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INNOVATION PROCESS OF THE MONGOLIAN HIGHER EDUCATION INSTITUTION AND ITS DEVELOPMENT PERSPECTIVE

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Abstract:-
Higher education institutions are part of the sub system that is to create knowledge base for the Mongolian national innovation system. Innovation process of the higher education institution aims at applying innovation into practice for the purpose of improving profitability, competitive edge, and productivity; undertaking activities to improve the quality of higher education, significant process improvement and the main outcome will be economic benefits and improvement in the social wellbeing.

Keywords:-*Mongolia, higher education, innovation, innovation process.*

I. INTRODUCTION

One of the developmental strategies in developed countries is that they initiate innovations in social, economic and technological sphere and they embody and promote these strategies. Innovation has been part of humankind history, but the concept has become popular very recently. One of the important criteria to evaluate a country's competitiveness is innovation activism where countries have developed and implemented policies and programs that corresponds to their needs. [1] The developed nations perceive innovation as a major factor of growth and developing nations perceive it as an opportunity to catch up with the other countries in short amount of time. [2]

Intellectual Property Organization of the United Nations has been assessing how countries have promoted innovations since 2007 by using "The Global Innovation Index" measurement. Mongolia scored 33.41 and was ranked at 58 out of 131 countries that were measured by "The Global Innovation Index"in 2020. Mongolian "Innovation Input Sub-Index 2020" score was 41.47 and was ranked 65 out of 66 countries." [3]

Since the transition to market economy, Mongolia has emphasized the development of science and technology and; innovation issues. Since 2006, it has been taking action to develop the legal environment of the innovation, devise programs, identify priority areas, and implement them. For example, "National Innovation System Development Program"(2007), "National Policy on High Technology Industry"(2010), "Law on Innovation"(2012), "National Policy on Innovation"(2018), and "Priority Areas of the Innovation" (2019) have took effect and they are being implemented. The higher education institutions are having streak of good progress in terms of the implementation of "Vision-2050"'s, Mongolian long-term development policy, goal which is "to become a research institute and a hub of training, training development, and innovation". [4]

II. CURRENT SITUATION OF THE INNOVATION PROCESS OF THE HIGHER EDUCATION INSTITUTIONS

Mongolia has adopted internationally recognized innovation systems theoretical models in the national innovation system development policies, programs and action plans. They are market-evolution model, free market- drastic change model, institutional development model, innovation activism model, and knowledge activism model.

"Innovation process" is an activity of organizing the industry for the purpose of developing new products by adopting new methodology and designs in the production process. In other words, innovation process refers to the activities of transferring the scientific knowledge of the innovation and applying them into practice while using the innovative ideas to create products and services or technology. Innovation process is composed of 5 stages and 7 elements. Please see following table for details. \Table 1\

№	**Stages of Innovation Process**	**Elements of Innovation Process**
1	Science	Innovation
2	Research	Innovation marketing
3	Design	Innovation production
4	Production	Innovation implementation
5	Application	Innovation progress
6		Technical and Economic Assessment of the Innovation
7		Application of innovation

Table 1- Stages and Element of Innovation Process

The higher education institutions shall adhere to the stages and elements outlined above in their innovation process.
"Innovation" is the result of using findings from the scientific research and development for the purpose of streamlining the process in all social sphere, including education, culture, science, economy, law and social relations. Innovation is the result of applying the novel for the purpose of reaping the benefits in social, economic, ecological and science sector and making management changes. [5] It is also a result of applying new designs of organizing management, labor, by using new research and monitoring methods and investments into new technology. The Mongolian Law on Innovation states that "innovation" is the products, services, marketing, and management solutions which resulted from process of transferring new knowledge into wealth, "innovation process" is the activities undertaken for the purpose of increasing the profitability, competitive edge and productivity by applying innovation into practice and improving the social services. Therefore, Mongolian government is paying tremendous attention on the higher education institution's innovation process development through circulating new knowledge, created as a result of research and development, in the economy, improving competitive edge, improving higher education service quality and amplifying its benefits. Moreover, "The National Policy of Innovation" is being implemented in in close conjunction with the science, technology, higher education, hi-tech industry, creative arts industry, food, agriculture, mineral resources, energy, green development and intellectual property policy, banking and finance, customs, and taxation policies. For example, an assessment criteria [6] has been developed in order to implement the objectives [7] of developing the higher education's innovation process by circulating the new knowledge, created as result of research and development work, in the economy. \Table 2\

#	Policy Objective	Assessment criteria	UOM	Base level		Target level	
				Year	Criteria	Year	Criteria
1	Developing the higher education's innovation process by circulating the new knowledge, created as result of research and development work, in the economy	Number of products and services created as a result of investment in start-up business through a designated fund.	number	2018	0	2021	5
2		Number of start-up companies which received compensations or deductions in accordance with the law.	number	2018	6	2021-2025	36
3		Number of intellectual properties circulating in the economy.	number	2018	2	2021-2025	10
4		Number of hi-tech factories and products and services created as a result of investments from private sector.	number	2018	5	2025	15
5		Percentage of higher education students who have participated in programs for entrepreneurship and business.	percentage	2018	0	2025	0.5

Table 2-Assessment criteria of the higher education institution's innovation process development level

Higher education institutions have started actively developing innovation processes in order to meet the objective above. An organizational unit within the higher education institution plays a significant role in planning the development of innovation process, organizing, directing, and managing. \Table 3\ For example:

Universities	National University of Mongolia	Mongolian National University of Medical Sciences	Mongolian University of Science and Technology	Mongolian University of Life Sciences	Mongolian National University of Education
Start year of innovation process	2011	2013	2009	2006	2014
An organizational unit responsible for the higher education innovation process	Innovation and technology transfer center	Department of Science and Technology, Innovation and technology transfer center	Department of academic research and innovation, Technology transfer center	Innovation and business development unit	Department of academic research and innovation

Table 3.-An organizational unit responsible for the higher education innovation process

Innovation and technology transfer centers at the higher education institutions in Mongolia play a major role in accelerating the innovation process. The innovation process of the higher education institutions can be assessed by the intellectual property (patent, new works, optimal solution, efficient model, trademark, intellectual property rights) and technology transfer measurements (start-up companies, license agreement, cooperation agreements with private sector entities). For example, Mongolian University of Life Sciences has recorded 48 patents, 25 new works, 53 optimal solutions, 210 efficient models, 5 trademarks, 94 intellectual property rights on the "Intellectual Property Information" as of October 2020. [8]

The comparison of technology transfer shows that National University of Mongolia is developing 3 startup businesses, Mongolian University of Life Sciences 11, Mongolian National University of Medical Sciences 2, and Mongolian University of Science and Technology 4. The findings from the universities show that having the opportunity to make expenditures from innovation process income and reap its benefits, will result in improved financial capability.

III.DEVELOPMENT TREND OF THE HIGHER EDUCATION INSTITUTIONS INNOVATION PROCESS

There are 7330 professors and academics working in 95 higher education institutions and 4254 researchers and scientist working in 62 academic research institutes in Mongolia. [9]

It is expected that higher education institutions will play a major role in implementing the "Vision-2050"

[10] Mongolian government's long-term development policy. One of the objectives in the document states that "Develop a national science, technology and innovation system with the competitive edge in the international market".

[11] Implementation stages and expected outcomes of the policy are planned as follows:

Stage I (2021-2030): Develop science and technology sector as one of the major factors to national sustainable development and ensure an efficient national innovation system.

Stage II (2031-2040): Comprise a system to bring the national science sector and innovation to the world market.

Stage III (2041-2050): Development of internationally competitive science and technological sector.

By 2050, the successful implementation of the objectives will bring 1) priority areas such as nano, bio, information technology, artificial intelligence, green and digital economy, intellectual industry sectors highly competitive in the world, and 2) increase the weight of the science and technology industry products in the export products by supporting hi-tech research and development.
In addition, Mongolian government has implemented "Priority areas for Innovation Process" as adopted by the cabinet meeting on October 2, 2020. The following table shows the priority areas of innovation process of 2019-2023. \Table 4\

#	**Priority area**	**Processes**
1	Information technology	Develop artificial intelligence, product development based on artificial intelligence, big data mining, protection, product development
2	Technology of new material	Animal skin, wool, cashmere in-depth processing, ventilation material development, new fuel material
3	Biotechnology	Industrial technology/ applying biotechnology on the agricultural and natural raw material to develop food, medicine, vaccine, bio supplements; veterinary medicines and vaccines; and medicines for protecting vegetation.
4	Renewable energy technology	Technology to store energy, energy efficient technology, construction and facilities using an up-to date technology.
5	Cultural innovation based on the national distinction, creative arts industry	Contents base on digital technology, cultural services, state and business services on smart devices

Table 4- Priority areas of Mongolian innovation process

For the first time in our history "Standing committee on innovation and digital policy" was established at the Mongolian parliament on July 9, 2020. The committee will be responsible for digital governance policy and processes, policy on introducing innovation into production and service industries in order to improve economic efficiency, national policy on innovation, policy to support private sector participation in introducing innovation products and services in international market, policy on developing infrastructure for innovation and framework of operation, policy on financing innovation, technical and technological upgrade.

Mongolian government action plan objective states that (2020-2024) the government will centralize resources by establishing national centers in cooperation with the universities and academic research institutes for the purpose of developing scientific and technological innovations; and improve the social, economic and scientific benefits of the research work by increasing the allocated expense and ensuring the proper utilization of it. [12] In details:

1. Identify the priority research areas for science, technology, innovation sector, capacity building of the researcher, increase the research and development budget by 4-fold.
2. Start the construction work for a science, technology and innovation park, center, and construction work for traditional medicine and technological institutions and bring it up to international standards.
3. Create a competitive environment for academic research work by adopting the social and economic benefits as the assessment criteria and improve the sector's competitive edge by establishing unified, categorized and open laboratories.

In addition, the action plan states that the government will support creative arts industry that encompasses innovation in the light of traditional contents, cultural tourism, film, classical arts and music productions, increase the types of services and circulate in the economy.
Higher education institutions in Mongolia have devised a mid and long-term programs for developing innovation processes in line with the innovation policy, goals and priority areas and its being implemented.

IV. CONCLUSION

Innovation is a complex process that transfers intellectual property, which resulted from scientific and technological endeavors and can provide solutions to social and economic situations, into wealth. [13]
According to Frascati manual of 1993, innovation is defined as the "final result of a process that introduces new and updated product into the market, streamlines the technological process and improves the social services". [14]
The higher education institutions shall consider the following three major pre-requisites in their innovation processes.

1. Application and need for the new idea and technology
2. Human resources and technological capability to implement new idea and technology
3. Financial support to promote the wider usage in the society.

These pre-requisites establish the grounds for innovation process development in high education institutions.
In order to develop innovation processes, higher education institutions shall undertake the following actions:

- Introduce lectures on intellectual properties, innovation, entrepreneurship management into the curriculum,
- Develop an institution where newly established companies in their infant stage, can get professional support in a one-stop-shop.

- Establish infrastructure for developing a start-up company, business incubator, shared office, adopt international practices and cooperate with international experts,
- Establish an innovative company that can create new and improved products and services,
- Develop open laboratories that promote inter-disciplinary research,
- Support the innovation and technology transfer center's activities, capacity building of the human resources, increase opportunities to work with professional organizations,
- Develop science and technology, evaluation on the intellectual property, accelerate the technology transfer, cooperate with the professional organization in promoting innovative culture,
- Support and develop public and private partnership.

Innovation process of the higher education institutions in Mongolia will succeed in a condition that there is a well-equipped human resource, hi-tech and enough financial capabilities.

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