



619413-EPP-1-2020-1-HU-EPPKA2-CBHE-JP

***T*Ackling the *C*limate change through *M*odernizing
*E*nvironmental *E*ngineering program – **TACMEE****

Brief report

Content

- Review of current environmental field of Mongolia (based on the available data)
- SWOT
- Survey results

Policies and action plans, Mongolia

Mongolia-2050 Vision

- **Education- quality and equity education**
- **Favorable living environment:**
 - Reduce air, water, soil pollution and noise level and create clean and green environment
 - Completely remove the negative impact on human health and the economy caused by environmental pollution, and create a comfortable eco-environment in cities, soums and settlements with parking lots, green areas, swimming pools and sporting spaces for residents to relax and spend their leisure time.
- **Green Development:**
 - Ensure and protect the value benefits of nature and maintain a balance of primary ecosystems
 - Rehabilitate natural resources, reduce scarcity, create productive resources and pass on to generations
 - Prevent water scarcity, accumulate surface water and create solutions to fully meet needs
 - Contribute to international efforts to mitigate climate change by developing low emission, productive and inclusive green economy

Source: Vision-2050 long term development policy of Mongolia, 2020

2021-2024 Government action plan

- Enhance the productivity of the main mining companies (Cu, Mo, Au, Ag, feldspar, steel, and others)
- Establish the factory recovery of rare elements
- Agriculture IV program will be established

Source: Government action plan, 2021

Climate

- Warming of over 2°C and declines in rainfall reported between 1940 and 2015
- Chronic drought, and increased exposure to secondary impacts (dust storms etc.,)
- Extreme climate-driven hazards including heat wave, drought, and river flood expected to increase
- potential loss of forest cover and associated species.
- pressure on yields of current agricultural crops, particularly wheat

Air

- The worst air quality in the world according to IQAir AirVisual air quality index (AQI).
- National air quality monitoring network showed large and significant reductions of 46% and 55% in the maximum PM_{2.5} and PM₁₀ concentrations in Ulaanbaatar, respectively in 2020.

Environment

Water

- Increasing water consumption, driven by rapid urban population increase and economic activity, is placing severe demands on Mongolia's groundwater supply.
- Groundwater reserves – the source of approximately 80% of Mongolia's water consumption – are deteriorating
- Up to 40% of the total population is supplied with unsafe drinking water, a trend that has continued for the last three years

Soil, solid waste

- Recent years show that 13 percent of the soil in Ulaanbaatar city has eroded to some extent due to the wrongdoings of citizens, entities and organizations, and 70 percent of the eroded areas are currently in a state of severe degradation.
- As ash and waste negatively impact air and soil pollution, a working group has been established on the matter of ash sorting and recycling.

HEI in environmental science, natural sciences and engineering

Higher education institutes	Number of graduates		
	Environment sciences	Natural sciences	Engineering and engineering trades
2019	210/162/1	115/92/19/1	3502/3081/237/12

Bachelor in Environmental Engineering

- National University of Mongolian
- German-Mongolian Institute of Mongolia
- Mongolian University of Science and Technology
- Mongolian University of life Sciences (SAB)
- New Mongol Institute of Technology (discontinued)

Master in Environmental Engineering

- Mongolian University of life Sciences (SAB)

SWOT Analysis

		Strength	Weakness
Internal		<ul style="list-style-type: none"> - Environmental related policies and regulations becoming more stringent - Establishment of liquid and solid waste treatment systems - Traditional view to protect nature 	<ul style="list-style-type: none"> - Lack of using modern technologies: recycling/ recovering - Insufficient practical skills during education institutes - Not equipped with necessary skills of future demand - Analytical laboratories have not enough sensitive equipment (or no human resource) - Limited/ not enough data base for environment
	External		
		Opportunity	Threads
	<ul style="list-style-type: none"> - High requirements for environmental protection and reclamation - Initiating of the partnership between industry and education institute - Collaboration with different technological enterprises - Funding of climate related projects 	<ul style="list-style-type: none"> - Complex environmental issues related to climate change and others - Shortage of human resources/ professionals in hydrology, environmental engineering - Reputation of Environmental engineering is not strong compared to other environmental science 	

STEEP trend analysis

Social

- 3.3 million population
- Increasing number of the chronically ill people
- Increased number of graduates who studied abroad
- Increase of the number of people who is critical about social issues, social engagement

Technology

- Use and application of electronics
- New, smart, automated technologies
- Technologies with Renewable energy
- Adaptation and use of Environmental engineering technologies
- Green engineering technologies
- Smart an passive house technologies

Economy

- Mining industry still will be important role in the economy
- National brand products, natural based products will be exported
- Increase of the SMEs
- Recycling SME increase

Environment

- Depletion of natural resources and increase of degradation
- Climate change and its related issues
- Pastureland desertification
- Emerging pollutants
- Urbanization and also center of provinces faces the waste problem
- Drinking water resource
- Application of renewable resources

Politics, policies

- Tendency of political stability
- More stringent environmental law and responsibilities

Implications as Opportunities / Challenges and in Shaping the Future of Work

Opportunities

- SME scale environmental engineering solution companies will be increased
- Water treatment units established on each private and public companies
- Smart technologies for analysis

Challenges

- Deficiency of human resources in Environmental engineering
- Automation of industrial processes
- Climate change will influence all sectors

Future of work

- An engineer with a basic understanding of software and sensors and the ability to correctly identify and resolve environmental pollution correctly interprets and implements environmental law

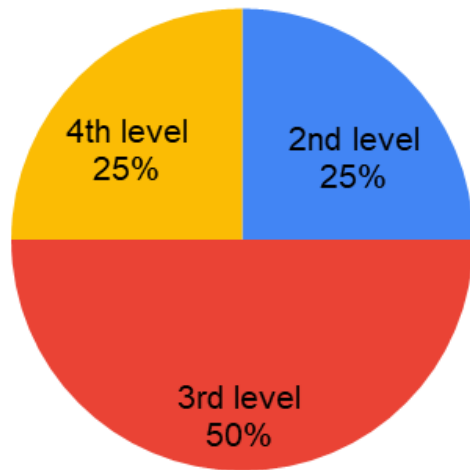
New Competencies

What new competencies are needed to meet the opportunities, challenges and new future of work?
What are the requisite attitudes, mindsets, skills & knowledge/thinking?

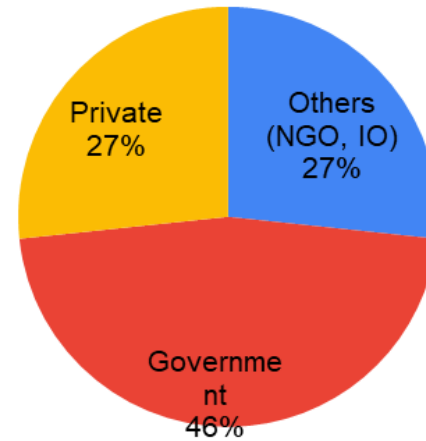
New competencies

- Ability to evaluate situations and understand others
- Creative, Developer and implementer of engineering solutions
- Work in a team
- Have high professional and personal ethics -
- Ability to use smart/technologies in their profession

Which level do you study?



Organizations that engaged in survey



Involved: Senior and *Mid-level managers*

How would you rate the importance of the program learning outcome

	Students	Current evaluation	Stakeholders
Be able to use theoretical and practical skills in environmental engineering	4.8	3.8	4.3
Identify human impacts on global and regional ecological issues and develop risk reduction and resolution techniques	4.6	3.6	4.3
Design engineering design develop the appropriate quality management methods and implement them	4.3	3.2	4.2
Be able to understand trends in technical and technological development, scientific and technical processes as a whole, and their impact on the environment.	4.4	3.1	4.6
Continuously develop his/her knowledge, skills and attitudes, be responsible and flexible	4.6	3.5	4.4
Responsible use of environmental and other legal knowledge	4.3	3.4	4.1

How would you rate the major curriculum areas?

	Students	Stakeholders
Environmental chemistry	3.9	3.9
Waste water treatment	4.6	4.1
Solid waste management and treatment	4.5	4.4
Hazardous waste management and treatment	4.4	4.2
Air pollution, its characteristics and treatment methods	4.8	4.1
Drinking water its treatment	4.7	4.1
Environmental contamination, its fate, transport	4.5	4.3
Climate change, adaptation, mitigation technologies	4.5	4.1
Engineering cartography	3.7	3.7
Environmental rehabilitation	4.7	4.3
Environmental toxicology	4.4	4.1
Waste gas treatment	4.2	3.7
Urban planning and logistics	3.9	3.9
Resource management, recycling and recovery	4.4	4.1
Environmental microbiology and its application	4.3	3.9
Project management	4.4	3.9

5- very important, 4- important, 3- someway important, 2- little important, 1- not important, x- no answer

Evaluate the importance of following skills and competencies

	Students	Stakeholders
Technical knowledge and skills	2.9	3.9
Ability to learn and apply technology and its advances	3.3	4.1
Practical skills to apply analytical methods to determine the contaminants	3.6	4.1
Ability to use applied and professional programs	3.3	4.0
Oral and written communication skills	4.2	4.1
Teamwork	4.2	4.1
Problem solving skills	4.1	4.1
Ability to work actively	4.1	4.1
Have a positive work attitude	4.2	4.1
Creative, innovative skills	4.3	3.9
Leadership, organizational skills		3.8

5- very important, 4- important, 3- someway important, 2- little important, 1- not important, x- no answer

Overall satisfaction of students

	Students
Quality of teaching	4.3
The guidance, counseling or advice that you were given regarding program	4.0
Library facilities	3.8
Laboratory and practical facilities	2.9
Computer facilities	3.3
Online learning facilities	3.7
Overall Environmental engineering courses	4.2

5- very satisfied, 4- satisfied, 3- somewhat satisfied, 2- little satisfied, 1- not satisfied, x- no answer

Other suggestions to improve the learning outcome

Increase the hours of laboratory and practices (field practice)

Skills to use the rapid analytical test (sensors,

Develop and use Environmental modeling

Professional ethics

Data analytical programs/languages

Research and innovations skills

Anything to emit from the curriculum

**Leadership
and
management is
not necessary**

**General
education
subjects
overloaded**

**Too much
focus on the
language is not
good**

Suggestions to include into them main curriculum topics

- Mathematical modeling
- Wildlife protection, rehabilitation
- Increase the hours of field works
- Environmental management systems
- Microbiology
- Programming languages

Overall how to improve the implementation of curriculum

Need more information about curriculum

- Brochure
- Handout
- Social media activities

Collaborative projects

Internship activities

Increase the number of admission

Environmental engineering laboratory (thematic- not final)

- 1 Safety and data analysis
- 2 Optimum Coagulant Dosage by Jar Test
- 3 Break Point Chlorination
- 4 Determination of sludge volume index
- 5 Adsorption of methylene blue on activated carbon
- 6 Filtration of waste gas
- 7 Solid waste structure and characterization
- 8 Solids / sediment analysis
- 9 Lake profile
- 10 Gas sampling and analysis
- 11 Water purification

Need some assistance

- Paper contract to establish an evaluation group for tendering process
- Templates for reporting
- Thematic list of Environmental engineering labs (UZ and UO)