore will be mined by underground mining in the near future. In addition, development of the Tsagaan Suvarga mine is also progressing smoothly.

Other important mineral resources include rare metals, uranium, iron ore, zinc and fluorite. Oil production began to increase rapidly from 2007, and production in 2018 reached 7.6 million barrels, and an oil refinery is currently under construction.

The Mongolian Government is promoting the export of mineral resources and foreign currency earnings. As Mongolia is a land locked country geopolitically between China and Russia, there are many issues involved in the case of exporting mineral resources to third countries. In addition, the Mongolian Government has been pushing on high added value and advanced use of mineral resources for many years. Especially for coal, industrial development by power plants and coal chemistry such as coal gasification and liquefaction are expected.

3.1.2 Mineral resources distribution

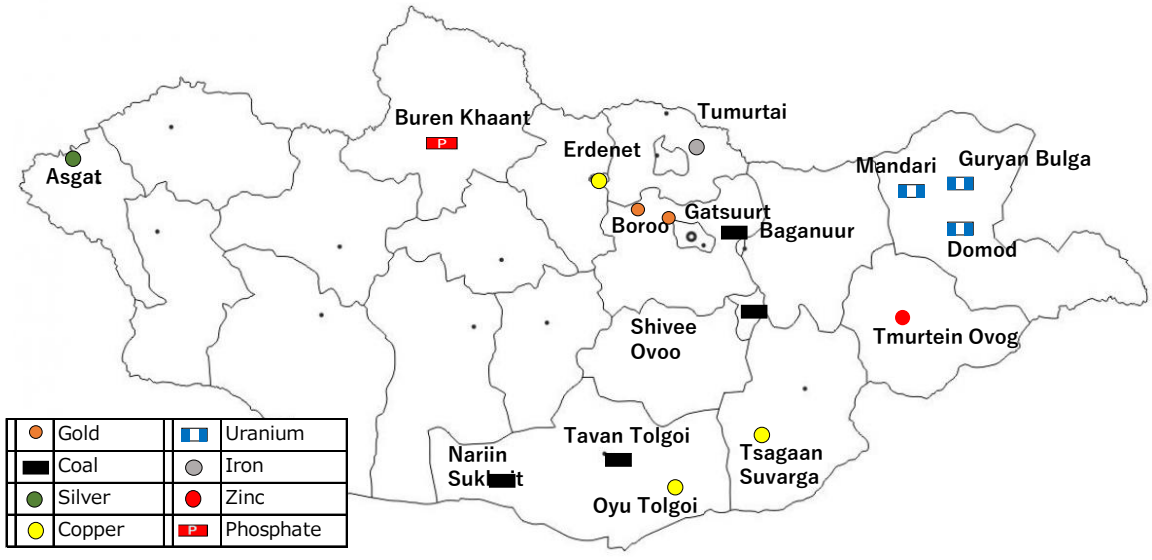
Figure 3.1.1 shows the geophysical map and the distribution of mineral resources such as coal, copper, gold, silver, uranium, iron, zinc and rare metal. They are unevenly distributed according to the types of mineral resources. Districts rich in mineral resources include the Aimags of Dornogovi, Dundgovi, Selenge and Umnugovi.



Source: Mineral Resources and Petroleum Authority of Mongolia（MRPAM）[12]

Figure 3.1.1 Geophysical Map

Figure 3.1.2 shows the location of strategically significant deposits which are designated by the Mongolian Government as priority such as coal, copper, gold, etc. There are many mines located in the eastern region.



Source: Erdenes Mongolia

Figure 3.1.2 Location of Strategically Significant Deposits

Table 3.1.1 shows the reserves of strategically significant deposits. There are the Tavan Tolgoi, Shivee Ovoo, Baganur, Nariin Sukhait coal mines, the Erdenet, Oyu Tolgoi, Tsagaan Suvarga copper mines, the Boroo and Gatsuurt gold mines, the Tumurtai iron mine, the Asgat silver mine, the Mandari, Guryan Bulga and Domod uranium mines, the Trumpet Ovog zinc mine, and the Buren Khaan phosphate mine.

[12] https://www.mrpam.gov.mn/article/102/

Table 3.1.1 Reserves of Strategically Significant Deposits

	Name of Mine	Reserves	Name	Name of Mine	Reserves
Coal	Tavan Tolgoi	7.4 billion t	Iron	Tumurtai	229.3 million t
	Shivee Ovoo	642.6 million t	Silver	Asgat	6.4 million t
	Baganuur	812 million t	Uranium	Mandari	1,000 t
	Nariin Sukhait	125.5 million t		Guryan Bulga	1,600 t
Copper	Erdenet	8.1 million t		Domod	2,900 t
	Oyu Tolgoi	37 million t	Zinc	Tmurtein Ovog	8 million t
	Tsagaan Suvarga	10.6 million t	Phosphate	Buren Khaan	300 million t
Gold	Boroo	60 t			
	Gatsuurt	75 t			

Source: Erdenes Mongolia

3.1.3 Production of mineral resources

Table 3.1.2 shows the transition of mineral resource production from 2011 to 2019. The production volume of copper concentrate in 2019 was 1.26 million tons, and 5,303 tons of molybdenum, 16.3 tons of gold, 156 thousand tons of fluorite, 8.57 million tons of iron, and 83 thousand tons of zinc were also produced.

Table 3.1.2 Production of Mineral Resources

Major commodities	2011	2012	2013	2014	2015	2016	2017	2018	2019
Copper concentrate with 35% /thous.t	513.7	517.9	803.0	1,080.4	1,334.7	1,445.1	1,317.6	1,310.8	1,262.4
Molybdenum, with concentrate /t	3,977.0	3,933.9	3,732.1	4,054.0	5,207.0	5,174.4	5,759.6	5,486.1	5.302.8
Gold /kg	5,457.0	5,977.1	8,900.9	11,503.8	14,532.8	18,435.7	19,849.0	20,655.2	16,251.3
Flour spar /thous.t	658.7	484.4	161.7	303.0	183.5	167.7	108.9	101.2	156.3
Flour spar concentrate /thous.t	116.4	157.2	76.4	71.9	47.3	34.1	55.2	80.7	47.4
Iron ore /thous.t	5,193.9	6,898.0	5,011.9	6,293.1	4,273.6	4,936.2	7,694.7	6,225.50	8,572.3
Zinc concentrate /thous.t	104.7	119.1	104.1	93.2	89.6	100.2	82.7	87.9	83.0
Tungsten concentrate/t	12.6	66.0	-	1,378.4	1,024.0	710.2	623.1	-	n/d

Source: National Statistics office of Mongolia

3.1.4 Export of mineral resources

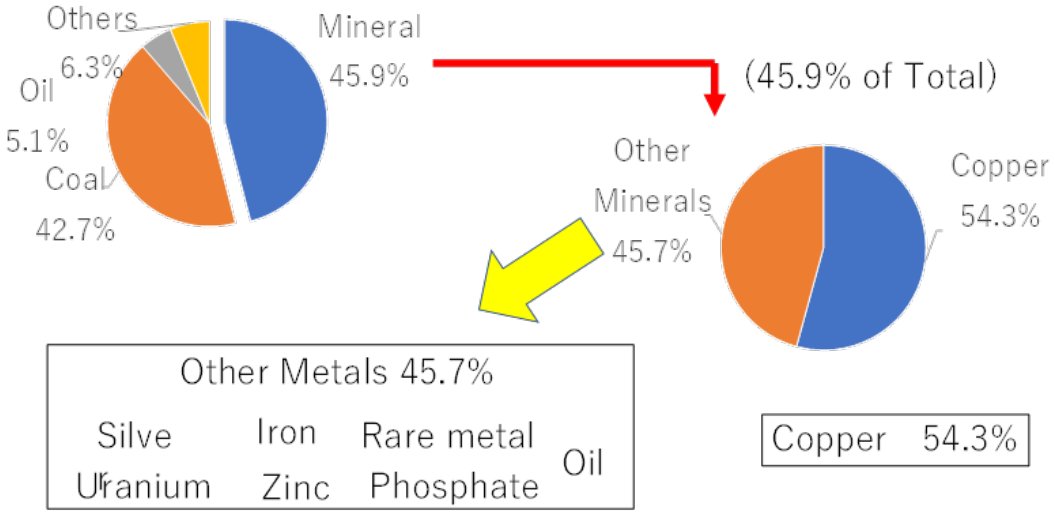
Table 3.1.3 and Figure 3.1.3 show the ratio of mineral resources export value to the total production respectively in 2019. The percentage of metal export was 45.9% and coal 42.7%, oil 5.1% and others 6.3%. The share of mineral resources in the total export value is over 90%, and it can be said that mineral resources are very important in Mongolia export. Among metals, copper accounts for 54.3% and iron for 17.4%.

Table 3.1.3 Mineral Resources Export Value as Shares in Total Export

	Commodity	US$	%	%	% in Metal/Mineral

Metal/ Mineral	Gold, unwrought or in semi-manufactured forms	418,394.40	5.8	45.9	12.6
	Copper concentrate	1,795,868.40	24.9		54.3
	Molybdenum ores and concentrate	49,012.20	0.7		1.5
	Fluor spar ores and concentrate	205,258.20	2.8		6.2
	Tungsten ores and concentrates	6,502.20	.1		0.2
	Iron ores	576,576.50	8.0		17.4
	Zinc concentrate	189,004.06	2.6		5.7
	Refined copper & copper alloys	68,903.90	1.0		2.1
	Iron scrap	211.20	0		0
Coal	Coal	3,078,818.70	42.7	42.7	
Oil	Crude petroleum oils	366,665.80	5.1	5.1	-
Others	Greezy cashmere	283,289.7	3.9	6.3	-
	Others	167,074.00	2.3		-
Total		7,250,579.80	100.00	100.00	-

Source: National Statistics office of Mongolia

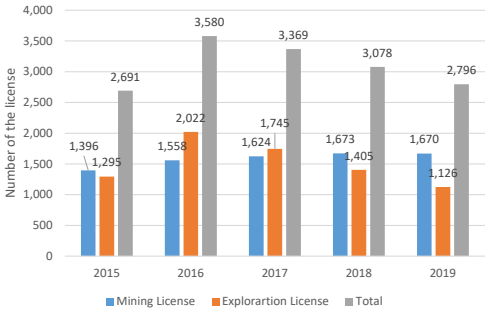


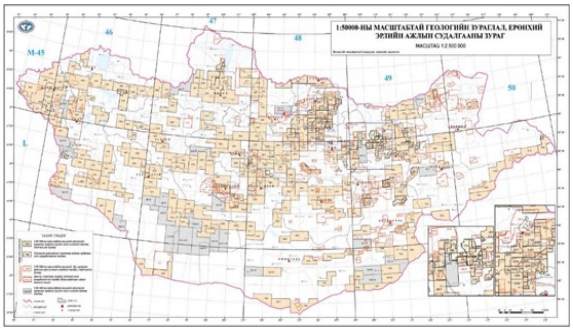
Source: JICA Project Team

Figure 3.1.3 Mineral Resources Percentage in Export

3.1.5 License status

The transition of the number of licenses in Mongolia is shown in Figure 3.1.4. The number of licenses at the end of 2019 was 1,670 mining licenses and 1,126 exploration licenses, for a total of 2,796 licenses. The number of licenses is on the decline. No new exploration license has been issued since 2016 for resource protection purposes. Domestic companies account for 70.9% of licenses granted, foreign capital 15.1% and joint venture 5.9%. Among foreign capital, China accounts for 40.1%, Singapore 13.2% and Canada 6.1%. Coal mining licenses account for 48% and gold 15%, copper 4.9% and uranium 4.7%. The contributions by Aimag are Dornogovi 12.3%, Dundgovi 7.3%, Selenge 6.4% and Umnugovi 6.3%.





Source: MRPAM[13]

Figure 3.1.4 License Status

3.1.6 Prices of mineral resources

Table 3.1.4 shows the changes in prices[14] of mineral resources. Gold prices have fallen since 2015 but have increased in 2019. Copper prices fell in 2015 but rose in 2018 and fallen again in 2019. Iron prices have fallen since 2013 but increased in 2019. Tungsten and tin prices have fallen in 2019. Silver prices remain at the similar level. Molybdenum prices increased and zinc and lead prices decreased in 2019.

Table 3.1.4 Trend of Prices* of Mineral Resources

Mineral commodities	Unit	2014	2015	2016	2017	2018	2019
Gold	$/ounce	1,271	1,160	1,151	1,257	1,269	1,392
Silver	$/ounce	19	16	16	17	16	16
Copper	$/tons	6,860	5,501	5,666	6,162	6,508	6,005
Zinc	$/tons	2,161	1,929	2,671	2,894	2,896	2,549
Blue lead	$/tons	2,095	1,786	2,230	2,317	2,237	1,994
Tin	$/tons	21,910	16,079	21,274	20,090	19,955	18,661
Molybdenum	$/tons	25,203	14,618	15,000	15,665	23,075	23,756
Tungsten	$/tons	50,971	36,082	32,000	36,011	41,640	33,953
Iron ore	$/tons	93	50	62	54	40	67
Fluorite concentrate AG-97	$/tons	306	283	260	345	486	448
Fluorite ore MG-85	$/tons	240	244	250	294	365	320

Note*: Selling prices from Mongolia linked to LME
Source: MRPAM

3.2 Coal and Oil

3.2.1 Overview of coal

(1) Current coal policy

At present, exploration licenses are not issued in accordance with the procurement procedure (tender) within the mining sector approved by the Government of Mongolia on August 8, 2018. A nationwide license for 317 coal mining is registered in the cadastral registration system at the end of 2019. Of these, 84 licenses have been operating, of which 38 licenses have been operating for export.

Table 3.2.1 shows coal production, exports and domestic consumption from 2014 to 2018. Table 3.2.2 shows the breakdown by coal mine. Coal production in 2019 was 57.13 million tons, export volume

[13] https://www.mrpam.gov.mn/article/47/
[14] Selling price from Mongolia

was 36.81 million tons, domestic consumption was 10.24 million tons, and sales volume was 47.05 million tons. Among coal mines, Energy Resources UHG (Ukhaa Khudag) is the largest at 16.53 million tons, followed by Erdenes Tavan Tolgoi with 10.23 million tons, accounting for 46% of the total at two coal mines. Both mines are located in the Tavan Tolgoi (east coal field of South Gobi) and Tavan Tolgoi is expected continuously to serve as a center of coal development in Mongolia.

Table 3.2.1 Coal Production, Export and Domestic Consumption

Unit: million ton

	2014	2015	2016	2017	2018	2019
Production	24.45	23.98	35.10	49.48	54.57	57.13
Export	19.51	14.47	25.81	33.40	36.67	36.81
Domestic	7.80	7.66	8.02	8.50	9.07	10.24
Sale	27.30	22.12	33.83	41.90	45.74	47.05

Source: MRPAM

Table 3.2.2 Coal Production, Export and Domestic Sale by Coal Mine

Unit: thousand ton

No	Coal Mine	2017			2018			2019		
		Production	Domestic	Export	Production	Domestic	Export	Production	Domestic	Export
1	Bagannur	4,019	4,039		4,260	4,296		4,100	4,133	
2	Shivee Ovoo	2,037	2,022		2,001	1,995		1,922	2,183	
3	Sharyn gol	912	797		1,089	1,114		105	1,147	
4	Chamdgantal	55	55		52	52		60	91	
5	Aduunchuluun	600	483					50		
7	Alagtogoo	4,267	71	1,226	2,004		725	198	544	466
8	Khoot	57	5		46		-			
9	Tevshinn Gobi	16	9		16	12		1	1	
10	Energy Resources UHG	9,608	138	4,205	11,365	192	4,322	10,028	5,579	4.074
11	Erdenes Tavan Tolgoi	9,937		8,475	11,067		13,090	16,528	15,326	15,125
12	Small Tavan Tolgoi	4,186	121	3,480	1,818	155	2,152	2,240	2,033	2,033
13	West Noyon uulyn	800		920	636		636	589	637	637
14	South Gobi Suns	6,378		4,960	4,340		2,551	5,051	3,546	3,546
15	Nariin Sukhait	4,690		5,883	7,186		7,073	4,049	4,074	4,073
16	Qinhua -MAK Nariin Suhait	571	0	575	411		413	316	271	271
17	Khuren Tolgoi	2,335		1,959	2,803		2,828	3,649	2,874	2,874
18	Khurengol	40								
19	Hus Huut	1,050	61	501	1,106	26	692	3,635	1,274	1,274
20	Bayanteeg	160	128		168	168		197	198	
21	Nuursthotgor	108	98		90	165		96	96	
22	Hartarvagatai	77	77		80	61		47	51	
23	Mogoin gor	74	74		115	115		130	83	
24	Others or adjust	-2,496	328	1,217	3,921	720	2,189	4,070	2,908	2,438
Total		49,480	8,504	33,400	54,572	9,070	36,670	57,129	47,048	36,809

Note: The volume of sales and exports may include the production volume of the previous year and also partly the volume of coal purchased.

Source: MRPAM

Table 3.2.3 shows coal exports by country and coal quality from 2014 to 2018. The export destinations are dominated by China with more than 96%. Other destinations include Russia, Korea, Hong Kong, Singapore and Germany. Most of the coal quality exported (more than 89%) is a bituminous coal, which is used mainly at metallurgical industries.

Table 3.2.3 Coal Exports by Country and Coal Quality

Unit: Ton

		Anthracite	Bituminous	Sub-bituminous	Lignite	Total	%
2018	China	108,207	31,767,697	3,484,781	506,480	35,867,165	98.9%
	Hong Kong		134,818			134,818	0.4%
	Singapore		164,392			164,392	0.5%
	German		98,305			98,305	0.3%
	German						
	Korea						
	Total	108,207	32,165,212	3,484,781	506,480	36,264,680	100.0%
		0.3%	88.7%	9.6%	1.4%	100.0%	
2017	China	72,072	30,424,531	1,795,113	408,418	32,291,716	96.9%
	Hong Kong		117,765			117,765	0.4%
	Russia		4			4	0.0%
	Singapore		91,632			91,632	0.3%
	German		489,822			489,822	1.5%
	Korea				9	9	0.0%
	Total	72,072	31,123,753	1,795,113	408,418	33,327,284	100.0%
		0.2%	93.4%	5.4%	1.2%	100.0%	
2016	China	99,825	24,646,497	571,001	96,710	25,414,032	98.8%
	Hong Kong	0	79,959	0	0	79,959	0.3%
	England	0	316,604	0	0	316,604	1.2%
	Total	99,825	25,043,060	571,001	96,710	25,710,771	100.0%
		0.4%	97.4%	2.2%	0.4%	100.0%	
2015	China	2,509	13,042,403	920,824	46,281	14,009,509	96.8%
	Korea		1,093	0		1,093	0.0%
	Russia		76,761	0		76,761	0.5%
	Singapore		221,220	0		221,220	1.5%
	England		161,502	0		161,502	1.1%
	Total	2,509	13,502,979	920,824	46,281	14,470,085	100.0%
		0.0%	93.3%	6.4%	0.3%	100.0%	
2014	China	1,561	18,693,333	766,449	17,653	19,477,435	99.9%
	Russia		19,937			19,937	0.1%
	German			1		1	0.0%
	Korea			36		36	0.0%
	Total	1,561	18,713,271	766,486	17,653	19,497,410	100.0%
		0.0%	96.0%	3.9%	0.1%	100.0%	

Source: MRPAM

(2) Coal quality

Coal quality from different deposits is shown in Table 3.2.4. Coal quality is classified broadly into raw coal and washed coal, and raw coal is further divided into coking coal, weak coking coal and thermal coal. Mongolia produces good quality coking coal for iron making. The index indicating the characteristics of coking coal is the free swelling index (FSI), but Mongolian coking coal has a high index of 5-9 and has high coking properties worldwide. In addition, high quality coking coal is produced only in limited areas worldwide, such as the Bowen coalfield in Qeensland, Australia, the Appalachian coalfield in the United States, and Shanxi Province in China. Therefore, the global production of high quality coking coal is decreasing and the value of Mongolian coking coal is increasing due to its superior quality.

Table 3.2.4 Coal Quality

Type of Coal	Classification	Deposit Name	TM (%)	Ash (ADB) (%)	VM (ADAF) (%)	TS (ADB) (%)	CV (kcal/kg)	FSI	GI
Raw coal	Coking	Baruun, Zuun Tsankhi	2.5	14.5	26.0	1.00	7,005	7.5	82.8

		Tavan tolgoi 4th orifice	2.8	18.2	28.3	1.05	6,720	7.0	80.2
	Weak coking	Tavan tolgoi 8th orifice	3.2	18.0	30.9	0.96	6,752	7.0	81.2
		Khuren Shand	3.1	6.1	37.2	1.15	7,025	6.0	92.5
		Nariin Sukhait	6.2	7.2	37.2	1.25	6,950	6.5	80.1
		South Gobi Sands	2.8	10.8	36.5	1.18	6,605	5.0	70.8
	Thermal	Erchin Khuch	3.9	25.2	27.2	0.92	6,152	n/d	n/d
		Nariin Sukhait	5.2	14.2	37.8	1.33	5,620	1.0	14.0
		Alag tolgoi	6.5	18.5	43.2	1.59	5,150	n/d	n/d
		Dalan Shtai	4.4	21.2	24.6	1.02	6,125	n/d	n/d
Washed coking	Coking	Ukhaa Khudag	9.2	10.2	24.2	71.00	6,806	7.0	84.0
	Thermal	Ukhaa Khudag	5.5	17.6	22.9	0.91	6,713	1.0	10.8

Source: MRPAM
TM: Total Moisture, ADB: Air Dry Base, VM: Volatile Matter, ADAF: Air Dry Ash Free, TS: Total Sulfur
CV: Calorific Value, FSI: Free Swelling Index, GI: G Indes=Roga Index

Table 3.2.5 shows coal sale by type in 2019. Washed coking coal is produced at 6.84 million tons and raw coking coal 16.79 million tons, weak coking coal 8.70 million tons, thermal coal 4.47 million tons and 10.24 million tons of lignite coal.

Table 3.2.5 Coal Sale by Type of Coal (2019)

Unit: million ton

	Export	Domestic	Total
Washed coking coal	6.84		6.84
Raw coking coal	16.79		16.79
Weak coking coal	8.70		8.70
Thermal coal	4.47		4.47
Lignite coal		10.24	10.24
Total	36.80	10.24	47.04

Source: MRPAM

(3) Coal prices

According to the 2019 statistics, the average coal prices for export mines are as follows:

- Washed coking coal: US$88-99/ ton,
- Raw coking coal: US$63-70/ton,
- Weak coking coal: US$31-55/ton, and
- Brown coal and Thermal coal: US$15-20/ ton.

These coal prices are the prices of mined coal, which are different from the selling prices. Selling prices vary greatly depending on the availability of railways and roads dedicated to coal as well as the transportation distance. Mongolia is a landlocked country, and the long transportation distance to the border ports increases the cost, constraining the coal export.

(4) Coal transportation

Coal is exported to China via international gates of Gashuun Sukhait, Shiveekhuren, Bulgan and Bichigt, depending on the location of mines. The road of 70 km from Nariin Sukhait to Shiveekhuren is paved. The road from Tavan Tolgoi to Gashuun Sukhait is not paved. The 310 km road from the Khushut coal mine to Bulgan located in Khovd district is paved. Coal in Sukhbaatar district is transported from Khukht to Bichigt. Gashuun Sukhait and Bichigt are transportation bases not only for coal but also for other industries.

(5) Coal domestic consumption for power plants

Mongolia's gross domestic consumption of coal for power plants was 7.4 million tons in 2019, of which

80% is supplied to central and eastern thermal power plants. The remaining 20% are used directly by small-scale plants (Table 3.2.6).

Table 3.2.6 Domestic Coal Consumption

Unit: Thousand ton

	N02 Power Plant	N03 Power Plant	N04 Power Plant	Darkhan Power Plant	Erdenet Power Plant	Other	Total
2014	204.6	1,238.8	3,381.0	405.2	306.8	546.1	6,082.5
2015	225.4	1,277.6	3,305.4	342.1	285.6	839.0	6,275.1
2016	236.7	1,267.4	3,286.6	371.2	269.4	1,070.0	6,501.3
2017	241.5	1,275.4	3,451.2	400.8	326.2	1,156.8	6,851.9
2018	261.6	1,325.1	3,409.3	401.1	318.4	1,677.8	7,393.3
2019	254.1	1,305.4	3,495.5	433.5	290.1	1,672.8	7,451.4

Source: Ministry of Energy
Note: CHP stands for Combined Heat Power

(6) Global coal trends and the position of Mongolian coal

According to the Coal Information 2020 published by the International Energy Agency (IEA), global coal production in 2019 will be 7,691 million tons, of which 1,001 million tons (13%) will be coking coal (see table below). By country, China accounts for the largest share (45%) at 3,470 million tons, of which 503 million tons (14%) is coking coal for steelmaker. And this is followed by the United States, Indonesia, India, and Australia. Russia's coal production was 418 million tons, of which 99 million tons (24%) was coking coal.

The world's coal export is 1,436 million tons, accounting for 19% of total production. Coking coal accounts for 337 million tons (23%) of this total. Russia has been increasing its exports to the Far East region, exporting 217 million tons in 2019.

The world's coal import is 1,423 million tons. China is the largest importer, accounting for 298 million tons, and 21% of total imports. Coking coal accounted for 74 million tons (25%) of this total.

Thus, the global trade in coal is thriving, and the need for coking coal is particularly high worldwide. Mongolia is exporting 23 million tons to China in 2019[15], which is as high as 31% of total Chinese imports. Mongolia is regarded as an important coking coal supplier to China. In addition, China is positioned as a major influencer in the global coal market, and Russia as a new coal supplier.

Table 3.2.7 Global Coal Trends

	World			China			Russia			Mongolia		
	All	Coking coal	Other coal	All	Coking coal	Other coal	All	Coking coal	Other coal	All	Coking coal	Other coal
Production	7,691	1,001 13%	6,690 87%	3,470 45%	503 14%	2,967 86%	418	99 24%	319 76%	45	31 69%	14 31%
Export	1,436 (19%)	337 23%	1,099 77%	-	-	-	217	25 12%	192 88%	28	23 82%	5 18%
Import	1,423	311 22%	1,112 78%	298 21%	74 25%	224 75%	27	1 3%	26 97%	-	-	-

Source: Coal Information2020（IEA）

(7) Coal development and greenhouse gas reduction

Coal use has a large impact on global warming due to its high greenhouse gas emissions. Since the Paris Agreement in 2015[16], member countries have been accelerating their efforts to reduce greenhouse

[15] This differs slightly from the figures published by MRPAM mentioned above.
[16] In December 2015, the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC), held in Paris, France, adopted the Paris Agreement as a new international framework for reducing 17.

gas emissions and are working to reduce and decarbonize coal by increasing the efficiency of coal-fired power plants with high efficiency low emissions (HELE) technology and carbon dioxide capture, utilization and storage (CCUS). In the past, the debate has focused on regulating coal users, namely coal-fired power plants, but recently, coal suppliers and coal developers have also been required to take measures to reduce greenhouse gas emissions after 2020.

Because coal development requires huge investment, some coal companies have been reluctant to take actions on climate change, but with the recent increase in momentum for climate change measures, the situation surrounding coal mine development is changing dramatically. As a concrete measure, each coal mine is reducing the number of heavy equipment in operation by optimizing and improving the efficiency of heavy equipment. Also, coal related companies are working to reduce greenhouse gas emissions throughout the entire value chain from coal mining to end uses.

Even under these circumstances, coal remains the cheapest energy source, and even with the impact of COVID-19, the price of coal has remained high, and is not expected to fall sharply in the near future. However, Mongolia needs to break out of its China-focused export structure and expand its export destinations in order to avoid risks.

As a new technical method to use coal, renovations are being made to produce hydrogen and ammonia from coal and use them as fuel. The carbon dioxide separated during the production process is stored by CCS (Carbon dioxide capture and storage) and reused by CR (Carbon recycling) so that it is not released into the atmosphere. It is expected to be used as a decarbonized fossil fuel.

Coal is expected to continue in the future because of its price competitiveness and the fact that coal supply countries are spread all over the world. If technical development is accelerated, hydrogen and ammonia production costs and CCS storage costs will be reduced, and value is added by CR, and as the result, coal will continue to be a price-competitive energy source for countries in need of cheap electricity.

The following is an overview of a project called Japan-Australia Hydrogen Energy Supply Chain Project (HESC) being undertaken by Australia and Japan to produce hydrogen from lignite coal.

Summary

This project aims to develop and demonstrate technologies for the production, storage and transportation of clean hydrogen from Latrobe Valley coal, in Victoria of Australia and to establish a supply-chain of hydrogen through to the use in Japan. It is subsidized by the New Energy and Industrial Technology Development Organization and the Commonwealth and Victorian governments,

Implementing company

This project is implemented by CO_2-free Hydrogen Energy Supply-chain Technology Research Association and the consortium including private firms: Iwatani, Marubeni, Kawasaki Heavy Industries, J-Power, Sumitomo Corporation, and AGL Energy Ltd.

CO_2 capture and storage

Carbon offsets have been purchased for the CO_2 in the pilot phase and in the future, the by-product CO_2 will be captured and stored underground in cooperation with, CarbonNet, the CO_2 storage project being promoted by the Commonwealth and Victorian governments.

State of progress

The demonstration plant of coal gasification and hydrogen refining facility had been under construction since November 2019 in Latrobe Valley, in Victoria of Australia, and began producing hydrogen on 23 January 2021.

3.2.2 Coal fields

In Mongolia, 15 major coal fields have been identified, where about 320 deposits of various sizes have been located. More than 100 of these deposits are expected to have coal mining potentials. The total resource of Mongolia is estimated to be about 165 billion tons, of which the measured coal resource is

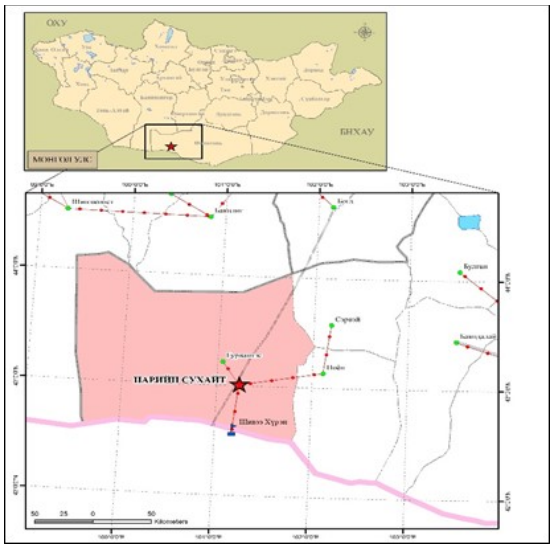
about 23 billion tonnes and the estimated coal resource is about 140 billion tons.

The coal field with the largest measured coal resources is the Umnugovi coal field with 16 billion tons. The Tavan Tolgoi deposit, located within this basin, is said to have resources of 6.4 billion tons. Assuming that the current production rate is maintained, the reserves will last for more than 200 years, even if the safety factor is taken into account.

(1) West coal field of South Gobi

General information

The west coal field of South Gobi is located 34 km southeast of Gurvantes Soum, 849 km from Ulaanbaatar and 296 km from Dalanzadgad (Figure 3.2.1). Existing licenses on coal deposits are summarized in Table 3.2.8.



Source: MRPAM

Figure 3.2.1 Location Map of West Coal Field in Southern Gobi

Table 3.2.8 List of Licenses on Deposits

No	Owner name	Name of field	Size of field / ha /	License	Reserve thousand ton
1	MAK LLC	Nariin sukhait	91.1	MV-000227	569,678.0
		Nariin sukhait	131.4	MV-005458	
		Nariin Sukhait left	30.9	MV-006852	
		Nariin sukhait west	872.2	MV-012225	
		Nariin sukhait left	35.8	MV-012226	
2	South Gobi Sands LLC	Ovoot Tolgoi	9274.0	MV-012726	22,015.7
3	MAK Nariinsukhait LLC	Brown head	70.4	MV-005459	333,863.8
4	Osokh zoos LLC	Khuren	350.1	MV-017317	34,957.1
5	Saud gobi coal trans	Bold Head-1	18,671.95	MV-017038	30,376.81
6		Bold Head-1	12,380.72	MV-019036	24,100.52
7	South Gobi Sands	Winter Park-1	10,992.92	MV-016869	115,884.9
8		Ovoo uul-1	2,473.40	MV-020436	40,839.03
9		Fire Ovoo-1	8,796.37	MV-020451	71,122.45
10	EIA	Fire Ovoo-1	17,841.05	MV-020781	3,940.0

Source: MRPAM

Current status of coal mines

- MAK LLC

The capacity[17] determined by the feasibility study is 14.0 million tons, and 45.8 million tons mined and 44.6 million tons sold by January 1st, 2018. In 2019, 4.0 million tons of coal was produced.

- South Gobi Sands LLC

The capacity determined by the feasibility study is 9.0 million tons, and 26.4 million tons mined and 26.2 million tons sold by January 1st, 2018. In 2019, 5.1 million tons of coal was produced.

- MAK Nariinsukhait mine

The capacity determined by the feasibility study is 2.0 million tons, 8.8 million tons mined and 10.7 million tons sold by January 1st, 2018. In 2019, 0.31 million tons of coal was produced.

- Osokh zoos LLC

The capacity determined by the feasibility study is 3.0 million tons, 7.6 million tons mined and 8.1 million tons sold by January 1st, 2018.

- Saudi Gobi Coal Trans LLC

The capacity determined by the feasibility study is 3.0 million tons with start in 2018. In 2019, 2.14 million tons of coal was produced.

- EIA LLC

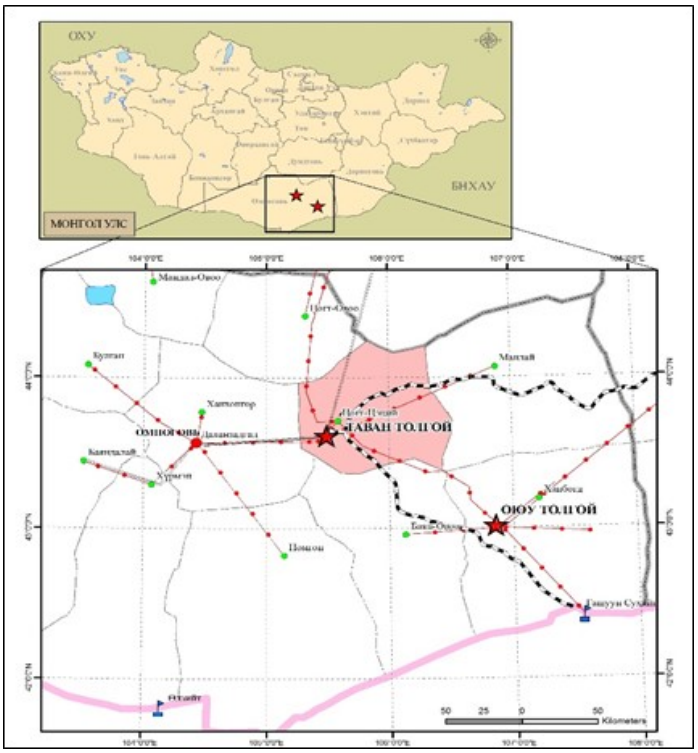
The capacity determined by the feasibility study is 0.5 million tons with start in 2018. In 2019, 0.54 million tons of coal will be produced.

(2) East coal field of South Gobi（Tavan Tolgoi）

General information

The Tavan Tolgoi coal deposit is located 600 km south of Ulaanbaatar, 100 km east of Dalanzadgad, and 254 km from Gashuun Sukhait border in Tsogttsetsii Soum. (Figure 3.2.2). Existing licenses on coal deposits are summarized in Table 3.2.9.

[17] Capacity：Maximum Annual Coal Production Capacity



Source: MRPAM

Figure 3.2.2 Location Map of East Coal Field in Southern Gobi

Table 3.2.9 List of Licenses on Deposits

No.	Owner name	Name of field	Size of field / ha /	License	Reserve thousand ton
1	Erdenes Tavan Tolgoi	Tavan Tolgoi	2,036.33	MV-011943	729,425.9
2		Bor head	12,864.47	MV-011953	
3		Bor teeg-1	22901.37	MV-011954	168,405.2
4		Yellow tag	23,813.10	MV-011955	542,261.3
5		Tavan tolgoi-1	3,151.92	MV-011956	1,082,020.5
6		Bor teeg-1	556.72	MV-016881	798,382.62
7		Tavan tolgoi-1	2,447.13	MV-016882	
8		Yellow tag	700.39	MV-016883	392,945.9
9	Energy Resource LLC	Ukhaa Khudag	2,960.23	MV-011952	687,572.3
10	Tavan Tolgoi coal mine	Tavan Tolgoi	276.91	MV-000287	209,068.1
11	Khaan-Exploration	West sun	4,481.82	MV-014493	333,120.47
12	Khaan-Exploration	Tsaiyut well	8,340.01	MV-017336	73,060.0

Source: MRPAM

Current status of coal mines

- Erdenes Tavan Tolgoi: Eastern Tsankhi mine

The capacity determined by the feasibility study is 15.0 million tons, and 20.2 million tons mined by by January 1st, 2018. According to the 2019 plan, 10.0 million tons of coal was to be produced.

West Tsankhi mine: The capacity determined by the feasibility study is 20.0 million tons, and 15.31 million tons mined by January 1st, 2018. According to the 2019 plan, 8.09 million tons of coal was to be produced. Also, Tsankhi have exported 44.75 million tons of coal as of January 31, 2019. Erdenes Tavan Tolgoi's overall production in 2019 was 16.5 million tons and exports were 15.1 million tons.

- Energy Resource LLC: Ukhaakhudag mine

The capacity determined by the feasibility study is 15.0 million tons, and 50.45 million tons mined and 43.03 million tons sold by January 1st, 2018. According to the 2019 plan, 11.18 million tons of coal was to be produced. The annual production in 2019 was 10.0 million tons and exports were 4.1 million tons.

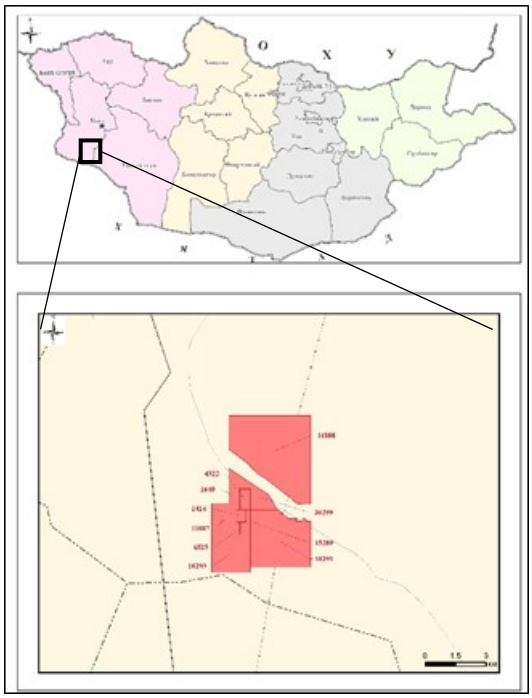
- Tavan Tolgoi mine: The Tavan Tolgoi mine

The capacity determined by the feasibility study is 5.0 million tons, and 29.28 million tons mined and 29.28 million tons sold by January 1st, 2018. According to the 2019 plan, 6.0 million tons of coal will be produced.

(3) Khushuut coal field

General information

The Khushuut coal field is located 210 km southeast of Khovd, 60 km southwest of Zero Soum, 29 km northeast of Tsetseg Soum and 1900-2250 meters above sea level in north-eastern Mongolia's Altai mountain range. The length of the deposit is 2.2 km and the width is 1.5 km (Figure 3.2.3). Existing licences on coal deposits are summarized in Table 3.2.10.



Source: MRPAM

Figure 3.2.3 Location Map of Khushuut Coal Field

Table 3.2.10 List of Licenses on Deposits

д/д	Owner name	Name of field	Size of field/ ha /	License	Reserve thousand ton
1	Moenko	Khushuut river	28.8	MV-001414	12,206.56
2		External program	40.87	MV-001640	1,261.53
3		Cross the Streets	203.48	MV-011887	4,581.10
4		Go on nose	1,296.31	MV-011888	1,908.10
5		Khushuut	45.79	MV-006525	18,787.31
6		Khushuut	39.25	MV-015289	7,678.40
7		The main river	53.97	MV-004322	38,138.66

8		Go on nose	176.55	MV-020299	36,966.58
9	Tethys mining	White backstage	733.28	MV-018291	49,128.90
10		Baya's back-2	353.39	MV-018293	7,616.34

Source: MRPAM

Current status of coal mines

- Moenco LLC: Khushuut mine

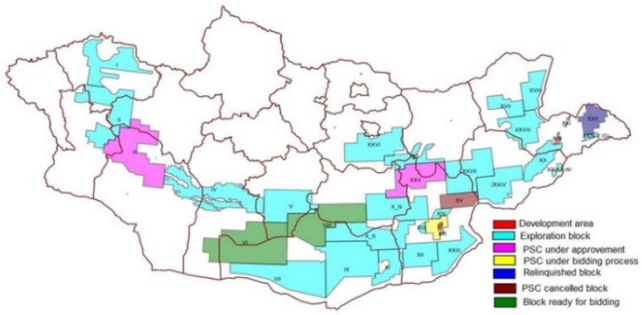
The capacity from the feasibility study is 4.1 million tonnes and it produced 3.6 million tons by 2019.

- Tethys Mining LLC: East Statuary mine

The capacity from the feasibility study is 2.15 million t, and it is planned to produce 800.0 thousand tons of coal by 2019.

3.2.3 Oil concessions

The measured oil resources in Mongolia are estimated at 2.5 billion barrels, and based on the current production rate, the Country can produce oil for more than 200 years, even taking the safety factor into account. For petroleum exploration, 32 prospective petroleum licenses were identified in Mongolia. Currently the Government of Mongolia has signed a production sharing contract with 21 companies for 25 of these prospective petroleum blocks. Of these, Petrochina Daqing Tamsag LLC and Dongsheng Petroleum (Mongol) LLC are producing oil from Toson-Uul XIX, Tamsag-XXI and PSC-97 licenses. (Figure 3.2.4)



	Development Blocks	Contractor	PSC Date
1	Toson-Uul XiX	Petro China Daqing Tamsag LLC	1993.04.26
2	Tamsag XXI		1995.12.11
3	PSC97	Dongsheng Petroleum （Mongol)LLC	1997.01.24

Source: MRPAM[18]

Figure 3.2.4 Information on Petroleum Concessions

3.2.4 Oil production, export and import

Table 3.2.11 shows crude oil production and exports and imported petroleum products such as gasoline and light oil. The crude oil production in 2019 was 6,876 thousand barrels, and the export volume was 6,546 thousand barrels. In addition, petroleum products are imported at 2,108 thousand tons. This includes 607,000 tons of gasoline, 1,169,000 tons of diesel fuel, 52,000 tons of fuel (TS-1), 45,000 tons of liquefied petroleum gas (LPG, GPL, etc.), and 236,000 tons of others. Mainly automobile fuel is imported. The import is dominantly from Russia (96%), and other countries are China and North Korea.

[18] https://www.mrpam.gov.mn/article/49/

Table 3.2.11 Crude Oil Production, Crude Oil Export, Oil Product Import

	Unit	2000	2005	2010	2015	2016	2017	2018	2019
Crude Oil Production	thousand Barrel	66	201	2,181	8,769	8,250	7,624	6,389	6,876
Crude Oil Export	thousand Barrel	68	188	2,071	8,135	8,015	7,514	6,188	6,546
Oil Product Import	thousand ton	430	551	809	1,120	961	1,252	1,871	2,108

Source: MRPAM

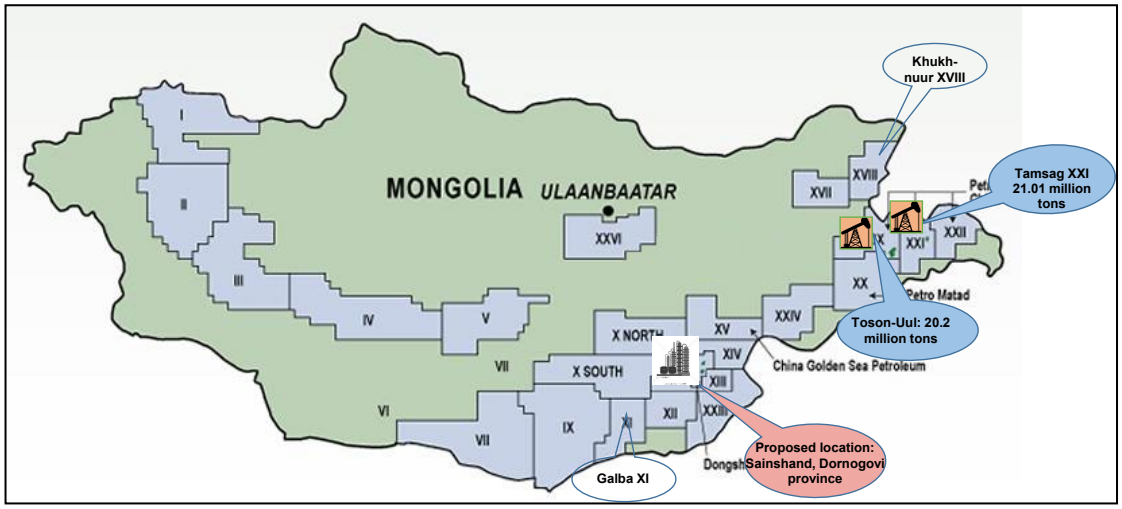
3.2.5 Construction of refinery

Mongolia is currently planning to build an oil refining plant 20 km north of Sainshand with assistance from India (Figure 3.2.5). The construction is now at the planning stage as a feasibility study is approaching the final stage. Construction is scheduled to start in 2020, and it is hoped that it will start operation in 2023.

Crude oil has already been mined in northeastern Mongolia, near the border with China. Crude oil is planned to be supplied by pipeline from Toson Uul XIX and Tamsag XXI fields in this region. From the refinery to the Toson Uul XIX block is 550km, and there is the Tamsag XXI block 90km away from the Toson Uul XIX block.

The planned products are gasoline, diesel, kerosene, LPG and jet oil. Of these products, 60-70% is diesel. The total production volume is 1.5 million tons, and petroleum products imported from Russia are currently 1.8 million tons. Therefore, the refinery product can substitute the considerable imports. Petroleum products will be transported by rail and tank truck. The railway line already exists in the north and south, and is close to the refinery. Petroleum products are transported by rail to the north and south, and by tank truck to the east and west.

In October 2020, a contract for the first phase of construction (housing, water supply and other non-factory construction) was signed with an Indian engineering company, and the project has essentially begun.



Source: Mongol Refinery

Figure 3.2.5 Proposed Location of Oil Refinery

3.3 Copper

3.3.1 Overview

In 2019, copper accounted for 24.9% of the total exports and is an important mineral resource in Mongolia. Production of other mineral resources like iron, gold, zinc, etc. is small, accounting for 2.6 to 8% in the total export. The copper mines in Mongolia include the Erdenet mine operated by the

state-owned company Erdenes Mongol, and the Oyu Tolgoi mine, which has been mainly developed with Rio Tinto and Ivanhoe.

There are three copper deposit belts in Mongolia in the Northern Mongolian, Central Mongolian and Southern Mongolian, which coincide with the volcanic belts. Copper deposits are found in areas related to volcanic rocks and plutonic rocks.

The list of copper deposits in Mongolia is shown in Table 3.3.1. The total amount of ore is 7,960 million tons. Copper reserves in Mongolia account for over 93% of the total at the Oyu Tolgoi, Erdenet and Tsagaan Suvarga mines, with the Oyu Tolgoi mine being particularly prominent.

The reserves of three mines at Oyu Tolgoi, Erdenet and Tsagaan Suvarga are shown in Table 3.3.2. The total amount of ore reaches 7,416 million tons and the amount of copper metal reaches 51 million tons. Of these, Oyu Tolgoi has 6,452 million tons of ore, 87% of the total, and copper metal is 45 million tons, 86% of the total.

Copper concentration is carried out at Erdenet and Oyu Tolgoi. There is cathode production by the refinery through the hydrometallurgy in the private companies operating near the Erdenet mine, and copper wire and electric wire processing using these as raw materials.

Table 3.3.1 Copper Mine Reserves

No.	Name of deposit	Province	Thous.tn
1	Oyu Tolgoi	Umnugobi	6,451,511
2	Erdenet	Orkhon	714,201
3	Tsagaan Suvarga	Dornogovi	250,396
4	Shand	Bulgan	194,584
5	Saran Uul	Bayankhongor	36,196
7	Bayan Airag	Zavkhan	15,443
8	Khadat Gun	Gobi-Altai	84,690
9	Ulaan Khud	Umnugobi	45,999
10	Tsakhir Tolgoi	Bayankhongor	15,501
11	Nomint	Dornod	13,640
12	Budag Tolgoi	Dundgobi	45,35
13	Nariin Khudag	Dornogovi	41,035
14	Nogtsot Tolgoi	Dornogovi	12,934
15	Oyut Ulaan	Dornogovi	19,071
16	Ulaan Tolgoi	Bayankhongor	20,764
17	Khokh Adar	Bayan-Ulgii	4,817
18	Mankhan Uul	Gobi-Altai	8,442
19	Tamgat	Umnugobi	896
20	Khadat Uul	Tov	8,350
21	Zuun Ikh salaa	Selenge	1,111
22	Khul Morit	Bayankhongor	7,393
23	Khul Morit-1	Bayankhongor	4,761
24	Khalzan Uul	Umnugobi	1,987
25	Bayantsagaan	Bayankhongor	1,908
26	Kharaat	Увс	1,906
27	Sangiin dalai	Bayankhongor	1,433
28	Avdar Tolgoi	Dornod	1,617
29	Artsat Tsunkheg	Bayan-Ulgii	403
Total			7,960,989

Source:2014 Copper Industry Sector Information Collection and Confirmation Survey

Table 3.3.2 Main Copper Mine Reserves

	Province	Ore (Mt)	Metal (Mt)	Purity (%)
Oyu Tolgoi	Umnugobi	6,452	45.03	0.698
Erdenet	Orkhon	714	5.22	0.731

Tsagaan Suvarga	Dornogovi	250	1.61	0.643
Total		7,416	51.86	0.700

Source: MRPAM

In 2019, copper exports were valued at US$1,796 million, accounting for 24.9% of total exports. It also accounts for 54.3% of the total metallic mineral resources. It is exported to China and Russia. Exports to China are expected to increase with the start of underground mining at the Oyu Tolgoi copper mine.

3.3.2 Erdenet copper mine

(1) Summary

The Erdenet mine is located 365 km northeast of Ulaanbaatar and 165 km southwest of Darkhan. The Mongolian Government owns 51% of Erdenet's interests and 49% is owned by the Russian government. It started operations in 1975 with joint venture with the Soviet Union and the Mongolian Government. Initially there were many Soviet employees, but now more than 90% are Mongolians. The Erdenet mine owns the copper smelter and copper processing plant, only plant available in Mongolia. Besides the copper, it also produces molybdenum concentrates.

(2) Geological structure.

The Erdenet deposit consists of Erdenet complex, mainly granodiorite intruded by plagioclase granite. The ore body is stockwork-like and is formed on top of the intrusive rock.

(3) Exploration

The exploration of the Erdenet deposit began with a survey by the Soviet Union government in the 1940s. In 1964-68, a joint geological survey team of Mongolia and the Czech Republic was organized to evaluate the mineral content. Subsequently, the Soviet survey team was formed to conduct a detailed assessment of the ore reserves. As a result, the Erdenet mine was established in 1975, and mining and ore processing and mine construction began. In 1977, the railway was constructed and export of concentrate was started. Erdenet exploration team conducts surveys to determine detailed ore reserves every five years.

(4) Ore quantity and ore grade

The Erdenet deposit has a copper ore reserve of 714 million tons and a copper metal content of 5.22 million (grade 0.731%). The current ore processing volume is 27 million tons/year, and it can be operated for nearly 30 years. Molybdenum ore reserves of 200,000 tons (quality 0.0106%) are reported.

(5) Concentrate

The processing of the ore at the concentrator is a series of beneficiation circuit designs such as crushing, grinding, flotation, filtering and drying. There are two lines for crushing and grinding processes, each with a processing capacity of 20.5 million tons/year and 5.0 million tons/year. The processing is using a method in which copper and molybdenum are in flotation together and later divided into concentrates.

(6) Production results

The production volume of copper concentrate is 535,000 tons/year, and the production volume of Molybdenum concentrate is 4,500 tons/year (the ore processing volume is 26,000,000 tons/year). The production of copper concentrate in Mongolia in 2019 is 1,262,000 tons, and the production of Erdenet reaches 40%. Molybdenum production in 2019 was 5,300 tons, and Erdenet production exceeded 80%.

(7) Future mine development

Erdenet mine life has been extended from 30 to 60 years due to the discovery of new reserves. In the future, however, it will be necessary to focus on copper production from the newly developed Oyu Tolgoi mine and urgently develop the Tsagaan Suvarga mine which is currently under constructio.

Molybdenum is an important rare metal used for refining special steel, lubricating oil, additives, etc., and will continue to be a strategic resource in Mongolia. The price of molybdenum rose by 50% from US$15,000 /ton in 2015-2017 to US$23,000 /ton last year. Molybdenum is not produced from the Oyu Tolgoi mine, but abundant molybdenum has been confirmed at the Tsagaan Suvarga mine.

3.3.3 Oyu Tolgoi

(1) Summary

The Oyu Tolgoi mine is located 600 km south of Ulaanbaatar. It is 100km from the Tavan Tolgoi coal mine toward the Chinese border. The Oyu Tolgoi mine is owned 66% by Turquoise Hill Resources[19] and 34% by the Government of Mongolia. The Turquoise Hill resources is under Rio Tinto. Open pit mining is currently operating, but the production from underground mining will start operation after 2022. The current copper grade is about 0.4%, but underground mining can produce high grade of about 1 to 2%, and it is larger than the Erdenet mine on mine scale. It secures more than 10,000 employees and most of them are Mongolians. Currently, more than 300 thousand tons of copper concentrate are produced annually and exported to China in total.

(2) Geology

The Oyu Tolgoi area consists of Devonian to Carboniferous continental margins and island volcanic rocks and sedimentary rocks extending in the east-west direction. At least seven types of intrusive rocks are classified according to composition and structure. In terms of geological structure, fault networks, folds and shear zones are intricately buried. Since most of these structures are not exposed to the ground surface, it was revealed by integrating detailed exploration data, high-precision geological mapping, geophysical exploration data, and so on.

(3) Exploration

Exploration activity began in 1996 by Magma Copper Corporation and the copper ore was confirmed at Oyu Tolgoi. After that BHP acquired Magma Copper Corporation and the exploration rights were transferred to BHP. In 1998, BHP carried out drilling exploration. However, BHP did not continue its exploration activities in 1999 due to the business review, and the exploration rights were transferred to Ivanhoe, and they continued drilling exploration from 2000 and this activity led to the discovery of huge deposits such as Hugo and Dummett.

(4) Ore quantity and ore quality

Table 3.3.3 shows the reserves and quality of copper ore by area. The mining area is divided into Southern Oyu, Hugo Dumett and Heruga. The total reserve is 6,543 million tons, but Hugo Dumett has the largest reserve. Currently, open-pit mining is being conducted in the Southern Oyu area, but in the future it is planned to shift to underground mining. In underground mining area such as Hugo Dumett and Heruga, the quality of copper ore is high. Oyu Tolgoi is characterized by rich gold and silver, but not molybdenum.

[19] It is currently renamed as Turquoise Hill Resources.

Table 3.3.3 Copper Mine Reserves and Quality

Ore Are	Mining Method	Class	Mt	Cu %	Mo %	Au g/t	Ag g/t
Southern Oyu	U/P	Measured					
		Indicated	1,096	0.45	-	0.3	0.93
		Inferred	218	0.27	-	0.17	0.77
	U/G	Measured					
		Indicated	172	0.37	-	0.52	0.93
		Inferred	237	0.38	-	0.29	0.87
	Sub Total		1,723				
Hugo Dumett	U/G	Measured	-	-	-	-	-
		Indicated	907	1.69	-	0.39	3.77
		Inferred	1,969	0.8	-	0.18	2.12
	Sub Total		2,876				
Heruga	U/G	Measured	-	-	-	-	-
		Indicated	-	-	-	-	-
		Inferred	1,944	0.38	-	0.36	1.37
	Sub Total		1,944				
Total			6,543				

Source: 2014 Copper Industry Sector Information Collection and Confirmation Survey

(5) Concentration

In 2013, one concentrator line which could process the ore transporting from the open pit was completed. The design capacity is 110,000 tons/day. In 2013, the supply to the concentrator was 72,032,000 tons (Cu quality 0.47%, Au quality 0.36 g/ton, Ag quality 1.39 g/ton). In the same year, the concentrate production at the concentrator was 290,000 tons (Cu quality 26.4%), and the actual yields were Cu 81.6%, Au 66.1%, and Ag 54.2%. Production of copper concentrate in 2018 is 746,400ton (Cu quality 21.3%). The raw ore currently sent to the concentrator seems to have exceeded 100 million tons. Around 2027, the total volume of copper concentrate in the Oyun Tolgoi mine is expected to reach a peak.

(6) Refinery

The problem is that there is no refinery factory for metal ore in Mongolia. The Mongolian government promote the no export of metal ore and to encourage the refinery construction for added value to ore. The Government calls for investment to build a value-added factory in Mongolia.

(7) Formation of mining city

The Oyu Tolgoi copper mine is developing various cooperation projects based on investment agreements in addition to creating local jobs to achieve local benefits. Tax revenues from Oyu Tolgoi range from US$230 to 320 million per year with a cumulative total of nearly US$2,300 million. In particular, the population of Hambogud Soum, 45km away from the mine site, is increasing rapidly, and the population growth rate is outstanding nationwide. In terms of job creation, 92.6% of the approximately 16,581 employees in the Oyu Tolgoi mine accounts for Mongolian nationality and 20.4% comes from Umnugovi Aimag (as of 2018). In addition, with the “Made in Mongolia” strategy, the company is procuring from the Country and Umnugovi Aimag. For example, copper concentrate storage bags and work clothes are produced in the Aimag. In addition, based on the investment agreements, a cooperation agreement was concluded in April 2015 between Oyu Tolgoi, Umnugovi Aimag, and four Soums in the same Aimag, and infrastructure maintenance project such as roads, electric power, heating facilities, schools, community facilities, animal hospitals, etc. is currently executing. The Gobi-Oyu Development Support Fund [3] are in operation.

3.4 Other Mineral Resources

3.4.1 Gold

The production of gold was 1 to 2 tons per year before 1994, but it then rapidly increased to over 10 tons in 1998, and gold production in 2018 attained 20 tons. There are two types of gold deposit, one is gold reef and another is sand drift deposits. The production from gold reef deposit was started by North American companies in 1999 in the Zaamar area, about 150 km west and in the Gatsuurt and area in the nrth respectively from Ulaanbaatar. The Boroo region, about 100 km north of Ulaanbaatar, has been mined from gold sand deposits. Since gold from Oyu Tolgoi in Mongolia is also expected in the future, an increase in gold production in Mongolia can be expected. Gold reserves are 763 tons for the entire Mongolia, and by region, the Boroo area is 60 tons, and the Gatsuurt area is 75 tons.

The photo in Figure 3.4.1 shows the situation of the Nergui Khundii gold mine located 126 km northwest of Ulaanbaatar.

Source: JICA Project Team

Figure 3.4.1 Nergui Khundii Gold Mine (Tod Undarga LLC）

3.4.2 Rare earth/rare metals

Rare metals are rare mineral resources that are rarely distributed and used in industry for various reasons. In Japan, it refers to 31 mineral species and 47 elements in the mineral resources. In terms of resources, 17 elements in the considered rare earths are grouped into one ore species. However, regarding the exploration of rare metals and rare earths in Mongolia, no deposits on a global scale have been discovered at present, but some rare metals (molybdenum, tungsten, etc.) have been mined in small quantities. The rare earth is famous for the Mountain Pass in the United States, but China accounts for 90% of the world's production, and 80% is produced in Bayan Ovoo in the Autonomous Region of Inner Mongolia. Among rare earths, the value of dysprosium has recently increased.

In Mongolia, rare earths and rare metals are recognized in the Mushgia Khudag, deposit in Umnogovi Aimag and the Khotgor deposit and the Khalzan Burgedei deposit in Khovd, and some area in Uvs which is located in the western part of Mongolia. However, the difficulty of development has been pointed out because Khovd and Uvs are nearly 1,700 km away from Ulaanbaatar and the infrastructure is not in place.

For exploration of rare earths and rare metals, the Japan, Oil, Gas and Metals National Corporation (JOGMEC) provided technology and funding, and trials have been conducted since 2010 by narrowing down the potential area for reserves using artificial satellite information. However, a promising deposit has not been identified yet.

3.4.3 Molybdenum and tungsten

Molybdenum is produced annually by 5,000 tons. Molybdenum is not produced alone but is produced

as a by-product of ore such as copper and is currently mined mainly at the Erdenet copper mine in Mongolia. Molybdenum is not produced from the Oyu Tolgoi mine, but abundant molybdenum has been found in the Tsagaan Suvarga mine, which is currently under development.

Tungsten deposits used for refining cemented carbides are mined by Mongolian and Chinese companies in Selenge and Dornogovi. The Tsagaan Davaa deposit, about 70 km northwest of Ulaanbaatar, is a mine that began with Hungarian capital (Figure 3.4.2). There are also deposits in Uvs and Khovd in Western Mongolia. There is information that deposits rich in reserves have been found near Chinese border in Sukhbaatar Aimag.

Source: JICA Project Team

Figure 3.4.2 Tsagaan Davaa Tungsten Mine

3.4.4 Zinc

Zinc is produced at 80,000 tons annually in Mongolia. The main production area is Tmurtein Ovoo in Sukhbaatar. It is produced by Chinese company Tasirt Mineral and Shinshin. It owns a refinery and exports 55% of concentrate to China.

3.4.5 Iron

Iron is produced at 6 million tons annually in Mongolia. Iron ore deposits have spread throughout the Country, including Dornogovi, Gobi-Altai, Khentii, Khuvsgul, Selenge, Sukhbaatar, Tuv and Uvs. The refinery of iron ore has selected the method in which iron ore is finely crushed and then recovered with a magnet, and is often exported to a purity of about 60%. In Darkhan, the state-owned steelworks Darkhan Metallurgical Plant was established and operated in 1993 with Japanese support. Darkhan Metallurgical Plant is producing the iron pellets by melting scrap in an electric furnace and sponge iron produced by directly induction refined method. Annual crude steel production has reached 1 million tons. Near the Darkhan Steel Plant, there are the Tumurtei deposit, the Tumur Tolgoin deposit and the Bayangol deposit of Iron.

3.4.6 Fluorite

The current production of fluorite is about 100,000 tons. Previously it had a production of 600,000 tons, but now it is decreasing. The biggest fluorite deposit is located in Bor Ondor and the company is operating from ore mining to processing final commercial product. Bor Ondor is about 270 km southeast of Ulaanbaatar and is connected by the railway line for the product transportation. Small mines in the surrounding area are also transporting products to the company for processing the commercial product. It is exported to Russia and Ukraine mainly for steelmaking and aluminum scouring.

3.4.7 Uranium, bauxite and lithium

The confirmed reserve of uranium in Mongolia is about 62,000 tons, but the estimated reserve is about 1.4 million tons, making it one of the largest deposit countries in the world. Uranium exists in Dornod, Mardai, and Gurvan Bulag in the northeastern part of Dornod Aimag. In the 1960s, Soviet Union conducted a survey, mining and exporting to the Soviet Union from the 1980s until the early 1990s, but no uranium deposits are currently in operation.

In July 2009, the Nuclear Energy Law was enacted. According to the law even if foreign companies invest, the Mongolian Government will acquire 51% or more of the joint venture's stock free of charge if the uranium deposit is explored by the national budget.

In addition, Dornogovi also has a deposit (Sainshhand-Dariganga block). French company AREVA owns licenses for 36 uranium mines that it has explored and discovered.

The bauxite deposits are the Bayan uul deposit of Dornod Dornogovi district and the Darvi deposit of Khovd Khovd district. The bauxite of Mongolia has hardened bauxite. The production volume has not been published in production statistics. Lithium deposits also exist, but at the present both the reserves and the contents are small and it is not possible to develop them.

3.5 Issues of Mining Development

Mongolia's mining sector has steadily grown initially through Soviet development promotion and subsequently by the introduction of foreign capital. However, due to the lack of experiences for international bidding and high expectation by the Government, it was often seen that the relationship between the Mongolian Government and foreign companies was not well managed and the development of mineral resources was stagnated. In particular, in the international bid for the West Tsankhi mining area in Tavan Tolgoi, although the Government had decided on three companies, the approval by the Parliament of Mongolia has not been obtained yet. Also, for Oyu Tolgoi, the global scale copper mine, the mine development plan for underground mining could not be agreed for many years due to the Government high expectation. Furthermore, the railway construction plan from Tavan Tolgoi had been stagnated for many years. Therefore, there are many challenges to Mongolian mine development.

JICA has carried out “2013 Mongolia Coal Development and Utilization Master Plan” and the “2014 Copper Industry Sector Information Collection and Confirmation Survey”. Based on the results of these investigation works and the field survey at this time, the measures to be taken in the field of mining development were identified as follows.

3.5.1 Improving export procedures at the border

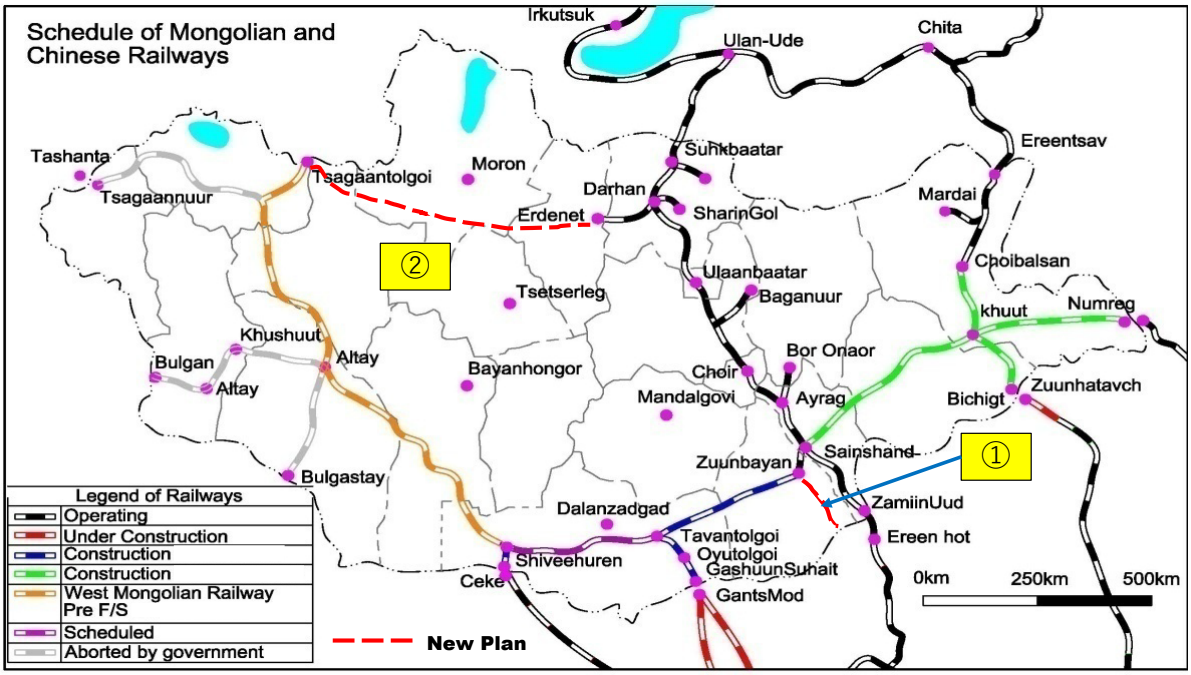
Currently, coal is exported to China except for the use for domestic power generation and boilers. Coal is transported to the international gate (border town) of Shivee Huren in the western region of South Gobi and to the international gate of Gashuun Sukhait in the eastern region. Smooth export procedures have not been realized, and the trucks loaded with coal are forced to wait normally for several days. The reason for this situation is said to be heavy traffic jam caused by the time-consuming export procedures in Mongolia and China at the borders. For this reason, the Mongolian Government is working to simplify the procedures at the borders.

3.5.2 Developing transport infrastructure

Railways are essential to transport of mineral resources such as coal and copper, but the development of railway transport infrastructure in Mongolia has been delayed. There is no railway in South Gobi, which is a major production area for coal and copper, and currently the truck transportation is utilized. Truck transportation causes environmental problems such as dust, and other environmental impacts for nomads are pointed out. Figure 3.5.1 shows the existing railway and future railway construction plans.

The current railway system is operated by the Ulaanbaatar Railway (UBTZ) founded in 1949, which is 50% owned by the Russian government and 50% owned by the Mongolian Government. The main

railway lines are the north-south route serving Sukhbaatar-Ulaanbaatar-Zamyn-Uud and the route between Choibalsan-Ereentsav. Also, there are only a few railway lines connecting the Darhan-Erdenet mine and the Bagnuur coal mine as branch lines. The railway plan was announced officially in 2010, divided into three phases, but there is no fixed time schedule. The revised railway plan in June 2018 adds two railway lines from Zuunbayan to the Chinese border, shown as (1) in Figure 3.5.1 and a railway 517 km from the northern railway from Tsagaan Tolgoi to Erdenet, shown as (2) in Figure 3.5.1.



Source: 2013 Master Plan Study on the Development and Utilization of Coal of Mongolia

Figure 3.5.1 Existing Railway and Future Railway Construction Plans

3.5.3 Securing transport routes to third countries

(1) Overview

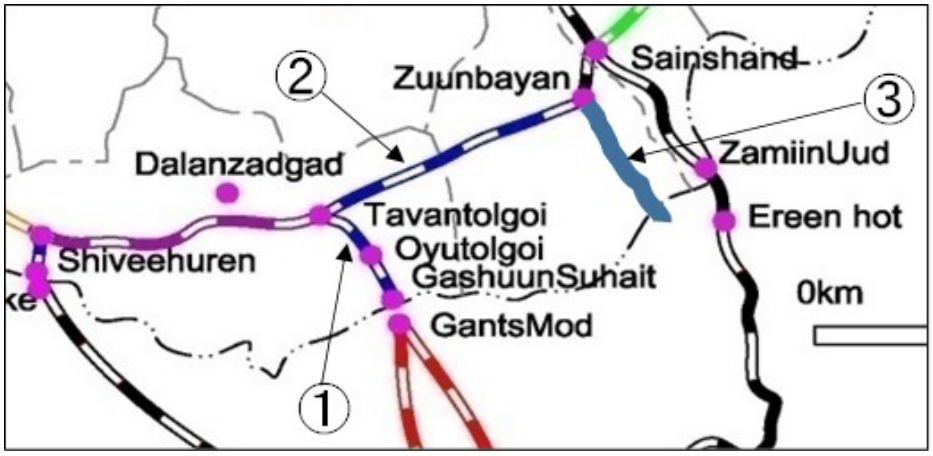
Mongolia has no coastline and is surrounded by Russia and China. Therefore, in the case of exporting mineral resources to a third country it is necessary to pass through China and/or Russia. The current international gates for railways are Sukhbaatar and Ereentsav in the north on the Russian side, and Zamyn-Uud in the south on the Chinese side, and Gashuun Suhait, Shivee Hurenga and Bulgan are used as road international gates. Numreg and Bichigt will be planned as international gates after the construction of railways.

In the case of transporting mineral resources via China and Russia, it is necessary to negotiate for the railway capacity and taxes and royalties associated with transit with Russia and China. The Mongolian Government has already started to negotiate with Russia and China, and is preparing to secure land in China's Tianjin, which will be an export port to foreign countries on the China route. It is also important to improve distribution systems and deregulate transactions by the cooperation with neighboring countries including Japan etc. which need coal and mineral resources produced in Mongolia.

As shown in Figure 3.5.2, the three transport routes for coal are planned currently from Tavan Tolgoi. One is the 240km railway from Tavan Tolgoi to Gashuun Sukhait (1). The second is the 410km railway from Tavan Tolgoi to Zuunbayan (2). The third is the 250km railway from Zuunbayan to the Chinese border (3). There is an existing railway from Zuunbayan to Saynshand. The railway from Tavan Tolgoi to Gashuun Sukhait has already begun construction and 53% construction work has been completed by 2015. This work is being carried out by Mongolian Railway. However, due to lack of funds, the construction has been suspended for four years. The remaining 47% will be conducted by

Tavan Tolgoi Railway which was established in November 2018, and it raised funds and started to build the remaining part of the route in September 2019. The construction will be completed in 28 months (by the end of 2021). Tavan Tolgoi Railway is a joint venture company between Mongolian Railway and Erdenes TT. In addition, the railway from Tavan Tolgoi to Zuunbayan is already under construction. The railway from Zuunbayan to the Chinese border will be constructed by the new company established by the Mongolian Government.

As of October 2020, the construction of the railway from Tavan Tolgoi to Gashuun Shait (1) has completed the foundations for laying 208 km (86%) of the railway track, with progress of 98% of the drainage ditch work, 97% of the animal trail mouth work, and 46% of the infrastructure work. Completion is scheduled in December 2022. The construction of the railway from Tavan Tolgoi to Zuunbayan (2) was scheduled to be operational in 2021, but due to the impact of COVID-19, the railway is expected to be operational by the end of 2021.



Source: 2013 Master Plan Study on the Development and Utilization of Coal of Mongolia

Figure 3.5.2 Routes from Tavan Tolgoi

(2) Third country export route via China and Russia

The following four routes can be considered to export coal from South Gobi, which produces high-grade coking coal, to the third countries via China and Russia (Figure 3.5.3).

Route1: Nariinsukhait →Shiveehuren →Tianjin

It is a route to transport from China's Tianjin port via Nariinsuhait located west of South Gobi via international gate of Shiveehuren. (Total distance: 2,056 km)

Route2: Tavan Tolgoi→Gashuunsukhait→Qinhuangdao

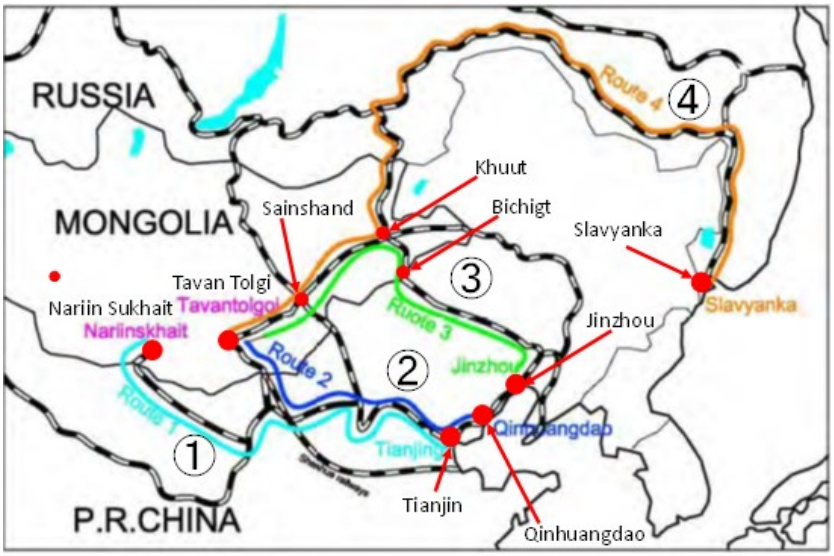
It is a route to transport from Tavan Tolgoi located in the east of South Gobi to the port of Qinhuangdao in China via the international gate of Gashuun Sukhait. (Total distance: 1,806 km)

Route3: Tavantolgoi→Sainshand→khuut→Bichigt→Jinzhou

It is a route from Tavan Tolgoi located in the east of South Gobi to the port of Zhengzhou in China via the international gate of Bichigt. (Total distance: 2,188 km)

Route4: Tavantolgoi→Sukhbaatar→Slavyanka

It is a route from Tavan Tolgoi located in the east of South Gobi to Sainshand-Choibalsan and then via the international gate of Ereentsav to the port of Slavyanka in Russia. (Total distance: 5,490 km)



Source: 2013Master Plan Study on the Development and Utilization of Coal of Mongolia

Figure 3.5.3 Coal Export Routes to Third Countries via China and Russia

Route 1 is the route from Nariin Sukhait coal mine located in the western part of the South Gobi coalfield through the international gate Shivehuren via China, with a total transportation distance of 2,056 km.

Route 2 is a route from the Tavan Tolgoi coal mine, located in the eastern part of the South Gobi coalfield, through the international gate at Gashuun Sukhait and via China. The transport distance is 1,806 km, which is shorter because the Tavan Tolgoi coal mine is located in the eastern part of the South Gobi.

Route 3 is a route from the Tavan Tolgoi coal mine through the international gate Bichigt and via China. The total transportation distance is 2,188 km, which is longer than Route 2.

Route 4 is the route from the Tavan Tolgoi coal mine through the international gate Sukhbaatar and via Russia. It is the longest route with a total distance of 5,490 m.

In terms of transportation distance alone, it is more economical to go through China, but there are issues such as the lack of surplus capacity for rail transportation in China. So far, the Mongolian Government has been in talks with China and Russia to transport coal via third countries, but which route to prioritize is still under discussion.

3.5.4 High added value of mineral resources

The Erdenet mine has the copper refining plant and a copper wire processing plant. However, most mineral resources such as coal and copper are exported without being converted into high added value products in Mongolia. By adding value to mineral resources, it will be possible for Mongolia to export the products at high prices. In addition, the construction of a coal washing plant, refinery and processing plant will lead to employment generation in Mongolia, and it is considered to greatly contribute to regional revitalization. The Mongolian Government encourages not to export cheap ore and raw coal, but to export it as a high added value and quality product.

(1) Coal washing

The South Gobi region has high quality coking coal, which is currently exported to China, but coal has been exported as raw coal for a long time. Higher added value coal can be produced for quality coking coal. Production of coking coal will be the first step in the strategy of the coal chemical industry such as coke industry in the future in Mongolia.

Securing water for coal preparation is one of the issues for constructing a coal washing plant. Water is essential for commercialized coal preparation. For example, in order to treat 1 million tons/year of raw coal, water of about 10 m^3/hour is required. However, the annual rainfall in the South Gobi region is

only about 150 mm. There is also a method of digging a well and using underground water, but there is a concern that sources of household water will be exhausted unless it is done carefully.

The coal washing in Mongolia started in 2011 at the Energy Resources UHG coal mine. The capacity of the coal preparation plant is 15 million tons (5 million tons x 3) per year. The Ovoot Tolgoi coal mine of South Gobi will have a 1.8 million ton/year coal washing plant in 2019. The construction of a 15 million ton/year coal washing plant is planned at the Erdenes Tavan Tolgoi coal mine.

(2) Concentrate and refining

The Oyu Tolgoi mine has 35% concentrate plant but has no smelting equipment. Therefore, there is a need to develop a downstream industry to construct a smelting and process plant in the future. For construction, it is necessary to select a candidate site for the smelter, study the smelting method, and develop an action program to foster the copper industry[20].

✓ Selection of smelter construction site

In selecting a site, the following factors should be taken into consideration: transportation infrastructure should be in place; there should be sufficient power and water resources available; skilled engineers and workers should be available; and engineering companies for smelter maintenance and material companies for parts procurement should be located nearby.

✓ Study of refining method

Considering the construction cost, operation cost, and difficulty of operation, the most important environmental measure to be considered is to reduce the leakage of exhaust gas (SO_2 gas) in particular.

✓ Action program for the development of the copper industry

There are two cases when a country with abundant natural resources tries to promote its own economy by utilizing them; one is the case of a "resource-rich country" that supplies the resources as raw materials, and the other is the case of an "industrialized country" that uses its natural resources to industrialize and manufacture as the final products in its own country. The former is represented by African countries and Peru, while the latter is represented by China and Brazil. Australia.

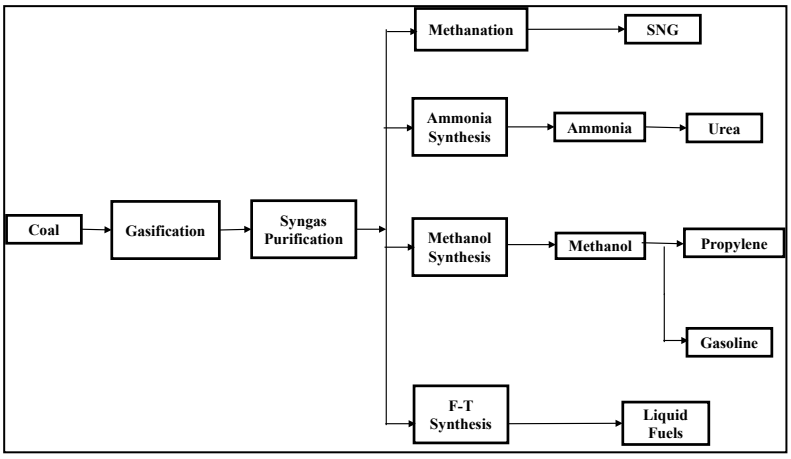
3.5.5 Effective use of lignite in Mongolia

The large amount of lignite is existing mainly in the eastern region of Mongolia. Effective utilization of this resource is considered for power generation and coal chemical industry. While high-grade coking coal is directed to export, effective use of domestic lignite is viable strategy for Mongolia.

(1) Lignite gasification

Lignite is the raw material for coal chemical industry and can produce natural gas, ammonia fertilizer, methanol, propylene, gasoline etc. as shown in Figure 3.5.4. In Mongolia, the research and survey on coal gasification is continuing at the Mongolian National University and the Mongolian University of Science and Technology. The gasifier may be divided into entrained flow gasifier and fluidized bed gasification system and fixed bed gasifier.

[20] JICA survey ”Mongolia Information Collection and Verification Survey on Copper Industry Sector”

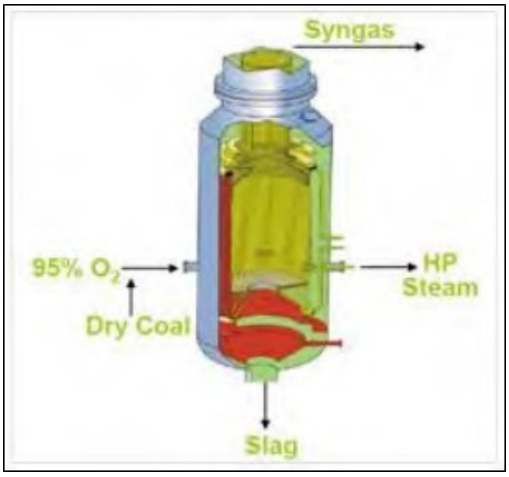


Source: JICA Project Team

Figure 3.5.4 Products Created by Coal Gasification

Entrained flow gasifier

Gasifiers have been developed by Hitachi/Electric Power Development Corporation, Mitsubishi Heavy Industries, Shell, and General Electric Company. The Shell coal gas process (SCGP) is shown in Figure 3.5.5. The maximum pressure is about 40 atm. The SCGP gasifier features a water-cooled membrane wall that is the same as a membrane wall used for coal boilers in the past. There are four horizontal burners in the center of the gasifier vessel. Slag discharges from the slag tap at the bottom of the vessel. Generated gases flow to the top and are rapidly cooled to about 1000ºC. More than 15 Shell gasifiers are in operation around the world, mainly in China.



Source: 2013 Master Plan Study on the Development and Utilization of Coal of Mongolia

Figure 3.5.5 Shell Gasification Unit

Fluidized bed gasification system

U-gas, high-temperature Winkler gasifiers have been developed.

Fixed bed gasifier

Lurgi, British gas/Lurgi gasifiers have been developed. Lurgi's gasifier has been in commercial operation since 1988 in North Dakota, USA.

(2) Power plant construction

The construction of large-scale coal fired power plant is planned in the Tavan Tolgoi project, which is

one of the 26 projects implemented by the Mongolian Government. It plans to build a power plant of 600 MW by 2025 and transmit power to Ulaanbaatar. In addition, a large-scale mine mouth power plant is being prepared at the Shivee Oboo coal mine and the Baganur coal mine which are owned by Erdeness Mongol, the state-owned mining company. The China takes the initiative by conducting a feasibility study and it is planned to build the grids and sell electricity to China and the Far East.

3.5.6 Securing water resources

Mongolia has little rainfalls and it is difficult to secure water resources for the mining and industry. When constructing a factory, its location is constrained by water availability. Therefore, it is necessary to investigate actual water resources conditions in advance. Only by confirming water availability based on scientific data, the planning for mining and industry development will be advanced. It is important to carefully investigate the effects on drinking water, agriculture and livestock farming of the people in surrounding areas when the groundwater is pumped up. Furthermore. it is essential to increase the water recycling rate and use water resources effectively

3.5.7 Human resource development for engineers

Human resource development is necessary in many fields to support sustainable development of Mongolia, and increasing engineers is particularly important for the mining industry. The production of coal increased by six times from 9 million tons 10 years ago to 54 million tons in 2018. Also, copper concentrate production increases four times with the development of Oyu Tolgoi. For other mineral resources, the production of gold and molybdenum is also increasing.

The development of new coal mines is planned in the future, and the Tsagaan Suvarga copper mine currently under development will start operation. The mining-related workers in 2017 are 52 thousand people[21], 4.2% of the total employment, but it is expected to increase significantly from now on.

In particular, since there are very few skilled mechanical and electrical engineers, it is necessary to implement an integrated and stepwise human resource development plan under active collaboration between the public and the private sectors. It is important to train skilled electrical and mechanical engineers while making good use of the newly established industrial vocational school in Mongolia.

3.5.8 Promotion of technical development in mining industry

In mining development, technical development for exploration, mining and processing and high added value utilization technology of mineral resources are important. The Mongolian National University and the Mongolian University of Science and Technology are carrying out studies on overseas technologies and have successfully introduced advanced technologies into Mongolia. There are high expectations for the introduction of new technologies such as dry washing and dry refining plant because Mongolia lacks water resources. In the new technologies of coal production, coal bed methane (CBM) and underground coal gasification (UCG) are being considered. These technological developments should be led by the Government together with private enterprises, and it is important that research organizations and research institutes communicate with each other under the initiative of the Government.

(1) Dry coal washing plant

A memorandum of understanding (MOU) was signed in February 2016 between the New Energy and Industrial Technology Development Organization (NEDO)[22] of Japan and the Mongolian Government for dry coal washing plant demonstration project in order to solve the water shortage problem dramatically. A demonstration plant with a capacity of 300,000 tons of raw coal will be installed at the Erdenes Tavan Tolgoi coal mine. The sand is utilized in the dry coal washing plant instead of water,

[21] Source is National Statistics office of Mongolia
[22] NEDO: New Energy and Industrial Technology Development Organization

and sand separates coal from rocks.

(2) CBM

CBM is an unconventional gas resource that exists in coal seams and has been of great interest as a promising gas resource in the future. After boring from the surface to the underground coal seams, methane gas is collected from the well.

Since the gas comes out with water, a separation device for the gas and water is required. CBM exploration started in 2010 with the cooperation of Korea Gas Co. (KOGAS) in Mongolia. Erdenes TT, Elgen, and KOGAS cooperated to implement three 500m depth CBM well test at the Erdenes TT coal mine area (Figure 3.5.6). This CBM recovering test started in 2013. The test has already been completed, but the analysis on methane gas component contained in the coal seams is being carried out currently at the laboratory in the testing site.

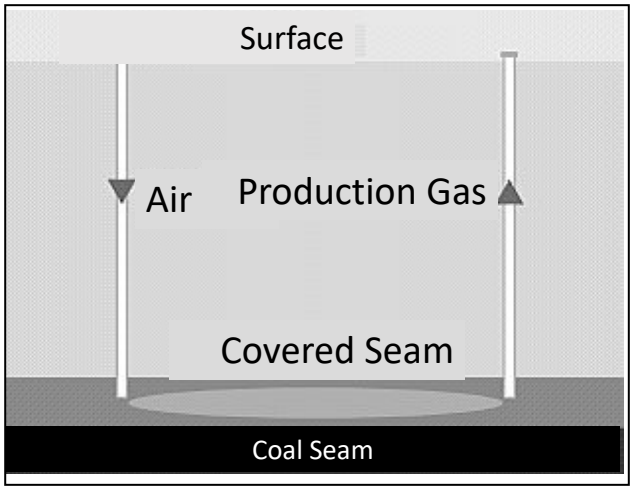
CBM well　　Separation device for water and methane gas

Source: JICA Project Team

Figure 3.5.6　　CBM Testing (Erdenes Tavan Tolgoi)

(3) Underground coal gasification (UCG)

UCG technology involves converting coal found in underground coal seams into low and medium calorie gases such as CH_4, CO, CO_2 and H_2, and the product gas is used as power generation fuel and chemical raw materials. The basic configuration is shown in Figure 3.5.7. UCG has two wells, one used for oxidant injection and the other for product gas recovery. In recent years, the advancements in directional drilling technology has made it possible to link routes by crossing injection boreholes and production boreholes at desired locations within the coal bed.



Source: 2013 Master Plan Study on the Development and Utilization of Coal of Mongolia

Figure 3.5.7　　Basic Configuration of UCG

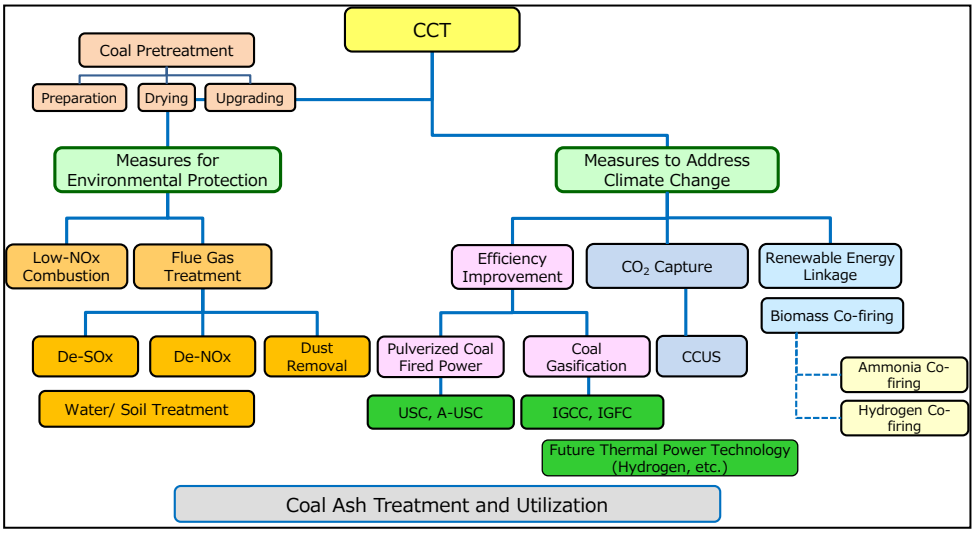
(4) Improved fuel

The Mongolian Government plans to distribute coal briquettes in Ulaanbaatar which is called improved fuel to replace raw coal in order to reduce air pollution in the city. An agreement to grant 800,000 tons of second grade coal from the UHG[23] preparation plant to the Government for use as coal briquette raw material was signed between Energy Resources and the Ministry of Energy. Coal briquette distribution has started from the winter of 2019. However, this measure is not a permanent but transitional measure before introduction of gasification and electrification. In addition, technical development of bio-briquettes which use biomass mixed with coal is in progress as kind of the improved fuel.

(5) Clean coal technology (CCT)

Coal has huge reserves worldwide and is an important resource over long-term future. Mongolia has abundant coal reserves, and it is important to use coal in an environment friendly way for sustainable development. Japan experienced serious air pollution during the high growth period but overcame these problems by the dissemination of the reduction technology to remove or suppress SOx, NOx and dust emission and water treatment technology.

At the same time, the global environmental warming is a pressing issue under COP21, and it is required to suppress the concentration of CO_2. Currently, it is important to develop thermal power technologies that reduce CO_2 emission and disseminate those technology in order to promote "CO_2 reduction in the whole world". In order to suppress CO_2, the technologies such as USC and integrated gasification combined cycle (IGCC) have been developed, and development of technologies related to carbon capture, utilization, and storage (CCUS), which makes effective use of CO_2 as a resource, has been promoted. These techniques are generally disseminated as CCT. Figure 3.5.8 shows a conceptual diagram of CCT technology.



Source: JICA Project Team

Figure 3.5.8 CCT Conceptual Diagram

3.5.9 Establishment of eco-friendly towns centering on mining

The population at the Tavan Tolgoi coal field in South Gobi has increased with the expansion of coal mine activities. Although it was less than a thousand people 10 years ago, it has now reached nearly 10,000 people. In addition, the population of the Oyu Tolgoi copper mine also is increasing, and it is expected that it will increase further after the new development of underground mining starts in the near future.

Many residential houses have been built in the town, and schools, kindergartens and hospitals have been

[23] Ukhaa Khudag Coal Mine under Energy Resource LLC (Limited Liability Company)

provided, and the town centering on mining is being developed (Figure 3.5.9). Also, a small textile company has been established to contribute to jobs creation. The town needs to form an eco-friendly community with environmental consideration such as procurement and treatment of water, solid waste disposal and dust control, and greening of town. It is desirable for mines to be in harmony with local residents.

The master plan for the Baganuur coal mine is being prepared in order to establish low carbon/resource recycling coal town by promoting the coal gasification, power plant and other industries which add value to coal. Thus, the establishment of eco-friendly towns centering on mining becomes extremely important with the development of mining industry.

1) School and kindergarten

2) Small sewing company (below)

Source: JICA Project Team

Figure 3.5.9 Town of Tavan Tolgoi Coal Field with Related Facilities

3.5.10 Implementation of basic survey of mineral reserve

Site exploration surveys for mineral resources are conducted every year in Mongolia, but the area completed with survey so far represents only a few percent of the whole of Mongolia and there still remains many mineral resources areas which have not been covered yet. In particular, the survey on rare metals has started recently by the cooperation of Japan and German raising expectation in the future exploration.

For the sustainable development of the mining industry, it is important to continue the basic exploration surveys of mineral resources and carry out detailed assessment of deposit data and confirm new deposit. As a result, companies are encouraged to enter mining development activities. It will be important to digitize existing detailed reports on exploration and related activities with drawings for easy access and reference by potential developers.

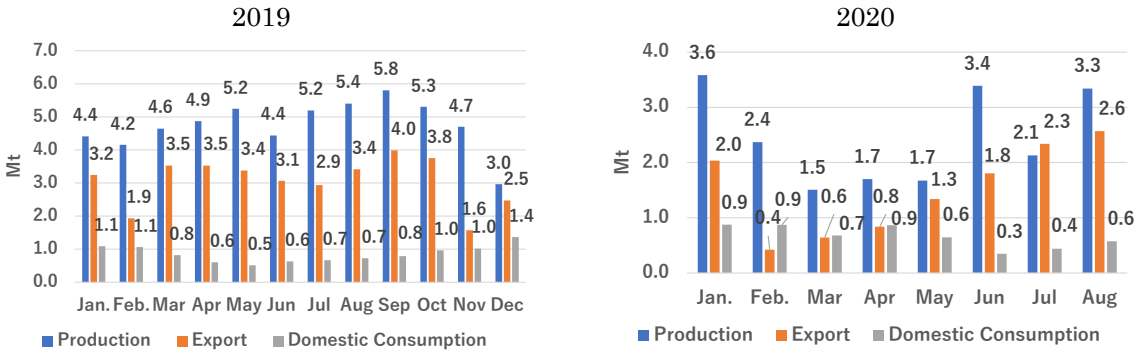
3.5.11 Impact of COVID-19 on the mining sector and future prospects

The impact of COVID-19 on the mining sector and prospects for the future mining development are described below.

(1) Coal

Coal exports were suspended due to the closure of the borders. Daily transit volume of the Gashuun Sukhait border crossing was 500-600 trucks in January this year, but reduced to only 300 trucks in March. The Government then signed an agreement with China on a temporary entry-exit mitigation measure "Green Exit" to overcome the economic impact of COVID-19. As a result, truck volumes have rebounded to 1,200-2,000 units since June and are showing signs of recovery.

Figure 3.5.10 shows monthly coal production, exports, and domestic consumption in 2019 and 2020 (until August). In 2019, coal production was 57.1 million tons and exports were 36.8 million tons, but from January to August 2020, production was 19.7 million tons (down 48.7% from the previous year) and exports were 9.4 million tons (down 52.1% from the previous year). Both production and exports have decreased significantly due to the influence of COVID-19. The production volume dropped sharply to 1.5 million tons in March, the export volume dropped to 420,000 tons in February and 640,000 tons in March, but then increased due to the recovery of demand in China, and the production volume increased to 3.4 million tons in June, 2.1 million tons in July and 3.3 million tons in August. Exports have recovered to 1.8 million tons in June, 2.3 million tons in July, and 2.6 million tons in August. The coking coal price, which was US$ 172 on March 6, 2020, fell to US$ 116 (down 33%) on June 5.



Source: Mineral Resources and Petroleum Authority of Mongolia（MRPAM）

Figure 3.5.10 Monthly Coal Production, Exports and Domestic Consumption in 2019 and 2020 (until August)

(2) Copper

Mongolia produced 1.26 million tons of copper ore in 2019 and earned US$ 1.8 billion. However, due to the influence of COVID-19, the borders were closed and the export volume by the end of August this year was only 7.7% lower than the same period of the previous year. However, copper exports were not as restricted as coal exports. The price of copper fell from February to US$ 5,058 in April due to the influence of COVID-19, but then started to rise and reached a high of US$ 6,705 in September.

(3) Gold

Expected global economic stagnation caused by COVID-19 has led investors to accelerate trading in gold, which has lower investment risk. As a result, the price of gold rose from US$1,393 per ounce in 2019 to US$1,969 per ounce in August. Mongolia's gold exports increased 2.7 times in volume and 3.3 times in value compared to the same period last year. This is due to the Bank of Mongolia's aggressive gold buying program. The Bank bought 13.1 tons of gold at the end of August, which is 5 tons larger than the same period last year. As a result, the Bank of Mongolia exported 19.9 tons of gold at the end of August, earning US$1.15 billion. The Bank's purchase target for this year is set at 19 tons of gold, with an estimated US$1,545 per ounce (Figure 3.5.11).

(4) Iron ore

The price of iron ore fell slightly from February to April due to COVID-19, but it started to rise in May and then surpassed US$100 per ton, reaching US$124 per ton in September which is the highest level in six years. Mongolia has set a target to export 8.2 million tons of iron ore this year which is almost the same as last year, and as of August, it exported about 5.6 million tons and earned about US$402 million (Figure 3.5.11).

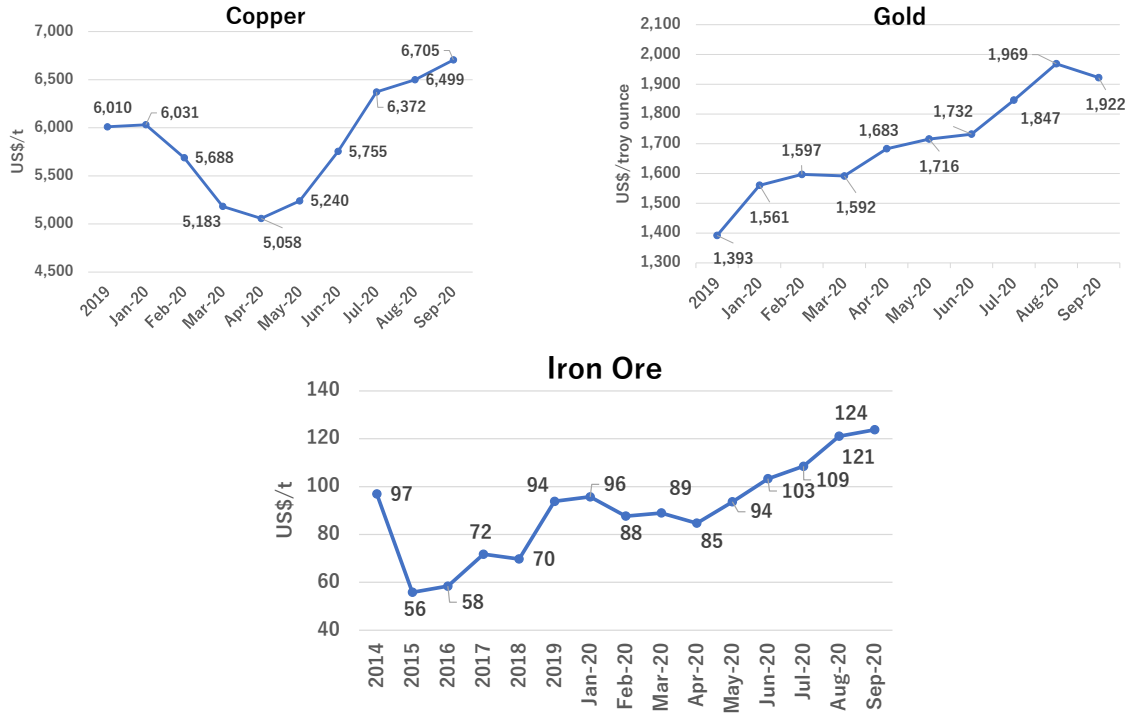
(5) Molybdenum, fluorite

Prices for lead, molybdenum and fluorite fell briefly from February to April, but then began to rise, with prices rising by 0.6% to 14.7% in September.

(6) Future prospects

The spread of COVID-19 has had a significant impact on the Mongolian economy. The Mongolian Government enforced strict travel restrictions such as border closure to prevent the spread of COVID-19 infections in the Country. Consequently, the Mongolian Government could prevent the spread of the disease throughout the Country reasonably well. However, the Mongolian economy was severely damaged and is expected to result in negative economic growth in 2020. Positive growth is expected by 2021, driven by rising prices of mineral resources and increased exports.

The mining sector accounts for 30% of national revenue and 90% of exports, and the Mongolia's economy and people's lives are heavily dependent on mineral resources. However, the mineral resources are susceptible to external influences due to their market structure, and there are many factors of uncertainty in the future. The bulk of mineral resource exports are expected to be relatively steady, and the export volume of mineral resources is returning to the pre-COVID-19 levels with the recovery of the Chinese economy, and positive growth can be expected in 2021.



Source: LME(London Metal Exchange)

Figure 3.5.11 Prices of Copper, Gold and Iron Ore

3.6 Development Policy, Objectives and Strategy for Mining Sector

3.6.1 SDV2030

The SDV2030 has established policies, objectives and targets for sustainable development under sound macro-economic policies by realizing economic diversity with agriculture and livestock, industry especially light and food industries, various processing industries, tourism, mining and extractive industries as well as energy and infrastructure sectors. Development policies related to the mining sector in the SDV2030 are summarized in Table 3.6.1.

Table 3.6.1 Development Policies Related to Mining Sector in SDV2020

Sector	Policies
Mining	- To strengthen geological, geochemical and geophysics capacity for exploration, survey, analysis and extraction of mineral resources with advanced technology

	- To create a comprehensive database of mining sector to facilitate effective investment in the sector
Industry	- To increase domestic production of fuels - To promote copper smelting, gold purification, and processing of energy resources such as petroleum, natural gas, oil shale and coal
Infrastructure	- To improve road and railway systems and develop logistic centers to serve agricultural, industrial and mining sectors

Source: SDV2030

3.6.2 Development objectives and strategy for mining sector

(1) Development objectives in mining sector

Through the discussions with stakeholders and literature review of policy documents, the objectives of the mining development in Mongolia to be pursued may be summarized as follows:

(a) To maintain the mining sector as the driving force for Mongolia's continuous economic growth and increase in export value;
(b) To facilitate capital accumulation through mining development to support investments in agriculture and livestock, processing industries and other economic activities as well as various infrastructure necessary for economic diversification; and
(c) To establish Mongolia as a model mining country for responsible mining in harmony with social and natural environment by utilizing mining activities for improvement of living environment and conservation of natural environment.

(2) Development strategy in mining sector

Development strategy for mining sector to attain the development objectives proposed above should follow the recent revision of the Constitution, which has established the following principles:

1) Natural resources are regarded as common public property of Mongolia;

2) Development of natural resources should be based on the Long-term Development Policy to realize national economic security, maintain natural balance and ensure healthy and safe environment for the present and future generations;

3) People have right to information on effects of natural resources development on environment; and

4) Revenues from natural resources development should be accumulated in the National Heritage Fund and their dividends should be shared equitably by all the people.

Specifically, the strategy for mining sector is established with the following components:

(a) Policy adjustment of mining activities to ensure modest and sustainable growth
    - ✓ Value-added production of coal for domestic and export markets
    - ✓ Promotion of mineral resources production that can be processed domestically for export market
    - ✓ Stable production and processing of domestic energy resources
(b) Establishment of a comprehensive database for mineral resources to ensure sustainable mining sector
    - ✓ Promotion of geological exploration activities
    - ✓ Introduction of advanced technology for efficient exploration, survey, analysis and extraction of mineral resources
    - ✓ Application of ICT for database management

(c) Establishment of responsible mining
- ✓ Establishment of principles to be applied to mining activities including ownership, licensing and contracting
- ✓ Preparation of standard contract formats to be observed by investors and developers for mining activities
- ✓ Establishment of environmental monitoring system by the local initiative in line with stepwise implementation of localization of development administration

3.7 Measures for Mining Development

Under the strategy established above, specific measures to be taken by the Mongolian Government to attain the mining development objectives are presented.

3.7.1 Policy adjustment of mining activities to ensure modest and sustainable growth

Mongolia is a country rich in mineral resources, and it is very important for Mongol to mine these resources in a stable and economical manner and to reflect their wealth in the development of the country. Mineral resources development is divided into the following stages: (a) Exploration, (b) Development planning and mine development, (c) Mine operation, (d) Closure and rehabilitation. Throughout these stages, smooth mine development is desirable under proper management of the national government. In Mongolia, the Ministry of Mining and Heavy Industry is in charge of administrative management of mines, and in recent years, development plans for large-scale coal mines have progressed, and in particular, coking coal development in Tavan Tolgo in the South Gobi region has attracted worldwide attention. In addition, large-scale copper mines are under development at Oyu Tolgoi, and there are great expectations from around the world for the development of mines in Mongolia.

(1) Value-added production of coal for domestic and export markets

Coal produced in Mongolia is consumed domestically and exported to China and Russia. Currently, raw coal is exported, but adding value to coal increases the value of coal and income. It also contributes to the reduction of greenhouse gases due to the increased transportation efficiency. In addition, the processing removes impurities from coal, which can contribute to alleviating domestic environmental problems. The measures to add value to coal are shown below.

1) Coal gasification

Overview

As a method of effectively using coal, coal gasification is considered in addition to the use of heat generated by combustion of coal such as power generation with heat only boilers (HOBs). Gasification enables power generation using a gas containing carbon monoxide and hydrogen as main components. It is also possible to manufacture chemical products such as synthetic natural gas (SNG), DME (di-methyl ether), ammonia fertilizer, methanol, propylene and gasoline.

Product use

The main uses of gasification products are as vehicle fuels and home fuels. In Mongolia, the demand for light oil and gasoline is increasing due to the recent increase in the number of automobiles in the cities and heavy vehicles for mining. However, since oil and natural gas resources are scarce in Mongolia, these fuels depend on imports from Russia and other countries. Therefore, in terms of energy security, it is important to manufacture synthetic fuel from coal, which is abundant in Mongolia.

At home, coal is used as a fuel for stoves and cooking, causing smog in Ulaanbaatar. In order to solve this problem, it is planned to disseminate SNG and DME produced by coal gasification.

Gasification project at Bagannur coal mine

A coal gasification project is underway at Bagannur coal mine, 130 km southeast of Ulaanbaatar. The total investment is US$2.5 billion. It can produce SNG, gasoline and ammonia as main products, and LPG, sulfur and ammonium sulfate as by-products. The required coal is 4.04 million tons for gasification and 1.27 million tons for power plants, and in total 5.31 million tons is needed per year. In addition, 18 tons of water is required per day. Main product SNG is pipelined to Ulaanbaatar and used for Gel (46%) 7, boilers (21%), public institutions (13%), LPG conversion (12%) and cooking (8%) (Table 3.7.1).

The coal gasification plant is expected to generate an annual income of US$127.2 million, and it is possible to recover the investment in 8 to 10 years.

Table 3.7.1 Gasification Project in Baganuur Coal Mine

(Products)

Production	Quantity	Unit
Main Products		
(1) SNG	725 million м^3	Ton/annual
(2) Gasoline	326,400 t	Ton/annual
(3) Ammonia	99,500 t	Ton/annual
		By-Products
(1) CNG, LPG	57,600	m3/annual
(2) Sulfur	15,440	Ton/annual
(3) Ammonia sulphate	31,000	Ton/annual

(Coal and water consumption)

No.	Item		Quantity	Unit	Remarks
1	Raw coal	Feed coal	4.04	million t/a	12,120t/d
2		Fuel coal（Power Plant、150MW）	1.27	million t/a	3,810 t/d
3	Fresh water		6.087	million m^3/a	18,261m^3/d

(SNG product usage plan)

Items of product	Unit	Selling price (including tax)	Annual sales volume(m3)	%
SNG	Nm^3		725,000,000	100%
For Ger area	Nm^3	$0.06	335,000,000	46%
For heating boiler	Nm^3	$0.29	150,000,000	21%
For public transport	Nm^3	$0.51	93,000,000	13%
For LPG replacement	Nm^3	$0.29	90,000,000	12%
Cooking for apartment	Nm^3	$0.29	58,000,000	8%

Source: Minister of Mining and Heavy Industry（MMHI）

2) Low-grade coal reforming /processing technology

Overview

Low-grade coal such as lignite is spreading in the eastern region of Mongolia. It has a low calorific value due to its high water content and causes spontaneous combustion when it is dried, so its use has not progressed compared to high-grade coal such as bituminous coal. Currently, it is mainly limited to the use such as power generation in production areas. However, there are some low-grade coals that have good properties even compared with bituminous coals such as low ash and sulfur content. If it can be converted to a high calorific value by a reforming process, it can be used economically. By dewatering and reforming the low-grade coal, it is possible to improve the disadvantages of low calorific value and transport and storage performance due to spontaneous combustion.

Types of dewatering methods

The dewatering methods can be roughly classified into "Mechanical dewatering method", "Evaporation method", and "Non-evaporation method". Mechanical dewatering methods such as press do not have

surface modification, so they are unsuitable as a reforming method because it reabsorbs water. The evaporation method removes water as vapor, and the non-evaporation method removes water in a liquid state.

Upgrade brown coal (UBC)

UBC is one of the reforming/processing technologies. This process is an application of the slurry dewatering technology of the brown coal liquefaction (BCL) process. It consists of three steps: 1) slurry preparation/dewatering, step, 2) solid-liquid separation/oil recovery step, and 3) molding step. This technology has already been demonstrated in Indonesia.

3) Manufacturing of semi-coke briquette

Overview

In urban areas such as Ulaanbaatar, coal is burned for heating. As a result, a large amount of harmful gases such as soot and SOx and CO are emitted, causing serious air pollution. Health damage such as respiratory diseases increases, contributing to an increase in medical expenses, and is regarded as a major social problem. In order to alleviate this urgent problem, the Mongolian Government has been considering various measures such as development of laws and regulations, improvement of fuel, and renewal of combustion equipment such as stoves.

Fuel improvement

As a renewal of the combustion equipment, old stoves have been converted to new ones with good combustion efficiency. On the other hand, characteristics such as efficiency and exhaust gas components depend on the fuel to be burned, so fuel improvement is implemented as a basic mitigation measure. Fuel improvements include the production of semi-coke briquettes. It is considered to be an effective measure to produce dry-distilled briquettes from low-grade coal, which is abundant in Mongolia, by utilizing Japanese dry and distilled technology and briquette production technology.

Government activity

The Mongolian Government banned raw coal burning in May 2019. Coal briquettes were distributed to Ulaanbaatar as an improved fuel to replace coal-fired burning, and a plan to improve air pollution in the city was advanced. The raw coal is used for coal briquettes with quantity of 800,000 tons of No2 coal that is produced after coal preparation at Energy Resources' Ukuhaa Khudag (UHG) coal mine, which mines coal at Tavan Tolgoi. Coal briquette distribution began in the winter of 2019, and as a result, air pollution has improved considerably. In addition, technological development of bio-briquettes, which uses coal mixed with biomass as one of the improved fuels, is in progress.

4) Activated carbon production

Overview

Water treatment in Mongolia is an important issue that coal mines also share. At coal mines, water obtained from rainwater and groundwater is treated and used for watering and tree planting. Also, the water can be purified and used for HOB. Further, the water of the coal mine pumped up from the groundwater can be subjected to water treatment to obtain drinking water. Activated carbon can be used for this water treatment. Activated carbon is also effective in treating harmful gases such as SOx and NOx and as a measure against dust and to reduce air pollution.

Manufacture of activated carbon

Regarding activated carbon, Japanese chemical manufacturers have many achievements. It would be effective to produce activated carbon from coal by utilizing Japanese manufacturing technology.

5) Coal preparation

Purpose of coal preparation

Mined coal (raw coal) contains inorganic minerals (ash, etc.) in addition to organic coal. Coal preparation is a process to produce commercial coal having the quality (particle size, moisture, ash, calorific value, sulfur content, etc.) by reducing this mineral substance. By the coal preparation, useless minerals (ash, etc.) is removed.

By preparation of coal mined at the coal mine site, many benefits will be generated: 1) reduced transport costs, 2) reduced coal storage need, 3) reduced pulverizer load, 4) reduced ash trouble, 5) reduced dust collector load, 6) reduced flue gas desulfurization equipment load, 7) ash reduced processing volume, 8) reduced air pollution, and 9) improved power generation efficiency as a result.

Types of coal preparation

There are two methods of coal preparation: gravity separation method using a difference in specific gravity and a flotation method using hydrophilicity (oleophobicity) of the surface of mineral particles. The most important issue in the design of coal preparation equipment is to optimize the equipment suitable for the quality of coal mined. Preparation equipment includes bulk heavy separation, heavy liquid cyclones, jigs, spiral sorters, TBS (Teetered Bed Separator) and flotation machines. For optimization, the most rational preparation equipment must be selected from these equipment by considering coal properties, particle size, separating accuracy, etc.

Coking coal preparation for steelmaking and No2 coal produced after coal processing

Coking coal for steelmaking is processed into coke, which is used as a reduction material for iron ore in a blast furnace. The mined raw coal usually varies in quality, and the ash and sulfur content of the coal is high. Coking coal for steelmaking is required to have "constant quality, low ash content and low sulfur content". Therefore, it naturally needs the constant coal quality. If the ash and sulfur contents are high, poor quality coke is generated and the pig iron produced in the blast furnace becomes brittle. For this reason, raw coal for steelmaking is adjusted to a certain quality, and ash and sulfur content are kept low through the coal preparation plant. The issues in this process is the handling of by-products. When producing coking coal (primary products) for steelmaking of good quality, intermediate products (secondary products) are always generated as by-products. This secondary product is called No. 2 coal. No. 2 coal has a large amount of ash but has a calorific value of about 4,000 kcal/kg. it can be used effectively unlike wasted rock and can be used as a thermal coal in coal-fired power plants and industrial boilers.

Dry coal preparation

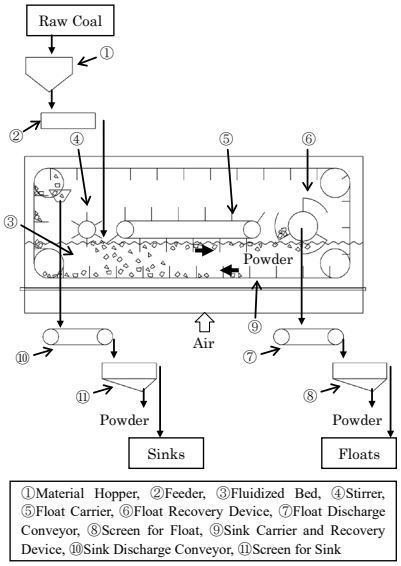
In Mongolia, rainfall is low and securing water for coal mine development is not easy. In order to use a large amount of water, coal preparation plants sometimes supply water by digging deeply for groundwater and through the pipelines from rivers far from the coal mine area. In recent years, people living in coal mining areas have been increasingly opposing water supply to coal mines. For this reason, it is necessary for the coal preparation plant to take measures such as reducing the amount of water and usage of the recycled water. Nowadays, dry coal preparation that does not require water has been developed. A pseudo-fluid having a constant specific gravity is prepared by using sand or the like as a fluidized bed, and dry coal preparation is used the specific gravity selection with no water required. However, the verification test has not started yet.

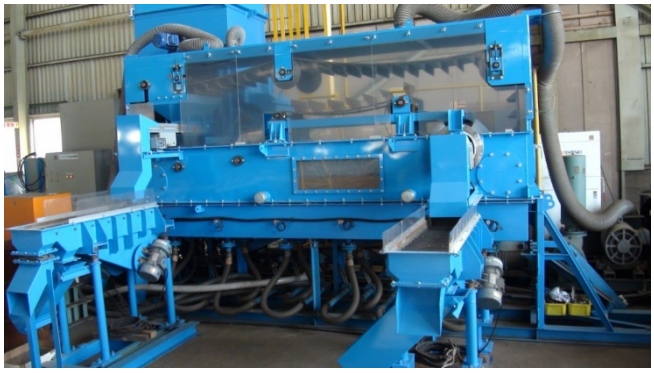
Most popular dry separation machines in China are dry separators which are fabricated domestically. They are also exported to Vietnam, Indonesia, Mongolia and other countries. A combined dry separator achieves specific gravity separation through the combined effect of buoyancy caused by a mixture of fine particles contained in raw coal and separation effect caused by a dry table. The diameter of raw coal grain needs to be below 80 mm, and the moisture content of raw coal should be less than 7%; however, the raw coal of smaller than 6mm diameter is hardly separated. Separation accuracy is considered not so high.

The fluidized bed type dry separator developed by a Japanese manufacturer is a device separating by

specific gravity that creates a pseudo-fluid with a constant specific gravity using sand or other materials like the wet heavy separating machine. It has high separation accuracy. The system has already been commercialized in the field of resource recycling in Japan, where high demand is expected in the future. This is a fluidized bed dry sorter developed jointly by Okayama University and Nagata Engineering, a coal sorting machine manufacturer, which separates and recovers PVC (Polyvinyl chloride) from crushed plastics.

In addition, other fluidized-bed separators for various applications such as iron and aluminium separators have been commercialized in Japan, but the coal sector has not yet reached the commercialization stage. In 2017, the Mongolian Ministry of Mining and Heavy Industry and Japan's New Energy and Industrial Technology Development Organization (NEDO) signed a basic agreement (MOU) on a dry coal preparation technology system demonstration project, which is expected to have commercial potential for the future. However, the implementation of the project has been postponed until 2021. The outline of the dry coal preparation system developed by Japan is shown in Figure 3.7 1.





Source: JICA Project Team

Figure 3.7.1 Pilot Plant of Fluidized Bed Type Coal （Capacity: 1.0 ton /hour）

Future action

It is important to consider a coal preparation method suitable for the natural conditions of Mongolia, according to the characteristics of mining regions, and production scale of the coal mine. It will also secure the water required for coal preparation, improve the recycling of the water, and promote the effective utilization of No. 2 coal, which will lead to the improvement of coal quality at all coal mines in Mongolia and increase of added value of coal. .

(2) Promotion of mineral resources production that can be processed domestically for export market

1) Processing of mineral resources

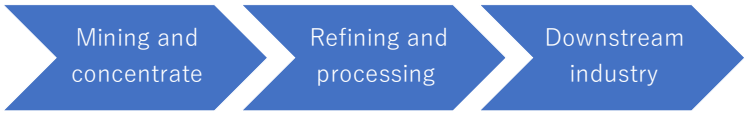
Processing technologies for mineral resources include concentrating and refining. These are treatment methods for extracting a highly pure metal from a metal having many impurities. Concentrate means a process of extracting a metal, and the metal extracted by the concentrate is often low in purity, and refining is necessary to increase the purity.

The metal concentrate generally uses a flotation method in which ore is finely crushed and the metal is recovered by bubbles. In refining, methods can be classified as follows depending on a metal-based

aqueous solvent and electrochemical treatment.

- Pyrometallurgy: Refining to obtain metal by heat treatment; it refers to general refining that does not use water-based solutions; reduction of iron with coke is a typical example.
- Hydrometallurgy: Refining in which metal is extracted by immersing it in an aqueous solution.
- Electrometallurgy: Refining to extract metals by an electrochemical method; typical examples are electrolytic refining of copper and electrolysis of molten salt of aluminum.

The simple flow of mining is as shown in the figure below. Basically, the process is to mine and concentrate minerals, and then supply the products obtained by refining and processing to downstream industries. However, most of the current Mongolian copper-related industries are mining ore and producing concentrate, and full-scale smelting has not been carried out. In addition, the manufacturing industry in the downstream is hardly developed.



2) Current view of exports of mineral resources

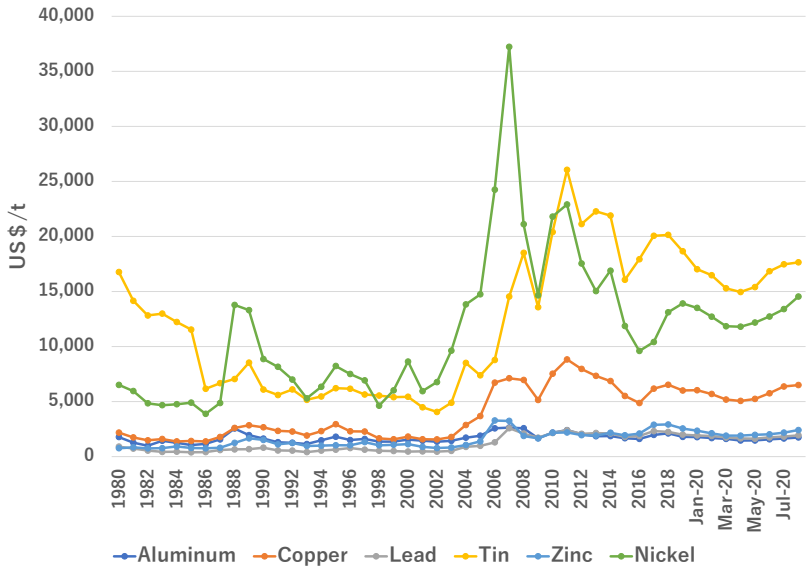
In 2019, mineral resources accounted for 93.7% of Mongolia's total export value, of which metal mineral resources accounted for the largest share of 45.9%, followed by coal 42.7% and oil 5.1%. Non-mineral exports account only for 6.3%. The total export value of metal mineral resources reached US$3,309 million (45.9%), and mining of metal mineral resources is a key industry in Mongolia's economy.

Copper concentrate accounts for 54.3% (US$1,796 million) of the total export value of metal mineral resources, followed by iron ore at 17.4% (US$577 million), zinc 5.7% (US$189 million), and fluorite 6.2% (US$205 million), gold 12.6% (US$418 million), copper or 2.7% (US$68 million), molybdenum 1.5% (US$49 million), and tungsten 0.2% (US$7 million). Metal mineral resources are an important export product for Mongolia, and stable production and export are expected in the future. To that end, it is indispensable to have a robust mineral resource export strategy based on the market prospect and expected demand.

3) International price of mineral resources

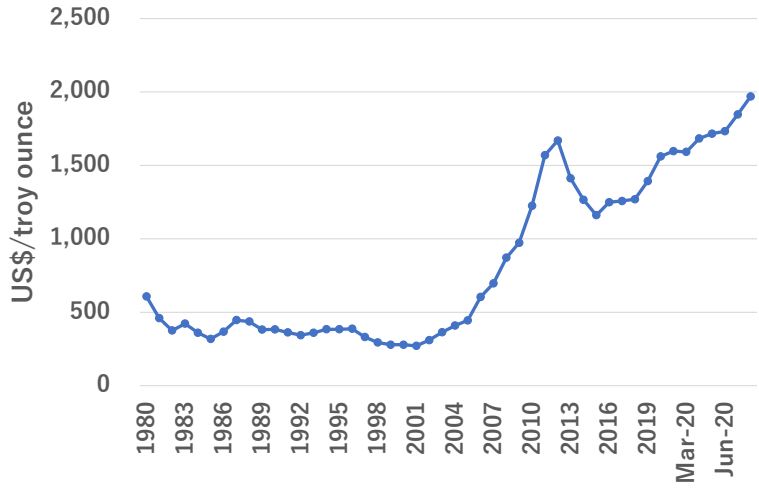
The global standard prices of metal mineral resources are determined as trade prices at the London Metal Exchange. Demand for metal mineral resources is increasing every year as the world economy develops, resulting in increasing prices.

In particular, the rise in prices since 2000 has been remarkable; the international price of copper had been lower than US$ 3,000 /ton until 2005. However, it has been rising since 2005 and is currently trading at a price above US$ 5,000 / ton. The highest price in 2019 was US$ 6,572 /ton. The prices of zinc and lead were below US$ 1,000 in the past period. It has risen since 2005 and are currently maintaining prices above US$ 2,000 /ton. The highest prices in 2019 were US$ 3,018 for zinc and US$ 2,267/ ton for lead. Nickel and tin prices have risen more rapidly than copper, zinc and lead, and have soared from the past 5,000- US$ 6,000/ton to US$ 10,000- 15,000/ton. The price of gold these days is four times higher than that in 2000 (Figure 3.7 2 and Figure 3.7 3).



Source: LME (London Metal Exchange)

Figure 3.7.2 International Price Trends for Mineral Resources



Source: LME (London Metal Exchange)

Figure 3.7.3 International Price Trends for Gold

4) Future supply and demand trends

Looking at the demand trend of metal mineral resources in the future, the price of copper is expected to rise due to the increase in demand by the spread of electric vehicles and plug-in hybrid vehicles in the future. Copper has traditionally been used in gasoline and hybrid vehicles, but electric vehicles (EVs) require three to four times amount of copper than gasoline vehicle. An estimate indicates the copper demand by EVs will increase by nine times in the next decade.

The production of stainless steel which is the main user of nickel and the demand of nickel for battery are expected to increase year by year causing nickel prices to increase. The demand for lithium will increase with the growth of the EV market, and there is a forecast that lithium prices will rise sharply after 2023 due to a shortage of lithium supply. Rare metals and rare earths are indispensable mineral resources for digital cameras, mobile phones, personal computers, televisions, abrasives of glass substrates, exhaust gas catalysts for automobiles, small motors, IC semiconductors, liquid crystals, superconductivity, etc. The demand is expected to grow significantly in the future.

5) Future action

A survey should be undertaken to investigate and analyze the current international supply and demand situation of copper, gold, molybdenum, silver, tin, tungsten, iron ore, fluorite, lead, zinc, etc. After that, a global forecast is conducted of the supply and demand of these mineral resources. Next, the survey will analyze international price trends and predict future mineral prices. Based on this information, a development plan, an export plan, and a processing technology introduction plan are selected. It is desired to develop a market for a sales destination based on market trends and demand prospects of metal mineral resources in the future.

(3) Stable production and processing of domestic energy resources

1) Overview

The prime energy resource in Mongolia is coal. Coal development has a long history and coal has been mined for many years. In Mongolia, coal accounts for over 90% of electricity and is an important energy resource. Coal is distributed throughout Mongolia, and power plants and heat only boilers (HOBs) in each region are supplied with coal from surrounding coal mines. Ulaanbaatar receives coal from neighboring Baganuur, Shivee Ovoo and Sharyn gol coal mines.

Crude oil production began in 2000, and production increased to 6,380,000 barrels in 2018, but most of it is now exported to China. However, with the support of India, it is constructing an oil refinery at a distance of 20 km north of Sainshand. If completed, 1.5 million tons of petroleum products can be expected annually. Petroleum products imported from Russia are currently 1.8 million tons, which can cover the current import volume.

2) Government action

Government actions are important for stable mine development. Mining development begins with the acquisition of mining rights and ground rights. The ownership of underground resources often belongs to the state, but there are significant differences between countries in the degree of shared ownership including private ownership. Mining concession is generally divided into exploration rights and mining rights, and the acquisition and ownership of these rights also differs depending on countries. According to the Mongolian Mineral Resources Law enacted in 1997, the mining area was open to both domestic and foreign applicants, and tax incentives were available. The Mineral Resources Law has been revised, and the New Mineral Resources Law focuses on securing national interests through resource development and protecting the environment. Regarding mine safety, it is necessary to prepare a mine safety law, train mine supervisors, and regularly conduct security supervision for each mine area.

For systematic and sound and stable mine development and safety in Mongolia, the following are proposed.

- Establishment of an attractive environment for domestic and foreign investments, ensuring equal conditions for all the investors.
- Activities in the field of mineral resources to be transparent and open to the public based on the law.
- Making short- and medium-term forecasts of international economy and domestic market regularly, and formulating and implementing long-term programs.

3) Environmentally friendly mine development

<u>Environmental problems</u>

Environmental problems associated with coal mine operations include sewage/drainage water problems created by coal mine operations, rehabilitation of mining sites, coal dust scattering in the mine, noise, environmental problems in the coal transportation, disposal of waste oil and garbage generated by

operations. Another major problem at present is the transportation problem by truck using unpaved roads to export coal from the coal mines to China in the South Gobi coal field. In the dry climate of South Gobi, many trucks running on dirt roads create a lot of dust, so nomadic and livestock pasture is covered with dust, and the pasture disappears by the truck runs through the meadow.

Many laws and standards have been enacted to protect the natural environment, and improvements are ongoing. Also, environmental impact assessments are stipulated by law and are required to be submitted by each company. It is important to ensure that each company conducts an environmental impact assessment.

Promotion of clean coal utilization technology to prevent air pollution

Dust, SOx, and NOx generated from power plants, Gels, and HOBs associated with the use of coal are major problems. It is necessary to promote clean coal technology (CCT).

Promotion of coal use in response to climate change

In recent years, there has been an increase in the number of financial institutions, insurance companies, and institutional investors who refrain from lending to coal businesses because of the increasing momentum for responding to climate change issues. However, coal demand is expected to increase, especially in Southeast Asia[24]. Mongolia's energy and electricity largely depend on coal, and coal will continue to be an important energy resource. In light of this situation, it is necessary to devise a coal utilization strategy that addresses climate change issues at an early stage. It is important to collect information on technologies such as promotion of renewable energy and best mix with coal, CCUS/carbon recycling, and fuel conversion to hydrogen energy, and to collaborate with related countries that will continue to require coal.

4) Coordination and cooperation in mines

Reuse of wastes

In the large scale mine development, there is concern that unused energy, wastes, and environmental pollutants are emitted in the large quantities. Emissions include methane gas and wastewater generated during coal mining, wastes and sludge generated during coal preparation, coal ash and air pollutants emitted from power plants. However, these can be recycled depending on the processing method, and can improve productivity and reduce environmental load.

Collaboration between industries

Promoting mutual energy interchange and recycling of wastes between industries can strengthen cooperation between different industries and create new industries and achieve low carbonization and resource recycling in the entire mining region. Clean technology is utilized from upstream to downstream in Japan to optimize production efficiency and make effective use of resources. It is necessary to strive to protect the environment from both the energy flow and material flow sides.

5) Creation of coal-related industry chain

Overview

The concept of coal-related industrial chain from coal production, processing to its utilization is an innovative idea that can contribute to urban development centering on coal and inducing related activities with value-added. The coal-related industry chain increases the value added of coal, induces clean use of coal to reduce adverse environmental impact, and optimizes production efficiency by utilizing clean coal technology, wastewater treatment technology and operation systems from upstream to downstream of coal related activities. It is expected to protect the environment in terms of both energy and materials while making effective use of resources. For example, it is possible to contribute to the improvement of the environment such as air and water quality by effectively utilizing coal mine drainage, briquetting coal, and producing activated carbon. Furthermore, promotion of employment

[24] World Energy Outlook 2020 (WEO2020) published by IEA (International Energy Agency)

and establishment of an academic city is realized by formulation and promotion of masterplan based on effective use of coal and environmental improvement. The basic concept is to build a coal-related industrial chain, which aims to operate coal mines efficiently, respond promptly to the environmental conditions, and reduce carbon emissions.

Value chain

In order to secure coal resources over the long term, it is necessary to consider comprehensive coal resource development projects ranging from resource exploration, coal mine development, production with security, environmental protection, and infrastructure development. In establishing effectively combined value chain, these coal-related activities should be considered as a package and upstream fields of coal mining to downstream related industries such as coal-fired power generation, coal chemical industry, and wastewater treatment industry must be linked efficiently.

Purpose setting

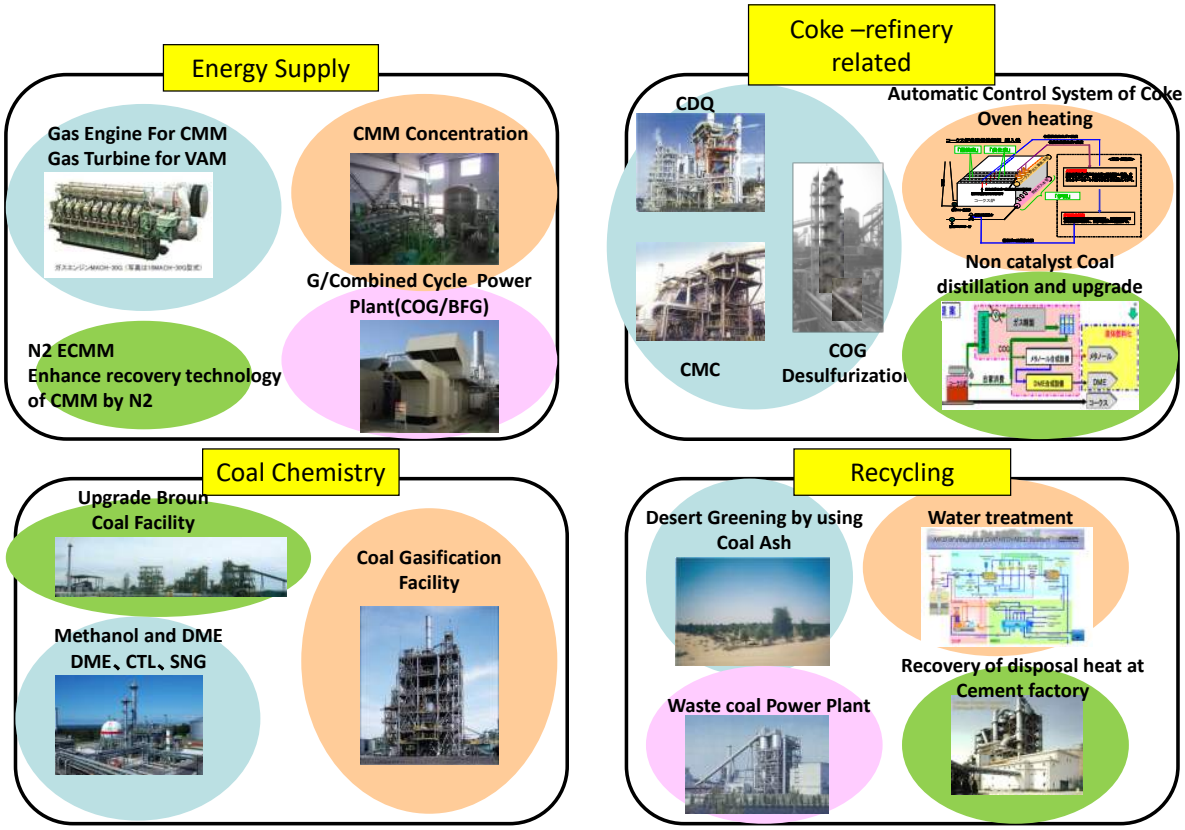
At the stage of the master plan formulation, targets are set related to energy saving, waste reduction, profit improvement, and reduction of greenhouse gas emissions. The effects of introducing seeds technology to coal development and utilization industries will be examined hierarchically and quantitatively. For coal mining areas that already have a regional development plan, the current situation of the plan will be analyzed, and the effect of introducing clean coal technology and environmental and energy saving technologies will be examined.

Specific method

In order to advance the coal-related industrial chain concept, it is necessary to follow the steps: 1) selection of candidate sites, 2) detailed survey on policies, 3) identification of technologies available in advanced countries, 4) feasibility study, and 5) master plan formulation. The specific method is shown below.

- Field survey of the target candidate areas will examine and evaluate the needs and feasibility of introducing advanced seed technology and determine whether or not to establish a coal-related industry chain.
- Examination of the needs of selected candidate sites and development targets of the development plan.
- Target setting with respect to CO_2 reduction, energy saving, profit, etc., evaluation of seed technology introduction, and preparation of business proposal.
- Business model construction with implementation system, policy tools, finance scheme, etc., preparation of the final master plan from a pre-feasibility study and implementation plan preparation.

The coal-related industry chain is shown in Figure 3.7.4.



Source: JICA Project Team

Figure 3.7.4 Coal-related Industry Chain

Considerations required

The conditions for the establishment of a coal-related industry chain are as follows.

- Securing input materials (coal, water, chemicals, etc.) necessary for production
  - ✓ Areas and properties that can be secured, procurement costs, etc.
- Securing human resources necessary for plant construction
  - ✓ Securing local engineers and labor costs
  - ✓ Presence or absence of Mongolian companies that can cooperate in plant construction
- Transportation infrastructure development status
  - ✓ Transportation infrastructure and costs for plants and construction materials
- Conditions related to the proposed construction site
  - ✓ Weather conditions
  - ✓ Usable site area, etc.
- Securing human resources necessary for operations
  - ✓ Securing local engineers and labor costs
  - ✓ Securing human resources necessary for operations
- Trends in demand for chemical products in Mongolia and abroad
  - ✓ Final product specifications
  - ✓ Demand for chemical products and transaction prices
  - ✓ Securing customers

Industrial clusters with a focus on mining

(a) Background

Industrial clusters related to mining may include energy, coke and smelting, chemicals, cement and recycling industries, all of which are based on mineral resources. In June 2012, the Mongolian Government drew up a master plan to build an industrial park in Sainshand, the capital of Dornogobi Aimag, a city of about 20,000 people located in the eastern part of the Gobi desert. Sainshand is served by the north-south railway line that connects Russia and China, and the large coal mine Tavan Tolgoi and the large copper mines of Oyu Tolgoi and Tsagaan Suvarga, and limestone mines are located nearby. A railway network is planned to run from Tavan Tolgoi to Sainshand, and it is expected that the town will become a heavy industry base in the future.

According to the existing plan, the industrial cluster focuses on four projecte: coke, refined copper, iron pellets and cement. These resources are located adjacent to the heavy industry area, and the site of a future light industrial park is planned in the east side of it. Copper is currently shipped to China in concentrate, but in the future, copper will be refined and shipped as copper wire through melting and casting, and iron pellets will be processed into iron bars and even rails for shipment.

The total investment in the industrial clusters is estimated at US$9.36 billion, of which US$5.32 billion is for the construction of the four projects and US$4.04 billion is related to infrastructure and utilities. Of the total investment, private investment accounts for 60% and government investment 40%. In addition to these four projects, there are likely to be other industrial clusters in the future, including the direct reduction iron (DRI) making and steel making that produces briquetted reduced iron (HBI) for export, a coal gasification plant that produces gas for DRI reduction and methanol and ammonia, and coal-fired power generation facilities.

(b) Issues related to industry clusters

The following issues are involved in the mining based industrial cluster development.

- ✓ The amount of investment is huge.
- ✓ In case of Mongolia, the technology and funding for many industrial clusters will depend entirely on foreign companies and investors, so the challenge will be how much advantage these foreign companies can find in terms of quality and cost of each project in Mongolia.
- ✓ The quality and cost performance of products and the development of high value-added products for each business are essential to develop overseas markets.
- ✓ Another issue is how to secure human resources.

(c) Future actions

The following actions are recommended:

- ✓ Expanding the market by making product quality and costs more attractive to companies investing in the project,
- ✓ Improving production efficiency, energy conservation and environmental characteristics through the complemental use of energy, byproducts, wastes and water between businesses and within industrial parks,
- ✓ Training domestic engineers and managers related to the project, and
- ✓ Providing timely support measures by the Government of Mongolia.

6) Development of coal transportation infrastructure and examination of coal export potential

Current situation of infrastructure construction

Regarding the coal transport of Tavan Tolgoi coalfield, the eastward and southward railways are currently under construction. The eastward railway will connect from Tavan Tolgoi to Sainshand and then to Choibalsan. The southward railway is the route from Tavan Tolgoi to Gashuun Suhait. It is not yet decided which route will connect Tavan Tolgoi coal to the international market.

Evaluation of railway routes

The Russian route has the same width as the railway track in Mongolia, so transhipment at the border is not necessary. In addition, the Siberian railway itself has the capacity to transport Mongolian coal. However, due to the lack of capacity of the existing port, it is necessary to improve the port to handle a large amount. Another disadvantage is that the transport distance is longer than the Chinese route. The Chinese route has a shorter transport distance than the Russian route and has a sufficient shipping port

capacity, but due to the difference in the rail track width with Mongolian railways, transhipment at the border is necessary. In addition, there are disadvantages such as lack of capacity in railway transportation in China.

Consideration of transportation costs

Four routes are being studied for coal transportation along with coal mine development in Umunugovi Aimag. Table 3.7.2 gives an overview of the four routes.

Route 1 (Nariinsukhait coal mine → Huanghua port) via China

Route 2 (Tavan Tolgoi coal mine → Tianjin port)

Route 3 (Tavan Tolgoi coal mine → Bichigt → Jinzhou port)

Route 4 via Russia (Tavan Tolgoi → Suhkbaatar → Vladivostok port) were estimated.

Estimation of railway transportation costs shows that Route 1 has a total length of 2,056 km, transportation cost US$58.58/ton, Route 2 has a total length of 1,622 km, transportation cost US$60.64/ton, and Route 3 has a total length of 2,188 km and transportation cost US$91.72/ton. Route 4 has a total length of 5,490km and a transport volume of US$120.61/ ton. Transportation costs include rail fares, customs fees, transhipment costs, port cargo handling, export taxes, etc. Rail fares vary from country to country, and are US$0.036/ton/km for Mongolia, US$1.75 + US$0.009/ton/km for China and US$0.0193/ton/km for Russia.

In 2019 Mongolia exported 36.81 million tons of coal, accounting for 42% of Mongolia's total exports. The breakdown of coal by volume and export by coal quality shows that coking coal after processing is 6.84 million tons (US$88-99/ton), coking raw coal 16.79 million tons (US$63-70/ton), semi coking coal 8.7 million tons (US$31-55/ton) and steam coal 4.47 million tons (US$15-20/ton).

Table 3.7.2 Four Coal Transportation Routes for Coal Mine Development in South Gobi Province

Route	Coal Mine to Port	International Gate	Transportation distance (km)	Transportation cost (US$/ ton)	Max transport volume (Mt / year)
Route1	Nariinsukhait→Huanghua	Shiveehuren	2,056	58.85	23.2
Route2	Tavan Tolgoi→Qinhuangdao	Gashuun Sukhait	1,806	62.29	18.1
Route3	Tavan Tolgoi→Jinzhou	Bichigt	2,188	91.72	15.7
Route4	Tavan Tolgoi→Vladivostok	Suhkbaatar	5,490	120.61	15.7

Consideration of transportation volume

Transport capacity by rail is 18.1 million tons per year between Tavantolgoi and the international gate at Gashuunskhait, and 23.2 million tons per year between Nariinskhait and the international gate at Shivehuren. Therefore, the total transport capacity of Route 1 and Route 2 will be 41.3 million tons. Future coal mining from major mines in the South Gobi coalfield is expected to be more than 55 million tons per year. Therefore, if the maximum export volume is 55 million tons per year, the maximum transport capacity of 41.3 million tons will be utilized to transport coal by Route 1 and Route 2, the remaining 13.7 million tons will be exported via Route 3 and Route 4. Route 3 from Tavantolgoi through the international gate at Bichigt and Route 4 through the international gate at Suhkbaatar have a capacity of 15.7 million tons each, so they are fully capable of transporting the cargo. Of course, it is also possible to increase transport via Russia.

In 2019, Mongolia's coal export volume was 36.81 million tons, of which 98% was for China. Currently, coal is transported by road, but in the future, it will be replaced by rail transportation, which is expected to reduce transportation costs.

Examination of international market and coal export potential

Currently, coal export countries in the international market include Australia, Indonesia, Mozambique, Colombia, Canada and the United States. However, in order to make the Mongolian coal more competitively with these countries in the international market, it is necessary to consider production costs, transportation costs, port handling costs, and transit costs via China and Russia.

7) Consideration of utilization of new environmentally friendly resources

Unconventional resources, which have not been used until now, are attracting attention due to the current technological advances. They include coal-bed methane (CBM), shale gas, oil gas, and methane hydrate, among others. In Mongolia, coal bed methane (CBM) is said to have high potential. The utilization of new resources is shown below.

Coal-bed methane (CBM)

(a) Background

Mongolia's CBM resources are known for large reserve (3.2 trillion cubic meters) and high calorific value, and its development began in 1991. In 2004, Storm Cat Energy (SCE) signed a Production Sharing Contract (PSC) with MRPAM to explore for CBM in Mongolia covering 49,101 km^2, and the first CBM exploration drilling started in 2005 near the Nariin Sukhait coal mine. After that, exploration activities were carried out by Korea Gas Corporation (KOGAS) in 2010 and the US Environmental Protection Agency in 2013. In 2013, Erdenes TT, Elgen, and KOGAS collaborated to test-drill CBM at the Erdenes TT coal mine and conduct a CBM recovery test. A CBM survey was also conducted at the Baganuur coal mine. As a result, it was found that a sufficient amount of CBM can be supplied to fuel a 5.0 MW power generation facility. The Mongolian Government passed an amendment to the Petroleum Law in 2014 and designated oil shale, tar sands, gas-rich shale, gas sands and CBM as unconventional oil resources.

(b) CBM resources by coalfield

Table 3.7.3 shows the amount of CBM resources by coalfield according to the 2015 report by ERINA (Economic Research Institute for Northeast Asia). Combined CBM reserve of 22 coal fields is 68 billion m^3, and the Tavan Tolgoi coalfield accounts for 80% of the total. The average methane reserve in coal is 6.3 m^3 per ton. Table 3.7.4 shows the results of CBM analysis of the boring results of the Tavan Tolgoi coalfield. The methane gas content contained in CBM varies from 90% to 30% depending on the depth.

Table 3.7.3 CBM Resources by Coalfield

Coal basins	Resource, (million tons)	CH4 content, (m^3/ton)	CH4 resource, (million m^3)
Nuurst Khotgor	143.3	4.5	715.7
Khar Tarvagatai	19.7	2.4	52.3
Khushuut	88.0	4.8	467.0
Zeegt	4.6	3.3	16.4
Mogoingol	4.1	2.6	11.5
Saikhan Ovoo	28.3	6.5	203.2
Uvurchuluut	3.8	1.4	5.9
Bayanteeg	29.7	2.8	92.7
Tevshiingovi	588.0	2.8	1,835.4
Tavantolgoi	6,400.0	7.7	53,938.1
Shariingol	61.3	3.0	200.9
Nalaikh	58.9	3.0	192.9
Baganuur	511.0	2.9	1,642.9
Shivee Ovoo	563.0	2.8	1,845.2
Chandganatal	123.0	1.8	249.6
Talbulag	81.5	2.7	241.7
Aduunchuluun	241.3	1.4	376.5

Nariin Sukhait	24.8	3.4	81.8
Ulaan Ovoo	54.0	3.7	219.0
Khuut	87.5	1.8	177.5
Uvdughudag	159.2	1.8	323.0
Amangol	1,500.0	3.1	5,150.3
Total	10,774.9	Average 6.3	68,039.5

Source: ERINA Report

Table 3.7.4 Analysis of CBM Recovered in the Tavantolgoi Coalfield

Depth (m)	N_2 (%)	CH_4 (%)	CO_3 (%)
363.0~363.4	9.00	88.80	2.20
570.0~571.0	11.60	84.80	3.50
623.0~623.3	23.20	73.30	3.50
626.5~626.7	68.70	30.40	1.00
630.0~631.5	3.90	92.10	4.10
635.5~635.7	49.50	48.00	2.50
654.5~655.6	0.80	93.30	5.80

Source: ERINA Report

(c) Characteristics of Mongolian CBM resources

The CBM resources in Mongolia are characterized by the following.

- ✓ The reserves are relatively large with high caloric value. The gas content per ton of coal is as high as 6.3 m^3.
- ✓ Exploration and extraction costs are relatively small making them superior economically to oil and natural gas. Exploration and production technology is almost the same as oil and natural gas.
- ✓ CBM may be used as a raw material for the production of chemical products such as liquid fuels, syngas, fertilizers, methanol, ammonia, polymers and solvents.
- ✓ CBM will contribute to the safety of underground mining operations.

(d) Issues to be considered

The following issues are involved in CBM resources development.

- ✓ Financing infrastructure development such as gas transportation pipelines, compression stations, water distribution facilities, road networks, and railways.
- ✓ Delays in legislation such as mining approval for unconventional resources and national development policies; Storm Cat Energy (SCE), which started the CBM business for the first time in Mongolia, is selling the license because it has no long-term development policy.

(e) Future actions

Mongolia has one of the largest CBM resources in the world, and its coal reserves per ton of coal are higher than the global average. Unconventional resources such as CBM are less well-defined than conventional resources such as oil, gas and coal in terms of legislation such as mining approvals and the organization of national development policies. However, from a long-term perspective, CBM should be positioned as an important resource and development should be promoted.

Underground coal gasification (UCG)

(a) Background

Coal underground gasification (UCG) is a technology that converts coal existing in the underground coal seam into low- and medium-calorie gases such as CH_4, CO, CO_2 and H_2. The produced gas can be used as a fuel for power generation and chemical raw materials. Since its inception in the 1930s in the former Soviet Union, UCG has been tested in many countries around the world. Table 3.7.5 shows the results of UCG in each country. UCGs have been implemented in the former Soviet Union, the United States, Australia and South Africa, and they have already been used to gasify more than 100,000 tons of coal underground. Since then, the former Soviet Union and the United States have ended their government funding, and Australia encouraged UCB and prohibited the implementation of UCG. South Africa is continuing the project as a privately funded project.

In addition, a new UCG project was launched in China in 2019 in Ordos, Inner Mongolia Autonomous Region of China. Indonesia has started a study for UCG trials in 2019, and several UCG trials are planned to be conducted in 2020 with the help of India. Indonesia is aiming for commercialization from 2023.

Table 3.7.5 Implementation Results of UCG in Each Country

Country	Activity
FSU / Former Soviet Union Before	Expenditure US$10 billion, 150,000 ton gasified Central Govt. direct funding withdrawn
USA – 1980s-1990s	Expenditure US$500 million, 100,000 ton gasified End of Govt. funded research grants
Australia – 2000- 2010	Private funding US$500 million,100,000 ton gasified Govt. regulation prefers CBM/CSG, bans UCG
South Africa – 2010 -2015	Govt. funding. 60,000 ton gasified Currently seeking private project finance

Source: Phoenix Energy Pty Ltd

(b) Implementation details by UCG site

Table 3.7.6 shows the implementation details of the world's leading UCG test sites. There are three sites in the former Soviet Union, two in Australia, one in South Africa, and one in New Zealand. The depth of the coal reserves ranges from 30 m to 540 m, the thickness of the coal seam ranges from 0.4 m to 17 m, and the calorific value ranges from 2,600 to 7,130 kcal/kg.

Table 3.7.6 UCG Coal Conditions at Each UCG Site

	Depth (m)	Seam thickness (m)	Calorific Value (kcal/kg)
Angren (FSU)	110-250	3-24	3,660
Lisichansk (FSU)	60-250	0.4-2	5,100
Yuzhno – Abinskaya (FSU)	130-380	2.2-9	7,130
Shatskaya (FSU)	30-60	2.6	2,600
Chinchilla (Australia)	135m	10m	5,200
Kingaroy (Australia)	130～300m	2～17m	4,500
Majuba (South. Africa)	285	3.5-4.5	4,800
Huntley (New Zealand)	220-540	4-22	5,800

Source: Phoenix Energy Pty Ltd

- Chinchilla

The project was implemented at Chinchilla in Queensland of Australia. This trial was done by Ergo Energy Technology of Canada in collaboration with Link Energy of Australia. It was conducted from 1999 to 2003, and nine wells were drilled during the test period. The gas was produced at a maximum rate of 80,000 Nm3 / h from a 10 m thick coal seam at a depth of 135 m. It consumed about 35,000 tons of coal and produced more than 80 million m^3 of gas at 300 °C and 5.0 MJ / N m3.

- Kingaroy

The project was conducted by Cougar Energy at Kingaroy in QLD of Australia. It covered two formations with a depth of 130-300 meters and a coal seam thickness of 2-17 meters. The amount is believed to be sufficient to support commercial gas production.

- Majuba

The project was implemented by South African Electricity Corporation Eskom in Mpumalanga province, located on South Africa's north-eastern border. This UCG project produces high quality syngas for use in power generation at the existing 4.2 GW power plant.

- Huntley

The project was conducted by Solid Energy at the Huntley coal field in the North Island of New Zealand. A feasibility study was conducted in 2008 and 2009.

(c) Issues for consideration

The following issues are involved in the UCG implementation.

- ✓ The concept of UCG is simple; however, it requires advanced technology and experience to control the reaction and produce a constant quality of gas under changing geological conditions and coal conditions; therefore, it is not easy to commercialize it.
- ✓ Without proper selection of coal seams and optimal management, UCG can create two environmental hazards: groundwater contamination and surface subsidence. In a test at Hoe Creek, USA, improper site selection and over-pressurization of the reactor resulted in groundwater contamination with benzene, volatile organic carbon, and other contaminants.

(d) Future actions

UCG can recover and use underground coal that cannot be economically produced such as deep and thin coal seams and coal seams with high ash and sulfur content by gasifying it in the underground. The gasification process has a great advantage for the utilization of unconventional resources. However, the introduction of government funds to UCG has been postponed in the former Soviet Union, the United States, and Australia due to the large impact on the environment such as groundwater pollution and land subsidence.

Currently, India and China are actively working on UCG. In addition, Indonesia has shown great interest in UCG, and joint trials with India are planned. In addition, technical issues remain, and inadequate pressure control in the reactor causes groundwater contamination. The technologies to be developed in the future include (1) directional borehole drilling, (2) setting up a gasified gas passage, (3) monitoring of temperature and environmental impact, and (4) environmental countermeasure technology for groundwater contamination. The development of these technologies is expected in the future.

If the vast deep coal resources in Mongolia can be recovered as gas, it can be used as an alternative energy source for natural gas, power generation and raw materials for chemical products. This would be an effective use of unconventional resources. Therefore, it is important to keep abreast of UCG and to monitor the status of UCG trials in India and China.

3.7.2 Establishment of a comprehensive database for mineral resources to ensure sustainable mining sector

(1) Promotion of geological exploration activities

1) Coal

Geological conditions

Coal resources in Mongolia are distributed in 15 coal basins, and about 320 coal deposits have been identified in these basins. The age of coal deposits varies from Carboniferous to Cretaceous, and its properties change from western to eastern Mongolia.

The Kharkhiraa basin, Bayan-Ulgii basin, and Mongol-Altai basin, located in western Mongolia, were formed in the Carboniferous. These basins contain bituminous coal (steaming coal and coking coal). These coal basins are characterized by coastal lagoons and advanced carbonization. The Umunugovi basin, located in the southern part of Mongolia, was formed in the Permian, and similarly in-situ bituminous coal (steaming coal and coking coal). This basin, containing promising coal deposits such as the Tavan Tolgoi deposit, is actively developed for coking coal. The Choir-Nyalga basin in central Mongolia and the Tamsag basin in eastern Mongolia are formed in the Jurassic and Cretaceous, respectively. The coal quality is sub-bituminous coal to lignite that is lower than the coal in the western and southern basins and is considered to have been produced in a closed sedimentary environment. The formation of coal seams in Mongolian is characterized by different tectonic movements and sedimentation sites depending on the age.

Coal development

Until 2007, coal mines developed during the socialist era produced less than 10 million tons of Cretaceous lignite for domestic supply. After that, a number of high-quality coking coals contained in Permian were discovered in Umnugovi Aimag, which led to the full-scale development of the Erdenes Tavan Tolgoi coal mine, Ukhaa Khudag coal mine, and Nariin Sukhait coal mine.

Need of exploration

Good coal resources are also known in Bayankhongor Aimag and Govi-Altay Aimag located in west from Umnugovi Aimag, and Khuvsgul and Bulgun near the border with Russia in the north of Mongolia. Unexplored areas still remain within Umnugovi Aimag. Coal deposits spreading in these areas have few data and records of coal resource exploration that can evaluate the total amount of resources. Therefore, the full potential of coal resources has not been clarified. At present, the amount of coal resources announced by the Mongolian Government is 162 billion tons, but the resources actually determined by exploration is small. Therefore, it is extremely important to conduct coal resource exploration in unexplored areas spreading throughout Mongolia, and to investigate the geological structure of coal deposits, the state of coal seams, the amount of coal reserves, and the quality of coal, and to evaluate the potential of coal resources. In recent years, a coking coal development project for the Ovoot coalfield has been promoted by Aspire Mining (Australia) in northern Kuhusgul Aimag.

Future actions

The sustainable coal resource survey is essential. In the selected survey area, satellite image analysis, wide-area aeromagnetic survey, and ground survey will be conducted. A database will be created after collecting existing drilling data and coal analysis data. It is important to analyze large area, geological structure, and coal resources condition. The areas for detailed study are selected based on the analysis results. After that, surface exploration, drilling survey, physical logging, seismic survey, coal quality analysis, creation of topographic and geological database, comprehensive geological analysis and evaluation work will be carried out.

2) Rare earth

Overview

There are five types of rare earth deposits: carbonatite deposits, iron rare earth deposits, ion adsorption deposits, drift sand deposits, and alkaline rock deposits. Each element of rare earths is contained in these deposits. Rare earths are used in a wide range of industries due to the characteristics of each element and are indispensable resources for electric vehicles (EVs), digital cameras, mobile phones, personal computers, and televisions among others. Their applications will expand in the future to other uses such as abrasives for glass foundation, exhaust gas catalysts for automobiles, small motors, IC semiconductors, liquid crystals, and superconductivity. Therefore, the demand is expected to grow significantly in the future.

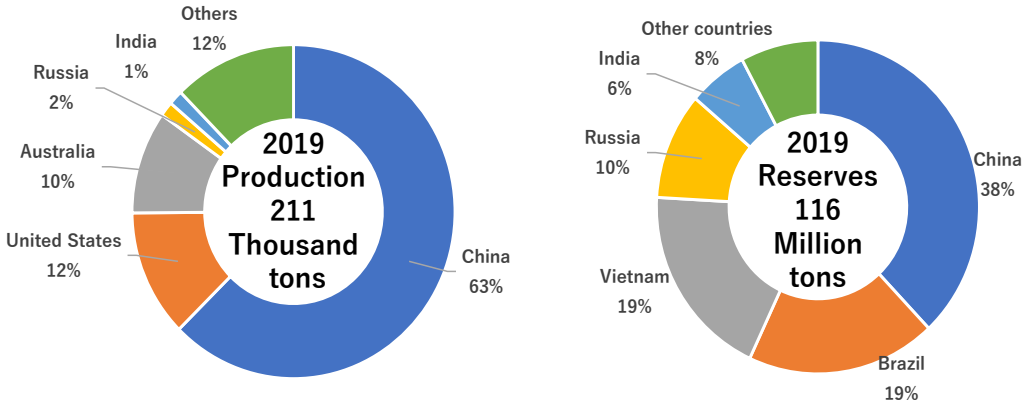
Among the rare earth elements, 15 elements besides scandium and yttrium are lanthanides. Among the lanthanides, elements with atomic masses smaller than those of gadolinium (from lanthanum to europium) are called light rare-earth elements (LREE). The heavier elements (from gadolinium to lutetium) are called heavy rare-earth elements (HREE). The intermediate ones are also sometimes referred to as medium rare earth elements. The price of heavy rare-earth is tens of times higher than that of light rare-earth. The ratio of heavy rare-earth elements is important in the economic evaluation of rare earth mines.

Producing countries

The United States was once the largest producer of rare earths in the world. However, production in most countries has been ousted by low price strategy adopted by China with rapid development and export promotion. Since the production in China surpassed other countries production in the 1990s, China has been dominating the international market for a long time. China having a large production share regards rare earths as a national strategic commodity, protecting this important domestic resource

with priority supply to domestic market.

In 2019, rare earth production (oxide materials base) was 211,000 tons worldwide, shared by China (63%), United States (12%), Australia (10%), Russia (2%) and India (1%). In 2010, China enacted restrictions on rare earth exports and total mining production, which caused price rise and procurement difficulty of rare earth materials in the world. As a result, several countries expect to develop new mines outside of China to diversify rare earth market. The estimated amount of rare earths reserved in the world is 116 million tons in 2019, and the mining life is sufficiently long in view of the expected production volume. Countries having larger shares of reserves are China (38%), Brazil (19%), Vietnam (19%), Russia (10%) and India (6%). China's share is not as high as production share. Depending on the progress of mine development in the future, China's share can be reduced.



Source: Mineral Commodity Summaries 2020 of USGS

Figure 3.7.5 Rare Earth Production and Reserves

Price

Prices of rare earths vary widely depending on the elements, and some elements have a price difference of 10 times or more. The rare earth average price temporarily rose to US$180/kg in 2011 due to China's export and production restrictions but is now settling at around US$40-60/kg.

Among the rare metals, neodymium, dysprosium and terbium have the property of increasing the coercive force/magnetic flux density at high temperatures. Therefore, the importance as additives for small magnets has been increasing. Demand for cerium as a glass abrasive for flat panel displays, yttrium as a phosphor, and lanthanum as a catalyst for purifying automobile exhaust gas is growing, and it is said that demand will continue to be strong in the future. Elemental prices for 2018 are US$70-75/kg of neodymium, US$3-4/kg of yttrium, and US$4-5/kg of lantern. Neodymium and dysprosium prices are over US$500/kg in 2019.

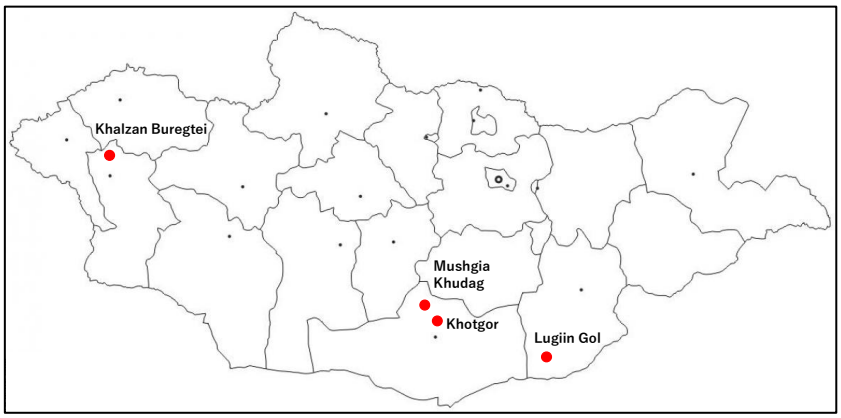
Processing

In the production of rare earths, ore is first concentrated as rare earth minerals (bastnasite, monazite, xenotime, ion-adsorbed ore, etc.) and then a mixed rare earth compound is produced by decomposition treatment. Then, by separating and purifying the compound, a metal rare earth is produced. In the concentration, flotation for bastnaesite and wet specific gravity and magnetic separation for monazite are used. Refining and processing rare metals will increase transportation efficiency and lead to cost reductions.

Current view of exploration

China's Baiyun Obo mine is adjacent to Umunogovi Aimag in Mongolia having many geological similarities. It is said that the potential of rare earths in Mongolia is high. According to the US Geological Survey in 2009, Mongolia has 31 million tons of rare earth reserves. There are currently four rare earth deposits identified in Mongolia: Mushgia Khudag and Khotgor in South Gobi and Khalzan Buregtei in Khovut and Lugiin Gol in Dornogovi. The Mushgia Khudag deposit was jointly

surveyed by the Soviet Union and Mongolia in 1983, and drilling exploration has already been carried out from 2007 to 2012.



Source: Mineral Commodity Summaries 2020 of USGS

Figure 3.7.6 Location of Rare Earth Reserves in Mongolia

Important considerations

Rare-earth metals are difficult for private companies to deal with due to their small market size (typically 130,000 tons per year, compared to 25 million tons of copper) and high volatility. Rare-earth development requires a national strategy and related tactics above all. Therefore, it is important to consider the following issues when developing rare earths

- Clarify the objectives of exploration projects
- Distinguish between development by private companies and national development
- Distinguish emphasis on profitability and non-profitability
- Decide whether to focus on quantity or quality
- Identify target deposit types (e.g., carbonatite deposits, ion-adsorption type)
- Calculate the ratio of light rare-earth elements (LREE) to heavy rare-earth elements (HREE)
- Identify the types of minerals which contains the rare earths
- Make a processing plan as an industrial material for mined rare earths

In addition, in order to proceed with the development, the project team should include someone with experience in the development of rare earth deposits.

Future actions

Resource surveys will be conducted for the four rare earth deposits in Mongolia.

- Surface reconnaissance: Perform satellite image analysis and geological analysis of this region.
- Drilling: Acquire detailed data for coring drilling. Sort rocks from collected cores (phosphate ore, carbonatite ore, fluorite ore, etc.). In addition, the host rock structure, mineralization rock structure and shape, etc. are analyzed.

(2) Introduction of advanced technology for efficient exploration, survey, analysis and extraction of mineral resources

1) Mineral resource survey

Before the development of the coal mine, a coal resource survey will be conducted.

- Remote sensing survey
  - ✓ Obtain of the extensive geological and terrain information. Used to selecting expecting areas from a wide area.

- Geological survey
  - ✓ Recognition of the actual rock composition, alteration, sedimentary structure, etc. through outcrop surveys on the ground
- Geophysical exploration
  - ✓ Use of the underground information by magnetic / gravity / electromagnetic exploration from the ground or in the air, useful for selecting the expecting areas. Exploration from the air can cover a wide area.
  - ✓ Recognition of physical properties by physical logging using boreholes.
- Drilling survey
  - ✓ Rocks are collected directly from the selected expecting (possible) underground at the ground or sea, and used for direct observation of mineral deposits, chemical analysis of minerals, and physical property tests.
- Deposit evaluation
  - ✓ Visualization of the three-dimensional distribution of minerals and resources, geological structure, and grade distribution by utilizing the acquired data with analysis software.

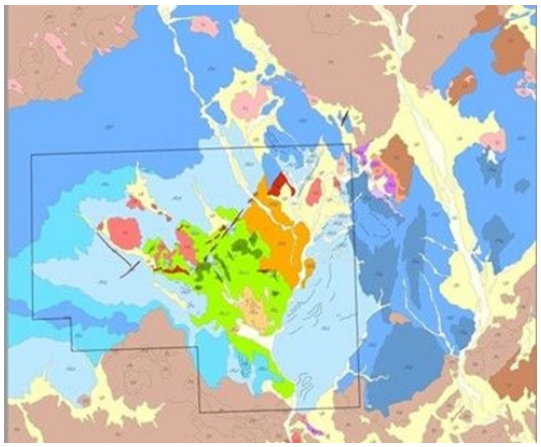
2) Advanced technology

Remote sensing

Remote sensing is a technique for observing the shape and properties of an object from a distance without touching the object. By using sensors as measuring instruments mounted on artificial satellite and aircraft, reflected waves of sunlight from various substances on the ground surface, water surface, and atmosphere, heat radiation from the substances themselves, and microwaves emitted from the sensors are observed. Objects are identified by using the reflection/radiation characteristics or spectral characteristics of electromagnetic waves of each object. Recently, there are various types of observations such as unmanned aerial vehicles (drones), vehicles, and ships, and various sensors have been developed according to the purpose. It is possible to observe from a wide range of satellites such as weather and global environment to a limited range of land such as cities and regions on various scales.

Remote sensing is used in the geological exploration to interpret and analyze the geology and geological structure for a wide area. In geological exploration, satellite data covering a wide area and high spatial resolution satellite data for detailed areas are used. It is possible to understand the surface distribution of sedimentary and igneous rocks, estimate subsurface geological structure, displacement due to faults, distribution of igneous rocks including the history of geological structure development and distribution of minerals and coal beds.

The function of remote sensing has improved remarkably from the range with a resolution of 10 to 30 m to a resolution of 1 to 2 m. In these artificial satellites, by moving the sensor together with the image data, the data at the same location can be acquired from two different points. As a result, aerial triangulation surveying is possible (Figure 3.7.7).



Source: JICA Proejct Team

Figure 3.7.7 Geological interpretation map by Remote sensing

Smart drilling

Smart drilling with a hole navigation system allow to manage the position information of drill bits. The drilling direction of the deep boring is automatically controlled by detecting a change or deviation from the target direction depending on the vibration or the state of the hole wall. Furthermore, by optimally controlling the pressing force of the drilling tool, efficient high-speed drilling and deep drilling are possible. A laser device is inserted in the drilling tool to enable automatic correction of the drilling direction.

Gravity exploration

This is an exploration method that measures the value of gravity and the deviation of gravity at the surface, water surface and the sea floor, and estimates the existence of geological structure and deposits from the value and gravity anomaly. It is often used for exploration of coal, petroleum, and natural gas, but it usually not for the detail structural analysis, so it is commonly used as a rough survey together with magnetic exploration at the initial stage of exploration. Gravity anomaly (Bouguer Anomaly) is calculated by correcting the gravity change peculiar to the earth and reflecting the underground density distribution. It can confirm expansion of sedimentary basin, deposit thickness and general geological structure.

Magnetic exploration

This is a geophysical survey using magnetic force. It is widely used for investigations of underground structures and crustal structures by measuring the strength of the earth's magnetic force with a magnetometer and detecting iron ore deposits and sandstone layers with strong magnetic force. Magnetometer measurements are performed not only on the ground, but also in the air and on the sea by aircraft and research vessels. The strength of magnetic force varies depending on the type of rock. The magnetic field observed on the surface of the earth differs depending on the place. The magnetic anomaly is obtained by subtracting the standard earth magnetic field from the measured earth magnetic field. It can confirm expansion of sedimentary basin, deposit thickness and general geological structure.

Gravity and magnetic exploration are used for wide-area exploration at the initial exploration stage. Both explorations are often conducted simultaneously.

Seismic exploration

This is an exploration method using seismic waves from artificial earthquakes. An artificial earthquake is generated at the ground and the sea surface by explosives, dynamite, compressed air, electric discharge, etc., and seismic waves are sent underground. The geological structure and underground condition are investigated by observing the propagation conditions of elastic waves that are refracted and reflected at the boundary of the stratum. It enables more detailed analysis than magnetic and gravity exploration

and is used for mineral, coal, and oil exploration. There exist various types: reflection seismic survey, refraction seismic survey, 2D seismic survey, 3D seismic survey and vertical seismic survey (VSP).

3) Application of ICT to database management

Overview

Geological exploration data for mineral resources in Mongolia are managed by the Mongolian Mineral Resources and Petroleum Agency (MRPAM). There are materials originally from Mongolia, but many are written in Russian language before 1960. The digitization of detailed reports and drawings for past ore explorations is an important issue. Therefore, creating a database system using ICT is considered urgent.

Target data

Data include topographic maps, geological maps, mining plots, coalfield maps, survey reports, mineral grade data, coal grade data, mineral coal quantity, coal production, Mongolian mining law, meteorological data, satellite photographs, aerial gravity and magnetic exploration data. Data cover a wide variety of exploration data. The drawings are 1/200,000 topographic maps, 1/200,000 geological maps, 1/1 million topographic maps, etc. Materials in Russian language will be translated into English in advance.

Analysis format

A dedicated software is used to conduct a database of related data. When constructing the database, the mineral deposits, coal deposits, and oilfield deposits will be compiled based on the data provided by MRAPM. All sources should be specified in the data to clarify the source of the individual data. Information on the collected data is displayed on the screen of the HTML file by clicking on the mineral deposit, coal deposit, or oilfield deposit displayed on the basic software on the screen. The collected information is linked to the basic information HTML file on the tree and displayed on the screen by clicking the necessary part. The necessary data incorporated in the database are used for analyses by combining the data according to the purpose.

3.7.3 Establishment of responsible mining

(1) Establishment of principles to be applied to mining activities including ownership, licensing and contracting

1) Revision of the Mineral Resources Act

In Mongolia, many laws and tax systems were established in the 1990s during the transition from the former Soviet Union's centrally planned economy to a free and market economy. The Mineral Resources Act was first enacted in 1997, establishing a transferable rights system for exploration, mining and ownership. Along with this, since 2001, a lot of exploration licenses have been issued, causing a boom in exploration and mining of mineral resources. As a result, it has led to the discovery of major deposits including giant deposits of Oyu Tolgoi (copper) and Tavan Tologoi (coal) in Umunugobi Aimag. However, there were concerns that export of valuable domestic resources could damage national property. Due to resource nationalism, in 2006, the Mongolian Parliament revised the Mineral Resources Act and changed some basic policies that were previously open to foreign capital into closed ones. The major changes are as follows.

- Excess profit tax (68%) on gold and copper ore was established. Excess profit tax is to pay tax equivalent to 68% of sales when 1 oz of gold exceeds US$500 and 1 ton of copper exceeds US$2,600. The purpose of the Excess Profit Tax Law for some minerals is to tax the excess profits from rising product prices.
- Regarding strategically important deposits, the ratio of national participation has increased significantly.

- At least 10% of the investment of strategically important deposits should be listed on Mongolian Stock Exchange.

Due to the closed policy of the Mongolian Government, many international investors withdrew from Mongolia. Following this, the Mongolian Government has abolished the excess profit tax and has changed its policy to attract foreign capital. Although Mongolia is blessed with abundant underground resources, it has no choice but to rely on overseas funds for infrastructure, technological innovation, and mining development. Harmonization between foreign national policy and resource nationalism in the development of mineral resources by the Government is a significant task for the Mongolian Government.

2) Ownership of mineral resources

The Mineral Resources Act is applied to the exploration and development of mineral resources. The mineral resources are owned by the Mongolian state.

3) Principle of license and contract

The Government, as an owner, gives mining companies the right of exploration and mining of mineral resources. The national share of strategically important deposits developed with national funding is determined by a mining agreement. If national funds are used to determine the proven reserves at the exploration stage, the Government can participate up to 50%. If the amount of confirmed reserves is determined by a fund other than the government budget, the ownership ratio can be up to 34%. However, a government-owned share can be given by the special royalties instead of the share (34% or 50%) depending on the agreement for mining the deposit. Mining rights holders of strategically important deposits must trade at least 10% of their shares on the Mongolian Stock Exchange.

4) Establishment of principles that should be applied to the mining industry

Principles that should be applied to the mining industry, including ownership, licenses and contracts should be established.

(2) Preparation of standard contract formats to be observed by investors and developers for mining activities

1) Exploration rights

Exploration rights are granted in order of the registration (excluding competitive bidding). Mining companies submit a specific format application form to the Mineral Resources and Petroleum Agency (MRPAM).

2) Mining rights

Only exploration rights holders can apply for mining rights in the designated block. If the exploration right expires, or if the exploration right holder fails to apply for the mining right, the mining right for the mining area will be granted by bidding. Application for mining rights is in the prescribed form. It is necessary to prepare the following materials as supplementary documents.

- Documents that prove that the applicant is a Mongolian corporation and paying taxes,
- Block map,
- Proof of service fee payment,
- Minutes of the Mineral Resources Council's evaluation regarding the results of exploration work and decisions of government agencies, and
- Certificate of fulfillment of obligation regarding environmental protection during exploration plan, and environmental impact assessment.

3) Obligations of owners of mining rights

Mining rights holders must have the following documents stored locally:

- Copy of mining rights,
- Natural environment protection plan,
- Business plan approved by government agency,
- Copy of mineral sales contract, and
- Land and water usage contract.

Mining rights holders give priority to taxpayers and companies already registered in Mongolia when purchasing goods, jobs or services required for business. Mining rights holders will report to the Mineral Resources and Petroleum Agency (MRPAM) if they terminate mining, coal preparation, concentrate and refining for any reason. In addition, when selling mined, coal preparation concentrate and refined products, the mining right holder provides the companies in order of priority that produce in the Mongolian territory at the market price.

4) Preparation of contract format

Standard contract formats should be prepared so that investors and developers would follow.

(3) Establishment of environmental monitoring system by the local initiative in line with stepwise implementation of localization of development administration

1) Relationship with local government

Owners of mining rights must conclude agreements with local governments on issues of mining development, employment, environmental protection, mining operations and infrastructure development. Mining rights owners organize public hearings in cooperation with local government agencies. The public elects a representative to publicly monitor the activities of the mining rights owner.

2) Environmental protection obligations of mining rights owners

Mining rights owners must have an environmental impact assessment and environmental protection plan in place prior to mining rights acquisition. Environmental impact assessments must identify adverse health and environmental consequences of proposed mining activities, and take preventive measures and minimize adverse consequences. Environmental protection plans are the method by which mining activities place a minimum load on the environment. Environmental protection plans are comprehensive measures to protect the atmosphere, water, humans, animals and plants from the negative effects of mining activities. The environmental protection plan must also include the following:

- Storage and management of harmful substances,
- Protection, use and management of surface water and groundwater,
- Construction of dams of mineral resources wastes from processing and ensuring safety of mining areas,
- Landfill measures, and
- Other appropriate measures depending on the type of mining works.

3) Local-led environmental monitoring system

Mining rights owners must submit a copy of the document immediately after approval of the environmental impact assessment and environmental protection plan to the head of Aimag, Soum and Ward, and the local environmental inspection agency. The impact of environmental damage resulting from the expansion of mining activities is described in the annual Environmental Protection Plan Report. The report shows the measures taken to protect the environment, the status of new exploration machinery,

and includes an environmental impact assessment and a proposed revision of the environmental protection plan to avoid adverse environmental impacts. The revised plan requires approval from the head of Soum and Ward. To ensure environmental responsibility, the mining rights owners must deposit 50% of the environmental budget for a particular year in a special account established by the Ministry of Environment in charge of the environment.

4) Establishment of environmental monitoring system

An environmental monitoring system should be established and operated by the initiative of Aimag administrations and local residents respectively.

Chapter 4 Manufacturing Industry

4.1 Existing Conditions of Manufacturing Industry

4.1.1 Introduction

Mining or extractive industries (coal, copper ore, iron ore, zinc ore, gold, and so on) have been the backbone of the national economy in Mongolia in recent years, which accounted for 23.8% of gross domestic product (GDP) at current prices in 2019. The manufacturing industry sector, composed mainly of small and medium enterprises (SMEs), accounts for 9.6% of GDP in the same year. The major products of this sector are food, beverage, wearing apparel, textiles and so on. Manufactured products are still only weakly diversified, and quality and technological contents are limited. In exports, output from mining sector accounts for 80% of the total export value and products of manufacturing sector account for 15% in 2019.

In this chapter, discussions on issues, policy measures, objectives, strategies and proposed projects are conducted not only for manufacturing sector, but for industry sector as a whole.

4.1.2 Scale of manufacturing industry

(1) Gross output of industry sector

According to preliminary estimates in 2019, the total gross output of the industrial sector amounted to MNT30.1 trillion. It is an increase by MNT3.6 trillion or 13% compared to the output in 2018. In 2019, as shown in Table 4.1.1, 58% of the total gross industrial output came from mining and quarrying sector with MNT17.3 trillion, derived mainly from coal extraction and metal ores. On the other hand, the gross output from manufacturing sector accounted for 33% of the total, which is composed of food products, coke and refined petroleum products, beverages, textiles, wearing apparel, other non-metallic mineral products, basic metals, wood and wood products, and so on. The utilities sector consisting of "electricity, gas, steam and air conditioning supply" and "water supply, sewerage, waste management and remediation activities" has the shares in the total gross output at 8.4% and 1.2%, respectively.

Table 4.1.1 Gross Industrial Output and Composition by Economic Sector

(1) Gross industrial output at current prices (MNT million)						
Economic Sector/Activity	2014	2015	2016	2017	2018	2019
Total	14,402,938	14,803,219	15,663,775	20,650,354	26,512,796	30,072,563
Mining and quarrying	9,271,286	8,154,564	8,711,414	11,577 036	15,348,619	17,301,987
Manufacturing	4,042,681	5,320,193	5,210,088	7,198,962	8,635,069	9,873,604
Electricity, gas, steam and air conditioning supply	842,769	1,047,366	1,427,497	1,526,905	2,186,312	2,523,560
Water supply; sewerage, waste management and remediation activities	246,202	281,097	314,775	347,451	342,796	373,412
(2) Composition of gross industrial output (percent)						
Economic Sector/Activity	2014	2015	2016	2017	2018	2019
Total	100.0	100.0	100.0	100.0	100.0	100.0
Mining and quarrying	64.4	55.1	55.6	56.1	57.9	57.5
Mining of coal and lignite	7.5	6.4	10.3	14.0	20.0	22.7
Extraction of crude petroleum	7.8	5.6	4.6	4.3	3.6	3.3
Mining of metal ores	44.9	39.6	37.6	34.5	29.9	27.2
Other mining and quarrying	1.0	1.0	0.9	1.1	1.8	1.7
Mining support service activities	3.2	2.4	2.2	2.2	2.7	2.6
Manufacturing	28.1	35.9	33.3	34.9	32.6	32.8
Food products	4.5	17.0	14.4	12.7	13.2	13.6
Beverages	4.7	4.3	4.2	3.2	3.6	3.2
Tobacco products	0.5	0.4	0.4	0.4	0.3	0.2
Textiles	2.2	2.1	2.2	1.8	1.4	1.4
Wearing apparel	1.9	2.0	2.1	2.8	2.0	1.7
Leather and related products	0.4	0.5	0.4	0.6	0.3	0.3
Wood and of products of wood and cork, except furniture	0.7	0.7	0.7	0.9	0.6	0.3
Paper and paper products	0.2	0.3	0.2	0.3	0.2	0.4
Printing and reproduction of recorded media	0.5	0.5	0.6	0.4	0.4	0.4
Coke and refined petroleum products	4.7	0.9	2.2	5.1	5.0	5.5
Chemicals and chemical products	0.4	0.4	0.8	1.1	0.7	0.7
Basic pharmaceutical products and pharmaceutical preparations	0.4	0.4	0.3	0.4	0.2	0.2
Rubber and plastics products	0.5	0.3	0.2	0.2	0.3	0.3
Other non-metallic mineral products	2.5	2.1	1.5	1.7	2.1	2.1
Basic metals	2.2	2.1	1.6	1.8	1.4	1.3
Fabricated metal products, except machinery and equipment	0.4	0.5	0.3	0.4	0.3	0.2
Computer, electronic and optical products	0.0	0.0	0.0	0.0	0.0	0.0
Electrical equipment	0.5	0.4	0.1	0.0	0.1	0.1
Machinery and equipment n.e.c.	0.1	0.1	0.1	0.1	0.0	0.0
Motor vehicles, trailers and semi-trailers	0.0	0.0	0.0	0.0	0.0	0.0
Other transport equipment	0.0	0.0	0.0	0.0	0.0	0.0
Furniture	0.2	0.3	0.5	0.4	0.4	0.7
Other manufacturing	0.2	0.1	0.1	0.1	0.1	0.1
Repair and installation of machinery and equipment	0.4	0.4	0.3	0.3	0.2	0.2
Electricity, gas, steam and air conditioning supply	5.9	7.1	9.1	7.4	8.2	8.4
Water supply; sewerage, waste management and remediation activities	1.7	1.9	2.0	1.7	1.3	1.2

Source: Mongolian Statistical Yearbook 2019, National Statistical Office of Mongolia

(2) Number of enterprises

As shown in Table 4.1.2, the total number of registered and active enterprises was 187,126 and 93,858, respectively in 2019. In active enterprises of the industry sector, construction has the largest number with 7,393 (7.9%), followed by manufacturing with 6,314 (6.7%), mining and quarrying with 1,290 (1.4%), and electricity, gas and water supply with 240 (0.3%). The total number of registered and active enterprises in the capital city of Ulaanbaatar amounted to 140,722 and 63,028, respectively in 2019 and accounted for 75% and 67% of those of the whole Country.

Table 4.1.2 Number of Registered and Active Enterprises by Economic Activity in 2019

Economic Sector/Activity	Registered		Operating (Active)	
	Number	Percent	Number	Percent
Total	**187,126**	**100.0**	**93,858**	**100.0**
Agriculture, Forestry, fishery and hunting	**8,538**	**4.6**	**3,812**	**4.1**
Industry	**29,562**	**15.8**	**15,416**	**16.4**
Mining and quarrying	2,660	1.4	1,290	1.4
Manufacturing	12,203	6.5	6,314	6.7
Electricity, gas and water supply	328	0.2	240	0.3
	280	0.1	179	0.2
Construction	14,091	7.5	7,393	7.9
Services	**149,026**	**79.6**	**74,630**	**79.5**
Wholesale and retail trade, repair of motor vehicles, household goods	76,633	41.0	37,454	39.9
Transportation and storage	3,908	2.1	1,633	1.7
Accommodation and food service activities	4,545	2.4	2,198	2.3
Information and communication	4,809	2.6	1,943	2.1
Financial and insurance activities	4,566	2.4	2,420	2.6
Real estate activities	1,934	1.0	1,015	1.1
Professional, scientific and technical activities	10,361	5.5	5,138	5.5
Administrative and support service activities	9,537	5.1	3,507	3.7
Public administration and defense, compulsory social security	1,565	0.8	1,565	1.7
Education	6,948	3.7	4,528	4.8
Human health and social work activities	3,598	1.9	2,735	2.9
Arts, entertainment and recreation	2,070	1.1	1,223	1.3
Other service activities	18,516	9.9	9,235	9.8
Activities of extraterritorial organizations and bodies	36	0.0	36	0.0

Source: Mongolian Statistical Yearbook 2019, National Statistical Office of Mongolia

(3) Number of employed persons

As shown in Table 4.1.3, the total number of employees in Mongolia was about 1.15 million in 2019. In the industry sector, manufacturing holds the largest number with 90,400, followed by construction with 68,800, mining and quarrying with 57,900, electricity, gas, steam and air conditioning supply with 19,300 and water supply, sewerage, waste management and remediation activities with 10,800, respectively. The total number of employees in Ulaanbaatar amounted to 471,000 in 2019 and accounted for 41% of those in the whole Country.

Table 4.1.3 Number of Employed Persons by Economic Sector

Unit: 1,000 persons

Economic Sector/Activity	2014	2015	2016	2017	2018	2019
Total	**1,110.7**	**1,151.2**	**1,147.8**	**1 238.3**	**1,253.0**	**1,146.2**
Agriculture, forestry, fishing and hunting	310.7	327.6	348.4	356.4	334.1	290.2
Mining and quarrying	40.9	42.6	38.2	52.0	57.7	57.9
Manufacturing	**85.5**	**81.3**	**86.1**	**93.1**	**100.8**	**90.4**

Electricity, gas, steam and air conditioning supply	15.5	15.6	16.2	17.5	16.3	19.3
Water supply, sewerage, waste management and remediation activities	7.2	5.9	6.0	4.9	6.9	10.8
Construction	81.1	88.1	71.4	70.6	76.6	68.8
Wholesale and retail trade, repair of motor vehicles and motorcycles	170.2	178.2	172.7	204.5	211.2	160.4
Transportation and storage	69.8	72.7	65.9	72.7	73.6	61.1
Accommodation and food service	36.6	37.8	32.1	36.4	37.4	36.3
Information and communication	17.8	16.0	18.1	14.5	14.1	13.0
Financial and insurance activities	22.9	23.8	21.9	24.1	25.7	24.3
Real estate activities	1.1	1.0	0.8	0.4	0.8	1.2
Scientific and technical activities	12.5	14.1	12.7	12.7	14.6	18.0
Administrative and support service activities	12.0	16.0	15.0	20.8	18.2	20.2
Public administration and defense; compulsory social security	66.1	68.1	74.2	82.2	76.2	86.0
Education	89.6	89.0	95.0	98.9	98.7	96.1
Human health and social work activities	37.5	38.2	41.0	40.0	49.4	44.4
Arts, entertainment and recreation	10.6	12.3	10.1	10.1	13.8	18.0
Other service activities	20.1	20.2	19.8	22.7	23.4	24.5
Activities of households as employers	1.4	1.0	1.1	2.3	1.2	3.3
Activities of extraterritorial organizations and bodies	1.6	1.7	1.1	1.5	2.3	2.0

Source: Mongolian Statistical Yearbook 2019, National Statistical Office of Mongolia

(4) Export of manufactured products

As shown in Table 4.1.4, Mongolia exports mainly raw material such as coal, copper ore and iron ore, gold, animal hair, stone such as fluorspar and so on. The share of the exports in the top 5 code accounts for more than 90% of the total exports in the recent five years. Value-added processing of existing mining and other products and therefore the export value of manufactured products are still very limited in Mongolia. Mongolia's main exports partners in 2019 are China (89% of total), United Kingdom (4%) and Singapore (2%). Major commodities to these export partners are coal, copper ore and animal hair for China, and gold for United Kingdom and Singapore.

Table 4.1.4 Exports of Products from Mongolia

Unit: US$ thousand

Code	Product	2015	2016	2017	2018	2019
Total	**All products**	**4,669,280**	**4,916,326**	**6,134,965**	**7,011,758**	**7,619,754**
'27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral. **(mainly coal)**	949,732	1,316,689	2,598,935	3,210,394	3,485,104
'26	Ores, slag and ash **(mainly copper ore, iron ore and zinc ore)**	2,662,330	2,108,362	2,166,880	2,670,048	2,686,199
'71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad, **(mainly gold)**	421,385	761,511	662,046	145,481	419,076
'51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	273,444	267,775	197,941	362,815	374,568
'25	Salt, sulfur, earths and stone; plastering materials, lime and cement (mainly fluorspar)	66,138	58,995	84,242	189,898	206,166
Sub-total in the Top 5 based on the order in 2019		**4,373,029**	**4,513,332**	**5,823,492**	**6,578,636**	**7,171,113**
Share (%) in the Top 5		**93.7**	**91.8**	**93.9**	**93.8**	**94.1**

Source: International Trade Center (ITC) calculations based on UN Comtrade statistics

(5) Import of manufactured products

As shown in Table 4.1.5, Mongolia imports mineral fuels, machinery and equipment, vehicles, electric appliances such as recorders, TV sets and spare parts, iron and steel, plastics, pharmaceutical products, food products and so on. To promote import substituting manufacturing of commodities, products

shown in the top 25 codes such as plastic, rubber, furniture, foodstuff, beverages and soap seem to have the potentials. Mongolia's main import partners in 2019 are China (33% of total), Russia (28%), Japan (10%), USA (5%), South Korea (4%) and Germany (3%). Major commodities from these import partners are dump trucks and trailers, machinery and iron products from China, petroleum oils and iron products from Russia, motor vehicle (passenger car) and machinery from Japan, aircraft and machinery form USA, dump trucks and buses from South Korea and machinery from Germany.

Table 4.1.5 Imports of Products to Mongolia

Unit: Thousand US$

Code	Product	2015	2016	2017	2018	2019
Total	**All products**	**3,797,518**	**3,339,604**	**4,337,320**	**5,874,788**	**6,127,356**
'27	Mineral fuels, mineral oils and products of their distillation; bituminous substances	874,591	680,536	971,427	1,314,653	1,359,922
'87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	358,669	397,826	554,901	827,646	991,750
'84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	517,712	375,097	554,617	797,053	867,579
'85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television	267,798	305,301	366,228	488,665	373,100
'73	Articles of iron or steel	193,034	125,833	207,094	322,624	294,419
'72	Iron and steel	104,724	50,571	82,719	153,109	194,304
'88	Aircraft, spacecraft, and parts thereof	4,664	29,225	44,096	11,013	157,511
'39	Plastics and articles thereof	84,448	76,022	95,945	126,634	138,693
'40	Rubber and articles thereof	55,814	60,981	86,522	100,161	121,559
'30	Pharmaceutical products	73,778	90,874	94,394	118,075	107,887
'21	Miscellaneous edible preparations	60,598	61,622	78,394	97,698	99,134
'90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical	83,739	53,108	59,689	102,692	84,625
'19	Preparations of cereals, flour, starch or milk; pastrycooks' products	47,817	48,001	53,475	63,798	72,463
'94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings	60,144	60,655	73,042	86,928	65,284
'24	Tobacco and manufactured tobacco substitutes	59,448	55,799	63,288	59,647	65,159
'70	Glass and glassware	41,453	38,555	41,909	51,302	56,062
'68	Articles of stone, plaster, cement, asbestos, mica or similar materials	38,870	26,557	22,663	36,804	53,125
'18	Cocoa and cocoa preparations	40,024	38,871	43,611	49,808	51,907
'22	Beverages, spirits and vinegar	33,010	34,322	36,745	44,723	49,911
'33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	44,888	37,987	44,087	48,343	49,059
'48	Paper and paperboard; articles of paper pulp, of paper or of paperboard	39,957	38,860	43,225	51,312	48,539
'17	Sugars and sugar confectionery	45,485	51,633	55,169	57,527	48,363
'31	Fertilizers	22,556	22,463	31,243	37,063	43,854
'44	Wood and articles of wood; wood charcoal	40,937	30,351	40,261	33,930	43,467
'20	Preparations of vegetables, fruit, nuts or other parts of plants	28,996	28,548	33,720	45,627	41,312
	Others	574,364	520,006	558,856	747,953	648,368

Source: ITC calculations based on UN Comtrad statistics

(6) Industrial linkages

The current situation of industrial linkages in Mongolia is analyzed by using the 2015 input-output Table. Figure 4.1.1 shows the current inter-industry linkages or inter-industry interdependence by index of the

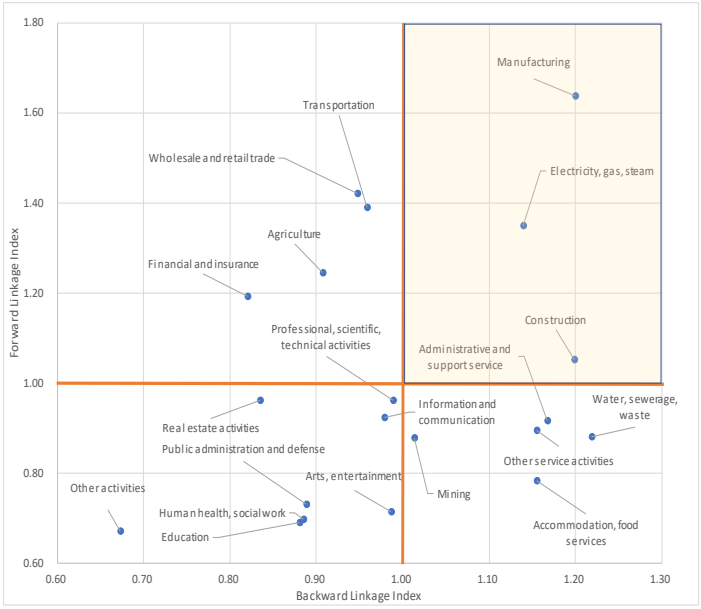
power of dispersion or backward linkage (BL) and index of sensitivity of dispersion or forward linkage (FL), consisting of 20 economic sectors.

Backward linkages measure the impact on the supplier industries of a unit of increase in the final demand for a particular industry's product. Forward linkages, on the other hand, measure the increase in the output of industry (i) needed to supply the inputs required to produce a unit of the final demand output in industry (j). Industries with both power and sensitivity of dispersion values greater than one play crucial roles in supporting other industries (FL effect), as well as in boosting other industries (BL effect).

The axes intersect in the point where BL=1.00 FL=1.00 and separate the key industries (with the value of BL and FL greater than 1) in the first quarter; these are only manufacturing, construction and electricity, gas and steam. In other words, manufacturing sector has a development potential in terms of industrial linkages formation. In the second quarter there are important forward linkage industries: wholesale and retail, transportation, and financial and insurance services, and agriculture.

The fourth quarter contains important backward linkage industries: water, sewerage and waste, administrative and support service activities, other services activities, accommodation and food services, and mining. It should be noted that the BL index of mining is 1.01, slightly greater than unity, although its GDP share is large, implying mining has limited power to induce the development of supplier industries. The third quarter contains the rest of the sectors with low backward and forward linkages.

Economic Sector/Activities	Back-ward Linkage	Forward Linkage
Agriculture	0.91	1.25
Mining	1.01	0.88
Manufacturing	1.20	1.64
Electricity, gas	1.14	1.35
Water, sewerage, waste	1.22	0.88
Construction	1.20	1.05
Wholesale and retail trade	0.95	1.42
Transportation	0.96	1.39
Accommodation, food services	1.16	0.78
Information and communication	0.98	0.92
Financial and insurance	0.82	1.19
Real estate	0.83	0.96
Professional, technical activities	0.99	0.96
Administrative and support service	1.17	0.92
Public administration and defense	0.89	0.73
Education	0.88	0.69
Human health, social work	0.89	0.70
Arts, entertainment	0.99	0.71
Other services	1.15	0.90
Other activities	0.67	0.67



Source: JICA Project Team calculations based on the 2015 Input-Output Table from National Statistics Office of Mongolia

Figure 4.1.1 Industrial Linkage among Economic Sector

(7) Foreign direct investment (FDI)

The total foreign direct investment amounts to US$2,900 million in 2019. Table 4.1.6 shows the total amounts of FDI in Mongolia by economic sector between 2014 and 2019. The mining and quarrying sector with US$8,773 million has the dominant share at 79.7%, followed by wholesale and retail trade sector with US$1,144 million (9.1%), financial and insurance activities with US$687 million (5.5%) and construction sector with US$407 million (3.2%). As for manufacturing and processing activities, light industry, food production, livestock raw materials processing, manufacture of electrical appliances

and manufacture of household appliances amount to US$184 million (1.5%) in the same period.

Table 4.1.6 FDI by Sector between 2014-2019

Unit: US$ million

Economic sector	**Total (2014-2019)**	**(%)**	2014	2015	2016	2017	2018	2019
Total	**12,589.1**	**100.0**	1,991.5	1,396.3	1,486.4	2,086.3	2,728.7	2,899.9
Mining and quarrying	**8,772.5**	**69.7**	1,271.7	789.7	941.2	1,442.4	2,130.3	2,197.2
Wholesale and retail trade; repair of motor vehicles and motorcycles	**1,144.3**	**9.1**	292.6	101.5	111.5	297.1	143.2	198.4
Financial and insurance activities	**686.6**	**5.5**	117.4	72.0	73.0	53.6	224.4	146.2
Construction	**406.9**	**3.2**	124.0	76.0	70.5	55.4	21.7	59.3
Accommodation and food service activities	**370.7**	**2.9**	4.8	170.8	144.9	23.5	10.2	16.5
Other service activities	**345.4**	**2.7**	66.6	78.6	53.9	42.5	64.2	39.6
Manufacturing	**184.1**	**1.5**	29.1	29.9	24.1	33.0	43.4	24.6
Administrative and support service activities	**143.0**	**1.1**	13.1	3.4	4.1	13.0	24.6	84.8
Professional, scientific and technical activities	**120.3**	**1.0**	11.3	15.3	12.1	5.9	16.6	59.1
Real estate activities	**116.0**	**0.9**	18.0	14.5	22.6	20.8	20.8	19.3
Transportation and storage	**98.1**	**0.8**	8.1	6.3	6.7	41.2	1.7	34.1
Information and communication	**80.3**	**0.6**	19.4	30.7	10.5	4.8	7.6	7.3
Agriculture, forestry and fishing	**34.5**	**0.3**	11.5	4.2	5.3	5.6	3.4	4.5
Electricity, gas, steam and air conditioning supply	**30.6**	**0.2**	1.0	0.6	1.2	25.1	1.4	1.3
Human health and social work activities	**25.1**	**0.2**	0.6	0.6	1.7	20.2	1.2	0.8
Activities of extraterritorial organizations and bodies	**14.0**	**0.1**	0.0	0.0	0.0	0.0	12.1	1.9
Education	**6.2**	**0.0**	0.4	0.0	0.9	0.6	0.6	3.7
Arts, entertainment and recreation	**4.2**	**0.0**	1.3	1.1	1.0	0.3	0.0	0.5
Activities of households as employers;	**2.8**	**0.0**	0.3	0.5	0.6	1.3	0.0	0.1
Public administration and defense; compulsory social security	**1.8**	**0.0**	0.0	0.0	0.0	0.0	1.4	0.4
Water supply; sewerage, waste management	**1.6**	**0.0**	0.1	0.6	0.7	0.0	0.0	0.2

Source: National Statistical Information Services, NSO

On the other hand, the total amounts of FDI (flow) by country between 2014 and 2019 are shown in Table 4.1.7. Canada keeps the top position with 47.1%, followed by China with 17.9%, Luxembourg with 7.4%, Singapore with 6.1% and Japan with 5.9%, respectively. These five countries account for more than 80 % of total amount of investments in this period. China is substantially the largest investing country in Mongolia since Luxemburg and the Netherland are "Tax Haven" countries where many companies in the world are registered to reduce and exempt various taxes. USA, United Kingdom, Korea, Germany and Australia rank between 6th place to 10th place.

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Table 4.1.7 FDI by Country between 2014-2019

Unit: US$ million

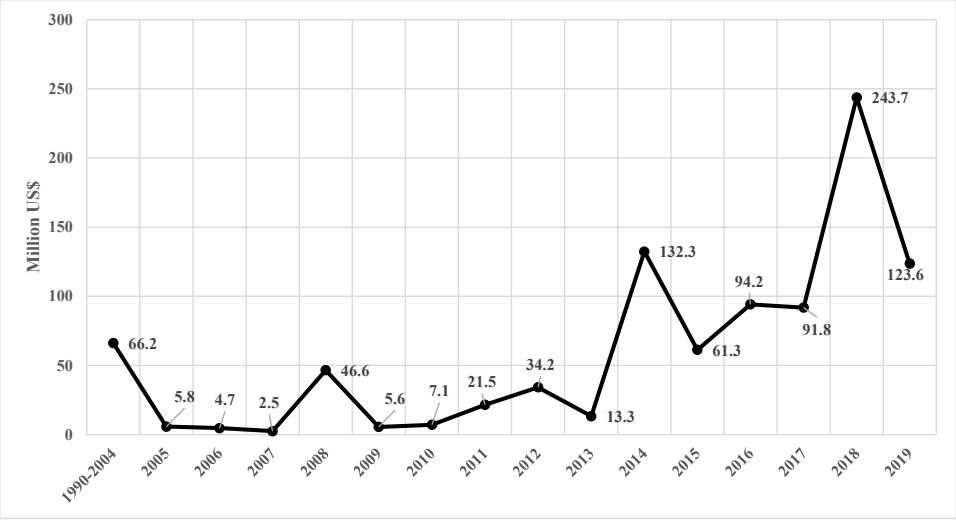
Economic sector	**Total (2014-2019)**	**(%)**	2014	2015	2016	2017	2018	2019
Total	**12,589.1**	**100.0**	1,991.5	1,396.3	1,486.4	2,086.3	2,728.7	2,899.9
Canada	**5,930.5**	**47.1**	611.4	468.7	531.1	766.3	1,647.5	1,905.5
China (including Hong Kong)	**2,252.2**	**17.9**	344.5	462.9	475.0	327.3	437.4	205.1
Luxembourg	**937.3**	**7.4**	366.3	65.9	59.1	247.0	64.2	134.8
Singapore	**764.0**	**6.1**	244.7	72.0	73.2	135.1	54.7	184.3
Japan	**747.0**	**5.9**	132.3	61.3	94.3	91.8	243.7	123.6
USA	**517.5**	**4.1**	71.3	68.8	90.2	138.9	78.0	70.3
United Kingdom	**230.8**	**1.8**	40.9	31.8	33.0	25.1	19.3	80.7
Republic of Korea	**179.1**	**1.4**	49.7	44.9	27.5	10.2	27.0	19.8
Germany	**165.0**	**1.3**	3.7	5.7	18.9	109.2	3.5	24.0
Australia	**136.3**	**1.1**	12.3	24.3	20.6	43.1	15.6	20.4
Netherlands	**126.1**	**1.0**	8.9	27.0	10.8	68.3	4.2	6.9
France	**101.7**	**0.8**	39.5	14.1	13.5	9.0	15.0	10.6
Russia	**99.3**	**0.8**	2.8	9.8	4.2	30.3	18.0	34.2
Switzerland	**75.9**	**0.6**	5.9	2.8	2.7	4.1	25.3	35.1
Italy	**41.4**	**0.3**	11.6	8.9	5.0	2.4	3.0	10.5
Belgium	**40.9**	**0.3**	0.4	0.2	0.8	24.9	1.4	13.2
Turkey	**14.5**	**0.1**	1.3	8.7	2.4	1.0	0.0	1.1
New Zealand	**13.8**	**0.1**	0.1	0.0	1.4	2.8	2.3	7.2
Qatar	**11.8**	**0.1**	0.0	0.4	2.7	5.0	0.8	2.9
Other countries	**204.0**	**1.6**	43.9	18.1	20.0	44.5	67.8	9.7

Source: National Statistical Information Services, NSO

(8) FDI from Japan and trade between Mongolia and Japan

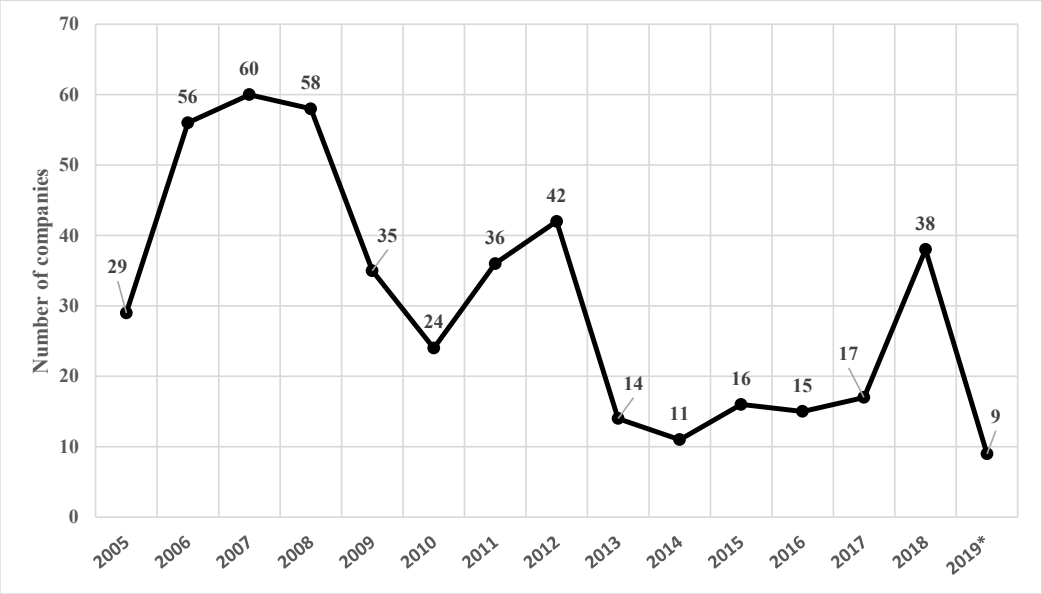
In May 2016, the Governments of Mongolia and Japan exchanged a diplomatic *note verbale* on implementation of the Mongolia-Japan Economic Partnership Agreement (EPA). Accordingly, the agreement entered into force starting from June 2016. The agreement seeks to (i) increase trade of goods and services, (ii) encourage investment between the two countries, and (iii) adopt know-how from Japan. The foreign direct investment from Japan and trade between Mongolia and Japan are analyzed from the viewpoint of the EPA.

The foreign direct investment (flow) from Japan amounts to US$124 million in 2019. As seen from Figure 4.1.2, the amount of FDI in Mongolia from Japan shows an upward trend since 2014, although it has fluctuated. On the other hand, the number of registered Japanese companies are shown in Figure 4.1.3. In recent years, the registered number in 2018 is the largest at 38.



Source: NDA and National Statistical Information Services, NSO

Figure 4.1.2 Foreign Direct Investment from Japan



Source: NDA
Note: The number of registered companies in 2019 is as at the end of June 2019.

Figure 4.1.3 Number of Registered Japanese Companies

As shown in Table 4.1.8, Mongolia exports raw materials such as stone (fluorspar) and animal hair, wool, apparel and clothing products, animal internal organs, mechanical appliances and parts, pet food and so on. The share of the exports in the top 10 code accounts for more than 90% of the total exports in 2019. The export value of apparel products has gradually increased in the recent years. Also, that of pet food has sharply increased in 2018 and 2019.

Table 4.1.8 Exports of Products from Mongolia to Japan

Unit: US$ Thousand

Code	Product	2015	2016	2017	2018	2019
Total	**All products**	**54,333**	**17,524**	**37,943**	**32,402**	**22,434**
'25	Salt; sulphur; earths and stone; plastering materials, lime and cement **(mainly, fluorspar)**	3,519	3,019	3,399	3,217	5,284
'61	Articles of apparel and clothing accessories, knitted or crocheted	1,954	2,537	3,235	4,543	3,979
'05	Products of animal origin, not elsewhere specified or included (mainly, guts, bladders and stomachs of animals)	1,383	2,012	1,566	1,645	3,325
'62	Articles of apparel and clothing accessories, not knitted or crocheted	1,206	1,468	2,383	3,756	2,926
'51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	1,274	1,708	1,479	2,337	1,818
'84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	1,287	1,560	1,994	2,438	1,309
'76	Aluminum and articles thereof	1,158	2,048	2,465	4,177	1,283
'99	Commodities not elsewhere specified	1,850	1,055	2,320	528	474
'57	Carpets and other textile floor coverings	497	256	328	318	440
'23	Residues and waste from the food industries; prepared animal fodder **(mainly, dog or cat food)**	8	49	6	267	310
Sub-total in the Top 10 based on the order in 2019		**14,136**	**15,712**	**19,175**	**23,226**	**21,148**
Share (%) in the Top 10		**26.0**	**89.7**	**50.5**	**71.7**	**94.3**

Source: ITC calculations based on UN Comtrad Statistics

As shown in Table 4.1.9, from Japan, Mongolia imports vehicles, machinery, rubber products (tyre), precision and medical products, electrical machinery and equipment, cosmetic preparation, iron or steel

products and so on. The share of the imports in the top 10 code accounts for almost more than 95% of the total imports between 2015 and 2019.

Table 4.1.9 Imports of Products to Mongolia from Japan

Unit: US$ Thousand

Code	Product	2015	2016	2017	2018	2019
Total	**All products**	**250,820**	**277,887**	**357,119**	**517,761**	**583,197**
'87	Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	171,355	172,706	228,979	368,428	375,662
'84	Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof	15,002	18,288	28,170	42,840	107,986
'40	Rubber and articles thereof (mainly tyre)	10,964	14,488	17,630	23,912	27,493
'89	Ships, boats and floating structures	21,094	44,630	48,261	24,255	20,426
'99	Commodities not elsewhere specified	3,354	3,025	5,462	9,609	9,570
'90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical ...	7,980	4,509	5,337	14,252	7,677
'85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television ...	2,249	3,651	2,303	4,651	4,793
'33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations	1,448	2,169	3,237	4,698	4,099
'73	Articles of iron or steel	2,464	653	1,218	1,375	2,637
'96	Miscellaneous manufactured articles	908	1,657	1,902	2,529	2,503
Sub-total in the Top 10 based on the order in 2019		**236,818**	**265,776**	**342,499**	**496,549**	**562,846**
Share (%) in the Top 10		**94.4**	**95.6**	**95.9**	**95.9**	**96.5**

Source: ITC calculations based on UN Comtrad Statistics

Based on the figures and tables above, FDI from Japan and imports from Japan to Mongolia have increased in recent years, but the large impact from EPA is not yet seen. As for exports to Japan, the total amount shows a downward trend from 2017 to 2019, although custom duties are exempted for some products through EPA. This is partially because the imports of meat (except horse meat) are still restricted by the Act on Domestic Animal Infectious Diseases Control of Japan and it is not easy for Mongolia to introduce HACCP and the appropriate heat treatment system to meet requirements of the food markets in Japan. However, exports of mechanical appliances and parts keep certain amount in recent years, those of pet food has sharply increased in two years, and those of dairy product, honey and juice of sea buckthorn (sea berry) are under planning.

4.1.3 Existing free trade zones and industrial parks

(1) Free trade zones (FTZs)

As shown in Table 4.1.10, there are three free trade zones (FTZs) in Mongolia: (i) Altanbulag FTZ, (ii) Zamyn-Uud FTZ and (iii) Tsagaan nuur FTZ, regulated under the Law on Free Zone of Mongolia 2015. Also, the development of a new FTZ (Khushgiin Khundii FTZ) near the New Ulaanbaatar International Airport (NUBIA) is taken into consideration. Each FTZ office is under the Deputy Prime Minister's Office.

Altanbulag FTZ is located in the northern part of Mongolia with a planned area of 500 ha. It is adjacent to the Khiagt border port of Russia, 335 km away from the capital city of Ulaanbaatar and 25 km away from the Sukhbaatar city of Selenge Aimag.

Zamyn-Uud FEZ (free economic zone) is located in the southern part of Mongolia next to the border port town of Zamyn-Uud in Dornogovi Aimag. It is situated 780 km from Ulaanbaatar, 230 km from Sainshand, the capital of Dornogovi Aimag, and 8 km from the Erlian town of China. The area size of the zone is 900 ha. The Law on the Legal Status of the "Zamyn-Uud" FEZ envisages to develop the zone with three major sections: industrial, commercial, and tourism.

Tsagaannuur FTZ is located in the northwestern part of Mongolia and at 1,700 km from Ulaanbaatar,

65km from the Bayan-Ulgii city, 28 km from Russian borders entry point. The zone is also found to be on the Euro-Asian international highway and covers land area of 708.4 ha.

Table 4.1.10 List of Free Trade Zones

Name of FTZ	Location and Area size	Number of registered establishments and employees	Direction for development and key targeted sector
Altanbulag FTZ 	Located in Selenge Aimag with 500 ha land, 335km from UB city and 25km from Sukhbaatar city of Selenge Aimag; It borders on Buryats, Russia with its northern part.	17 registered companies 34 employees	Full utilization of the potential as a gateway and a corridor connecting Mongolia and Russia. Promote of industry such as construction materials (wood products etc.), trade, tourism and services.
Zamiin Uud FTZ 	Zamiin-Uud FTZ is located in Dornogobi Aimag with 900 ha land, 780km from UB city, 230km from Sainshand Soum, and 5km from Erlian (Erenhot) city, China.	The FTZ has not been officially opened. Currently, 58 companies (about 115 ha in total) have obtained their approvals to run their businesses in the FTZ.	Full utilization of the potential as a gateway and a corridor connecting Mongolia and China. Development of an industrial hub and commercial and logistics centers through Foreign Direct Investment (FDI) and foreign trade. Promotion of tourism activities.
Tsagaannuur FTZ 	Tsagaannuur FTZ is located in Bayan-Ulgii Aimag with 708.4 ha land.	7 registered companies 18 employees	Full utilization of the potential as a gateway of Western Mongolia and cross border area in Mongolia, Russia and Kazakhstan Promotion of trade, tourism and light industries

Source: Deputy Prime Minister's Office

According to the Law on Free Zone 2015, "goods imported to the FTZs and goods exported from the FTZs" are not subject to taxation including value added tax (VAT). Also, corporate income tax (CIT) is exempted for five years under the conditions of the investment amount and type of economic sector such as manufacturers of export and import-substituting goods. Moreover, foreign labor force quota ratio is not applicable for companies employing foreign individuals in FTZs.

Currently, three FTZs are not yet fully opened although a few companies have started the operation in Zamyn-Uud FTZ. The support and development of FTZs (the existing three FTZs plus a new FTZ in NUBIA) is designated as a project in the Long-term Development Policy 2050 in Mongolia. Also, a new FTZ in NUBIA is included in AeroCity Master Plan by MCUD and Ulaanbaatar Municipality.

(2) Industrial parks

Beside FTZs, there are several industrial parks in Mongolia. Table 4.1.11 shows industrial parks in the surrounding area of Ulaanbaatar. Each park has a feature in terms of the located enterprises. In Sainshand, the development plan for new industrial park or a heavy industrial complex, which includes an oil refinery and coal gasification power plant, is being prepared by an American engineering company.

As for Emeelt Light Industry and Technology Park, the negotiation between the leather industries group and the Ulaanbaatar city government is not progressing partly due to the cost sharing.

Table 4.1.11 Industrial Parks in Surrounding Area of Ulaanbaatar

Name of industrial park	Area (ha)	Location, distance from Ulaanbaatar	Year of establishment	Number of operating/ registered enterprises	Key targeted subsector/ type of industry
Emeelt Light Industry and Technology Park	160 (36 separate lots)	Khan-Uul district, 30 km west of UB	2015	-	Light industry such as leather(tanneries), wool, and cashmere. One of the objectives is to relocate leather industries operating in UB, which is the main cause of water contamination.
Nalaikh Construction Material Production, Technology Park	120	Nalaikh district, 35 km east of UB	2014	16 (including 2 foreign enterprises)	Iron, copper, reinforced concrete, dry admixture and others
Baganuur Industrial Technology Park	414	Baganuur district, 130 km east of UB	2015	6	Plants, Nanobiotechnology factory, and others

Source: Ministry of Food, Agriculture and Light Industry
Note: UB stands for Ulaanbaatar

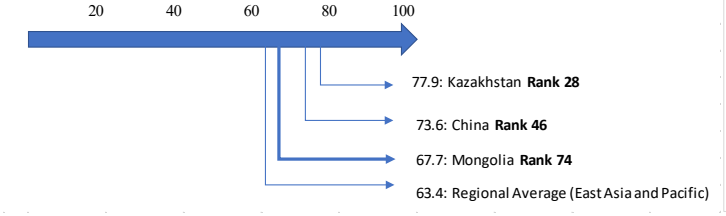
(3) Agro-IT park

The concept of the Agro-IT park initially aims to consolidate the processing business in four different sectors of vegetable, cashmere/wool/leather, meat products, and dairy products to provide an efficient production and logistics environment. About 40 candidate sites were initially selected. However, in site selection, basic factors such as infrastructure, transportation and balance in location in the whole Country were not fully considered. The concept of the Agro-IT park development should be carefully reviewed from the viewpoint of agro-supply chains including applicable technology and machine/equipment. A few Agro-IT park may be implemented early after establishment of viability from regional development points of view.

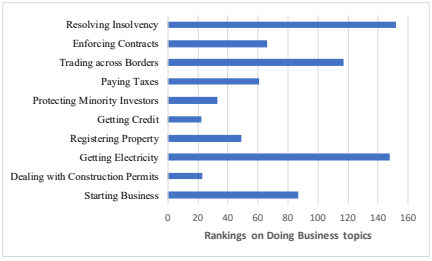
4.1.4 Business environment

(1) Ranking in doing business

Mongolia's ranking in doing business by the World Bank went down from 62 in 2018 to 74 in 2019, although the point is more than the regional average for East Asia and Pacific, as shown in Figure 4.1.4. By topic or criterion as shown in Figure 4.1.4 (b), "Getting credit," "Dealing with construction permits," and "Protecting minority investors" show relatively high ranks. On the other hand, "Resolving insolvency," "Getting electricity," and "Trading across borders" show low ranks.



(a) Ranking in the total



(b) Rankings on Topics

Source: World Bank, Mongolia Doing Business 2019

Figure 4.1.4 Ranking in Doing Business

(2) JICA survey

The Enterprise Survey conducted in the JICA's Data Collection Survey on the Regional Comprehensive Development in Mongolia in 2016, which covered 160 private companies including industry associations, shows the business environment in Mongolia as summarized in Table 4.1.12. The similar comments are given by the Mongolian National Chamber of Commerce and Industry (MNCCI) through interviews on April 2019.

Table 4.1.12 Problems Associated with Business Environment Identified by JICA Survey

1. Overall problems for industry as a whole (i) Unbalanced and lopsided industrial structure depending on specific limited sectors and regions (fragile manufacturing foundation, inefficient industrial dispersion); (ii) Heavy dependence on imports (raw materials, parts, final products, consumer goods, etc.); (iii) Comparative disadvantages in foreign direct investment other than mining (high logistics cost, limited domestic supply of raw materials); (iv) Limited industrial human resources (discipline, skills, craftsmanship, high quality know-how); (v) Difficulty in access to finance (high loan interest rate, lending period and conditions).
2. Problems for industrial promotion in priority sectors (i) Limited interaction and linkage between agro-livestock sectors and related processing sectors (difficulties in efficient procurement of raw materials); (ii) Weak foundation of supply chain development, delay in scale of economy (productivity, technology transfer/adoption, market development); (iii) Delay in value-added (export of raw materials, import of finished goods); (iv) Delay in upgrading processing in the mining sector; (v) Limited utilization of existing industrial resources.

Source: JICA's Data Collection Survey on the Regional Comprehensive Development in Mongolia in 2016

(3) World Bank survey

Some problems or constraints to private enterprises identified by the World Bank's Enterprise Survey (2013) are also shown in Table 4.1.13. According to this survey, as for infrastructure indicators, the high proportion of electricity from own generators and delay in obtaining an electrical connection are indicated as constraints. As for innovation and technology, percentages of firms that introduced a new product/service and firms that introduced a process innovation are low compared to the average of the East Asia and Pacific countries, while percentages of firms having their own web sites and firms using e-mail to interact with clients/suppliers are higher than the average of the East Asia and Pacific countries.

In foreign trade, percentages of firms exporting directly or indirectly (at least 10% of sales) and firms exporting directly (at least 10% of sales) are low compared to the average of the East Asia and Pacific countries. Moreover, 19.3% of firms identifies customs and trade regulations as a major constraint. This ratio is much higher than the average (12.0%) of the East Asia and Pacific countries.

As for workforce, 22.8% of firms identified an inadequately educated workforce as a major constraint. This ratio is much higher than the average (13.9%) of the East Asia and Pacific countries, although 60.9% of firms offers formal training in Mongolia, which is nearly double compared to the average (32.2%) of the East Asia and Pacific countries.

Table 4.1.13 Several Indicators Discovered through Enterprise Survey by World Bank

Indicators	Country/Region	
Firm Characteristics	Mongolia	East Asia & Pacific
Age of the establishment (years)	10.5	15.6
Proportion of private domestic ownership in a firm (%)	92.9	86.0
Percent of firms with at least 10% of foreign ownership	8.1	13.5
Percent of firms with at least 10% of government/state ownership	0.1	0.6
Percent of firms with an internationally-recognized quality certification	15.9	12.4
Infrastructure	Mongolia	East Asia & Pacific
Percent of firms experiencing electrical outages	38.4	45.9
Number of electrical outages in a typical month	1.0	4.9
If there were outages, average duration of a typical electrical outage (hours)	11.6	4.3
If there were outages, average losses due to electrical outages (% of annual sales)	2.1	3.2
Percent of firms owning or sharing a generator	22.8	32.5
If a generator is used, average proportion of electricity from a generator (%)	49.2	25.8
Days to obtain an electrical connection (upon application)	93.9	22.2
Percent of firms identifying electricity as a major constraint	10.8	15.5
Percent of firms experiencing water insufficiencies	4.3	10.6
Proportion of products lost to breakage or spoilage during shipping to domestic markets (%)	2.9	1.4
Innovation and Technology	Mongolia	East Asia & Pacific
Percent of firms using technology licensed from foreign companies	17.8	17.7
Percent of firms having their own Web site	51.0	36.5
Percent of firms using e-mail to interact with clients/suppliers	64.0	60.0
Percent of firms that introduced a new product/service	23.7	26.4
Percent of firms that introduced a process innovation	35.5	38.1
Percent of firms that spend on R&D	16.1	14.4
Foreign Trade	Mongolia	East Asia & Pacific
Days to clear direct exports through customs	10.2	7.1
Percent of firms exporting directly or indirectly (at least 10% of sales)	10.7	13.3
Percent of firms exporting directly (at least 10% of sales)	5.0	9.6
Proportion of total sales that are exported directly (%)	4.2	6.5
Days to clear imports from customs	11.8	10.0
Percent of firms using material inputs and/or supplies of foreign origin	39.7	41.1
Proportion of total inputs that are of foreign origin (%)	24.6	25.8
Percent of firms identifying customs and trade regulations as a major constraint	19.3	12.0
Workforce	Mongolia	East Asia & Pacific
Percent of firms offering formal training	60.9	32.2
Proportion of workers offered formal training (%)	65.8	66.8
Years of the top manager's experience working in the firm's sector	15.7	15.4
Proportion of permanent workers (out of all workers)	84.0	94.9
Proportion of temporary workers (out of all workers)	16.0	5.1
Proportion of production workers (out of all permanent workers)	70.8	75.7
Proportion of skilled workers (out of all production workers) (%)	66.0	77.4
Percent of firms identifying an inadequately educated workforce as a major constraint	22.8	13.9

Source: Enterprise surveys: Mongolia Country Profile 2013, Washington, DC: World Bank Group.
http://www.enterprisesurveys.org/data/exploreeconomies/2013/mongolia

4.1.5 Human resources development for industry sector

Quantity and quality of human resources are decisive factors to determine possibilities and types of industrial development. As of 2019/20, there are 175 universities, institutes, colleges and technical and vocational schools in Mongolia as shown in Table 4.1.14.

Table 4.1.14 Number of Universities, Institutes, Colleges, Technical and Vocational Schools in Mongolia

Unit: Number

Classification of educational institutions	2016/2017	2017/2018	2018/2019	2019/2020
Universities, institutes, colleges, technical and vocational schools (Total)	**181**	**179**	**180**	**175**
Public:	67	68	69	71
Technical and vocational schools	50	50	51	50
Institutes and colleges	4	4	4	7
Universities	13	14	14	14
Private:	110	108	108	101
Technical and vocational schools[1]	36	33	35	30
Institutes and colleges	56	54	52	50
Universities	18	21	21	21
Foreign affiliated institutes which perform operations in Mongolia	4	3	3	3

Source: Mongolian Statistical Yearbook 2019, National Statistical Office of Mongolia

In Mongolia, the formal technical and vocational education and training (TVET) programmes are delivered by Vocational Training and Production Centres (VTPC), polytechnic colleges, and some higher educational institutions as shown in Table 4.1.15. These institutions provide two distinct programmes: vocational education and technical education. Vocational education programmes are designed to train skilled workers. On the other hand, technical education programmes have aimed to prepare mid-career professionals such as mechanics, technicians, accountants and so on. In recent years, an alternative type of technical education institutions adopting Japanese "Kosen" has been established, namely, Institute of Engineering and Technology (IET), Institute of Technology of Mongolian University of Science and Technology (MUST) and New Mongol Institute of Technology. These Kosen institutions are classified as higher educational institutions.

Table 4.1.15 Vocational Education and Training Institutions in 2018/2019

	Vocational Training and Production Centers (VTPCs)		Polytechnic colleges		Higher education institutions		Vocational training providers	Kosen	
	state-owned	private	state-owned	private	state-owned	private	private	state-owned	private
Vocational Education and Training institutions	27	25	14	4	10	6	712	1	2
Total enrolment of which	11,135	5,125	12,028	4,407	4,549	1,282	n/a	130	597
• in Technical education	-	80	2,765	1,097	2,668	223		130	597
• in Vocational education	9,960	4,841	8,466	3,258	967	1,059			
• in Vocational training	1,175	204	797	52	914	-			
Total number of Teachers	746	209	777	184	481	72	n/a	14	71

Source: TVET policy Review 2019, United Nations Educational, Scientific and Cultural Organization (UNESCO) and Ministry of Labour and Social Protection (MLSP)

The current enrolment by economic sector and program type in vocational education and training institutions are shown in Table 4.1.16. These data show that 77% (28,551 divided by 37,039) of students attend vocational education programs for skilled workers. As for economic sector, the program for manufacturing sector holds the largest number of enrolment, followed by construction, transportation and mining.

Table 4.1.16 Enrolment of Vocational Education and Training Institutions by Economic Sector and Program Type, 2018/2019

Economic sectors	All	Technical education	Vocational education	Vocational training
Manufacturing	10,401	1,402	8,683	316
Construction	7,135	814	6,057	264
Transportation	4,269	921	3,316	32
Mining	2,519	457	1,905	157
Service	2,254	231	1,952	71
Health	2,033	1,863	170	
Art & culture	2,032	404	1,628	
IT	1,738	164	1,574	
Agriculture	1,559	277	1,282	
Emergency & security	1,064		249	815
Tourism and environment	854	85	769	
Commerce & finance	547	73	474	
Energy	277	87	190	
Education	155	55	100	
Mail and communication	101		101	
Urban development	101		101	
Total	37,039	6,833	28,551	1,655

Source: TVET policy Review 2019, United Nations Educational, Scientific and Cultural Organization (UNESCO) and Ministry of Labour and Social Protection (MLSP)

Table 4.1.17 shows the number of graduates and careers after graduation in the three Kosen institutions in 2019 and 2020. It should be noted that the graduates have three options: (i) finding a job in Mongolia, (ii) finding a job in foreign countries and (iii) continuing study in university or abroad.

Table 4.1.17 Number of graduates and careers after graduation in the Kosen institutions

Institute of Engineering and Technology (IET)			Institute of Technology of Mongolian University of Science and Technology (MUST)			New Mongol Institute of Technology		
	2019	2020		2019	2020		2019	2020
Number of graduates in total	**64**	**32**	**Number of graduates in total**	**25**	**26**	**Number of graduates in total**	**53**	**40**
Architectural engineering	26	6	*Electrical and electronic engineering*	12	12	*Civil & architectural engineering*	20	7
Mechanical engineering	15	10	*Civil & architectural engineering*	13	7	*Electrical and electronic engineering*	8	15
Electrical and electronic engineering	23	13	*Mechanical engineering*		7	*Mechanical engineering*	11	12
Biotechnology engineering		3				*Chemical engineering*	14	6
Number of graduates employed in total	**41**	**20**	**Number of graduates employed in total**	**6**	**6**	**Number of graduates employed in total**	**23**	**17**
In Mongolia	19	10	In Mongolia	2	4	In Mongolia	11	8
Type of industries	Construction, Electrical machine, Machinery and		*Type of industries*	Construction, Mining and Repairing		*Type of industries*	Construction, Telecom, IT and Financial organization	

	IT							
Overseas	22	10	Overseas	4	2	Overseas	12	9
Number of graduates proceeding to university including study abroad	**18**	**11**	**Number of graduates proceeding to university including study abroad**	**19**	**20**	**Number of graduates proceeding to university including study abroad**	**29**	**18**

Source: JICA Project Team based on the data from Kosen institutions

As for university level, the Higher Engineering Education Development Project (MJEED) has been implemented since 2014 by a Japanese ODA loan in the two main Mongolian universities, namely, National University of Mongolia (NUM) and Mongolian University of Science and Technology (MUST). The objectives of this project are to cultivate human resources in engineering through enhancing the quality and expanding the quantity of engineering education and research in the universities and to contribute to sustainable development of industry. The main components of the project are: (i) improvement of curriculum and syllabus for engineering education, (ii) strengthening of research and education capacity of faculties program, (iii) Kosen fellowship program for studying at Kosen in Japan and (iv) procurement of educational and research equipment and renovation of facilities. As of the beginning of 2021, 773 students and researchers have been involved in the project.

4.1.6 Regional distribution of manufacturing and construction enterprises

As shown in Table 4.1.18, the enterprises/organizations are highly concentrated in Ulaanbaatar and only a few Aimags. For example, more than 70% of enterprises/organizations in industry sector (a total of manufacturing and construction sector) concentrated in Ulaanbaatar. Currently, clear announcement of preferred investors, sub-sectors and regions are not fully made, but prioritized industries are indicated by NDA (Table 4.1.20). NDA is now conducting a study for evaluation of the optimum locations for several sub-sectors such as leather, wool, cashmere, dairy industry, meat industry and so on. A logical next step is to introduce region and sector specific investment promotion and incentive system to achieve a more balanced distribution of industries in the whole Country.

Table 4.1.18 Distribution of Active Enterprises/Organizations in the Country as of June 2019

Unit: Number of active enterprises/organizations

Region/Aimag	**Manufacturing**	**Construction**	**Sub-total**	**Share (%)**	**All sector**	**Share (%)**
Western	**715**	**237**	**952**	**7.1**	**7,438**	**8.4**
Bayan-Ulgii	**202**	**70**	**272**	**2.0**	**1,701**	**1.9**
Gobi-Altai	62	32	94	0.7	862	1.0
Zavkhan	139	28	167	1.3	1,392	1.6
Uvs	141	49	190	1.4	1,492	1.7
Khovd	171	58	229	1.7	1,991	2.2
Khangai	**843**	**436**	**1,279**	**9.6**	**9,112**	**10.3**
Arkhangai	105	37	142	1.1	1,114	1.3
Bayankhongor	122	85	207	1.6	1,313	1.5
Bulgan	90	31	121	0.9	1,192	1.3
Orkhon	203	149	352	2.6	2,375	2.7
Uvurkhangai	131	64	195	1.5	1,383	1.6
Khuvsgul	192	70	262	2.0	1,735	2.0
Central	**660**	**345**	**1,005**	**7.5**	**9,789**	**11.0**
Govisumber	22	11	33	0.2	376	0.4
Darkhan-Uul	207	124	331	2.5	2,208	2.5
Dornogovi	52	58	110	0.8	1,203	1.4
Dundgovi	38	16	54	0.4	673	0.8
Umnugovi	122	62	184	1.4	1,680	1.9
Selenge	134	37	171	1.3	2,313	2.6
Tuv	85	37	122	0.9	1,336	1.5
Eastern	**213**	**106**	**319**	**2.4**	**3,523**	**4.0**

Dornod	105	61	166	1.2	1,603	1.8
Sukhbaatar	36	18	54	0.4	803	0.9
Khentii	72	27	99	0.7	1,117	1.3
Ulaanbaatar	**3,977**	**5,809**	**9,786**	**73.4**	58,993	**66.4**
Total	**6,408**	**6,933**	**13,341**	**100.0**	**88,855**	**100.0**

Source: National Statistics Office

4.1.7 Important issues of industry sector

From the analysis on existing conditions of industrial sector described above, more important characteristics of the industrial sector are identified as follows:

a) Small manufacturing sector with respect to GDP contribution and employment generation,
b) Limited and undiversified export products of manufacturing,
c) Relatively high backward and forward linkages of manufacturing as well as construction and utilities, while mining with small backward linkage does not induce other industries,
d) FDI heavily concentrating on mining with 70% share, while manufacturing FDI has a share of 1.5%,
e) Only a few FTZs operational with limited companies established, and concentration of operational industrial parks in Ulaanbaatar and its vicinities,
f) Business environment undermined by electricity supply, financial and institutional constraints related to external trade, and underdeveloped industrial structure itself, and
g) Limited human resources of high-quality suffering from limited employment opportunities due to the underdeveloped industrial sector.

These characteristics have been discussed at meetings of the Project Working Group (PWG) members and others. Also, a very skewed distribution of manufacturing activities with the majority taking place in Ulaanbaatar has been noted by many. The NCDP addresses the following issues to promote regional development for more balanced and diversified development of Mongolian economy.

(a) Planning for promising industrial clusters based on agriculture and livestock with promotion measures including high value-added and research for product development, and market development for exports;
(b) Development of the free trade zones and the border areas of the neighboring countries;
(c) Maximum utilization of potentials for value-added processing of existing mining products and linkage among economic sector;
(d) Development of import substituting and technology development in manufacturing sector;
(e) Measures for skill training linked to employment generation and job matching; and
(f) Support of setting up information and incubator centers in collaboration with relevant professional association.

Each issue is described below.

(1) Planning for promising industrial clusters

As discussed in the SDV2030/Vision2050, it is an important issue to introduce advanced methods, technology and innovations, and increase productivity through organizing export-oriented processing industry clusters including processing of leather, wool and cashmere. Relating to this issue, the Action Program for the "National Production" for 2016-2020 also stresses the need to create a system for stacking and transporting wool, cashmere and rawhide in order to secure a sustainable supply to national industries and set up a raw materials reserve.

Currently NDA is conducting a study for evaluation of the optimum locations for several sub-sectors such as leather, wool, cashmere, dairy industry, meat industry, flour industry, iron ore industry, coal industry, copper industry, and oil industry using indicators such as "volume of raw materials,"

"population and labor force," and "access to road" in all Soums. The result of this study may to be helpful for development of industrial clusters.

(2) Development of free trade zones and border areas

Free trade zones or special economic zones such as Altanbulag FTZ, Zamyn-Uud FTZ, Tsagaannuur FTZ and the new zone near the New Ulaanbaatar International Airport will play an important role to boost economic development in the Country through introduction of foreign and domestic investors with maximum use of tax and non-tax incentives.

Some issues to be discussed for development of free zones are (i) selection of the targeted type of FTZ/SEZ in each zone in consideration of functions expected at each zone and balanced distribution of locations in the whole Country, (ii) measures to promote investors, (iii) management and implementation arrangements such as management contract, public private partnership (PPP) or others, and (iv) linkages with local resources as raw materials, locally based manufacturers including SMEs, logistics, ICT and service industries.

(3) Value-added processing of existing mining products for linkages among economic sector

Based on the analysis of industrial linkages by using the 2015 input-output table, the linkages of mining sector with other sectors are not currently strong as discussed in 4.1.2 (6), although mining commodities such as coal, copper ore and iron ore, gold, copper account for most of the total exports and the large share of GDP. Therefore, value-added processing of existing mining and other products are indispensable for development of industry sector.

(4) Development of import substituting and technology development

Mongolia imports mineral fuels, machinery and equipment, vehicles, electric appliances such as recorders, TV sets and spare parts, iron and steel, plastics, pharmaceutical products, food products and so on since the accumulation and variety of industry are small due to historical background of the planned economy and the small domestic market. However, among these products, plastic products, rubber, furniture, food, beverages and soap seem to be promising commodities for import substitution. In particular, development of food industries with (i) introduction of the advanced technology, (ii) enhancement of competitiveness, and (iii) increase of the domestic supply is expected by the SDV2030. Important conditions to realize these potentials are value added products development by introduction of relevant technology and markets development to diversify export markets.

(5) Skill training linked to employment generation and job matching

The Action Program for the "National Production" for 2016-2020 indicated the need of (i) capacity-building, training and retraining system for light industry and SMEs and (ii) implementation of a "Qualified Worker" program. Curriculum reforms in both technical vocational education and training (TVET) and higher education will be needed to promote job-matching and skill-matching.

According to the Enterprise Survey conducted as part of the JICA's Data Collection Survey on the Regional Comprehensive Development in Mongolia in 2016, the factor of "limited industrial human resources (discipline, skills, craftsmanship, high quality know-how)" is pointed out as critical. Also, the World Bank Enterprise Survey in 2013 indicates that 22.8% of firms identified an inadequately educated workforce as a major constraint for business.

Directors of Kosen institutions adopting Japanese Kosen system state that the graduates from Kosen do not have enough opportunities to obtain an appropriate job due to a weak accumulation of manufacturing and engineering industries in Mongolia. Also, the curriculum of Kosen institutions, which is almost equivalent to that of the undergraduate level of universities, are not well understood among the private sector.

Furthermore, the TVET Country Profile 2020 in Mongolia by UNESCO stipulates the challenges facing the TVET sector as shown in Table 4.1.19.

Table 4.1.19 Challenges Facing the TVET Sector

Inter-sectoral coordination and partnership	There has been involvement of private sector and professional associations at the management level of TVET sector, but there has been an insufficient joint effort, and inter-sectoral coordination in the regular operations.
Accurate forecasting of labor force supply and demand and proper matching	There is still insufficient information regarding the career choice, demand-based enrolment and the proper identification of needs of skilled workers. To counter this, the following strategies are under discussion: • An online information database should be established to ensure accurate forecasting and matching of labor force supply and demand. This database should contain real-time information including job openings, skills and qualification needs, TVET institutions courses and qualifications offered, learners, teachers, graduates, skills profile and the latest changes; • Policy cohesion and inter-ministerial cooperation should be promoted on advocating career related information and career guidance among general public.
TVET institutions reform	There are number of challenges to reforming TVET institutions. These include: • Development and implementation of policies and guidelines for specialization and development of TVET institutions in cooperation with the relevant ministries and private sector. These policies and guidelines need to be consistent with the regional development policy and industrial development plans. • Implementing a specialization policy to make TVET delivery cost-effective, regions accessible and to limit training duplication and to expand learning opportunities; • Inadequate quality of industrial practical training; • Limited investment and resource allocation to conduct research and upgrade training materials, equipment and tools of TVET institutions.
Reform on improving curriculum and the methodology of TVET training	Developing and implementing the training standard, curriculum and "Occupational Directory" for common occupations needs to be reconsidered to: • Ensure the autonomy of Regional Methodological Centers, capacity development, research on training content and methodology, facilitate the provision of methodological support to TVET institutions and its teaching staff; • Counter the limited access and quality of training textbooks and materials, through the use of digital forms of training resources; • Seek new solutions to introducing flexible curriculum, short-term training modalities aligned with emerging needs of employers; • Promote and expand the highly demanded short-term (1 year) vocational training programs.

Source: TVET Country Profile 2020 in Mongolia, UNESCO

(6) Information and incubator centers in collaboration with professional associations

The Action Program for the "National Production" for 2016-2020 indicates support for setting up information and incubator centers in collaboration with relevant professional associations to provide counseling, information sharing and training for private enterprises. Information and incubator centers can contribute to activation and diversification of industrial activities in the whole Country.

4.1.8 Existing institutions and policy for industry sector

(1) Institutions for industry sector development

MOFALI is the prime institution for development of light industries such as wool and cashmere industry,

leather industry, textile, wood industry, printing and electric appliances, packaging, building materials and reprocessing industry and promotion of SMEs.

The Ministry of Mining and Heavy Industry (MMHI) oversees mining and heavy industries related to coal, oil, copper, gold and other minerals. Currently several large-scale projects such as coal processing plant, oil refinery plant by an Indian fund, copper processing and smelting plant, and gold refinery plant are in progress under this ministry.

NDA, established as a government regulatory agency with the aim to ensure the Country's economic stability and to develop and implement the integrated socio-economic and investment policy, supports industrial development as a whole and foreign investment promotion.

In February 2019, "One-stop-service center" (OSSC) started to provide the consolidates services of registration, customs, taxation, and immigration as well as other relevant public services to foreign investors. As for free trade zones, the Deputy Prime Minister's Office is responsible for the policy formulation and development planning.

(2) Policy related to industry in the SDV2030

The SDV2030 has established policies, objectives and targets for sustainable development under sound macro-economic policies by realizing economic diversity with agriculture and livestock, industry especially light and food industries, various processing industries, tourism, mining and extractive industries as well as energy and infrastructure sectors. Development policies related to the industrial sector in the SDV2030 are summarized in Table 4.1.20.

Table 4.1.20 Development Policies Related to Industry Sector in SDV2030

Sector	Policies
Industry	1) To increase production, processing and export of manufacturing products 2) To develop export-oriented industrial clusters by applying advanced technology for products development 3) Introduce advanced technology in food industry, improve competitiveness against imported food products and increase domestic supply of main food products and healthy and safe food products 4) Develop chemical industry for quality fuel products
Energy	3) To ensure stable and reliable supply of energy to meet domestic demand fully 4) To increase supply of renewable energy
Infrastructure	1) To improve road and railway systems and develop logistic centers to serve agricultural, industrial and mining sectors

Source: SDV2030

(3) Existing policies, plans and programs for industry sector

Existing development policies, plans and programs for industry sector are summarized below.

State Industry Policy 2015

(a) Improve the legislation of the industrial sector and to create the optimal conditions for manufacturing;
(b) Determine the industrial development regions and develop the "General industrial plan and layout of Mongolia" coordinating with the policy of ecosystem, population density and settlements, raw materials' resources and infrastructure;
(c) Determine the priority industrial mainstreams to plan for manufacturing clusters, free trade zones, industrial and technology parks, and transportation and logistics' network in an integrated manner, and to implement them;

(d) Support socio-economic efficient factories that are based on advanced techniques, high technology and innovation by investment and financial policy;
(e) Support efficient State, science and business collaboration in industrial sector;
(f) Prepare skilled human resources of the industrial sector; and
(g) Create optimal conditions for trade and to diversify the export.

In accordance with this policy, top priorities of industry to create the knowledge and skill driven manufacturing of high value-added products and services from agricultural raw materials and mining industry are shown in Table 4.1.21.

Table 4.1.21 Top Priority Industries According to State Industry Policy 2015

Heavy industry	Light industry	SMEs
- Oil production - Coal chemical production - Coke chemical production - Copper smelting - Steel production - Cement industry	- Leather and hide production - Cashmere production - Wool production - Wood production	- Dairy production - Construction material production - Food production - Bio preparations - Information technology

Source: NDA, Your guide to invest in Mongolia 2017

Action Program for the "National Production" for 2016-2020

(a) Implement the industrialization program "21:100" and create favorable taxation, legal and business environment for priority export-oriented sectors to substitute imports as well as for SMEs, cooperatives, trade and services and increase the share of the value-added products in the GDP;
(b) Create a commodity price regulatory legal framework for agricultural goods and products.
(c) Implement flexible long-term investment and financial/loan policy for light industry, small and medium-size enterprises and cooperatives;
(d) Create a system for stacking and transporting wool, cashmere and raw hide in order to secure a sustainable supply to national industries and set up a raw materials reserve;
(e) Promote the development of trade and manufacturing at both the international trade zones and the border port areas of the neighboring countries;
(f) Develop capacity-building, training and re-training system for light industry and SMEs and implement a "Qualified Worker" program;
(g) Support setting up information and incubator centers in collaboration with relevant professional associations to provide counseling, information sharing and training to promote the development of light industry sectors;
(h) Promote putting up "development model" factories in light industry, SMEs through franchising and adapting foreign industries with advanced technologies;
(i) Strive to regularly host in Mongolia international exhibitions on leading and advanced techniques and technology in light industry and support manufactures' participation in exhibitions organized abroad on machinery, goods and products; and

Industrialization 21:100

Industrialization 21:100 was approved by the cabinet in late January 2018. The program will cover all sectors, except the mining, such as agriculture, light industry, construction and steel industries. Within the frame, 100 factories that will manufacture export-oriented and import-substituting products will be established. According to an initial estimate, the program will require approximately MNT 1.4 trillion investment, produce over six thousand workplaces and will be implemented in two phases from 2018 to 2019 and from 2019 to 2020.

(j) Render policy support by setting up a light industry park, promoting collaboration among the manufactures and registering clusters.

(4) Mongolia-Japan Economic Partnership Agreement (EPA)

The EPA agreed between Mongolia and Japan in May 2016 consists of 11 chapters covering topics such as trade in goods and services, customs procedures and trade facilitation, electronic commerce, investment protection, movement of persons, competition, protection of intellectual property, dispute resolution, and the improvement of the business environment.

To facilitate trade in goods between the two countries, the EPA removes or gradually decreases customs duties and taxes for certain goods and commodities. Specifically, Mongolia's tariff-related obligations under the EPA concerning the main import products from Japan are agricultural machinery, mining machinery, textile machinery and vehicles (new and nearly new, and older cars). On the other hand, Japan has the following obligations in relation to customs duties on Mongolia's main export products such as meat products (beef, lamb, horse, etc.), animal skins, metals, petroleum oils and vodka and other alcoholic beverages. As for beef, the Government of Japan will eliminate customs duties on certain beef products once Mongolia is officially recognized as foot and mouth disease free based on a risk assessment.

The EPA contains detailed rules on the protection of investment made by an investor from the other party. The protections afforded under the EPA are typical rules that are generally found in bilateral investment treaties. Both parties agreed to grant and ensure adequate, effective and non-discriminatory protection of intellectual property rights and provide measures for the enforcement of intellectual property rights against infringement in accordance with the EPA. The scope of protection extends to patents, industrial designs, trademarks, copyrights and related rights, geographical indications, unfair competition and undisclosed information.

The EPA aims to promote trade and investment flow between the two countries through liberalizing and facilitating trade in goods and services, facilitating the free movement of persons, increasing investment opportunities, and enhancing protection for investment and intellectual property. It also creates a framework for further cooperation between them to improve the general business environment.

(5) Laws related to industry sector

1) Law on Support of Manufacturing Industry

The purpose of this law is to regulate provision of State support and development of export-oriented and import substituting manufacturing activities. The law stipulates that the Government will support the manufacturing industries in the following measures; (i) to grant interest rate differences of loans approved by commercial banks for investment for technological innovations, (ii) to grant one time compensation, equal to but not more than 75% of expenses spent for research and development, (iii) to support export-oriented sector, and (iv) to set up the industry development fund aiming at financial support to manufacturing industries and so on.

2) SMEs Law

The purpose of this law is to define the policies and guidelines of the Country on the basis of small and medium enterprises and to determine measures and scope for their support and to ensure national economic development. Beside the legislation and definition of SMEs, the major components of the Law are (i) rights and duties of SMEs, (ii) policy and main directions of the Government to support SMEs, (iii) provision of support to SMEs entrepreneurs in business reforms, (iv) strengthening the foundation for SME management, and (v) improving the ability to adapt to the social and economic changes and to protect against risks.

3) Investment Law 2013

In 2013, the Government of Mongolia passed a new law on investment, which replaced both the old

Investment Law of 1993 and the Law on Strategic Sectors to attract foreign direct investments. The new Investment Law enables as open an investment environment as possible for investors focusing on:

- No approval needed to enter into market and buy a local company,
- No discrimination between foreign and local investors,
- Fast registration process,
- Stability guarantees: provision of tax stabilization certificates, and
- Flexibility and friendly conditions for investors.

As for investment types, the following are defined:

- Joint ventures and consortia,
- Mergers and acquisitions,
- Concession PPP, product sharing, and management contracts,
- Bond, securities and other assets,
- Financial leasing, and franchising, and
- Other investment types.

4) Free Zone Law

The purpose of this law are to provide for establishment of free zones determining their location, management powers, and control systems, and to establish the legal basis for taxes and special treatment of customs, entry/exit clearance, legislation of legal entities and individuals and employment to be adopted at free zones. Special treatments (incentives) of taxation in free zones are (i) exemptions from import tax, customs duty, VAT, and excise tax and (ii) exemption of cooperate income tax for five years or tax credit in accordance with the requirement of business type/subsector or investment amounts.

Table 4.1.22 shows the comparison of incentives in free zone or special economic zone among the selected countries. Tax incentives given in Mongolia are considered to be common. Considering the inland location of FTZs in Mongolia, introduction of other type of incentives such as decrease of the utility cost may be taken into consideration.

Table 4.1.22 Comparison of Tax Incentives Given in Free Zone or Special Economic Zone in Selected Countries

	Period of Exemption of Cooperate Income Tax (CIT)	Other incentives and remarks
Mongolia	**Entities using innovated and enhanced technology: 5 years, Businesses with invested amount of USD 300 thousand or more in manufacturers of export and import-substituted goods: CIT credit equal to 50% of their invested capital**	**Goods imported to FTZs are not subject to value added tax (VAT), customs and excise taxes.**
Kazakhstan	For the duration of a company's residence in a SEZ	Exemption of VAT (for goods fully consumed during performance of activities corresponding to purposes of creation of the SEZ and included in the list of goods established by the government of Kazakhstan), land tax and payment for the use of land plots and property tax
Russia	CIP may be reduced from 20% to 2% (for Manufacturing SEZs)	CIP may be reduced to 0% for Technology & Innovation and Tourism & Recreation SEZs. Property tax exemption for ten years; "Free customs zone"
China	2 years ("2 + 3 years," which means an exemption from tax for the first two years	For certain projects in basic infrastructure, environment protection and energy there is

	and tax at the rate of 12.5% for the next three years)	a "3+3" years tax holiday in the 5 SEZs in the South.
Korea	3 years (100% reduction for three years and 50% reduction for 2 years)	For manufacturing sector, 100% exemption of local tax (acquisition, registration, property taxes) for 15 year

Source: JICA Project Team based on Investment Guidebook 2019 by NDA, Doing Business Guide in Mongolia by PwC, the websites of investment promotion agencies, Free Zones, and SEZs in selected countries.
Note: SEZ stands for Special Economic Zone

4.1.9 Policy measures for industry sector as compared to general policy measures

Various policy measures have been taken in both developed and developing countries. They are largely common in many countries but measures successfully taken in a country are not necessarily applicable if transferred to another country. Applicability and transferability of different measures to the local setting of another country need to be evaluated carefully.

In Mongolia, many measures for industry sector have been introduced. Many of them are largely in line with the standard policy measures applied in other countries. Other measures may need to be additionally introduced or existing policy measures modified to make them effective in the context of Mongolia's industrial development.

The general policy measures for industrial sector are classified into seven categories: 1) Formulation of legal and policy framework, 2) Human resource development, 3) Strengthening and diversification of private firms, 4) Promotion of FDI and domestic investment including FTZ/SEZ development, 5) Value-chain development and strengthening of business linkage including industrial cluster, 6) Improved access to finance, and 7) Support of business start-up, incubation and innovation. Existing policies, current situations and development issues in Mongolia are described for each measure, and future direction and policy recommendations are presented in Table 4.1.23, where evaluation of existing policies are shown in bold letters.

Table 4.1.23 Comparison of General Policy Measures for Industrial Development and Existing Policies in Mongolia

Categories	General policy measures	Existing policies, current situations and development issues in Mongolia	Future direction and policy recommendations
1) Formulation of Legal and Policy Framework	Provision of necessary laws and regulations	**Necessary laws and regulations are already prepared.** However, as for FTZ development, detailed regulations are not fully prepared.	Provision of the detailed regulations including incentives for the FTZ development is needed.
	Designation or creation of lead ministry/agency for industrial development	Lead ministries for industrial development are divided into three ministries/agency such as MFALI, MMHI and NDA.	The consolidated ministry for industrial development may be needed from the viewpoint of the long-term perspective.
	Introduction of effective public-private partnership (PPP)	**Not yet be fully introduced.** Especially for FTZ/SEZ development, the government does not partner with private firms in financing and constructing infrastructure.	Introduction of PPP or equivalent scheme is needed at the national and Aimag levels in cooperation with MNCCI and private sector.
	Policy structure consisting of vision, roadmap and action plans	**Policies/strategies** such as Action Program for the National Production for 2016-2020 and the SDV2030 **are prepared**, but some of them are not implemented well.	The steady implementation of the action program and vision are needed.
	National standard for quality	**Being prepared, but not yet be fully developed.**	National standard for quality should be fully

Categories	General policy measures	Existing policies, current situations and development issues in Mongolia	Future direction and policy recommendations
			developed.
	Strategic mobilization of international cooperation	The number of countries signing of bilateral and multilateral trade agreements are increased. Mongolia is a member of WTO (World Trade Organization) since 1997. Economic Partnership Agreement (EPA) between Mongolia and Japan entered into effect in June 2016.	Strategic mobilization of international cooperation will be promoted.
2) Human Resource Development	Establishment of engineering universities and institutes	**Already established.**	N/A
	Establishment of polytechnics, industrial college and KOSEN	**Several schools are already established.** Some KOSEN and MJEED project have just generated graduates of their students. However, the level of skills of individuals does not match the level of skills required in the jobs.	The steady implementation of the Action Plan for the "National Production" for 2016-2020 is needed. Provision of assistance to SMEs for training of their employees is needed.
	Technical support in specialized skills for engineers	The Action Program for the "National Production" for 2016-2020 indicates the need of (i) capacity-building, training and retraining system for light industry and SMEs and (ii) implementation of a "Qualified Worker" program including curriculum reforms in both TVET and higher education to promote job-matching and skill-matching.	
	Technical Vocational Education and Training (TVET) for new and/or current workers		
	Subsidies and incentives for worker training		
	Skill certification and awards	**Not well introduced**	Skill certification and awards scheme should be introduced.
3) Strengthening & Diversification of Private Firms	Introduction of productivity tools (5S*2, QC circles, suggestion box, just-in-time system, etc.) <especially for SMEs>	**Some tools are already introduced.**	Introduction of productivity tools for SMEs should be considered by MOFALI and private associations.
	Enterprise diagnostic and technical and business advisory system (institutionalized technical extension services by visiting consultants or experts) <especially for SMEs>	**Not well introduced.** UNDP (United Nation Development Program)'s Enterprise Mongolia Project (EMP) has provided this advisory system from 2005 to 2013 with support of Japan, aiming aiding business/ entrepreneurship development and job creation.	Introduction of institutionalized technical extension for SMEs will be considered.
	Quality standards and certification, testing services <especially for SMEs>	**Not well introduced.**	Quality standards and certification, testing services should be strengthened.
	Subsidies & incentives for upgrading management, technology,	**Not well introduced.**	Subsidies & incentives for upgrading management, technology, marketing and

Categories	General policy measures	Existing policies, current situations and development issues in Mongolia	Future direction and policy recommendations
	marketing and ICT <especially for SMEs>		ICT should be introduced,
	Utilization of potentials for value-added & import substituting processing	The strong linkages of mining sector with other sectors are not seen currently. For value-added processing, the MMHI's action plan states development & implementation of (1) Copper concentrate processing plant, (2) Gold purification plant, (3) Iron/ metal production accessory factories, (4) Coal processing and chemical industries, and (5) Oil processing plant.	Potentials for value-added processing of existing mining related industries should be promoted. The action plan by MMHI should be implemented. For import substitution, development of food industries with introduction of the advanced technology will be needed. Also, these products such as plastic products, rubber, furniture, beverages and soap seem to be promising commodities.
4) Promotion of FDI & Domestic Investment including FTZ/SEZ Development	Region specific investment promotion and incentive system (Clear announcement of preferred investors, sectors, regions, etc.)	**Prioritized industries are indicated by the government** as follows: Heavy industry: Oil production, Coal chemical production, Coke chemical production, Copper smelting, Steel production and Cement industry Light industry: Leather and hide production, Cashmere production, Wool production, Wood production, SMEs; Dairy production Construction material production Food production	Currently NDA is conducting a study for evaluation of the optimum locations for several sub-sectors such as leather, wool, cashmere, dairy industry, meat industry and so on. The result of this study seems to be helpful for investment promotion and incentive system by sub-sector and by region (Aimag and Soum).
	Effective investor information package and website	**Not well developed.**	Effective investor information package and website should be developed.
	Investment promotion seminars, missions and office abroad	**Investment promotion seminars are being held.**	Investment promotion seminars, missions and office abroad should be strengthened.
	Provision of high-quality infrastructure (power, transport, land, water, wastewater and solid waste treatment) and logistics services	**Being developed in the whole country.**	The steady and continued development of high-quality infrastructure is expected in the long-term perspective.
	Development of industrial estates/parks including FTZs, SEZs and special zones for priority sectors, high-tech firms, etc.	Industrial parks, FTZs, SEZ are **being developed with the preparation of laws and regulations.** However, according to the private investors, lack of fund from the government to be a barrier of the infrastructure development in the zones. Also,	Infrastructure development of the industrial zones, consistent policy measures, and involvement of private sector for the management seem to be indispensable.

Categories	General policy measures	Existing policies, current situations and development issues in Mongolia	Future direction and policy recommendations
		the inconsistency of the development policy and the ineffective management of the zones is indicated. Beside FTZs, several industrial parks especially in the surrounding area of Ulaanbaatar are planned, but not fully developed.	
	Rental factories for local and/or foreign SMEs	**Not be considered**	Development of rental factories or standard factories in the new industrial parks or zones will be needed especially from the viewpoints of relocation from the city center.
5) Value-chain Development & Strengthening of Business linkage including industrial cluster	Support for domestic and export market development	Several projects had been conducted including UNDP's Enterprise Mongolia Project (EMP), which promote market linkages based on One Village and One Product initiative (OVOP).	Support for domestic and export market development should be continued and strengthened.
	Enterprises database (SMEs, supporting industries, sectoral)	**NSO has the database for registered companies**, but not linked to the networking of industries.	Enterprises database for the networking of industries should be developed.
	Incentives and subsidies for FDI-local firm linkage and technology transfer	**Not well developed.**	Incentives and subsidies for FDI-local firm linkage and technology transfer should be considered.
	Official promotion/ intermediation of subcontracting	**Not well developed.**	Official promotion/ intermediation of subcontracting should be promoted by MOFALH and NDA in cooperation with MNCCI.
	Establishment and strengthening of industry/business associations and local firm networks	**Being developed with MNCCI.** MNCCI plays an important role for business networking	Establishment and strengthening of industry/business associations and local firm networks should be promoted.
	Development of Industrial Clusters	**The SDV2030 states that it is important** to introduce advanced methods, technology and innovations, and increase productivity through improving agricultural products exchange network and **developing export-oriented processing industry cluster**. The similar concept is also taken into consideration by ADB (Asia Development Bank) funded projects.	It is important to introduce industrial cluster development from the perspective of the new development paradigm. Also, unique and identifiable "brand" for agricultural products in the cluster should be developed.
6)	Development of financial institution and provision of special loan and grants	**SMEs Development Fund has already established in 2000.** Several donor funded projects	Coordination among governmental fund/bank and private commercial

Categories	General policy measures	Existing policies, current situations and development issues in Mongolia	Future direction and policy recommendations
Improved Access to Finance	for priority products and activities and SMEs	have facilitated the access to finance including micro-finance scheme.	banks is needed to provide a loan to SMEs in response to their demand.
	Subsidized commercial bank loans for targeted firms (two-step loans)	**For SMEs, Development Bank of Mongolia (DBM) provides on-lending loan** (two-step loans) through commercial banks. JICA have already provided two-step loan	Implementation of subsidized commercial bank loans or two-step loans for targeted firms should be taken into account.
	Linking loans with enterprises diagnostic and advisory system	**Not developed.**	Loans and enterprises diagnostic and business advisory system should be linked.
7) Support of Business Start-up, Incubation and Innovation	Support of business start-up (including venture capital) and business incubation	**Not well developed.** The Action Program for the "National Production" for 2016-2020 indicates support for setting up information and incubator centers in collaboration with relevant professional associations.	Support of setting up incubation centers including the functions of R&D in collaboration with relevant business and professional associations should be promoted.
	Innovation and technological capacity building (including intellectual property right)	The Vienna Program in Action for Landlocked Developing Countries including Mongolia for the Decade 2014-2024 emphasizes that science, technology and innovation play a critical role in achieving structural economic transformation, productive capacity development and value addition.	Strengthening and building capacity to effectively utilize scientific and technical information including Intellectual Property (IP) tool is needed.
	Development of innovation clusters, which is an evolution of the original concept of industrial/businesses cluster, among industry, research institutes and government	**Not well developed.** Ministry of Education, Culture, Science, and Sports has a development plan of Science City.	The innovation cluster stimulates the development of new technologies with educational and research institutions. An innovation cluster or a Science City will be developed.

Source: JICA Project Team *

Note 1: List of categories and standard policy measures are relied on Table 3.3, Pages 63-64, "Learning to industrialize, from given growth to policy-aided value creation," by Mr. Kenichi Ohno, Routldege 2013 and industrial development policies in several countries, but they are modified by JICA Project Team.

Note 2: 5S is a workplace organization method that uses a list of five Japanese words: Seiri, Seiton, Seisō, Seiketsu , and Shitsuke. These have been translated as "Sort", "Set in order", "Shine", "Standardize" and "Sustain."

4.2 Development Objectives and Strategy for Manufacturing Industry

4.2.1 Development objectives in industry sector

Through the discussions above on the current situations and issues, existing institutions and policies, future direction, and policy recommendations, the objectives of the industrial development in Mongolia to be pursued may be summarized as follows:

(a) To contribute significantly to increasing value-added and employment opportunities by processing of primary products of crop and livestock farming, and mining;
(b) To contribute to diversification of economic activities and export products; and
(c) To realize more balanced distribution of population and economic activities and reduced income disparities between Ulaanbaatar and regions by creating employment opportunities in local cities.
(d) Support of a wide range of socio-economic activities to reduce consumptive use of resources in line with the alternative socio-economy paradigm.

4.2.2 Development strategy in industry sector

In line with the policy direction described in the preceding sub-section, development strategy for industry sector to attain the development objectives proposed above is established with the following components:

(a) Establishment of clear distinction of roles of the private sector and the Government to avoid over-specification of industrial location and FTZ development initiative etc. by the Government,
(b) Formulation of sound, stable and transparent legal and policy framework for industrial development, and
(c) Facilitation of products development with technology and market development for export by private investors, and
(d) Promotion of ICT industry to support a wide range of socio-economic activities to reduce consumptive use of resources in line with the alternative socio-economy paradigm.

4.3 Projects and Institutional Measures in Industry Sector

4.3.1 Formulation of rules and regulations for attraction of investment

Formulation of effective rules or regulations on the development of FTZ/SEZ including incentives and one-stop services are imperative. Specific incentives for targeted industries, longer periods of concessions, exemption of customs duties on equipment and raw materials, exemption of income tax, employment of foreign staff and discount on utility fees should be taken into account.

Guidelines for the regulations may be provided by the following.

Chapter 1: Title and Definition

Chapter 2 Formulation of the Management Committee or the equivalent organization for FTZ/SEZ and its roles and activities

Chapter 3: Establishment of FTZ/SEZ, In the case that the selected developer shall submit a detailed development project for the establishment of a FTZ/SEZ

Chapter 4: Boundary Demarcation and Land Use in FTZ/SEZ

Chapter 5: Submission of Proposal and Issuance of Permit

Chapter 6: Types of Targeted Investment Businesses and Requirements

Chapter 7: OSSC for FTZ/SEZ from the government departments in charge of customs, FDI, revenue, labor, immigration and so on

Chapter 8: Procedures for Establishment of Businesses

Chapter 9: Exemption or incentives for targeted industries

Chapter 10: Regulations relating to Duty and Tax

Chapter 11: Movement of Goods into a Free Trade Zone

Chapter 12 Import and Export Procedures

Chapter 13 Rules for distribution of goods from FTZ/SEZ to the Domestic Tariff Area

Chapter 14: Labor and Employment

**The above items are mainly coming from Myanmar Special Economic Zone Rules 2015*

4.3.2 Program for strengthening of public-private partnership (PPP) scheme

The Government of Mongolia, focusing on supporting public-private partnerships, had developed and implemented essential policy documents in 2009 such as the State Policy on Public-Private Partnerships (PPP) and the Law on Concessions in 2010. Also, the Law on Procurement of Goods, Works and Services with state and local funds was approved in 2005. The purpose of these policy documents is to promote the sustainable development of the Mongolian economy by ensuring the rapid growth of the private sector-led economy and promoting all-round partnership.

However, the legal documents mentioned above have revealed that the legal environment for PPPs in Mongolia differs slightly from international standards. For example, internationally, PPPs are implemented within the framework of a unified policy and law, and the types of partnerships are specified, where each partnership characterizes respective implementation.

The PPP unit of NDA stated in an interview by the JPT that there would be need to renew the State Policy on PPP to establish a unified policy and concepts for PPPs and improve the linkages between regulations of PPPs and concessions defined by the laws. Also, there is a need to establish a new law on PPP to improve a favorable legal environment for beneficial partnership.

At MSH meetings for the NCDP, the Mongolian National Chamber of Commerce and Industry (MNCCI) stressed the importance of strengthening public-private partnership (PPP) scheme to improve the business environment in the Country. MNCCI has already started to establish the Public-Private Partnership Council at the Aimag level.

The Vision2050 also states the needs of strengthening PPP scheme to implement various projects and programs. In Objective 5.2, for example, it aims to refine the distribution of mandates and powers of public administrative bodies through a rational identification of institutions and arrangements. In this regard, the optimal distribution of government mandates will be made based on the private-public-partnership in Phase 1 (2020-2030). Table 4.3.1 presents the PPP related objectives and activities in the Vision2050. In Phase 2 (2031-2040), such a smart government will be formed that respects citizen's

interests and promotes private sector development.

Table 4.3.1 PPP related Objectives and Activities in the Vision2050

Objectives	Activities
Create conditions for strengthening cooperation and ensuring participation of the private sector and civil society in policy formulation, implementation and monitoring processes	- Refine the legal environment for ensuring participation of the private sector and civil society organizations in policy development and implementation processes and protecting their interests. - Introduce a system for contracting the private sector and civil society organizations to performing all possible state functions. - Create the legal environment for independent development of civil society organizations. - Develop e-democracy and enable electronic participation of citizens in government policy and decision-making and monitoring processes.
Create a legal and policy environment to support the development of the private sector and the protection of private property	- Create a legal environment on full protection of private property by refining policies and regulations on investment, property protection and ensuring its stability. - Update the banking and financial system following private sector development policies and create a favorable investment and credit environment. - Nurture a favorable environment for investment protection and attraction by ensuring the stability of public policies and tax legislation. - Integrate the activities of special government funds into a system open to the public with proper oversight, aimed at supporting private activities.

Source: Long-Term Development Policy; Vision2050

A supplemental survey related to PPP was conducted under the NCDP by a local consultant (i) to review and analyze the public private partnership structure at the national level and the Aimag level, (ii) to evaluate roles and activities of donor agencies in terms of the formulation and activation of Aimag's Public Private Partnership Councils, (iii) to identify the needs or requests from Aimag administrations for PPP promotion, and (iv) to identify the targeted or promising projects in selected Aimags for early implementation. The result of the Survey has been compiled into a separate report.

4.3.3 Human resource development for industries

As the Action Program for the "National Production" for 2016-2020 indicates, the curriculum reforms in both technical and vocational education and training (TVET) and higher education will be needed to promote job-matching and skill-matching. Also, provision of customized training in response to demand from the private sector should be introduced in cooperation with business associations such as MNCCI.

Moreover, provision of assistance to SMEs for training of their employees should be strengthened. Establishment of a Skills Development Fund (SDF), which aims to provide financial assistance to employers of SMEs to encourage them to train and upgrade the skills of their employees/workers, is an option to provide technical training. Financial resources of SDF may be supported by the government and mining companies.

4.3.4 Comprehensive SME support program

To solve the problems and issues raised among SMEs such as (i) limited industrial human resources (discipline, skills, craftsmanship, high quality know-how), (ii) difficulty in access to finance (high loan interest rate, lending period and conditions), (iii) limited interaction and linkage between agro-livestock sectors and related processing sectors and weak foundation of supply chain development (productivity, technology transfer/adoption, market development), a comprehensive SME support program should be formulated. The program will include the following measures:

- Introduction of productivity tools for SMEs,

- Enterprise diagnostic and technical and business advisory system covering upgrading management, technology, marketing, networking/business linkage, access to finance and ICT, and
- Institutionalized technical extension services by visiting consultants or experts.

4.3.5 Development of new industrial parks

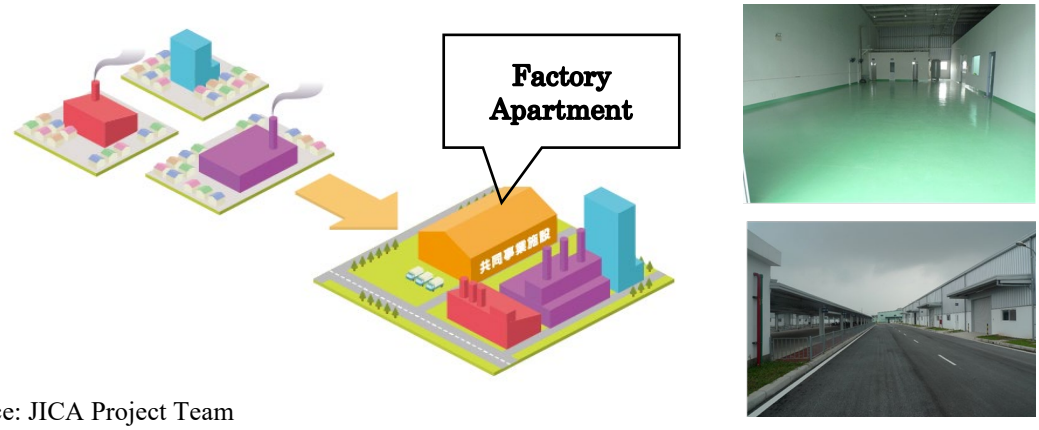
The Mongolian Government has taken a step towards formulating the industrial parks to attract investors to boost the local economic growth. As shown in Table 4.1.8, development of several industrial parks especially in the surrounding area of Ulaanbaatar were planned, but two of them are not fully developed yet due to the delay of infrastructure development in the surrounding area. In this context, the development of these industrial parks should be accelerated. Besides the surrounding area of Ulaanbaatar, industrial parks are currently under development in Darhan and Sainshand.

Each park has a feature in terms of the targeted enterprises. As for the Emeelt light industry and technology park, the Ulaanbaatar city government conducted a revised feasibility study in 2015 to promote industrial relocation since this will be an effective measure for urban renewal from "mixture of industries in residential and commercial area" to "industrial park." Also, from the environmental point of view, the relocation is required of leather industry (tanneries), wool and cashmere processing factories in the middle of the urban center, which causes air and soil pollution and water contamination.

Establishment of factory apartment or ready-made apartment in the industrial park especially for SMEs is an option to promote relocation as shown in Figure 4.3.1. The relocated enterprises are consolidated to a factory apartment.

Provision of incentives such as exemption or reduction of taxes for a certain period is another option to promote smooth relocation. The following steps taken through workshops and meetings for stakeholders may be needed:

- Clarification of benefits to relocation (land tenure or land title, developed infrastructure, factory apartment, common facilities, cooperative marketing, vocational training, etc.),
- Formulation of the association,
- Formulation of the implementation plan including acquisition or rent of land/ factory apartment,
- Financial arrangement, and
- Formulation of sales and marketing plan of the products.



Source: JICA Project Team
Note: The image above is taken from the website of Small & Medium Enterprises and Regional Innovation of Japan (https://kodoka.smrj.go.jp/syudanka/). Pictures are taken in a factory apartment in Vietnam.

Figure 4.3.1 Image of Industrial Relocation and Factory Apartment

4.3.6 Development of Agro-IT parks

Enhancement of the value added of abundant agricultural and livestock raw materials would be one of the most important paths to be pursued to accelerate economic growth of Mongolia. Creation of Agro-IT park would be an effective approach in this direction. The concept of the Agro-IT park was initially proposed by the Ministry of Industry in cooperation with the former Ministry of Food and Agriculture, but later the initiative was transferred to National Development Agency.

Agro-IT park aims to promote the food processing business in four different sectors of vegetable, cashmere/wool/leather, food meat, and dairy products by providing an efficient production and logistics environment in the form of industrial park. While about 40 candidate sites were initially selected, thorough review on such basic factors as infrastructure, transportation and balance in location in the whole country was yet to be made. The Agro-IT park development concept should be carefully reviewed from the viewpoint of agro-supply chains including applicable technology and machine/equipment before proceeding to implementation. While the proposal below is preliminary requiring further technical and financial analysis before implementation, it is presented as a step to promote further efforts within the Mongolian Government toward its implementation.

Table 4.3.2 shows the result of an assessment of the 17 candidate locations of Agro-IT Parks, which were presented in JICA's Data Collection Survey for Agriculture & Livestock Sector in Mongolia 2017, based on the information from the former Ministry of Industry and NDA.

The assessment is conducted to compare the 17 locations by assessing the following factors scoring from 1 (low) to 3 (high).

(a) Infrastructure: level of development
(b) Water: availability and quality
(c) Access: distance to national road
(d) Implementation body: initiative by local private entity
(e) Intensive livestock possibility: distance to areas suitable for intensive livestock
(f) Operational efficiency: Distance to Ulaanbaatar
(g) Negative factor: foot and mouth disease

According to the total score, three most promising locations for Agro-IT parks are preliminarily selected: Selenge district in Bulgan Aimag, Burentogtoh and Murun districts in Khuvsgul Aimag, and Kharkhorin district in Uvurkhangai Aimag.

Table 4.3.2 Assessment of 17 Candidate Locations of Agro-IT Park

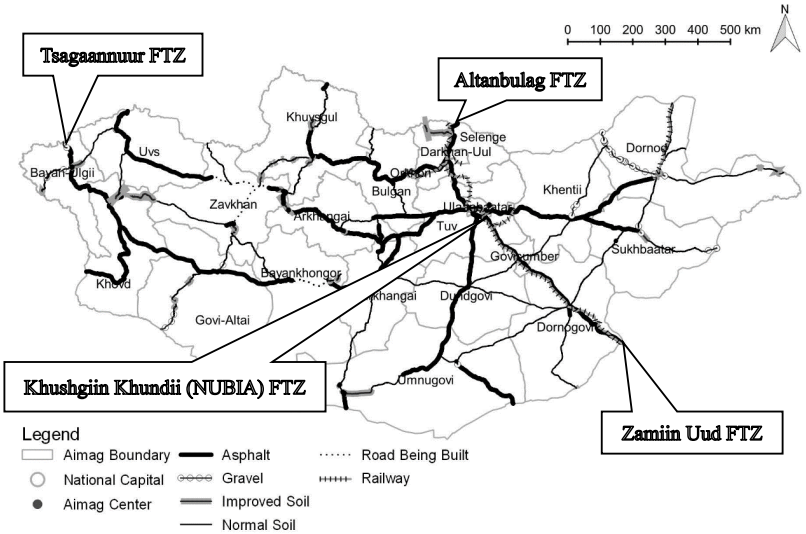
No	Province	District	Characteristics		a. Infrastructure: Level of development	b. Water: Availability, quality	c. Access: Distance to national road	d. Implementation body		e. Intensive livestock (IL) possibility: Distance to IL suitable area	f. Operational efficiency: Distance to UB	g. Negative factor: Foot & mouth disease	Total Score	
			Type of product: C for crop, L for livestock	Market: UB, export, mining etc.				Initiative from local end	Promoting entity				Total score	Rank
1	Arkhangai	Erdenmandal	L	UB	1	3	1	1	Former MOI, former MOA	2	2	0	10	11
2	Bulgan	Hutag-Undur	L	UB	2	3	3	1	Former MOI, former MOA	2	2	0	13	7
3	Zavkhan	Tosontsengel	L	UB	2	2	3	1	Former MOI, former MOA	1	1	0	10	11
4	Khuvsgul	Hatgal	C	Tourists	2	3	3	1	Former MOI, former MOA	1	1	0	11	10

5	Tuv	Bayanchandmani	L/C	UB	2	1	3	1	Former MOI, former MOA	3	3	0	13	7
6		Jargalant	C	UB	3	2	2	1	Former MOI, former MOA	3	3	0	14	5
7	Selenge	Mandal	C	UB	2	3	2	1	Former MOI, former MOA	3	3	0	14	5
8	Sukhbaatar	Erenetsagan	L	China	1	1	3	1	Former MOI, former MOA	2	1	-2	7	15
9	Bulgan	Hutag-Undur	L/C	UB, Russia	2	3	3	3	Bulgan Park LLC	2	2	0	15	4
10		Selenge	C		3	3	2	3	Regional cooperative	3	2	0	16	1
11	Dundgovi	Erdenedalai	L	Mining	1	1	1	2	Province mayor, district mayor	3	2	0	10	11
12	Zavkhan	Ikh-Uul	L	UB	1	2	3	2	District mayor	1	1	0	10	11
13	Khuvsgul	Burentogtoh, Murun	L	UB, tourists	3	3	3	3	Murun Agro LLC, province	3	1	0	16	1
14		Tunel	L		2	3	2	2	Province	3	1	0	13	7
15	Uvurkhangai	Kharkhorin	L	UB, tourists	3	3	3	2	District mayor	3	2	0	16	1
16	Umnugovi	Guvantes	L	Mining	1	1	1	1	Parliament	1	1	0	6	17
17		Tsogttsetsii	L	Mining	1	1	2	1	Parliament	1	1	0	7	15

Source: JICA Project Team
Note: 3: high, 2: medium, 1: low

4.3.7 Development of FTZs/SEZs

Free trade zones or special economic zones such as Altanbulag FTZ, Zamyn-Uud FTZ, Tsagaannuur FTZ and the new zone near the NUBIA, as shown in Table 4.3.2 and Figure 4.3.2, will play a very important role to boost the economy in the whole Country through introduction of foreign and domestic investors.



Source: JICA Project Team

Figure 4.3.2 Location of Free Trade Zones

These free zones should be developed through the following steps/measures.

- Development and completion of infrastructure (road, electricity, water supply, industrial waste treatment) within the zones and surrounding area,
- Introduction of private developer/operator or PPP scheme for effective management and implementation arrangements,

- Undertaking of appropriate measures to attract foreign investors, anchor firms in particular, to promote linkages with subcontracted firms, locally based manufacturers including SMEs, logistics, ICT and service industries, and
- Preparation of detailed rules/regulations on FTZ development, which is already discussed in the preceding section.

The representative types of the existing FTZ/SEZ are summarized in Table 4.3.3. Especially for Khushgiin Khundii FTZ (near NUBIA), it is expected to be developed as FTZ/SEZ with multi-functions.

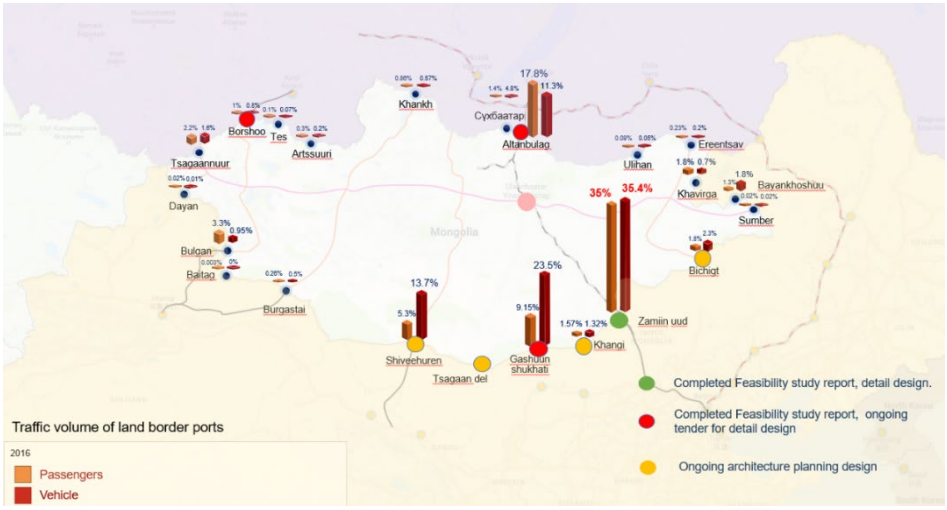
Table 4.3.3 Types of FZ/SEZ

Type of FZ/SEZ		Features	Functions
SEZ with multi functions		Strategic and core SEZ for the acceleration of national economy with medium/long term perspective to compete with neighboring countries.	Multi-function SEZ integrating high-technology manufacturing, advanced technology manufacturing, R&D, ICT, financial business, high-grade/international education, international medical services, MICE (Meeting, Incentive Travel, Convention/Conference and Event/Exhibition) tourism, logistics, etc.
Conventional SEZ		This SEZ will be a sort of economic centers.	SEZ with manufacturing industry, international /inter-regional trade, R&D, ICT, etc.
Resource-based SEZ	Mineral resources	This type of SEZ is mainly characterized by the regional resources.	Primary/secondary processing industry of mineral resources and energy center
	Agro/ timber resources		Food, leather, textile, and wood processing manufacturers
	Tourism		Villa, resort, hotels, and tourism destinations with attractions
	R&D, ICT		R&D, ICT industry, knowledge-based industry complex
	Logistics		Logistic center and cargo terminal near airport and port

Source: JICA Project Team

As for Zamyn-Uud FTZ, the joint development with China (Erenhot SEZ on the border) seems to be promising. According to the interview with Mongolian investors, Chinese investors have an interest to establish processing plants in Zamyn-Uud FTZ to avoid the effects of a trade war between the U.S. and China. In Tsagaannuur FTZ, the cooperation with Russia and Kazakhstan (Khorgas) is expected.

Figure 4.3.3 shows the cross-border points in Mongolia. According to the Development Initiative-Infrastructure Project (DIIP) under the Ministry of Finance, development plans for more than 20 cross border points including Altanbulag, Zamyn-Uud and Tsagaannuur are being prepared especially in terms of smooth traffic of passengers and vehicles. Completion of infrastructure of these border points will stimulates (i) border area development through simplifying the procedures for movement of goods in transit, and expansion of tourism and other service activities, and (ii) FTZ/SEZ development along the border.



Source: Presentation materials for Development Initiative-Infrastructure Project (DIIP) in July 2019

Figure 4.3.3 Cross Border Points

4.3.8 Introduction of region and sector specific investment promotion and incentive system

As described in sub-section 4.1.6, NDA is now conducting a study for evaluation of the optimum locations for several sub-sectors in preparation for introducing region and sector specific investment promotion and incentive system to achieve a more balanced distribution of industries in the whole Country. This approach applies particularly to promotion of various industrial clusters proposed by the NCDP. The NCDP, however, shall not pinpoint locations of core facilities for any industrial cluster as it should be developed by the private sector initiative supported by promotion and incentive measures by the Government. Rather, the NCDP indicate broadly more promising Aimags for any industrial cluster and establish conditions to be satisfied for industrial location by development vision and strategy by region (Chapter 6 of the Main Report).

Table 4.3.4 shows advantages of industrial sub-sector by locational factor. As for typical advantageous sub-sectors in Mongolia such as food, textile, wearing apparel, construction materials emphasize the locational factors such as "Access to market," "Access to transportation/logistics," "Trunk road & railway," "Accumulation of urban functions," and "Access to raw materials." These conditions will be helpful to decide sector specific investment promotion and industrial cluster development, which is discussed in the Main Report.

Table 4.3.4 Industrial Location Factors

Type of Industry	Industrial Sub-sector	Market & Transportation					Local resources & Utilities							Accumulation of Industries & Colleges	
		Access to Market	Access to Transportation/Logistics	Airport / Sea Ports	Trunk Road & Railway	Accumulation of Urban Functions	Border Area / Border Zone	Land (a large area)	Water Supply	Electricity	Access to Raw Materials	Labor Force (Intensive)	Qualified Engineers/Experts	Accumulation of Support Industries	University/College, Research Institutes

Light Industry	Food	X	X		X	X									
	Beverage	X	X		X	X					X				
	Textile	X	X												
	Wearing Apparel	X	X			X					X	X			
	Wood & Wood Product		X	X				X							
	Furniture		X	X		X									
	Leather	X									X				
	Printing/paper product	X	X			X									
	Plastic	X	X												
Heavy Industry	Ceramic & Construction Materials	X	X	X	X			X		X	X				
	General Machinery & Equipment		X		X							X	X		
	Electrical/Electronic Machinery		X	X	X							X	X	X	
	Transport Equipment	X	X	X	X	X		X		X		X	X	X	
	Basic Metal (Iron and Steel)	X	X	X	X			X	X	X	X				
	Basic Metal (Non-ferrous Metal)	X	X	X	X			X	X	X	X				
	Fabricated Metal Products	X	X							X					
	Oil & Coal Product	X	X	X	X			X	X	X	X		X		
	Chemical Product	X	X					X	X	X			X	X	
High-tech Industry	High-tech Industry		X	X									X		X
Logistics-related industry	Packaging/ Parts and Service Support		X	X			X								
FTZ/SEZ			X	X	X		X	X		X					

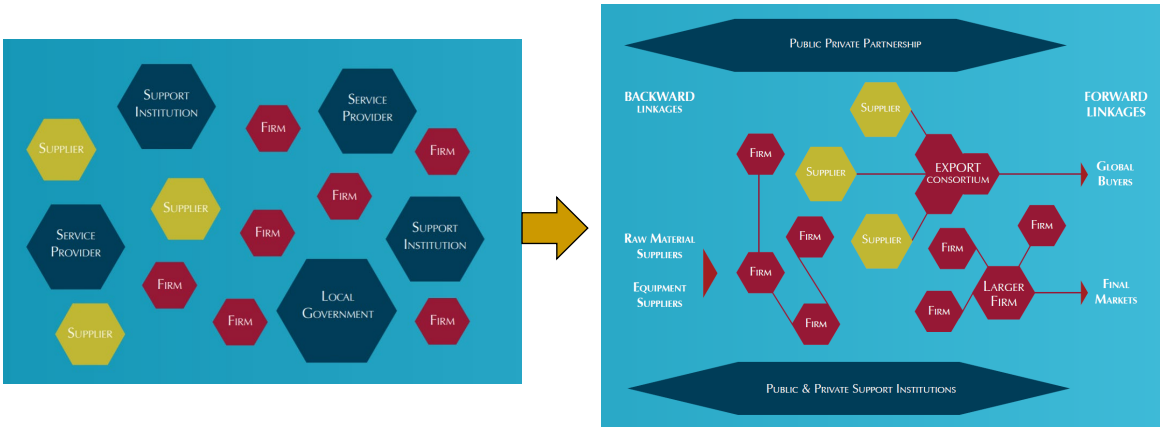
Source: JICA Project Team
Note: X Applicable Factors

4.3.9 Industrial cluster development

As discussed in the SDV2030, it is an important issue to introduce advanced methods, technology and innovations, and increase productivity through organizing clusters of export-oriented processing industry including processing of wool and cashmere and others. Related to this issue, the Action Program for the "National Production" for 2016-2020 also stresses the need to create a system for stacking and transporting wool, cashmere and rawhide in order to secure a sustainable supply to national industries and set up a raw materials reserve. Most important challenges on increasing the value of agricultural exports is improving the supply of raw materials and semi-processed goods from the rural areas to the production zones. Additional challenges include upgrading the quality of processing activities and improved access to foreign markets.

To plan for these challenges, industrial cluster strategy would be very effective. In particular, vertical industrial clusters based on primary products are highly applicable relying mainly on primary products production for economic growth. Industry clusters are groups of competing, collaborating and interdependent businesses within a value chain. Also, it has increasingly been recognized as an effective approach in industrial development and promotion of SMEs.

As shown in Figure 4.3.4, an underperforming cluster consists of many players (private firms, also farmers /herders, governments and local support institutions), but it does not display clear linkages among the different entities. On the other hand, a performing cluster is well organized with strong linkages between various actors. The industrial cluster is generally composed of the operation of upstream (raw material suppliers, production inputs) and downstream (value added processing, packaging, marketing and exporting) economic activities.



Source: United Nation Industry Development Organization (UNIDO) Approach to Business Investment Technology Services, Key Principles and Project Experiences for Inclusive Growth, Technical Paper, 2013

Figure 4.3.4 Underperforming and Performing Industrial Cluster

Support policy measures and recommendations to facilitate the establishment of the promising industrial clusters are listed and summarized in Table 4.3.5.

Table 4.3.5 Selected Industrial Clusters

Primary product/cluster	Processing/services	Current conditions/possibilities	Support policy measures/ recommendations
Sea buckthorn (sea berry)	Omega7 (Unsaturated fatty acid) Health products, cosmetics etc.	- Integrated production and processing system being developed by major food industries - Production of sea berry in China has rapidly increased.	- Production increase and quality improvement necessary for international competitiveness - Technical training for increase of production and improvement of quality - Establishment of industrial association among domestic firms
Sheep, goats, horse, cow, etc.	Meat products, halal food, pet food	- Possibility of use of bones as construction materials, dungs for medicine, fat of fat-tail sheep, leather products for industrial cluster	- Support for products and markets diversification - Enhancement of the quality of meat - Support for exports - Improvement of the reliability of input supply in cold seasons

Primary product/cluster	Processing/services	Current conditions/possibilities	Support policy measures/ recommendations
Placenta of sheep and horse	Medicine, cosmetics, health products	- Collection system of placentas being introduced by foreign investor - Primary processing units for sheep meat are not handling placenta	- Support of dissemination of collection system of placentas - Support for markets diversification
Natural casing of sheep	Sausage Casing	- Some of primary processing units hand over to other processing units for export	- Support for markets diversification
Wool and cashmere	Production for value added final products	- Product diversification for insulating materials, stuffing, felt etc. is being developed.	- Export promotion of value-added final products - Facilitation of the creation of network among herders to aggregate supply with high quality
Camel milk, yak milk	Omega7, yoghurt, camel milk liquor	- Livelihood activities by nomadic people to be organized to promote export - - Camel milk is popular among Chinese people especially along the border	- Support for products and markets diversification including dry camel milk
Honey	Natural honey, propolis, royal jelly for health products, cosmetics, beeswax	- Japan Association for International Collaboration of Agriculture and Forestry (JICAF) has conducted the project for "Generation of Rural Income through Beekeeping Development with JICA	- Organization of small producers (beekeepers), - Support for product development and markets diversification/exports

Source: JICA Project Team

Procedure to develop any industrial cluster involves the following:

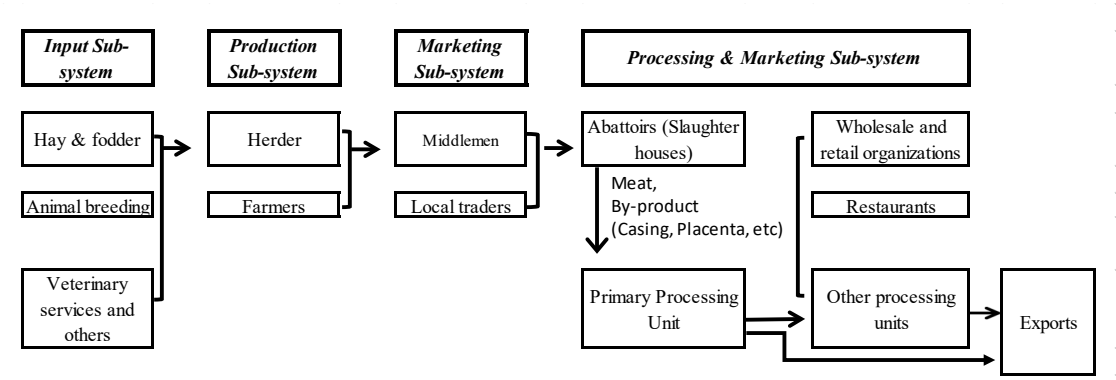
1) Define a full scope of economic activities to be involved in each industrial cluster as proposed by the NCDP,
2) Enumerate all components of core facilities for the industrial cluster,
3) Clarify specific infrastructure needs to support the industrial cluster such as access roads, water supply and prepared industrial land,
4) Prepare a stage-wise implementation plan for the industrial cluster development, and
5) Implement the industrial cluster development following the stage-wise implementation plan.

Development of livestock industrial cluster is described in Section 2.4 as an example.

As for products of sea berry, meat and wool and cashmere, the proposed value chains for production as industrial cluster are shown in Figure 4.3.5, Figure 4.3.6 and Figure 4.3.7, respectively. The proposed industrial clusters as Anchor projects are described in project profiles (Chapter 10 of the Main Report).

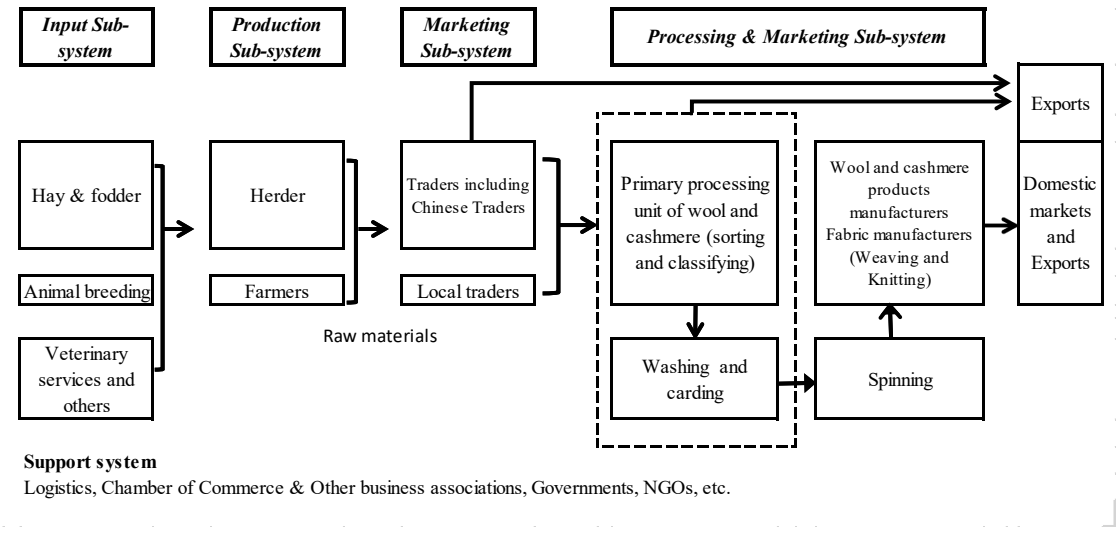
Source: JICA Project Team

Figure 4.3.5 Proposed Value Chain for Production of Sea Berry



Source: JICA Project Team

Figure 4.3.6 Proposed Value Chain for Production of Meat



Source: JICA Project Team

Figure 4.3.7 Proposed Value Chain for Production of Wool and Cashmere

4.3.10 Improved access to finance

The subsidized commercial bank loans or two-step loans for targeted firms/SMEs should be strengthened through (i) Small and Medium Enterprises (SMEs) Development Fund, (ii) Development Bank of Mongolia (DBM) and (iii) donor agencies. In operating these facilities, loans and enterprises diagnostic and business advisory system should be linked.

JICA undertook Two-Step-Loan Project (TSLP) Phase 1 (March 2006 – December 2009) and Phase 2 (November 2010 – December 2016) for SMEs development. Currently JICA prepares TSLP Phase 3 by considering qualification of borrowers (SMEs), selection of the prioritized type of economic sector or activities and other factors to maximize the benefit of the loan, although the implementation of this phase is postponed due to economic situations and change of the government resume of Mongolia.

4.3.11 Support of business start-up, incubation and innovation

The Action Program for the "National Production" for 2016-2020 on support for setting up information and incubator centers including the functions of R&D should be implemented in collaboration with relevant professional and business associations. Also, strengthening and building capacity to effectively utilize scientific and technical information including IP tools is needed.

The innovation cluster stimulates the development of new technologies. Thus, an innovation cluster, which is an evolution of the original concept of industrial/businesses cluster, or a Science City, should be developed by industry, research institutes and the government.

4.3.12 Utilization of ICT

As the Government emphasizes the importance of ICT through SDV2030/Visin2050, the new digital technologies associated with ICTs /digital transformation (DX) will enhance the entire manufacturing process. Several advantages of new digital technologies and ICTs in manufacturing sector are summarized as follows:

- Saving cost and time through increase of the efficiency of production schedules, logistics, inventory management and equipment maintenance,
- High precision and quality of the products,
- Increase of capabilities on product development and innovation, and
- Provision of better after-sales service through access to the integrated data.

The new digital technologies/ICT technologies for industrial use, which are summarized in Table 4.3.6, are seen at different stages in various countries, but in Mongolia, their use is still limited partly due to a weak accumulation of manufacturers.

Table 4.3.6 New Digital Technologies Used in Manufacturing Processes

Technology	Attributes
Industrial robots	Robotics is a field of technology, which have had many impacts on manufacturing. Robots are able to perform tasks repetitively and tirelessly, and with precision, high efficiency with very little error. Industrial robots are automatically controlled, reprogrammable, multipurpose manipulators programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications. They largely rely on algorithms driven by software, which may be enabled to communicate with other machines through the Internet of Things (IoT).

Additive manufacturing (three- dimensional (3D) printing)	3D printing, also known as additive manufacturing, is a computer-controlled process in which three-dimensional objects can be created by materials deposited in layers. Using 3D modelling software, machine equipment and layering material, additive manufacturing equipment reads data from CAD files and applies layers of liquid, powder, sheet material or other, to fabricate a 3D object. 3D printers, can be regulated and controlled using CNC (computer numerical control).
Computer-aided design and computer aided manufacturing (CAD/CAM) techniques	CAD/CAM techniques are used to design and manufacture prototypes, finished products, and production runs. CAD systems allow an engineer to view a design from any angle with a push of button and to zoom in or out for close-ups and long-distance views.
Industry 4.0 technologies	Industry 4.0 refers to the fourth industrial revolution and describes the growing trend towards automation and data exchange in technology and processes within the manufacturing industry, including: - Internet of things (IoT); a typical component of digital transformation (DX) - Industrial internet of things (IIoT), - Smart factories that are highly digitized for manufacturing to take place more efficiently through connected systems, - Big data and cloud computing, - Artificial intelligence, etc.
Big data and cloud computing	Big data analytics refers to a set of techniques that allows voluminous amounts of machine-readable data to be rapidly generated, accessed, processed and analyzed. These processes are often undertaken through cloud computing that substantially increases the availability and affordability of computing services by using servers, storage, databases, networking, software, analytics, etc. over the Internet (i.e. the "cloud").
Artificial intelligence and machine learning	Algorithms allowing computers and machines embodying or linked to computers to learn from data and to mimic and predict human behavior.

Source: JICA Project Team based on "Digitalization and Industrialization: friends or foes?" UNCTAD Research Paper No. 25, 2019 and information provided on the websites of various organizations

In the context described above, several policies for industries should be taken into consideration related to (i) provision of digital and network infrastructure, (ii) strengthening of the capability and use of digital technology and (iii) identification of priorities for government-funded research and initiatives. Also, seminars on new digital technologies and ICTs should be provided to manufacturers, especially SMEs, by public research institutes, universities, MNCCI and other associations of industries.

4.4 Anchor Projects

Many projects and programs, which have been formulated in different sectors and Aimags, are packaged into four initiatives to clarify characteristics of different projects and programs and facilitate coordination between them. These initiatives are:

(a) Spatial structure strengthening initiative,
(b) Economic and export diversification initiative,
(c) Green development promotion initiative, and
(d) Broad-based empowerment initiative.

Industry sector is included in the economic and export diversification initiatives and the following projects and programs are designated as anchor projects. The details are discussed in the Main Report with project profiles.

(a) Border areas Free Trade Zones (FTZs) and Special Economic Zones (SEZs) promotion project,
(b) Ulaanbaatar airport-side Special Economic Zone (SEZ) development project,
(c) Industrial clusters support program, and
(d) Agro IT parks development.

Chapter 5 Tourism

5.1 Existing Conditions of Tourism in Mongolia

5.1.1 Overview of tourism sector

The tourism industry has been identified as one of the leading economic sectors in Mongolia to diversify the economy, along with the worldwide tourism development as a major socioeconomic force. However, in order to reap the economic benefits of the industry, careful and strategic planning is required with the involvement of various stakeholders as it is a complex industry with its unique and different challenges spanning over economic, environmental, social and political aspects.

The total number of tourists worldwide was 25.2 million in 1950, whereas in 2018 the number reached a total of 1.4 billion[25] for the second consecutive year. Hence, the tourism sector has been growing at an exponential rate, making it one of the most competitive sectors. However, the COVID-19 crisis had an unprecedented impact throughout the world, and the tourism sector is one of the hardest hit by the crisis. It is estimated that the return to 2019 levels in terms of international arrivals would take 2.5 to 4 years[26]. As the whole world is dealing with the pandemic and its outcomes, the recovery aspect is critical to the survival of tourism businesses, jobs and economies that depend on it. The tourism industry is at standstill, and the current circumstances have forced everyone to rethink the old ways and find innovative ways to maintain some revenue. It is also necessary to strategize and plan for the future when the travel restrictions are lifted and redefine the trajectory of the industry's overall development.

The competitiveness of the industry, which goes hand-in-hand with the industry's sustainability, is highly influenced by the quality of tourist destinations, that takes into consideration the natural and cultural environment while ensuring that local communities are well integrated[27]. However, there is no one-size-fits-all model for tourism development as each tourism destination's conditions and circumstances are dependent on various factors and influences. Nonetheless, it is equally important to draw successful examples and have personalized approach to adopting solutions.

The most important factor to consider for maximizing the benefits from tourism sector is for host countries and communities to bring out their uniqueness, in different words the things that set them apart from the rest of the world. For Mongolia, it is unquestionably the wild nature and the nomadic culture, which are intertwined and cannot be separated as dictated by the slogan of the tourism industry - Nomadic by Nature.

One of the main challenges of the industry is that any given small tourism business is in competition with all the great destinations in the world. Therefore, in order to increase the competitiveness of a country or a region and putting it on the tourism map, collaboration and cooperation of all the stakeholders are essential.

Not only the tourism sector plays an important role for economic diversification, moving towards lesser consumptive use of resources and towards preservation of natural and cultural heritages, but if planned and managed well, the tourism sector has the potential also to become a vehicle that drives towards sustainable development.

[25] United Nations World Tourism Organization (UNWTO) (2020). International Tourism Highlights https://www.e-unwto.org/doi/pdf/10.18111/9789284421152

[26] United Nations World Tourism Organization (UNWTO) (2021). World Tourism Barometer, vol. 19, No. 1, January 2021; https://www.e-unwto.org/doi/epdf/10.18111/wtobarometereng.2021.19.1.1

[27] European Commission (EC). Sustainable Tourism https://ec.europa.eu/growth/sectors/tourism/offer/sustainable_en

5.1.2 Development stage of Mongolia's tourism sector

The tourism sector in Mongolia expanded significantly with a total arrival of foreigners reaching a milestone of a half million (529,370) for the first time in 2018 (MSIS, 2019) (Figure 5.1.1), increased by 11.0% from 2017. Majority of the tourists came from the following countries in 2019 totaling 577,300: China (29%), Russia (25%), South Korea (18%) and Japan (4%) comprising about 75.5% of total foreign tourists (Figure 5.1.2). A similar trend was observed for Japan, where approximately 73.5% of the overseas residents' visits consisted of four countries, including China (26.9%), South Korea (24.4%), Taiwan (15.3%) and Hong Kong (7.1%) (JTB[28], 2019). Details of foreign visits to Mongolia are given in Table 5.1.1. The number of tourists in 2020 dropped by 90% due to the border closures and travel restrictions.

Table 5.1.1 Number of Foreign Tourists (above 1000) by Country, 1999-2020

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*
Total	154,936.	154,207.	187,434.	228,719.	201,153.	300,538.	338,768.	404,480.	451,788.	446,393.	411,664.	456,090.	460,360.	475,892.	417,815.	392,844.	386,204.	404,163.	469,309.	529,370.	577,300.	58,859.
China	55,596.	56,223.	64,752.	89,041.	90,337.	139,283.	170,345.	162,858.	211,007.	196,832.	181,523.	193,730.	201,032.	228,547.	178,326.	157,561.	145,029.	131,312.	142,481.	163,979.	168,298.	13,513.
Russia	54,684.	47,424.	64,895.	69,778.	51,438.	53,917.	57,926.	82,214.	98,759.	109,922.	107,911.	121,647.	102,738.	83,707.	74,468.	73,055.	70,668.	84,065.	106,885.	129,095.	141,927.	29,635
Korea	5,161.	7,899.	10,028.	14,474.	17,166.	26,602.	30,787.	55,523.	43,930.	43,396.	38,272.	42,231.	43,994.	44,360.	45,178.	45,476.	47,213.	57,587.	74,921.	84,184.	101,279.	5,060
Japan	11,733.	11,323.	11,390.	13,262.	7,717.	13,092.	12,952.	19,971.	17,238.	14,939.	11,399.	14,140.	14,988.	17,119.	18,178.	18,282.	19,277.	19,985.	22,519.	20,990.	24,419.	1,131
United States	5,302.	6,390.	6,577.	6,725.	5,533.	9,431.	10,153.	11,384.	12,223.	12,474.	11,335.	12,808.	15,423.	15,587.	14,701.	13,987.	14,420.	15,859.	16,667.	17,838.	18,838.	1,147.
Kazakhstan	991.	1,551.	1,543.	1,820.	1,782.	3,101.	3,928.	3,949.	4,882.	5,473.	5,053.	5,757.	7,973.	10,523.	11,422.	13,562.	14,434.	13,370.	14,234.	16,144.	16,264.	1,509
Germany	3,450.	4,186.	5,370.	6,780.	4,973.	8,769.	8,168.	8,231.	8,250.	8,027.	6,858.	8,095.	8,545.	8,909.	9,499.	9,551.	8,992.	9,709.	10,582.	10,819.	12,405.	599.
France	1,922.	1,841.	2,751.	2,845.	2,744.	5,545.	5,822.	5,859.	6,341.	6,688.	6,701.	7,527.	7,570.	7,553.	7,407.	7,733.	7,989.	9,026.	10,038.	9,773.	10,572.	305
Australia	1,054.	1,007.	1,259.	1,754.	2,244.	3,461.	3,454.	4,053.	4,502.	4,466.	3,721.	5,443.	7,093.	7,480.	6,765.	5,118.	4,804.	5,631.	7,287.	7,495.	7,014.	383

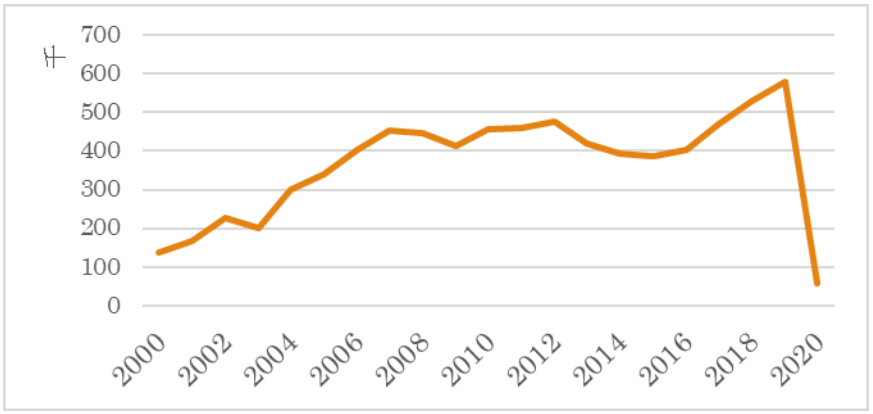
[28]JTB Tourism Research & Consulting Co. (JTB) (2019). Overseas Residents' Visits to Japan by country, 2018. https://www.tourism.jp/en/tourism-database/stats/inbound/

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*
United Kingdom	2,197.	2,795.	3,101.	3,474.	2,854.	4,965.	5,206.	5,590.	6,717.	6,781.	5,847.	6,209.	7,120.	6,804.	6,391.	5,758.	6,148.	6,161.	5,996.	5,905.	5,931.	302
China, Taiwan	502.	574.	627.	589.	438.	1,277.	1,162.	1,476.	1,280.	1,404.	1,086.	1,235.	1,864.	2,288.	2,005.	2,404.	2,810.	3,732.	4,452.	5,233.	5,930.	95
China, Hong Kong	174.	184.	252.	366.	380.	757.	636.	584.	434.	369.	434.	791.	1,878.	1,888.	1,729.	1,927.	1,848.	1,583.	2,808.	3,121.	4,311.	147.
Italy	802.	742.	957.	987.	565.	1,918.	1,921.	2,452.	2,744.	2,454.	2,415.	2,810.	2,737.	2,769.	2,682.	2,491.	2,853.	3,000.	2,971.	3,192.	3,655.	74.
Netherlands	1,116.	1,391.	1,338.	1,679.	697.	3,140.	2,672.	8,988.	3,380.	3,255.	2,775.	3,244.	3,239.	2,999.	2,594.	2,360.	2,495.	2,876.	3,099.	3,777.	3,613.	86.
Canada	719.	606.	825.	1,05	1,14	2,33	2,30	2,40	2,42	2,64	2,25	2,86	3,17	2,82	2,60	2,21	2,56	3,05	3,43	3,57	3,59	169.
Singapore	965.	381.	499.	729.	386.	778.	947.	860.	995.	932.	922.	1,164.	1,798.	1,982.	1,772.	1,593.	1,755.	2,064.	2,485.	2,649.	3,010.	65.
Switzerland	447.	637.	665.	863.	638.	2,231.	2,247.	2,232.	2,580.	2,377.	2,163.	2,394.	2,564.	2,730.	2,648.	2,450.	2,378.	2,627.	2,767.	2,665.	2,927.	76.
Belarus	104.	150.	160.	185.	139.	285.	155.	239.	177.	237.	188.	177.	284.	299.	709.	653.	1,078.	1,329.	2,107.	2,210.	2,902.	2,090
Thailand	58.	141.	99.	128.	176.	236.	207.	382.	292.	418.	443.	546.	660.	968.	1,019.	869.	962.	1,100.	1,492.	2,259.	2,631.	127.
India	359.	320.	401.	340.	402.	556.	417.	688.	777.	881.	941.	940.	1,478.	1,340.	1,519.	1,307.	1,478.	1,713.	1,874.	2,298.	2,478.	184.
Spain	314.	245.	269.	290.	220.	937.	763.	1,156.	1,213.	1,314.	1,315.	1,340.	1,426.	1,125.	1,036.	1,090.	1,309.	1,461.	1,647.	1,969.	2,080.	48.
Malaysia	242.	195.	235.	363.	266.	516.	755.	792.	843.	881.	846.	926.	1,350.	1,409.	1,296.	1,249.	1,506.	1,372.	1,672.	1,731.	2,062.	53.
Turkey	243.	351.	302.	342.	214.	346.	513.	517.	436.	578.	498.	1,157.	851.	1,676.	2,720.	2,306.	2,421.	2,209.	2,189.	2,699.	1,874.	545
Austria	310.	502.	630.	664.	319.	1,017.	938.	1,201.	1,484.	1,219.	1,105.	1,118.	1,057.	1,183.	1,254.	1,216.	1,137.	1,333.	1,579.	1,349.	1,533.	57.
Poland	148.	324.	489.	731.	205.	902.	613.	932.	1,180.	1,338.	1,048.	1,163.	1,172.	1,292.	1,489.	1,315.	1,351.	1,363.	1,276.	1,196.	1,499.	42.
Sweden	686.	904.	1,328.	1,277.	991.	2,063.	1,926.	1,781.	2,112.	1,894.	1,634.	1,625.	1,463.	1,407.	1,392.	1,040.	1,302.	1,134.	1,166.	1,154.	1,439.	50.
Belgium	303.	383.	519.	708.	405.	1,060.	788.	966.	1,089.	1,005.	819.	964.	1,158.	1,045.	1,113.	1,083.	1,260.	1,380.	1,532.	1,505.	1,436.	30.

Year / Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020*
New Zealand	363.	428.	487.	633.	450.	921.	952.	676.	961.	928.	710.	882.	961.	974.	928.	795.	765.	887.	986.	1,059.	1,250.	57.
Ukraine	798.	699.	633.	879.	994.	1,069.	902.	968.	1,205.	960.	967.	818.	1,009.	1,080.	1,186.	1,279.	1,495.	1,470.	1,309.	1,541.	1,233.	190.
Philippines	172.	246.	207.	239.	219.	412.	394.	374.	479.	510.	600.	823.	941.	767.	611.	608.	767.	795.	1,219	1,169	1,204	79
Israel	173.	208.	337.	478.	231.	573.	471.	569.	628.	642.	600.	757.	827.	864.	819.	748.	939.	887.	902.	939.	1,152	48.
Czech Republic	387.	414.	490.	519.	419.	719.	716.	825.	888.	932.	815.	841.	756.	977.	912.	858.	958.	1,086.	1,036.	1,116.	1,068.	50.
Viet Nam	131.	112.	163.	135.	189.	318.	233.	607.	381.	665.	381.	415.	362.	393.	310.	441.	484.	768.	947.	704.	1,061.	8.

Source: MSIS, 2020; JICA Project Team

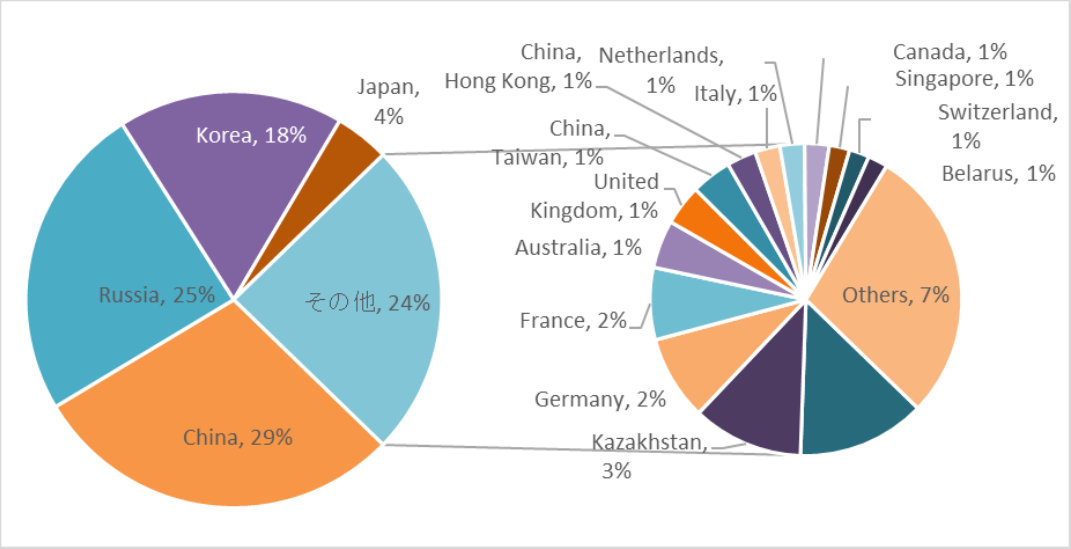
The pace of expansion of Mongolia's tourism market pre-COVID-19 at 7.9% per year between 2000 and 2019 (Figure 5.1.1, Table 5.1.2) exceeded that of the world at 4.1% per year during the same period. Mongolia's tourism market has been rapidly expanding; however, compared to the countries with most tourist arrivals in 2019 (Table 5.1.2), the size of Mongolian tourism industry is quite small. France received the largest number of tourists (89.4 million foreigners) in the world, making Mongolian tourism sector equivalent to 0.59% that of France's. The percentages in comparison with some major Asian tourist destinations are 0.84% and 1.38% respectively that of China and Thailand (UNWTO[29], 2020; MSIS, 2020).



Source: Mongolian Statistical Information Service (MSIS), 2020; JICA Project Team

Figure 5.1.1 Number of Foreign Tourists during 2000-2020

[29]United Nations World Tourism Organization (UNWTO) (2018). World Tourism Barometer.; Mongolian Statistical Information Service (MSIS) (2019). Tourism. http://www.1212.mn/stat.aspx?LIST_ID =976_L18



Source: MSIS, 2020; JICA Project Team

Figure 5.1.2 Percentage of Foreign Tourists by Country in 2019

Table 5.1.2 Comparison of Tourist Arrivals to Mongolia Compared with Tourist Arrivals to Top 10 Tourism Destinations in the World

	Country	(million in 2019)	(% of Mongolia)
1	France	89.4	0.65%
2	Spain	83.7	0.69%
3	USA	79.3	0.73%
4	China	65.7	0.88%
5	Italy	64.5	0.90%
6	Turkey	51.2	1.13%
7	Mexico	45	1.28%
8	Thailand	39.8	1.45%
9	Germany	39.6	1.46%
10	UK	39.4	1.47%

Source: UNWTO, 2020; MSIS, 2020; JICA Project Team

Data availability on domestic tourists compared to foreign tourists is very poor, as there is no formal and systematic data collection has been undertaken. The numbers of visitors are counted only at the entries of Specially Protected Areas (SPA) as shown in Table 5.1.3. Locations of the SPAs are shown in Figure 5.1.8. While these numbers of SPA entries do not portray the accurate picture and need to be treated with special precautions, it is a starting point to questioning how the data collection system is set up and what aspects need to be improved and how. These numbers represent the minimum of domestic tourists and should be cross-checked with data at other data points to form the baseline.

The role of domestic tourists is quite significant, as the number keeps increasing from year to year. Due to the closing of borders responding to COVID-19, this number is expected to increase significantly as the situation is resolved in view of the increasing number of outbound Mongolian travelers reaching 2.4 million. There exist also extremely limited studies on domestic tourists in general, which makes the appropriate planning and preparation for the tourism season quite difficult. Therefore, there is acute need for conducting research and studies on the behaviors and preferences of domestic tourists as well as tourist visits to different destinations.

Table 5.1.3 Entries to Specially Protected Areas

№	Name of protection authorities	2013		2014		2015		2016		2017		2018		2019		2020	
		Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic
1.	Gobi Ikh SPA "A" section	-	-	-	-	170	1,600	110	1,450	40	2,145	9	8	50	1,873	150	1,078
2.	Gobi Ikh SPA "B" section	-	-	-	-	-	-	-	-	8	-	53	1583	29	-	-	-
3.	Uvs Lake SPA	329	6,868	677	7,772	10,166	553	533	1,331	860	13,469	981	10,724	997	14,883	794	11,960
4.	Dornod SPA	6	2	-	-	-	-	17	15	10	130	14	4	10	16	172	56
5.	Khar-Us Lake SPA	92	50	200	100	150	150	50	200	161	1,904	339	2,624	-	2,216	1,000	5,922
6.	Tujiin Nars SPA	-	-	-	-	-	-	-	-	-	297	7	-	-	124	-	3,07
7.	Khukh Serhiin Lake SPA	-	-	-	-	63	1,987	172	2,467	525	2,142	241	1,365	655	1,144	50	2,323
8.	Khugnu Tarniin National Park	5,051	-	4,120	-	2,107	1,355	1,008	5,400	509	253	669	1,339	783	1,210	-	20,926
9.	Dariganga National Park	35	4,500	100	5,200	-	3,000	21	3,800	-	1,982	-	8,326	-	3,333	268	2,776
10.	Munkh-khairkhan National Park	97	592	24	132	20	260	35	120	1,171	1,000	713	1,000	2,271	9,100	1,035	906
11.	Gobi Baga SPA	-	-	-	-	-	-	-	-	-	-	-	55,786	-	68,576	-	-
12.	Orkhonii Khundii National Park	8,669	12,749	5,224	13,999	6,718	14,900	6,312	4,153	8,309	9,213	8,750	9,900	121,350	15,150	-	3,230
13.	Onon Balj National Park	153	877	324	1,218	438	3,407	491	3,461	320	6,133	531	4,810	327	6,730	1	7,590
14.	Tarvagatai n Nuruu National Park	-	808	20	90	62	82	53	-	49	539	149	1,098	62	1,837	-	2,576
15.	Numrug SPA	28	7	71	17	80	47	99	24	22	44	3	336	17	137	117	585

16.	Mongol Altain Nuruu SPA	750	193	1,500	550	2,013	500	1,998	1,448	2,769	2,847	2,632	1,050	- 1,74	3,550	71	10,50
17.	Otgontenger SPA	345	3,434	278	5,256	350	5,253	454	9,327	655	7,137	1,081	11,968	-	30,000	1,547	14,094
18.	Gobi Gurvan Saikhan National Park	7,304	2,060	10,829	7,181	7,949	3,324	8,689	5,631	6,640	10,720	8,050	7,823	15,207	13,888	2,540	44,600
19.	Khuvsgul SPA	3,690	28,761	3,346	42,097	4,994	57,824	3,278	36,131	10,135	66,833	15,358	74,120	16,482	59,422	50	80,591
20.	Khan Khentii SPA	-	-	2,450	4,700	500	5,837	406	11,637	3,468	8,966	2,061	296	236	5,705	3,969	22,851
21.	Khangain Nuruu National Park	1,829	10,642	2,926	14,563	4,291	17,423	3,354	22,500	3,432	28,053	5,392	41,747	6,327	32,400	-	37,073
22.	Khustain Nuruu National Park	9,386	6,638	10,177	7,319	9,918	8,097	12,452	8,819	-	-	-	-	18,880	5,114	270	6,500
23.	Ikh Bogd Uul National Park	-	243	35	747	23	815	56	855	118	1,059	53	532	73	788	32	1,753
24.	Bogdkhan Mountain SPA	2,120	41,250	1,480	69,950	330	31,650	2,000	42,000	2,749	31,805	2,150	32,000	2,000	25,162	151	1,749
25.	Mongol Els National Park	40	500	60	600	82	1,440	81	800	25	1,400	103	400	162	106	-	1,686
26.	Myangan Ugalzatiin Nuruu National Park	40	213	200	520	-	-	184	157	-	180	-	2,887	7	1,016	-	2,200
27.	Khan Khukhiin Nuruu SPA	-	-	125	2,355	594	4,068	490	4,449	52	2,846	949	3,033	2,220	4,900	1,018	486
28.	Zed Khantai Buteeliin Nuruu SPA	-	-	-	650	-	177	-	1,965	11	1,400	-	1,100	-	1,925		3,625
29.	Ulaan Taiga SPA	889	300	650	642	459	377	602	143	820	166	827	300	930	263	252	813
30.	Gorkhi-Terelj National Park	18,300	80,500	20,800	112,700	19,100	108,400	22,300	113,000	28,828	125,641	30,764	104,051	17,797	75,026	10,571	94,500
31.	Ikh Gazriin Chuluu National Park	-	-	10	841	84	334	79	261	123	502	67	348	310	659	-	1,170

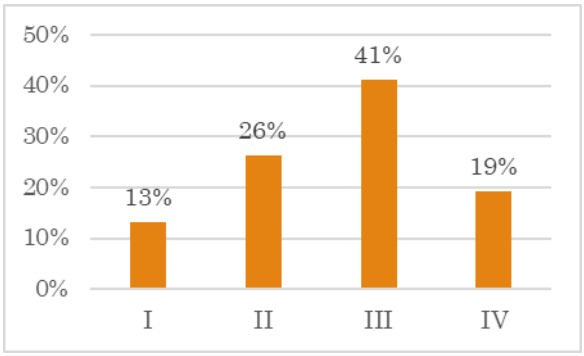
32.	Ikh Nart Nature Reserve	-	-	-	-	-	-	-	-	-	-	-	-	499	22		
33.	Khar Yamaat Nature Reserve	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Total	**59,153**	**201,187**	**65,626**	**299,199**	**70,661**	**272,860**	**65,324**	**281,544**	**328,806**	**71,809**	**81,946**	**380,558**	**209,429**	**386,275**	**24,058**	**387,204**

Source: MET

5.1.3 Characteristics of Mongolia's tourism sector

(1) Seasonality

Mongolian tourism sector is characterized by short seasons, mainly concentrated in the summer months of June, July and August due to harsh climate for the rest of year. According to the statistics, the average number of tourists per quarter from 2010-2019 is as follows: 13% in the 1st quarter, 26% in the 2nd, 41% in the 3rd and 19% in the 4th quarters (Figure 5.1.3), which shows that the current tourism development is seasonally dependent.



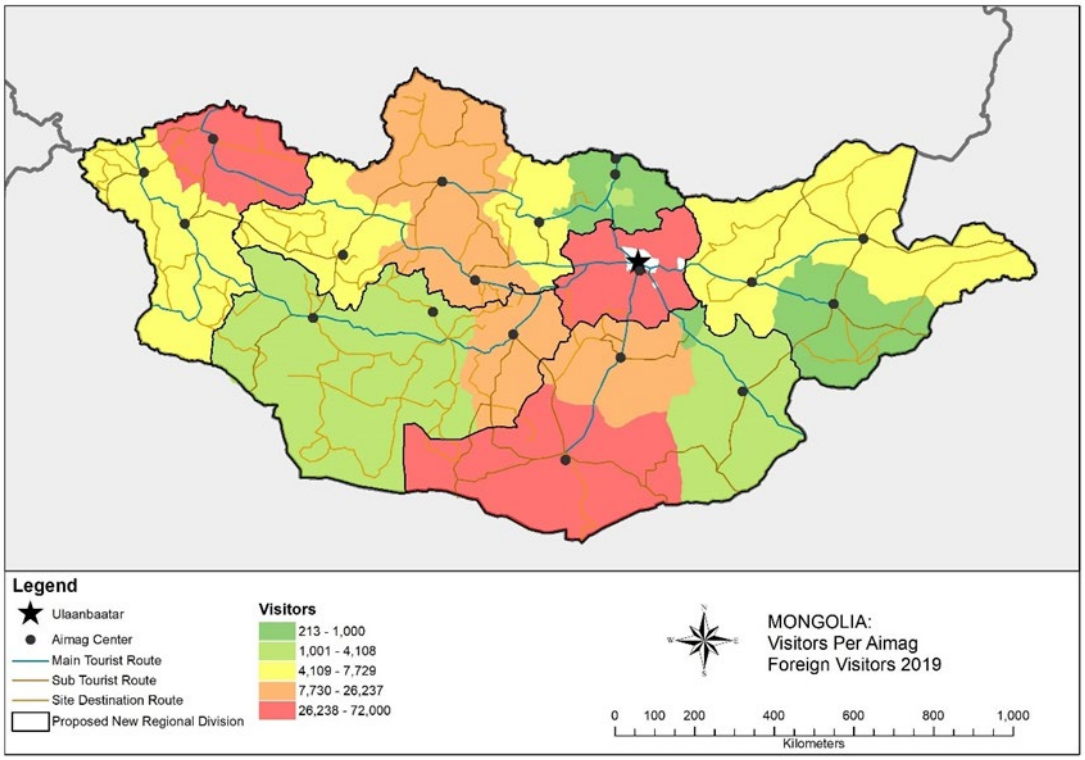
Source: MSIS, 2019; JICA Project Team

Figure 5.1.3 Quarterly Average of Tourist Numbers from 2000-2019

(2) Spatial distribution of tourists

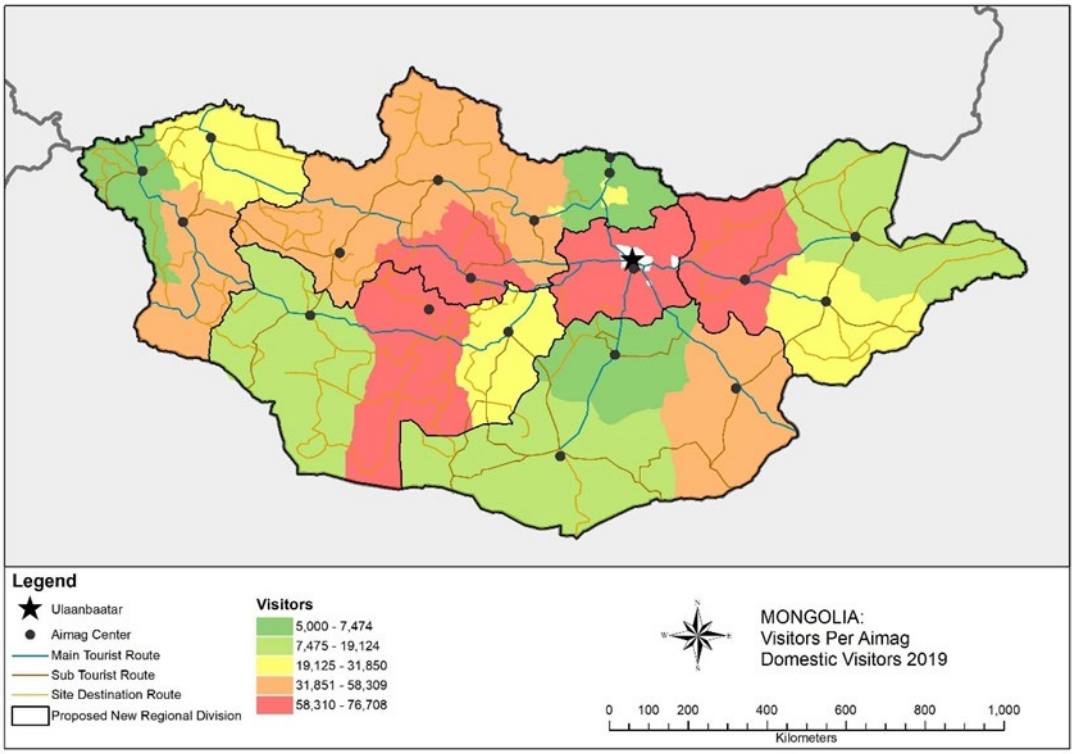
The number of tourists per Aimag was visualized in Figures 5.1.4 through 5.1.7 and shown in Table 5.1.4. The data were extrapolated from various sources by the Tourism Developemnt Center under MET. The accuracy of the data need to be validified, thus the data should be taken precautisously. The darker green colors are the Aimags with fewer visitors, in cotrast to the Aimags indicated in red with more visitors. There was missing data for the Aimags indicated in white. The number of foreign and domestic tourists varied per each Aimag. It can be seen that the travel behavior is quite different for domestic travelers from that of foreign visitors. As domestic tourism is an ever increasing market, much effort should be directed towards awareness raising and educational programs for traveling responsibly.

It should be noted, however, the data collection system is not effective, while more comprehensive analysis per region and Aimag is missing, that should be the basis for informed decision making. The importance of this stage cannot be overlooked, as there is an immence gap in the data availability and reliability.



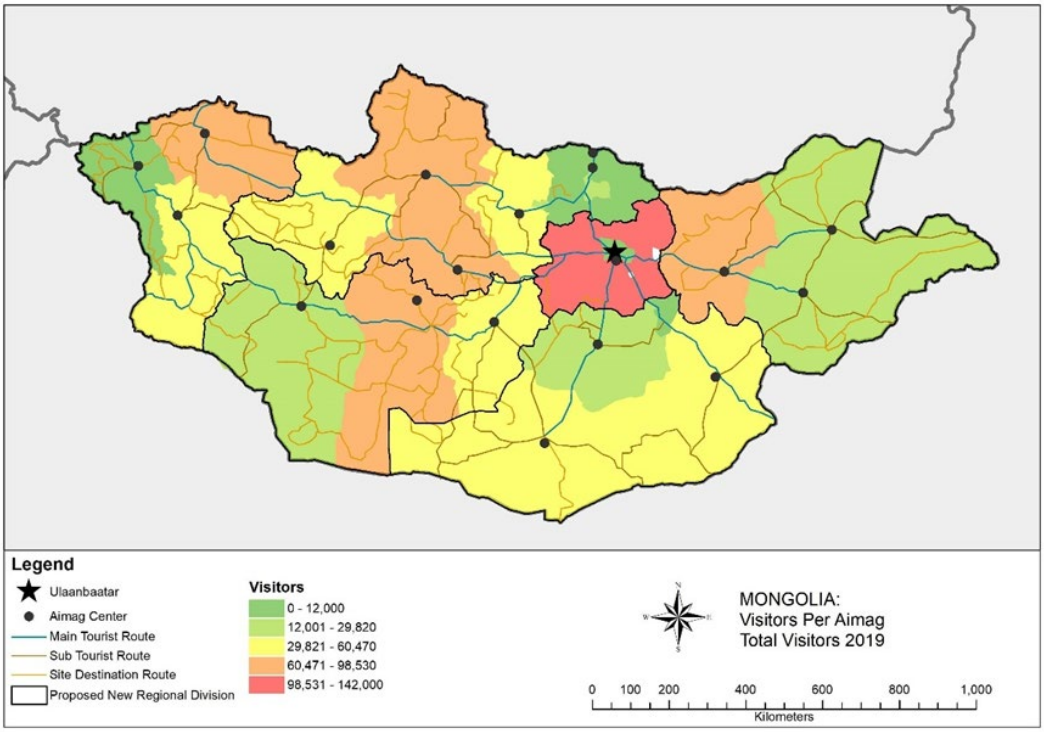
Source: Aimag reports; JICA Project Team

Figure 5.1.4 Number of Foreign Tourists by Aimag in 2019



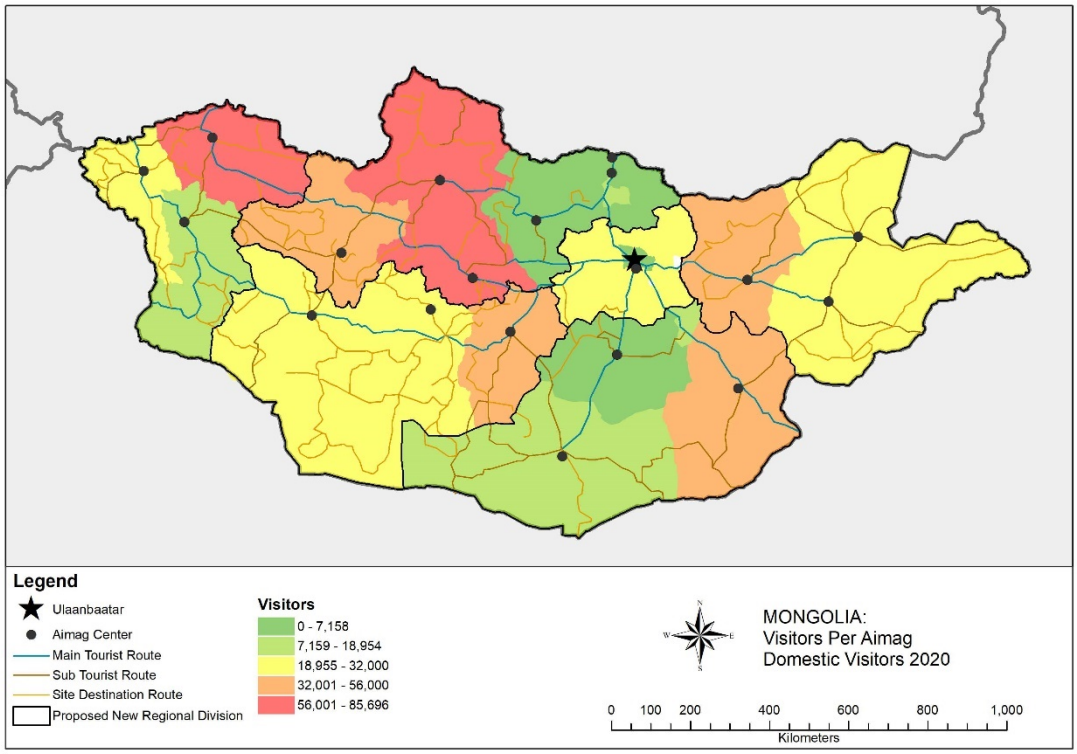
Source: Aimag reports; JICA Project Team

Figure 5.1.5 Number of Domestic Tourists per Aimag in 2019



Source: Aimag reports; JICA Project Team

Figure 5.1.6 Number of Total Tourists by Aimag in 2019



Source: MET; JICA Project Team

Figure 5.1.7 Number of Domestic Tourists by Aimag in 2020

Table 5.1.4 Number of Tourists per Aimag

#	Aimag	2019 Foreign	2019 Domestic	2019 Total	2020 Domestic
1	Arkhangai	21822	76708	98530	85696
2	Bayan-Ulgii	6000	6000	12000	25000
3	Bayankhongor	2000	70080	72080	30787
4	Bulgan	6825	40827	47652	100000
5	Gobi-Altai	1752	19124	20876	21653
6	Govisumber	213	7474	7687	16957
7	Darkhan-Uul	4108	25712	29820	16410
8	Dornogovi	2161	58309	60470	52077
9	Dornod	7729	16000	23729	23000
10	Dundgovi	16767	5285	22052	7158
11	Zavkhan	5388	44598	49986	45832
12	Orkhon	422	27434	27856	1744
13	Sukhbaatar	964	23150	24114	23026
14	Uvurkhangai	26237	31666	57903	43000
15	Selenge	1000	5000	6000	-
16	Tuv	72000	70000	142000	32000
17	Uvs	45104	31850	76954	67900
18	Khovd	6892	45630	52522	18954
19	Khuvsgul	26137	56531	82668	80591
20	Khentii	6105	65030	71135	56000
21	Umnugovi	42132	12955	55087	12600
	Total	**301758**	**739363**	**1041121**	**760412**

Source: MET

(3) Specially protected areas

As of 2020, 32.7 million ha (21%) of Mongolia's territory has been taken under special state protection, and as a result, 50% of water resources, 40% of forest lands, and about 350 species of rare and endangered animals and plants have been protected. Currently there are a total of 120 specially protected areas (32.7 million ha), including 21 strictly protected areas (13.8 million ha), 37 national conservation parks (13.5 million ha), 48 nature reserves (5.3 million ha), and 14 monuments (0.1 million ha) contributing to the preservation of the nature, and ensuring the balance of the ecosystem (Table 5.1.5, Figure 5.1.8). The specially protected areas are managed by the Specially Protected Areas Authority of the Ministry of Nature, Environment and Tourism and its 33 Specially Protected Areas administrations (Table 5.1.3). The number of entries to each SPA was visualized in Figures 5.1.9 and 5.1.10. In addition, 23.4 million ha of land or 15% of the total territory is under local special protection.

Policy documents including the Vision2050, Mongolia's national security concept, green development policy, five-year development guidelines, and the Government action plan for 2020-2024 set comprehensive goals related broadly to tourism. They cover protecting areas of special importance for protection of historical and cultural heritages, endangered animals and plants, gradually expanding the areas in phases by covering 30% of the total territory by 2030 and 35% by 2050, and bringing the protected areas management to international standards.

However, increasing by itself is not the main issue, management of the SPAs is of utmost significance. There are such cases called “paper parks” that exist only in government documents, where protected areas are established before acquiring the capacity to adequately manage those areas[30]. However, there

[30] Reading et al. (2016). From “Paper Park” to Model Protected Area: The Transformation of Ikh Nart

are few examples of success cases, such as Khustai National Park, Ikh Nart and Khar Yamaat Nature Reserves. Additionally, a study on feasibility of concessions for tourism and ecosystem services in Mongolia's protected areas has been conducted[31].

The transformation of Ikh Nart Nature Reserve from "Paper Park" to model protected area is an example that needs to be widespread throughout the rest of the SPAs. The following factors were indicated for its success: 1) Rigorous research, 2) Management structure, plan and process, 3) Building local capacity, 4) Cultivating local support and 5) Creating sustainable administrative policies and funding.

Another issue with the national parks in Mongolia is the lack of routes and trails that are designed for tourists and visitors. In the long run, this can create more adverse impacts to the surrounding environment, as well as creating difficulty to explore the area. Several projects are being conducted for creating short distance tourist routes in the SPAs by MET. However, the experts and staff lacking technical skills could benefit from capacity building and training programs, as well as partnering up with other organizations both domestic and international to complement the skills and knowledge (i.e. SPAs, National Parks – sister-park associations through research and skill transfer programs).

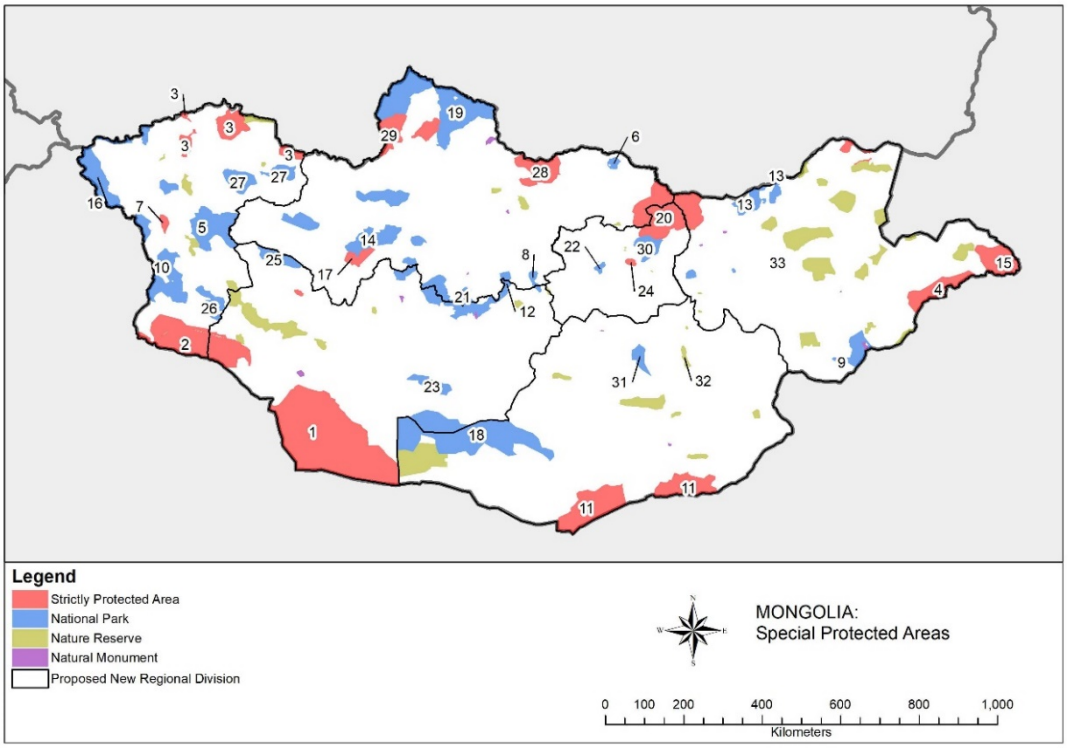
Law on SPA and other related laws and regulations need to be reviewed. Moreover, the law is, in some ways, contradictory to the indigenous lifestyle of the locals; i.e. some of the indigenous communities have been living in the forest areas, on the banks of lakes for centuries, whereas in the law it is indicated to be banned.

Table 5.1.5 Specially Protected Area by Type

Types	Number	Land size (ha)	Percentage of total land size
Strictly protected area	21	13,798,749	8.8%
National conservation park	37	13,496,406	8.6%
Nature reserve	48	5,336,473	3.4%
Natural monument	14	106,577	0.1%
Total	120	32,738,175	21%

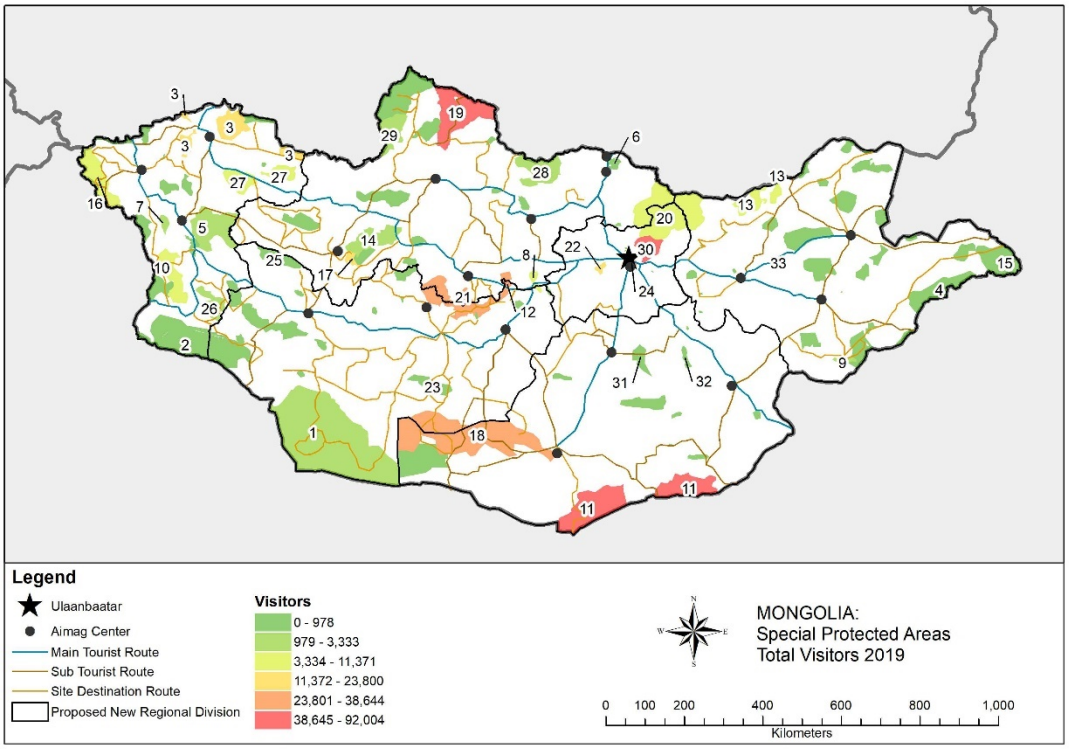
Nature Reserve, Mongolia. https://parksjournal.com/wp-content/uploads/2014/04/PARKS%2022.2%2010.2305IUCN.CH.2016.PARKS-22-2.en.pdf

[31] TRC Tourism (2013). Feasibility of Concessions for Tourism and Ecosystem Services in Mongolia's Protected Areas. https://www.undp.org/content/dam/mongolia/Publications/Environment/mrpa-project/SPAN_Concessions_PA_Tourism_eng.pdf



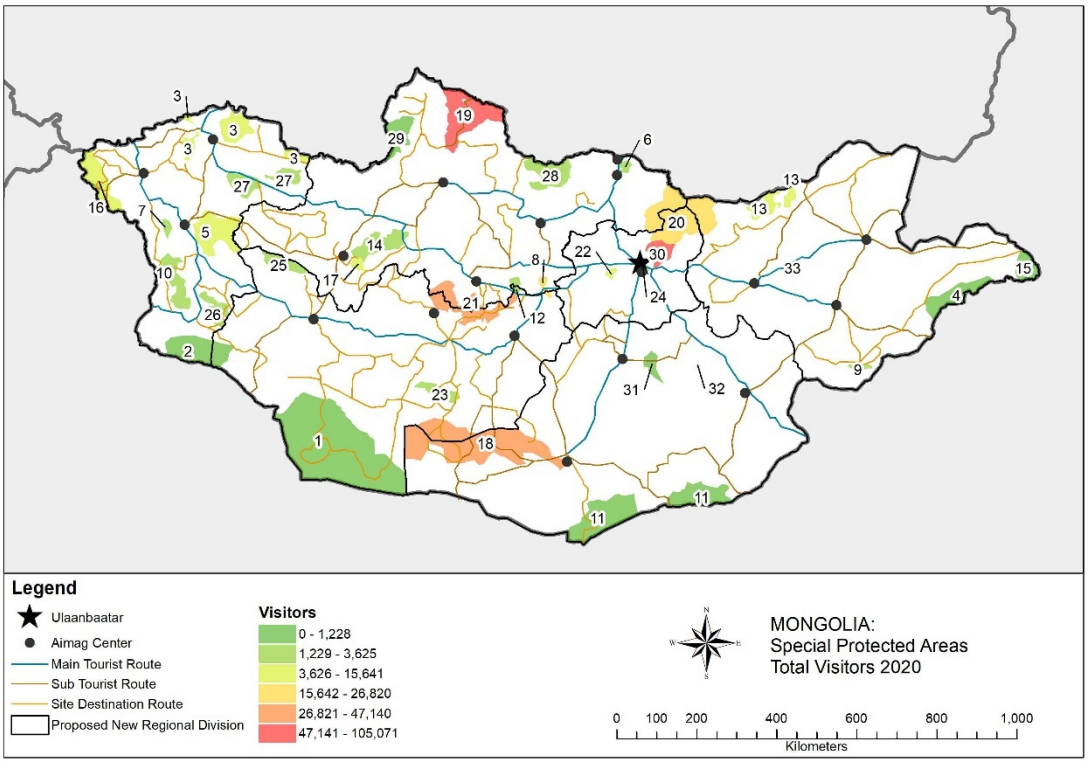
Source: MET

Figure 5.1.8 Map of Special Protected Area Location



Source: Aimag reports; JICA Project Team

Figure 5.1.9 Number of Tourist Entries per SPA



Source: Aimag reports; JICA Project Team

Figure 5.1.10 Number of Tourist Entries per SPA

(4) Economic aspect

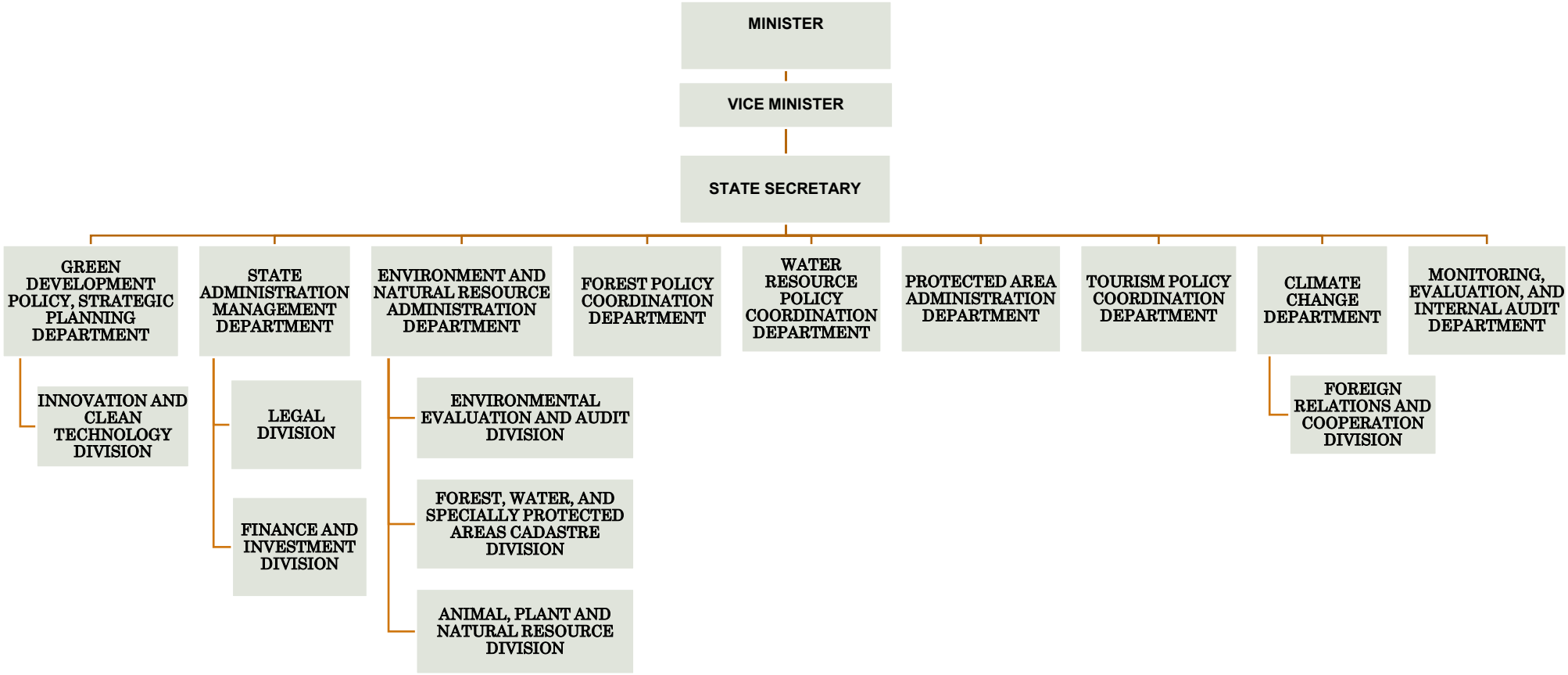
The tourism sector makes substantial contribution to the economy, employment and export sectors, signifying the further potential of tourism sector development. According to the World Travel and Tourism Council (WTTC)[32], direct contribution of tourism sector to Mongolia's GDP was US$330 million in 2017, or 3.1% of the total GDP. The total tourism economy (direct and indirect economic impact) was US$1.2 billion, or about 11.4% of total GDP.

The tourism industry also serves as an economic multiplier, which not only helps create job opportunities, but also has indirect impacts to the local economy as a whole. The sector generates about 34,000 direct jobs (around 2.9% of the total employment), and 87,500 indirect jobs (some 7.5% of total employment). Visitor exports generated MNT1,118.3billion (US$459.3million), 6.7% of the total export value in 2017. This is forecast to grow by 2.5% in 2018 (WTTC, 2018). Tourism sector also became one of the top sectors that generated foreign currencies, ranked the third after coal and copper.

5.1.4 Existing tourism policy in Mongolia and its challenges

MET is the main body in charge of formulating the policy and legal framework regarding tourism sector's development and promotion. It consists of nine departments, with an addition of Climate Change and International Cooperation Department in 2017. The new organizational chart of MET as of August 2020 is presented in Figure 5.1.11. A Tourism Development Center was formed in 2017 in order to ensure the implementation of tourism policy under MET. In April 2021, a Tourism Board was established consisting of senior tourism experts to support the activities of the Tourism Development Center.

[32]World Travel and Tourism Council (WTTC). (2018). Travel & Tourism, Economic Impact 2018 - Mongolia.



Source: MET

Figure 5.1.11 Organizational Chart of the Ministry of Environment and Tourism (MET)

(1) Law on tourism

The law on tourism was adopted in 2000. It is accompanied by 12 sets of rules, regulations and standardizations as listed below. However, the law is outdated and currently under discussion for revision.

(a) Basic terminology for tourism and types of accommodations (MNS 5409:2004)
(b) Tourist accommodations – types and basic requirements (MNS 5824:2007)
(c) Tourist services – hotel basic requirements (MNS 4588:2008)
(d) Tourist services – hotel service and quality ranking, basic requirements (MNS 5927:2008)
(e) Tourist services - Inn basic requirements (MNS 5738:2007)
(f) Tourist camps – service quality ranking, basic requirements (MNS 4934:2002)
(g) Tourist services - resort service quality, basic requirements (MNS 5374:2004)
(h) Tourist services - service stops along the road, basic requirements (MNS 5537:2016)
(i) Basic requirements for resorts, tourist camps and ger camps (MNS 6043:2009)
(j) Automobile service for tourists – basic requirements (MNS 5231:2003)
(k) Tourism organization classification and grading (2009.09.02 #31)
(l) Appointing of a tourism envoy, representative

(2) TDNP

The Tourism Development National Program (TDNP) was formulated and approved by the Government in 2015. The objectives established by the program are as follows:

(a) Improvement of the infrastructure and increasing the capacity (accommodations and transportation);
(b) Development of tourism clusters/regions, and tourism products and services through community-based tourism (CBT) and national protected areas;
(c) Development of the survey method and information system, improvement of data collection and ensuring quality of data;
(d) Human resource and capacity development;
(e) Promotion of international collaboration and marketing; and
(f) Promotion of domestic tourism and raising of tourism awareness among the local residents.

(3) SDV2030

The SDV 2030 was approved by the Government in 2016. The SDV2030 objective for tourism industry states ‘Mongolia would become the international destination for nomadic culture and tourism’. Table 5.1.6 indicates the targets set for tourism sector for each phase of the SDV 2030.

Table 5.1.6 SDV2030 Targets for Tourism Sector

Theme	Phase I (2016-2020)	Phase II (2021-2025)	Phase III (2026-2030)
Infrastructure and service quality	Improve the infrastructure and service quality of major natural and cultural heritage sites (NCS) and exhibitions	Improve the quality of infrastructure and services	
Tourism promotion	Create Mongolia's unique tourism image in the international platforms	Consistently improve the promotion of Mongolia's nomadic culture and tourism	Promote Mongolia's nomadic culture and tourism brand globally
Regional tourism corridor		Join the international tourism corridor regionally	
Eco-tourism	Develop eco-tourism regions and products compliant with environmental and health requirements	Develop eco-tourism regions and products and services compliant with environmental and health requirements	Develop eco-tourism regions and products and services compliant with environmental and health requirements
Seasonal tourism		- Diversify and develop seasonal tourism	
Revenue from tourism industry			Increase revenue from tourism
Tourist target (base level: 0.39 million – 2014)	Increase the number of foreign tourists to 1 million annually	Increase the number of foreign tourists to 1.5 million annually	Increase the number of foreign tourists to 2 million annually
Area of specially protected Land (base level: 17.4% - 2014)	Increase the area of specially protected areas to 25 percent	Increase the area of specially protected areas to 27 percent	Increase the area of specially protected areas to 30 percent

Source: JICA Project Team based on SDV2030

The SDV2030 includes a target to increase the number of foreign tourists to 2.0 million annually by 2030. In order to attain the target, significant improvements need to be realized by a systematic approach. In terms of environmental protection, the SDV2030 sets a target to increase the special protected areas to 30% of the national land. Figure 5.1.8 depicts the current location and type of special protected areas in Mongolia.

(4) Three pillar development policy (TPDP)

The Three Pillar Development Policy (TPDP) was approved by the Cabinet in February 2018. The following targets were included regarding tourism development: 1) infrastructure development, 2) increasing the competitiveness at the regional level, and 3) development of CBT and specialized tourism based on local conditions and context. TPDP is also the main document of the 2018-2020 investment program of Mongolia.

These policy documents including Law on Tourism, three policy documents, TDNP, SDV 2030 and TPDP, cover various issues and the necessary objectives. However, further refining of the priority tasks in view of different criteria is required.

(5) Vision2050

The Vision2050 was approved by the resolution 52 of the Parliament in May 2020. In the policy document, tourism sector was deliberately planned in all the six economic regions newly proposed in order to ensure balanced development. The Vision2050 will be implemented in three phases: Phase I (2021-2030), Phase II (2031-2040) and Phase III (2041-2050).

The tourism development in the six economic regions is conceived in the Vision2050 as follows:

(a) Dornod Mongolia Economic Development, Industrial, Tourism, Green Development Region (Khentii, Dornod and Sukhbaatar Aimags) – historical tourism, development of tourism infrastructure, cultural heritage-based tourism cities and clusters for historical tourism;
(b) Industrial, Service, Paleontological Tourism Region based on Responsible Mining and High Technology (Umnugovi, Dundgovi, Dornogovi, Govisumber) – development of tourism infrastructure and govi nature, archaeology, paleontology and historical and cultural, nomadic heritage based eco-tourism centers and cities, and national zoo park of rare Govi animals;
(c) Natural Resources, Tourism and Green Development Region (Govi-Altai, Bayankhongor, Uvurkhangai) – development of tourism infrastructure, nature (rare and endangered species and plants, special interest, leisure), health (spring sanatorium) and cross-border tourism;
(d) Economic Development Arteries of Western Mongolia and Altai Culture, Natural Resources and Green Development Region (Khovd, Bayan-Ulgii, Uvs) – development of tourism infrastructure and nature, special interest (eco-tourism) and cross-border tourism (international tourism complex);
(e) Khangai Intensive Agriculture, Tourism and Green Development Region (Selenge, Darkhan-Uul, Orkhon, Bulgan Arkhangai, Khuvsgul, Zavkhan) – tourism infrastructure and sustainable tourism development, nature, special interest and cross-border tourism; and
(f) Science and Technology International Center, Transportation Hubs, High-Tech Manufacturing and Service Region (Tuv Aimag, Ulaanbaatar city) – development of tourism infrastructure, historical, cultural, business, science, nature, special interest and cross-border tourism.

(6) State policy on tourism development

The state policy on tourism sector development was approved by the resolution 333 of the Parliament in August 2019 under the decree #333. The vision of the policy document indicates Mongolia to be the center of world's nomadic heritage and historical tourism. The implementation period is divided into the following two stages: first stage 2019 – 2022 (the number of tourists would reach to 1.2 million), second stage 2022 – 2026.

The specific targets include:

(a) Enhancement of tourism sector's legal framework;
(b) Tourism sector infrastructure development;
(c) Broadening tourism sector's international cooperation, marketing and promotion aspects;
(d) Development of tourism regions based on their unique features including geographic, natural, historical and cultural heritages, improvement of hygiene, service quality and standards and creation of jobs;
(e) Enhancement of tourism sector's education, training, research aspects and capacity development of sector's human resources; and
(f) E-tourism solutions based on technological and scientific advancements.

(7) Action plan of the Government of Mongolia 2020-2024

The action plan of the Government has set the following goals for the tourism sector.

- 2.6.3.3. Support innovative creative culture with national content, increase the range of products and services of cultural tourism, cinema art and classical art for commercialization.
- 3.4. Develop sustainable tourism based on nature, history and cultural heritage.

- 3.4.1. Implement "Sustainable Tourism Development-I" project in Khuvsgul and Khentii Aimags and "Sustainable Tourism Development-II" project in Arkhangai, Bayan-Ulgii, Uvurkhangai, Uvs and Khovd Aimags within the framework of state policy of tourism development and increase incomes of local community and enterprises.
- 3.4.2. Complete the construction of "Millennium Genius Chinggis Khaan Complex" within the framework of historical tourism development and carry out step-by-step activities to preserve historical sites included in the Mongolian Secret History, promote it internationally and ensure that sites are connected through infrastructure.
- 3.4.3. Commence the construction of an international complex of culture, religion and tourism based on the Manzshir historical site.
- 3.4.4. Increase the number of citizens and tourists to one million by improving tourism products, services, quality and standards, and increasing its competitiveness.
- 3.4.5. Promote tourism through production of innovative, masterpiece and branded products tailored to the specifics of Mongolian nomadic culture.
- 3.4.6. Develop tourism infrastructure in Bayan-Ulgii, Uvs, Khovd, Uvurkhangai, Arkhangai, Bayankhongor, Umnugovi, Dornod and Zavkhan Aimags and set up service areas and complexes along the roads; develop tourism in the Gobi region.
- 3.4.7. Increase the number of tourists by promoting cross-border tourism.
- 3.4.8. Introduce technological advances in tourism sector within the framework of "E-Mongolia" program and expand foreign advertising.
- 3.4.9. Set up a tourism training center to develop competent human resources.

(8) World Economic Forum (WEF): travel and tourism competitiveness index

In the Travel and Tourism Competitiveness Report (TTCR) conducted by the World Economic Forum (WEF) (2017)[33], Mongolia ranked 102nd out of 136 countries, dropping three places from 2015 (99th out of 141 countries) while scoring 3.3 points out of 7 in both years. However, in 2019 Mongolia moved up nine spots ranking 93rd globally (out of 140), and was recognized as most improved in terms of prioritization of travel and tourism and natural resources (WEF, 2019)[34]. The travel and tourism competitiveness index (TTCI) comprises four sub-indexes: A) enabling environment – comprising five pillars; B) travel and tourism (T&T) policy and enabling conditions – four pillars; C) infrastructure – three pillars and D) natural and cultural resources – two pillars. Table 5.1.7 presents the scoring, ranking and the sub-indexes of the 14 pillars for Mongolia. The pillars are ranked from the lowest scoring to the highest. The lower ranking pillars are indicated in red. It is necessary to consider both scoring and ranking of individual pillars in order to make further improvements, especially both of lower scoring and lower ranking pillars must be taken into consideration for future planning.

Table 5.1.7 Mongolia's Scores and Ranking in Travel and Tourism Competitiveness Ranking

Ranking /140	Pillar	Score	Sub-index
7	Price competitiveness	6.2	B
38	Health and hygiene	6.1	A
59	Cultural resources and business tourism	1.9	D
62	Safety and security	5.6	A
66	Natural resources	3.1	D

[33]World Economic Forum (WEF). (2017). The Travel & Tourism Competitiveness Report 2017. http://www3.weforum.org/docs/WEF_TTCR_2017_web_0401.pdf
[34]World Economic Forum (WEF). (2019). The Travel & Tourism Competitiveness Report 2019. http://www3.weforum.org/docs/WEF_TTCR_2019.pdf

78	Human resources and labor market	4.5	A
83	Business environment	4.3	A
85	ICT readiness	4.3	A
85	Prioritization of T&T	4.5	B
97	Air transportation infrastructure	2.2	C
105	Tourist service infrastructure	2.9	C
126	Ground and port infrastructure	2.2	C
128	International openness	1.9	B
131	Environmental sustainability	3.6	B

Note: A) Enabling Environment; B) T&T Policy and Enabling Conditions; C) Infrastructure and D) Natural and Cultural Resources.
Source: The Travel and Tourism Competitiveness Report (WEF, 2019); JICA Project Team

There are three categories of indicators that can be drawn out for further improvement: the lowest ranking, the decreased and the higher ranking indicators with potentials.

Mongolia scored and ranked one of the lowest in terms of environmental sustainability, international openness, ground and port infrastructure and tourist service infrastructure. The next set of indicators include those that dropped from the previous report: business environment and safety and security. The top three higher ranking indicators are price competitiveness, health and hygiene and cultural resources and business tourism.

There are several challenges facing the tourism sector in Mongolia. The current tourism sector of Mongolia is characterized by short tourism seasons, lack of a unified vision, long-term strategies and effective measures for sustainable growth, unequally shared social and economic benefits, poor service quality driven by lack of industry-led guidelines, limited capacity of tourism facilities and personnel and lack of experienced tourism service providers, on top of inadequacy of tourism data collection and reliability. For proper planning and policymaking, there should be evidence-based data and research in order to get valuable insights that will help improve the system.

5.2 Prospects of Tourism Development in Mongolia

5.2.1 Tourism resources and tour routes

The main tour routes and cross-border tour routes were approved by the Government in 2018. It consists of seven main routes, 30 sub-routes and 17 border routes. The following governmental organizations will work collaboratively for the development of these tour routes with MET in charge of developing the plan for tourism products and services while ensuring the safety of tourists: Ministry of Road and Transportation Development (MRTD) for infrastructure plan, Ministry of Finance (MoF) for financial aspects, and NDA for investment for the infrastructure.

The worldwide trend of tourism sector is moving towards specialization and experiential tourism, where the visitors and the locals are co-creating experiences and values rather than one side being on the receiving end of the equation. Tourists and visitors can also be part of the solution for helping protect the natural environment and the cultural treasures.

(1) Development of tourism clusters/regions

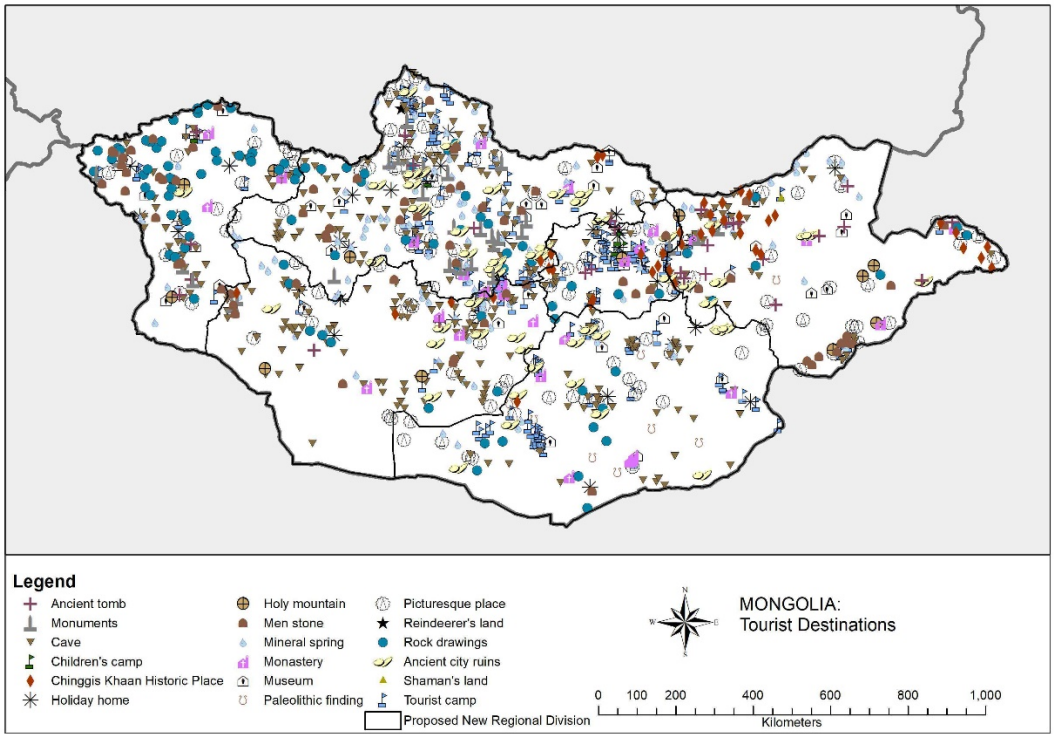
In 2017, during a conference on 'Sustainable Tourism Development' held by the industry leaders, all stakeholders came to a consensus on developing tourism clusters/regions. In the TDNP approved in 2015, the objective 2 includes developing tourism clusters and increasing tourism products and services.

The Government of Mongolia named Khentii Aimag as the center of historical tourism. A number of tourism complexes are being planned in the following locations to be constructed with the investment

of MNT5.7 billion from the state budget: the 'Mongol Empire' complex in Binder Soum, 'Valiant warrior Boorchu-Friendship residence' in Batnorov Soum and 'Shikhikhutag- The Secret History' in Norovlin Soum. Moreover, the 'Man of Millennium- Great Chinggis Khaan' complex will be built in Dadal Soum of Khentii Aimag with the ADB soft loan of US$19 million. The Government stopped the issuance of mineral licenses in the three rivers basin and historic sites of Khentii Aimag and started taking steps to take these areas under special protection.

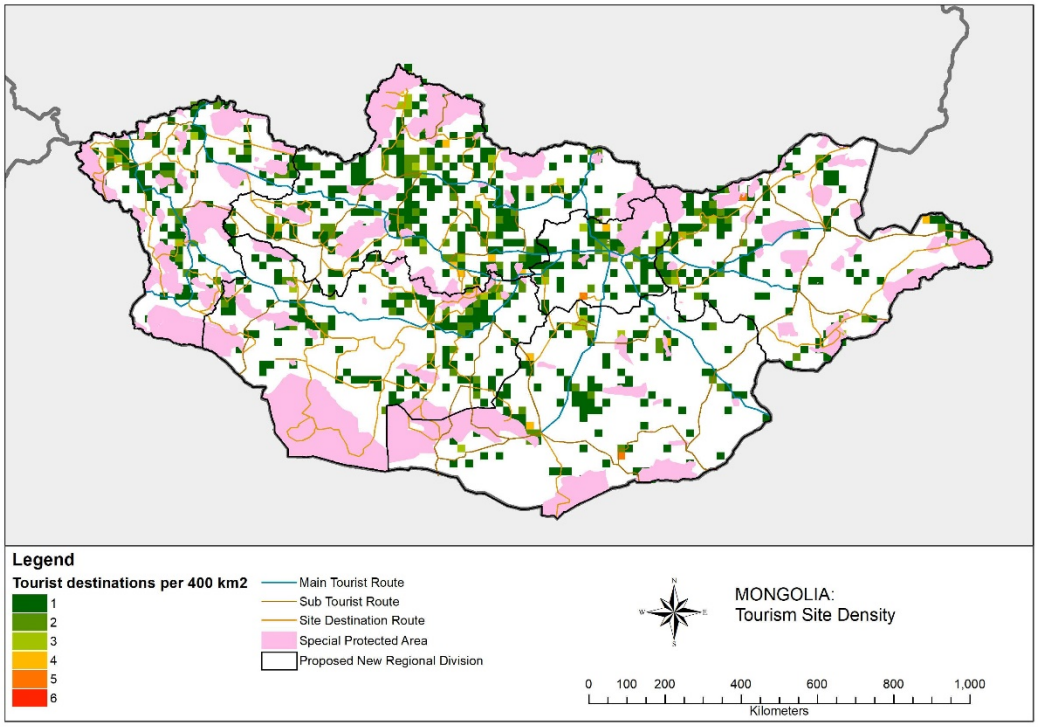
Khuvsgul Aimag was announced as the center of natural tourism and R&D and business tourism will be developed in Ulaanbaatar city. Central, Western, Eastern, Khangai, Gobi and Ulaanbaatar regions will also be further planned for tourism based on their geographical locations and tourism resources.

Developing the tourism sector through clusters/regions by identifying significant differences and unique characteristics of each region can help increase the tourism products and services, while fostering an environment to encourage collaboration. The further analysis on tourism clusters will include the socio-economic aspects of all the regions, existing and future infrastructure projects, natural and cultural resources etc. (Figures 5.2.1 through 5.2.4) for creating tour itineraries. Tourist site density is identified in Figure 5.2.2, which can help in identifying the sites with most potentials. The pixels with the most sites are indicated in red and the those with one site are indicated in dark green.



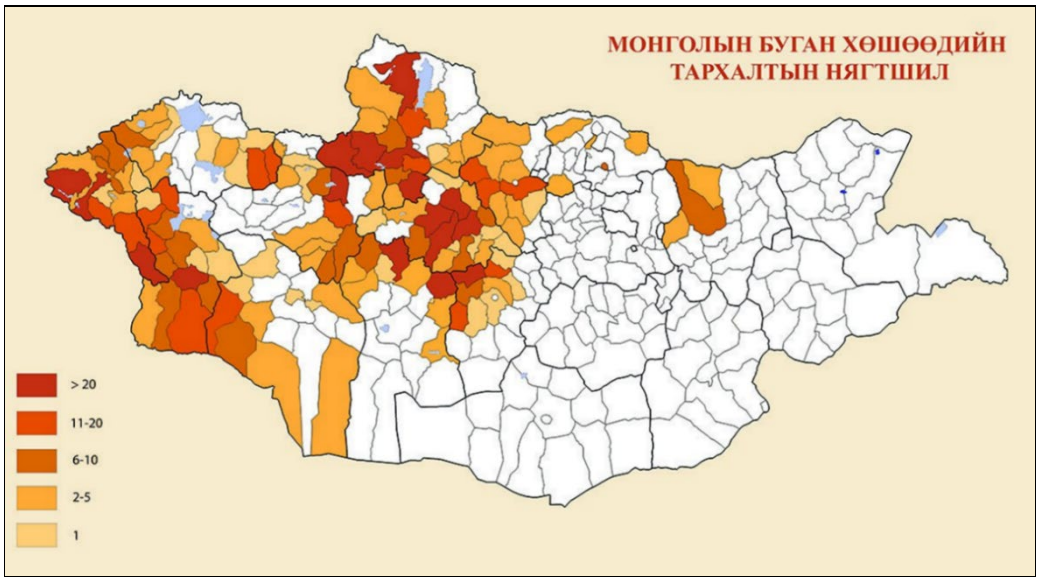
Source: ALAMGaC; JICA Project Team

Figure 5.2.1 Tourism Sites and Tour Routes



Source: ALAMGaC; JICA Project Team

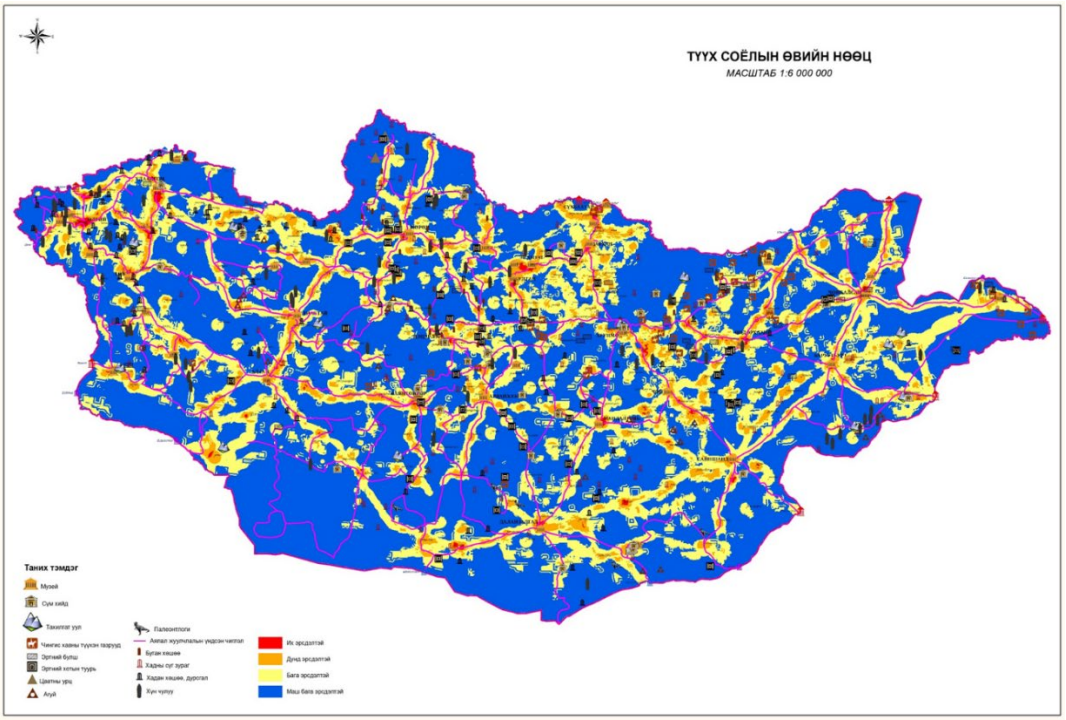
Figure 5.2.2 Tourist Site Density



Source: Institute of Archaeology, Mongolian Academy of Sciences

Figure 5.2.3 Map of Density and Distribution of Deer Stones of Mongolia

A cultural heritage risk assessment project was conducted by the Center for Cultural Heritage in 2017. Figure 5.2.4 illustrates the cultural heritage risk assessment map along the tour routes, indicating the importance of preserving cultural heritage alongside tourism development.



Source: NDA

Figure 5.2.4 Cultural Heritage Risk Assessment Map and Tour Routes

(2) Efforts to reduce seasonal dependence of the tourism sector

Mongolia is known for its cold winters and harsh climate; however, it also affects the image of Mongolia's tourism that the best time to travel is summertime (Figure 5.1.3). In order to reach the target of 2.0 million tourists, the tourism sector must embrace the potentials of winter tourism and shift people's mindset that Mongolian winter is travel worthy.

The short tourism season of Mongolia is one of the downsides of the industry as majority of the tourists visit during the summer months (the first and fourth quarters make up one third of the total arrivals). Reducing seasonal dependence is one of the strategies that Mongolian Government included in the policy documents. There have been various winter tourism festivals and events planned for attracting foreign tourists, for instance the Khuvsgul ice festival, eagle hunting festival and camel festival, that were organized back to back. This gives a unique opportunity to witness a wide range of cultural and traditional experiences for visitors. However, it is already time to go to the next level and think beyond the festivals and events that only take place during a short and specific timeframe. The key is to increase the number of winter tourism products that are tied to the festivals and events such as hunting with the eagles in the western part of Mongolia, living with the Tsaatan people of the north etc..

As tourism is mainly active during summer seasons, this creates job insecurity and makes tourism sector less appealing. The baseline has already been established, as there are constant number of tourists coming in wintertime including repeaters as well. The segment market for winter tourism in Mongolia includes countries that have similar winter as opposed to tropical countries that have never experienced winter. According to recent international trends, the off-season travel has been taking off in countries such as Iceland.

According to recent surveys, off-peak travel is gaining more appeal. For instance, Iceland welcomed 2.2 million tourists in 2017, with 32.9% of which arrived during the winter months accounting for 42.4% of the total increase. Winter festivals around the world attract millions of visitors such as the China's Harbin ice festival and the Sapporo snow festival in Japan.

The municipal tourism agency has initiated a contractual agreement to reduce the hotel prices in Ulaanbaatar by 50% in wintertime. Currently there are several ongoing projects to reduce the seasonal

dependence of tourism sector such as Ulaanbaatar winter festival, Eagle festival of the Kazakh people in the west, Khuvsgul Lake ice festival, and Umnugovi Aimag's camel festival. The Lunar New Year of Mongolia, "Tsagaan Sar" is a valuable cultural asset that has great potentials as well. However, these events occur at specific places for a short period of time. There is an opportunity for Mongolia to take advantage of the winter season for creating a niche product for winter themed activities/sports (a winter complex with various functions that could be used all year round, Olympic training facilities for international athletes, curling, adventure sports etc.) outside of Ulaanbaatar which is easily accessible, yet outside of the city close to the nature.

Mongolia is a country of four distinct seasons. Each season has something different and unique to offer. For instance, the nomadic family has different roles and duties throughout the whole year. These could be made into tourism products as well. Local cuisine is one of the most important parts of the experience. Local specialties, including seasonal vegetables, fruits, fish, should be utilized in order to give a taste of what the whole destination has to offer further elevating the visitor experience. Tourists are more interested in finding new things than to be served what they can get in other places.

Creating a multilingual online platform will be effective for promoting winter tourism in Mongolia, that contains all the information on winter tourism products and service providers, as well as the best possible accessway to the destination sites.

5.2.2 Utilization of unique opportunities

(1) Fossil heritage

Mongolia's fossil heritage with over 100 years of paleontological research is an asset that has not been fully realized. However, fossil poaching has become a serious issue in the Govi area. Lack of knowledge contributes to fossils being smuggled and sold. The Institute for the Study of Mongolian Dinosaurs, founded in 2007, is helping transform through education the lives of the younger generations and their families. It also provides a unique opportunity to develop a relationship with the locals and help them be part of their scientific heritage conservation and discovery. Their solution is to combine education and dinosaur-based tourism.

(2) Alternative tourism

The development of tourism sector especially in rural areas should shift from competition to collaboration. Majority of the tourist camps are registered in the capital, and therefore, most of the tourism-related tax revenue does not necessarily go back to the local regions and communities[35]. There are important strategic measures to take such as requiring outside run tourist facilities hire local staff, offering entrepreneurial training and capacity development programs for local residents, and setting a quota for the number of outside owned tourist facilities[36].

Instead of focusing only on the revenue, it is important to consider minimizing leakages and strengthening linkages of the tourism sector through effective policy and legislation in order to realize maximum benefits attainable with available resources.

In Khuvsgul, it was reported that the number of wildlife has increased due to intensive measures in the past several years. Initiatives such as junior ranger program by Mongol Ecology Center NGO, and other similar programs help raise and prepare the next generation of environmental conservationists and advocates.

[35] World Bank. (2011). Mongolia, Tourism Sector Policy Note: Strengthening Management of Natural and Cultural Heritage Assets to Scale-up Tourism and Stimulate Local Economic Opportunity. http://documents.worldbank.org/curated/en/138151468286292629/pdf/686400ESW0P122080201100ENG04297547.pdf

[36] McCarthy et al. (2018). Assessing Local Indigenous Knowledge and Information Sources on Biodiversity, Conservation and Protected Area Management at Khuvsgul Lake National Park, Mongolia. https://www.mdpi.com/2073-445X/7/4/117

(3) Capacity development

Lack of knowledge and know-how to develop products and services is one of the drawbacks for the local people to increase their income. Oftentimes they might not recognize their assets and what the tourists and visitors are looking for. Therefore, skill transferring as well as various training programs are essential for the local community's empowerment, where standards for the products and services will be introduced as well.

In 2019-2020, nationwide specialization trainings for 10 tourism services (waiters, bartenders, baristas and cooks etc.) were organized free of charge, and 26,000 citizens were issued certificates and registered on the unified electronic human resource system. Also, a series of educational and hands-on capacity development programs are needed for translating the tourism sector policy documents with its vision, targets and objectives to the locals in a manner that every tourism sector agent is aware of their role and how they fit in the bigger picture. Utilizing Technical Vocational Education and Training (TVET) centers for these purposes is another way to make use of the resources as well as creating further linkages within the communities.

Cost of inaction (COI) for such kind of projects is enormous, as opportunities to help educate the tourists and also locals are lost as they will be the main guardians of the resources available. A platform directed at strengthening tourism sector's human resources has been developed (www.travelhubmongolia.com), which is a valuable initiative. It can help map out the current status of human resources as well as help organize and develop the human resources related issues.

5.2.3 International tourism network

International tourism networks will also provide opportunities to attract tourists. In 2016, the Outline of Planning for the Construction of China-Mongolia-Russia Economic Corridor (CMREC) was signed under the Belt and Road Initiative of the Chinese government strategy for infrastructure development and investment in the region encompassing Europe, Asia and Africa. Tourism cooperation is one of the key outcomes of establishing CMREC. For instance, "Tea road" international tourism program was launched in July 2018 with its first 400 tourists from China visiting Mongolia. The travel itinerary included the Gorkhi-Terelj national park, Tsonjin Boldog and Aglag Buteel monastery besides Ulaanbaatar.

Through the CMREC tourism cooperative, a series of tourism regions is aspired to be created such as China-Mongolia "Cultural customs tourism belt", China-Mongolia-Russia "Ancient silk culture", and Mongolia "Humanistic tourism block".

International Silk Road Conference on Nomadic Tourism and Sustainable Cities took place in Ulaanbaatar in October 2016. The silk road does present extensive opportunities for the member countries; however, it was stated that the long-term success will depend upon increased collaboration in the three key areas identified in the Silk Road Action Plan: marketing and promotion, capacity building and destination management, and travel facilitation (UNWTO, 2017)[37].

Within the CAREC region, there are several potential regional tourism clusters and partnerships based on geographical proximity and shared geographical features as well as subregional thematic-based partnerships (ADB, 2019)[38]. Subregional partnerships based on geographical aspects include: 1) Eastern subregion (Mongolia and the China's autonomous regions); 2) Altai region (Kazakhstan, Mongolia, Xinjiang Uygur Autonomous Region); and 3) Desert tourism (Gobi desert of northern China and Mongolia etc.). Subregional thematic-based partnerships cover a variety of cultural and historical features, religion, adventure and sports and so on.

The strategic objectives of the GTI include promoting the Greater Tumen region (GTR) as a globally

[37] United Nations World Tourism Organization (UNWTO) (2016). Silk Road Action Plan 2016/2017.
[38] Asian Development Bank (ADB) (2019). Promoting Regional Tourism Cooperation Under CAREC 2030: A Scoping Study. https://www.adb.org/sites/default/files/publication/490681/carec-2030-regional-tourism-cooperation-study.pdf

attractive tourist destination and increase the cross-border tourist flows in the Northeast Asia.

There is also a unique opportunity to develop Altai mountain tourism of four countries: China, Russia, Kazakhstan and Mongolia. Each country can offer unique cultural and recreational assets. The Tsagaannuur FTZ can play an important role for the establishment of the Mongolian side of the tourism corridor.

5.2.4 Promotion measures for private investments for tourism

Travel and tourism investments in 2017 totaled MNT1,691.7billion, 26.4% of total investment (US$694.8million). It was projected to fall by 1.4% in 2018 and rise by 4.6% per annum over the next 10 years to MNT2,605.7billion (US$1,070.1million) in 2028, 24.6% of total[39]. Travel and tourism investments can contribute not only to economic diversification and sustainable development but also to poverty reduction and preservation of the Mongolian cultural identity.

A significant barrier for growth and improvement of facilities and services of local service providers is lack of access to affordable finance. Better access to finance that is combined with programs for capacity building and improving local business culture, would yield the most desirable outcomes.

Through linking various public and private stakeholders, including relevant government agencies, international donor organizations, non-government organizations (NGOs), private investors in Ulaanbaatar, Japan, South Korea, China, especially Inner-Mongolia etc., investment possibilities need to be sought out in the early stages. Additionally, a one stop service center (OSSC) for foreign investors aimed at providing quick and easy access to government services and creating a favorable environment for investment was opened in 2019.

Currently tourism cooperation with various entities such as Central Asia Regional Economic Cooperation (CAREC) including several tourism cooperation subregions, China-Mongolia-Russia Economic Corridor (CMREC), and the Greater Tumen Initiative (GTI) including three western Aimags, and international tourism routes, such as tea road and silk road. Utilizing these connections and partnerships would help accelerate the development process as well as identifying the areas for public and private investments.

It is essential to have proper criteria for investors who will protect the land with its environmental and cultural treasures. There should also be a development approval committee for the region, consisting of government officials, leading developers, environmentalists, ecologists, landowners and other relevant stakeholders. A regulatory package promulgating the standards for a development needs to be introduced as well (i.e. height restrictions of buildings, allowed distance between developments, and other development standards).

5.2.5 Community based tourism

Mongolia's attractiveness lies in its unique and untouched nature. However, in terms of environmental sustainability, Mongolia ranked one of the lowest among countries evaluated by the WEF, while the natural environment is among the most important assets in Mongolia to attract tourists. All the policy documents unanimously support the community based tourism (CBT) in order to increase the livelihoods of the locals. There are several examples of how the local communities are being engaged and presented the opportunity to partake not only in the tourism activity itself but also being empowered to take ownership and pride in their environmental and cultural heritages.

There are several ongoing projects that would help to form a model for developing CBTs throughout the SPAs: ADB project being implemented in national parks of Khuvsgul and Khentii Aimags, and the project of Deutshe Geselleschaft fuur Internationale Zusammenarbeit (GIZ) in three Aimags of Uvs, Selenge and Bayankhongor (project duration: September 2017-June 2020). The objectives of tourism development include increasing the number of tourists and the revenue from tourism sector in order to

[39] World Travel and Tourism Council (WTTC). (2018). Travel & Tourism, Economic Impact 2018 - Mongolia.

diversify the economy and increase the income of local people, especially around national parks where the poverty rates have reached staggering heights.

(1) ADB's sustainable tourism development project

The ADB's sustainable tourism project (2018) focuses on helping transform two national parks in Khuvsgul and Khentii Aimags, chosen among five protected areas listed for ecotourism development, as models for economically inclusive tourism and conservation of the natural environment through improving park infrastructure, sanitation, and capacity to sustainably manage tourism growth.

The Khuvsgul Lake National Park (KLNP) has undergone through development efforts, that resulted in improved roads and air access, and became the third most visited destination in the Country receiving 89,652 tourists in 2017. However, such increase brought negative outcomes of overcrowding and impacts to the natural resources. Similar trends are expected at the Onon-Balj National Park (OBNP) in Khentii Aimag, where a national road will be constructed in 2020 and the number of visitors is expected to reach about 30 thousand by 2024, increasing from 6,696 in 2017.

The key areas to be addressed are:

(a) Inclusive planning and benefits for communities,
(b) Enabling infrastructure,
(c) Improved waste management, and
(d) Improved park management.

High-levels of microplastic pollution threat in the Khuvsgul lake (Free et al., 2014) has been an alarming news in addition to the deteriorating environment due to overcrowding and lack of proper management. Works are under way to implement the target measure "5.1.2. Carry out a risk assessment of the pollution of Khuvsgul lake ecosystem and pullout vehicles and machineries submerged in the lake with the support of international organizations" reflected in the Government action plan of 2020-2024.

(2) GIZ's community-based tourism development project

In collaboration with Thailand International Cooperation Agency (TICA) and National Development Agency (NDA), GIZ is implementing a CBT project in Bayankhongor, Selenge and Uvs Aimags. As part of the project, each province was given a funding of Euro30,000 for tourism development. The total budget of the project is around Euro500,000 that will be financed by the participating organizations. Eco-tourism products and a value chain are expected to be created in the three Aimags as a result of the project.

(3) Other cases

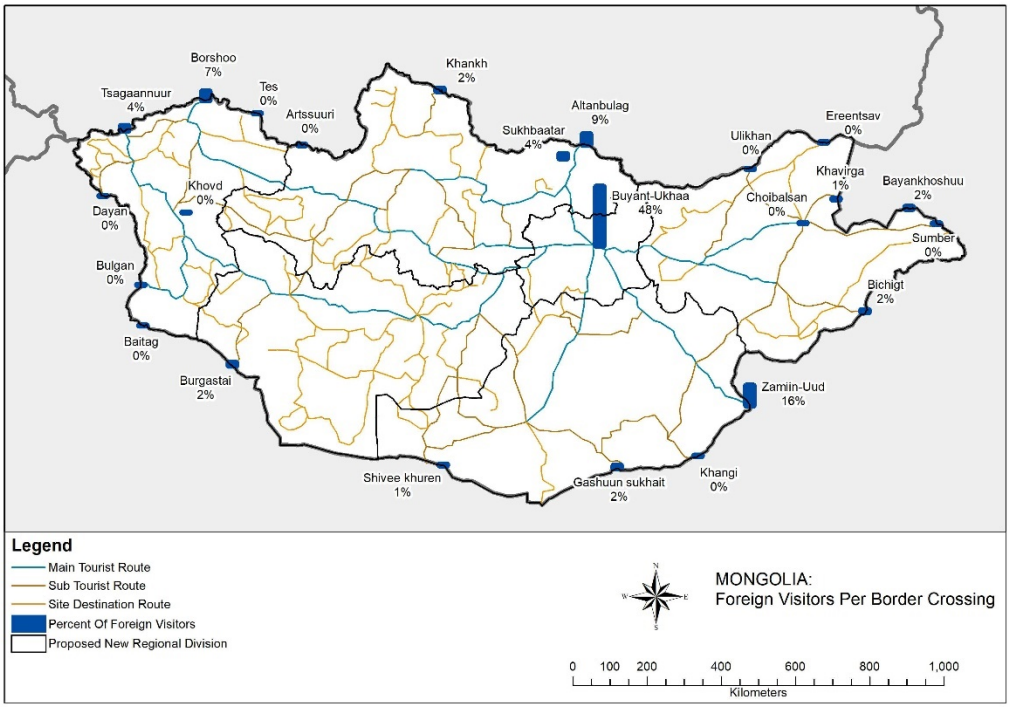
There are successful cases on the ground that are tested and can be applied to other areas. For instance, the Argali Wildlife Research Center (AWRC) is the first non-governmental organization to acquire the authority to manage a nature reserve based on their initiative on scientific research for better understanding the area with its ecological and social context. The research not only helped inform science-based management, but also helped integrate the local communities in the conservation and related activities. The research station that developed from a single Ger and eventually expanded to include multiple Gers, outbuildings with specialized equipment and sustainable energy (solar) capable of accommodating about 40 people, also served an important purpose. Such research stations can be useful throughout the country further strengthening research and becoming a bridge between the local communities and other stakeholders.

The Amazing Gobi Tourism Association of Umnugovi Aimag is another organization that is helping the locals to increase their income while engaging them in the conservation activities and being a part of the wildlife observation tours. This continued dialogue and cooperation with the locals is the key to a successful and sustainable development.

5.3 Infrastructure and Tourist Services

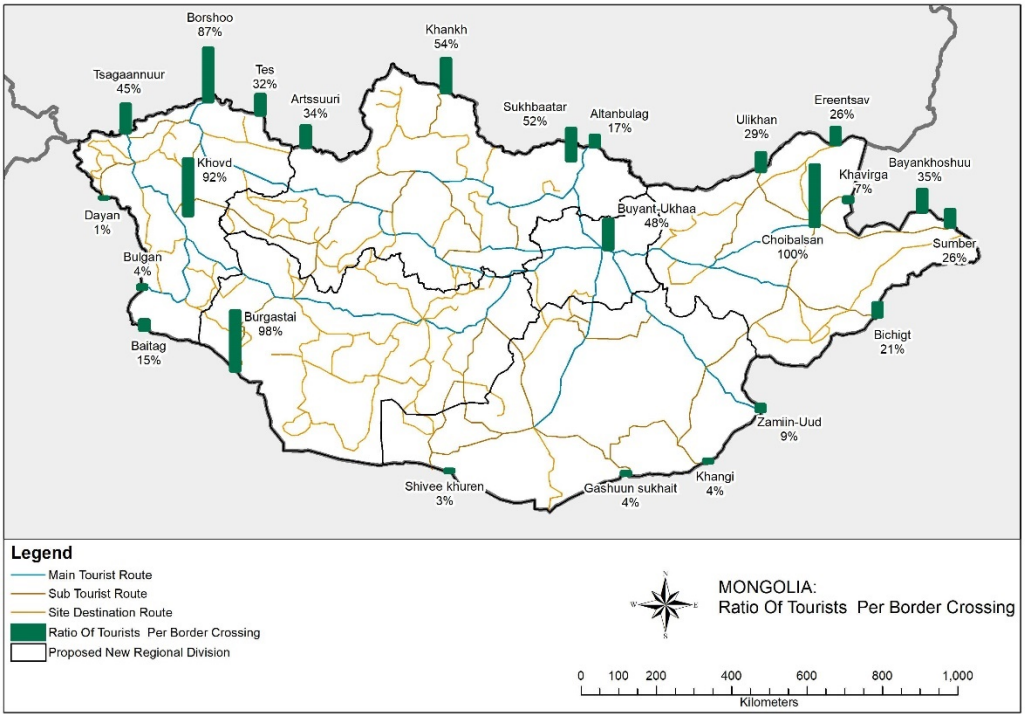
5.3.1 Transport infrastructure

Quality that visitor experience from the moment tourists landed until the moment they leave the country depends much on infrastructure and tourist services. The current stream of inbound tourists is indicated in Figure 5.3.1. The percentage of total tourists is displayed at each port. The ratio of tourists versus local crossings are displayed in the bars below, where light green indicates the ratio of tourists. The number of total inbound crossings/passengers in 2019 was 3.04 million, while the number of tourists comprised 0.577 million. Figure 5.3.2 indicates the ratio of foreign visitors to domestic travelers per each border crossing. This in turn can help identify strategically significant ground ports for enhancing the stream of foreign tourists as well as deepening the cooperation with bordering regions and promoting regional tourism.



Source: MSIS 2019; JICA Project Team

Figure 5.3.1 Foreign Visitors at Border Crossings

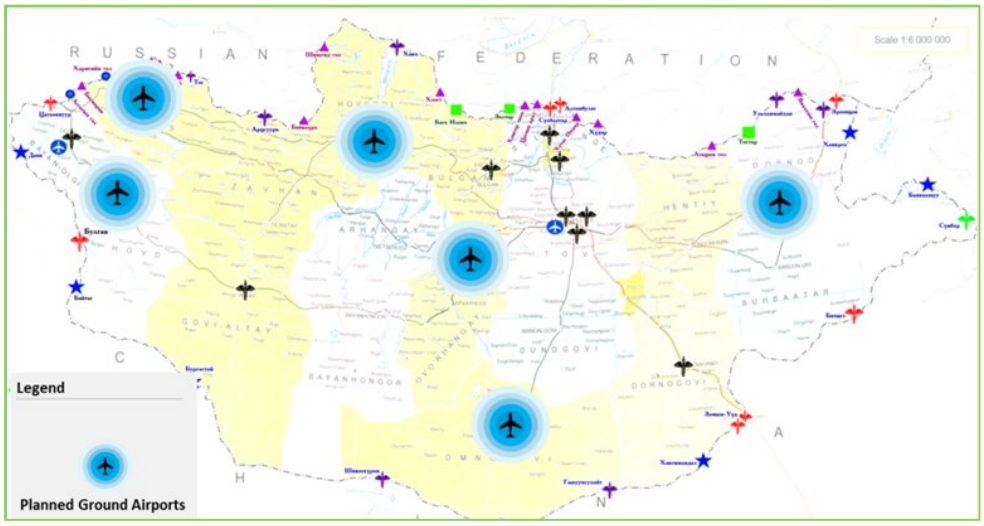


Source: MSIS 2019; JICA Project Team

Figure 5.3.2 Ratio of Tourists at Border Crossings

Currently there are 23 ground ports operating with the two neighboring countries and one international access point to Mongolia, which is the Chinggis Khaan International Airport (Figure 5.3.2). A total of ten airlines are operating (WEF, 2019), and the cost to travel to Mongolia is comparatively expensive.

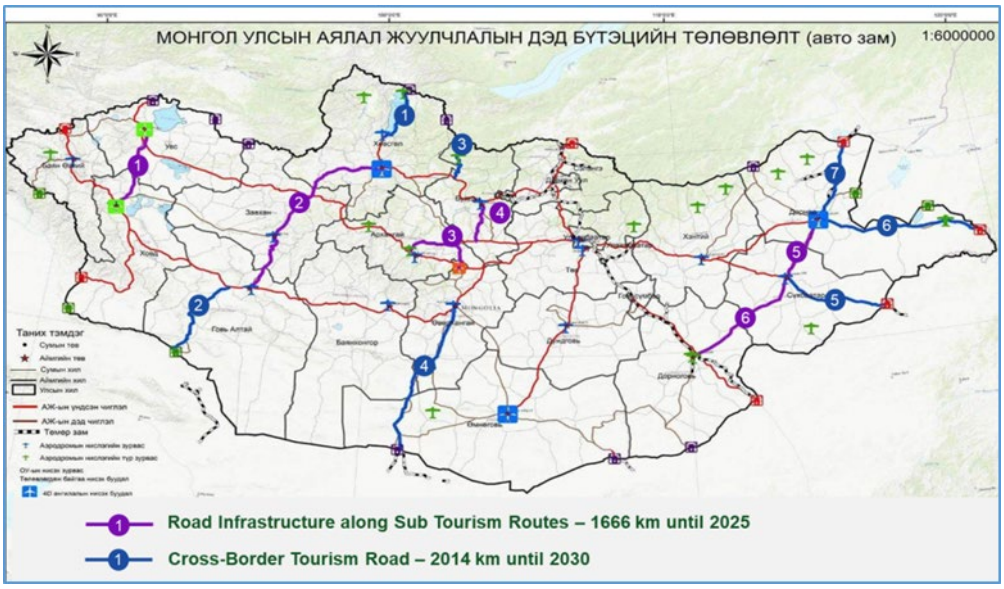
Six international airports are currently being planned in Uvs, Khovd, Khuvsgul, Uvurkhangai, Umnugovi and Dornod Aimags according to MET (Figure 5.3.3) in addition to the NUBIA.



Source: NDA

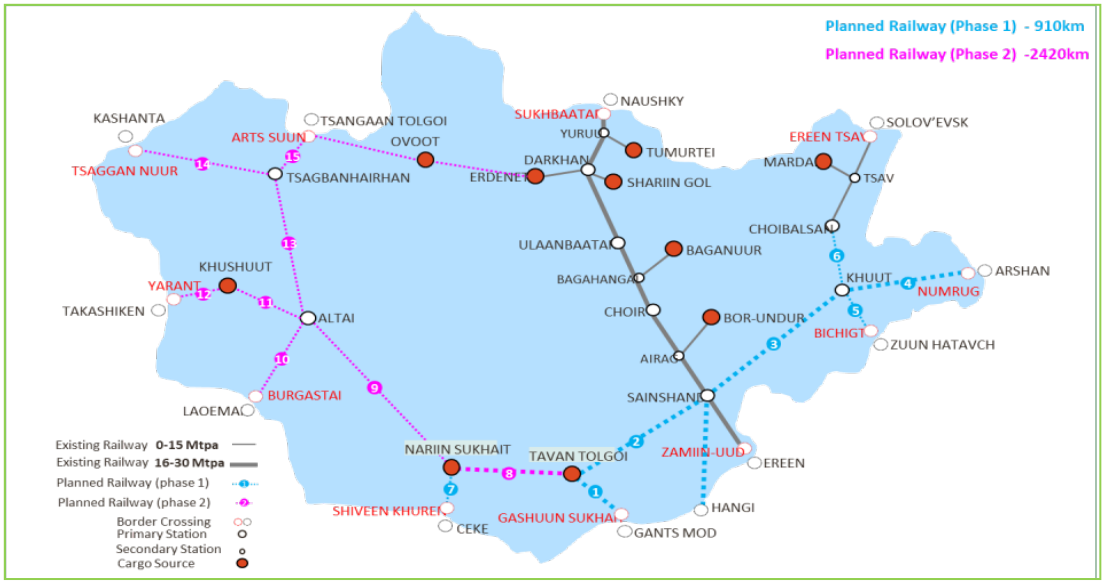
Figure 5.3.3 Planned Ground Airports

In 2017, developing tourism clusters/regions gained consensus among stakeholders. The official tour routes and infrastructure planning (Figures 5.3.3 through 5.3.5) need to be integrated in the tourism cluster development along with the cooperation areas with international tourism networks.



Source: NDA

Figure 5.3.4 Planned Road Infrastructure Projects



Source: NDA

Figure 5.3.5 Railway Development Projects

5.3.2 Tourism accommodations

Tourism accommodations available in Mongolia are summarized in Table 5.3.1 and Table 5.3.2. Ulaanbaatar dominates the number of tourism accommodations with 40.9% of hotels,71.1% of guest houses and 42.9% of tourist camps. There is no unified data collection system. Therefore, different sources use different methodologies, and the data must be crosschecked for validity.

Web platforms such as www.ihotel.mn and www.joinme.mn have been such important developments towards digitization and allowed users to plan their vacations in advance by providing all the necessary information and ease of use. Once all the tourist accommodations and tourist services are registered on these platforms, it would make tremendous progress towards making detailed analyses that would help form the decision making and policy support.

Table 5.3.1 List of Tourist Accommodations and Spas/Sanatoriums in Ulaanbaatar and Other Regions

No	Location	Hotels	Guest houses	Resorts	Tourist camps	Ger houses	Spas, sanatoriums	Total
Ulaanbaatar		210	322	30	234	40	6	842
1	Chingeltei	38	22	6				66
2	Khan-Uul	26	9	7	6		3	51
3	Songinokhairkhan	15	69	10				94
4	Bayanzurkh	29	86					115
5	Bayangol	62	91					153
6	Sukhbaatar	37	45	7	89			178
7	Nalaikh	3			139	40	3	185
8	Bagakhangai							0
9	Baganuur	0			0	0	0	0
	Western Region	31	14	17	21	18	9	110
1	Bayan-Ulgii	6	3	1	8	2	2	22
2	Gobi-Altai	3	3	3	2		3	14
3	Zavkhan	3	6	6		10		25
4	Uvs	7	2	3	8	4	3	27
5	Khovd	12		4	3	2	1	22
	Khangai Region	76	58	15	133	207	111	600
6	Arkhangai	10	2	3	26	9		50
7	Bayankhongor	8	25	3	3	20	5	64
8	Bulgan	17				17	86	120
9	Uvurkhangai	7		6	30	31	3	77
10	Khuvsgul	6	14		74	130	17	241
11	Orkhon	28	17	3				48
Central Region		168	37	63	131	71	32	502
12	Dornogovi	17			7	19	3	46
13	Dundgovi	5	9		15	4	1	34
14	Umnugovi	61	10	4	25	48		148
15	Selenge	53		16	10		3	82
16	Tuv	3		37	73		23	136
17	Darkhan-Uul	27	17	6			2	52
18	Govisumber	2	1		1			4
Eastern Region		29	22	10	27	13	24	125
19	Dornod	8	19	7	1	7	1	43
20	Sukhbaatar	10	3	2	4		1	20
21	Khentii	11		1	22	6	22	62
Total		514	453	135	546	349	182	2,179

Note: To be cross-checked with data from other sources.
Source: NDA

Table 5.3.2 List of Tourist Accommodations per Aimag in 2019

Aimag	Number of hotels	Number of hotel beds	Number of guest house	Number of guest house beds	Number of spas, sanatoriums	Number of beds in spas, sanatoriums	Number of tourist camps	Number of tourist camp beds	Number ger houses	Number of beds in ger houses	Tourism sector human resources	Number of foreign tourists	Number of domestic tourists
Arkhangai	6	141	32	407		210	30	2726	91	1380	935	83035	53822
Bayankhongor	8	285	2	31	6	118	6	194	10	35	496	1877	55905
Bayan-Ulgii	13	425	4	95	2		15	704	5	145	303	8000	4000
Bulgan	4	95	11	103	6	1234	16	905	32	2205	753	6825	40827
Gobi-Altai	5	165	13	129	2		3	91			474		
Govisumber	1	38	1	17			1	12			77	4724	42211
Dornogovi	6	48					6						
Dornod	8	280	28				4	285	20	400			
Dundgovi	5	125	7	89	1	60	13	1004	12	212	200	16767	5285
Zavkhan	4	132	18	243			11	815			791		
Orkhon	25	603	12	95			2	280			2297	1072	26774
Uvurkhangai	13	682	8	212			29	1774	31	302	800	42663	43297
Umnugovi	61	971					26	2128	61	1047	916		
Uvs	9	326	2	28			19	1017					
Darkhan	28	783	14	143			19	1908			1055	4108	25712
Sukhbaatar	14	243	4	39			7	248	1	25	180	946	23150
Selenge	34	458					6	640			803	4550	3000
Tuv	5	38	1	25	23	1600	56	5677	95	1450	802	31200	26535
Khuvsgul	8	280	16				96	8997	120			26137	56534
Khentii	10	309	46	646	5		32	1856	8				
Khovd	8	313	6	111	1		7	360			390	6892	45630
Ulaanbaatar	290	11075	312	3636			41	3369					
Total	**565**	**17567**	**537**	**5896**	**46**	**3222**	**445**	**34990**	**486**	**7201**	**11272**	**238796**	**452682**

Note: To be cross-checked with data from other sources.
Source: MET

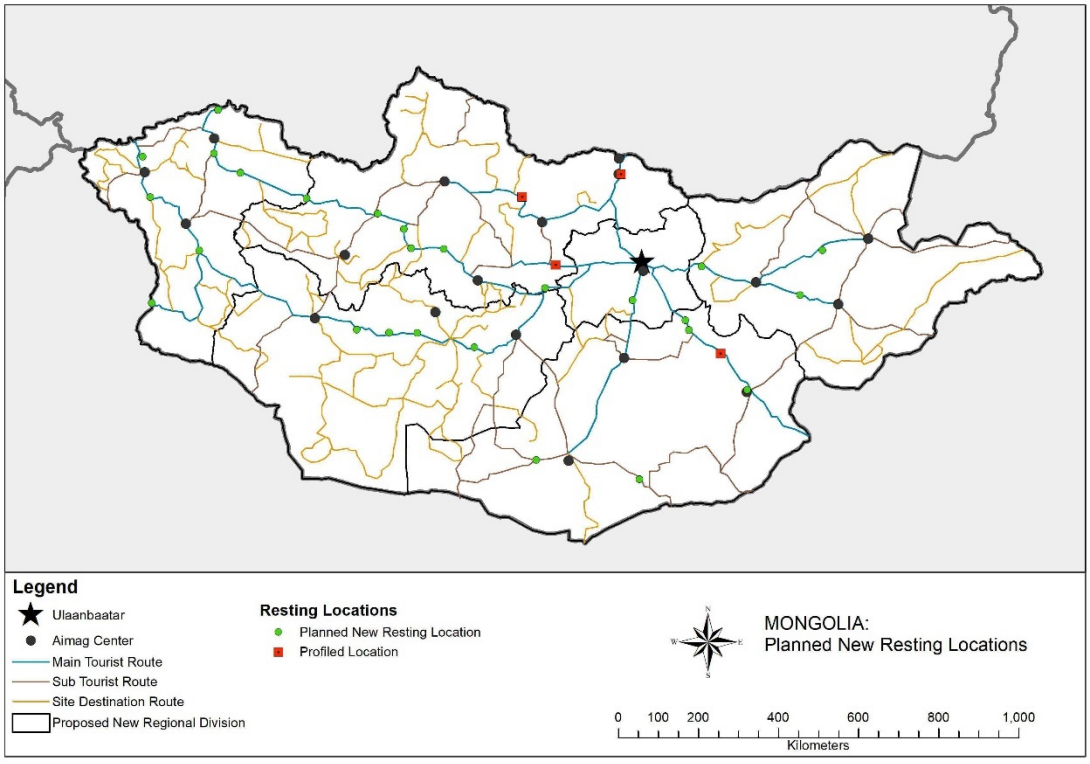
5.3.3 "Urtuu" service stop area network

Service stop areas are one of the priority areas for development as the current conditions lack proper facilities. With proper management, these service stop areas will not only provide rest area with sanitary and hygienic facilities, but can also be used as information centers and a marketplace for selling local brand products, while contributing to the local economy.

The Mongolian Government is working towards establishing service facilities along the major tour routes. MET and MRTD are working on developing a conceptual framework for the establishment of roadside facilities. Figure 5.3.6 indicates the location proposals for 30 service facilities. It is of utmost importance to consider the impact of such service facilities on the livelihoods of the local people and economy as well as their overall roles in the tourism development of the Country for generations to come.

Mongolia has a history of establishing one of the first and most efficient postal systems in the world during the Mongol Empire 800 years ago. The so called "Urtuu" stations were located at discrete intervals, which served as a service stop for changing the horses, resting and getting supply for the King's messengers. Also, during that time, travel along the Silk Road was safe for everyone including traders carrying goods and treasure. This period was known as the Pax Mongolica.

The "Urtuu" system can be reintroduced as the modern-day service stop areas with enhanced standards while retaining its traditional and historic image. The key is to develop a network of these stations that would further enhance both safety and access for travelers, while serving as a gateway to connect with the locals.



Source: MET; JICA Project Team

Figure 5.3.6 Planned Location of New Service Facilities for Resting

The current status of tourist information centers is not quite sufficient, especially in the countryside. A private sector run tourist information center was quite successful (www.touristinfocenter.mn). Such centers need to be established throughout strategic locations. However, it is quite costly to run such a center. The advantage of developing Urtuu complexes as a network lies in the strengthening of tourist

service infrastructure, that will have information center as an essential component. Hence, the travelers will have all the necessary information about medical aid, hospitals, and emergency situations at every Urtuu complex. Therefore, it is of utmost importance for the government agencies to set the directions and rules for such service facilities.

5.4 Development Directions, Objectives and Strategy

5.4.1 Policy for tourism development

(1) NCDP policy for tourism development

Competitiveness and sustainability are two sides of the same coin as the quality of tourist destinations is determined by their natural environment and cultural aspects, and their integration into the local community.

According to the UNWTO[40], it is predicted that arrival rates in emerging destinations (increasing at 4.4% annually) are forecast to increase twice than that of the advanced economies (2.2% annually) between 2010 and 2030. Mongolia has the potential to attract more tourists as an emerging destination by promoting the uniqueness of its untouched nature and the nomadic culture as well as a country redefining its cultural and social heritage through its democracy. Redirecting of tourism flows may be realized through stronger travel demand, increased connectivity, more affordable air transport and simpler visa requirements.

Long-term growth vision for sustainable development needs to be established with the least adverse impact on the environment, benefitting the locals by creating an inclusive tourism industry, and with a goal to provide a quality visitor experience from the moment they arrive in the place until they leave.

Prioritization of tourism sector is not only expressed through policy documents, but in real action and implementation. The tourism sector is one of the highly affected sectors during the COVID-19. Therefore, prioritization of the sector through appropriate policy measures will be essential in order to revive it. It might also present with opportunities to change the direction towards focusing on the quality rather than quantity.

Mongolia's fragile and sensitive ecological environment makes the country highly vulnerable to climate change. Therefore, determining how prepared Mongolia is should be clarified for tourism industry in terms infrastructure, services, local people's participation, inventorying the capacity and tourism resources.

(2) Policy shift under COVID-19

COVID-19 crisis had an unprecedented impact throughout the whole world in all walks of life, specifically tourism sector being one of the most stricken. International tourist arrivals (overnight visitors) declined 70% in the first eight months of 2020 over the same period of last year[41], whereas in Mongolia it declined 88% in the first three quarters[42]. As a result, travel and tourism export experienced a drop of 80% in the first five months[43]. It is estimated that the return to 2019 levels in terms of international arrivals would take 2.5 to 4 years.

"Understanding domestic tourism and seizing its opportunities" has been the theme for countries all over the world in order to sustain the tourism industry under the current conditions. Worldwide, domestic tourism is over 6 times bigger than international tourism, while the share of domestic trips can account

[40] United Nations World Tourism Organization (UNWTO) (2017). Tourism Highlights https://www.e-unwto.org/doi/pdf/10.18111/9789284419029

[41] United Nations World Tourism Organization (UNWTO). World Tourism Barometer, October 2020. https://www.e-unwto.org/doi/epdf/10.18111/wtobarometereng.2020.18.1.6

[42] Mongolian Statistical Information Service (MSIS) (2020). http://1212.mn/tables.aspx?TBL_ID=DT_NSO_1800_003V2

[43] United Nations Mongolia (UN Mongolia), Socio-Economic Response Plan for COVID-19, July 2020, Ulaanbaatar.

for 70% or greater of all arrivals[44].

People will tend to have higher awareness in where to travel as result of the extended global travel restrictions and their outcomes. It is the time to strategize the long-term future of the sector and do the appropriate preparation.

(3) Tourism itineraries

The tourism growth has not been balanced throughout the Country resulting in overcrowding and diminished appeal of some of the most popular sites, while there are many other attractive sites that are not properly developed and remain inaccessible (World Bank, 2011)[45]. In order to achieve sustainable tourism development, the tour routes need to be examined and created with certain targets assuring the balance is not going to be disturbed and overcrowding in any specific area is avoided. Therefore, a variety of travel destinations need to be identified and promoted, based on examining all the currently available data, each with their unique specialties and experiences.

(4) International openness

1) Air access

Mongolia scored one of the lowest in terms of international openness ranking 128 out of 140 countries (WEF, 2019)[46]. Traveling to Mongolia is still quite expensive. Standard tours in Mongolia include long days of driving to remote areas in the countryside that leave the travellers exhausted. Therefore, having direct international access to different regions of Mongolia is an important strategy. Currently 44.6% of all the tourists come through the Chinggis Khaan International Airport. There are several initiatives for developing regional tourism cooperation. Therefore, linking the access points according to those areas of international cooperation is essential.

2) Visa requirements

In 2016, destinations worldwide required 58% of the world's population to obtain a visa prior to departure, which was significantly improved compared to 2008, when 77% of the world's population was made to apply for a traditional visa. In effect, the great majority (approximately 85%) of countries have reduced, at least partially, the burden of obtaining a tourism visa in the past two years. Simplified visa policies will benefit the tourism sector of Mongolia by boosting the stream of incoming tourists along with reduced air travel fees.

For instance, the Chinese market has kept its leading position in the global tourism market since 2012 and comprised 20% of the world's total spending on tourism. In 2017, Chinese travelers turned more towards enjoying niche sectors like whisky tasting, aurora chasing, outdoor activities and other high-quality and less mass-oriented products and experiences.

(5) Cooperation among stakeholders

Collaboration of various stakeholders for maximizing tourism benefits and for preservation of common tourism resources is one of the key aspects of moving forward and making substantial progress. This also includes educational and capacity development trainings for locals and hospitality industry experts. Bringing forth the local specialties is realized by educating the local people on how to utilize their resources, product development, how to cooperate with each other for creating more value and benefitting from the tourism sector as a region. Collaborations with both domestic and foreign entities

[44] United Nations World Tourism Organization (UNWTO). Understanding Domestic Tourism and Seizing its Opportunities. September 2020. https://www.e-unwto.org/doi/epdf/10.18111/9789284422111

[45] World Bank (2011). Mongolia Tourism Sector Policy Note http://documents.worldbank.org/curated/en/138151468286292629/pdf/686400ESW0P122080201100ENG04297547.pdf

[46] World Economic Forum (WEF). (2019). The Travel & Tourism Competitiveness Report 2019. http://www3.weforum.org/docs/WEF_TTCR_2019.pdf

need to be further explored and taken to a whole new level.

(6) Infrastructure and tourist services

Infrastructure and tourist services remain one of the biggest challenges for Mongolian tourism sector development. Developing proper service stops along the main tour routes will add tremendous benefits and will be a major connecting point of various stakeholders and information sharing, while benefitting the local economy.

On the service side, integration of various tourist services into the local experience of place is gaining momentum all over the world, while the relevance of standardization of global hospitality brands has diminished. Specializing and selling truly enhanced experiences, that one cannot buy elsewhere is the key to a successful tourism business. Among them is customized authenticity in sustainable destinations, that are not homogeneous.

Communities are also looking for partnership or a reputation alliance in which all actors are thinking about the long-term reputational stability. For tourism businesses it should remain a concern as their long-term success depends tremendously on local communities.

Rather than focusing on tourist arrivals, it is more critical to pay attention to the tourists and the resources that they are leaving behind are being managed and distributed. Different types of taxation can be introduced in order to ensure the local community would benefit from the tourism sector through investing in fresh water, waste management and other critical issues that the destination communities are faces with.

(7) Institutional mechanism for ensuring environmental sustainability

Mongolia ranked the lowest in terms of environmental sustainability. Data reveals that tourism revenue is directly dependent on the environmental strength of a country (WEF, 2017)[47]. Uncontrolled tourism contributes to the degradation of tourism destinations, the very products that tourists are paying for. Hence, the willingness to pay for tourism products will be reduced, that will affect the livelihoods of various stakeholders including the local communities. As the natural capital depletes, destinations lose revenue. On the contrary, tourists are willing to pay to access well-preserved areas with pristine natural environment. Although the independent hotels/tour operators are in competition with each other, they have tourism destinations in common and tourism projects they are selling. Therefore, mutually complementing their resources in order to protect the common resources and ensure the sustainability of tourist destinations is of utmost importance. A proper institutional mechanism should be introduced in order to ensure the balance of environmental preservation with economic development.

5.4.2 Development objectives and strategy for tourism

(1) Development objectives in tourism sector

Through the discussions with stakeholders and literature review of policy documents, the objectives of the tourism development in Mongolia to be pursued may be summarized as follows:

(a) To develop tourism as a major industry supporting the new paradigm of alternative socio-economy not depending much on consumptive use of resources;
(b) To contribute not only to economic growth and employment generation but also to preservation and enhancement of natural environment, cultural heritage and traditional/historical structures;
(c) To enhance the image of Mongolia in the international society as the Country with environmental strength, openness and free land rich in natural beauty and culture; and
(d) Promotion of ICT industry to support a wide range of socio-economic activities to reduce consumptive use of resources in line with the alternative socio-economy paradigm.

[47] World Economic Forum (WEF) (2017). The Travel & Tourism Competitiveness Report 2017. http://www3.weforum.org/docs/WEF_TTCR_2017_web_0401.pdf

(2) Development strategy in tourism sector

In line with the policy direction described in sub-section 5.4.2, development strategy for industry sector to attain the development objectives proposed above is established with the following components:

(a) Establishment and strengthening of selected tour routes that appeal to international tourists due to the uniqueness of its untouched nature and the nomadic culture,
(b) Stronger initiatives for developing tourism products based on regional and international tourism cooperation,
(c) Open sky policy for air access including direct access points in regions and simplified visa policy,
(d) Proactive and cooperative marketing to protect and utilize common tourism resources and ensure sustainability of tourist destinations,
(e) Developing proper service stops along the main tour routes to increase benefits to local economies and to provide quality tourism information and services, and
(f) Introduction of institutional mechanism to use tourism income for investing in fresh water, waste management and other critical issues that host communities are faced with.

(3) Strategy for post/with COVID-19

The tourism sector recovery strategy for post/with COVID-19 should be two-fold: 1) crisis management and mitigation, and 2) comprehensive recovery planning with renewed vision.

1) Crisis management and mitigation

(a) Stimulating the economy and employment, supporting tourism enterprises, jobs and incomes as the tourism sector is one of the most affected sectors
(b) Political will and government support are crucial throughout these times of crisis for committing to save the tourism sector
(c) Health and safety protocols in place for providing assurance to travelers and restoring their confidence
(d) Tradition inheritance and traditional experience / education programs to stimulate domestic demand and overcome seasonal disparities
(e) Similar experience sightseeing package utilizing ICT / DX (digital transformation – E-tourism solutions)
(f) Relying on social dialogue for solutions – coordination and partnerships among stakeholders, public and private sectors

2) Comprehensive recovery planning with renewed vision

(a) Enhancement of the legal and institutional framework, promoting the structural transformation needed to build a stronger, more sustainable and resilient tourism economy
(b) Development of resilient and sustainable tourism destinations and products utilizing local resources
(c) Infrastructure development
(d) Improvement of hygiene, service quality and standards
(e) Education, training, research, and capacity development of human resources
(f) International cooperation and proactive marketing promotion

Tourism strategies for post/with COVID-19 era should be made in accordance with the international guidelines, while recognizing specificities of the local context. Undoubtedly, the COVID-19 crisis has set an unprecedented impact to the whole tourism sector. As international tourist arrivals decreased by 70% (700 million fewer), US$730 billion in exports from tourism were lost in the first eight months of

2020[48] – more than eight times the loss during the global economic crisis of 2009[49].

The COVID-19 crisis has significant impact on the tourism sector and airlines in Mongolia. Value added in the tourism sector is estimated to decline by US$ 1 billion, which would lead a 7% drop in GDP and 60,000 jobs in the travel and tourism sectors are at risk in 2020. Due to this pandemic, Mongolian airline revenue was estimated to fall by US$100 million in 2020.

The foreign direct investment (FDI) is the main driver of the economic growth in Mongolia, accounting for 20% of the total economy. FDI decreased by 25% in the first five months of 2020, from the same period in the previous year. The COVID-19 pandemic has affected implementation of the largest investment project in the mining sector (Oyu Tolgoi) due to imposed international travel restrictions affecting foreign workers as well.

However, with unanimous recognition this crisis is also an opportunity to rethink the tourism sector and its contribution to SDGs, nature, and the Paris Agreement on climate change; an opportunity to work towards a more sustainable, inclusive and resilient tourism (UN-Policy Brief). This downtime should be utilized to prepare for the future and refine the course of actions needed for full recovery where every stakeholder can thrive. In this regard, Mongolia started to pursue the paradigm shift from resource intensive and economic efficiency-oriented development to the alternative socio-economy based on indigenous resources as capital should have a definite advantage over most other countries in the world.

5.5 Tourism Development Projects

Through discussions with stakeholders in Mongolia and Japan, selected projects have been formulated in the tourism sector, which are instrumental in developing the sector under the strategy established in sub-section 5.4.2 as listed below. Profiles of the proposed projects are contained in Chapter 10 of the Main Report.

(a) Dinosaur museum,
(b) "Urtuu" service stop areas,
(c) Ger district handicraft street,
(d) Winter sports and leisure center,
(e) Nalaikh mining museum, culture and education center,
(f) Tourism sector database development, and
(g) Tourism industrial cluster development.

[48] World Tourism Organization (UNWTO), World Tourism Barometer, vol. 18, No. 6, October 2020, Madrid, available at https://www.e-unwto.org/doi/epdf/10.18111/wtobarometereng.2020.18.1.6.
[49] United Nations (UN), Policy Brief: COVID-19 and Transforming Tourism, August 2020, available at https://unsdg.un.org/resources/policy-brief-covid-19-and-transforming-tourism.