Data Collection Survey on Higher Education of Engineering in Mongolia

Final Report

January 2013

Japan International Cooperation Agency (JICA)

Registered Non-Profit Organization Asia SEED

Global Development & Management Consultants

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List of Abbreviations

ADB	Asian Development Ban
ATVET	Agency for Technical and Vocational Education and Training
GDP	Gross Domestic Product
GIZ	German Technical Assistance
HEIs	Higher Educational Institutions
IT	Information Technology
JICA	Japanese International Cooperation Agency
KOIKA	Korean International Cooperation Agency
LECO	Labor Exchange Central Office
MCA-Mongolia	Millennium Challenge Account-Mongolia
MCC	Millennium Challenge Cooperation
MDG	Millennium Development Goal
MECS	Ministry of Education, Culture and Science
MNCEA	Mongolian National Council for Education Accreditation
MNT	Mongolian National Currency
NCVET	National Council for Vocational Education and Training
NDIC	National Development and Innovation Committee
NGOs	Non-Governmental Organizations
NVQF	National Vocational Qualification Framework
OT	Oyu Tolgoi LLC
PPP	Public Private Partnership
TVET	Technical and Vocational Education and Training
UB	Ulaanbaatar
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States Dollar

Introduction: Overview of the Survey

Background of the Survey

Since the adoption of the market economy system in the 1990s, Mongolia has experienced low growth for nearly a decade due to difficulties in keeping up with the rapid change of the economic system. But there has since been economic growth and steady progress driven by an increase in the international prices of major export commodities such as copper and gold.

In addition, the needs for industrial human resources development are correspondingly growing with economic growth, and the higher education sector is expanding rapidly. The number of higher education institutions has increased by four times and student enrollment has increased by six times between 1992 and 2007. The gross enrollment rate has also been increasing from 14% to 47%. However, the quality of higher education has become an increasingly crucial issue, since the rapid quantitative expansion of the sector has not been met by a corresponding improvement in quality. In addition, there is a mismatch between the human resource needs of the market and higher education institutions produced. Many students entering institutions of higher education choose to specialize in social science and business management courses; therefore, enrollment in the fields of science and engineering (which has high industry needs) make up only 23% of the total student enrollment. Similarly, for the TVET sector, it has not been able to respond adequately to industry needs in terms of both quantity and quality of human resources.

As such, the Government of Japan and JICA has been supporting the education sector, mainly in the primary education sector, through the re-training of teachers, technical cooperation and development facilities by grant aidto date. However, since needs for support in the TVET and higher education sectors are expected to rise, JICA has decided to implement the current survey for the following purposes:

Objectives of the Survey

The objectives of the Survey are as follows:

1) To research and analyze the industrial human resource development needs of the country
2) To collect information and analyze the TVET and higher education sectors regarding their related sector plans, current status and challenges
3) To identify crucial problems and consider the effective approaches to solve them

Work Schedule

（１） Preparatory Work in Japan: Mid-October 2012

- Preparation of the Inception Report
- Mapping of current information and carrying out interviews with the relevant personnel
- Review of survey methodology, direction and plans
- Confirmation of survey plan

（２） First field survey: middle to late October 2012

- Presentation and consultation of the Inception Report with the Mongolian Government
- Identification of sub-fields of high priority in engineering and technology through in-person interviews and questionnaires with major local companies
- Narrowing down key TVET institutions to study
- Conducting a general study of Mongolia’s education administration

（３） Second survey in Japan: late October to early November 2012

- Reporting outcomes of the first field survey to JICA, and conducting a survey
- Identification of sub-fields of high-priority
- Identification of the key TVET institutions to study
- Preparation of the next site survey based on the comments from relevant personnel in Japan and results of the first site survey

（４） Second field survey: early November to mid-December 2012

- Compiling overall information related to Higher Education in Mongolia, and detailed information about the National University of Mongolian and Mongolian University of Science and Technology
- Gathering detailed information of Technical & Vocational Education & Training (TVET) institutes
- Conducting survey on overseas education and credit transfer systems in Mongolia
- Analysis of primary challenges in Extracted Technical & Vocational Education & Training (TVET) institutes
- Studying solutions to identified issues
- Studying key points for support from JICA (Japanese government)

（５） Domestic survey task after the 2nd field survey: mid-December 2012 to early January 2013

- Reporting the results of the 2nd field survey to JICA and domestic survey
- Drafting, submission, and discussion of final report with JICA
- Completion and submission of final report to JICA

The Survey Team

This survey was conducted jointly by Registered Non-profit Organization Asia SEED and Global Development & Management Consultants, with help from Nagoya University. The team members who implemented the survey are as follows:

The Survey Team

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Chapter 1 Industrial Human Resource Needs in Mongolia

1.1 Outline of Mongolian Economy

Current Economic Situation

Mongolia is a country with a population of about 2.7 million, which is almost the equivalent of the City of Osaka, Japan. Conversely, the land area is about four times of Japan, and the population density is the lowest among UN member states. While Ulaanbaatar, the capital city of Mongolia, is a big city with a population of about 1.2 million, the local population is relatively small, with the total population of local cities and provinces not exceeding 100,000. As such, state infrastructure, such as the development of railways and roads is inadequate, and integration of the national economy has not been fully achieved. The harsh climate also has a significant impact on the life and the economy of Mongolia. Temperatures in Ulaanbaatar goes up to nearly 40 degrees in summer, and goes down to minus 40 degrees or less during the long winter, especially between the bitter cold of December and January. Due to the extreme weather climate, work in construction projects is suspended from November to March, and the tourism peak is concentrated in the short summer from May to October.

Mongolia's economy was supported by a loan and grant from the Soviet Union during the socialist era, and the economy was mainly dependent on the export of copper and nomadic. Transition to a market economy was supported by a US initiative. American scholars were involved in the development of liberalization policies as government advisors. From late 1990s Mongolia began to walk the path of economic growth driven by increasing global demand for minerals such as copper and gold, which are the major export commodities. In 2006, it achieved a trade surplus for the first time.

Following which, upon recovering from the Lehman Shock of 2008, the Mongolian economy has entered a period of rapid high growth, with 17.5% GDP growth in 2011. GDP in the first quarter of 2012 was 16.5% , followed by a slower 11% in the second quarter GDP due to international depression caused by the European finance crisis as well as slowdown of China’s economy. However, GDP growth rate of 2012 still stands as a double-digit figure.

Domestic demand increased due to construction investment supported by flourishing of the mining sector, rise in the salaries of public officials, and an increase in bank-lending. However, inflation stayed high at about 15% in the beginning of 2012, mainly due to an increase in consumption and the price hike of meat. Inflation has since become a worrisome factor in Mongolia’s economy.

In the external sector, due to a rise in imports from strong mining activity, trade balance showed

an expanded deficit, but this was financed by foreign investment inflow. The Mongolian Tug rug (MNT) depreciated slightly against the US dollar, and foreign reserves are in the declining trend. However, this seems to be a temporary phenomenon and the MNT is expected to rise in 2013 when export from Oyu Tolgoi commences as scheduled. Balance of payment forecast is optimistic.

The Mongolian Government's fiscal revenue expands if mining export rises. The Government will allocate a part of the revenue to infrastructure construction, promotion of education, etc. The Mongolian Government will also implement a fiscal stabilization law from 2013 for the management of mid-term fiscal revenue, which is anticipated to increase rapidly.

The structure of Mongolian economy is such that external demand consists of approximately 50%, of which most is from China. Major exports to China are mineral resources including coal, copper and iron ore. As long as the Chinese economy runs smoothly, Mongolian export to china will stay stable. Recent decline in the prices of international natural resource hit Mongolia, where the price of coal declined by nearly half and LME copper price declined to 7000US$ per ton from a record high price of 10,000 (forward contract). Unless prices continues to drop, the Mongolian economy will not be severely hit. In the worst case scenario, growth rate would gradually slow down.

The recent discussion of construction suspension measures adopted by the Government might have a cooling effect on the economy, as the city government issues suspension orders to about 80 construction projects in UB since these construction projects have not complied to Mongolian laws and regulation. Some sources say about 170 projects are in suspension.

Table 1-1 Growth Rate of GDP

	2008	2009	2010	2011
GDP Growth Rate (nominal %)	8.9	-1.3	6.4	17.5
Per Capita GDP (US$)	1,847	1,855	2,065	2,562
Loan Outstanding (in 1 Million MNT)	2,635,551.6	2,655,000.4	3,264,778.0	5,641,233.7

Source：MSY

Table 1-2 GDP, Breakdown by Industry

	2009	2010	2011
GDP (%)	100	100	100
Mining	19.8	23.6	21.7
Wholesale. Retail	12.2	15.6	18.9
Agricultur.etc.	17.9	14.3	13.0
Manufacturing	8.3	8.4	9.2
Transport/Storage	8.3	7.8	7.3
Real Estate	7.3	6.6	6.7
Education	4.7	4.0	4.0
Public Service	4.1	3.6	3.5
ICT	4.7	4.0	3.3
Others	12.7	12.1	12.4

Source : MSY

Table 1-3 Employment by Industrial Sectors

	Year 2011
Agriculture	33%
Wholesale/Retail	14.7
Industry	12.3
Transport/Communication	7.3
Construction	5.0
Mining	4.3
Others	23.4

Source: MSY

Figure 1-1: Inflation Trend

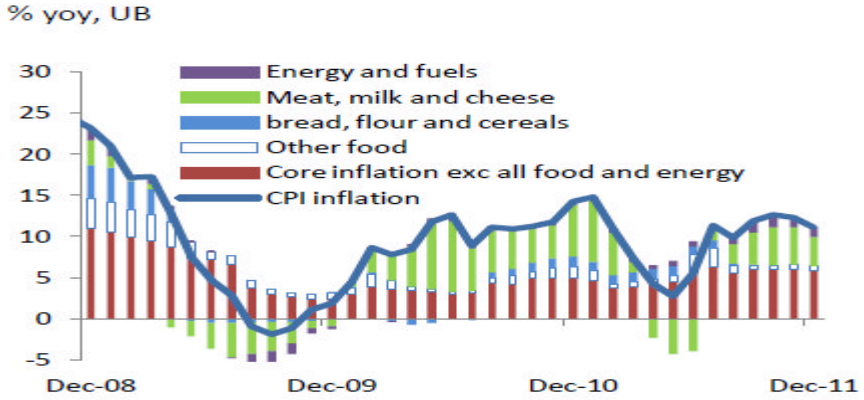
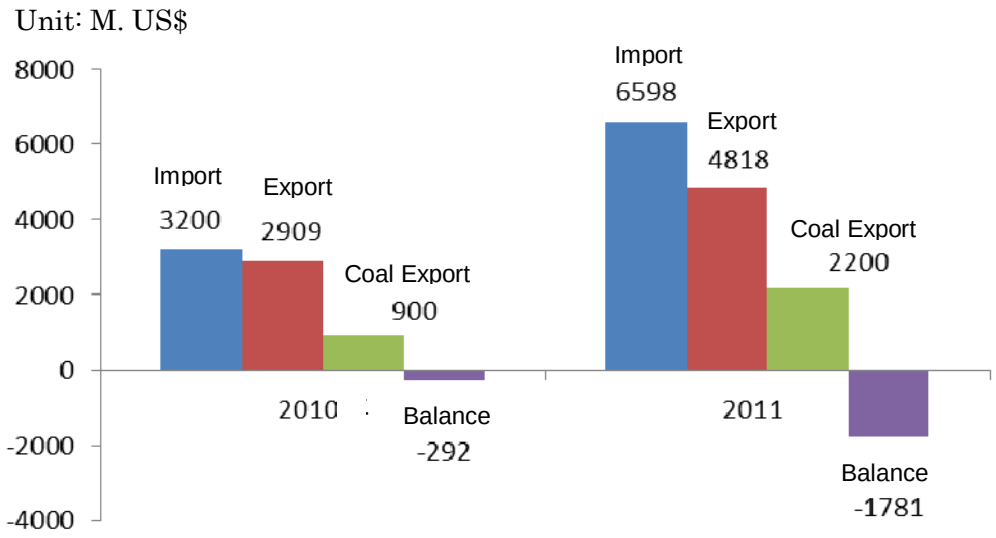
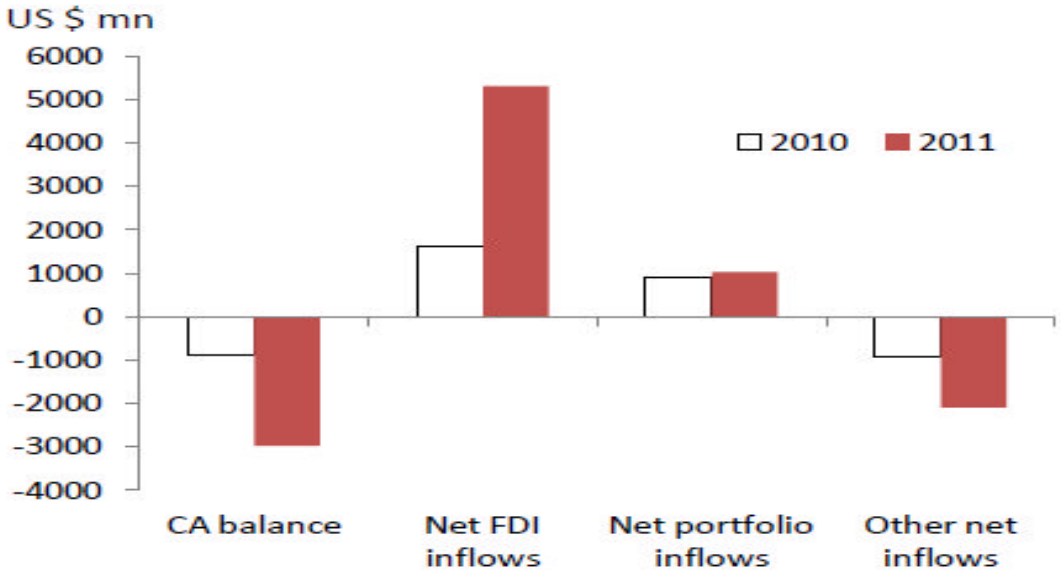


Figure 1-2: Trade Balance



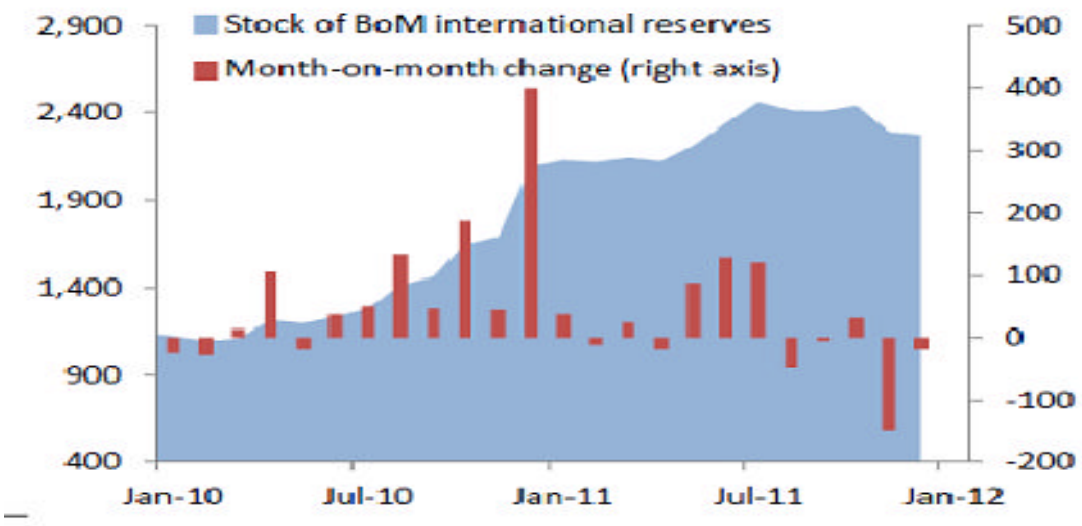
Source: MSY

Figure 1-3: EDI Inflow



Source: MSY

Figure 1-4: Foreign Reserve



Source: MSY

Political Influence

In 2012, the general election was held on 28 June, followed by a realignment of the government organization and a change in top government officials. As a result, there was a delay in the operations of each of the ministries. Mongolia used to adopt the liberal policy after changing to a market economy, as advised by IMF and WB in the areas of trade and foreign exchange and foreign investment regime. However, a nationalistic policy has been observed recently in the areas of mining and other important industries such as banking, finance and ITC sector, which places relatively greater priority on national companies. An apparent example is the Government's intention to revise the investment agreement for Oyu Tolgoi Project, which is currently under negotiation between the Mongolian government and Rio Tinto. Mining-centered development in Mongolia is characterised by staggered economic development which leads to widening income gap to the extent that has required government intervention. People suffering from extreme poverty account for more than 30% of the population, and the Government plans to implement policies to raise the living standards of the poor.

Politics in Mongolia is dominated by two major parties—one is the People's Revolutionary Party (which evolved from the old-communist party) and the other is the democratic party. The leading faction of the People's Revolutionary Party recently changed its name to the Peoples Party dropping the word "Revolutionary" and a small group separated, remaining as the original People's Revolutionary Party). Separation of government powers are by the three branches of legislature, administration, and judiciary. Among these branches, the legislative branch, referred

to as the “Great Khural”, is the strongest power. The Diet is made up of 76 members, of which the quorum is just over half, passing diet resolutions. Lawmaking is relatively easy and easy to revise. For this reason, one defect is that law might not be stable.

Industrial Sector

Mongolia is originally a nomadic country. After independence from the Qing dynasty, Soviet Russia helped Mongolia and Mongolia became a satellite country of Soviet Russia for about 70 years. During that time, Mongolia incorporated collective farm schemes and the COMECON scheme. Upon democratization following the fall of the Soviet Empire, Mongolia transited to a market economy. However, due to difficulties in adapting to changes during the transition period, the industry sector collapsed and the agriculture sector deteriorated significantly. Till today, agriculture production has not managed to recover to previous production levels. In the industry sector, Czech-made machines and equipment from machinery companies were sold at scrap prices. Due to the collapse of the industry sector then, development of the Mongolian industry sector still suffers today.

Under these circumstances, the Government of Mongolia adopted the policy of value added production to promote national industries. In the national resources sector, export priority was not for ore export but for increasing the value of ore. For example, export price rises much more than extracted coal export if coal-dressing plants are used in Mongolia, such that extracted coal price is 30-49US$ per ton and coal through coal-dressing plant is 150US$ per ton.

As for copper, Mongolia is planning to construct smelter plants, and iron ore is also processed to intermediate products. The Government is promoting the establishment of heavy industry estates including coal chemistry plants, steel plants, oil refineries and the like. This strategy also applies to the light industry. The Mongolian policy is to free itself from too much dependence on the mining industry and to attain diversification of industries as well as creating employment opportunities.

The traditional industry of textile is cashmere and wool, but priority is on the export of procesed textile products and not raw wool. Industries that use raw materials from Mongolian livestocks and natural plant products, such as the food industry, leather industry, natural products like chachargana （a fruit which contains a high level of vitamin C）and others, are adopting similar policies of value added production.

In the construction industry which benefits the most from the mining industry, the government plans to increase import substitute production of construction materials up to 70% of total domestic needs.

The role of technical engineers for both heavy and light industries is indispensable for the promotion of value added production, and this especially applies to the heavy industry where almost no local engineers are available.

Population, Unemployment and Mismatch

According to the National Statistical Office of Mongolia (NSO), the population of Mongolia was 2,754,685 in 2010; and it is estimated to increase to 3,030,000 in 2016, 3,224,000 in 2020, and 3,556,000 in 2030. As for the population structure by age, the composition in 2010 (0-14 age group: 27.3%, 14-64 age group: 68.9%, over-65 age group: 3.8%), is expected to change in 2020 (to 0-14 age group: 23.2%, 14-64 age group: 63.8%, and over 6 age group 5: 8.0%). It is said that the demographic window that opened in 2011 will close and the proportion of the elderly population will grow from 2020.

According to the latest LFC, as of the first quarter of 2012, there are 1,152,800 economically active people in Mongolia (labor force participation rate is 64.9%). Of this, 118,800 people are unemployed, which makes an unemployment rate of 10.3%. However, according to the Labor Exchange Central Office (LECO), of which the number of registered unemployed people is 53,979. The breakdown by educational attainment of the registered unemployed people is: MA, PhD (192), Diploma, Bachelor (15,417), Specialized Secondary education (3,300), Vocational education (3,974), Completed Secondary education (23,878), Completed Basic education but not Secondary (8,307), Completed Primary education (2,553), and Not educated (538). This indicates that there are many highly educated people who are unemployed, particularly university graduates.

There is a statistic that represents another aspect thereto. As can be seen in Table 1-4 and 1-5, LECO compared the number of new employment and the number of jobs opening in each economic division and occupational level, and issued a filled share of each. From these data, it can be seen that the filled share is very low in many areas, despite the presence of a large number of unemployed university graduates mentioned above. As for the economic division, Information and communications (8.7%), Construction (8.8%), Accommodation and food service activities (11.0%), Water supply, sewerage, waste management and remediation activities (11.7%) are the lowest, followed by Professional, scientific and technical activities (18.2%), Mining and quarrying (23.1%), Manufacturing (30.7%) and Electricity, gas, steam and air conditioning supply (24.0%). In terms of occupational level, fulfillment rate is low in almost all occupations, including professionals (24.6%), and Technicians and associate professionals (20.4%). From these, it can be found that there are few applicants with the skills and experience from the employer's point of view, despite a sufficient number of applicants for the job. Since

few people (even with a university degree) have required skills, employers find them unsuitable for employment. There is thus a serious mismatch in skills required by employers and skilled obtained by graduates through education. This mismatch is caused by the following, as further elaborated in later chapters:

- Not many students are enrolled to higher education in courses on science & engineering (only 20% in 2012 were enrolled in science, engineering and agriculture fields), while many go to the social science and business.
- Both the quantity and quality of institutions of higher education offering science and engineering is insufficient, compared with industry requirements.
- The same things are happening in TVET sector as well.

Table 1-4 Number of New Openings and Employed in New Workplaces by Economic Divisions, May 2012

Economic division	New opening	Number of citizens employed in new workplaces	Difference	Filled share
Construction	16,714	1,469	15,245	8.8%
Manufacturing	5,741	1,762	3,979	30.7%
Other service activities	5,256	1,519	3,737	28.9%
Mining and quarrying	4,734	1,094	3,640	23.1%
Wholesale and retail trade, repairing motor vehicles and motorcycles	3,096	836	2,260	27.0%
Accommodation and food service activities	1,440	156	1,284	10.8%
Transport, and storage	1,431	424	1,007	29.6%
Financial and insurance activities	1,126	152	974	13.5%
Information and communication	972	85	887	8.7%
Education	999	444	555	44.4%
Public administration and defense; compulsory social security	925	649	276	70.2%
Water supply, sewerage, waste management, and remediation activities	300	35	265	11.7%
Agriculture, forestry, fishing and hunting	924	667	257	72.2%

Human health and social work activities	496	265	231	53.4%
Electricity, gas, steam and air conditioning supply	263	63	200	24.0%
Art, entertainment, and recreation	230	58	172	25.2%
Activities of households as employers	180	100	80	55.6%
Activities of extraterritorial organizations and bodies	57	9	48	15.8%
Real estate activities	52	11	41	21.2%
Professional, scientific and technical activities	33	6	27	18.2%
Administrative and support activities	250	552	-302	220.8%
TOTAL	45,219	10,356	34,863	22.9%

Table 1-5 Number of New Openings and Employed in New Workplaces by Occupations, May 2012

Occupation	New opening	Number of citizens employed in new workplaces	Difference	Filled share
Craft and related trades workers	12,535	2,023	10,512	16.1%
Elementary occupations	8,050	1,842	6,208	22.9%
Professionals	6,383	1,568	4,815	24.6%
Plant and machine operators and assemblers	4,612	1,100	3,512	23.9%
Legislators, senior officials and managers of governmental and non-governmental organizations	3,419	319	3,100	9.3%
Service workers, shop and market sakes workers	4,475	1,375	3,100	30.7%
Technicians and associate professionals	2,587	527	2,060	20.4%
Clerks	1,571	721	850	45.9%
Skilled agricultural and fishery workers	1,191	767	424	64.4%
Armed forces	396	117	279	29.5%
TOTAL	45,219	10,359	34,860	22.9%

1.2 Priority Areas in the National Plan

Outline of the National Plan

The Government of Mongolia, in January of 2008, formulated a national development general policy based on the Millennium Development Objectives in 14 years, with a comprehensive policy aiming at the development of Mongolian people, economy, society, science, technology and culture in the democratic society as well as keeping in linkage with global and regional development.

Furthermore, they formulated the Government Action Plan which listed (1) acceleration of natural resources development, realization of profit allocation to the people from mining production, (2) promotion of industrialization, promotion of local industries, (3) improvement of rate of self –sufficiency in agriculture and livestock products, (4) improvement of health・education・employment environment, human resource development of technical workers, (5) strengthening of mutual trust of nation and nationals through increased transparency and accountability of administration process, as basic objectives.

The guideline for the policy direction of the new Government from 2012 was adopted in the national Diet as the Action Plan of the Government of Mongolia for 2012-2016. The action plan highlighted economic diversification policies and specified concrete objectives and projects in the seven policy areas including (1) industrial policy, (2) policy regarding wool, cashmere, raw leather, (3) traditional livestock industry, policy for milk production, (4) policy for sightseeing industry, (5) High-tech, Biotech. Nanotech and IT policy, (6) production promotion policy for import substitute and export goods, (7) promotion of service industry.

In this policy connection, at present, many national development projects are planned as described below. As such, a growing need for industrial engineers has emerged. (Refer to attachment 1 for details)

- Mining
  - There are many mines being developed, such as Oyu Tolgoi mine and Tavan Tolgoi which is one of the largest undeveloped coal mines in the world, as well as many other small and medium-sized mines.
  - Serving as the direct peripheral industries of mining, there is a network of mine-related civil construction industry, structure construction, import of necessities for mine development including pipes, construction machinery, trucking, workers clothing, gloves, accommodation, catering food, drinking water, hotels, cafeteria, etc.
- Improvement of infrastructure (road, railway, power, water, etc.)

  - Altanbrag-Zamin Uud Highway Project, which is the first high-speed road plan in Mongolia
  - Plan of new railway linking the southern Mongolia and the central railway system
  - Power plant plans in Oyu Tolgoi and Tavan Tolgoi
- Development of the heavy industry
  - Building materials such as cement plant project
  - Coke plant
  - Iron and steel pellet plant
  - HBI / DRI Plant
  - Coal gasification plant
  - Oil refinery
  - Copper smelter
  - Power stations
  - Iron and steel metallurgy plants, etc.
- Self-sufficiency of energy
  - Coal gassification and CTL (Coal to Liquid) projects using coal resources which are abundant in Mongolia
  - Use of renewable energy, such as thermal power plants, wind power, and solar
  - Development of oil shale, CBM of (coal bed methane), and others
- Light industry
  - food industry, construction material, textile industry, leather industry, beverage, metal processing, furniture and the like
- Addressing air pollution and environmental problems in Ulaanbaatar
  - Development of gel districts
  - Waste disposal problems, water and sewage facilities development, river purification, water source problem, environmental destruction associated with the development of mine development, and solve the problem of desertification
- 100,000 housing construction projects
  - Construction of 75,000 units in Ulaanbaatar, and 25,000 units in rural areas
  - Relocation of residents of gel districts to urban housings
- New sum center project
  - Housing construction by 2x4 construction method as targeting Sum of 96
- New International Airport Construction by the Japanese ODA fund
- Other important projects
  - National satellite launching project
  - Energy production from waste and biomass project

- Karakorum Century Project 13
- High-tech industrial park
- Student Town Plan
- Industrial training complex projects for information technology, etc.

On the other hand, the Government of Mongolia conducted a barometer study of the labor market with the support of the MCA-Mongolia Vocational Education and Training Project. Uon which, mining and construction industry and their related manufacturing industries were listed and the importance of required skills such as communication, IT, foreign language, management, team work were specified. Furthermore, in 2001, the National Development and Innovation Committee（NDIC）made a forecast of change of population and labor force in 2016-2030, Under this forecast, most demand is expected to come from the construction sector followed by the livestock industry and mining.

Priority Areas in the National Plan

Based on the national plans mentioned above, the priority areas of industrial human resource needed in Mongolia are as follows:

(1) Industrial human resources for mining industry
(2) Industrial human resources for infrastructure constriction
(3) Industrial human resources for heavy industry
(4) Industrial human resources for energy industry
(5) Industrial human resources for light industry
(6) Industrial human resources for environment protection
(7) Industrial human resources for high-tech industry and IT industry

Priority areas indicated above are the fields of the human resources necessary to reduce the mismatch between the two of university education and the labor market needs.

1.3 Important points in Mongolia Assistance Program of Japan

The important point in the Mongolia Assistance Program of Japan is described in the Japanese Assistance Program to Mongolia dated April, 2012, made by the Ministry of Foreign Affairs of Japan. The summary is as follows:

The basic principle of assistance (top objective) is to support self-efforts for poverty reduction through sustainable economic growth, including the diversification of economy and stable macroeconomic management, which are the foundations of sustainable economic development.

Taking that into consideration, the three priority fields are:

- Firstly, the sustainable development of natural resources and intensification of governance are supported in terms of sustainable economic growth and balanced growth, including plans of development, processing and utilization of natural resources as well as further study for support of improvement of the related infrastructure construction.
- Secondly, support is made for realization of growth through which the people of Mongolia enjoy benefits through the creation from SME and micro enterprises by possible diversification of industries and projects for the improvement of living standard of the poor.
- Thirdly, the maintenance and improvement of urban infrastructure in Ulaanbaatar will be supported by Japanese experience and technology.
- Others: remarks are included for fields connected to future investment by Japanese companies where environmental problems like expansion of desertification and global warming are taken into consideration.

When the Japanese assistance program above is considered in terms of industrial engineer needs in Mongolia, the following breakdown of required human resources is possible:

(1) Industrial human resources for mineral resources development, processing and utilization
(2) Industrial human resources for infrastructure construction
(3) Industrial human resources for economic diversification
(4) Industrial human resources for infrastructure for intensification of urban function in UB
(5) Industrial human resources for environmental concern

1.4 Important fields for industry

1.4.1 Engineer needs of Mongolian Industrial Circle

This section describes the need for engineers in the industry. Interviews and questionnaires surveys were conducted to study the current situations for engineers at the company. Then, the future needs of engineer was studied through the SINSHAND industrial park which is one the planning national projects.

Interview and questionnaire investigations were implemented to study the current situations for engineers at the company. The survey questionnaire consists of 3 parts: ① engineer needs for university graduate or upper class, ② engineer needs for TVET school graduate, and ③

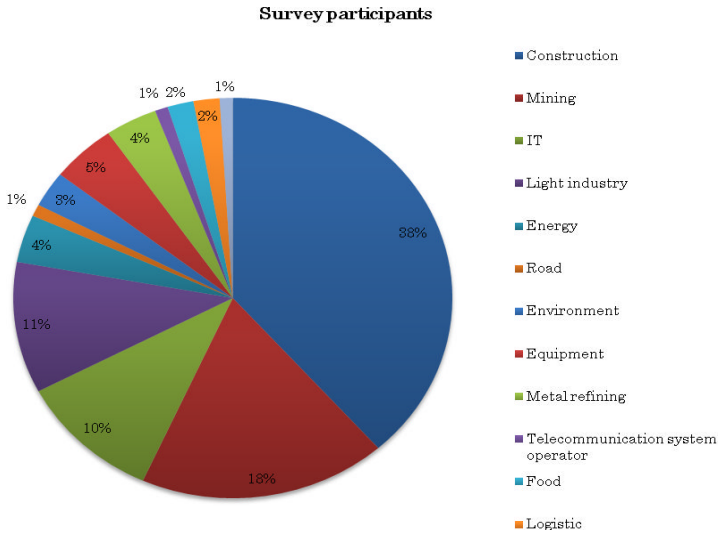
industry-university linkage, The questionnaire applied is attached in attachment 2. Survey items are followings;

- Need of Industrial engineer
- General Assessment (shortfalls) of engieers
- Any Request for domestic University

A survey was conducted for industrial engineer needs in Mongolia, which includes 13 industrial sectors, covering overall Mongolian industry. Contacts were made to 113 companies, which selected randomly in top 20 ranking of each industrial sector, with 93 companies responded eventually. In order to avoid bias of the answers, we tried to select different sizes of companies. About 70% of the respondents are the companies that started business in 2000s after the market-oriented economic reform in 1990s, 80% of respondents were Mongolian company and 20% is foreign investment company. Figure 1-5 shows the rate of the survey respondent companies, which consist of Construction (38%), Mining (18%), Information technology (10%), Light Industry (11%) in order of rank. The current booming of the mining industry has a ripple effect on the construction industry, and Light industry and Information Technology industry are growing and expanding rapidly.

In addition to the questionnaire, about 60 interviews were carried out with individual companies (mainly large companies) and certain experts.

Figure 1-5 Breakdown of Questionnaire Respondents



Needs of Industrial Engineers who graduated from Higher Education Institutes

The results of the respondents on the engineering fields of engineer working in companies is shown in Fig. 1-6. The Figure shows the current engineer needs, which are Mechanical Engineering, Electrical and electronic engineering, Food Engineering, Architectural Engineering and Information Technology Engineering in order of ranking. Mechanical engineers as well as electric and electron engineers are necessary in not only the construction and mining industries, but also wide industrial areas. Although architectural engineers and civil engineers also has high needs from industries, one reason is that many responses for the questionnaire survey are from construction and the mining industries. The other is due to the increase of the plant construction in the mining industry. As for the need of Information technology, information technology is required from not only the information-communication technology industry but also the general companies which apply the information technology to internal infrastructure upgrading. In third place, food engineers are required by the light industry and other industries.

The future needs for the industrial engineering field for existing companies is shown in Fig. 1-7. Top 5 responses are mechanical engineering, Information Technology engineering, Material Engineering, Electronics and electronic engineering, and Production engineering. Mechanical Engineering, information technology engineering and electronics and electronic engineering have high need from industry as before. In addition, the result shows that the needs of the material engineering and the production engineering are increasing. It may be caused by the governmental policy which promotes the value-added productions. Industries in Mongolia are shifting to the system that exports value-added productions by processing raw material. Therefore, various industrial engineering may be raised.

Figure 1-6：Engineer needs of the incumbent companies（University Graduate or Upper）

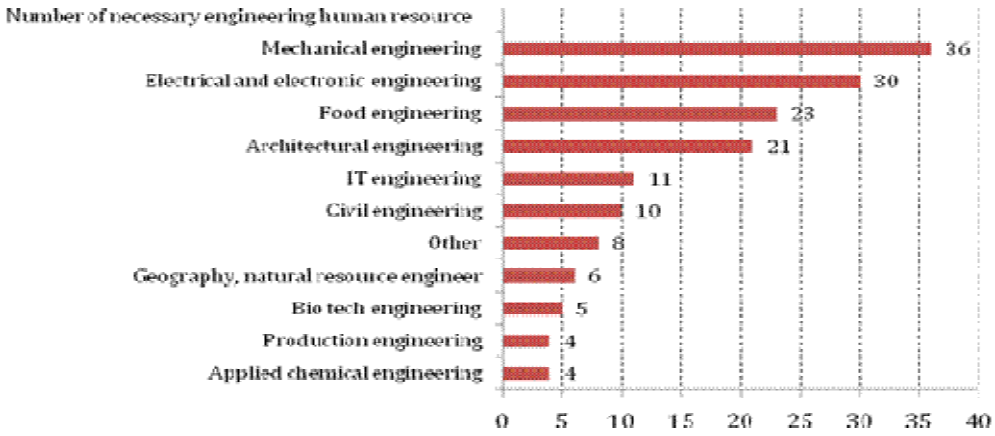
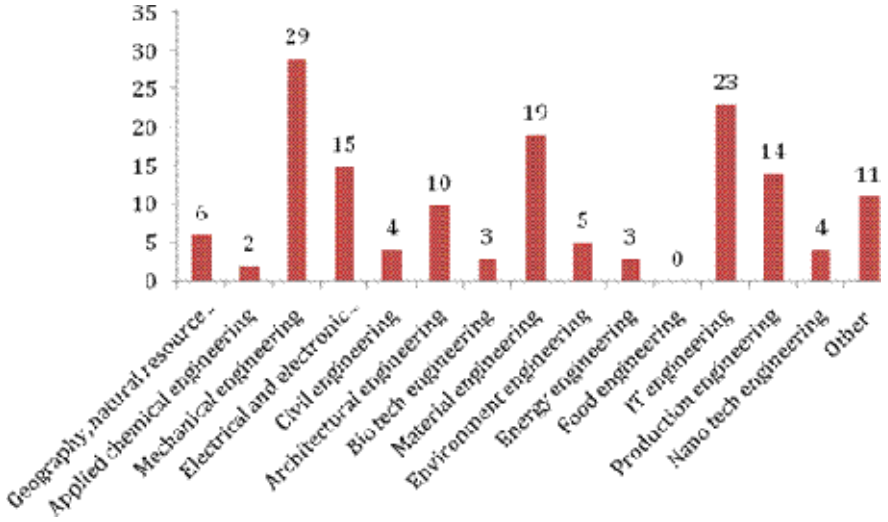


Figure 1-7：Future Engineer Needs of the incumbent companies

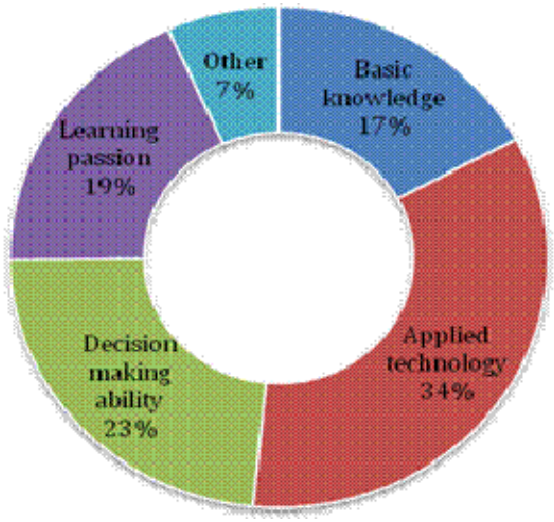


General Assessment (shortfalls) of engineers who graduated from Higher Education Institutes

A general assessment of currently employed engineers was conducted in order to find out current issues for the industrial engineer. The top 4 responses are as follows; Applied technology, Decision making Ability, Learning Passion and Fundamental engineering knowledge.

Notable points are the lack of applied technology and fundamental engineering knowledge. According to individual interview surveys, respondents pointed out that the major subjects in university are too fractionalized, so they lack knowledge in fundamental engineering. The University seems to have a policy that emphasizes on specialized and indepth field study; however there is a shortage of experimental tools and resources to carry out this study. This educational method might to lead shortage of practical ability and the decision making ability. A certain foreign investment company said that normally Mongolian engineers are 1year -1.5 years behind the educational levels of those in advanced nations.

Figure 1-8：General Assessment (shortfalls) of engineers now employed



Any Request for the domestic Universities

Result of the survey for the general assessment of the current industrial engineer indicates clearly the lack of the applied technology and fundamental engineering knowledge. The requests from the industry sector to the domestic universities were surveyed. As for the requests for the domestic universities, The answers occupied in the high rank are practical training, level up of class concept, global human resource training (foreign language), advanced facilities, leadership training. These answers except for global training are closely related to the issues of the currently employed industrial engineers.

In individual interviews, many said that new graduates are not operationally ready immediately. Most of the companies request the university to conduct practical training, but even universities have difficulties doing so. Although it might be a good idea that students first undergo a stimulated experience using virtual instruments and use real instruments later, universities do not have both.

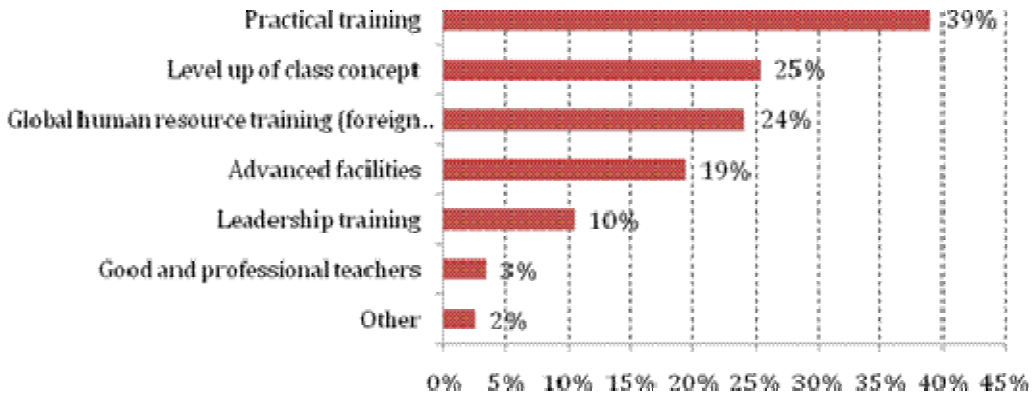
The following introduces the current situation as obtained through interview surveys:

- **Practical Training**
  - ✓ The lack of experimental instruments; the students have to depend on paper learning.
  - ✓ Necessary to prepare the environment for the practical training
  - ✓ Faculty members cannot teach the practical knowledge, due to the lack of practical experiences

- **Level up of class concept**
  - ✓ Some universities adopt Old Russian type teaching system. As s result, advanced technology cannot learn
  - ✓ Quality of teaching staffs has to be improved, due to the low education

- **Advanced facilities**
  - ✓ 80% of equipment introduced in the universities is old, accordingly difficult to learn new technologies.
  - ✓ There is no staff that can operate the advanced facilities.
  - ✓ Lack of the budget to maintain the facilities.

Figure 1-9 : Request for Domestic University



The need of Industrial engineers who graduated from TVET School

The need of industrial engineers who graduated from TVET School was investigated. Existing company needs for TVET engineers are Geology and natural resources engineering, Electrical and electronic engineering, Mechanical engineering, Food engineering, in order of rank. The result is similar to that of engineer from the higher education institutes. However, what is notable is that most of the companies admit that human resources from TVET are recognized not as technical engineers, but as technical workers.

Any Request to TVET School

The request of the industrial sector to TVET Schools has 2 main aspects: one is to upgrade the quality of learning contents (46%) and the introduction of advanced machinery (45%). There might be issues like instructors' teaching methods, insufficient knowledge and experience and shortage of school facility including laboratory instruments for practical application. It is key to

formulate teaching plans that meet advancing technology as well as introducing advanced equipment.

Future needs of the industrial engineer

Subsequently, emerging needs for industrial engineers was investigated through the Sainshand Industrial part project, which is the one of national planning projects. Sainshand Industrial part project is the construction project which build the heavy industries including the refining plants for the minerals, Direct-reduced iron (DRI) plant, Coke plant, power plant and Cement plant etc. at Sainshand, which is located in the south-east of Ulaanbaatar. (See Appendix 3)

Table 1-6 indicates the manpower demand for Sainshand Industrial part project. According to the table, the project will require 2,717 engineers, which consists of 1,902 local professionals, 543 local technical engineering workers and 272 foreign workers.

Area of expertise for the manpower demand by each plant is shown in Table 1-6. Although the expertise depends on the plant types, the common needs among technical engineering worker and professionals are electrical engineers and the mechanical engineers. Technical engineering workers require the skills of the mining engineering and knowledge of chemistry and physics. Professionals require the mining metallurgical engineering as other specialties. Under Sainshand Industrial part project, 4 vocational training centers, college and Poly-technical school will develop the engineers for the project.

Other large-scale infrastructure development projects such as are railway, heavy industries, highway and house constructions are under planning (see Appendix 3). Therefore, the demand for industrial engineers is expected to increase. On the other hand, according to the information about the graduates from the engineering fields in Higher education institutes, there are only 3,714 graduates from the bachelor program in 2012. It shows imbalance of demand and supply on industrial engineer. As described before, Sainshand industrial park project requires the engineers over 2,700 engineers. This situation may induce the shortage of industrial engineer, if several national projects are started in parallel. In the future, it should establish a close linkage between the higher education institutes and industrial sector in order to respond to the escalating needs for industrial engineers.

Table 1-6 Demand for manpower (by plant)

Plants	Total no. of workers	Foreign workers	Mongolian workers in the thousands	
			Technical Engineering workers	Professional
Cement plant	270	27	54	189
Pellet Plant	295	30	59	207
DRI plant	136	14	27	95
Coke plant	270	27	54	189
Power plant	161	16	32	113
Gasification plant	515	52	103	361
Copper production plant	395	40	79	277
Railway repair station	100	10	20	70
Total owner's organization, 20% from above	453	45	91	317
Total	2,717	272	543	1,902

Table 1-7 Manpower demand by skill levels

Plants	Technical Engineering workers	Needed skills	Professionals	Needed skills
Cement plant	54	Industrial Engineer, Electrical Engineer, Technicians in Chemistry and Physics	189	Electrical engineering technicians, Mechanical engineering technicians Mining metallurgical engineer, Plumbers, Welders, Electricians
Pellet Plant	59	Mining Engineer、Technicians in Chemistry and Physics、Electrical Engineer	297	Electrical engineering technicians, Mechanical engineering technicians, Mining metallurgical engineer, Plumbers, Welders, Sheet metal worker, Metal machinery worker, Electricians
DRI plant	27	Mining Engineer、Technicians in Chemistry and Physics、Electrical Engineer	95	Electrical engineering technicians, Mechanical engineering technicians, Mining metallurgical engineer, Plumbers, Welders, Sheet metal worker, Metal machinery worker,

				Electricians
Coke plant	54	Mining Engineer、Technicians in Chemistry and Physics、Electrical Engineer	189	Electrical engineering technicians, Mechanical engineering technicians, Mining metallurgical engineer, Plumbers, Welders, Sheet metal worker, Metal machinery worker,
Power plant	32	Electrical Engineer、Technicians in Chemistry and Physics	113	Electrical engineering technicians, Mechanical engineering technicians, Electricians, Welders, Metal machinery worker
Gasification plant	24	Chemical Engineer, Technicians in Chemistry and Physics	85	Electrical engineering technicians, Mechanical engineering technicians, Electricians, Welders
Copper production plant	79	Electrical Engineer, Mining Engineer, Technicians in Chemistry and Physics	277	Electrical engineering technicians, Mechanical engineering technicians, Mining metallurgical engineer, Plumbers, Electricians, Welders, Metal machinery worker
Railway repair station	20		20	

Source: "Activities from NDIC to Support the "Sainshand Industrial Park"（Table 1-6 / Table 1-7）

Current situation of Industry-University collaboration

Industry-university collaboration is carried out to supplement the shortage of human resources as needed for industries. However, this is a new concept in Mongolia, and according to survey response, 90% answered that they have not implemented industry-university collaboration yet for developing new product or in any business development with university or research institute. At the moment, they have no clear collaboration between industry and University for the above objective. However, an innovation law was passed at the Diet in 2012, and venture business at universities have become available. Innovation law was made but the operational details have not yet been laid down. Accordingly, Industry-University collaboration might be accelerated hereafter.

Current Industry-University collaboration in Mongolia aims not at development of new product or new field, but simply at dispatching instructors from the company side or receiving students for practical training. Industry-University collaboration is one way and not two- way interactive.

It is hard to say that the company side fully understands implication of Industry-University collaboration. On the other hand, university does not have much funds to allocate for this activity, while companies have more available funds. It is also observed that both sides are taking a wait-and-see attitude. In particular, national company of UBEDN has cooperated with Mongolia University of Science and Technology and decided the research theme for study, and concluded contract with funds provided by UBEDN.

1.4.2 Engineer needs of Japanese investment companies

Investment trend of the Japanese company into Mongolia

This section's information is based on interviews with Japanese companies and experts. Japanese company investment into Mongolia is behind that of other countries. Two to three years ago, Japanese company investment was ranked third or fourth after Korea. But in a couple of years, ranking dropped rapidly to eighth position. Mongolia is a small country, then, if the countries other than Japan make large investment like Oyu Tolgoi and other mining investment, Japan's investment ranking will fall easily. Japanese investments include MOBICOM by Sumitomo/KDD, Khan Bank by Sawada Holdings and Suruga Mongol as construction developer.

Major projects which involved Japanese companies include the New Airport Construction Project by Japanese ODA assistance, Darkhan Oil Refinery Project to be financed by JBIC, F/S study of UB Subway Project, No.5 Power Station which Sojitsu have shown interest, and a Hospital Project.

In the mining area, Mitsubishi Corp has expressed interested in uranium mine development projects, while other major Japanese trading companies have expressed interest in Tavan Tolgoi Coking Coal Mine Development Project. Construction machinery distribution by Sumitomo and Marubeni respectively, Steelworks project by Kobe steel, LPG gas sales by Unigas, and as future project, Oil shale and Coal Bed Methane gas development are also expected.

In the construction and civil engineering, Dai Nippon, Suruga Mongol, Nippo, Sakura Construction and others has operated in Mongolia. There are also companies that participated in the PPP bidding for road construction design and construction management.

In the manufacturing sector, Sankou Seiki produces camera parts and photo voltaic products. Some companies are also considering setting up manufacturing plants in Mongolia.

In the textile industry, an investment was made at cashmere factory and many factories have introduced Shima Seiki's automatic weaving machines. In the renewable energy sector, Kyosera and others have interest in wind power, Softbank is making F/S for a large capacity project.

In the IT sector, Fuji-Infox joint venture INI has ranked No.5 in the domestic IT industry.

For the railway project, Shin Nippon Steel has interest in supplying rail of 600US$. Sleepers (0.5 million sleepers) and Signal supply are also opportunities for Japanese companies. Japanese companies have a big chance for Mongolia for infrastructure, smart city, etc., because Japanese Government is pushing those industries' investment abroad as a growth strategy for Japan's Economic Development.

An Attractive area for Japanese Investment

At present, due to an increase in domestic demand in Mongolia as a result of rapid GDP growth, there is an attractive industry for Japanese companies, particularly SME industries. New demand arises and consumption increases. Corespondingly, construction, civil works, construction material manufacturing industry, food industry, and textile industry for domestic use, Hotels, eating-out industry, health and medical industry, IT industry, education industry will expand and Japanese companies have a competitive edge in these industries.

JBIC is now considering providing export credit line to Mongolia. If this is realized, a framework of plant and machinery export from Japan. JICA and JBIC have respective overseas investment support system to provide investment loan of grant of F/S for Japanese companies' direct investment overseas. Mongolia has a big expectation for the Japanese technology transfer to Mongolia, and then technology Transfer Company is much welcomed by Mongolia. They are waiting for the Japanese company to come to Mongolia.

Now, Economic Partnership Agreement (EPA) between Japan and Mongolia is under negotiation. Japan and Mongolia has mutual complementary relation in economic field. Japan is narrow land country with no underground resources, less labor force, but with affluent fund and technology. Mongolia is a vast land country with a lot of underground resources, a lot of unused land for agriculture and livestock industry, young labor force and without enough fund and technology. They are mutually complementary, if Japanese company recognizes more about this complementary relationship, they might come for investment.

Engineer needs of the Japanese investment companies

When we took the Japanese investment movement into main theme of this report, we can extract the following category as the Japanese company engineer needs;

(1) Construction and civil engineering
(2) Mining
(3) IT・Communication
(4) Railway and other infrastructure
(5) Power Generation and renewable energy
(6) Plant and machinery
(7) Environment and food
(8) Agriculture/ livestock, national science

1.5 Identification of priority science sub-division

Taking the report result above, priority sub-divisions are specified as summary at the Tale below.

Table 1-8 Priority Sub-sector among science field

Emphasis on National Plan	Priority on Japanese Assistance	Important area for Industry	
		local company	Japanese Company
Mining Sector	Mineral Resource development	Mechanical Engineer	Construction and
Infrastructure	Processing, Utilization		Civil work
Heavy Industry	Infrastructure Construction	Construction & Civil	Mining
Energy Industry	Economic Diversification	Work	ITC
Light Industry	Intensification of UB urban	Material Engineering	Railway & Other
Environment	Function	Electric & Electronic	Infrastructure
High Tech including	Environment	Engineering	Power, Renewable
Bio, Nano ,IT		Production	Energy
		Engineering	Plant & Machinery
		IT Engineering	Environment, Food
		(Future Needs)	Agro Business,
		Applied Chemical	Natural Products
		Nano Engineering	
		Environment	

In narrowing down tto 5 prioritized and efficient engineer needs, we considered two aspects: inadequacy of skills and availability of engineers. Supply of engineers for Mining , IT and Electric & Electronics Engineering is comparatively available in Mongolia than other sector engineers. Then we eliminated those three sectors from the choice.

Based on information from two experts in the course of interview (the justification is seen in the two tables below), the 5 important sub-divisions as chosen accordingly are:

(1) Mechanical engineering
(2) Material Engineering
(3) Production Engineering
(4) Civil engineering
(5) Applied chemical engineering

In future, more attention should also be paid to applied chemical engineers and nano-engineers.

Chapter 2 Overview of Education Sector

2.1 History of Mongolian Education System

The modern education system in Mongolia was developed over 70 years of the Socialism country era under the strong influence and support of the former Soviet Union from the independence until the 1990s. The government owned the whole education sector. Schools and school dormitories was developed at the places where the children can commute from any places in the vast land of Mongolia. In addition, education was provided free of charge from primary to higher education. These have a very important meaning as a legacy of socialism and have produced the result of the very high literacy rate in Mongolia.

Higher education in Mongolia has been developed with the National University of Mongolia. The National University of Mongolia is the oldest in Mongolia and was the only "university" in the country. The models of this university were the universities in the former Soviet Union. Since its foundation till 1990s it was assisted by the former Soviet Union on the most of the development aspects. After the foundation of the National University of Mongolia, the other major universities of the present, including the Science and Technology University of Mongolia, have been developed in a form of diverged from the National University of Mongolia.

In the Socialism country era, the Soviet Union subsidized of a third of Mongolia's GDP at the peak time and such huge financial assistance made Mongolian Government possible to invest to the public sectors including education sector. It was said the government has spent for education 17.6% of the Government budget and 11.3% of GDP until the late 1980s.[1]

However, the education system of Mongolia was exposed to a sudden change with the collapse of the former Soviet Union in the early 1990s. Financial assistance from the Soviet Union was suspended and the trade was stopped due to abolishment of Council for Mutual Economic Assistance (COMECON), which pushed Mongolia down to one of the poorest countries of the world. The expenditure on education in 2003 was reduced down to 3.8% of GDP. As a result, various problems occurred including shortage of teachers, lack of facilities, and increase of dropout of schools due to poverty. But it is noteworthy that, even in such situation, Mongolia minimized the decrease of the literacy rate and school enrollment rate.

Upon entering the second half of the 1990s, GDP growth has turned positive, and the new government has made educational reform one after another. Especially after 1996, the government accelerated the educational reform mainly by getting assistance from Asian

[1] Robinson, B (1995). Mongolia in transition: a role for distance education

Development Bank (ADB). The chronology of educational reform since 1990 was summarized in Table 2-1.

Table 2-1 Chronology of Education Reform in Mongolia (1990 - current)

Chronology of Education Reform in Mongolia (1990 - current)			
Year	Mongolian Histry	Chronology of Education Reform	Content, etc.
1990	Democratic Party formed as the first opposition party		
	Mongolian People's Revolutionary Party		
	First free multi-party elections		
	Enactment of private property		
1991	Start privatization of state-owned property	Education Law 199 1	
	Donor's Conference for Mongolia (in Tokyo)	Reorganization of the National University of Mongolia	Introduction of private universities
		The Education Audit Committee	4・2・2 System
		Introduction of the principal election	
		Approval of the establishment of the first private universities	
1992	New democratic constitution adopted		Explicit right to education
	Renamed the country "Mongolia"		Guarantee the freedom of the private
	Election based on the new democratic constitution (Win People's Revolutionary Party)		Unification of science and technology
	Announced the complete withdrawal of the former Soviet Union	Ministry of Education to the Ministry of Science and Education	
1993		Cabinet Act	Explicit mission of the Minister of Science
		National action ploan for the development	
		First private ordinary school approved	
1994		Master Plan for Human Resource Development and Education Reform Project Mongolia (1994-1998)	Reorganization of the Board of Education Audit Committee HRD corresponding to the market
			Establishment of the National Education
			Installation Management Conference
			Organizational reform of the ministry
1995		Education Law 1995	Differentiation to Fundamental Law of
			5・3・2 Sysytem
1996	2nd general election (win People's	Education Sector Development Program	Educational reform aided by ADB
		Ministry of Education and Science changed to Ministry of Education, Culture and Science	Integration with Ministry of Culture
1997		Government Basic Instructions for the	Established administrative measures
1998		Mongolian Action Plan for the 21st Century	The key issues in Mongolian society, pointed out the importance of the education sector in particular
		Partially revised Education Act 1995	
		Enactment of the National Standard	Back to 4・2・2 System
		Introduction of accreditation (facilities assessment)	First National Standard of Primary and Secondary Education
			Natural science, health, foreign language introduced
1999		Medium-term socio-economic	
2000	3rd general election (Democrat victory)	Mongolia Education Sector Strategy (2000-	
		Education Act Reform	
2002		Preschool education law, elementary and junior high school law, high school law,	To 6・3・3 System from 2005 (in fact from 2008)
2003		Education Act Reform	Vocational Education Act created
2004	4th general election (breakthrough of Motherland & Democratic Coalition)		
2005		Enactment of the National Standard	5・4・2 System
2006		Mongolia Education Master Plan (2006-2015)	12-year System introduced in 2008 (6-year-old enrollment)
2008	5th general election (win People's	New Education Law	12-year 5・4・3 System
2012	6th general election (Democrat victory)		
	Inauguration of Prime minister Arutanhoyagu	Changed to Ministry of Education and Science	

(Soruce) Issues of transformation of social system and education policy in Mongolia (2009 Naomi Miyamae)

Reform of primary and secondary education in Mongolia was launched in the early 1990s. The reform was directed towards more decentralization, strengthening the school autonomy, renewing the curriculum, and allowing establishment of the private schools. The concept of the new Education Law of 1991 is confirmed in the new Constitution of 1992, which proclaimed human rights, freedom, an open market system, pluralism and participation. The first "Education Sector Master Plan (1994)" was developed with the technical assistance of the Asian Development Bank (ADB) enhancing basic and general education, strengthening the administration of the central government and providing education for eradication of poverty. In 1995 the Education Law was differentiated to Fundamental Law of Education, Elementary and Secondary Education Law, the Higher Education Law respectively. In 1996, the "Education Sector Development Program" was formulated with the support of the Asian Development Bank, and in 1997 the "Government basic instruction" was issued on the basis of it, in which the goals along the framework of sustainable development and education for all were established.

In addition, in "Mongolia Education Sector Strategy (2000-2005)" in 1999, the donor countries and international agencies provided the assistance for education sector by sector-wide approach, in which a revision of the school curriculum and methodology was focused on shifting from an academic-focused instruction to practical-oriented one aiming at changing to student-centered teaching. At the same time, the transition to the 12-year school education system was initiated, but the actual transition was carried out in stages. Firstly it was shifted to a 5-4-2 of 11 years system from 2005, and shifted to 12 years system from 2008 (realized in 2006-2015) as defined in the "Millennium Development Goals" for 2005 and Education Development Master Plan Mongolia in 2006[2].

The education in Mongolia since 1990 has been recovered together with the educational cooperation of foreign countries and international organizations including a number of foreign aid agencies, international organizations and NGOs such as ADB, UNESCO, World Bank, UNICEF, UNDP, Japan, Korea, America, Germany, Save the Children, World Vision and others[3].

2.2 School Education System in Mongolia

The Mongolian school education system is under transition from the current 11-year system of 5-4-2 to the 12-year system of 5-4-3 in line with the international standards. In other words, after the transition, the five-year of elementary school, four years of junior high school, and

[2] Issues of transformation of social system and education policy in Mongolia (2009 Naomi Miyamae)
[3] Capability Supply Landscape Study – Mongolia, American University of Mongolia, October 2012

three years of high school, total of 12 years of basic education are necessary for students to go on to higher education. Entrance age to primary school is at the age of six. The school system diagram of after the transition to the 12 years system is as shown in Figure 2-1.

Most of the local elementary school has a dormitory to accommodate the children of nomads. In order to be awarded a certificate of elementary education, it is necessary to pass the standard test students.

In the system of the past, study at middle school for four years is the period of compulsory education, and there was a high school education of two years subsequent to it, but in the new system study, secondary education is divided into two respective programs of middle school for compulsory education (Compulsory Lower Secondary Education) and high school education (Upper Secondary Education).

In order to be awarded a certificate of completion of basic education, students must pass standardized tests at the end of compulsory education of middle school education. Also, at the end of the high school students are tested. At the primary and secondary education, it is still commonly seen the Soviet-style ordinary school, which elementary, junior high and high school schools have come together. The class week per year at elementary school is 34 weeks, junior high school is 35 weeks, and higher school is 36 weeks.

As for the vocational education, students are enrolled there after graduating from middle school in general, and it is a two-year training program. The students can be also enrolled after graduating from high school, in which case it is a one-year training program.

In order to be enrolled in the professional technical education diploma program students are required to graduate from high school. The most of such programs are two-year program. However, even if the students acquired a Diploma, in the current education system of Mongolia, it is not permitted to be transferred to the third year at the University. Short-term vocational training courses are offered in vocational training centers. Many of the programs take place 1-3 months. There is no particular entrance qualification for those.

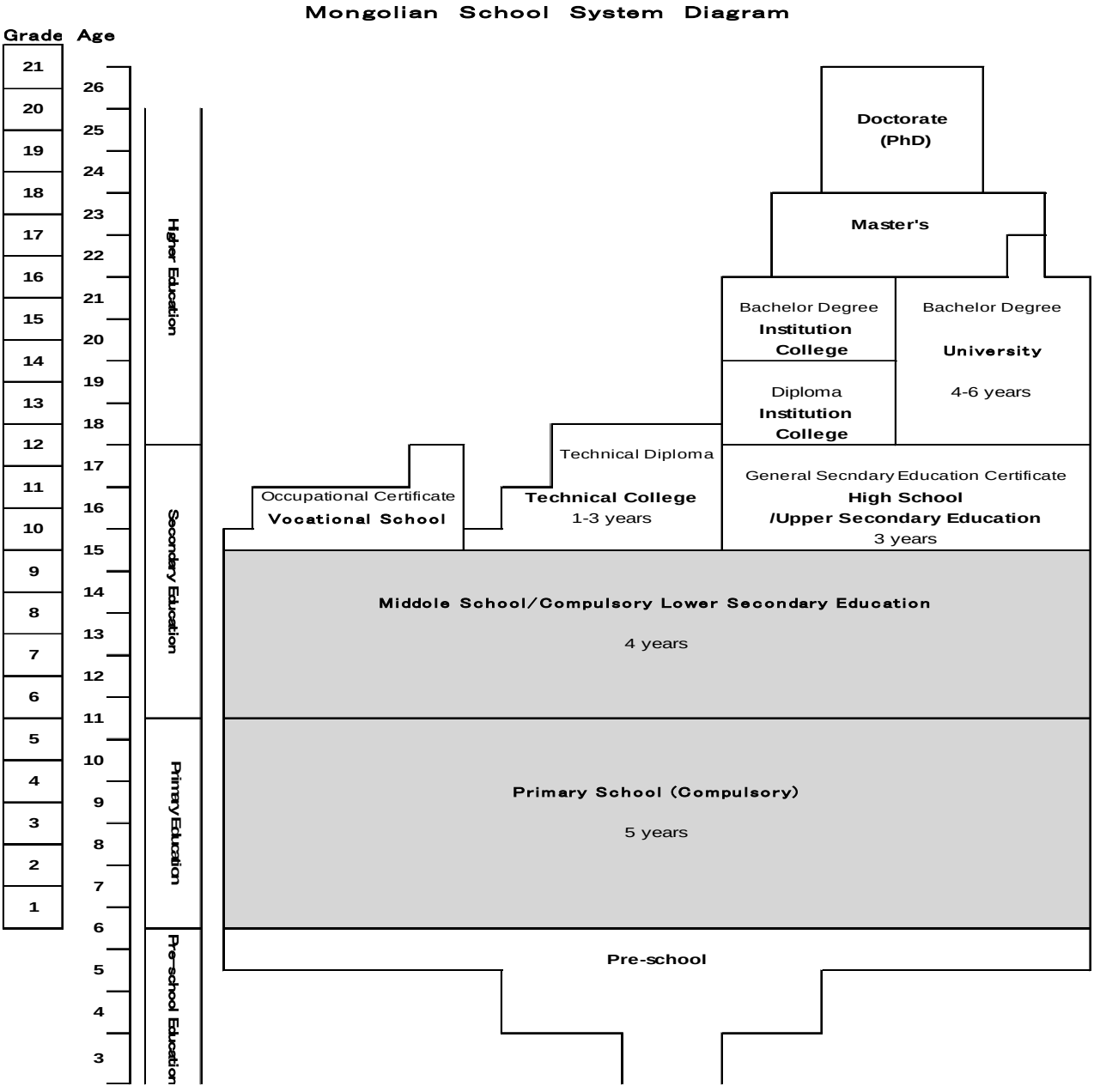
Higher education has been provided at Universities, Institutes and Colleges. The Colleges can offer only bachelor degree programs and diploma programs of three years.

The bachelor degree program at the universities need four to five years, the master programs need one to two years, and the doctoral degree programs require three to four years respectively[4].

[4] World Data on Education 2010/11, UNESCO

In Mongolia, the University, Institute and College can offer any of the vocational education programs, professional technology diploma programs and bachelor degree programs. Therefore, the name of the school does not represent the level of the program offered.

Figure 2-1 Mongolian School System Diagram after Transition to 12-year System



Source : Capability Supply Landscape Study-Mongolia (October 2012)

2.3 Educational Administration in Mongolia

In Article 16 of the Constitution of Mongolia (1992), it is guaranteed to provide free basic education and the right to education of the public. In addition, the Education Law 2002 stated the goal of education is to develop the ability to learn, work and live on their own providing proper intellectual, moral and realistic skills to the people, based on the principles of humanism. As a basis of educational administration, five Education Acts were enacted in 2002, such as the Education Law, the Higher Education Law, the Elementary and Secondary Education Law, technical and vocational education and training Law, and Pre-school Education Law.

Educational Administration has been played by the Ministry of Education and Science, and its role is defined by the law. Basically, all the public education is under the jurisdiction of the Ministry of Education and Science:

- Ensure to organize the implementation of legal service of the whole country on education
- Develop a comprehensive and appropriate system of education for all (including non-formal education)
- Coordinate the activities of the organizations in accordance with the provision of training and support for various programs
- Provide training to all personnel of the organization relating to the education, and move the issue forward in accordance with the social benefits of the teachers.

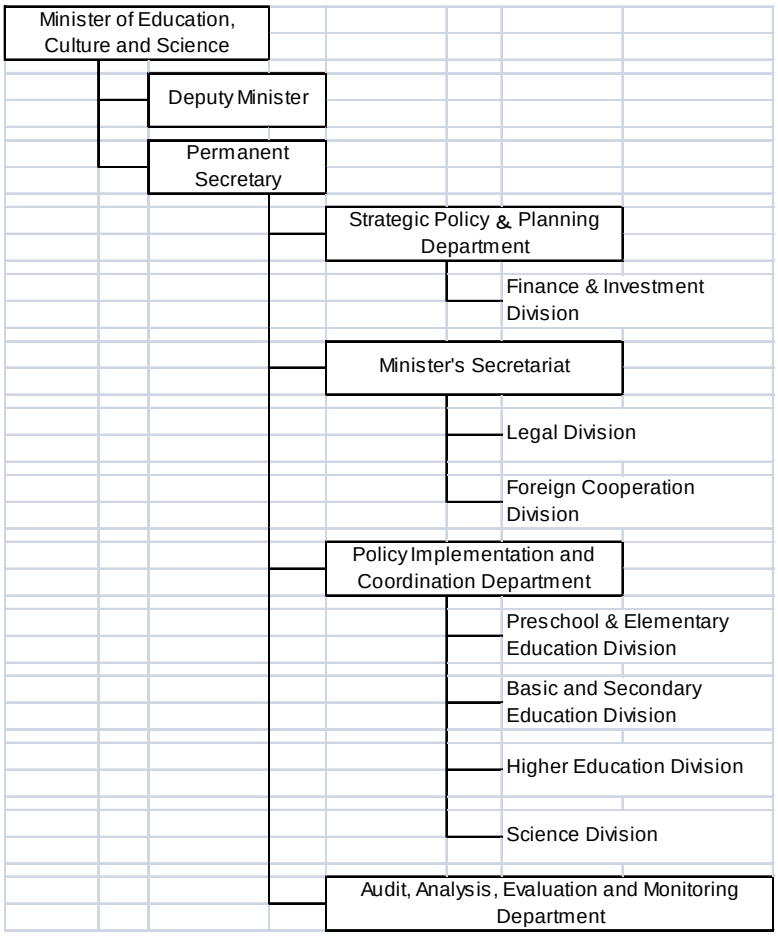
Therefore, the guidance and financial support to the public and private educational institutions of the country, related policy formulation, approval of curricula and textbooks, and control of the schools and National University are done by the Ministry of Education and Science.

However, after the transition to the new government in 2012, administration of the Technical and vocational education (TVET) has been transferred to the Ministry of Labor. In accordance to this change, TVET Agency (A-TVET), former agency under Ministry of Education and Science, has been also transferred to the Ministry of Labor together with the personnel in charge (but one person remained in Ministry of Education).

Relating to this change, some questions regarding legal consistency were raised by the people concerned. For example, the TVET curriculum has been under the jurisdiction of the Ministry of Education, but can it be really transferred to Ministry of Labor? Some TVET institutions are now registered as an internal part of the national universities, but how do you divide the jurisdiction between the two ministries. For the division of role on TVET between the two ministries, some further discussion will be made within the government.

After the change of government, the Ministry of Education and Science consists of the following four departments for the administrative organization:

Figure 2-2 : Organization Chart of Ministry of Education and Science



The detailed roles of the departments are not yet clear in some parts due to the changes by the new government, but the Strategic Policy & Planning Department deals with the policy planning and budget basically, operating by 4 sections of about 20 people each, divided into pre-school education, primary education, secondary education, and higher education sections. Minister's Secretariat has been dealing with legal and external relations, in which the legal department is busy with various adjustments for legal consistency with the transfer of TVET to the Ministry of Labor. The Policy Implementation and Coordination Department is responsible for the implementation of the policy at each level. The Audit, Analysis and Monitoring Department is engaged in monitoring of the educational institutions. They are currently creating a university evaluation methods and index.

2.4 Education Budget

The budget of the Ministry of Education and Science is as shown in Table 2-2. This indicates a change in the budget from 2008 to 2013. However, vocational and technical education budget have been omitted for the previous years as well since TVET has been transferred to the Ministry of Labor from 2013.

Table 2-2 Changes in budget of the Ministry of Education and Science

Budget of Ministry of Education, Culture & Science

Unit: milliom Togrick

	2008	2009	2010	2011	2012	2013	%
Total Expenditure	377,247.6	370,942.2	448,119.0	577,034.3	984,677.1	1,532,696.1	100.00%
Operational Expense	332,248.9	339,159.3	389,379.2	475,342.6	827,380.8	1,119,451.2	
Investment	45,025.7	31,783.0	58,739.8	101,691.7	157,296.3	413,244.9	
% in GDP	6.9%	6.4%	6.2%	5.5%	6.1%	8.0%	
% in State Budget	27.6%	25.9%	20.9%	18.7%	19.3%	20.5%	
Education Expenditure	363,462.7	360,249.0	438,085.2	562,946.9	956,152.9	1,486,197.6	96.97%
Operational Expense	317,724.1	326,640.6	374,675.8	457,399.2	799,761.8	1,081,970.7	
Investment	45,739.6	33,608.4	63,409.8	105,547.7	156,391.1	404,226.9	
% in GDP	6.7%	6.2%	6.1%	5.3%	5.9%	7.8%	
% in State Budget	26.6%	25.1%	20.5%	18.3%	18.7%	19.9%	
S & T Expenditure	18,385.8	14,054.0	16,374.9	19,340.4	30,865.1	46,498.5	3.03%
Operational Expense	14,524.8	12,518.6	14,703.9	17,943.4	27,619.1	37,480.5	
Investment	3,861.0	1,535.4	1,671.0	1,397.0	3,246.0	9,018.0	
% in GDP	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	
% in State Budget	1.3%	1.0%	0.8%	0.6%	0.6%	0.6%	
GDP	5,464,300.0	5,779,000.0	7,171,400.0	10,563,488.0	16,137,396.1	19,063,775.5	
State Budget	1,364,731.1	1,433,985.0	2,140,492.0	3,080,005.0	5,114,655.5	7,473,000.0	
Pre-school Education	89,907.4	83,833.1	111,201.3	141,340.3	221,751.0	381,821.7	24.91%
Operational Expense	69,325.0	68,709.3	82,666.9	103,343.1	168,390.0	234,437.1	
Investment	20,582.4	15,123.8	28,534.4	37,997.2	53,361.0	147,384.5	
% in GDP	1.6%	1.5%	1.6%	1.3%	1.4%	2.0%	
% in State Budget	6.6%	5.8%	5.2%	4.6%	4.3%	5.1%	
Primary & Secondary Education	235,814.1	232,747.8	277,063.0	376,580.8	548,176.5	803,583.9	52.43%
Operational Expense	217,518.6	219,304.4	251,699.1	319,829.2	456,129.7	568,162.5	
Investment	18,295.4	13,443.4	2,533.9	56,751.5	92,046.8	235,421.4	
% in GDP	4.3%	4.0%	3.9%	3.6%	3.4%	4.2%	
% in State Budget	17.3%	16.2%	12.9%	12.2%	10.7%	10.8%	
Higher Education	33,302.9	40,307.4	43,379.9	39,772.9	183,884.5	300,792.1	19.63%
Operational Expense	31,015.9	38,626.9	40,309.4	34,226.9	175,242.0	279,671.1	
Investment	2,286.9	1,680.4	3,170.5	5,546.0	8,642.5	21,421.0	
% in GDP	0.6%	0.7%	0.6%	0.4%	1.1%	1.6%	
% in State Budget	2.4%	2.8%	2.0%	1.3%	3.6%	4.0%	

Source: Strategic Policy & Planning Department, Ministry of Education, Culture and Science

Proportion of overall budget of the Mongolian Ministry of Education and Science in GDP was 6.1 % in 2012, and 8.0% in 2013. This is higher than the average of member countries OECD of 5.8%. Compared to the national budget it was 19.3% in 2012 and 20.5% in the 2013, which is in accordance with the guidelines that at least 20 percent of the national budget is to be devoted to

education as defined in the Education Law. As seen from this table, the higher education budget increased suddenly in 2012 by more than four times from the previous year, and it is expected to increase further in 2013.

The Universities are financed by the government only about 3% of its budget, which covers the fixed costs, such as personnel costs and welfare expenses. The most of the budget of the University are covered by tuition fee. But since the tuition fee is subsidized by the government loan of the education fund to the students, it can be said the universities are indirectly subsidized by the government through tuition fee too. Seven universities including University of Police, University of Defense and University of border security are under the ministries other than Ministry of Education and they are financed by the ministries concerned. No private universities are subsidized by the government budget.

Higher education budget is divided into investment costs and operational expenses. This operational expense includes the budget for the above mentioned government education fund.

2.5 Future Trends in Educational Reform

Since the new administration was launched just last year, not many Policy Papers are available in the field of education. But the Action Plan of the Government of Mongolia 2012 -2016 indicates the direction of educational reform in the future. The followings are the excerpts from the Action Plan which indicate the direction of future educational reform:

- Re-organize and bring together the ministries and departments responsible for employment, vocational education, small and medium-sized enterprises.
- Place great importance to quality than the number of university. Improve the quality of university education by introducing a new standard.
- Review the system of dispatch students to developed countries.
- Build a system that connects directly to the employer and the vocational education center.
- Be consistent the activities of vocational training centers with the trends in supply and demand in the labor market. Decide the number of students enrolled based on the needs of employer and by contract with the employer in order to secure the workplace for the graduates.
- Increase the motivation of admission by not reducing the amount of scholarships to the students of vocational training centers
- Reduce the number of low quality university and introduce the education system to train experts to reconcile the development of education and research, and to answer the needs of the market. Government encourages the development of incubator of research, manufacture

and test in the university, growing high-tech companies, to disseminate products to the market.

- Support the idea of opening of a branch campus in Mongolia of one or more of the world's top universities of engineering and technology.
- Promote the university campus construction projects.
- Pay special attention to the training of teachers and technicians, and provide support for students of high-performance.
- Introduce participatory, independent, open and democratic principles to the executives, organizations and management of the education and scientific institutions.
- Establish a national education promotion fund whose purpose is to promote the development of Education techniques, methods and initiatives.
- Lists the high priority professions for the development of Mongolia based on the survey, and send the 300 students to the world's top universities.

Chapter 3 Higher Education in Mongolia

3.1 Outline of the higher education in Mongolia

Higher education in Mongolia started from the establishment of the National University of Mongolia in 1942. Well into the 20th Century, there was little formal education at any level outside of Buddhist monasteries.

The first nationally funded institution for formal higher learning, the National University of Mongolian was established in 1942 in the capital city of Ulaanbaatar. Modeled after universities in Russia, it had three departments: pedagogy, medicine, and veterinary medicine. The primary emphasis of this new institution was teaching in the departments represented. In order to meet the country's increasing needs for teachers at the primary school level, the State Pedagogical Institute was founded in 1951 as a specialized secondary school. It was reorganized into the State Pedagogical College in 1957, becoming an institution where teachers with higher education were trained.

Most of the limited advanced research was done under the auspices of the National Committee of Science that was not directly affiliated with the university. Even preceding the 1921 Mongolian revolution, there had been a government agency for overseeing scientific research. By the mid-1950's, there was a joint recognition by this body, the National Committee of Science, and researchers in the university of the need to establish research programmers in several of the academic areas represented among the faculty teaching at the Mongolian State University. Thus, the first major reform of Mongolian higher education involved moving faculty at the Mongolian State University into partially autonomous research institutes where both teaching and research would take place but that would emphasize research. In 1958, the zoological-veterinary medicine faculty at the Mongolian State University was the first to be transformed into the Agricultural Institute.

Even though the National Committee of Science was amalgamated with the Mongolian State University in 1959, this structure lasted only until 1961 when the Mongolian Academy of Sciences was founded, thereby perpetuating the pattern of concentrating advanced research in the Institutes of the Academy of Sciences rather than in the university. The Academy of Sciences also controlled awarding of the highest scientific research title, the Doctor of Science degree. Continuing this trend toward institutional specialization, the Medical Institute was formed from the medical faculty of the State University in 1961. The polytechnic faculty was

established as part of the State University in 1969 and became the Polytechnic Institute in 1982. Higher education was designed to meet the needs of a command economy, with specialized program leading directly to specific jobs in government ministries and state-owned enterprises.

The strong Russian influence on Mongolian higher education continued until the break-up of the Soviet Union. Legislation for the second major reform of higher education, passed late in 1990, mandated further restructuring. Four institutes that had been parts of the Mongolian State University became independent universities in 1991: the Mongolian Agricultural University, the Mongolian Medical University, the Mongolian Technical University, and the Mongolian Pedagogical University (Weidman, et al., 1997). These institutions, all except the Agricultural University in close physical proximity within the city of Ulaanbaatar, continued into the 21st Century as independent, but still highly specialized universities.

Mongolian Higher Education during the Transition

Following the collapse of the U.S.S.R., Mongolia took a different path than its Central Asian neighbors that had actually been part of the Soviet Union. It allowed its currency to float (with accompanying hyper-inflation), established a multi-party democracy, and began privatizing state-owned enterprises. Recognizing the importance of building a strong legal foundation for the newly independent republic, a constitution was approved and the Parliament passed the first education law of the newly independent republic in 1991. This law was amended in 1995, 1998, 2000, and 2002, each time clarifying and defining various dimensions of the tertiary education system (e.g., standards, degree structure, institutional types, assessment and accreditation, governance, finance, etc.).

Enrolment in bachelor degree level programs increased dramatically, from 13,825 in 1990 to 59,444 in 1998 (Table 1.1). Important factors in the rapid expansion of tertiary education in the 1990s were authorization, for the first time, of private higher education institutions, increased demand for advanced education required to find employment in the emerging market economy, and increases in government funding for students. Donor activity also accelerated, with funding from multi-lateral (Asian Development Bank, EU) and bi-lateral (Japan, Korea, USA, Denmark, UK, Germany) sources (Weidman, 1995, 2001).

Reform Effort in the higher education sector

Efforts to reform higher education were guided by a series of education sector studies, all funded by the Asian Development Bank (ADB), the first of which was completed in 1993. This led to the Education and Human Resource Master Plan (Government of Mongolia, 1994) which

identified several key issues for higher education reform at that time.

In last 3 years, Higher Education Institutes (including the institutes that confer the bachelor degree or higher degree) has changed the individual public university into 8 colleges specialized in Technology, Culture, Economics, Business. National University of Mongolia is an only Institute which offers the traditional curriculum. The private university is increasing year by year.

Summary of Higher Education in Mongolia

Higher Education sector in Mongolia consists of University, Institute and College. University offers the Bachelor, Master and Doctoral Programs, Institute offers Bachelor and Master programs, and College can offer only a bachelor program. The president of every institute of higher education is assigned by MECS. Although autonomy in university has been discussed in the last 20 years, it has not started. Quota of full-time bachelor program in every university is also set up by MECS.

Table 3-1, 3-2 and 3-3 show the major information regarding the higher education sector during the last decade, the current situation, and the distribution of higher education institute, respectively.

Table 3-1 Main indicators of higher education during the last decade

Indicators	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Higher Education Institutes (HEIs)	185	183	184	180	170	162	154	146	113	101
State HEIs	42	48	49	49	48	47	48	42	16	15
Pribate HEIs	136	128	129	125	116	109	101	99	92	81
Brabches of foreign univesities	7	7	6	6	6	6	5	5	5	5
Accredited HEIs	58	68	85	88	88	91	86	86	68	67
Total enrollment of HEIs	98,453	108,738	123,824	138,019	142,411	150,326	161,111	164,773	170,126	172,798
State HEIs	66,834	74,134	84,041	91,755	93,478	99,037	106,611	100,581	104,431	104,101
Public HEIs	31,197	34,134	39,405	45,784	48,552	50,878	54,114	63,835	65,306	68,302
Branches of foreign universities	422	470	378	480	381	411	386	357	389	395
Accredited HEIs	79,202	86,599	108,339	110,000	123,609	133,071	140,768	151,049	161,304	164,884
Total staff employed by HEIs	10,674	11,046	11,555	11,676	12,175	12,492	12,555	12,849	12,824	13,021
Full-time faculty members	5,642	5,990	6,337	6,517	6,818	6,892	7,020	7,219	7,183	7,295

Reference: Statistical Year Book Education, Culture, Science and Technology (2011-2012 academic year, 2011 fiscal year)

Table 3-2 Current information regarding the higher education sector in Mongolia

Indicators	Universities	Institutes	Colleges	Branche of Foreign Universities	Total
Number of HEIs	14	55	27	5	101
Public HEIs	10	4	1	-	15
Private HEIs	4	51	26	-	81
Branches of foreign universities	-	-	-	5	5
The number of students in	118,347	47,243	6,813	395	172,798
Public HEIs	100,763	3,112	226	-	104,101
Private HEIs	17,584	44,131	6,587	-	68,302
Branches of foreign universities	-	-	-	395	395
Full-time faculty	4,867	1,965	424	39	7,295
Public HEIs	4,401	179	66	-	4,646
Private HEIs	466	1,786	358	-	2,610
Branches of foreign universities	-	-	-	39	39
Staff	8,730	3,396	772	123	13,021
Public HEIs	7,906	342	105	-	8,353
Private HEIs	824	3,054	667	-	4,545
Branches of foreign university	-	-	-	123	123

Reference：Statistical Year Book Education, Culture, Science and Technology (2011-2012 academic year, FY2011)

Table 3-3 Distribution of Higher education in Mongolia

	All HEIs	Branches in Rural Areas	All students	All Full-time Faculty
Western Region	2	5	5,037	289
Khangai Region	3	6	5,831	276
Central Region	3	5	7,449	373
Eastern Region	1	1	993	58
The capital (Ulaanbaatar)	92	0	153,488	6,299
Total	101	17	172,798	7,295

Reference: Statistical Year Book Education, Culture, Science and Technology (2011-2012 academic year, FY2011)

These tables indicate the following;

Total number of students in HEIs has increased from 98,435 of FY 2003 to 172,798 of FY 2012 by booming of higher education. Although the number of the student study in HEIs increases with 75%, the number of the faculty member increases with only 29% during the last decade.

On the other hand, the government integrated HEIs to assure the educational quality. As a result, the number of HEIs decreased from 185 of FY 2003 to 101 institutes of FY 2012. Referring to the Table 3-3, 91% of HEIs and 89% of students concentrate in Ulaanbaatar.

The number of the student in HEIs is caused by the increase of the population who would like to study at HEIs and high education rate of Mongolia.

According to the Nation Master.com, the rate of education rate in Mongolia is 33.3%. It is 47 ranking among 151 investigated nations. The population may increase from 2.8 million of FY 2012 to 4.0 million of FY 2050; about 50% of current population may be increased. Hence, the needs for the HEIs get higher and higher. The issue for the lack of the teaching staff will be described hereinafter. The list of accredited HEIs in Mongolia is attached in Appendix 3.

Expenditure for Higher Education Institutes

Table 3-4 shows the expenditure of public HEIs in 2012. Tuition payment occupies 83.5% of total income. Budget from central and local government is only 7% of total income. However, 50% of income from tuition is provided from the scholarship by State Training Fund. The practical government support is about 48% of total income.

Table 3-4 Higher Education Expenditure

(Currency:000MNT)

Expenditure items	Diploma program	Bachelor program	Master and Doctral program	Short course	Total
Finance resources for expenditure					
Central budget	1,287,248	9,348,801	1,194,512	502,660	12,333,220
Local budget	-	698,337	-	-	698,337
Income from core activities (Tuition payment)	3,159,353	141,489,684	8,657,222	1,438,691	154,744,951
State Training Fund	1,443,890	72,207,390	1,733,918	479,962	75,865,159
Private payment	1,715,463	69,279,794	6,923,305	958,729	78,877,291
Income from subsidiary activities	278,039	6,445,778	224,575	319,260	7,267,652
Donations from organizations and individual	170	552,148	9,327	1,631	563,274
Funding for programs and projects	10,544	3,606,525	376,196	18,082	4,011,346
Other	111,095	5,383,556	259,481	56,056	5,810,189
Total	4,846,448	167,524,829	10,721,313	2,336,378	185,428,968
Expenditure items					
Running expenses	4,528,299	139,194,999	9,512,794	2,223,011	155,459,103
Salary and allowances	1,470,124	46,203,251	3,222,406	796,287	51,692,067
faculty salary	947,898	28,495,716	2,162,585	459,731	32,065,929
Welfare expense	20,820	8,665,475	568,859	150,680	9,705,834
Research	65,344	4,168,161	411,149	68,758	4,713,413
Expenses on training & practice	229,679	5,401,971	506,157	163,311	6,301,119
Other	1,794,433	46,260,426	2,641,638	584,243	50,980,740
Investment	-	19,024,413	194,562	32,778	19,251,753
Total	4,528,299	158,219,412	9,707,356	2,255,788	174,710,856
Total asset	2,316,252	392,027,622	8,023,284	-	402,972,158

Reference：Statistical Year Book Education, Culture, Science and Technology (2011-2012 academic year, 2011 fiscal year)

Quotas for full-time student by Major Fields

The admission quotas of full-time student by major fields are shown in Table 3-5. It can see the government policy for human resource development on the Engineering field. The table indicates the needs of development on human resource in the engineering area.

Table 3-5 Admission quotas for full-time, day student by Major Field

Major Category	Quota
Teaching	4,840
Arts	1,200
Psychology, languages	2,435
Foreign languages	2,000
Economics, finance. Histry	2,730
Journalism	663
Management	8,100
Law	1,335
Biology, biotechnology	285
Physics, chemistry	970
Geology	265
Mathematics	125
Computer science	2,005
Engineering	**3,745**
Industrial Processing technology	2,370
Metallugy	45
Machinary	55
Mining	315
Mineral concentration	130
Construction materials	95
Construction and architecture	855
Civil and industrial building	190
Heating, ventilation, sewage	155
Agriculture, anumal husbandary	1,125
Land development	375
Veterinary	185
Medicine and health science	2,915
Social work	415
Sports, tourism	995
Transprot	125
Railroad	60
Ecology, environmental science	445
Uniformed services, military	750
Total	42,298

Engineering subgroup of possible interest to Mining Indutry	Quota
Metal processing	130
Mineral concentration	20
Mining electric equipment	260
Mining deposit assessment	70
Mining exporation technology	25
Mining machinery	135
Engineering geology	80
Geodesy	80
Hydromechanics	60
Industrial waste processing	60
Water recources	30
Industrial ecology	30
Industrial mechanization	145
Combusion engines	30
Automotive	105
Engineering mechanics	105
Electric works and systems	435
Thermal and heating	155
Renewable energy	110
Information technology and system	630
Telecomunication	190
Railroad communication	20
Engineering mathematics	25
Engineering processing modeling	25
Engineering physics	30
Construction materials production	70
Agricultural mechanics	80
Engineer instructor	140
Total	3,275

Source: Capability Supply Landscape Study-Mongolia (October 2012)

Regarding the State Training Fund mentioned above, the Order #19 (2012) listed up the priority area, “High Demand Higher Educational Profession” as below. The students who pursue these areas are given scholarship of better conditions.

- Road Construction
- Primary School Teacher
- Pre-school Teacher
- Teachers for Natural Science
- Geology
- Hydrogeology
- Hydromechanics
- Water Resource Ecology
- Mining
- Mining Machine & Equipment
- Veterinary Science
- Information Technology
- Oil Storage and transportation
- Civil Engineering, Pipeline
- Renewable Energy
- Nano Engineering
- Bio Technology
- Nuclear Energy
- Diagnosis
- Medical Science

The graduates from Higher Education Institutes by degree

Table 3-6 shows the graduates from HEIs by each degree. Ratio of the female graduates for the total number of graduates is 63%. In addition, the ratio of the graduates who can take a job within 1 year after graduation is 36% of the total number of graduates and only 25% for the number of graduates from full-time bachelor program.

Table 3-6 Higher Education graduates by degree

	Graduates			Jobfinder	%
	Male	Female	Total		
Public HEIs					
Diploma program	83	761	844	509	60%
Full-time program	83	761	844	509	60%
part-time program	-	-	-	-	-
Remote program	-	-	-	-	-
Bachelor program	6,818	10,569	17,387	5,145	30%
Full-time program	6,032	9,208	15,240	3,828	25%
part-time program	199	343	542	201	37%
Remote program	587	1,018	1,605	1,116	70%
Master program	685	1,299	1,984	1,652	83%
Full-time program	535	836	1,371	1,066	78%
part-time program	-	-	-	-	-
Remote program	150	463	613	586	96%
Doctoral program	35	54	89	87	98%
Full-time program	19	35	54	52	96%
part-time program	-	-	-	-	-
Remote program	16	19	35	35	100%
Total (Public HEIs)	7,621	12,683	20,304	7,393	36%
Private HEIs					
Diploma program	6	89	95	60	63%
Full-time program	6	89	95	60	63%
Part-time program	-	-	-	-	-
Remote program	-	-	-	-	-
Bachelor program	5,012	9,252	14,264	4,518	32%
Full-time program	4,525	7,872	12,397	3,838	31%
part-time program	208	694	902	237	26%
Remote program	279	686	965	443	46%
Master program	317	862	1,179	999	85%
Full-time program	290	810	1,100	920	84%
Part-time program	13	26	39	36	92%
Remote program	14	26	40	40	100%
Doctoral program	3	2	5	5	100%
Full-time program	3	2	5	5	100%
part-time program	-	-	-	-	-
Remote program	-	-	-	-	-
Total (Private HEIs)	5,338	10,205	15,543	5,582	36%
Total	12,959	22,888	35,847	12,975	36%

Source: Statistical Year Book Education, Culture, Science and Technology (2011-2012 academic year, FY 2011)

The high rate of female student in University is caused by the Mongolian traditional custom. According to the Mongolian traditional custom, the men stay in their hometowns to support their families, and the females go out to gain education.

Table 3-6 shows the low rate of employment for the graduates from the bachelor program. It can be seen that the number of graduates from the faculties of the social science and the law is higher than that of faculties of engineering, as shown in Table 3-7. The number of graduates from the bachelor program of engineering is 3,714, which is only 12 % of the total number of graduates. On the other hand, the industrial sector requires engineers who graduated from the faculties of engineering area. Therefore, there is an imbalance of demand versus supply in human resource. The rate of employment of graduate from the bachelor program is low.

Table 3-7 Higher Education graduates by field of study and degree earned

Field of study	Diploma	Bachelor	Master	Doctral	Total
Teacher training and education science	133	5,012	623	7	5,775
Arts	8	563	35	3	609
Humanity	38	2,202	310	15	2,565
Social science, busuness low	43	13,089	1,395	17	14,544
Science	14	1,858	244	10	2,126
Life science (biology)	(1)	(167)	(72)	-	(240)
Physics, chemistry, geology and geography	(2)	(543)	(120)	(9)	(674)
Mathematics and statistics	-	(113)	(29)	(1)	(143)
Computer science	(11)	(1,035)	(23)	-	(1,069)
Engineering, manufacturing and construction	165	3,714	290	9	4,178
Engineering	(85)	(1,799)	(172)	(3)	(2,059)
Manufacturing and processing	(61)	(1,342)	(77)	(4)	(1,484)
Architecture and civil engineering	(19)	(573)	(41)	(2)	(635)
Agriculture	4	687	91	9	791
Health and welfare	941	2,096	77	21	3,135
Service	41	1,982	98	3	2,124
Total	1,387	31,203	3,163	94	35,847

Source : Statistical Year Book Education, Culture, Science and Technology (2011-2012 academic year, 2011 fiscal year)

Quantity and Quality of Administrative staff and faculty

Table 3-8 shows the indicators for the quality of the full-time staff and faculty member in the public HEIs. According to the table, the ratio of the Ph. D holder is only 24% relative to total faculty numbers. It is relatively low in comparison with the developed countries including Japan. In addition, the most of faculty members with Ph.D. earned the degree from the universities in Russia during the socialist era.

As for the quantity of faculty members, the number of faculty member increased by 10% the last decade, as explained in the previous section. However, the number of students increased by 75% in the same period. The growth rate of faculty member cannot keep up with the growing ratio of student. Table 3-9 indicates the mobility and attrition of HEIs in 2012. In 2012, the leavers and newcomers are 1,360 and 1,248 respectively. The total number of faculty is slightly raised. The reasons why the faculty members left the HEIs are “moved to non-educational entity (6%), “became a self-employed (6%)” and “Others (47%)”. It means that more that 50% of leavers moved to the private sectors. This loss of faculty members to the private sector can be attributed to the increase in the pay standard in a booming economic situation.

Table 3-8 Higher education administrative staff & faculty

Item	Full-time faculty (FTF)	
Achademic position		
Assistant Lecturer	807	11%
Lecturer	2,944	40%
Senior Lecture	1,934	27%
Associate Professor	862	12%
Professor	748	10%
Total	7,295	100%
Yeas of experience		
1 - 5 years	1,868	26%
6 - 10 years	1,857	25%
11 - 15 years	1,063	15%
16 - 20 years	718	10%
21 - 25 years	610	8%
more than 25 years	1,179	16%
Total	7,295	100%
Age		
up to 30years	2,109	29%
31 - 50 years	3,550	49%
51 - 55 years	761	10%
56-60歳	446	6%
above 60 years	429	6%
Total	7,295	100%
Education		
Doctral	1,783	24%
Master's	4,890	67%
Bachelor's	601	8%
Doiploma	21	0%
計	7,295	100%

Source：Statistical Year Book Education, Culture, Science and Technology (2011-2012 academic year, 2011 fiscal year)

Table 3-9 Higher Education faculty mobility & attrition

Forms of members reported and attrition		Total	of which female	
Number of faculty members reported previous year		7,183	4,174	
All leavers		1,248	687	100%
of which	to institutions in other aimags or cities	114	72	9%
	to institutions in the same aimag or city	114	57	9%
	changed their position within the institution	147	104	12%
	moved to non-educational entity	76	43	6%
	those who became self-employed	77	44	6%
	retired	79	39	6%
	deceased	26	4	2%
	position was eliminated	23	10	2%
	convicted	-	-	-
	other reasons	592	314	47%
all comers		1,360	800	100%
of which	employed after graduation	265	173	19%
	from institutions in other aimags or cities	127	92	9%
	from institutions in same aimag or city	226	136	17%
	other reasons	742	399	55%
Number of faculty members reported this year		7,295	4,287	

Source：Statistical Year Book Education, Culture, Science and Technology (2011-2012 cademic year, FY2011)

Quality assurance system on Higher Education

Mongolia Council for Education Accreditation (MNCEA) which is a non-profit organization is set up for accrediting the HEIs and Technical and Vocational Education and Training. MNCEA is a full member of the International Network for Quality Assurance in Higher Education (INQAAHE) which consists of 173 quality assurance organizations. Minister of MECS is a chairman of MNCEA. 67 institutes among 101 HEIs are accredited. 95% of the total student is studying at the accredited HEIs.

Table 3-10 indicates a summary of Quality Assurance in Mongolian Higher Education, which is Accreditation, Attestation, Licensing, Monitoring and Ranking systems.

Table 3-10 Mongolian higher education quality assurance system

	Accreditation		Attestation	Licensing		Monitoring	ranking
Purpose	Institutional performance	Preformance improvement	Compliance check	Permission for operation		Status check	Comparison
Focus	HEIs	Achademic programes	HEIs	HEIs	Academic programes	HEIs	HEIs
Responsible institution	MNCEA		MECS	MECS		MECS & contracted parties	Interested parties
Step	Self-evaluation, External evaluation	Self-evaluation, External evaluation	Self-evaluation, External evaluation	External evaluation	External evaluation	External evaluation	External rating
Follow-up or result	Periodic reaccreditation of HEIs	Periodic Reaccreditation of academic program	Periodic renewal of attestation	Renewal of HEIs license	Renewal of academic program license	Periodic monitoring in HEIs	Periodic ranking

Source: Capability Supply Landscape Study-Mongolia (October 2012)

The standard of curriculum for the higher education in Mongolia is set up by MECS. Subjects are categorized into 3 contents: General Content, Professional Core Content and Specialization Core Content. “General” and “Professional Core” contents of each major subject are determined by MECS, and “Specialization Core Content” is determined by each HEI. In principle, the curriculum is composed of “General Content” of 30%, “Professional Core Content” of 40% and “Specialization Core Content” of 30%. The licensing for faculty member is also defined in the program standard. Attestation is to check whether the program adhere to the compliance. However, some HEIs cannot observe the program standard.

Regarding the ranking of top HEIs in Mongolia, the ranking is determined by a voting by educators and journalists. The result of TOP HEIs ranking in 2012 is shown in Table 3-11. National University of Mongolia is the clear number 1 HEIs, Mongolia University of Science and Technology takes a second place.

Table 3-11 TOP higher education Institutions in Mongolia

Rank	Name of the Institution	Score	Frequency
1	National University of Mongolia	522	127
2	University of Science and Technology	383	110
3	University of Health Sciences	309	91
4	Institute of Finance and Economics	199	60
5	University of Education	137	49
6	University of Agriculture	105	47
7	Mandakh Burtgel Institute	83	29
8	University of Humanities	66	23
9	Otgontenger University	44	15
10	Academy of Management	32	14
11	University of Art and Culture	38	13
12	Ikh Zasag University	28	12

Source: Capability Supply Landscape Study-Mongolia (October 2012)

3.2 Trends in Other Development Partners

As for recent developments of other development partners in the field of higher education in Mongolia, the activities of the GIZ of Germany are noticeable.

GIZ of Germany

GIZ is preparing a "Mongolia-German University of Technology Development Project", as a Technical Assistance project in the higher education sector. TA is scheduled to begin in the fall of 2013. The project scale for the initial four-year will be around 4 million Euros.

The project aims to establish the European standard University of science and engineering in Mongolia, but at the first stage a new faculty will be established under National University of Mongolia or Mongolian University of Science and Technology, maintaining independence from the university. Then it is planned to be independent as a new national university few years later. However, it is said that the Mongolian side wants it to separated as an independent university from the beginning.

The building is to be built by the Mongolian side. The only undergraduate program will be offered for the first five years of implementation, then the master and doctoral programs will be set up. Around 600 talented students will be selected in 2013 as a first batch of the undergraduate program. The faculty members will be about 25 people according to the tentative plan. The main field of study will be the mining related field, but other electrical and electronic engineering fields will be also considered based on the investigation currently going on. The

feature of the programs will be on German-style practical training in which a cooperation programs with companies are introduced. Several universities in Germany will cooperate with the project and Professors will come and go in the short term. Scholarship to study in Germany is not included at the moment.

3.3 Current situation of Major Higher Education Institutes in Mongolia

3.3.1 National University of Mongolia

Outline

National University of Mongolia, the first higher education institution in Mongolia, was established in 1942 with the 3 faculties of medicine, zoo technology and pedagogy, 6 departments of zoology, biology, mathematics and physics, organic and inorganic chemistry and anatomy. In 1942, 93 students and 53 students enrolled the preparation courses in the NUM, and 35 students graduated in 1946.

In 1947, the faculty of social sciences was established, and offered the Department of History and Economic studies. In 1958, the program of geology was introduced. The faculty of Agriculture became an independent University as Institute of Agriculture (Presently, the Mongolian University of Agriculture). In 1961, the programs of Geology, Mechanical engineering were introduced. The Medical Faculty separated from the NUM and became a Medical Institute (Presently, the University of Health Science). In 1962, the program of metrological engineer, construction and energy engineer were established, and the Nuclear Research Center was founded in 1965. In 1979, the Institute of Russian Language separated from the NUM (It is now the University of Humanities). The Institute of Mathematics in 1997 and the Ulaanbaatar University and the Institute of Commerce and business in 2010 were merged into NUM respectively. In 1969, the Poly-Technical Institute was separated from the NUM and became the University of Science and technology (Presently, the Mongolia University of Science and Technology). National University of Mongolia is consisted of 14 Schools, 5 Institutes and 15 Research centers by separation and merging through the several times of organizational restructuring.

As for the Engineering program in NUM, some schools offer the engineering program; Nano-Technology and Chemical Technology in the School of Chemistry and Chemical Engineering, Renewable energy and Nuclear Technology in School of Physics and Electronics,

and Biochemical Engineering, Bioinformatics and Bioscience in the School of Biology and Biotechnology.

According to the history of National University of Mongolia, the Polytechnic Institute founded at National University Mongolia was separated from NUM, and became a Mongolian University of Science and Technology, as independent HEIs. Therefore, NUM does not have the engineering program in the strict sense.

School of Chemistry and Chemical Technology

- ✓ Nano-technology program
- ✓ Chemical technology program

School of Physics and Electronics

- ✓ Renewable energy program
- ✓ Nuclear technology program

School of Biology and Biotechnology

- ✓ Bio chemical program,
- ✓ Bio Informatics program
- ✓ Bio technology program

At present, NUM is discussing the organizational restructuring of NUM. Presently; the graduate courses in NUM are operated by each school. According to the Administrative member of NUM, these graduate courses may be separated from each school, and be relocated under the control of head office of NUM. Then, the head office of NUM will operate the new graduate courses with the Natural science, the Social science, the Law and the Economy. The Engineering course may be set up under this concept. There are 2 idea of installation of engineering course. One is to set up the independent engineering course, and the other is to set up the engineering program in the Natural science course in combination with the natural science and the applied science. The applied science includes Renewable energy technology, nuclear technology, Nanotechnology, Biotechnology and Information technology.

The concept is under discussion phase, there are several challenges to realize. One is to develop the human resources of faculty on engineering field, next is to develop the curriculum on engineering, and final is to overhaul the equipment and devices for the education and research on engineering.

NUM is investigating the administrative structure of the Universities in Japan, German, Korea,

Taiwan and USA to develop the new engineering education system suitable for NUM.

Present situation of engineering program in NUM

As mentioned in previous sections, there are some engineering programs in NUM. In this JICA investigation, the following schools were investigated.

School of Chemistry and Chemical Engineering (SCCE)

Chemistry sector is one of the oldest sectors if NUM was founded in 1942 as the Department of chemistry. In 1998, Faculty of Chemistry was established as an independent faculty of the NUM. From 2010, the faculty was developed with name of School of Chemistry and Chemical Engineering, conducted the academic and research activity alternatively. Typical engineering program under SCCE are the chemical Engineering program, and the nanotechnology program. Nanotechnology program is to develop the nano-material by applying the nanotechnology to the enriched minerals in Mongolia. International collaboration research with Tokyo Institute of Technology is implemented by using some devices donated from Tokyo Institute of Technology. The Chemical Engineering program is conducting research related with chemical process engineering. Both programs are feasible research to develop the future industrial sector in Mongolia.

School of Physics and Electronics (SPE)

In 1942, the Physics Branch was first established in NUM. Since 1997, it is called as the School of Physics and Electronics. The typical Engineering programs offered in SPE are the renewable energy program and the nuclear technology program. Energy resource in Mongolia highly depends on the coal resource, the electricity has generated by thermal electric power generation. Therefore, it is necessary to develop new energy resources alternative to coal. The renewable energy program is the education to study the solar energy and the wind power in view of the geographic feature of Mongolia. Nuclear technology program is the education to study the monitoring and analytical techniques for the environment by applying the nuclear technology.

School of Biology and Biotechnology (SBB)

Department of biology, which was a former organization of the School of Biology and Biotechnology, was founded at the Faculty of Education at NUM in 1942. In 2010, the School of Biology and Biotechnology was formed after a series of mergers and separations between the agriculture and the veterinary departments.

SBB offers the Bio chemical program, the Bio informatics program and Biotechnology program,

as an engineering program. Bio chemical program conducts research related with a drug discovery by using rich biological resources growing under unique conditions in Mongolia. The research of drug discovery has received remarkable attention from International and domestic industries, and the international collaboration and industrial-university collaboration research of drug discovery is currently conducted. Bio informatics program is required to keep up with the information of biological resources in Mongolia. Information of the biological information has never been accumulated until now. Therefore, it has high potential to develop the new industries by preparing information about the biological resources in Mongolia.

Table 3-12 Structure of Degree program

Programs	Duration	Credit
Bachelor degree program	4 years or 8 semester	120
Master degree program	1.5 years to 2 years	30
Doctoral degree program	3 years	60

Structure of staff in NUM

Table 3-13 shows the number of staff in NUM. Faculty member consists of Professors, Associate professors, Lecturers, and Assistant lecturers. The total number of staff is 1,517, which consists of 875 faculty members, 36 international faculty members and 1,517 supporting staff. 25 of the international faculty staff come from Asian countries, 8 from European countries and 2 from USA.

Table 3-13 Number of staff in NUM

Position	Number
Local faculty members	875
International faculty members	36
Supporting staff	606
Total	1,517

Table 3-14 Faculty Educational background (%)

Degree	Number	(%)
Doctoral program	383	44
Master program	483	55
Bachelor program	9	1

Table 3-14 shows the educational background of the local faculty members: the number of faculty members with a doctoral degree is 383 and the rate of the faculty members with doctoral degree relative to the total staff is 44 %. This ratio is higher than the average of the higher education institutes in Mongolia (the average of the whole of higher education institutes is 26%) and the public universities in Japan (the average of the whole of public university in Japan is 31%).

Table 3-15 Rates of the staff who get the Doctoral degree in Schools of science fields

School	Number of staff	Faculty member who has Ph. D	
		Number	Ratio (%)
School of Information Technology	51	13	25.5
School of Mathematics and Computers	55	24	43.6
School of Physics and Electronics	73	25	34.2
School of Biology and Biotechnology	63	30	47.6
School of Chemistry and Chemical Engineering	52	25	48.1
School of Geography and Geology	70	25	35.7

The rate of the faculty members that have a doctoral degree in the schools of science field is shown in Table 3-15. In the event that the departments are related with the science and engineering fields in Japanese Universities, the staff earns a doctoral degree before becoming the full-time staff. The number of the staff with a doctoral degree in National University of Mongolia is lower than that of Japanese universities.

Table 3-16 shows the number of students per a faculty member in the higher education institutes. A faculty member has supervised 26.2 students. This value is higher than Japan (11.7(and the average of the OECD countries is 15.7. It suggests a severe lack of the faculty members in National University of Mongolia.

Table 3-16 Number of students per faculty member

Name of country	Number of student / Number of faculty member
Australia	14.4
France	15.6
German	11.5
Italy	18.4
Japan	11.5
Average of OECD countries	15.7
National University of Mongolia	26.2
Mongolia University of Science and Technology	29.7

Source: "International index of education indicators" 2012, MEXT Report

Student structure

Table 3-17 shows the number of students in the schools of science field in National Mongolia University. The total number of students studying science subjects is 5,606, which is 28.8% of the whole number of National Mongolia University. The largest school is the School of Geography and Geology, and the smallest schools is the School of Information Technology.

Table 3-17 Number of students in Schools of science fields

School	Number of students		
	Bachelor program	Master program	Doctoral program
School of Information Technology	990	21	7
School of Mathematics and Computers	1,004	45	4
School of Physics and Electronics	821	103	38
School of Biology and Biotechnology	789	156	106
School of Chemistry and Chemical Engineering	772	95	35
School of Geography and Geology	1,230	183	55
Total in National University of Mongolia	19,461	3,222	-

Employment rate for the students

The state of employment situation opportunities for the students who graduated from the engineering programs is unclear as these programs are relatively newer programs in the National University of Mongolia. Some programs have not yet produced graduates. Therefore, Table 3-18 shows the employment situation of only schools that offer the engineering programs. The employment rate of the School of Chemistry and Chemical technology is 70 – 80%. Typical employment places are the public and private companies related with the mining industries. The employment of the School of Physics and Electronics is 50%, which is relatively lower than that of the School of the Chemistry and Chemical Technology. However, the employment rate of the student who graduated from the renewable energy program offered under the School of Physics and Electronics is 100%. The places of employment include companies that have developed renewable energy technologies.

In addition, the rate of employment is compared between the National University of Mongolia and the Mongolia University of Science and Technology. The employment rate of the Mongolia University of Science and Technology is higher than that of the schools of science fields in the National University of Mongolia. The employment rate for the student in Mongolia University of Science and technology are 95 to 100%. It is considered that the present industrial sectors highly require the students who study the engineering such as mining engineering, mechanical engineering, electric engineering and Information technology. Students at the Schools of science fields in National University of Mongolia are specifically different from engineers. The difference of specialization between the engineering and the science explains the different employment rates.

Table 3-18 Rate of employment for the students which graduated from the schools offering the Engineering program

	Employment rate	Typical employment place
School of Chemistry & Chemical Engineering	70 - 80 %	Public and Private mining company
School of Physic of Physic and Electronics	50 %	Mining company etc.
School of Biology and Biotechnology	-	Hospital, pharmaceutical company etc.

International collaboration

As for the international cooperation in the National University of Mongolia, there is no international cooperation program including the academic degree. However, various international cooperation programs have been conducted. Table 3-19 shows the number of project implemented in last 7 years. The number of project on International cooperation is

quite a lot in comparison with other projects, such as contractual project with the industrial sectors and the National University of Mongolia's independent project. The international cooperation with Japanese University has been started by the personal linkage among the faculty members. Some projects have developed to the department-to-department. Typical international collaboration research are the research on the development of the advanced nano-technology and the development on the photovoltaic generation technologies. However, most of international collaboration projects are funded by the foreign counterpart universities, a few projects are funded by the government of Mongolia and the National University of Mongolia.

As for the future planning on the international cooperation project, the development of teaching and research abilities for young faculty members and researchers are rather important issues. National University of Mongolia has a policy to promote the international cooperation programs for improving the quality of education program and research activity.

Table 3-19 Number of projects in last 7 years

Project type	2005	2006	2007	2008	2009	2010	2011
Government funded project	58	68	89	96	64	66	63
Contractual work	4	9	24	31	74	76	52
NUM	3	6	2	3	7	7	3
International	93	67	79	60	66	68	88

Industrial-University Collaboration

The National University of Mongolia is a research-oriented university. Most research implemented in National University of Mongolia are not only from engineering fields, but also scientific research. It is hard to make a collaboration research between university and industry due to the difference of research field. Therefore, most of the research budget depends on the governmental budget for the research and innovation. However, the amount of national budget for research and innovation is very limited with the GDP of Mongolia.

In the past, there are a few projects for the industrial-university collaboration. To improve this situation, National University of Mongolia has shifted from the pure scientific research to the scientific research in combination with an applied science, and the industrial-university collaboration has been promoted. The establishment of Technical Transfer Office is one of the actions for promoting the Industrial-University collaboration. Technical Transfer Office is

established under the control of vice president for research and innovation. In the future, the industrial-university collaboration has managed in an integrated fashion by Technical Transfer Office. Technical Transfer Office has only 2 staffs, which are the specialist of the intellectual property and the marketing.

3.3.2 Mongolian University of Science and Technology

Outline

Originally established in 1969 as the Mongolia University of Science's Polytechnic Institute, the Mongolian University of Science and Technology is the nation's only university dedicated to science and engineering, and the only higher education institution specializing in scientific, technological and engineering fields. The main campus is in Ulan Bator, with other campuses located in Darkhan, Erdenet, Uburkhangai and Sükhbaatar.

The Mongolian University of Science and Technology develops educational programs in collaboration with the business sector in order to respond to the needs of a changing society, and carries our lively exchanges with domestic and overseas universities and research institutions aimed at raising the educational and academic level of Mongolia to international standards.
The Mongolian University of Science and Technology is composed of 18 schools, 42 research centers operated by the various Schools, and a further six research centers under the direct jurisdiction of the university.

Around 37,000 students currently attend the university, and education, research and the operation of the university is conducted by a teaching staff with 1,200 members, which includes 150 professors.

Education system

The Mongolian University of Science and Technology provides bachelor degree courses and postgraduate courses (master's and doctoral degrees) and occupational training programs.) In order to enter the university candidates need to have graduated from an upper secondary educational institution, vocational training school or special vocational school, while candidates for the master's and doctoral courses have to have obtained a bachelor and master's degrees respectively.

Table 3-20 shows the degree composition of the Mongolian University of Science and

Technology. The period of study for the undergraduate courses last for 4.5 years or nine semesters, and 130 credits are required for graduation. The period of study for the master's and doctoral courses are 1.5 years or three semesters and 30 credits, and from four to six semesters and 60 credits. Each study year is composed of two semesters, each of which last for 17.5 weeks. The semesters consist of 16 weeks study and one week of examinations.

Table 3-20 Degree composition of the Mongolian University of Science and Technology

	Period of study	Credits
Undergraduate courses (134 major fields)	4.5 years or nine semesters	130
Master's courses (134 major fields)	1.5 years or three semesters	30
Doctoral courses (78 major fields)	4 to 6semesters	60

The Mongolian Ministry of Education, Culture and Science, which formulates the educational programs and curricula responding to each academic degree, specifies the educational fields in each course.

The curricula are devised so that students are able to make a cross-cutting selection from all available fields, thus enabling them to devote themselves to wide-ranging and interdisciplinary research. Moreover, in only the undergraduate courses two programs, fulltime programs and in-service training programs, the latter of which are aimed at people in work, are offered.

The fulltime program is for students who have completed a course of upper secondary education and passed the entrance examination, while the in-service training program is aimed at working people who passed the entrance examination. Nearly all of the teaching for the in-service training programs takes place in the evening. There are no differences between the entrance requirements for the fulltime and in-service training programs. The undergraduate program provides over 3,500 programs in 134 major fields across 18 schools.

Master's courses are provided across all 18 schools, with over 100 major fields; doctoral courses are available only in a restricted number of schools, and around 70 major fields are catered for, administered by the Office of Graduate Studies.

The students graduating from the Mongolian University of Science and Technology are able to acquire the degrees indicated below in Table 3-21.

Table 3-21 Degrees and Major Fields Offered by the Mongolian University of Science and Technology

Doctoral Degree (1)	Master's Degree (8)	Bachelor Degree (8)
Doctor of Philosophy	Master of Arts, Master of Science, Master of Engineering, Master of Computer Science, Master of Public Administration, Master of Business Administration, Master of Industrial Management, Master of Information Technology	Bachelor of Arts, Bachelor of Science, Bachelor of Engineering, Bachelor of Computer Science, Bachelor of Public Administration, Bachelor of Business Administration, Bachelor of Industrial Management, Bachelor of Information Technology

Composition of personnel

The occupational ranks of the Mongolian University of Science and Technology are grouped into the following, in descending order: Professor, Associate Professor, Senior Lecturer, Lecturer, and Assistant Lecturer. The table below shows the composition of the Mongolian University of Science and Technology's teaching staff.

Table 3-22 Composition of the Mongolian University of Science and Technology's teaching staff

Assistant Lecture	Lectures	Senior lectures	Associate Professors	Professor	TVEC & Lyceum	Total
138	336	314	126	157	202	1273

Table 3.15 shows the number of personnel in each school and the rate of their acquisition (percentage) of doctoral degrees. While the rate varies since the size of the personnel in each school is different, it is around 40% compared to the total across the 12 schools, a comparatively low rate when measured against the rate of doctoral degree acquisition among the teaching staff of universities in developed nations. There is also an age group bias in the teaching staff holding doctoral degrees, the majority of whom are over the age of 50, and the remainder of which are comparatively younger people under around 35 years of age. The teachers aged over 50 acquired their degrees at universities in the former Soviet Union, and those acquiring degrees after the collapse of the Soviet Union did do at universities in Russia, Germany, America, Japan, South Korea, China and elsewhere. On the other hand, those in their 30s and 40s who have acquired a doctoral degree are extremely small in number. This is because the teaching staff who acquired their master's degrees after the collapse of the former Soviet Union was attracted to working in the comparatively higher-paid private sector due to livelihood and economic factors.

Table 3-23 Number of teaching staff in each school and the rate of their acquisition (%) of doctoral degrees

Schools	Number of teaching staff	Acquisition Rate (%)
Civil Engineering and Architecture	174	40
Geology and Petroleum Engineering	90	53
Computer Science and Management School	105	27
Mathematics	100	35
Material's science	55	52
Mechanical Engineering	76	33
Information and Communication Technology	90	33
Mining Engineering	61	38
Industrial Technology and Design	80	39
Food Engineering and Biotechnology	46	61
Power Engineering	86	50

One issue the university faces is the fact that there is not adequate number of teachers to cope with the burgeoning amount of students, which will be further discussed later. Table 3-16 shows the number of students per teacher at OECD countries. Referring to the Table, it indicates that the average of the students/teacher for the OECD countries is 15.7, the student/teacher ratio at the Mongolian University of Science and Technology is 29.7, clearly indicating an severe lack of teachers at the university and showing that this is a serious issue for science and technology in Mongolia's higher education.

Student composition

As mentioned above, the Mongolian University of Science and Technology provides an undergraduate program, postgraduate program and in-service training program. In 1992-1993 there were 3,083 students at the university and in 2011-2012 there were 37,776 students, an increase of roughly twelve times over the space of around 20 years.

Because the Ministry of Education, Culture and Science decides upon the university's student quota according to the research it conducts each year into personnel requirements, the quotas for each school fluctuate from year to year. However, as can be seen in table 3-25, the need for personnel in the fields of science and technology are rising dramatically throughout Mongolia.

The table below shows the number of students in each program at the Mongolian University of

Science and Technology as of March 2012.

Table 3-24 Changes in the number of students by year

Year	Number of students
1992-1993	3,083
1995-1996	5,091
2000-2001	15,156
2005-2006	21,572
2009-2010	26,312
2010-2011	36,331
2011-2012	37,766

Table 3-25 Number of students (March 2013)

Schools	Bachelor	Master	Doctor	Lyceum	Vocational Training	Total
Civil Engineering and Architecture	3389	234	89			3712
Geology and Petroleum Engineering	1781	227	68			2076
Technology School in Darkhan	3302	107	8			3417
Computer Science and Management School	2363	504	109			2976
Mathematics	460	26	25	179		690
Material's science	791	55	48			894
Mechanical Engineering	2039	91	69		581	2760
Information and Communication Technology	2265	239	73			2577
Social Technology	491	36	24			551
Mining Engineering	2881	597	111			3589
Industrial Technology and Design	2313	105	71	105	125	2719
Food Engineering and Biotechnology	1384	120	45			1549
Language Education	543	27	28	253		851
Power Engineering	2508	252	15			2775
International Higher Education Research Center		27	13			40
Technology School in Erdenet	927				138	1065
Technology School in Uvurkhangai	455				1487	1942
Technology School in Sukhbaataar	192				593	785
College of Polytechnics in Ulaanbaatar					1833	1833
College of Polytechnics in Darkhan					632	632

Training and Vocational Education Center in Bor-Undur					333	333
Total	28084	2647	796	557	5682	37766

Student employment rate

The Mongolian University of Science and Technology has established an employment support center in its head offices, each school conducts research into potential places of employment through individual studies of the personnel needs of business sectors, and a support system to help students find work has been created. In addition, personnel managers from companies are invited to meetings about graduation and master's theses, and full support is offered to students by providing, for example, opportunities for the students to present themselves in front of corporate personnel managers.

Currently between 95% and 100% of the students in the various schools have been able to find employment, and between 85% and 87% of these students are working in sectors related to the fields they studied at the university.

The outstanding students in each school become employed in the mineral resources-related companies that are presently forming the backbone of the Mongolian economy. This is mainly because the mineral resource companies are currently enjoying good results and are therefore able to offer better employment packages than companies in other sectors. There are reports that this is making it difficult for companies in sectors other than mineral resources to recruit outstanding students.

Table 3-26 Student employment rate by school

Schools	employment rate (%)	Types of employment
Civil Engineering and Architecture	100	Construction, Mineral resource-related
Geology and Petroleum Engineering	97	Mineral resource-related
Computer Science and Management School	95	Internet, Telecommunication, Software development
Mathematics	100	Internet, Power plant, Light industry
Material's science	96	Mineral resource-related, Steel, Light industry
Mechanical Engineering	100	Mineral resource-related, Construction, Railway
Information and Communication Technology	100	Telecommunication, Railway, Airline etc.

Mining Engineering	100	Mineral resource-related
Industrial Technology and Design	97	Light industry （Textile , Outfitting, etc.）
Food Engineering and Biotechnology	95	Food-related, Light industry
Power Engineering	97	Power, Energy-related

Research and technical development

The Mongolian University of Science and Technology implements research with an emphasis on technical development suited to the social needs of the nation. In order to achieve this objective they enter into collaborations with industry, and pursue industry-academia cooperation that encourages mutually beneficial research activities.

In the course of their work within the university the researchers at the Mongolian University of Science and Technology participate in government projects and joint research with private sector companies, and promote industry-academia cooperation projects. The teaching staff and researchers at the Mongolian University of Science and Technology account for around 60% of the team members in these projects.

The Mongolian University of Science and Technology maintains around 40 research centers and six research laboratories, with 96 professors leading approximately 150 frontier research efforts (as of 2009). In the year 2010 an incubation center was established in order to make the ‘seeds’ of the technologies developed at the university commercially viable, and an environment for industry-academia cooperation is being put in place.

One example of industry-academia cooperation identified in our research is the efforts by the School of Information and Communication Technology to develop high-speed communications technologies with a Mongolian telecoms company; however, no such efforts were identified in any of the other schools.

International exchange

The international projects of the Mongolian University of Science and Technology feature many initiatives aimed at realizing the objective of bringing the level of education and research at the university up to international standards. The Mongolian University of Science and Technology’s internationalization process consists of the following measures.

- Bilateral cooperation agreements with other nations
- Participation in international university networks

- Participation in international education and research programs and projects
- Academic exchange on student and departmental level
- International exchange on school, research lab, department and individual level
- 2+2 dual degree program

As programs for its teaching staff and researchers, the Mongolian University of Science and Technology promotes programs for participation in meetings, seminar and symposiums held by international academic associations, partner universities and other academic institutions, short-term overseas programs for teaching staff and joint research; as international programs for its students the university promotes twinning programs with collaborating universities, exchange stay programs, summer training programs and internship programs.

The following table is a list of the international educational programs planned and implemented by the Mongolian University of Science and Technology. Currently, all the international educational programs are twinning programs, and are planned and implemented in both the bachelor degree courses and postgraduate courses. In the case of the bachelor courses the initial two or two and a half years are spent studying at the Mongolian University of Science and Technology, with the subsequent one and a half or two years being spent at one of the partner universities. The lectures at the Mongolian University of Science and Technology are mainly conducted by teaching staff that have acquired their degrees at a partner university or another university in that country, and the tuition is carried out in the language of that country, although Mongolian is used for the explanation of specialist terms. Under the programs the degrees are acquired from the partner university, but it is planned that in the future the program will result in the awarding of double degrees from both the overseas university and the Mongolian University of Science and Technology itself.

Table 3-27 International educational programs planned and implemented by the Mongolian University of Science and Technology

Schools		International educational programs
Civil Engineering and Architecture	Postgraduate	Some National University at Korea, 2+2
Geology and Petroleum Engineering	Bachelor	University of Alaska, Fairbanks (USA), 2+3
Computer Science and Management School		--
Mathematics		--
Material's science	Bachelor Bachelor	Inner Mongolian University of Science and Technology (China), 2+2

		South Dakota School of Mines and Technology (USA), 2+2
Mechanical Engineering		--
Information and Communication Technology	Postgraduate Bachelor	University of Pavia (Italy), 1+1 Moscow State University (Russia)、2+2
Mining Engineering	Bachelor Bachelor Bachelor	The University of Arizona (USA), 2+2 University of Alaska, Fairbanks (USA), 2+3 Shandong University of Science and Technology (China), 1.5+2.5
Industrial Technology and Design	Postgraduate	National Taiwan University (Taiwan), 1+1
Food Engineering and Biotechnology		--
Power Engineering	Bachelor	North China Electric Power University (China), 2+2

As of November 2012 no international educational programs are being implemented between the Mongolian University of Science and Technology and any Japanese universities. However, joint research, short-term training and exchange stay programs are underway on an individual teaching staff and departmental level. The university's School of Geology and Petroleum Engineering has accepted the establishment of the Nagoya University Field Research Center on its premises, where joint research into geological fields is currently underway. Akita University also has a Mongolian office on its campus, where it is preparing an environment for distance learning, research meetings and other academic exchanges in the future. The schools of Mechanical Engineering and Civil Engineering and Architecture are conducting joint research that will contribute to improving Mongolia's regional infrastructure with Ashikaga Institute of Technology, and Miyakonojo National College of Technology has for over ten years been conducting joint research with the university into monitoring the environment in Mongolia. The School of Mining Engineering has implemented an exchange stay student program with Kyushu University, in which students from both universities stayed in each other's country as interns. In the field of information and telecommunication too, the university participated in the School on Internet Project operated and managed by Keio University, and carried out distance learning. Several of the schools accept specialists sent to them under JICA's expert dispatch project.

The Mongolian University of Science and Technology hopes to enthusiastically develop and implement international educational programs. It seriously regards international educational programs as effective methods with which to improve the quality of both education and research at their university. In particular, it feels that at this moment in time it is imperative that international programs aimed at the teaching staff and researchers are enriched and improved. The university believes that by enhancing the skills of its teaching staff and researchers the

quality of the university will be improved, that by providing better education it will be possible to nurture higher quality students, and that through fostering human resources the needs of Mongolian business will be responded to and a contribution to the development of society will be enabled. In terms of international programs aimed at teaching staff and researchers, there were ardent requests for joint research, with calls for joint research in fields that would be of mutual benefit to both organizations – specifically research areas covering Mongolia's rich natural environment such as those related to mining engineering, geology and biodiversity – and in fields contributing to Mongolia's infrastructure.

There were also calls for support for the promotion of programs aimed at students. There is a strong urge to study overseas among students in Mongolia, and while the Mongolian University of Science and Technology is designing and conducting twinning programs that take into account the financial burden of students, in the future they hope to implement double degree programs that will be accompanied by degrees.

3.4 Common Issues for the National University of Mongolia and Mongolia University of Science and Technology

The following items are common issues for National University of Mongolia and Mongolia University of Science and Technology

- Ensuring of the faculty members with higher education and research ability
- Maintenance of the facilities for education and research
- Development of the curriculum with practical education

Ensuring of the faculty members with higher education and research ability

As for the present structure of faculty members in National University of Mongolia and Mongolia University of Science and Technology, the rate of the faculty member who got doctoral degree is almost 40% of the total faculty member. According to the statistic information for the Higher education Institutes in Mongolia, the rate of the staff with a doctoral degree is 24% of total higher education institutes in Mongolia

It can be said that both universities have a good number of staff with doctoral degrees in comparison to other higher education institutes in Mongolia. However, 100% of all staff in the department of engineering fields in Japanese Universities has doctoral degree; therefore, the rate of the staff with a doctoral degree in both universities is still low in comparison with Japanese

Universities. Looking at the staff with a doctoral degree by age group, it was found that staff over 50s and before early 30s have a doctoral degree. There are a few staff with doctoral degrees in age group 30s and 40s. Most of the faculty members with a doctoral degree over 50s earned their doctoral degree from the universities in Russia. After the collapse of the Soviet Union, the staffs earn a degree from the universities of Germany, Korea, USA, Japan and so on.

Some of the staff who earned their degree from the overseas universities after the collapse of the Soviet Union moved to the public and the private companies after returning to Mongolia. This trend is due to the difference of working conditions. It is said that the working condition of the private and the public companies is relatively better than that of the university. Therefore, some staffs move from the universities to the companies. In particular, this trend can be seen among the staff in their 30s and 40s.

The government of Mongolia has a policy to raise the number of faculty members in the higher education institutes in Mongolia. However, it cannot catch up the increase of the student in National University Mongolia and Mongolia University of Science and technology. In case of Mongolia University of Science and Technology, the number of student per faculty member is 29 students, which is quite higher in comparison with the situation of OECD countries. It indicates the lack of the faculty members in Mongolian University of Science and Technology.
Faculty members of Mongolia University of Science and Technology are excessively occupied by the education work. They cannot preserve enough time to conduct their own research. As a consequence, the faculty members can hardly conduct the international collaboration research and the industrial-University collaboration work due to the lack of the knowledge about advanced technologies.

In addition, it is difficult for the university to employ new faculty members who have excellent education and research skills. The government of Mongolia supports the students who would like to enter the graduate school by providing the scholarship. Although the government of Mongolia supports the students by providing the scholarship, the students take their job due to their economic situation.

Maintenance of the facilities for education and research

It is hard to say that the current conditions of the facilities for the education and research are enough to conduct advanced research. Some of the equipment can support the student to study the basic engineering subjects, because most of the facilities introduced in National University of Mongolia and Mongolia University of Science and Technology are old. In addition, the increase in the number of equipment is behind the increase in students. The following table shows the sample of the equipment list installed at the School of Geology and Petroleum Engineering. As shown in Table 3-28, most of the equipment were made in Russia and China and installed in the 1960s and 1970s. The situation is seen at most of the schools in National University of Mongolia and Mongolia University of Science and Technology.

Deteriorating facilities makes it difficult to conduct world-class advanced research. To conduct advanced academic research and research that meets the needs of industries, a well equipped research environment is necessary. In addition, deteriorating facilities may result in the loss of trained specialists, since faculty members who get advanced technical knowledge from the overseas universities cannot continue their research at the home university due to the difference in research environment. The lack of equipment prevents the student from practical training. The education program in the universities thus mainly consists of the classroom lecture. Graduates from these universities then have to undergo a practical training at each place of employment and TVET. Therefore, this situation results in the loss of the expense and the time.

According to the results of the field survey at the Mongolia University of Science and Technology, the School of Information and Communication Technology has advanced equipment, which was introduced by the international projects of German, Korea, China and the collaboration research with the national communication companies.

At present, the state budget for the innovation and research is quite limited, and it is hard to install the advanced equipment into universities. Therefore, the universities have to get the fund to maintain the education and research environment by promoting the international collaboration projects and the industrial-university collaboration project.

Table 3-28 Sample of Equipment list installed at Mongolia University of Science and Technology

	Item	Year	country of manufacture
1	Microscope MIN-8	1972	Russia
2	Microscope MIN-8	1967	Russia
3	ISA Table	1972	Russia
4	Fedorv Table	1972	Russia
5	Fedorov Table CD-1	1972	Russia
6	Microscope MIH-8	1972	Russia
7	Computer	2002	China
8	Polarization microscope	2008	Japan
9	Ore microscope	1985	Russia

(Source: School of Geology and Petroleum Engineering)

Development of practical education system

A large part of the practical education system development can be done through the measures of quality and quantity improvement of the university teachers and facility and equipment development. But the issues to be added are introduction of excellent international engineering education methods and international collaborative education programs.

As for the international engineering education methods, Mongolian University of Science and Technology is considering to introduce CDIO, and discussing about the dual education system betting assistance of GIZ. In this regards, it is also worth considered to technology transfer of Japanese engineering education system featuring “Monozukuri” (Hands-on procreation) education and “Koza system” (organized continuous research and education system) with close linkage to industries.

For international collaborative education, there are some cases of double degree and twinning programs, but the recent trend of rapid development of international education in the world is one of the challenges for Mongolia.

Chapter 4 Mongolian TVET

4.1 History

The origins and development of the technical and vocational education in Mongolia have a close relation to the stage of the industrial prosperity of the country (Bat-Erdene, 2012). It was after the revolution in 1921 that technical and vocational education started in Mongolia, and before it, as a state, industrialization did not start and no needs to train workers (Tseepil, 2000). Receiving the support from the Soviet Union as 2nd socialist countries in the world after independence from the Qing Dynasty, Mongolia had accelerated its modernization. After the conclusion of World War II, to pursue her industrial development, collectivization of stock farming and the spread of agricultural, planning economy were implemented. In education fields, high education rate and the literacy education to workers were attained. In addition, the general education for workers was raised, and talented people with expertise were trained. In 1984, Technical and Vocational Education and Training (TVET) regulatory authority was established under the influence of the Department of Education.

However, the perestroika of the Soviet Union spread over Eastern countries from the second half of the 1980s, a democracy movement increases, and Mongolia also greets the end of socialism and one-party dictatorship politics. For training of the talented people corresponding to the market economy, educational reform was performed and it has been advanced mainly gaining the support from the Asian Development Bank (ADB) in 1996 and afterwards. Mongolia, started the public education from the 1920s, has experienced the political drastic change in about 90 years with socialist construction, the abandonment and shift to the subsequent market economy, and establishment of a democratic state. We can say that occupation technical education has also been subject to big influence to the change of such a political system.

As for the history of Mongolian technical and vocational education, we can see it at table 4-1.

Table4-1 Chronological table of Mongolian technical and vocational education

(After independence from the Qing Dynasty to date)

Year	Mongolian modern history	Date	History of Mongolian occupation technical education
1911	The Xinhai Revolution	Before 1921	Before industrialization Establishment of national elementary school (1921) and secondary school (1923) Dispatch first students to Moscow(1921)
1915	Kyakhta Conference		
1921	Outer Mongolian Revolution		
1924	Mongolian People's Republic	1920-1930s	Technical vocational education by apprentice at small enterprise Establishment of professional school for commerce, agriculture and stock raising, medical care, communication, and art 10-year plans for national education development (1926-1936) Expansion of mainstream schools and professional schools
1939	Battle of khalkhyn Gol		
1945	Yalta agreement/ the end of the Second World War	1940-1950s	The first 5-year plans (1948-1952) Establishment of professional school for Industry/Railway (1951) Emergence of new economic front and enterprises: implementation of short term technical vocational education by the demand of professional workers The second 5-year plans (1953-1957) Implementation of elementary education as compulsory: introduction of the class of "work" and beginning of technical education at secondary level
1946	Recognition of Mongolian independence by the Chinese Nationalist Party		
1952	Sino-Mongolian Agreement on Economic and Cultural Cooperation		
1958	Institutionalization of Kolkhoz		
1961	U.N. participation	1950-1960s	The third 5-year plans (1961-1965) Implementation of lower secondary education as compulsory Strengthen the tie between school and life environmental studies Emergence of large enterprises and rapid economic growth in major economic sectors: implementation of intensive vocational education with equipments and instructors within industrial facilities
1962	COMECON participation		
1965	Agreement on economic and cultural cooperation between Mongolian and Soviet		
1966	Mongolian Soviet Treaty of Friendship		

1972	Establishment of diplomatic relations with Japan	1964-1990	With rapid development of agriculture and stock raising, and industries, comprehensive vocational technical education system consisting of theory and practice has been established. Establishment of supervisory authority of TVET (1984)
1977	5 billion yen grant from Japan		
1986	Beginning of Open Door Policy		
1991	Transition from one-party regime to multiparty democracy	1990-2000	Human resource development educational reform project master plan (1994-1998) Reorganization of education audit committee, and establishment of national education council Education Act (1995) Education sector reform (1997-2005)
1992	Change the country name as Mongolia		
	Promulgation of new constitution		
1996	The birth of Democratic League Administration		
2000	One-party administration by People's Revolutionary Party	2000-2011	Reform of Education Act (2003) Vocational Education Act
2004	The birth of grand coalition administration		
2008	Grand coalition administration between majority PRV and Democratic Party		
2012	Coalition government by DP initiative	2012	Transfer of TVET authority from MECS to MOL

Prepared by survey team

As a result of the Diet member general election in June, 2012, the coalition government centering on the Democratic Party was born, and TVET was transferred to the Ministry of Labor from the Ministry of Education by the ministries-and-government-offices reorganization of new government announced in August. Before change of jurisdiction, it was MECS that exercised jurisdiction over formal TVET with more than two years schooling whereas MOL had jurisdiction over non-formal TVET with short term schooling (from two weeks to 45 days). Considering the creation of employment as an important problem, the new government affiliated TVET under MOL, and newly established an employment support center and Institute for Labor Studies.

According to the Minister of Labor, past employment policy was not implemented based on sufficient data investigation. The policy shall interlock with market needs based on performing data firmly from now on[5]. Specifically, 150,000 people's employment shall create focusing on a railroad-related field from 2012 to 2016. It is supposed that the government will lead by the

[5] The words of Ya. Sanjmyatav at "Toward value creation" 222 at the Governmental office on December 11, 2012.

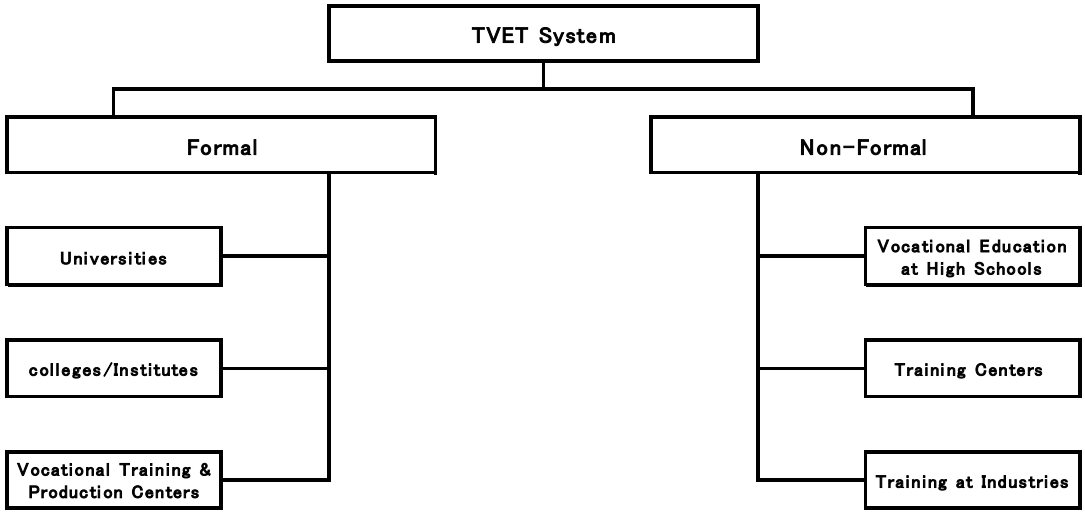
steady employment policy so that employment in the country is increased, sufficient salary shall be paid and national income will increase, preventing the spill of job seeking young people to overseas.

On the change of jurisdiction, A-TVET (office for TVET) which MECS had was abolished, and the MECS personnel who were taking charge of TVET were also transferred in part at MOL. It is the bureau of TVET at MOL that works out the index whose synthetic ability rating in private enterprises becomes possible based on market needs, and the concrete measure about TVET will be implemented under MOL. However, it is fair to say that the judgment about the policy effect accompanying supervisor ministries-and-government-offices change is premature.

4.2 The outline of TVET

The system of Mongolian TVET consists of various types of both formal and non-formal TVET. If we make it as a figure, it can be seen as follows.

Figure 4-1 : Mongolian TVET system



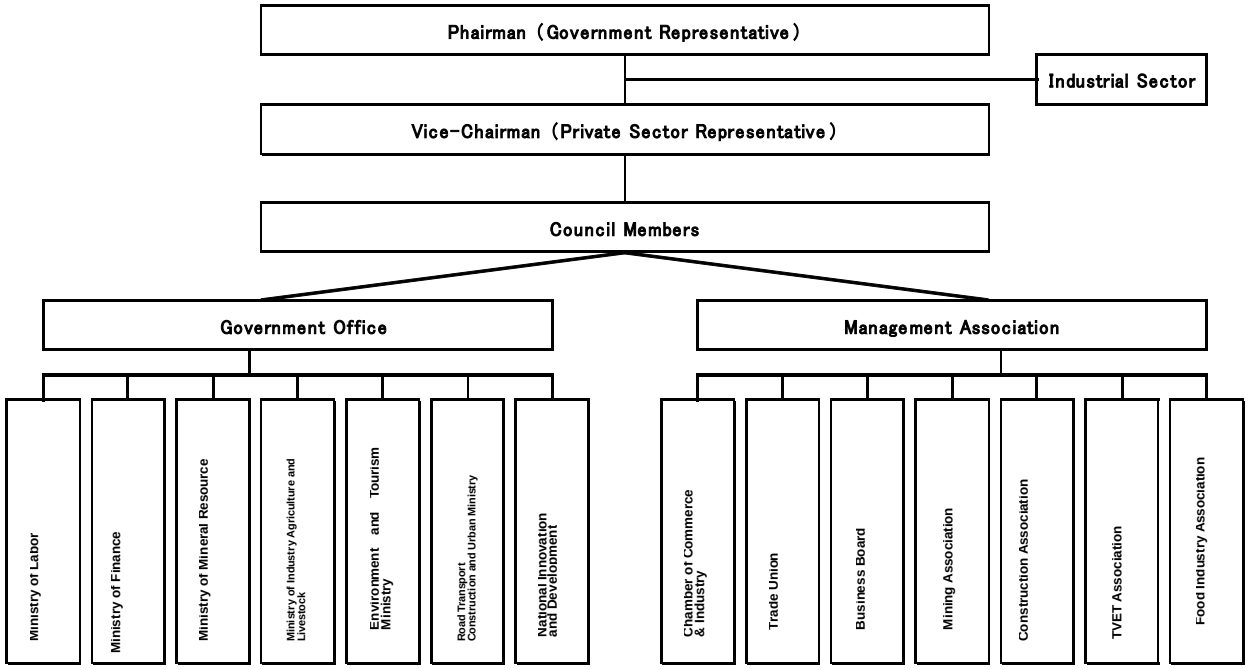
Source: MECS

Formal TVET programs are provided at Vocational Training & Production Centers (VTPC), Colleges/Institutes, and Universities. While VTPC and Colleges/Institutes require the completion of 9 years schooling of applicants, the high school graduate or that of 12 years schooling are requested for entry. Non-Formal TVET programs offer mainly short term vocational technical education for about 3 months. Training centers operated by such as NGO

provide various types of vocational technical education to the jobless, and they offer certificate of vocational skills. Training at the industry is On-the-Job Training (OJT), and it is used for capacity building of newcomer and employees.[6]

Although the organizations which offer formal TVET programs are under the supervision of MOL, based on the Law of Mongolia on Professional Education and Training (TVET Law) in 2009, the National Council for Vocational Education and Training (NCVET) was established as the highest decision-making body.

Figure 4-2 : NCVET organizational chart



Source: MOL

The Mongolian government attaches a high value to the employment policy and thinks that cooperation participation of private enterprises is indispensable to educational development of TVET. Although the past TVET was centered on school education and the curriculum was fitted for it, the government thinks that new TVET should shift to company oriented, inviting companies for management, preparing curriculum for what they wish, and handling budget flexibly.

[6] As far as OJT, most TVET schools visited by research team have contract of OJT programs with companies, the partnerships between TVET and companies are ongoing well in this point.

4.2.1 TVET program and curriculum

In TVET, approximately 140 special vocational technical education courses are offered, and there are 4 types of formal TVET organizations as seen in figure 4-1: Vocational Training and Production Center (VTPC) founded in each prefecture, college, institute, and university attached vocational school. In general, these TVET institutions offer three kinds of courses: vocational education (VE) for those who completed lower secondary education, technical education (TE) for those who completed vocational education or upper secondary education including working people, and vocational training (VT) for ordinary adults. After the completion of the coursework, they offer certificate: VE for secondary education certificate with some professional skills, TE for diploma, and VT for training certificate.

Table 4-2 Type of formal TVET institutions

No.	Type	Number	Public/Private		%
			Public	Private	
1	VTPC	43	29	14	58%
2	College	9	5	4	12%
3	Institute	7	2	5	9%
4	University	15	14	1	20%
	Total	74	49	24	100%

Source: MOL

There are 74 TVET schools across the country. Compared with foreign countries, Mongolia has many TVET schools in proportion as habitancy. Another aspect of Mongolian TVET is that many TVET schools are distributed to local region. 1,000 or more organizations operate TVET in non-formal way.[7] In order to offer various programs by TVET, educational organization needs the approval from regulatory authority (MOL), and need to fill all the demands such as annual number of students, an enforcement period of a program, and training fields.

[7] For example, 56 TVET exist in Cambodia which has the population of 15 millions. Malaysia, ten times bigger population than Mongolia has 38 TVET as well as about 140 Mala activity centers around the country in which basic skill trainings are highly concerned for catching the employment needs of local industry.

Table 4-3 Training programs at TVET

	2 years vocational education program	2.5 years vocational education program	3 years vocational education program
1st year・2nd year	General education with vocational angle	General education with vocational angle	General education with vocational angle
3rd year		Vocational education theory & practice	Vocational education theory & practice
		Working practice at some schools	General education & working practice at some schools

（Bat-Erdene, 2012）

Table 4-4 Type of TVET and obtainable certificate

No.	Type	Period	Provider	Obtainable certificate
1	Vocational Education	2.5 years	VTPC/Colleges/ Institutes	Secondary Education Certificate
2	Training of Professional Workers	1 to 2 years	VTPC/Colleges/ Institutes	Vocational Certificate
3	Training of Technicians and Technologists	1.5 to 3 years	VTPC/Colleges/ Institutes	Vocational Diploma
4	Skills and Competency Training	1 to 2 months	Short term training provider VTPC/Colleges/ Institutes	Competency Certificate
5	Apprenticeship Training	3 months	Companies	Certificate

(Bat-Erdene, 2012)

Based on the national curriculum, approved by NCVET, the curriculum of TVET is created by each TVET in accordance with industry and academic levels. Currently, two and a half years vocational educational program is determined the total school hours as less than 3,600 hours. Among them, 1,100 hours are allocated to general education and 2,500 hours to vocational education.

4.2.2 Students

For the curriculum of vocational technical education, 30% is allotted to a lesson in theory or the classroom based knowledge, and the remaining 70% is allotted to practical skill training at school and internship at a company. About the new student to TVET, it is increasing continuously, and the total student enrollment has attained 3 times as much growth in 2000 and afterwards. However, in Mongolia, the number of students going to university is more than 3.5 times of that of students going to TVET. This shows that the inversion phenomenon in the educational pyramid has taken place in Mongolia.[8] Moreover, about 60 percent of the student who learns at TVET is learning at local region other than Ulan Bator. If we see the new student in the 2011 to 12 fiscal year, 57% of TVET new entrants complete nine-year basic education before entry: for the rest, 21% is a high school (upper secondary education) graduate, 13% is jobless people, 6% is working people, and others have 3%. As the new students to TVET increase, graduates are also on the increase. In terms of employment rate, average TVET has more than a 60% placement rate.[9]

The Mongolian government is supplying monthly amount 45,000 Tugrik per student to those who learn at TVET beginning in the 2006 fiscal year. The purpose of this support is that it shows the policy of a country over unemployment and poverty reduction by providing a subsidy, and getting people to have the interest and concern about the problems. However, the policy of allotting about 45% of TVET budgets to the subsidy provision to the students has received indication that sufficient budget for institution maintenance or the purchase of training equipment is not allotted.[10]

[8] Whereas the number of students who go on to TVET is 48,138 that of university is 172,798: more than three point five times bigger than that of TVET. In terms of the number of institution, university is 101 and TVET is 71 as of 2011.

[9] Current government aims to reach the employment up to 100%. Continuation of the Scholarship for TVET enrollees, encouraging companies to involve the TVET operation, and flexibility of budget use are some of government policies.

[10] According to a World Bank report in 2010, the budget allocated to facilities improvement and the purchase of experiment equipment was below 1% MOL would like to increase the subsidy to students and acquire more enrollees.

Table 4-5 The school condition and the work situation of young adult segment (15 to 24 years old)

Age-group	Only in employment	Only in education	Both Activities	Only unemployed	Inactive	Total
15-17	8.2	77.5	7.9	1.0	5.4	100.0
18-19	22.5	52.2	4.1	6.9	14.4	100.0
20-24	46.6	24.4	1.8	9.7	17.5	100.0
15-24	27.7	49.3	4.5	6.0	12.5	100.0

Source: UCW2009

Table 4-6 TVET enrolled students and graduates (2009-2012)

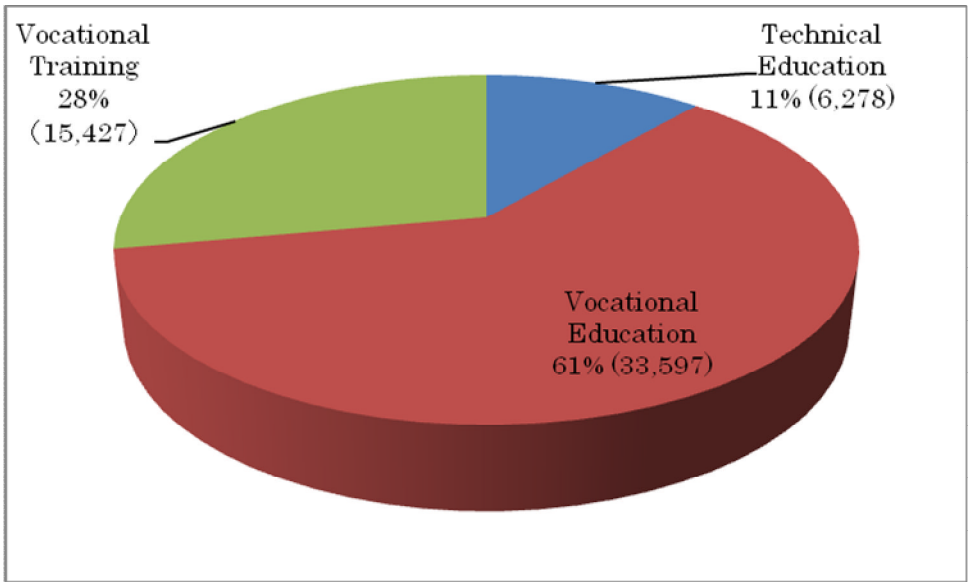
	School year		
	2009-2010	2010-2011	2011-2012
Total students (female)	44,682 (21,011)	46,071 (20,491)	48,134 (21,694)
Ulaanbaatar	17,962	18,976	18,762
Local region	26,719	27,095	29,414
New entrants（female）	19,754 (9,135)	19,358 (8,047)	19,417 (8,213)
Graduates 9th grade	13,952	13,186	11,116
Graduates 11th grade	3,426	2,865	4,094
Graduates from TVET	14,834	18,705	22,080
Graduates employed（%）	7,684 (51.8%)	10,418 (55.7%)	Na

Source: MECS

The number of students and ratio according to TVET courses are as in Figure 4-3, and 60 percent or more of the student is studying at vocational education program. For those who finished the program is awarded an upper secondary education diploma or secondary education certificate with some professional skill certificate, and it makes it possible for graduates to go on to a university.[11]

[11] Those who go on to university obtaining secondary education certificate at TVET seem to be around 10 % from this survey. There is less educational corroboration between TVET and University. Only few TVET graduates affiliated to UMST go on to the university.

Figure 4-3: TVET students according to the program (2011-2012)



Source: MECS

Table 4-6 shows TVET students according to the area and the major field. It divides the students of 2011-2012 between non-graduating year students and graduating year students, and shows their study fields according to the region. Overall, for non-graduating year students, the fields with the highest number of enrolled students include catering and bread making, electrical engineer, followed by construction. On the other hand, for graduating year students, the fields with the highest number of enrolled students include construction, catering and bread making, followed by electrical engineer. The number of graduation year students who learn electrical engineering is outstandingly high in Ulaanbaatar. In Hanggai and central region, many students learn construction, and sewing in the West and mining machine repair in the East were common study fields.

Table 4-7 TVET students field of study according to the region (2011-2012)

No	Professions	Eastern		Western		Central		Khangai		Ulaanbaatar		Total	
		Students enrolled	Graduating students	Students enrolled	Graduating students	Students enrolled	Graduating students	Students enrolled	Graduating students	Students enrolled	Graduating students	Students enrolled	Graduating students
1	Sewer and tailor	129	70	451	270	162	119	473	251	324	141	1539	851
2	Repairman of machine, deiver	89	56	200	82	448	198	502	102	511	89	1750	527
3	Carpenter	82	54	223	118	187	78	256	98	335	89	1083	437
4	Electrician	81	26	135	70	404	195	249	110	809	2005	1678	2406
5	Plumber	94	79	331	116	345	125	254	165	814	343	1838	828
6	Repairman of heavy machinery					123	123			282	282	405	405
7	Welder	174	81	288	164	445	242	105	73	151	151	1598	711
8	Chief			112	77	177	94			120	120	839	291
9	Catering and bakery	201	61	448	242	532	224	345	150	389	389	2679	1066
10	Constructional occupation	195	56	354	248	775	297	868	460	165	165	2729	1226
11	Hairdesigner	92	45	165	53	243	168	288	97	88	88	964	451
12	Commercial Officer	86	32	147	59							233	91
13	Construction plaster	238	130	373	230	710	305	207	103	238	238	2360	1006
14	livestock production farmer	105	23	127	60			281	192	60	60	617	335
15	Concrete, bricklayer	30	20	163	90	202	94			101	101	679	305
16	Repairman of mining equipment	163	97			213	115	30	30			406	242
	Total	1759	830	3517	1879	4966	2377	3858	1831	4261	4261	21,397	11,178

Marked according to magnitude of numbers 1 2 3

Source: MOL

In response to the Government request every year, TVET follows the capacity adjustment of the offering courses. The number of students taken by each course is varied in every fiscal year. Thus, the table 4-6 shows what kind of field has needs from the market in which area.

A policy report of World Bank (2010) tells of which sector employment has grown based on living standard index investigation (LSMS). Highlighting the promotion of employment in construction and in transport and communication, followed by in mining, especially attracting the employment of 25 to 34 years old, the trend is regarded to be continued from the demand of mineral resources and its investment, and it is concluded that the labor market has strong possibility to accept employment of youth population, and the demand for engineering vocational skills is large.

Table 4-8 Distribution of Wage Employees by Sector, 1998 and 2007

Industry	1998(%)	2007(%)	1998-07 Change（%）
25-34 Age Group	(n=383)	(n=2,579)	
Agriculture	4.18	1.86	-55.5
Mining	0.78	6.01	670.5
Manufacturing	4.69	9.93	111.7
Utilities	3.39	3.44	1.5
Construction	2.08	9.74	368.3
Trade	9.89	11.02	11.4
Transport/Communication	6.77	14.19	109.6
Public Administration	25.52	9.55	-62.6
Services	42.56	34.25	-19.5
35-55 Age Group	(n=700)	(n=4,780)	
Agriculture	6.43	3.28	-49.0
Mining	1.28	5.06	295.3
Manufacturing	4.70	9.50	102.1
Utilities	3.85	5.84	51.7
Construction	3.56	8.37	135.1
Trade	5.13	7.85	53.0
Transport/Communication	7.26	10.66	46.8
Public Administration	22.36	10.91	-51.2
Services	45.29	38.52	-14.9

p.8 Mongolia Policy Note June 2010

4.2.3 Teaching Staff

With the increase in the new students to TVET, the number of school staffs is also increasing. About 60 percent of school staffs including administrative personnel or a janitor are women. For 3,735 persons, there are 2,347 female school staff of the number of school staffs of TVET in the 2011 fiscal year (about 62%). The number of full time teachers is 2,093 or about 56% of all the administrative and teaching staff, of which 1,330 are female staff (about 63%).

Table 4-9 TVET Teaching Staff

Year	2008	2009	2010	2011
Teaching Staff (Female)	2,740 (1,694)	3,371 (2,071)	3,598 (2,253)	3,735 (2,347)
Full-time teaching Staff (Female)	1,667 (1,057)	2,033 (1,256)	2,143 (1,331)	2,093 (1,330)

Source: MECS

Table 4-10 TVET Administration and Teaching Staff (2011-2012)

Position	Number	%
Full-time Teaching Staff	2,093	56%
Director/Vice Director	106	3%
Head of academic affair	54	1%
Administrative staff	177	5%
Support staff	1,212	35%
Total	3,735	100%

Source: MECS

As far as teaching staff's educational background is concerned, 60 % of teachers have a university degree and 29% of teachers have a master degree or more. 11% of teachers are diploma holders. Most of TVET teachers are relatively young teachers who had education during the transition period from socialism to capitalism. 70 % of teachers are aged 40 or below. The rest of 30 % TVET teachers received education in the socialist time.

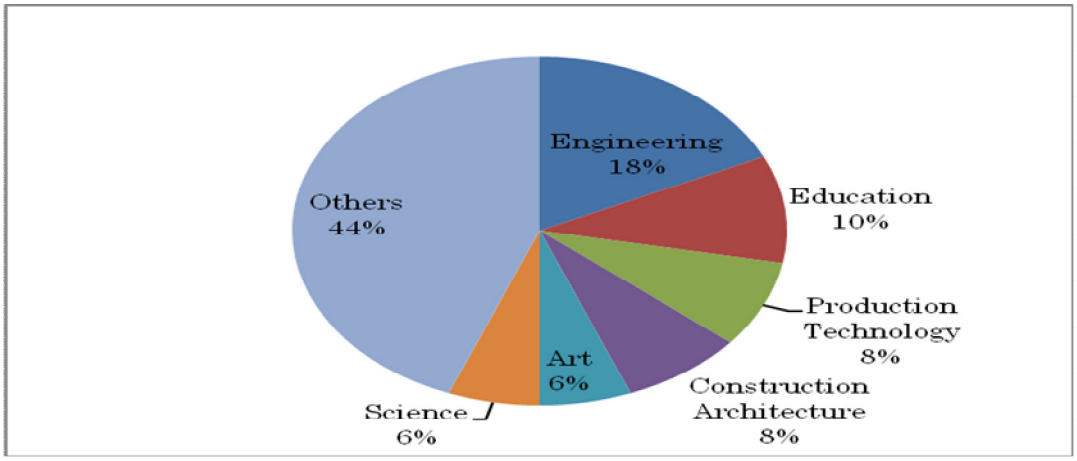
As for years of experience, since there are many young teachers, 62% of teachers have less than 10 years of experience, and 10% have 11 to 15 years, and 28% of teachers have more than 15 years of teaching experience at TVET. Currently, 1,365 of teachers which account for 65 percent of the total are teaching the vocational technical field, and 728 teachers, the remaining 35% are teaching the general education subject based on the curriculum of Mongolian's upper secondary education (high school). The composition TVET teachers with a university degree is that Engineering (18%) is the most, followed by Education (10%), Production Technology (8%), Construction and Architecture (8%), Art (6%), and others (44%).

Table 4-11 TVET Teaching Staff Basic Data

Educational Background	Degree	Numbers	Percentage （%）
	Bachelor (BA)	1248	60%
	Master (MA)	593	28%
	Ph.D.	17	1%
	Diploma	235	11%
Age	Age Group	Numbers	Percentage （%）
	Under 30	872	42%
	31 to 40	567	27%
	41 to 50	352	17%
	51 to 60	262	12%
	Over 61	40	2%
Year of Experience	Period	Numbers	Percentage （%）
	Under 5 years	869	41%
	6 to 10 years	443	21%
	11 to 15 years	202	10%
	16 to 20 years	162	8%
	21 to 25 years	142	7%
	Over 26 years	275	13%

Source: MECS

Figure 4-4 : TVET Teaching staff's field of study (university degree holders)



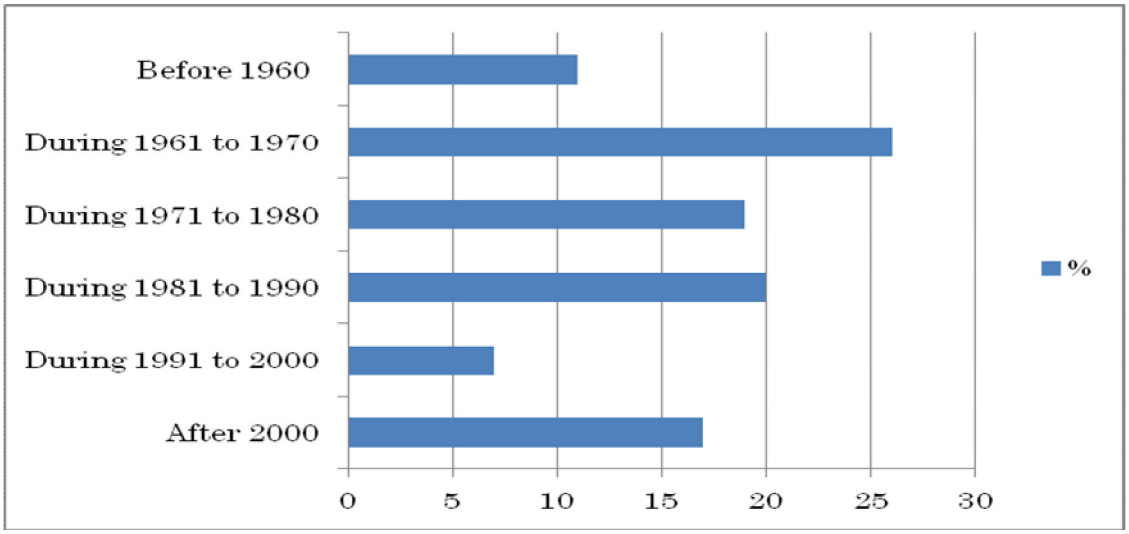
Source: MECS

It is often said that many TVET teachers in Mongolia lack knowledge new technology and business oriented instruction method, and continuous training opportunity to teachers is not fully given. As a result, they do not have the technical educational know-how which raises the talented people corresponding to the market needs. In order to raise industrial human resources with technology, it can be said that TVET teacher's capacity building should be made first.

4.2.4 Facility and Equipment

As for TVET facilities and equipment, in 2011-2012, there were 834 buildings in an area of 166,570.7 square meters where 33,466 students received vocational technical education. 76 percent of TVET buildings were built before 1990, and the buildings which constructed during 1960s share a quarter. Those buildings are getting old. TVET has 1,033 classrooms, 217 laboratories, 70 libraries, 68 PC rooms, 45 gymnasiums, and 27 boiler rooms in total.

Figure 4-5：Construction age of TVET buildings



Source: MECS

In terms of the environment of the usage of PC, TVET has 3,566 PCs (50 PCs par school): 2,556 PCs or 71.7% have the CPU of Intel Pentium 4 or above and 511 PCs or 13.3% have an Intel Pentium 3 processor. 2,603 PCs or 73% are connected with internet and 2,273PCs or 63% are connected with internal access. 56 dormitories which can accommodate 9,780 people have 5,859 people live on them.

Table 4-12: TVET equipment and assets

Equipment & Assets	Total	Average par school
Printer	77	1.08
Scanner	310	4.37
TV	397	5.59
Copy Machine	247	3.48
Video Camera	81	1.14
Over Head Projector	116	1.63
Projector	253	3.56
Black Board/White Board	1,481	20.86
Student Desk	19,569	275.62
Student Chair	29,315	412.89
Land (Hectare)	709.6	9.99
Livestock	5,387	75.87

Source: MECS

In order to tackle facilities upgrading which needs for corresponding to the increasing number of students and the human resources development for enterprises, the expansion of TVET facilities and the introduction of new equipment are the matters should be committed as early as possible. International donors and NGOs, such as Millennium Challenge Corporation (MCC), and Oyu Tolgoi inc., boost up investing large amounts of money to upgrade school facilities. TVET schools with support in physical infrastructure from major donors are as follows:

Table 4-13 TVET schools supported by major donors in hardware

No	Name of TVET Institution	MCC	OT
1	Arkhangai	✔	✔
2	Bayan-Olgii	✔	✔
3	Bayankhongor		✔
4	Bulgan		✔
5	Gobi-Altai	✔	✔
6	Dornogobi		
7	Dornod		✔
8	Laddered training (Dornod)	✔	✔
9	Dudgobi	✔	

10	Zavkhan	✔	✔
11	Omnogobi	✔	
12	Selenge	✔	✔
13	Shaamar (Selenge)		✔
14	TOV	✔	
15	Zaamar (Tov)		✔
16	Khovsgol		
17	Khentii		✔
18	Orkhon	✔	
19	Darkhan-Uul	✔	
20	Darkhan-Urguu (Darkhan-Uul)		✔
21	Nalaikh (UB)	✔	
22	Gobi-Sumber	✔	
23	Zuunkharaa (Selenge)		✔
24	School of Production & Art (UB)		✔
25	Railway (UB)		
26	Erdene (Tov)		✔
27	Sant (Selenge)		
28	Plant & Agriculture (Bulgan)		✔
No	Name of TVET Institution	MCC	OT
1	Donbosko (UB)		
2	Abuka (UB)		
3	Bulgan (Arkhangai)		
4	Ulziit (Bayan-khongor)		
5	Anima (UB)		
6	Amidrakh ukhaan (UB)		
7	Khamag Mongol (UB)		
8	USI Tech		
9	Baz school (UB)		
10	INI (UB)		
11	Railway (Dornogovi)		
12	Altan Gorkhi (UB)		
No	Name of TVET Institution	MCC	OT
1	Music & Dance College (UB)		
2	Music & Dance College (Zavkhan)		

3	Mongolian-Korean Technical College (UB)	✔	✔
	Mongolian-Korean Technical College (Bayanchandmani-Tov)		
4	Ulaangom College (Uvs)	✔	✔
5	Khogjil College (Khovd)	✔	
No	Name of TVET Institution	MCC	OT
1	Food Technology College (UB)	✔	✔
2	Mongol Famer College (UB)		
3	Khangai College (UB)		
4	Construction College (UB)	✔	✔
5	Technical & Technology College (UB)		
No	Name of TVET Institution	MCC	OT
1	University of Culture & Art (UB)		
No	Name of TVET Institution	MCC	OT
1	Shine irgenshil Institute (UB)		
2	Mongol Business Institute (UB)		
3	Monos Institute (UB)		
4	Enerel Institute (UB)		
No	Name of TVET Institution	MCC	OT
1	College of Technology (MUST), Ovorkhangai		✔
2	School of Technology (MUST),Sukhbaatar		✔
3	College of Technology (MUST), Orkhon		
4	Mechanic & Engineering School, MUST	✔	
5	Production Technology & Design School, MUST		
6	UB Technology College, MUST	✔	✔
7	School of Technology MUST (Darkhan-Uul)	✔	✔
8	Bor-Undur VTPC		✔
9	Institute of Plant & Agriculture, MSUA (Darkhan-Uul)		
10	College of MSUA (Orkhon)		
11	School of Commerce, National University of Mongolia		
No	Name of TVET Institution	MCC	OT
1	Ikh Zasag University (UB)		

- Note: VTPC stands for Vocational Training and Production Center
- VTIC-Vocational Training and Industrial Center
- Surveyed by study team

Source: MOL

4.3 TVET support by donors

In addition to the cooperation in hard side, soft side assistance such as curriculum development and offering a teacher capacity building training is provided actively. The major projects implemented or to be implemented by donors are as follows:

The USA Millennium Challenge Corporation (MCC)

It is the largest supporting organization in Mongolian TVET field, and 47 million-U.S. dollar investment is carried out from 2008 to 2013. In addition to the donation of facility and equipment to TVET, shown on table 4-11, preparation of a National Vocational Qualification Framework and offering a teacher capacity building training are ongoing projects.

The Swiss Agency for Development Cooperation (SADC)

A bilateral TVET program (it is an about 5 million-euro project at the periods from 2012 to 15) between Switzerland and west-Mongolia is being carried out. Practical training focusing on raising the capability to obtain an income from traditional pasturage is performed, and capacity development of TVET of seven west areas is performed through curriculum development and teacher training.

The German International Cooperation (GIZ)

Selecting three TVET (Mining Polytechnic College in Choir, Polytechnic College in Ulaanbaatar, and Polytechnic College in Darkhan) as a pilot school for TVET support in mineral resource sector, the project of total amount of 5 million Euros is implemented from November 2012 to October 2015.

CARITAS, Czech Republic

Eight projects, each for a duration of six months, were implemented at eight TVET schools in 2011. The new agricultural curriculum developed by MCA has been utilized, offering teacher's training and educational manual. Moreover, educational training has been offered in area training Development Center (Regional Methodology Centre) in Darkhan.

The Mongolian National Chamber of Commerce (MNCCI)

Technical trainings at a training center installed by industry in each field are implemented. However, none of the trainings follow the national standard. Support for teacher training of a private agricultural college is also carried out.

Oyu Tolgoi

The company which is the largest mining company of copper and gold in Mongolia invests 30 million U.S. dollars in TVET, and offers the extension of VTPC, provision of equipment and technology, and 3,300 persons' educational support in 19 vocational fields.

Singapore

Singapore Polytechnic gave training to 56 teachers in design fields in 2010, and it made module development based on the capability to be beneficial for future curriculum development and improvement.

India

Installing 8 vocational courses (automobile maintenance, radio/TV repair, plumber, electric technician, machine technician, computer programming, gem, and printing) at Rajiv Gandhi Production and Art College[12] after 1995, 200 to 300 students attend the course annually. In addition, 150 Mongolian students have scholarship to study at Indian technical professional school every year. APTECH, an Indian IT company runs a training center for more than 10 years in Ulaanbaatar, and conducts capacity development in computer software.

Korea International Cooperation Agency (KOICA)

Capacity development at Mongolian Korean College is in practice. In order to train multi technical experts to Interior Design, ICT, Industrial Facilities, Electronic Engineering, Automobile Maintenance, and Fashion Design, 5 Million US dollars are invested for the project from 2011 to 2015. The project includes the construction of a practical room, a class room, an administration office, a multipurpose room, the purchase of study equipment, dispatch of the expert of school administration, management of 6 workshops, and training invitation for administrators and teachers.

Japan (JICA) and others

Supports from Japan in educational field in Mongolia have been mainly in elementary education: “elementary school education facilities improvement plan” and "grass roots and

[12] Currently, JICA senior volunteer teaches the course of hair design.

human security grants-in-aid" have been implemented. Assistance for TVET area has been mainly in the dispatch of the Japan Overseas Cooperation Volunteers and Senior Volunteers, and in training activities.

While the education in TVET is carried out focusing on skill education, attentions have gathered in Japanese technical college which has raised the engineer supporting the production site in substantial Japan as a leader, performing early engineer education at the same time. An organization, calls “Mongol ni Nihon shiki Kosen wo tsukuru kai” or establishing Japanese style technical college in Mongolia was launched. In the original plan on 2010, it was intended to open the college in 2013, dispatching 4 to 5 teachers from both Tokyo Metropolitan College of Industrial Technology and Sasebo National College of Technology for guidance, and those two schools accept Mongolian teachers for studying the teaching methods and contents systematically. The initial costs for the project are to be borne by a grant from the Sasagawa Peace Foundation.

Asian Development Bank (ADB)

Specializing in three fields about 10 to 15 job types of construction, agriculture, and food processing which is called for especially in labor market for the purpose of job creation for TVET graduates, ADB supports TVET, which has these three fields’ course programs. A concrete support plan is that clarification of the TVET development indicator, upgrading the facilities and equipment for both formal and non-formal TVET, improvement of the skill of management staff and teachers, pre-vocational training at secondary school and special school for disabled children, capacity building for project management. The budget scale shall be 25 million US dollars. The pre-vocational training is a new support area which other donors have not made a start.

While the support for Mongolian TVET by donors becomes active, the donor meeting for the information exchange and support adjustment was held in June 2012. OT utilizes the meeting positively for avoiding the support duplication among donors, and it actively works for setting up the organization, which aims at support cooperation between donors.

Table 4-14 Major Implemented Support Projects for TVET

No.	Projects	Main Focus
1	Asian Development Bank (ADB) HER (TVET) Sector Review and Master Plan (1993-1994)	Conducted TVET sector study and set objectives for reforming TVET in transition to a market economy
2	European Training Foundation created the network of National Observatories (1997-2003)	Established national observatory for TVET, set data collection and reporting
3	GIZ support to VET (2000-2002)	Specific training
4	GIZ Competence Centers (SME 1998-2007), wood 2000, construction 1999, printing 2000, wool 2003	Created several competence centres and provided specific training
5	UNEVOC activity since 1997	International conferences and workshops
6	ADB/NDF Social Security Sector Development Program 2002-2007	Conducting sector assessment
7	ADB/JFPR Non-formal skills training for unemployed Youth and adults (2006-2009)	Competency-based, module-based curriculum and training in some sectors, partnering with employers
8	ADB: Third Education Development Program (2005-2010)	Rehabilitation of 6 TVET schools and provision of equipment for practical training workshops in those 6 schools

(Bat-Erdene, 2012)

Table 4-15 Current Major Support Projects for TVET

No.	Projects	Main Focus
1	MCC funded TVET project with US$47.6 million budget (2008-2013)	Vocational education based on market needs Identification of industry requested technology Development of 30 new pre-vocational courses Development of teacher training
2	Oyu Tolgoi LLC Vocational education project: US$ 30 million	Expansion of VTPC, Provision of facilities and technology 3,300 human resources development in 19 vocational fields
3	KOICA project: US$ 5 million	Facilities expansion of Mongolia-Korea Technical College
4	Singapore Polytechnic International Project: US$ 2 million	54 Teacher trainings 60 adult education

(Bat-Erdene, 2012)

4.4 Surveyed TVET schools

A visit-cum-survey for TVET schools was carried out, targeting major technical education organizations in upper secondary education or higher education levels which offer two to three years course for human resources development of technicians. In terms of selection, 5 TVET schools which the survey team proposed in advance, and another 5 TVET schools added after the suggestion from JICA and MOL were selected. The reason for selection made into the visiting place and the surveyed TVET schools are as follows.

(1) Polytechnic College of MUST in Ulaanbaatar:
an affiliated school of MUST, and located at Ulaanbaatar

(2) Mongolian and Korean College:
a college supported by Korea, and it serves as a useful reference for Japan

(3) Institute of Engineering and Technology:
architectural technology is a priority sub-areas, and it has contact with Japan

(4) Food and Technological College:
food technology is a priority sub-areas, and it has contact with Japan

(5) Rajiv Gandhi Production and Art College:
a TVET which receives supports from India and JICA

(6) Polytechnic College of MUST in Darkhan:
a TVET which belongs to MUST and located in the 2nd largest city, Darkhan

(7) Darkhan Urguu Polytechnic College:
a designated TVET school for teacher's training and located in the 2nd largest city, Darkhan

(8) Darkhan-Uul aimag's Vocational Education and Training Center:
a TVET located in the 2nd largest city, Darkhan

(9) TOV Vocational Training Production Center:
a local standard TVET, recommended by MOL from a standpoint of comparison

(10) Erdene Vocational Training Production Center:
a local TVET, recommended by MOL from a standpoint of comparison

（**Polytechnic College of MUST in Ulaanbaatar**）

	Item	Outline
1	Name	Polytechnic College of MUST in Ulaanbaatar
2	Director	Batmyagmar Tserendorj
3	Address	Enkhtaivan avenue, Bayangol district, Ulaanbaatar
	URL	http://www.cc.edu.mn
4	Foundation	1954
5	Students	1833
6	Teachers	71
7	Staff	46
8	Program	TE/VE/VT
9	Graduates	565
10	Remarks	A polytechnic college under MUST（AC：Y）

Known as Construction College, the school is derived from the name of Taleikhan. O, a famous Mongolian architect. Focusing on construction-related programs, it has programs, such as piping, electricity, and welding. It aims at training of the workers of an international level, and international exchange activities are also prosperous. Obtaining the first international accreditation (Asia Pacific Accreditation and Certificate Centre: headquarters Philippines) as a Mongolian TVET in 2009, the diploma has been recognized among 29 countries in the Asia-Pacific region. It is also eager for a teacher's capacity development, and all the teachers and staff members were participated in some training last year.

Receiving 1 million dollars support from MCC in the last three years, the school has introduced new equipment including the inauguration of electric library, and opened new courses, such as turner, and heating and cooling.

The employment rate is 80% or more, and twenty percent of students enter a school of higher grade (mainly go to a private university). Although it became an attached school of MUST in 2010, there is no cooperation in particular with the university: faculty education (BA) was offered before the attachment).

Courses	Main fields	Duration	Requirement
Vocational Education Training (VE)	Construction/Architecture Electronics technician	2.5 years	Completion of 9th grade
Technical Educational Training (TE)	Construction/Road building Electronics technician	1.5 years	VE/ Completion of 11th grade
Adults course for National specialists (VT)	Construction/Electric technician Plaster	1 year	Completion of 9th grade/ over 24 years

International Exchanges

Name of institution	Country	Execution year/month
Kyungmin College	Korea	October 2002
Construction University of Hot hot	China	May 2004
Construction College of Irkutsk	Russia	August 2004
Vocational lyceum No.18	Russia	May 2006
Vocational lyceum No.15	Russia	May 2008
Asia Pacific Accreditation and Certificate Centre	Philippines	January 2008
Warsaw University of Technology	Poland	2009
Changwon College	Korea	2009

(Main entrance)

（Book machine） making their own text books

（**Mongolian and Korean College**）

	Item	Outline
1	Name	Mongolian and Korean College
2	Director	D. Munkhbaatar
3	Address	Chinggis Avenue-3, Khan-Uul District, Ulaanbaatar
	URL	www.mstk.gov.mn
4	Foundation	1966
5	Students	2300
6	Teachers	136
7	Staff	N/A
8	Program	TE/VE/VT
9	Graduates	859（2011）
10	Remarks	Korean supports the school since 2001　(AC：Y)

Established as Light Industry Vocational school in 1966, it has nurtured human resources for light industry. Aside from spinning related programs, textile machine repair, quality control, and recently heavy industry related vocations, such as heavy industrial machine operation and mining repair are offered. A light industry related course also received a support from Japan. Since 2001, a Korean volunteer teacher has worked for the school.

South Korea has also offered 5 million US dollars in support for extension of the institution for an interior design, ICT, industrial facilities, electronics, automobile maintenance, and the multi-skill engineer training in a fashion design and the project for equipment introduction and a teacher's improvement in capacity building. Students' employment rate is about 80 percent. Companies request the school to hold training. For example, a theoretical course is offered for cashmere maker employees at the school, and a practical course is offered at the maker's factory during summer.

Courses	Main fields	Duration	Requirement
Vocational Education Training	Spinning/Spinning machine repair/Car	2.5 years	Completion of 9th grade
Technical Educational training	Spinning/Computer Programming	1.5 years for VE 3 years for others	VE/ Completion of 11th grade
Adults training course	Heavy machine operation/Car repair	1 year	Completion of 9th grade

（Institute of Engineering and Technology）

	Item	Outline
1	Name	Institute of Engineering and Technology
2	Director	B. Ganbat
3	Address	Peace Avenue 90, 10th Khoroolol, Bayan Gol District Ulaanbaatar
	URL	http://www.iet.mn
4	Foundation	1984
5	Students	2342
6	Teachers	103
7	Staff	57
8	Program	(BA)/TE/VE/VT
9	Graduates	638
10	Remarks	Private TVET awarded COE at school environment (AC：Y)

Founded as the 5th Secondary School of Construction Technicians in 1984, the school cultivates human resources in the fields of construction related, such as construction, road building, electrician, and automobile repair. After being promoted to College-rank in 2001, the school was privatized in 2006, and operated by current managers who have strongly connections with the construction industry. In 2012, it becomes an institution. The government subsidizes each student by 50 million MNT. Due to the quota system by Government, 60 students enrolled to automobile repair course and the program has attracted more applicants this year. It also receives MCC support in facilities and equipment. It has 80% employment rate, and only the specialist of road building other than MUST. The school has MOU with Holmesglen Institute in Australia, for school management and teacher training.

Courses	Main fields	Duration	Requirement
Vocational Education Training	Construction/Road building/Electrician/Auto	2.5 years	Completion of 9th grade
Technical educational training	Construction/Plumbing/ Food related	1.5 years for VE 3 years for others	VE/ Completion of 11th grade
Adults training course	Mining machine operation/Welding	1 year	Completion of 9th grade

International Exchanges

Holmesglen Institute	Australia
Komzet Vocational Training Center	Germany
State Construction University of Moscow	Russia
Engineering and Pedagonical College of Ulan-Ude	Russia
Construction School of Taagshan	China

（Food and Technological College）

	Item	Outline
1	Name	Food and Technological College
2	Director	B. Baramsai
3	Address	Khan Uul District, Chinggis Avenue 6, Ulaanbaatar
	URL	http://www.foodtech.edu.mn
4	Foundation	1965
5	Students	3200
6	Teachers	120
7	Staff	n/a
8	Program	（MA）(BA）TE/VE/VT
9	Graduates	964
10	Remarks	Private TVET　focusing on food related (AC：Y)

Founded in 1965 as a professional training school, it was privatized in 2000, and become present name. Emphasizing the training of specialists in the food fields, such as catering, bread making, and cookery, a large number of the workers and engineers including in the field of milk dairy processing, meat processing, and hotel restaurant service at bachelor level, is produced. It is only this school that cultivates food-related workers systematically, and it has confidence that education at the bachelor level is equivalent to a MUST in food biotechnology. It has a farm in Sükhbaatar prefecture and conducts livestock management, cultivation of vegetables, a sale of dairy products, and so on.

Although the school receives financial support from the government, some company laboratories are used for practical training since the inspection machines for food hygiene and safety control are scarce. The school dispatches teachers to some companies in a positive manner, and two South Korean teachers teach computer programming and cooking, and one Filipino teaches English. As a support from MCA this year, it receives experiment material. The

employment rate is about 70%, and 20 to 30 % of the graduates advance to universities (mainly private). The employment rate of the graduate is supposed to be 100%.

Vocational Courses
Alcohol and Beverage Industry, Bakery and Product Industry, Computer Design, Construction, Cookery, Environment, Machine repair, Welding, Hotel and Restaurant service, Meat processing, and Pasta Product Processing and Milling

Diploma Education Courses
Catering Technology, Food Processing Technology, mechanics, Refrigeration

Bachelor Degree
Catering Service Technology, Computer Programming, Food and Factory Machinery Management, Food Processing Mechanical Engineer, Food Processing Technology and Hygiene, and Hotel Restaurant Management

Master Degree
Food Processing Technology

（Rajiv Gandhi Production and Art College）

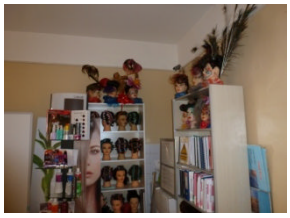
	Item	Outline
1	Name	Rajiv Gandhi Production and Art College
2	Director	J. Yura
3	Address	P.O-317 University Street, Sukhbaatar district, Ulaanbaatar
	URL	http://www.past.edu.mn
4	Foundation	1960
5	Students	1552
6	Teachers	80
7	Staff	n/a
8	Program	TE/VE/VT
9	Graduates	813
10	Remarks	TVET supported by India (AC：Y)

Founded as School of Productivity and Cooperative in 1960, it has various major fields which other TVET institutions do not offer, such as travel, accounting, fashion design, gardening, beauty, hair designer, folk song, painting, sculpture, and interior design. 8 classes including automobile repair, radio/TV repair, plumbing, electrical technician, machine maintenance, computer programming, gem curving, and printing have been supported by India since 1995. It has the support of senior JICA volunteer who works as a teacher of hair design. With

coordination between the school and University of Culture & Art (UCA), graduates of some courses can advance to the second year of UCA.

Courses	Main fields	Duration	Requirement
Vocational Education Training	Automobile repair/Electrician/ Computer programming/ Art/Interior design/printing	1 to 2 years	Completion of 9th grade
Technical educational training		2 years	VE/ Completion of 11th grade
Competency training		3 months	Completion of 9th grade

(Main entrance)



(Training material for hair designer)

(class of sculpture)

（Polytechnic College of MUST in Darkhan）

	Item	Outline
1	Name	Polytechnic College of MUST in Darkhan
2	Director	SH. Mungunduulga
3	Address	Darkhan soum, Darkhan-Uul province
	URL	http://www.polytechnic.edu.mn
4	Foundation	1939
5	Students	860
6	Teachers	60
7	Staff	n/a
8	Program	TE/VE/VT
9	Graduates	304
10	Remarks	An affiliated TVET of MUST in Darkhan (AC：Y)

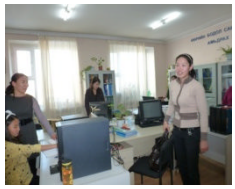
Founded as a factory school that nurtured professional technician first time in Mongolia in 1939, it has trained industrial human resources in Darkhan and around prefectures for more than 70 years. It became an affiliated TVET with MUST in 2010. The school emphasizes the training of

workers who work for a mine and plant related areas, such as a mining machinery engineer and a plumber. Oil-refining processing plants are due to be constructed with the technology of Japan, and cultivation of workers is necessary. OT offers the scholarship for 250 students and the dormitory accommodating 112 persons was also completed with the support of OT. Moreover, GIZ's development project of the total amount of 5 million euros has begun, and this school is subject to see an improvement in operation instruction and curriculum development of heavy industrial machines, method of instruction, and support of training by teacher dispatch over two years. While an academic level of the school is higher in TVET of this area, teacher's capacity development seems to be a big subject. While the employment rate is also higher than an average of a country, there is no demand of winter seasons in construction industry which has much demand in summer. Since MUST in Darkhan is next to a site, it is ideal that 25% of the graduates can advance to the MUST for further study: there is no coordination between the school and UMST.

Courses	Main fields	Duration	Requirement
Vocational Education	Mining machine operator/ Plumber	2.5 years	Completion of 9th grade
Technical education	Safety technician/ Geological technician	1.5 years for VE 3 years for others	VE/ Completion of 11th grade
Professional education for adults	Welder/ Mining machine technician	1 year	Completion of 9th grade

(Main entrance)

(Class room)



(Staff room)

（Darkhan Urguu Polytechnic College）

	Item	Outline
1	Name	Darkhan Urguu Polytechnic College
2	Director	Nurzed Jargal
3	Address	Student street, Darkhan soum 15th bag, Darkhan-Uul aimag
4	Foundation	1977
5	Students	1,120
6	Teachers	60
7	Staff	n/a
8	Program	VE/TE/VE
9	Graduates	733
10	Remarks	Designated TVET in the region for teacher training (AC：N)

Founded as a Construction College in 1977, the school provides construction related human resources in Darkhan and central region. The school became Polytechnic College in 2012. The school designates Intensive Centre of Vocational and Methodology in Central Region, and teachers are gathered from Darkhan and Tov prefecture for training. It offers 1.5 years practice teaching training. The school itself faces lack of teachers who can teach practical subjects, and nurturing and capacity building of teachers should be acted together. Commissioned by OT, the school implements the training for adults, especially for jobless people. As for employment, approximately 55% of graduates have got a job and 20% has advanced to university. The employment rate of technical education is more than 80%: the course is highly committed by a company at practice, and this makes students to find a job easier after the graduation.

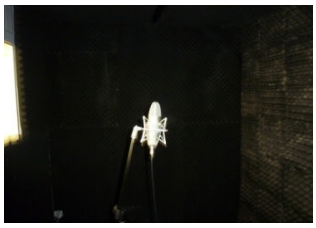
(Major course fields)
Construction, Carpenter, Hair designer, Welding, Plumbing, Heavy machine operation, and Plaster

(School entrance)

(New building supported by OT)

(PC rooms supported by Czech)

(Broadcast room used for teacher training)



(Radio broadcasting room)

（Darkhan-Uul aimag's Vocational Education and Training Center）

	Item	Outline
1	Name	Darkhan-Uul aimag's Vocational Education and Training Center
2	Director	B. Erdene
3	Address	Darkhan-Uul Province, Darkhan soum, V bag
4	Foundation	1984
5	Students	1229
6	Teachers	59
7	Staff	30
8	Program	VE/VT
9	Graduates	523
10	Remarks	A public TVET located in the second city, Darkhan (AC: N)

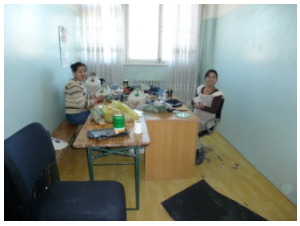
Founded as Construction Technical Professional School No.2 in 1984, the school cultivates human resources in the fields of construction related, and it became present name in 2000. The school establishes three departments, facility management, teaching development, and business management: facility management is in charge of school facility; teaching development strives to improve the educational contents; and business department opens up its business opportunity, offering incubation center to local community. With the support from MCC, four practical rooms (welding, lathe, plumbing, and heating and cooling) are established, and the education in a new curriculum is implemented. From OT, the school received the order of the short-term training by the governmental measure for jobless people. Moreover, about repair of farm machines and implements, the school receives support of the Prague University of Czechoslovakia for training equipment and teaching techniques.

(Main courses)

Construction planning, Hair designing, Cement mold, Carpenter, Electrical technician, Plumbing, Welding, Automobile maintenance, and Cookery.

(School photo)

（Class room）



（a company at incubation center）

（Vocational Training and Production Center）

	Item	Outline
1	Name	TUV VTPC
2	Director	S. Shaariikhuu
3	Address	Tuv Province, Zuunmod city
4	Foundation	1984
5	Students	557
6	Teachers	25
7	Staff	n/a
8	Program	VE/VT
9	Graduates	280
10	Remarks	TVET located in the capital of TOV prefecture (AC: N)

Founded as TVET located in the capital of TUV prefecture, the school offers construction related courses, such as brick layer, interior decorating, carpenter, and welding as well as sewing, hair designer, cookery, accounting, and secretary. The ration of male to female student is 40:60, and most students come from TUV prefecture and around. The employment rate is around 60 %. The school received a support from MCC to build a new building for laboratory teaching and its equipment. The new building is just completed, and the facility is utilized for a class.

(Main Entrance)

(Class Room)

(New Training Building)

（**TUV Vocational Training and Production Center**）

	Item	Outline
1	Name	Erdene VTPC TUV Province
2	Director	Ts. Bataa
3	Address	Erdene, TUV Province
4	Foundation	1955
5	Students	320
6	Teachers	13
7	Staff	n/a
8	Program	VE/VT
9	Graduates	168
10	Remarks	TVET located in a village of TUV prefecture (AC: N)

Founded in 1955 and located in Erdene village, TUV prefecture, the school has nurtured local vocational human resources. Currently, it offers 9 vocational fields of study including welding, sewing, construction, interior decorating, cookery, and automobile repair. The facilities and equipment are old. Unlike other TVET, the school does not receive any support from donors. Nonetheless, it does not seem to be big disadvantage for the school. As the director says, the school is necessary to make a strong effort to teacher's capacity building rather than educational environment.

(School Entrance)

(Construction Class Room)

(Student Dormitory)

4.5 Challenge and prospective for TVET

Considering the current environment of Mongolian TVET, we would like to pick up the following 5 agendas.

1）Strengthening the cooperation with industry

The student enrollment to TVET tends to increase every year. With the growth of Mongolian economy, the demand of vocational education with a focus on construction field is high. However, the employment rate in the whole TVET is about 60 percent. In order to connect the demand with employment, it is necessary to strengthen the cooperation with industry. As a place of re-education for employees, many companies utilize the short term vocational training courses. While MOL promotes practical studies with reorganizing the curriculum and involving companies in the management, it is still early to say if TVET truly works as a practical institute for employment.

As far as the population ratio is concerned, Mongolia has many TVET, comparing with other countries. For functioning continuously as a personnel training organization which suited market needs, corroboration among educational institutions becomes important.

When the survey team visited 10 TVET schools, the importance of career instruction or employment support made the strong impression. For the present curriculum, not enough career education can be carried out. Although we cannot discuss the relation with the high unemployment rate of younger generation here, strengthening the cooperation with industry and developing the students' awareness of "employability" lead to the improvement of employment rate and the steady employment.

2) The improvement of facilities and equipment with nurturing the teachers who can handle the new machines

Among Mongolian 74 TVET, 70 to 80 % of TVET has some supports from MCC, OT, and other international donors, and the improvement of facilities and equipment has been advanced significantly in recent years. While the technical guidance is also promoted along with the improvement of facilities and equipment, the introduction of new equipment cannot produce the effect fully as learning effect due to the lack of skilled teachers and of the curriculum. The problem is that only a teacher can utilized the newly introduced facility and the know-how is not shared among the faculty. It is necessary to establish the method of instruction which utilized the equipment among teachers. Otherwise, competency based curriculum, implemented at TVET would not be fully worked.

As for the TVET teachers, those with five years or less of experience accounts for 40 percent by aged 30 and below. More attention should be paid to working conditions aspects such as a salary and a welfare condition, so that young teachers may involve positively and they can play an active part and work for TVET sustainably.

3) Teacher's capacity development

Although one of the reasons for not being able to fully utilize the new equipment donated by domestic and international donors and private companies is due to the lack of teachers' capacity, we can also see it from the point of implementing vocational educational training which answers the market needs. The issue is common among the countries which experience the transition from socialism to capitalism. While they face the lack of skilled industrial labor and of the training institutions, they introduce foreign direct investment and cultivate private companies for economic development (e.g., Vietnam and Cambodia). In Mongolian TVET, both general education and vocational education are performed, and many teachers are instructing vocational education only in the qualification of general education, and they are insufficient of the experience in actual business. In order to improve this situation, the government is giving the opportunity of company training to the teacher who instructs vocational education, or employing the person experienced in a company as a teacher of TVET. No results can be observed as yet.

4) Cooperation among domestic and international donors

Although the support of domestic and international donors to TVET is active and the reform of facilities and equipment had progressed dramatically in the past few years, sharing the information among the donors is insufficient until now, and an overlap in assistance may occur if the situation continues. In order to improve the situation, there is now discussion to share information among donors. With regards to assistance, it seems that the assistance trend will be shifted from the hardware to soft sides, such as curriculum creation and teaching-methods training for teacher's capacity development. Oyun Tolgoi, a private enterprise that offers the support to TVET energetically promotes this dialogue. According to a proposal from OT, it would like to invite JICA as a key partner like donors who have already recommended support in a TVET field strongly, such as MCC, GIZ, and ADB. Therefore, it is necessary to analyze donor trends.

5) The possibility of Japan's assistance to TVET

The support from Japan in TVET field has been in the technical guidance and grassroots assistance by JICA volunteers. Considering Japan's effective support to TVET from a

viewpoint of industrial human resources development in the higher education of engineering, 1) an assistance which contributes to the improvement of teacher's capacity building and policy planning by administrators (studying abroad to the graduate school in Japan, such as a TVET teacher and an executive official in connection with TVET in the Ministry of Labor); and 2) environment improvement for setting up incubation center which foresees the introduction of entrepreneurship education at TVET, can be considered. As we have seen, the assistance for TVET facilities and equipment is in widespread. The priority will go to soft aspects. A plan for the establishment of incubation center in TVET is shown in attachment 7.

On the other hand, some say that more nurturing industrial workers at TVET leads to more workers who work under foreign engineers. This criticism comes from the idea that more engineers who can take the role of site supervisor should be nurtured in Mongolia which has a smaller population as compared with other countries.

To this extent, the government, especially MECS has also shown strong interest in the Japanese Technical College or Kosen, an institute which offers early education of engineering, connecting high school and university education by practical education. Concerned parties have organized a project team to establish a Japanese Technical College in Mongolia, and a preliminary survey has since been conducted.

Chapter 5 Studying-abroad program in Mongolia

5.1 Studying-abroad Program

a. Student Exchange

If Mongolian universities and colleges are able to conclude academic exchange agreements with foreign universities or institutes, it will open the way for collaborative study and the exchange of researchers and students. If they also manage to absorb fees, researchers and students will not have to pay the school expense. However generally speaking, the absolution of school expenses is limited to a year whereby researchers or students are unable to complete a full degree and thus choose to become research students. If student is exempted from paying school expenses, he or she must pay the living cost because scholarships for research students are few. In this case, students could apply for the scholarship program of each universities, rural international exchange association, NGO and private foundation. Universities from Europe and USA have individual scholarship programs for research students and it thus has a competitive position in international markets. It is also noted that some universities in Mongolia collect “fees” from students when they dispatch student to the partnership universities; this is against the spirit of academic exchange and discourages dispatching of excellent students who cannot afford.

Table 5-1 Mongolian Students Studying Abroad

Year	No. of Students studying abroad	Top 5 Destination Countries
2010	9,798	Rep. of Korea (2,190), Russian Fed. (1,654), U.S.A. (1,247), Japan (1,153), Turkey (939)
2009	9,059	Rep. of Korea (1,621), U.S.A. (1,497), Russian Fed. (1,390), Japan (1,122), Turkey (839)
2008	7,046	U.S.A. (1,309), Korea, Rep. (1,236), Japan (1,073), Germany (866), Turkey (839)
2007	6,427	U.S.A. (1,182), Germany (1,101), Japan (971), Korea, Rep. (903), Turkey (712)
2006	5,649	Germany (1,137), U.S.A. (960), Japan (872), Kazakhstan (607), Korea, Rep. (539)
2005	5,162	Germany (1,458), U.S.A. (803), Japan (766), Kazakhstan (652), Turkey (413)
2004	4,567	Germany (1,400), U.S.A. (711), Japan (689), Kazakhstan (569), Turkey (309)

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b. Long-term exchange program

Long-term exchange program to complete a degree, i.e. 2 years of study, requires the payment of school expense. However if students receive scholarship from the Japanese government, he or she may not need to pay.

Japanese Universities also has a system to waives school fees depending on the academic performance and income of student; however it will cover only regular full-degree student and not research students. In recent years, not all but half of the school expense is waived as a result of the economic downturn and the Tohoku earthquake. Conditions of long-term exchange program are different depending on the country and organization, and details are provided in 5.3.2 and 5.3.3.

c. Researcher exchange and assistance for PhD

Some countries and organization offer the scholarship for the researcher who has the PhD or PhD candidate. Typical scholarships are “Japanese Studies fellowship” by Japan foundation, “JSPS RONPAKU Program” (Dissertation PhD program) and “Invitation Fellowship Program for Research in Japan (Short-term, Long-term) by Japan Society for the Promotion of Science, “Research Grants for Doctoral Candidates and Young Academics and Scientists” and “Re-invitation Program for Former Scholarship Holders” by Deutscher Akademischer Austausch Dienst (German Academic Exchange Service).

In Germany there are 5 foundations organized by 5 political parties, they also offer scholarship for researchers’ exchange. These foundations clarify the basic principles as social justice, realization of rightness, human rights, rule of law, gender and minority rights and they make it’s a conditions to offer the scholarship. Meanwhile it is often pointed that these foundations are not private foundation because they are financially supported by the Federal Government.
Mongolian Government does not have the researcher exchange and assistance for PhD Program, however if the Academy of Science and University has enough budget, they sometimes dispatch researchers to foreign countries.

d. International joint educational program

“Action Program of Mongolian Government from 2012 to 2016” is described “to set on the exchange between Mongolian universities and foreign universities in the field of IT, nanotechnology and biotechnology” as industrial policy and “to attract more than 1 branch of university which has world highest level engineering technology” as educational policy. International joint educational program as double-degree program or twinning program were implemented mainly in the National University of Mongolia and Mongolian University of Science and Technology in Mongolia in the past. Besides this, Mongolian State University of Agriculture implements the international joint educational program with universities of Korea, China, Russia, Netherlands and Canada. Some private universities implement the short-term

student exchange, especially for the foreign language training; however it does not include degree.

Professors of Mongolian point out 1) a difference of quality of undergraduate education between advanced countries and Mongolia including the quality and educational method of secondary education, 2) the problem of foreign language ability in the secondary education. So they gave attention to implement sufficient preparation in the foreign language to the maximum possible achievement. They also advised that international joint educational programs should implement intensive foreign language and short-term dispatch to foreign partnership universities in summer, as the case of Japanese Legal Educational Center of Nagoya University, Korean Legal Educational Center of Korean Kookming University and educational cooperation Soviet and Eastern European Countries in Socialist era.

e. Accreditation

After the democratization, many private universities were established in Mongolia and it brings the problem of educational quality. The Mongolian Government established the council of higher educational accreditation to guarantee the quality of higher education. This council is an agency under the Ministry of Education and Science. The Secretariat of council organizes the accreditation in each specific discipline. Each accreditation committee is composed of honorable professors including the principal and the dean.

However the council of higher educational accreditation does not evaluate the curriculum and contents of international joint educational program, because each university evaluates and accepts the responsibility for the curriculum and contents.
Each engineering school of university aims to raise the level of education to the international standard as stated in the Washington Accord in the future. However there is no equivalent qualification of Japan's JABEE in Mongolia.

5.2 Studying-abroad and student exchange between Mongolia and Japan

In the socialist era, the number of Mongolians who studied in Japan was limited to diplomat and researchers due to political reasons. However as a result of Japanese contribution for the democratization and capitalization in the transitional era, the number of Mongolians who have studied in Japan has increased gradually. Especially after 2000, Mongolian students in Japan radically increased, because firstly Japanese Government started the government-sponsored scholarship program for 20 students per year and secondly privately funded students was

increased with the economic growth of Mongolia.

According to a survey in May 2011, there were 1,170 Mongolian students studied in Japan. Looking at the persons belonging to professional institutions, Graduate students 406 persons, undergraduate students 478 persons, Junior college 22 persons, Special vocational high school 74 persons, Special training school 153 persons, College preparation course 37 persons. Looking at the persons in professional discipline, Social science is 458 persons, Engineering 245 persons, Humanities 189 persons, Health 80 persons, Agronomics 43 persons, and Science 30 persons. It is also notable that the number of students in social science makes up about 40% of the data.

As mentioned above, Mongolian students in Japan radically increased, however it seems that their expertise acquired in Japan does not necessarily fulfill with the economic and social demand in radically changing Mongolia. Because the “Decision No. 19 of the Mongolian government in 2012” identified 20 areas of specialization as demanded in Mongolia and 18 specializations are in the field of Engineering and Science. However the 40% of Mongolian students who study in Japan major in social science and only 23% major in Engineering and Science.

The causes may be explained as follows: Firstly, Mongolian students avoid the Engineering and Science to study abroad due to the lack of developed manufacturing industry and research facilities in Universities and institute of government.

Secondly, Mongolian students tend to prefer executive officer or management positions in company or government rather than engineer positions which has the image of something simple. Mongolian students tend to major in social science for this reason and develop into a large gap between the demand of the companies or government and major of students.

5.3 Brief overview of Studying-abroad program

5.3.1 Scholarship program of Mongolian government

Though the scholarship program of Mongolian Government for studying-abroad has existed from 2000, it was a small fund. However the National Educational Foundation has been established by the contribution of private companies including mining companies, and started a large scale scholarship program from 2011.

This scholarship program pays for school expense and living cost to 100 students who have gained admission to the top 500 world excellent universities of the Thomson Reuters' ranking. However this program obliges the conditions as 1) student must sign a contract with the foundation 2) before the dispatch student must sign a contract with university or company that he or she will enter upon graduation 3) student must return the school expense and living cost after the graduation as loan, to avoid the getting employment abroad after the graduation. Although this scholarship seems somewhat like a finance loan, it is in fact beneficial as students do not have to return the loan if they work in Mongolia for more than 5 years upon graduation.

Most students who received this scholarship in 2012 entered schools related with social science and few students entered schools related to engineering. As such, mining companies who contributed to the fund are dissatisfied with the program.

5.3.2 Scholarship program of foreign countries

a. Germany

Scholarship program of Germany is composed of DAAD which responsible for handling the academic exchange, and GIZ which responsible for handling the training of practical person and specialist. "Study Scholarships for Graduates of All Disciplines" of DAAD cover the long-term studying-abroad for the academic degree.

DAAD also has started "Joint Mining Scholarship Program" which specialized in mining technology on the "Agreement mineral resources development between Germany and Mongolia" by the joint project between Germany and Mongolia from 2010 and this program will continue until 2015. This program will dispatch 20 students of the Mongolian University of Science and Technology per year to the Freiberg University of Mining and Technology and Division of Mineral Resources and Raw Materials Engineering of Aachen University to train expert of mining technology. This program obliges the conditions as 1) 2nd grade student of School of Mining of the Mongolian University of Science and Technology, 2) foreign language ability. Mongolian government and Germany Government contributed each half of fund for this program.

DAAD has also "Sustainable Water Management Program" to train expert of water technology. This program is Global Program, for not only Mongolian students but also other transitional countries in Asia, and intends to accept geological students.

DAAD has also “long-term Professor dispatch program”, which dispatches German professors for 5-7 years to transitional countries. 2 professors work at National University of Mongolia, history and biology, by this program. This program dispatches not only incumbent professors but also former professors in East Germany. East German professors can speak Russian and sometimes Mongolian, and also understand the situation of transitional era from socialism to capitalism. So this program is a unique program of Germany. In Japan, if the Ministry of Education or JICA were to dispatch a professor, it is only within a 2 year period. In comparison, the German program is suitable for the educational cooperation in universities of the transitional countries.

As for the students from Asia, Mongolia 145, Malaysia 73, Nepal 154, Pakistan 470, Philippines 109, Taiwan 164, Thailand 353, Vietnam 599, and North-Korea 13 in 2011 according to the DAAD Annual Report. This shows that student number is decided not only by the population or economic development, but also German foreign policy.

b. Russia

Though Russia took over the Soviet Union, which had strong relation with Mongolia in socialist era, academic and educational relations between Russia and Mongolia has since cooled down after democratization. The scholarship program from Russia was 150 Mongolian students in 2000.

However the Russian Government has increased the number of scholarships from 5 years ago by request from Mongolian Government, offers 300 students per year now. There are 7000 Mongolian students in Russia, includes students study in the Railway Engineering College and National Defense University. Specialized field for scholarship is decided by the request from Mongolian Government. Generally, Mongolian students study in Russian, and decide to study in Russia by the recommendation of parents or their parents work in Russia. This indicates influence from the socialist era exists now.

Plekhanov Russian Academy of Economics has a high school in Ulaanbaatar and if Mongolian student graduates from it, he or she receives the qualification of candidacy for an exam in Russia. However this qualification does not include scholarship.

c. USA

The Fulbright program of USA dispatches 10 Mongolian students per year to USA. Though this program dispatched 5 students before, it has dispatched 10 students since 2010 by the request of Mongolian Government. Selection of candidates is implemented by the Embassy of USA, and staff of the Ministry of Education of Mongolia join in the selection process. Though this program covers the priority academic field which Mongolian Government designated, it does not indicate the university and college.

d. Australia

Australian Development Scholarship of AusAID dispatch students to mainly Masters courses in Australian universities. This program offers scholarships to 38 students of 2 categories. Category 1 includes dispatching 21 officers of the Mongolian Government and category 2 dispatches 17 students from the private sector and NGO per year. Academic fields of category 1 students are decided by the Mongolian Government, and academic fields of category 2 students are decided by the Australian Government. However students who study in the field of engineering are few. Program Coordination Committee, composed by AusAID, MOF, Ministry of Education, MOFA, Civil Servant Council, President Office and Open Society Forum, and Ministry Working Group join to selection process of category 1. Selection Panel, composed by Employer Federation, Chamber of Commerce, Open Society Forum and AusAID join to selection process of category 2.

This program offers English Language Training from 3 months to 9 months depending on the English ability of students. Though this training was part time class before, it became full time class from this year to make considerable achievement. Australian Development Scholarship program demand IELTS 5 when student apply and he or she must improve to 6.5 before leaving for Australia. Until now, 200 students have studied in Australia by this program and the number of dropout students was only 2-3.

e. Japan

The Japanese government offers official scholarships as 1) Japanese Government sponsored scholarship for students of university, junior college and specialized vocational high school in long-term and short-term, 2) Japan Foundation research fellowship for graduate students and professor in the long-term and short-term.

The Japanese Government also has other fellowships for researchers and specialists with work experience, as 1) fellowship by Japan Society for the Promotion of Science in Short-term,

Long-term and RONPAKU Program" (Dissertation PhD program), 2) Japanese Studies fellowship by Japan foundation, 3) Japanese Grant Aid for Human Resource Development Scholarship program (JDS).

Aside from this there are some scholarships organized by local public authorities and private foundations. Generally speaking, students must apply after entry to universites as private students, so only students who manage to pay the minimum school expense and living costs in Japan are able to apply for it.

f. Other

The Mongolian Government has started to discuss new scholarship programs as joint scholarship program of DAAD with Austrian Government.

The Chinese Government also started some kind of scholarship program in Mongolia.

5.3.3 Scholarship program by international organization

a. Asia Development Bank (ADB)

The Japan Scholarship Program of Asian Development Bank dispatches students to Master or Doctoral courses of university and institute and this program covers Mongolian students. If student wants to study in the field of engineering, the program designates the following organizations: Keio University, Saitama University, Tokyo Institute of Technology, University of Tokyo, University of Melbourne, Indian Institute of Technology Delhi, University of Auckland, Asian Institute of Technology in Thailand and East-West Center of USA. Candidates are required to 1) have 2 years work experience and 2) return to work in their home country after graduation. This program covers the transitional countries in Asia which joined ADB, so it does not necessarily select Mongolian students every year.

b. World Bank

World Bank implements training in each program and it sometimes include long-term dispatch for Master or Doctoral degrees. In the past, national legal institute which was established by the loan of World Bank dispatched researcher abroad by this scheme.

c. European Union

"Erasmus Mundus program" of European Union has dispatched 60 Mongolian students to European countries since 2004. "Erasmus Mundus program" from 2009 to 2013 offers 1) joint

program of graduate universities level (action 1), 2) formulation of cooperation program between educational organizations (action2), 3) Scholarships for professors, students and staff of organizations which joined action 1 or action 2.

In the case of Mongolia, students of the Gate consortium (of which the National University of Mongolia and Mongolian University of Science and Technology are members of) were possible candidates for scholarship in 2012; in 2011, students of the AREaS consortium (of which the National University of Mongolia and Mongolian University are members of) and One More Step consortium (of which the National University of Mongolia and Mongolian University of Science and Technology are members of) were possible candidates for scholarship. “Erasmus Mundus program” designated the academic discipline and university which student would study.

5.3.4 Scholarship program of NGO and company

International NGO works in Mongolia as Asia foundation and Open Society Forum dispatched some Mongolian students to USA. Scholarship program of USA is organized through NGO and it is different from the Germany and Japanese scholarship program. Scholarship programs of the Asia Foundation is reputed because it cultivates friends of USA in South-Eastern Asia in Cold War era. Soros Foundation (Open Society Forum), established by famous investor George Soros who was emigrated from Hungary, offered scholarship program in East Europe, Central Europe, Russia, Central Asia and Mongolia after cold war. Germany foundations managed by political parties have received financial support by the Federal Government, so some say they are not actually NGOs. To this extent, international NGOs of Europe and USA are different from NGOs in Japan.

In recent years students who received scholarship from foreign companies are increasing in Mongolia. These companies might be related to mining fields or military officials of foreign countries. Details of these scholarships are not obvious because they sometimes do not open for recruitment. These scholarships are managed by another purpose with official scholarship, so if these scholarships increase, it might decrease the role and significance of official scholarships.

Chapter 6 Direction of Japan's Assistance

6.1 Priority Issues in TVET and Higher Education Sector

In response to the findings of the previous chapters, the priority issues of the higher education and TVET sector, based on the comparison the industry human resources needs in Mongolia, are summarized as follows:

Industry human resources needs

- With the development of the mining industry, the Mongolian economy has entered into a healthy cycle of economic processes.
- Related infrastructure development of railways, roads, power, water and other related industries including heavy industries, energy industries, environment related industries, and processing industries are booming.
- The government adopted the value added production policy taking advantage of domestic resources, for instance, heavy industries at the mining site, textile industries transferring from export of raw wool to products export and food and leather industry processing the domestic raw materials.
- Also the government action plan instructed the import substitution in construction materials etc. and introduction of hi-tech education at universities including Bio-Nanotech and IT.
- But the engineering human resource to implement the above activities is not enough in terms of the both quantity and quality, and there is a serious mismatch between the industrial needs and supply of higher education institutions.
- According to interviews and questionnaire surveys with industries, their voices included the following:
  - Heavy industry, oil-related new projects are in serious shortage of technical human resources
  - In the construction industry, foreman, road-related technician and railway-related technician are seriously in short.
  - IT engineers who can do the design and project management are very scarce.
  - Graduates cannot be immediate force in general, because hands-on practical education is not enough due to the lack of experimental equipment in the university, etc.
- Regarding the priority engineering sub-sector, the industrial needs spread over many fields as below:
  - Priority engineering sub-sector:
    - geology/mining engineering
    - civil engineering

        - mechanical engineering
        - electrical & electronic engineering
        - materials engineering
        - food engineering
        - production engineering
        - information technology
    - For future needs:
        - applied chemical engineering
        - environmental engineering
        - bio-nanotech
    - Sub-sector of high urgency:
        - construction/civil engineering
        - mechanical engineering
        - electrical & electronic engineering

Issues of the vocational and technical education and training sector

- Responding to the above situation, the need for expansion and development of TVET schools has been advocated. As a result, around 70 to 80% of 74 vocational and technical education and training schools in Mongolia have improved significantly in recent years in terms of facilities and equipment by the assistance of OT, MCC, and foreign aid agencies.
- Although technical guidance has been provided, along with the improvement of facilities and equipment, the introduction of new equipment has not demonstrated a positive learning effect due to insufficient efforts to develop the capacity of leaders that can operate the newly introduced equipment as well as teaching methods (curriculum) that utilize new equipment.
- The lack of capacity of teachers is also given as a reason why new equipment is not sufficiently exhibited a learning effect. Upgrading of the teachers' ability is required from the point of view of the implementation of vocational education and training in line with market needs.
- Enrollment age of TVET is 15 years old. Since around 70% of the contents are of the skill training, 30% is of the general high school education, the graduates of TVET are not allowed to be transferred to the third year of University in general. With regard to this, there is some criticism that while this form of mass education manages to address the problem of skilled workers for the time being, they are only training workers who will work under foreign engineers. Since Mongolia has a small population, many raised that young Mongolians should be educated as technicians or engineers who can manage a large number of foreign workers.
- In this context, attention has concentrated in Japanese KOSEN (Technical College),

which has been training engineers to support production sites in Japan substantive while performing the same early engineering education. "Society to Establish Japanese KOSEN in Mongolia" was organized and has begun the search for its establishment.

Issues of Higher Education Sector

- On the other hand, the development of experimental and research equipment in Universities has been slow compared with TVET. In most of the lab-equipment in universities are old and most of them are the equipment for educational level (for student experiment), cannot be used in the research work. Since the equipment in industries is quite new now, graduates lack the capacity to operate them. And this may be one of the reasons of why industries are dissatisfied, such as university graduates are not trained practically, etc.
- A significant proportion of PhD holder teachers are occupied by the elderly Russian universities graduates. On the other hand, teachers who earned a degree in foreign universities after the collapse of the Soviet Union, has been headhunted by the private sector after returning, because of the low salary at the University. This is a cause of a small number of teachers for the 30s and 40s.
- The number of teachers is insufficient for the number of students which is increasing every year. Therefore, teachers are constrained in teaching, they have no time to do their own research activities.
- Therefore, it is urgently needed for universities to promote the training and securing of teachers, enhancement of equipments, and promotion of practical education.
- As for study abroad programs, both universities hope to have a study abroad program at graduate level for their staff. It is also desired to have sandwich programs, dispatching of Japanese experts to Mongolia, as well as short-term study in Japan.
- In terms of priority areas of engineering, the above priority engineering sub-sectors which the industries needed are equally important for the universities, although some schools have advanced facilities already like in the school of information.

6.2 Direction of Japan's Assistance

From the above, the direction of Japan's assistance would be considered as follows:

- TVET sector has been developed in recent years as donor assistance has been concentrated. Therefore, if the Japanese government support is carried out now, it is appropriate to support mainly the higher education sector, although some support needs remain still in the TVET sector, as described in Chapter 4,.

- As a way of supporting the higher education sector, it should be done to develop human resources in priority areas of the engineering where the industry needs are very high.
- In this regard, the objectives of the assistance will be:
  ① To develop industrial human resources for industrial development of Mongolia by strengthening the Mongolian higher education institutions in engineering
  ② To narrow down the mismatch between industry needs and higher education
  ③ To achieve technology transfer from Japan to Mongolia
- Establishment of Japanese style "KOSEN" (technical college) in Mongolia is another area of assistance

6.3 Approaches to Solve the Priority Issues

Similar to the directions set out above, the approaches to solve the issues of the higher education sector can be considered as follows:

- Select the model universities first and strengthen the capability to develop industrial human resource in the model universities, and the case of the model universities is disseminated to other universities in Mongolia.
- The basic approaches to strengthen the capability of developing industrial human resource in the model universities will be:
  ① Provide opportunities to study abroad in Japan for present university teachers and potential university teachers to upgrade the present teachers and secure and increase the number of university teachers of engineering field by imposing them a condition to work at university for certain time after coming back from Japan.
  ② Improve facility and equipment of the university to develop the conditions to do practical education and also to prepare conditions for returnees to continue their research and educational activities in Mongolia.
  ③ Promote joint research and educational exchange with Japanese universities to improve the contents of research and education.
  ④ Introduce an international collaborative education program with Japanese university in the field of urgent HR needs for internationalization of the university and students' international exposure.
- As for the model universities, the National University of Mongolia and Mongolian University of Science and Technology will be appropriate.
- For the priority engineering field, it is appropriate to follow the industrial needs as follows
  - geology/mining engineering

- civil engineering
- mechanical engineering
- electrical & electronic engineering
- materials engineering
- food engineering
- production engineering
- information technology
- applied chemical engineering
- environmental engineering
- bio-nanotech

- Then the target laboratory or division or center will be selected in the above-mentioned fields and make the coupling with a Japanese university department or laboratory, which will be the basic unit for the following activities in accordance with the four basic approaches mentioned above:
  ① Study abroad program in Japan for present university teachers and potential university teachers
  ② Improvement of facility and equipment
  ③ Promotion of research and education collaboration
  ④ Development of international collaborative education program
- Selection of the target laboratory will be done by the selection committee, which will include not only university officials but also intellectuals and people from industry. The criteria for selection will be as below :
  - Content of research education / Importance of the theme
  - Necessary system to effectively utilize the purchased equipments and trained teachers
  - Existence of cooperation with Japanese universities
- The tasks of the partner universities or laboratories are:.
  - Acceptance of teachers and candidates teachers in the Master and PhD courses in Japan
  - Dispatch of Visiting Scholar from Japan to Mongolia
  - Acceptance of Non-degree research students or internship from Mongolia to Japan
  - Promotion of joint research
  - Advice on investment of equipments for research education
  - Advice and direct educational support for improvement of undergraduate education program
  - Development of international collaborative education program

Oversea degree program for teachers

- Participants of the overseas degree programs will be required to work at the university for certain period after graduation. When the condition is fulfilled, the scholarship will be granted. However, if the condition is not met, the scholarship will be a loan.
- Participants of overseas degree programs should not concentrate only on research at postgraduate university in Japan, but should participate in internships at university, college of technology, and institutions to experience education activities in Japan which will be useful for practical education at university in Mongolia.
- Certain proportion of scholarships for overseas degree programs will be secured for other divisions, such as the units which are not selected as a target (including units which are in the selected study area).

International Collaborative education program

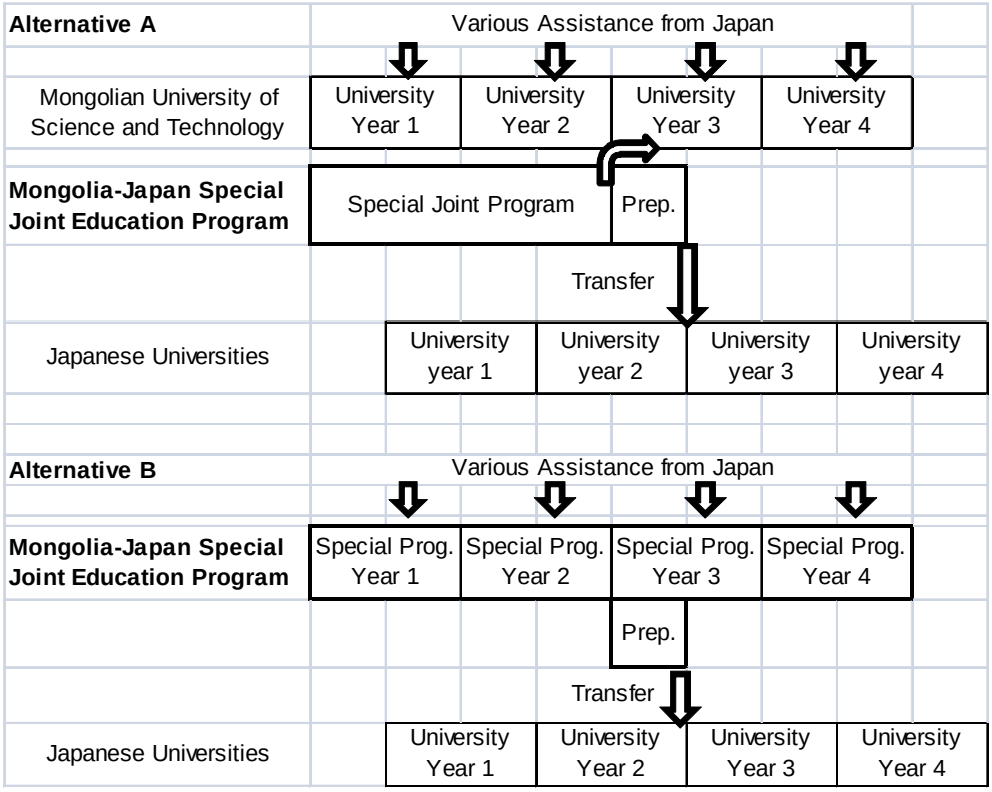
- International collaborative education program aims to cultivate engineering industrial human resource with Japanese cutting edge technology and work ethics, through introducing the credit transfer program to the engineering department in Japanese universities based on Japanese-style engineering education in Mongolia.
- Mongolia-Japan Special Joint Education Program should be established at Mongolian University of Science and Technology. The students who completed the 2nd year of this program can be transferred to the 3rd year of the Japanese university upon an addiitonal few months of preparatory training. The students can also finish the whole degree program at the Mongolian University of Science and Technology.
- Target areas of study will be selected from the areas with serious shortage of human resources, as below:
  - Civil engineering
  - Mechanical engineering
  - Mining engineering and geology
- There are two alternatives in terms of the form of Mongolia-Japan Special Joint Education Program as described in the figure 6-1.

  Alternative A is: the Mongolia-Japan Special Joint Education Program is the additional 2.5 years program attached to the present undergraduate program of MUST providing the preparatory education, including Japanese language education and some subjects teaching in Japanese.

  Alternative B is: the Mongolia-Japan Special Joint Education Program is the 4 years independent program from the present undergraduate program of MUST, but the students who completed the 2nd year of this program can transfer to the 3rd year of the Japanese

university through few months' additional preparatory training.

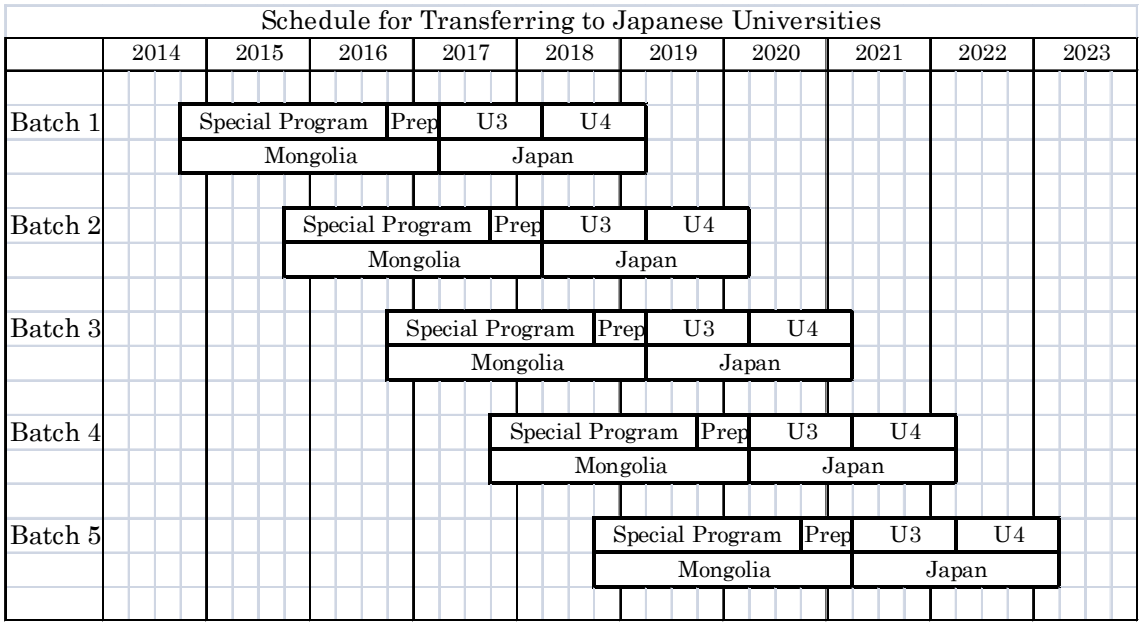
Figure 6-1 Image of alternatives of Mongolia-Japan Special Joint Education Program



- In any case, the Mongolia-Japan Special Joint Education Program will be an undergraduate program featuring Japanese style "Monozukuri" (Hands-on procreation) and Project Based Learning (PBL) to cultivate human resources who will play an active role in actual working world.
- It is necessary to dispatch some Japanese university lecturers or retired teachers.
- Scholarships to study in Japan will be provided to the top students, who should first secure in advance a job to start working at upon graduation.

- An example of the schedule for transferring to Japanese universities, assuming the project starts in 2014, is as follows :

Figure 6-2 Schedule of Mongolia-Japan Special Joint Education Program



(Appendix 1) **Trend of National Development Project**

In accordance with " General Policy for National Development based on Millennium Development Objectives" and" Government Action Plan of Mongolia over 2012-2016" many national developmental projects are under planning in many field.

(1) Mining

(2) Improvement of infrastructure- road, railway, power, water)

(3) Creation of heavy industries

(4)Energy self-sufficiency

(5)Light industries (food industry, construction materials, leather industry, beverage, metal processing,

Furniture and the like)

(6)Solution of air pollution problems in UB and environmental isuues

(7) 100,000 housing project

(8) New Soum-Center project

(9) Other projects of priority

The following are description for the each project mentioned above,

(1) Mining and other related projects

Mining sector is engine of Mongolian economy and at present, most favorite sector for university graduates to find , The big company like OT and Energy Resources have own human resources training plan and such companies are pulling Mongolian economy including human resources aspect. Flourish of mining sector invites similar flourish of the surrounding sectors of civil works, construction, import of equipments and materials for mining, construction machinery, truck transportation and workers garments, gloves, food catering, drinks hotels and accommodation, etc. Khaanbogd at South Gobi will become center city in South Gobi.

(2) Improvement of infrastructure

One of the obstacles of mining development is shortage of infrastructure, Mongolian Government is now changing priority from development mines to construction of infrastructure to add value to Mongolian mines.

Infrastructure in Mongolia is in shortage both of quality and quantity. Supply rate of infrastructure is Power(67%),water(35%), road(3.5% for paved road) and railway capacity also does not catch up speed of economic development. Infrastructure bottleneck becomes more serious as major mines start

production from 2012-2013. In South Gobi 8000thousand employment creation is expected, Most of them come from other regions, water, heat power demands will increase. Furthermore road construction is urgently needed because automobiles and trucks also increases. The railway to transport huge demand of mineral resources for domestic and external sources is urgent ly needed.

Infrastructure needs vast investment, According to NDIC materials, construction needs 8billion US$ over 10 years. Funding is not enough at the moment.

Table 1-1 attachment : Medium- Investment Plan

Project	Content	Estimated Investment
Railway	First Phase Tavantolgoi-Tsagaansubarga Zuunbayan-Sainshand-Baruunnurt-Choibalsan	3 billion US$
Industry	Sainshand Heavy Industry Estate Process,manufacture 6 plants	13.9 billion US$
road	7,875 km new road and highway	4.8 billion US$
Housing	100,000 housing construction	6.2 billion US$
Soum Center	96 Soum Center construction	0.7 billion US$

(Source : NDIC)

The on-going infrastructure construction is Railway Phase 1 (map 1-1 attachment), The Government establish new railway company and it is now heading for tender under PPP scheme per each construction sections.

The more attention should be paid to a route to sea . The popular route was Tianjin via Beijing route and Siberia route to Russia East coast port, however, recent spotlight is lease of DanDon port at Bohai. Thereupon, Manchuria railway might be usable. It seems that Mongolia Government now moved forward to assure external port which is definitely needed to transport extracted minerals and ores from Mongolian mines. If this infrastructure is established, pacific ocean countries except China increase its intention for development of Mongolian mines.

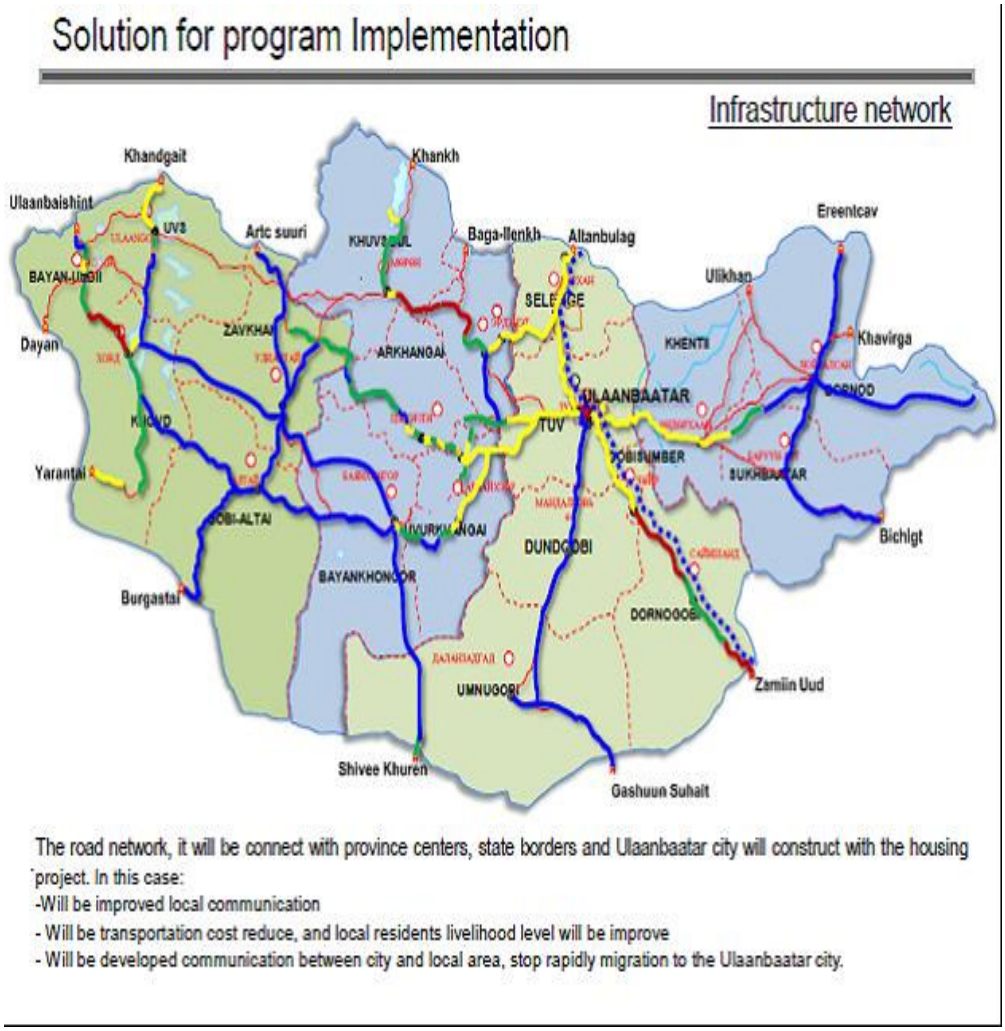
Map 1-1 attachment: Railway Construction Plan

(source: Ministry of Transportaiton)

Road construction and power development is also important with road construction plan being showed in Map1-2 attachment below. In particular , the road to transport coal, using 100 ton heavy truck, Mongolian civil construction company lacks experience. UB city has a lot of new road construction and repair plan ,parly with PPP scheme. The Mongolian road construction plan includes too much projects which exceeds local construction compqnies' capacity, Then foreign companies' participation will be encouraged.

Power station and transmission line is also indispensable. Unless power supply is sufficient, mining development in South Gobi dose not go forward. OT and TT has their own power supply plans. OT is going to buy power from China up until their own power station becomes available.

Map 1-2 road construction plan ,attachment



(source: Ministry of Tarnsportation)

（3）Heavy industry

The Government of Mongolia applies policy to add value to mineral resources extracted from local mines. In this connection, they are planning to promote heavy industry using available mineral resources locally. They plans to build heavy industry estate at Sainshand in East Gobi. Its master paln was made by Bechtel corp. of USA. The projects include:

a. Construction material project including cement plant

Total required fund: 190 million US$

Sainshand cement factory: 100 million US$

Ceramic plant: 20 million US$

Thermal insulation material plant: 3million US$

Block plant: 40 million US$

(b) Coking plant using technology of Thyssen Krupp Uhde

(c) Pelletizing plant

Manufacturing of pellet, as intermediate materials for steel production using Direct Reductio n Iron Process.

(d) HBI/DRI plant

To produce hot buriquetted iron product using DR pellet produced from the pelletizing plant mentioned above.

(e) CTL (Coal to Liquid) Project

There are 3 plans: Sponsors' companies are MCS, ICM and MAK.

(f) Oil Refinery

Total required fund: 900 million US$, Construction Period: 3 years. Capacity, refine 1milllion ton oil per year.

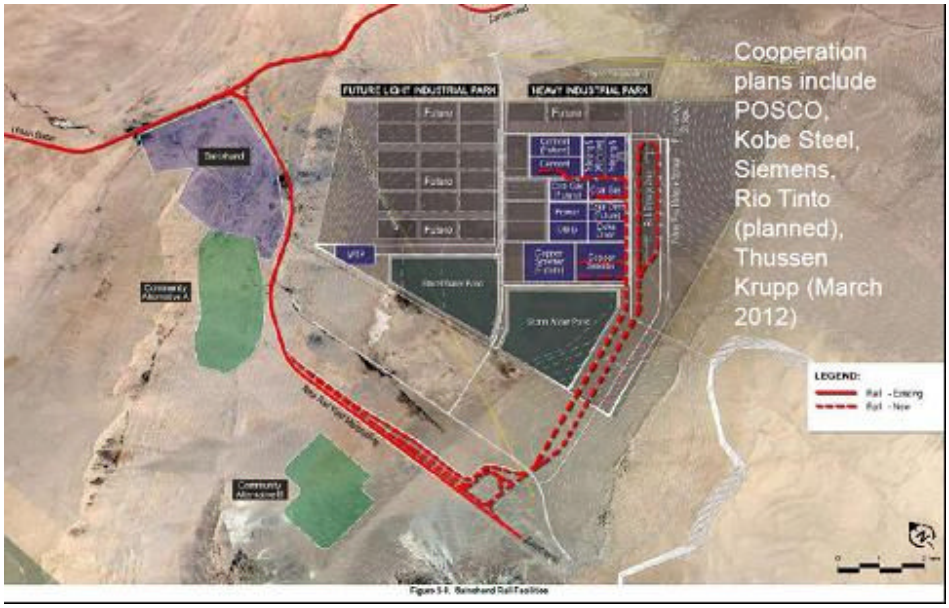
(g) Copper smelter

Total required fund: 1billion US$, Construction period: 2 years , capacity : Cathode copper 300 thousand ton/year

(h) Power plant

2 Giga class power station, electricity produced will be partly exported to China.

Map 1-3 , attachment : Shainshand industrial park plan



(Source: NDIC)

Other heavy industry projects

(a) Metallurgy plant (at Sainshand or Darkhan)

Total required fund:1billion plant, construction period: 3 years, Capacity : processing of 2 million ton.

(b) Coal Chemistry project

Total required fund of 1billion US$, Construction period: 2 years, Combustible Gas, Production: methanol, DME and other chemical product using clean gas technology

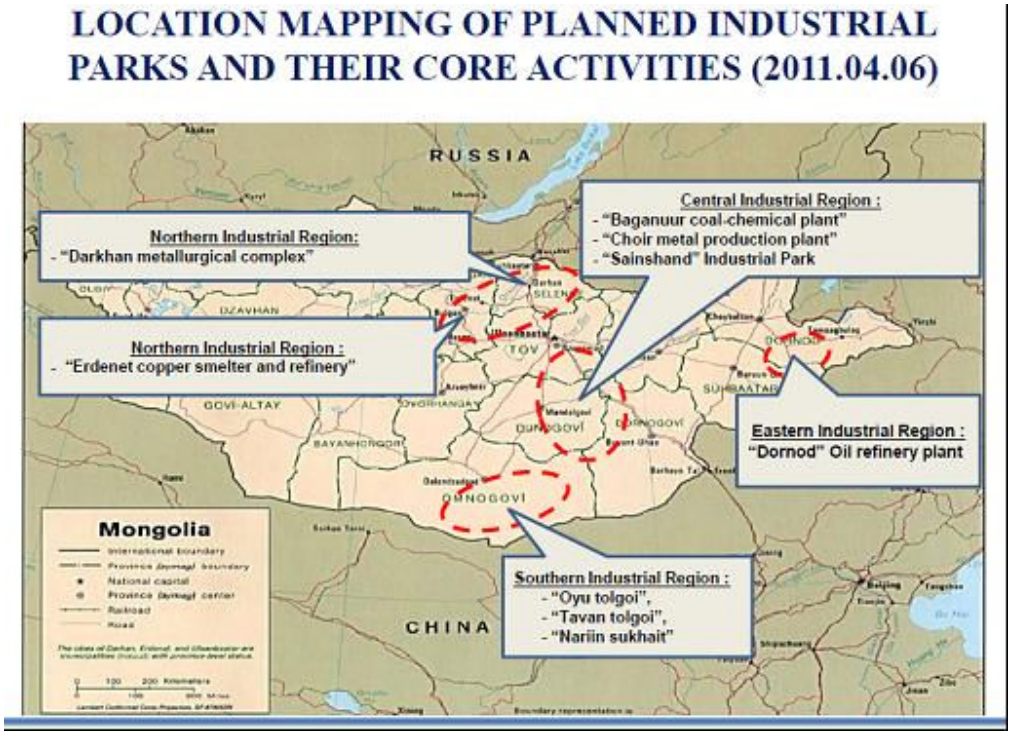
(c) Tavan Tolgoi Power Plant

Total project fund: 1 billion US$, Construction period: 2.5 years , Capacity: 600MWT

(d) The 5th Power Station

Total required fund: 1.4billion US$, Construction Period: 9 years (Phase 1, 2011-2015, Phase 2: 2015-2019), Capacity: 820MW, Heat :1100Kcal/Hour

Map 1-4, Planned Industrial Park location



(Source: NDIC)

（4） Energy Self- Sufficiency

Mongolia depends most of the petroleum product to Russia. Because of one-supply source, negotiation power of Mongolia is quite weak. Mongolia is in urgent needs for local oil production and domestic refiner Mongolia also started CTL (coal to liquid) project as well as coal chemistry project, using abundant local coal resources. For power shortage, thermal power, wind power, solar power, etc, are encouraged to cope with rapid growth of electricity demand prospected. In near future, Mongolia aims at export of energy to China. Future development of shale gas, CBM is also expected, as Mongolia is potential big reserve country of those resources.

(5) Light industry and construction industry

Mongolia's industry sector development is far behind of that of the advanced countries. Since industry sector collapsed in the course of introduction of market economy after socialist system. Most of the industrial products are imported mainly from China and Korea. Industry share in GDP occupies only 8% . Main is cashmere industry followed by steel works, carpet, leather, metallurgy, furniture. Food processing beverage, etc. Machinery sector had existed in Socialist era but collapsed ,because the sold machinery and equipment at scrap price a t the time of confusion occurred in transition to market economy. Industry technology ,as a whole, is low at SME industries. Accordingly industry engineer is

not well growing up. Though construction sector is flourishing, however, most of the workers are imported from China. Mongolia is in acute needs of infrastructure construction. Mongolia has only 28,000 skilled workers, compared with that at least 40,000 skilled labor is needed. Mongolia is definitely in shortage of engineers and skilled labors in the sector concerned.

The traditional industries except for mining industry are important areas for employment. The Government applies many promotion measures including development of value added production using local raw materials. The textile industry, food processing industry, leather industry and natural products are promoted. The Government tries to establish industry clusters.

Table 1-2, attachment: Light industries sales trend

Table 25. Revenue of light industry, million USD

	2009	2010	2011
Food products and drinks	272.3	366.2	525.4
Knit production	115.7	107.3	142.2
Fur and leather processing, leather, shoe production	2.2	1.1	1.9
Other manufacturing production	140.3	223.2	568.7
Total manufacturing production	**530.5**	**697.8**	**1238.1**

Wool, cashmere, knitted goods			
Knitted goods, thous pcs	613.9	731.5	759.2
Combed down, ton	1 586.7	824.7	874.3
Felt, thous m	128.7	134.9	263.2
Camel woollen blanket, thous m	36.9	15.3	25.8
Felt boots, thous pairs	13.0	27.9	42.6
Sheepskin coat, pcs	12 094	16 558	22 520

Construction materials	2009	2010	2011
Wooden building door and windows, thous.m2	2.5	13.8	13.6
Plank for floor, thous.m3	1.2	0.6	1.7
Sawn wood, m3	14 460.4	20 172.0	16 857.7
Railway sleeper, thous.m3	14.3	12.5	10.0
Vacuum windows and doors, r2	4 015.7	2 712.7	9 971.9
Cement, thous ton	234.8	322.5	425.8
Lime, thous ton	43.1	50.2	45.3

(Source: National Statistic Yearbook)

(6) Air pollution in UB and solution of environment issue

In UB, 25% of household lives in apartment with heat and water supply pipe. 75% of them lives in Ger area without such heat and water supply pipe . In severe winter climate, ger people burn 13.5kg of coal for warming. Exhaust gas flows into UB city and it causes air pollution. Successive Governments made efforts to solve this problem using smokeless coal, briquette, air cleaner equipment, etc. with World Bank assistance. Ultimate solution has not yet found. Rich people is moving to suburban area seeking cleaner air. University town project in Baganuur also relates to air pollution problem in UB.

As to environment point of view, garbage treatment in UB and improvement of plumbing, river purification, environment destruction relative to Mining activity, desertification, etc. are important issues to solve.

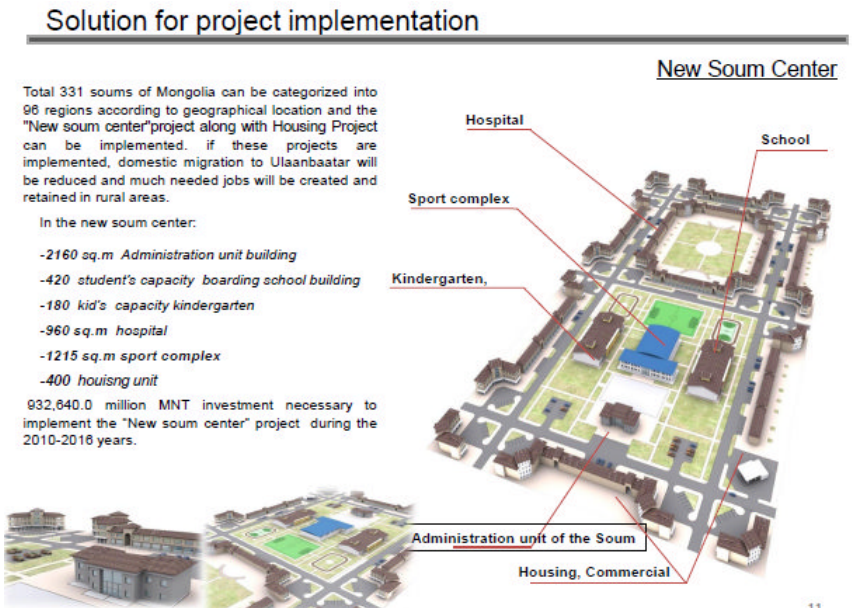
(7) 100,000 housing project

The Government is now implementing 100,000 housing project to supply health accommodation to people. In UB, 75,000 houses and in provincial area, 25,000 houses are to be supplied. In particular, Ger people receive benefit. D evelopment Bank of Mongolia supplies fund for loan (175 million US$) through Government housing entity and a certain private bank

(8) New Soum- Center Construction Plan

As a special –feature of regional development, the Government makes construction of soum-center with total numbers of 96 soums . Soumcenter is to be built by 2x4 construction technology.

Illustration 1-5 attachment: New Soum-Center Construction



(Source: NDIC)

(9) Other emphasized development plans

(a) Altanbrag-Zamin Uud Hoghway Project

The first Mongolian highway project (Total fund:1.2 billion US$, 5 years construction period) linking North and South Mongolian national borders. 990 km large scale PPP project. As a first phase, from UB to Zamin Uud is to be constructed.

Illustration 1-6, attachment: North-South Highway Project

(Source: Ministry of Transportation)

(b) New Railway Plan

This project t is to link South Mongolia to central railway system. The following 3 sections are liked.

- Tavan Tolgoi-Gashuun Sukhait
- Nariin Sukhait-Shivee Khuren
- Tavan Tolgoi, Tsagaan Suvarga, Zuunbayan-Sainshand

Illustration 1-7, attachment: New Railway Plan

(Source: Ministry of Transportation)

(c) National Satellite Launching Paroject (Total fund: 600 million US$, Preparation period: 5 years)

Small scale satellite launching for information and communication system. Pre-feasibility study ended.

(d) Energy project for biomass and waste (Total fund: 200million US$, 1 year construction period)

The project to produce combustible gas from biomass and organic waste. Further study needed.

(e) Kharkhorum 13 century project (Total fund 500 million US$,5 years construction)

Old Capital project of the Mongol Empire at 13th Century, aiming to receiving 1 million tourists, with facilities of museum of advanced technology, international hotel, airport and other service centers.

(f) High-Tech Industrial Park (Total fund:380 million US$)

Establishment of 22 corporation in high-tech, nano -tech, biomass field, aiming at creation of high-tech products export. R&D center and infrastructure for 21st century society, industrial clusters are also planned.

(g) Student town construction (Total fund: 300 million US$)

2,000 Ha land is used for Student town absorbing 20,000 students in Baganuur, linking to UB by train and highway. Innovation law and innovation fund is prepared for encouraging University- Industry Linkage.

(h) Industry Training Complex Project for IT (Total fund: 100 million US$)

In the suburbs of Baganuur close to student town, the following is considered:

- High-level human resource development
- Infrastructure for ICT business
- Encouragement of outsourcing, digital contents, software companies.
- New product development for ICT and construction of ITC study Center
- Production of ICT products and sales to domestic and foreign market
- Construction of outsourcing study center
- ICT training center
- Creation ICT cluster and control

(Attachment 2) Questionnaire for Industrial engineer needs

Industrial human resources needs questionnaire

Date : Day…Month … 2012 ( ) Respondent name :

***We are holding an investigation about human resources needs of [Industrial technology, engineering] field in Mongolia. We kindly ask you to contribute to our investigation by responding following questions. Thank you.**
1. Higher education sector (university and higher level) 2. Technical special education training sector (technical vocational school, high school level)

<table>
<tr><td colspan="4">Ⅰ. Information about respondent company</td></tr>
<tr><td colspan="4">1. Company name</td></tr>
<tr><td>2. Capital</td><td></td><td>3. Date of establishment</td><td></td></tr>
<tr><td>4. Address</td><td colspan="3"></td></tr>
<tr><td>5. Type of industry</td><td colspan="3">□Geo engineering, natural resources engineering □Construction
□Food processing □Energy
□Heavy industry □Machinery and metalworking □Light industry
□Environmental industry
□Information and communication □Others ( )</td></tr>
<tr><td>6. Number of employees</td><td></td><td>7. Annual sales</td><td></td></tr>
<tr><td>8. Type of company</td><td colspan="3">□National □Private □ Foreign investment □Other</td></tr>
<tr><td colspan="4">9.Main products : ① ② ③</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Ⅱ. About human resources of higher education sector (university and higher level)</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">1.Field where your company engineers belong (Number of professionals) : Multiple answers allowed.</td></tr>
</table>

□Geo engineering, resources engineering( ), □Applied chemistry engineering ( ), □Mechanical engineering( ), □Electricity, electronic engineering( ), □Civil engineering( ), □Architectural engineering( ), □Biotechnology( ),□Material engineering( ), □Environmental engineering( ), □Energy engineering( ),□Food technology( ), □Information technology( ), □Manufacturing engineering( ), □Nanotechnology( ), □Other_____( )

2. What do you feel your professionals lack?

□Basic knowledge, □Applied technology, □Problem solving skill, □desire to learn,

□Please write additional comments you recommend.

①

②

③

3. Does your company have sufficient number of professionals?

□sufficient.□around 80%, □50%, □insufficient.□I don't know. □Other ( )

4. Your company demand from domestic universities:

□improvement of teaching staff、□ input of modern technology, □improvement of class contents , □practice based training, □prepare professionals who can work at global level(teaching foreign languages etc),□teaching leadership skill

□ Please write additional comments you recommend.

①

②

③

5. How do you recruit necessary human resources?

□we recruit annually from new graduates, (%),□hire when necessary(%),□choose from our relatives and acquaintances(%),

□head-hunting(%),□hire foreign professionals(%),

□Other (_____)

6. How do you train your employees?

□study abroad, □Domestic training, □Training inside own company, □Find effective

workers from outside.

□Other_____( )

7. Fields of the professionals necessary to your business near future (Number of people): Multiple answers available.

□Geo engineering, resources engineering( ), □Applied chemistry engineering ( ), □Mechanical engineering( ), □Electricity, electronic engineering( ), □Civil engineering( ), □Architectural engineering( ), □Biotechnology( ),□Material engineering( ), □Environmental engineering( ), □Energy engineering( ),□Food technology( ), □Information technology( ), □Manufacturing engineering( ), □Nanotechnology( ), □Other_____( ).

Ⅲ. About special technical education sector (special vocational school) level human resources

1. Field of your company professionals belong (number of people. Multiple answers allowed.

□Construction specialist ( ), □civil engineering specialist( ), □welding specialist( ), □Machinery maintenance specialist( ),□Chemical analyst( ),□Food analyst( ), □Measurement specialist( ),□machine operator( ), □Boiler specialist( ),□information and communication specialist( ), □other ( )

2. About your specialists(points need to improve)

□insufficient basic knowledge. □Insufficient practical training. □ problem solving skill is not enough.

□Others, please write down additional points you recommend.

①

②

③

3. Does your company have sufficient number of professionals?

□sufficient, □around 80%, □50%, □insufficient, I don't know. □Other ( )

4. Your company demand from domestic technical vocational schools:

□improvement of teaching staff、□ input of modern technology, □improvement of class contents , □practice based training, □prepare professionals who can work at global level(teaching foreign languages etc),□teaching leadership skill

□Please write additional comments you recommend.

①

②

③

5. How do you recruit necessary human resources?

□we recruit annually from new graduates, (%),□hire when necessary(%),□choose from our relatives and acquaintances(%),

□head-hunting(%),□hire foreign specialists(%),

□Other (_____)

6. How do you train your employees?

□Domestic training, □Training inside own company, □Find effective workers from outside.

□Other_____( )

Ⅳ.About collaboration with educational institutions

1. Have you worked on development of new product in cooperation with universities and research institutions?

□Yes.

□No.

2.In a case if your answer is 「Yes」:

Please list university and research institution name, product name and research theme. 1. Cooperation organization (Universities, Research institutions):

2.Product name and research theme:

(Appendix3)Sainshand Industrial Park Project

NATIONAL DEVELOPMENT AND INNOVATION COMMITTEE

Governmental Coordination Agency

www.ndic.gov.mn

ACTIVITIES FROM NDIC TO SUPPORT THE "SAINSHAND INDUSTRIAL PARK"

2012.06.08

Head NDIC Б.Ганбаатар

1. PREPARATION OF HUMAN RESOURCES

Demand for manpower

Plants	Total no. of workers	Foreign workers	Mongolian workers /in thousands/	
			Technical engineering workers	Professionals
Cement plant	270	27	54	189
Pellet plant	295	30	59	207
DRI plant	136	14	27	95
Coke plant	270	27	54	189
Power plant	161	16	32	113
Gasification plant	122	12	24	85
Copper smelting plant	515	52	103	361
Copper production plant	395	40	79	277
Railway repair station	100	10	20	70
Total owners' organizations, 20% from above	453	45	91	317
Total	**2717**	**272**	**543**	**1902**

Manpower demand by skill levels

Plants	TEW	Needed skills	P	Needed skills
Cement plant	54	2141 Industrial engineer 2151 Electrical engineer 3111 Technicians in Chemistry and Physics	189	3113 Electrical engineering technicians 3115 Mechanical engineering technicians 3117 Mining metallurgical engineer 7126 Plumbers 7212 Welders 7411 Electricians
Pellet plant	59	2146 Mining engineer 3111 Technicians in Chemistry and Physics 2151 Electrical engineer	207	3113 Electrical engineering technicians 3115 Mechanical engineering technicians 3117 Mining metallurgical engineer 7126 Plumbers 7212 Welders 7213 Sheet metal worker 7223 Metal machinery operator 7411 Electrician
DRI plant	27	2146 Mining engineer 3111 Technicians in Chemistry and Physics 2151 Electrical engineer	95	3113 Electrical engineering technicians 3115 Mechanical engineering technicians 3117 Mining metallurgical engineer 7126 Plumbers 7411 Electrician 7212 Welders 7213 Sheet metal worker 7223 Metal machinery operator

Coke plant	54	2146 Mining Engineer	189	3113 Electrical engineering technicians
		3111 Technicians in Chemistry and Physics		3115 Mechanical engineering technicians
		2151 Electrical engineer		3117 Mining metallurgical engineer
				7411 Electricians
				7212 Welders
				7223 Metal machinery operator
Power plant	32	2151 Electrical engineer	113	3113 Electrical engineering technicians
		3111 Technicians in Chemistry and Physics		3115 Mechanical engineering technicians
		2151 Electrical engineer		7411 Electricians
				7212 Welders
				7223 Metal machinery operator
Gasification plant	24	3111 Technicians in Chemistry and Physics	85	3113 Electrical engineering technicians
		2145 Chemical engineer		3115 Mechanical engineering technicians
				7411 Electricians
				7212 Welders

Copper production plant	79	2151 Electrical engineer	277	3113 Electrical engineering technicians
		2146 Mining engineer		3115 Mechanical engineering technicians
		3111 Technicians in Chemistry and Physics		3117 Mining metallurgical engineer
				7126 Plumbers
				7411 Electricians
				7212 Welders
				7223 Metal machinery operator
Railway repair station	20		70	

Some considerations:

- The committee has developed the project criteria and requirements to organize the national manufacturers and entrepreneurs that are intended to participate in the implementation of development project initiated by the Mongolian government, and assist them by means of policy and financial support.

- According to the offer of the Japanese International Cooperation Agency (JICA) for a long term scholarship loan for 460 students to develop the human resources in the Science and Technology field of Mongolia, the committee is doing research of the labor market for engineers and technicians and making requests to JICA (this includes 360 bachelors, 160 masters).

- According to the research results, 4774 bachelors, 250 masters in engineering are needed in coming 5 years. From this amount, Sainshand industrial park needs a total of 543 engineers and technical workers.

Possibilities to prepare qualified workers

- In September, 2013, a VTPC is going to start in Nalaikh.
- VTPC in Gobi Sumber (central resort college)
- Poly-technicum in Darkhan
- Mongolian-Korean college (UB)
- VTPC in Dalanzadgad
- VTPC in Baganuur (starts working in 2015)

Important future considerations

- Support State and Private universities to prepare engineering and technical workers through policy.

- 2.2 million tugrug is required as investment to prepare one professional worker3 (about today 590.0 tugrug have been spent)

- Expand and provide equipment for practice to VOCATIONAL TRAINING AND PRODUCTION CENTER,

- Organize training to prepare the specialized workforce based in training centers with enough resource materials and capable teaching staff,

- Support the training of specialized personnel relying upon large entities and companies and to organize on-the-job training for this personnel,

- Organize training within the industry to prepare specialized workers.

2. EXPERIENCE WITH INDUSTRIAL PARK ESTABLISHMENT

- NDIC and representatives of related ministries and agencies visited and were introduced to the “Industrial Park in Tsenkher” and the Metallurgy plant in Bugat which are located in the north of Bayannuur town in IMAR of PRC, and the coal gasification plant in Ordos, Shenshua.

- Considerations related to the construction of the industrial park:

- develop and follow the laws for “heavy industrial parks”, assign levels to companies depending on their income by the State,

- provide possibilities to get loans and tax exemptions for certain period of time,

- implement the infrastructure of the industrial park supported by State funding,

- it is required to develop policies to determine the capacity depending on processing levels and mineral types in the plant operation.

3. In line with cooperation with technology owners and investors

• Related to the construction of the “iron plant” a memorandum was made with “Siemens” company of the Federal Republic of Germany on the 20th of the December, 2011 and “Kobe Steel” Ltd of Japan on 19th of the March, 2012.

• To implement the “copper smelting plant” construction a memorandum with Rio Tinto of England-Australia is ready to be signed.

• To intensify the “coal gasification plant” construction cooperation is in progress with the “industrial corporation of Mongolia” Co Ltd, “MCS” Co Ltd, “Mongolian Gold” (MAK) Co Ltd and “Petrovis” Co Ltd within the framework of a memorandum.

• Working on offers from companies such as BNP Paribas, Sumitomo Mitsui, Standard Chartered, PricewaterhouseCoopers, ThyssenKrupp, Uhde, the “industrial corporation of Mongolia” Co Ltd, and “Beren” to cooperate and to invest.

4. Improvements of research work

- A meeting of the working group was organized 3 times and met in person with related ministries and agencies each 3-4 times to ensure the fulfillment of the master plan and gathered their input.

- To intensify receiving, evaluating and concluding the report, set up a sub working group according to order number 124, made in 2012 by the director of NDIC.

- A decision was made to develop a comparative study for the location to construct the plants.

- A decision was made how to manage Sulphuric Acid and develop market research more accurately.

- Choose potential technology for the iron plant

- Arranged the calculation of the labor demand for each profession.

- Cooperated to prepare the information about international experience of industrial complex establishment (prepared the information, delivered to ЗГХЭГ-Mongolian Governmental agency).

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5. CONCLUSIONS ECONOMIC ANALYSIS

The economic study has been made according to international standards and methodology and based on cash flow.

	Sainshand (without discounts)	Return on investment period	Other location alternatives
Coke plant	15.0%	11	8.8%
Cement plant	7.8%	5	N/A
Pellet plant	4.4%	18	2.2%
DRI plant	N/A		N/A
Copper smelting plant	1.1%	25	0.6%
Coal gasification plant	9.1%**	14	N/A
Power plant	9.1%**	14	N/A

CONCLUSIONS ECONOMIC ANALYSIS

Ways to improve the productivity of the iron reduction and copper smelting plants that are intended to build into park:

- Provide power supply and rate discounts,
- Decrease the price of Syngas supplied to the iron reduction plant such as easing the coal price,
- Sulphuric Acid from the copper smelting plant,
- It is possible to use the approach for decreasing the cost of investment, by reducing import tax and VAT.

CONCLUSIONS ECONOMIC ANALYSIS

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CONCLUSIONS ECONOMIC ANALYSIS

Sainshand industrial park	Cement	Coke	Pellets	Smelted copper	DRI
Base case (Syngas price $9 /MMBtu)	7.3%	13.8%	3.2%	0.4%	N/A
Electricity (Syngas price $8 /MMBtu)	17.7%	10.4%	7.0%	3.5%	N/A
Equipment, construction material exempt from VAT and import duties		11.4%	9.0%	4.1%	N/A
Income tax exempted		14.0%	11.2%	5.1%	N/A
Water cost exempted			11.5%	5.5%	N/A
Governmental ownership of coal gasification plant (Syngas price $6/MMBtu)			12.8%	5.5%	N/A
100% cost subsidy for coal gasification plant (Syngas price $3/MMBtu)				5.6%	7.8%
Electricity cost subsidized for goal gasification plant (Syngas price $2/MMBtu)				5.6%	11.8%
Cost of investment reduced by 40%				9.4%	18.8%
Calculation with highest commodity prices				13.2%	

6. Determination of responsible organizations for implementation, needed technological development, production strategy, manufacturing and their issues

Interrelations between industrial and innovation policies

Industrialization program (2009-2016)

1. Provide a favorable legal and business environment for the industry
2. Contribute through industrial investment and financial, market policies
3. Find human resources required to maintain industrial operation
4. ***Intensify the introduction of industrial research, innovation, progressive technology and establish methodologies, technology innovation to increase industrial capacity and productivity***
5. Increase total production by promoting raw material processing
6. Support products toward export by trade policies

Innovation policy

Pleasant business environment	Provide and promote possibility to intellectual property become a part of the economic circuit Provide rebates and encouragement to start-up companies
New investment institution	- Establish innovation funds /ЗГТС/ - Establish venture investment funds
Human resource	Prepare specialized professionals Promote foreign specialists to work Develop business skills and entrepreneurship
Science and business cooperation	Science park, Research centers, Infrastructure for a national innovation framework
Technology innovation	Technology transfer, dispersion Technical and equipment innovation Companies based on technology
New markets, competing new products	- Nanotechnology, nano-material - Biotechnological products - Information technology, outsourcing - Electronics

Innovation development framework program in Mongolia (2008-2015)

Program of high-tech industry development (2012-2014)

Leading science and technology development program (2009-2014)

Law on Innovation (project)

National program Technology (project)

Mineral production

Vision	Strategy development	Strategic products	Universities and scientific institutes to implement related technologies
Use strategic fields of advanced technology, produce and export integrated cost end-products, develop new products for export	Coal production plant	•Coking coal •Gas •Liquid fuel •Chemical coal products	1. МУИС-ийн ХХТС 2. ШУА-ийн ХХТХ 3. ШУА-ийн ГЭБХ 4. ШУТИС-ийн МТС
	Base metal plant	•Cathode copper, copper wire •Enrich and explore precious metals •Car batteries	1. ШУТИС-ийн Уул уурхайн хүрээлэн 2. Эрдэнэт. Тех._сургууль
	Iron plant	•Heat resisting steel •Cold resisting steel •Construction reinforcement steel •Railway steel	1. ШУТИС-ийн Уул уурхайн хүрээлэн 2. ШУТИС-ийн МИС 3. Дархан. Тех._сургууль
	Crude oil production plant	•Diesel •Gasoline •Chemical and crude oil products	1. МУИС-ийн ХХТС 2. ШУТИС-ийн ГГТС

Power plant

Vision	Strategy development	Strategic products	Universities and scientific institutes to implement related technologies
Produce and export electricity from many sources	Heating • Coal • Gas	Electricity	1. ШУТИС-ийн ЭХИС 2. ШУТИС-ийн ДТҮЭХ
	Renewables •Sun •Wind •Water •Bio mass		1. Сэргээгдэх ЭХ-ний үндэсний төв 2. ШУА-ийн ФТХ
	Nuclear •Nuclear power plant •Enriched uranium •Processed uranium		1. МУИС-ийн Цөмийн судалгааны төв

Construction, railway and roads

Vision	Strategy development	Strategic products	Universities and scientific institutes to implement related technologies
Connect province, capital and regional centers by hard cover roads and railways.	Develop construction and construction materials production.	•Cement •Concrete •Bricks •Window glass •Paint	1. **ШУТИС-ийн БИАС** 2. **ШУТИС-ийн МИС** 3. **МУИС-ийн Шинэ матриал, хими-технологийн суд. Төв** 4. **МУИС-ийн ХХТС**
	Develop road and railway infrastructure	•Asphalt •Дайрга •Railway rails •Concrete railway sleepers	

Food, agriculture and light industry

Vision	Strategy development	Strategic products	Universities and scientific institutes to implement related technologies
Provide healthy food for the population, increase products for export	Animal industry	• Wool, cashmere products • Leather products • Meat and dairy products	1. **ШУТИС-ийн Нэхмэлийн хүрээлэн** 2. **ШУТИС-ийн УТДС** 3. **ШУТИС-ийн ХИБС** 4. **ХААИС** 5. **МААЭШХүрээлэн** 6. **АРМОНО Корпораци**
	Farming	• Grains • Potatoes • Vegetables • Ecological food products • Develop and plant selective fodder	1. **ХААИС** 2. **Дарханы УГТХ** 3. **ШУТИС-ийн ХИБС** 4. **ХАА-н Техникийн корпораци**

THANK YOU FOR YOUR ATTENTION!

(Attachment 4) Weak areas of Mongolian Industrial Engineer in Mongolia through interview to experts

As for weak areas of Mongolian industrial engineer, we got expert view through direct interview from OT and MUST. The lists below describe interview result as a reference.

(1) From interview to OT. (Underlined bold letter shows weak point)

Engineering field classification list

(Bold Letter shows weak field)

Interview to OT

Macrotaxonomy		Small classification		Macrotaxonomy		Small classificaion	
A	**Geo-engineering, Natural resources engineering**	1	**Geology**	H	**Materails engineering**	1	**Physical metallurgy**
		2	Lithology,Mineralogy, Science of Ore deposits			2	**Inorganic materials,psysical properties**
B	**Applied chemistry**	1	**Analytical chemistry**			3	**Composite materials, properties**
		2	**Synthetic chemistry**			4	**Structural, functional materials**
		3	High polymer chemistry			5	**Material processing, management**
		4	Functional material chemistry			6	**Metal industrial engineering**
		5	Environmental chemistry	I	Environmental engineering	1	Environmental change analysis
C	**Mechanical engineering**	1	**Mechanics of materials, strength of materials**			2	Environmental assessment, environmental policy
		2	**Industrial engineering, processing studies**			3	Radiation, influence of chemical substance
		3	**Design engineering, machine elements**			4	Environmental technology, environmental materials
		4	**Hydraulic and thermal engineering**	J	**Energy technology**	1	**Renewable energy**
		5	**Dynamics of machinery, machine control**			2	Nuclear energy engineering
		6	**Automotive engineering**			3	Bioenergy engineering
D	**Electric and electronic engineering**	1	**Electricity engineering, electricity conversion, electric equipment and supply**	K	Food technology	1	Brewing technology
		2	**Electromagnetic engineering, electric materials engineering**			2	Fermentation technology
		3	**Electronic device, electronic equipment**			3	Refrigerating engineering
		4	**Communication, network engineering**			4	Dairy engineering
		5	**System engineering**			5	Nutritional science
		6	**Instrumentation technology**			6	Hygiene
		7	**Control engineering**	L	Information engineering	1	Basic informatics
E	**Civil engineering**	1	**Materials of construction, operation, building management**			2	Software
		2	**Structural engineering, earthquake engineering, maintenance engineering**			3	Computer system, network
		3	**Geotechnical engineering**			4	Media informatics, database
		4	**Hudraulic engineering**			5	Intelligent information technology
		5	**Civil planning, traffic engineering**			6	Gognitive science
		6	**Civil environment system**	M	Industrial engineering	1	Production control
F	Architectural enigineering	1	Architectural designing			2	Production engineering
		2	Building structure, building materials			3	Quality control
		3	Building environment, facilities			4	Management engineering
		4	Urban planning, architectural planning	N	Nanotechnology	1	Nanostructure
G	Biotechnology	1	Genetic engineering			2	Nanomaterials

		2	Biotransformation			3	Micro, nano devices
		3	Bio-remediation			4	Nanobioscience
		4	Biology				

（2）From interview to MUST（Dr.Baasandash : Vice Director, Research and Innovation Dept.
(Underlined bold letter shows weak point)

Engineering field classification list

(Bold Letter shows weak field)

Interview to MUST

Macrotaxonomy		Small classification		Macrotaxonomy		Small classificaion	
A	Geo-engineering, Natural resources engineering	1	Geology	H	Materails engineering	1	Physical metallurgy
		2	Lithology,Mineralogy, Science of Ore deposits			2	**Inorganic materials,psysical properties**
B	**Applied chemistry**	1	**Analytical chemistry**			3	**Composite materials, properties**
		2	**Synthetic chemistry**			4	**Structural, functional materials**
		3	**High polymer chemistry**			5	**Material processing, management**
		4	**Functional material chemistry**			6	**Metal industrial engineering**
		5	Environmental chemistry	I	Environmental engineering	1	**Environmental change analysis**
C	**Mechanical engineering**	1	**Mechanics of materials, strength of materials**			2	**Environmental assessment, environmental policy**
		2	**Industrial engineering, processing studies**			3	**Radiation, influence of chemical substance**
		3	**Design engineering, machine elements**			4	**Environmental technology, environmental materials**
		4	**Hydraulic and thermal engineering**	J	Energy technology	1	Renewable energy
		5	**Dynamics of machinery, machine control**			2	**Nuclear energy engineering**
		6	Automotive engineering			3	**Bioenergy engineering**
D	**Electric and electronic engineering**	1	Electricity engineering, electricity conversion, electric equipment and supply	K	Food technology	1	Brewing technology
		2	**Electromagnetic engineering, electric materials engineering**			2	**Fermentation technology**
		3	Electronic device, electronic equipment			3	Refrigerating engineering
		4	Communication, network engineering			4	Dairy engineering
		5	System engineering			5	Nutritional science
		6	**Instrumentation technology**			6	**Hygiene**
		7	Control engineering	L	Information engineering	1	Basic informatics
E	**Civil engineering**	1	**Materials of construction, operation, building management**			2	Software
		2	**Structural engineering, earthquake engineering, maintenance engineering**			3	Computer system, network
		3	Geotechnical engineering			4	Media informatics, database
		4	**Hudraulic engineering**			5	Intelligent information technology
		5	Civil planning, traffic engineering			6	Gognitive science
		6	**Civil environment system**	M	Production engineering	1	**Production control**
F	**Architectural enigineering**	1	Architectural designing			2	**Production engineering**
		2	Building structure, building materials			3	**Quality control**
		3	**Building environment, facilities**			4	Management engineering

		4	Urban planning, architectural planning			1	**Nanostructure**
		1	Genetic engineering			2	**Nanomaterials**
		2	**Biotransformation**			3	**Micro, nano devices**
		3	Bio-remediation	**N**	**Nanotechnology**	4	**Nanobioscience**
G	**Biotechnology**	4	Biology				

(Appendix 5)

ACCREDITED HIGHER EDUCATION INSTITUTIONS /as of June 2012			
ACCREDITED UNIVERSITIES			
1	Mongolian State University of Education	8	University of the Humanities
2	Health Sciences University of Mongolia	9	Khovd University
3	National University of Mongolia	10	“Ikh Zasag” University
4	The Mongolian University of Science and Technology	11	“Orkhon” University
5	Mongolian State University of Agriculture	12	Defense University of Mongolia
6	Mongolian State University of Arts and Culture	13	University of Internal Affairs
7	"Otgontenger" University	14	National Academy of Governance
ACCREDITED INSTITUTIONS			
1	“Mongol Business” Institute	24	“Zasagt Khan” Institute
2	Institute of Accounting "Mandakh burtgel"	25	Mongolian National Institute
3	Ulaanbaatar Institute	26	“Sutai” Institute
4	Institute of Finance and Economics	27	“San” Insitute
5	“Otoch Manramba” Institute	28	“Mongol” Institute
6	Institute of Mongolian National Institute of Physical Education	29	“Shine Irgenshil” Institute
7	Mongolian Railway institute	30	Institute of Economics and Business
8	Institute of International Economics and Business	31	“Avarga” Institute
9	"Shihihutug" Law Institute	32	“Ulaanbaatar-Erdem-Sudlal” Institute
10	“Seruuleg” Institute	33	“Ach” Medical Institute
11	Plant Science, Agriculture Research and Training Institute of	34	“Citi” institute
12	Технологийн сургууль	35	Institute of Labour
13	"Tenger" Institute	36	“Tushee” Institute
14	Ider Institute	37	Institute of International Studies
15	Institute of Social Science	38	“Khangai” Institute
16	“Gazarchin” Institute	39	"Zokhiomj" Institute
17	“Ulaanbaatar-Erdem-Oyu” Institute	40	Choi.Lubsangjab "Language and Civilisation" Institute
18	Darkhan Institute	41	“Etugen” Institute
19	Dornod Institute	42	“Khuree” Institute
20	“Ikh Mongol” Institute	43	“Jonon” Institute
21	“Gurvan Erdene” Institute of Pedagogy	44	“MIU ”Institute
22	“Soyombo” Institute	45	“Global Leadership” Institute
23	“Chinges Khaan” Institute		
ACCREDITED COLLEGES			
1	“Soyol Erdem” College	7	“Tsetsee Gun” College
2	Mon-Altius” College	8	“Enkhorchlon” College
3	“Gurvan Tamir” College	9	“Sod Khiimori” College
4	"Dalay Van" College	10	“Enerel” College
5	Technical and Technological college	11	"Setguulch" College
6	Mongolian College Literature and Social Work		

Source: MECS

(Appendix 6)　National University of Mongolia (Facilities and Equipment)

- School of Chemistry and Chemical Technology






- School of Physics and Electronics,　Renewable Energy Program

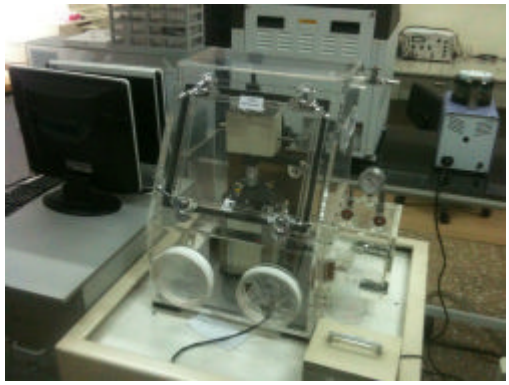


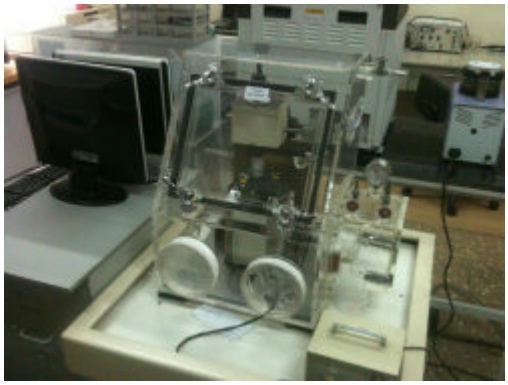


- School of Physics and Electronics, Nuclear technology program




- School of Chemistry and Chemical Technology, Nano-technology program





(Appendix 7)

Mongolian University of Science and Technology (Facilities and Equipment)

- **Faculty of Mathematics**





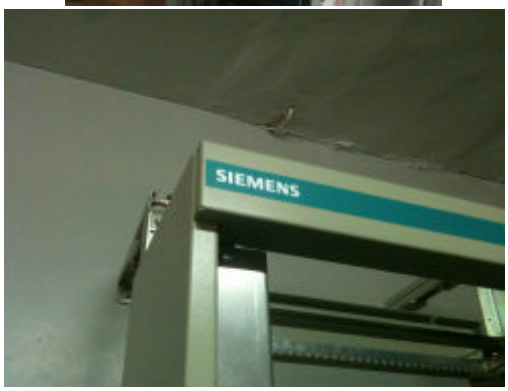


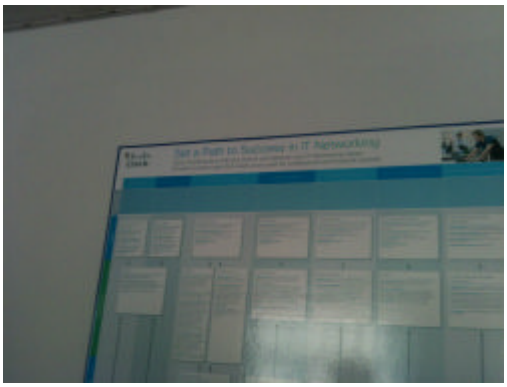
- School of Power Engineering




- Faculty of Information and Communication Technology





- Faculty of Industrial Technology and Design



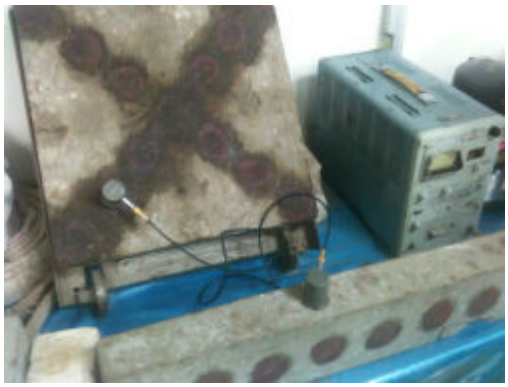



- **Faculty of Material's science**


- Faculty of Materials sciences, Mano-technology Laboratory

- Faculty of Geology and Petroleum Engineering

- **Faculty of Civil Engineering and Architecture**



(Attachment 8) Plan of setting up incubation centers in TVET

To strength the cooperation between TVET and companies, setting up incubation centers, promoting the employment and regional development, is one of the effective tools.

In order to cope with subjects, what MOL gives importance such as human resources development in TVET, promotion of small medium enterprises, poverty reduction, and employment creation, the cooperation among TVET teachers, local companies, and entrepreneurs is highly important. Observing the ASEAN case, there are many discussions to establish incubation centers in which local entrepreneurs are produced effectively. In Japan many local governments and universities established the incubation centers which intend to support entrepreneurs, it is often said that these incubation centers are not working well since the management lapses into only collecting a rental fee. It is ideal that both education and cultivation are available in incubation center at the same time.

Therefore, it is possible to nurture TVET students and local young people as an entrepreneur, using a vacant class room or dormitory in TVET and having a support from local companies and the chamber of commerce as a resource person.

Teaching Incubation Center in TVET (A draft)

- Location
  TVET Schools (use vacant rooms)
- Ideal size-use existing facilities
  One floor type/ Open and private rooms
- Center staff
  TVET teacher (business/career guidance)
  Operation staff
- Prospective tenants
  TVET teachers, students and local people
- Cooperation
  Local companies/the chamber of commerce
- Budget and rental costs
  Set by each TVET
- Benefits
  Access to the facility, and have advice and employment opportunities from local companies, the chamber of commerce, etc.

(Ex. Darkhan Business Incubator Center)