



Current Situation and Prospects of Higher Education of Engineering and Technology in Mongolia

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Abstract - In this study, we conducted a quantitative and qualitative analysis of the development policy and planning documents of our country, the quantitative and statistical data of the last 5 years of studies of students in this field, and the research data obtained from 86 educational institutions to determine the status and prospects of higher education of engineering technology in Mongolia. Due to the growing demand in the labor market for higher education specialists in engineering technology at the level of Mongolia, it is necessary to develop material and human resource planning for training qualified engineers and technicians in accordance with the development policy of active economic sectors.

Keywords— curriculum analysis, labor market, students, engineering education, technology skills, higher education

I. INTRODUCTION

In Mongolia, a four-level system of higher education (diploma, bachelor's, master's, doctorate) has been in place since 1995, when the Law on Higher Education was first approved and amended in 2002, 2006, 2012, 2015, and 2016. Institutions of Higher Education (HEIs) are independent legal entities according to this law and these are classified as universities, institutes of higher education, colleges, and colleges of technology. [1].

The number of universities and colleges operating in our country for the 2020-2021 academic year is 88. Of these, 37 (42.1 %) are universities, 45 (51.1 %) are institutes, 3 (3.4 %) are colleges, and 3 (3.4 %) are branches of foreign

universities. Also, 65 (73.9 %) are non-state-owned schools, 20 (22.7 %) are state-owned schools, and 3 (3.4%) are public/religious schools. The most of the HEIs (89.8 %) are located in Ulaanbaatar city and 10.2 % are in rural areas.

A total of 148,954 students are studying in the school in the 2021-2022 academic year. 12.8% of these students are engineering, manufacturing, and construction students. A total of 19,083 students are studying in 137 programs in this area. Moreover, 13,966 (73.1%) of these students are in the following detailed 5 fields: electricity and energy (4,925), civil and industrial construction (3,725), architecture and urban planning (1,819), mechanical and metallurgical production (1,788), and mining (1,709). Considering the level of education, there are 204 diploma students, 16646 bachelor's students, 1980 master's students, and 253 doctoral students [2].

II. IMPLEMENTED POLICIES AND RESULTS OF HIGHER EDUCATION

"Vision-2050" long-term development policy of Mongolia, "Government Action Program of Mongolia (2020-2024)", "Mid-term Education Sector Development Plan 2021-2030" to create basic conditions for effective implementation, economic, aimed at improving infrastructure and government productivity, and is a medium-term target program that will be implemented over a period of up to 10 years. As part of these policies, the "New Revival Policy" was approved in 2021, and a total of 20 projects to implement the program are directly related to the engineering and

technology sector. It is estimated that Mongolia needs 38,000 skilled engineers to implement the new revival policy.

In addition, within the framework of the medium-term strategic partnership program between Mongolia and Japan, the project "Higher education in engineering and technology" has been implemented since 2014 with a discounted yen loan. The main goal of the project is to prepare engineers and technology specialists with high knowledge and skills in Mongolia, to improve the competitiveness of engineering education, to strengthen teaching staff resources, to update the learning environment, and to improve quality. Within the framework of the project, joint bachelor's curriculum in "Construction and Environmental Engineering", "Architecture", and "Mechanical Engineering" are being implemented, as well as joint research is being carried out on 20 topics within the 8 priority areas of research of National University of Mongolian (NUM) and Mongolian University of Science and Technology (MUST).

Moreover, within the framework of the cooperation between the governments of the two countries, the joint Mongolian-German University of Mineral Technology was established in 2013, and the curriculum was developed jointly with Freiberg University of Technology, Aachen University of Technology, and other universities, inviting professors to teach professional courses.

We are working together to get support for training and research activities, participating in student exchange programs, industrial internships, and managing bachelor's work. This opens up the opportunity to study in the country with quality programs that meet international standards, while providing an opportunity to train engineers at the international level in the specialized professions that are urgently needed in the market [3].

III. RESEARCH METHODOLOGY

The purpose of the study is to analyze the current situation of higher education in Mongolian engineering and technology, and to develop recommendations to be reflected in the policies and activities of the higher education sector.

Research objectives:

1. Quantitative and qualitative analysis of Mongolian development policy planning documents
2. To analyze the statistics of the higher education sector
3. Analysis of employment research reports
4. Collecting, processing, and analyzing quantitative data of curriculums and students implemented in the last 5 years from 86 TVETs operating at the level of Mongolia.

Data analysis and processing were performed using SPSS 23.0 research software, in accordance with quality requirements. A comparative analysis of single counts and participant factors expressed in numbers and percentages is done.

A. Study results

General requirements for the program are approved by the order A/178 and A/370 of the Ministry of Education, Culture and Science of 2014, and the name and index of the training program are approved by the order of the Minister of Education, Culture and Science A/78 of 2014.

A total of 86 universities participating in the study are implementing bachelor's, master's and doctoral curricula. Of these, 20 state-owned universities organized 774 (49.9%) courses, and 64 non-state-owned universities held 692 (44.6%) programs (2020-2021 academic year).

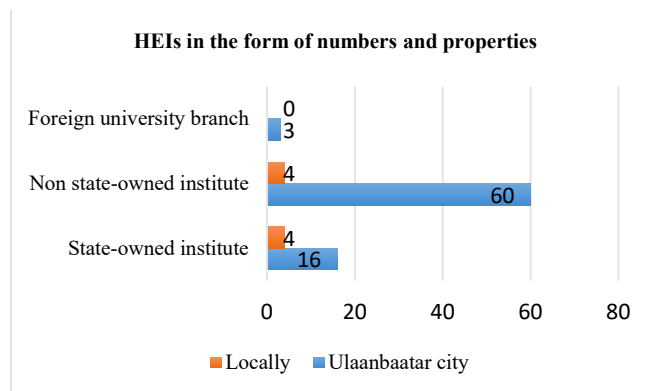


Fig 1 . HEIs in the form of numbers and properties

18.2% of the 88 secondary schools operating in the 2020-2021 school year are state-owned, 68.2% are non-state-owned, and 3.4% are foreign branch schools. Out of 88 institutions of higher education, 80 are located in Ulaanbaatar and 8 are placed in rural areas.

According to the classification of the World Bank, 71.2% of universities, 21.2% of colleges, 0.6% of foreign-invested HEIs, 1.5% of foreign-invested higher education institutions, and 0.1% of foreign-invested HEIs are organizing training programs.

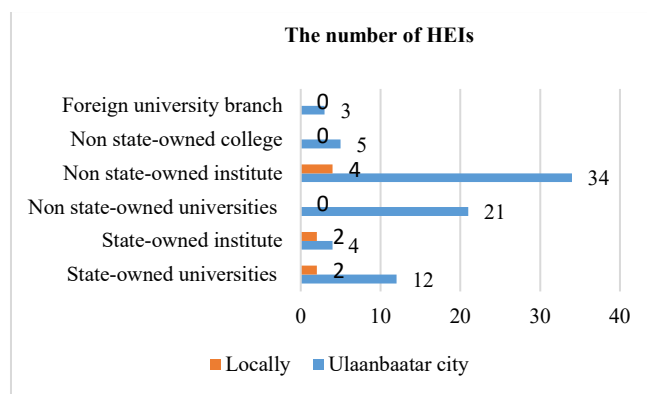


Fig 2. The number of HEIs (by HEIs)

State and non-state-owned HEIs are more concentrated in capital cities in terms of location.

The school that implements the most curriculum of the state-owned HEI is MUST-183 curriculum, while NUM-118 curriculum are organized. The total number of curriculum is 1466, of which 692 are state-owned and 774 are non-state-

owned. Among the non-state owned universities, the largest number of curriculum are organized by the National University of Mongolia with 68 curriculum, the Ikh Zasag International University with 31 curriculum, and the University of Humanities with 29 curriculum.

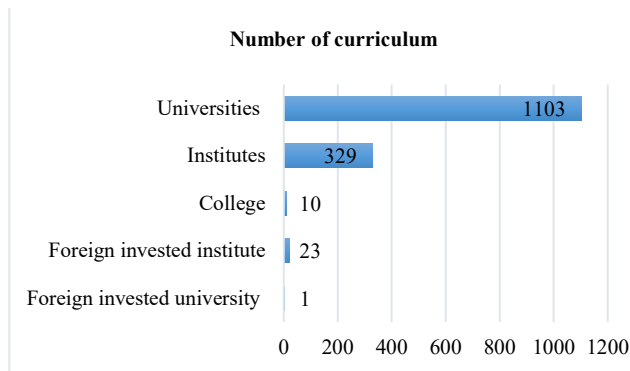


Fig 3. Number of curriculum (by HEIs)

From the results of the overlap analysis of our curriculum, it was seen that the most courses are organized in engineering, production and design studies.

Table 1. Curriculum Overlap in Engineering, Manufacturing, and Design

Number of curriculum being implemented	Number of schools implementing the curriculum	Percentage
1	113	69.3
2	16	9.8
3	11	6.7
4	10	6.1
5	1	0.6
6	1	0.6
7	1	0.6
8	1	0.6
9	2	1.2
13	4	2.5
19	1	0.6
163	333	-

The largest number of curriculum (345 (22.3%)) are implemented in engineering, manufacturing, and design.

Therefore, we aim to clarify the degree to which the students who graduate in this field are working according to the qualification in accordance with the demand of the labor market.

Figure 4 shows that schools that offer curriculum in civil engineering, architecture, and mining exploitation are the most numerous.

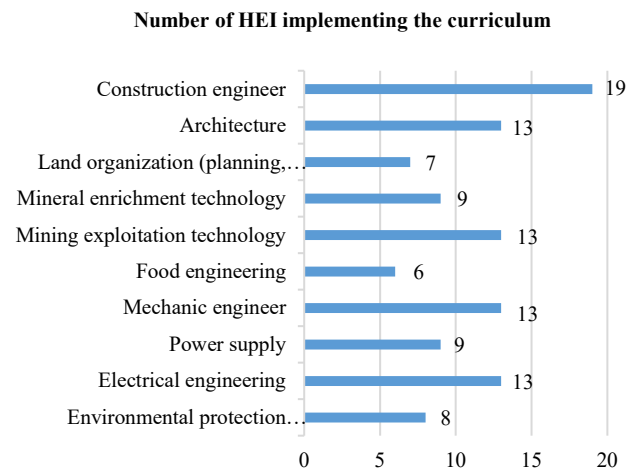


Fig 4. Curriculum overlap by name and number of curricula implementing the curriculum

According to the 2021 barometric survey of Mongolia's labor market demand, the sectors with the highest demand for labor in 2022 are trade, construction, manufacturing, hotels, apartments, and catering services, as in previous years. Total workers of 12.7% who were employed in the last 12 months were employed in the construction sector, 9.8 percent were hired in the manufacturing sector, and 8.5% were engaged in the education sector, which is 31.0% of all newly employed workers in the last 12 months [4].

According to follow-up studies conducted in recent years, the percentage of workers needed in the engineering and technology sector is high, on the one hand, as shown that the appropriate ratio of human resources trained by this program is being met, but in reality, phenomenon is still exists in the demand for simple occupations which do not require special skills, education and skills makes up the majority of the total demand. Particularly, construction and production assistants, cleaners, and security guards have been regularly mentioned in the list of in-demand occupations for the past 10 years. This is directly related to the high mobility of workers in these professions and the instability of employment. In most developing countries, commonly the uneducated population is jobless, while in our country educated people tend to be more unemployed.

Also, this is due to high participation in professional and higher education. Also, 22.9 % of graduates who are out of the labor force or economically inactive are the potential labor force interested in paid employment. By school type, 17.6% of HEIs graduates are out of the workforce, and 29.4% of vocational education and training institutions graduates are in the potential workforce. 26.1% of the potential labor force is male and 73.9% is female.

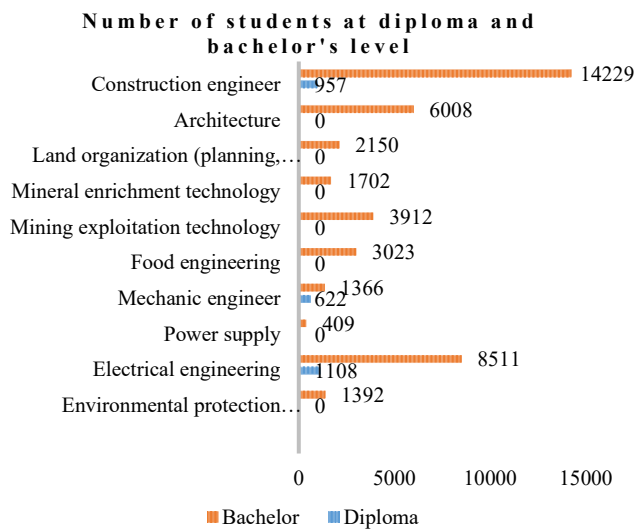


Fig 5. Number of students at diploma and bachelor's level (2016-2021)

As we can see from the above figure, the demand for students in construction and minerals continues to grow. Besides, according to the 2019 graduate employment survey, looking at the transition of economic activity since 2017, 79.8% of graduates in construction and architecture and 72.7 percent of graduates in mathematics and statistics are still the highest compared to employed within 3 years [5]. The salaries of workers with engineering and technology specialization are high compared to other fields, and the number of students are not decreasing due to the expansion of the infrastructure and construction industry in our country.

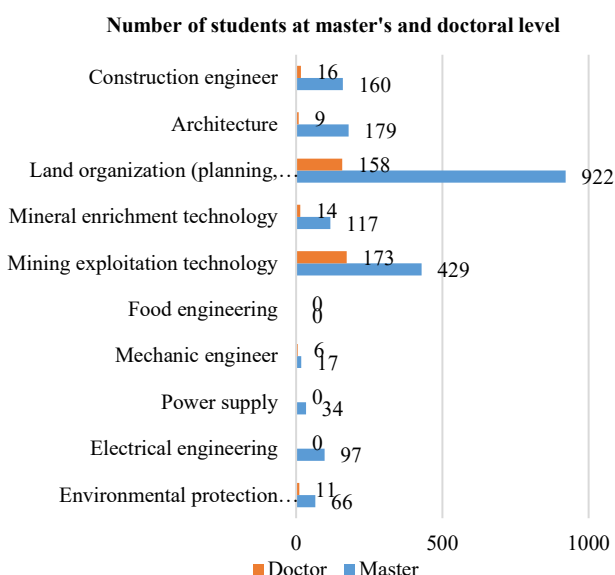


Fig 6. Number of students at master's and doctoral level (2016-2021)

Figure 6 shown that future specialists will have land management (planning, cadastre) and mining technology, which is in line with the policy plan for the development of satellite cities in our country, likewise, there are reasons such as the fact that it is economically more beneficial to develop and employ internal human resources instead of employing

foreign experts at high salaries in the mining industry. All graduates of 34.4 percent of the academic year 2017-2018 got a job right after graduation. Almost all doctoral graduates (96.2%) and 80.1% of master's graduates have jobs, while the employment status of bachelor's graduates is about 27.1%. It is believed that it is due to the fact that he/she does not have time to get a job [6].

Table 2. Number of students at research level and students at diploma and bachelor's level (2016-2021)

Curriculum name	Diploma, Bachelor	Doctor, Master	Number ratio (percentage)
Environmental protection technology	1392	77	5.5
Electrical engineer	9619	97	1
Power supply	409	34	8.3
Mechanic engineering	1988	23	1.2
Food engineering	3023	0	0
Mining exploitation technology	3912	602	15.4
Mineral enrichment technology	1702	131	7.7
Land organization (planning, cadaster)	2150	1080	50.2
Architecture	6008	188	3.1
Construction engineering	15186	176	1.2

Table 2 shows that the number of students in the above-mentioned curriculum did not decrease. According to the 2019 research conducted by the Labor and Social Security Research Institute, 83.8% of the graduates who were employed in 2017 are still employed, 2.0% are unemployed, and 14.2% are economically inactive.

To find out whether the graduates who were employed in that year are employed in that field in 2019 by school type, 58.6% of HEIs graduates and 53.6% of TVET graduates are still working in their respective fields, while 41.4% of HEIs graduates and 46.4% of TVET graduates are working in other fields. University graduates 9 out of 10 who are employed, and professional education and training institutions graduates 7 out of 10 are working in permanent jobs. One of the most pressing skills shortages for graduates in the workplace is foreign language skills, the need for which is increasing year by year. As well as, professional skills and teamwork skills continue to play a significant role in the skills shortage faced by graduates.

However, skills such as knowledge of science and technology, use and mastery of information technology occupy a certain percentage in the first year of employment, but as time passes, the percentage of missing skills decreases [7]. Total 28.6 percent of graduates have problems related to educational inconsistency. This is an increase of 2.6 point compared to the previous year. Three years after graduation, graduates who are employed lack of soft skills such as teamwork, time management, communication, organization, and decision-making. During the three-year period, the

graduates are deficient in foreign language, computer, document processing, professional knowledge and skills.

IV. CONCLUSION

1. The high percentage of universities that offer only one curriculum in the field of engineering shows that there is little duplication of curriculum in this field. However, there is a high demand for human resources in this field, according to labor market research and information from professional organizations.
2. The number of master's degree students in the field of land management (planning, cadastre) is the highest percentage of bachelor's and diploma level students, which shows that there is a human resource for research and analysis in this area.
3. There is a tendency to increase the demand for specialists with higher education in engineering and technology for the implementation of the goals and objectives included in the action plans comprised in the long-term and short-term development policy documents of Mongolia.
4. Although construction and engineering specialization programs continue to produce personnel, there are still economically inactive graduates due to the unstable employment of alumni and the lack of skills in the workplace. In the future, it is necessary to carry out a detailed study of the factors affecting them and work in the direction of reducing the negative consequences.

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