

## ARTICLE

## The role of intermediaries in sectoral innovation systems: The case of Mongolian information technology sector

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**Abstract:** This paper analyses the types of innovation intermediaries that have emerged in Mongolia and investigates their roles within the information technology sector of the country. The study finds that diverse innovation intermediaries have emerged, and the majority of the intermediaries are non-sector specific, with only a few specializing in a single industry. The sector-specific intermediary plays a crucial role in building linkages and providing access to resources in sectoral innovation systems in developing countries. The study identifies several constraints related to funding and innovation policy support for these intermediaries. Consistent policy and financial support for sector-specific intermediary organizations could strengthen their role in the developing countries, particularly those with limited human and capital resources, such as Mongolia.

This study contributes to an important understanding of the roles of intermediaries in underdeveloped and newly developed immature innovation systems of developing countries with low income and limited resources. As for the innovation system of Mongolia, it is impending to strengthen the sector-specific intermediary organizations through government and budgetary support and training for specialized human resources. The study also provides valuable insights that can guide the future development of the industry.

**Keywords:** *sectoral innovation system, innovation intermediaries, Mongolia, software industry;*

### INTRODUCTION

The innovation system concept has garnered significant attention among researchers since its emergence in the mid-1980s and has been studied extensively for several decades. The concept is internationally recognized as a crucial tool

for increasing competitiveness and overcoming underdevelopment in a brief spell of time, and efforts have been made to achieve high-performance innovation systems.

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Countries around the world have different development history of innovation systems (IS), and the research methodology, theory or standards have yet to be established or maintained [1]. Countries that have developed IS specific to their nations [2] apparently have the most successful experience in this sphere. Researchers categorized the IS approach as geographical, technological, and sectoral based on the general features and detailed studies conducted in various subsectors, including national, regional, technological, and sector-specific innovation systems [3], [4], [5], [6], [7], [8]. Regardless of the type of IS, the primary function is to develop an innovation, and the system actors are responsible for developing, creating, and diffusing the innovation.

The success of IS relies on the effectiveness of key actors, and it also determines the system's errors and outcomes. If the key actors fail to fulfil their roles, the secondary actors or intermediaries like industry associations or technology transfer offices can coordinate the interactions. In this sense, effective policies and planning are crucial in detecting and correcting failures by considering the direct and indirect actors equally and studying each in detail. The definition of the system in a broader term, such as national or regional, may inhibit the ability to specify the role of performances or identify and correct the errors. This can cause challenges for newly established IS of developing countries with limited resources in determining which activities to prioritize. Most researchers agree that the innovation system allows a country with limited resources to achieve rapid growth and progress in its development, regardless of its context, with the right mix of imported knowledge/technology and localized or domestically developed knowledge [5]. Thus, the sectoral innovation system (SIS) approach focuses on specific demand-based product production groups, and the system may

have a broader impact as it extends to production subsystems [9], product groups, and segments.

The researchers proposed the approach of considering the operation of the IS from the functional point of view to evaluate capabilities and analyse problems faced by the system [10], [11], [12], [13], [14]. The key activities of the IS are defined as 3 general components or 10 specific elements. Although it differs in numbers, the principles remain the same when grouped based on meaning. It is desirable to make a list of system functions or activities, however limiting them to a certain number and scope is not appropriate [11], [15]. Nonetheless, the high priority is to study the role of constituent or bridging elements in correcting and rectifying failures within the IS [16]. Some researchers studied the role of intermediaries in both developed and developing countries, focusing on various sectors; examples include the work of Intarakumnerd et al., in Thailand [16], [17], Klerkx et al., in Chile and the Netherlands [19], [20], Shou et al., in China and Thailand, and Germundsson et al., in Sweden [21]. These researchers found various intermediary organizations, including industry-specific and cross-industry, as well as regional, local, and national systems that have played crucial roles in developing SIS.

Mongolia is confronted with challenges in establishing the IS, just like all other developing countries with incomplete IS. This is evident from the integrated reports assessing international innovation indicators, such as the Global Innovation Index and the Competitiveness Index, and some domestic research literature [22], [23], [24], [25], [26]. Mongolia was one of the former command socialist states that went through socio-economic transitions in 1990. As developing countries like Mongolia move away from these drastic changes, the need to specify the origin, development, and functions of innovation

connector/intermediary organizations becomes increasingly important every year. To address this gap, we adopted the research model developed by Klerkx [19] and Intarakumnerd [18] and focused on a country that has experienced a socio-economic transition and was developing a new SIS. This research aims to answer complex issues by initially examining the types of intermediaries established and evolved in developing countries. Subsequently, it has explored what types of intermediaries play what roles and rectify system errors and the opportunities they create through the SIS concept within the software sector in Mongolia.

The article is divided into 3 sections; the first half of Section 1, discusses the role of the intermediaries and the concept of the SIS. The second half of this Section focuses on studying and integrating Mongolia's innovation policy and intermediary organizations. In section 2, we outlined the research methodology and described the roles of the intermediaries. And finally, we have summarized recommendations and findings of intermediary capabilities, resources, and requirements that are necessary for innovation policy. The findings may benefit managers or policymakers in similar developing countries that have undergone systemic transition, as they provide insights and recommendations for addressing their challenges.

### **Theoretical framework**

#### ***The roles of intermediaries in sectoral innovation systems***

The role of the intermediary organizations is to connect and strengthen the links within the IS and to create a complex network [6], [8], [12]. The term *structure* is also considered a "*network*" in a sectoral innovation system (SIS).

The SIS refers to a collection of new and existing products designed for a particular application, along with the knowledge base, the relevant learning process, basic technology, and a group of agents participating in market and non-market interactions involved in creating, producing, and selling them [7]. The entities that support innovation activities are also included within those agents and are generally referred to as innovation intermediaries [27]. Before the term "innovation intermediary" emerged, researchers used a number of different names such as intermediary firms, intermediaries, bridge builders, links, brokers, and coworking organizations. The researcher Howells [27] defined the terms of *innovation intermediaries*. He discovered that the main activities and roles of all intermediaries are similar, such as transferring newly developed knowledge and technology from research institutions or universities to companies in a particular industry and providing consulting services that involve intellectual property and business knowledge.

As defined by Howells, an innovation intermediary is an organization or an institution that acts as an agent or broker in any part of the innovation process involving two or more parties [27]. Henceforth, this article will use the following definition of an innovation intermediary: "According to the SIS approach, a sectoral innovation intermediary is an organization that links and understands the needs of actors in the innovation process and provides them with crucial information. Importantly, it also offers essential services to industry organizations, ensuring they have the support they need to access and utilize

resources that may be otherwise difficult to obtain".

Innovation intermediary organizations can be broadly classified into three categories: Knowledge Intensive Business Service (KIBS) providers, Research and Technology Organizations (RTOs), and (semi-) Public Organizations or Industry Associations [28]. Additionally, intermediaries can be categorized as traditional or emerging based on their origin and innovative activity, which directly relate to the development and evolution of the social and economic sectors.

Interdependence, network structure, knowledge type and base, and actors' performance vary from sector to sector, as intermediaries differ in their scope of activity. For instance, some brokers exclusively serve their specific sector, while others operate nationally, internationally, and across different regions [29]. The role of intermediaries in the system can be either direct or indirect. Intermediaries involved in the innovation process play various crucial roles, including linking key actors; bridging gaps in understanding; providing or assisting in acquiring knowledge and technology; evaluating technology; coordinating cooperation; facilitating and bridging capacity building to access critical resources such as investment, technology and talent; supporting market introduction, checking, proving, verifying, consulting; and planning policies and participating in developing/changing the legal framework [27], [28], [30], [31]. Regarding ownership, intermediaries are classified as public, private, or mixed, while they can be for-profit or non-profit for operational purposes.

In addition to the mentioned roles,

intermediaries are responsible for identifying and rectifying functionality errors in the IS. System failures can occur during the following core innovation processes: These include 1) Provision of new knowledge, 2) Competitiveness building of human resources, 3) Formation of new product markets, 4) Specifying and assessing of levels of new product quality, 5) Creating and changing organizations necessary for developing new fields of innovation, 6) Networking to connect actors, 7) Creating and changing the legal environment, 8) Incubation activities, 9) Financing and investing, and 10) Provision of consultancy services related to the innovation process (Edquist, 2011). A summarization all research works note that the intermediary organization of the IS has four principal roles: a) consulting, b) mediating, c) brokering, and d) providing resources [31]. Even though intermediaries play a crucial role in mediating innovation processes, their activities vary based on the characteristics of the types of SIS [18].

Given that innovation sectors differ as constituent elements of a system, it is essential to grasp the various structures and functions of sector-specific innovation intermediaries. Therefore, Intarakumnerd et al. [18] and their research team utilized the SIS approach to investigate the role and potential of various types of intermediaries in rectifying weak and flawed innovation systems in developing countries using the case of the Thai automobile industry. This study was significant for understanding the structure, goals, and implementation of intermediary organizations in developing countries, particularly in determining that the structure that affects their efficiency performance. Nevertheless, for underdeveloped or emerging innovation

systems in low-income and resource-limited former socialist countries, there is still a need to address issues related to the emergence and development of intermediary organizations and variations in their roles and availability.

### ***Innovation policy and innovation intermediaries in Mongolia***

The concept of innovation is still relatively new in Mongolia given the country's ongoing transition from the former socialist system to a free market system, which began in 1990. Developing the production sector's technology is key to successfully implementing this system transition. Mongolia has relied on foreign technology resources and investments to develop its manufacturing sector. In addition to supporting foreign investment, Mongolia has also focused on forming and developing the national innovation system. Like other developing countries, it strives to overcome its development gap by implementing innovation policy within the public policy framework.

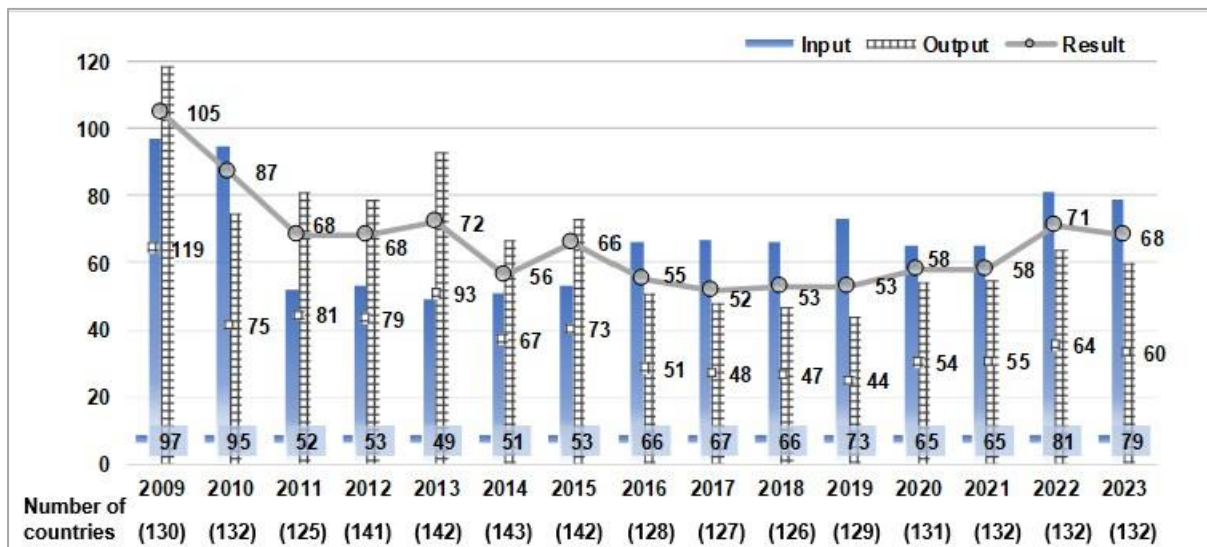
In 2007, Mongolia adopted the "Master Plan for the Development of Science and Technology from 2007 to 2020" and set the goal of "Modernizing the economy through technological innovation". Within the framework of the above objectives, the "Innovation System Development Program in Mongolia" was approved and implemented in 2008, and the "Law on Innovation" was passed in 2012, which established the legal framework for

the national innovation system [32]. The long-term development policy of Mongolia - "Vision 2050" sets goals for developing a national science, technology, and innovation system with international competitiveness [33].

Because of the system transition, government policies, development strategies, and laws have rapidly changed with new approvals and revocations. For example, between 1990 and 2020, 12 documents related to the development of the IS were approved and then revoked. There were a further 11 policies created by the government regarding the development of the sector, which were included in the "Vision 2050" long-term development policy, which form the basis for implementing the integrated innovation policy. This process indicates that Mongolia's innovation policies have come a long way. After overcoming significant challenges, it has transitioned from general to specific approaches with long-, medium-, and short-term planning.

In less developed countries such as Mongolia, the development of IS is still in its early stages, which has been a significant challenge in addressing errors rooted in the composition, capabilities, and resources of the system's elements. The reports, such as the Global Innovation Index (GII), the Competitiveness Index, and domestic research results, indicate that the main weakness of the Mongolian IS is the lack of coordination within the system [22], [23], [24], [25], [26].

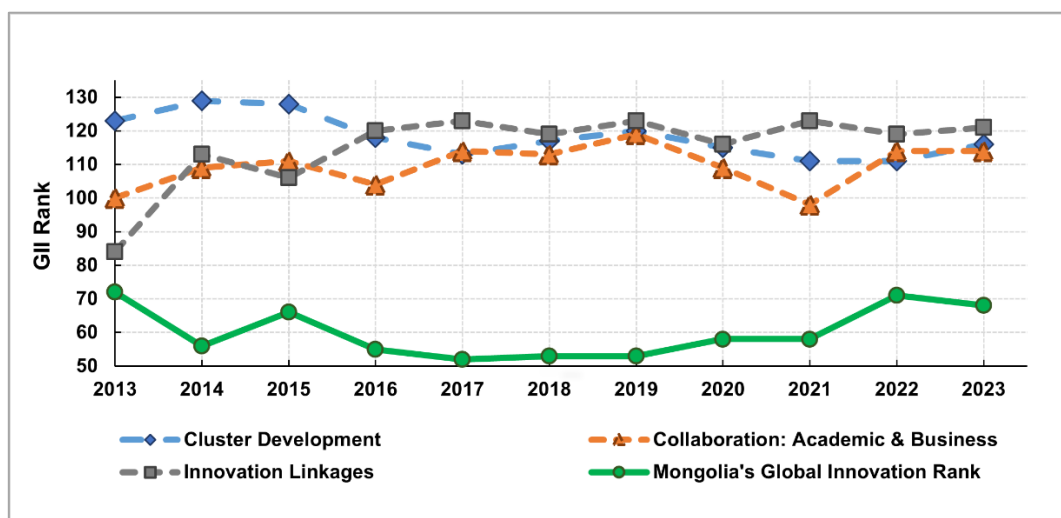




**Figure 1. Mongolian innovation Input and Output Sub-Index and integrated index ranking, as of 2023.**Source: Global Innovation Index Reports 2009-2023 (<http://www.globalinnovationindex.org>)

In the GII Report, conducted for 2009-2023, Mongolia's input and output innovation index was compared with that of about 130 countries worldwide (Figure 1). Despite having a low input rank and limited resources, Mongolia has managed to exceed its expected output performance, demonstrating the potential that ranks it at an average level of about 60th among all countries. Mongolia has improved its

general score over the entire 15-year research period. However, the lack of progress in IS coordination and partnership indicators, such as cluster development, collaboration between academic institutions and private firms, and innovation links, which are the general indicators to determine the quality of the country's innovation system, continues to remain a weakness (Figure 2).

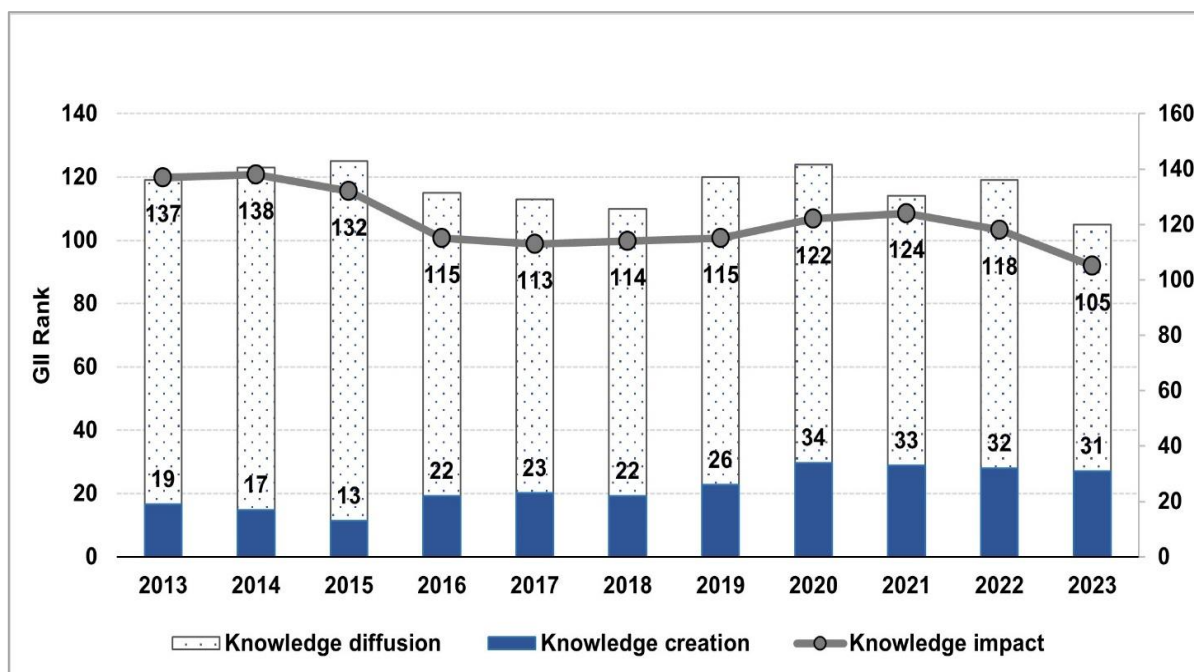


**Figure 2. Weak Indicators of Mongolia's Global Innovation Index (2013-2023)**  
Source: Global Innovation Index Reports, 2013-2023

The IS index of Mongolia is higher than expected among countries belonging to the same income group (low-middle income), whereas, in terms of quality indicators, it has been ranked 100 out of 130 countries included as in the GII report from 2009 to 2019. This underscores the urgent need for more effective implementation of the policy documents designed at fostering the development and support of the IS. On the other hand, while the knowledge creation level is in the top 30 on average regarding resources spent (Figure 3), the impact and dissemination/diffusion of the created knowledge on the development of the nation ranks more than 100. Figure 3 indicates a significant issue: limited knowledge creators' and users' coordination and cooperation. This lack of coordination among the elements of the IS is a key challenge. Specifically, the absence of partnership and coordination between knowledge-creating parties, particularly state-owned institutions and private

property participants, suggests that the impact and diffusion of knowledge are not interrelated. These issues are indicative of system failures during the implementation of IS processes, such as the supply or efficient dissemination of new knowledge, the creation of new product markets, the creation of organizations necessary for the development of innovations, the linkages, incubating of actors, technology transferring, and business-legal professional consults.

International professional organizations (World Bank, OECD, WIPO) have recommended improving the linkages between public-private organizations and supporting innovation by developing various tools adaptable to the country's characteristics, including co-working spaces, incubators, technology transfer centers, venture capitals, and consulting services.



**Figure 3. Indicators related to innovation system knowledge, Mongolia**  
Source: Global Innovation Index Reports, 2013-2023

In order to realize this recommendation, Mongolia created an IS element specialized in the policymaking level and formed conditions for developing and implementing a more specific innovation policy by establishing a standing committee on innovation and e-policy for the first time in the structure of the Parliament in 2020. By binding together the policy of IS and digital development while focusing resources on the priority areas, the policy of evolving innovation intermediaries to help implement innovation has been defined, and attention has been directed to forming and operating effective innovation links [33].

Based on the research reports mentioned above, it is important to determine whether innovation intermediaries have been established in Mongolia or whether they are functioning effectively. Otherwise, for countries transitioning from a centrally planned economy with a single property system to a system of multiple property forms and free competition, the lack of institutes at the legal or organizational levels responsible for connecting, understanding, coordinating, and mediating between innovation actors may cause significant challenges.

## MATERIALS AND METHODS

Research on intermediaries in innovation systems remains unexplored in developing countries, particularly in the former socialist countries. Therefore, the following research questions arise:

- *What types of intermediaries emerged after the system transition?*
- *In which sectors are those intermediaries dominant?*

- *How does the form of public and private property affect their activities and success?*
- *What kind of intermediary capabilities and spare capacities are required?*

In this article, Mongolia, as a developing country that has undergone a system transition, is studied as a case to explore the origin and development of IS intermediaries and the functions of public and private intermediary organizations. The research focuses on the software industry sector and aims to contribute to addressing unexplored areas. The research was conducted in two stages to explore IS intermediaries. First, intermediary organizations were identified using a questionnaire survey based on the of Klerkx et al., [19] methodology, focusing on their activities, roles, and functions, with an emphasis on differences arising from public and private ownership forms (see Table 1). Second, a case study analysis was undertaken to analyse the policies, developmental stages, and contributions to addressing system failures and fostering innovation within the specific sector.

This paper aims to study and explain, using SIS approaches, the differences in functions and opportunities of intermediaries depending on the forms of property in the former socialist countries, where the majority of forms transferred from under the state's control to private firms and companies; thus, we did not prioritize to detect all the intermediary organizations operating in Mongolia.



**Table 1. Main fields of research on innovation intermediaries**

Type of fields	Explanation
<ul style="list-style-type: none"> <li>- Regular activities</li> <li>- Functions of innovation intermediaries</li> <li>- Bridging types</li> <li>- Sectors /production industries/</li> <li>- Scope of activities</li> <li>- Business model</li> <li>- The timeframe of the organization since its founding</li> <li>- Independence</li> <li>- Key deliverables/ achievements</li> <li>- Key issues/drawbacks</li> <li>- Effects on the innovation system performance</li> </ul>	<p>Technology transfer, incubator, consulting, supporting to build investments, broker, etc</p> <p>Consultant, broker, mediator, resource provide</p> <p>Academic institutions – industry, public organizations – private sectors, among businesses, etc.</p> <p>Life science, Information technology –communication, etc.</p> <p>Sector, regional, national, international, etc.</p> <p>Non for-profit, for-profit, private sector, etc.</p> <p>Long history, newly established in recent years, etc.</p> <p>Independence, dependence, attached or part of other wider organization</p> <p>Reported results on network, cultural change, and organizational structure</p> <p>Legal, financial, efficiency, etc.</p> <p>Implications for the innovation system on governance and legal change</p>

Source: Based on the research methodology of Klerkx et al., [19]

As a result of the first round of research, general information of 22 established organizations was gathered that participated in the study, each serving a specific role as an innovation intermediary in Mongolia. Among these, 3 intermediaries specializing in information technology were identified. Of the three intermediaries considered, two were excluded for the following reasons: the first, established in 2021, lacked sufficient operational history to provide a reliable basis for evaluating its performance, and the second, an industry-representative organization, did not have a clear and developed organizational structure, which made it unsuitable for detailed analysis. The third intermediary, the National Information Technology Park (NITP) of Mongolia, was selected as it demonstrated a clear and well-defined role within the IS software industry. We studied the policy, development stage, and role of the intermediary organization of the IS software industry and analysed the potential resources using the National

Information Technology Park in Mongolia as an example.

## RESULTS AND DISCUSSION

### *Characterization of innovation intermediaries: origin, organizational form and roles*

In this section, we aim to explain some of the characteristics and special conditions of the intermediary organizations included in the study (see Table 2). An analysis of the activities of the 22 intermediaries highlights five key roles in fostering business and innovation development. These organizations provide a) incubation and support for startups through coworking spaces and accelerator programs. They also deliver b) consulting and mentoring, guiding businesses in overcoming challenges and navigating growth opportunities, alongside c) training and capacity building to enhance workforce competencies. Furthermore, intermediaries facilitate d) networking and investment connections, linking entrepreneurs with

investors and resources to drive expansion. Finally, they play a vital role in e) policy and legal advocacy ensuring regulatory alignment, intellectual property protection, and effective public-private partnership.

With regard to the number of employees working in the organization, out of the 22 organizations considered, 7 have 10 or more employees, while the remaining 15 have less than 10 employees. The vast majority (over 80%) of these organizations are newly established and began operating after the implementation of the national innovation system creation program in Mongolia. Currently, around 20 per cent of them have wholly or partially ceased their activities, and the human resource turnover rate has exceeded 30 per cent.

The dominant sectors in which the main activities are carried out include information technology, life sciences, and biotechnology. More than one half of intermediaries are involved in extensive activities across all sectors. In contrast, the remaining half are engaged in several sectors, while the remainder focuses solely on one specific sector.

The majority of organizations responded that they were established to bridge actors, facilitate effective collaboration, and support activities in the national innovation system. Most of them concluded that they have significantly impacted on fostering a community that promotes understanding and a common culture among the key actors in IS, establishing networks within a particular framework, and implementing initiatives for innovation cooperation. The surveyed participants agreed that although the nascent and developing networks are small, they could serve as a foundation for further expansion. However, some organizations

cautioned to the reduction of effectiveness and degradation of conditions for mutually beneficial cooperation due to the innovation culture and lack of confidence among parties.

Most survey participants stated that the lack of specialized human resources, the large gap in common culture and understanding, and the lack of confidence are the key problems and challenges.

The joint table about general information on intermediaries shows that private organizations dominate most coworking offices, incubators, and accelerator programs regarding activity, whereas technology transfer offices are concentrated in academic institutions. A prevailing section of intermediaries focus on training, consulting, and expanding the innovation network, while a few are engaged in investment-related activities. For the scope of activities, most have operated at the national level, while a few of them are operating at the local and international levels.

Out of organizations conducted in a specific industry, the National Information Technology Park (NITP) is the only one with more than 10 employees. In addition, MOSA is the only organization for innovation mediation that has endured the tests and challenges in the industry.

Additionally, many intermediaries were established as a result of the policy to form and develop the national IS. Most of these organizations are not purely intermediaries but rather part of key elements of the IS or the system with a hybrid feature to play dual roles to a certain extent.

**Table 2. Summary of the studied innovation intermediary organizations**

Organization names	Year founded	Number of employees working on intermediation/total	Sectors	Type of intermediation relationship	Type of intermediation role (consultant, broker, mediator, resource provider)	Activities	Organizational form		Scope (international, national, regional)
National Information Technology Park	2002	27/42	Information Technology (IT), Software, Hardware	Multilateral	Consultant, Broker, Mediator, Resource provider	Business incubator, Coworking office, IT policy development, Supporting the development and formation of the sectoral business and ecosystem, Training of the HR, Advertising to the public, Providing consulting Link to investment and network	Public, not-for-profit		National, International
Mongolian National Chamber of Commerce and Industry	1995	3/98	All sectors	Multilateral	Consultant, Broker, Mediator	Coordinate, connect, and support the development of business, To establish a system of public-private negotiations, To protect business-related laws and policy documentation, solution, implementation, and improvement, Certification, Arbitration, Support with training, Research	Chamber, not-for-profit		National, International
MOSA Mongolian Software Industry Association	2007	1/1	IT, Software	Multilateral	Mediator	Public-private coordinator, Legal, business rights and policy regulations for introducing products and services of enterprises to the market, Public dissemination	NGO, not-for-profit		National
Socratus Startup Studio	2018	10/14	IT, Education, Biotechnology	Trilateral	Consultant, Resource provider	Coworking office, Incubate innovative projects/firms, and startups, Support for investment, Incubator program based on systems engineering, Support with training Consulting, Network building	Ltd, for-profit		National
Startup Mongolia	2011	4/4	All sectors	Trilateral, Multilateral	Consultant, Mediator	Support with training, Mentoring, Consulting and implementation of innovation ecosystem development projects	NGO, not-for-profit		National, International
Startup Terminal	2016	7/10	All sectors	Trilateral	Consultant, Resource provider	Coworking office, Mentoring, Support with training,	Ltd, for-profit		National

						Network building that needs access to investment and other technical resources, Link with later-stage investors		
Club Coworking*	2015	3/5	All sectors	Bilateral	Consultant	Coworking office, Training for HR, business, and innovation projects Event organizing	Ltd, for-profit	Regional
Gerel+ Creative Coworking Space*	2016	3/3	Creative industries	Trilateral	Consultant, Resource provider	Coworking office, Helping creative works to enter the domestic and global market Support with training, Network building	Ltd, for-profit	National
MStars Hub	2021	4/5	IT	Trilateral	Consultant, Resource provider	Coworking office, Accelerator program, Linking with international and national investors, Network building	Ltd, for-profit	National
WorkCentral*	2017	4/6	All sectors	Trilateral	Consultant, Resource provider	Coworking office, Accelerator program, Network building, Support with training, Networking events with investors	Ltd, not-for-profit	National
Startup Marketing Space*	2017	6/9	All sectors	Trilateral	Consultant, Resource provider	Coworking office, Incubator, Support with training and programs, Consulting service, Broker to investment	Ltd, for-profit	National
Hub Innovation Center	2018	6/35	All sectors	Trilateral	Consultant, Resource provider	Coworking office, Business incubator, Support with training, Event organizing, Network building	Public	Regional
Inno hub	2023	5/10	Life science, All sectors	Trilateral	Consultant, Resource provider	Coworking office, Accelerator program, Consulting service, Broker to investment	Ltd, for-profit	National
Moffice	2019	5/7	All sectors	Trilateral	Consultant	Coworking office, Consulting service, Support with training	Ltd, for-profit	National
M-Space*	2018	7/10	All sectors	Trilateral	Consultant, Resource provider	Coworking office, Incubator, Accelerator program, Consulting service, Support with training, Network building, Event organizing	NGO and Ltd	National, International

START	2019	2/2	All sectors	Trilateral	Consultant, Resource provider	Incubator, Accelerator program, Investment and fund-building activities, Disseminating innovative products and services to the market Supporting implementation of innovative program and project	Ltd, for-profit	National
MUST Innovation and Technology Transfer Office	1998	3/3	All sectors related to engineer and technology	Trilateral	Consultant, Broker	IP consulting Technology transfer, Incubating startups and innovation projects, Consulting service Support with training	Public, not-for-profit	National
Open Innovation Lab*	2015	1/1	All sectors	Trilateral	Consultant	Coworking office, Incubating startups and innovation projects, Consulting services, Support with training	Public, not-for-profit	Regional
NUM Technology Transfer Office	2011	2/2	All sectors	Trilateral	Consultant, Broker	IP consulting, Technology transfer, Management, Ensuring the participation of professor and researcher, Supporting implementation of innovative program and project	Public, not-for-profit	National
MULS Technology Transfer Office	2005	2/2	Life science, Biotechnology	Trilateral	Consultant, Broker	Research science, Medium-term program, Incubating innovative products, Intellectual property, Consulting service	Public, not-for-profit	National
MNUMS Department of Science and Technology	2013	2/6	Medical science, Biomedicine, Pharmaceuticals, Traditional medicine, Public health science	Trilateral	Consultant	Research center, Scientific research projects, New technology and product development, Providing researchers and employees with innovation policy and planning	Public, not-for-profit	National
MAS Coworking Space22	2023	3/5	All sectors	Trilateral	Consultant, Broker	Coworking office, Support with training, Innovative programs, Network building, Intellectual property	Public, not-for-profit	National



### ***Roles of the MNITP in the Mongolian Software Industry***

The National Information Technology Park (NITP) was established under the Ministry of Education and Science with the support of the Republic of Korea, according to Government Resolution No. 107 of 2002. The above resolution started the organization's activities on June 1, 2002, to develop the IT industry and enhance the competitiveness of firms operating in the sector by creating an incubator environment for newly operating IT companies and establishing a database of the information network of science and technology. NITP is not a government agency but is established as a state-owned corporation specializing in science, technology, and industry. At that time, the central government decided to provide 80 million MNT annually in financial support until NITP is able to finance itself from its operating income and become fully independent. This support continued until 2016, when NITP's organizational structure was renewed. In the process of development, NITP's goals and objectives have been expanded to include support for startups and ecosystem development; provision of comprehensive incubator services and innovation development; not only disseminating the support system but also creating the research and development trends; fostering collaboration between Park-Industry-Research and academic institutions; cultivating intellectual property culture and technology transfer system; enhancing human resource skills; implementing specific management policies and planning; and improving the

legal environment.

The Information Access Center (IAC) was established and started operating at NITP in 2022 with the help of the National Information Agency (NIA) of the Republic of Korea. This center is also responsible for achieving the digital skills of citizens, organizing courses to empower people with functional disabilities, supporting content makers, and encouraging innovation activities for citizens.

NITP consists of 6 departments with a total of 42 employees. Figure 4 shows NITP's organizational structure. 27 employees serve as innovation mediators, focusing on developing the IT industry, providing consulting services, training and empowering human resources, offering information, networking with investors, supporting market dissemination, and presenting proposals to decision-makers in sectoral policy and legislation. NITP conducts various key activities, some of which are as follows:

#### **Support companies in the sector**

**A. Incubator services were provided to support the growth of sectoral firms and have been particularly successful (see Table 3). The following incubator services are offered through cooperation with specialized teams, the private sector, and universities which includes:**

- Main Incubator
- Accubator/Combination of advanced incubator and accelerator/
- Virtual incubator
- Women's business incubator
- Student business incubator

*Table 3. Overview information of NITP Incubator Activities*

№	Index /2002-2022/	Statistics data
1	Incubating period	3 months to 2 years
2	Number of companies launched to market	140 companies
3	Number of created workplaces	1,500 workplaces
4	Number of top graduate companies	13 companies
5	Total number of admissions	42 enrollments
6	Number of incubated companies and graduates	128 companies and graduates
7	Number of successful companies	85 companies
8	Incubator capacity, per enrollment period	20 companies
9	The size of the total area of the building	1000 square meters
10	Amount of investment	MNT 15.028 billion for 151 companies

Source: National Information Technology Park

#### **B. Accelerator Program:**

- Post-incubator services
- Virtual office
- “TechGer” coworking space
- Co-learning space
- IT Hub

#### **C. Consulting service:**

- Consulting for legislation, financial, marketing and technology
- Consulting for the protection of intellectual property rights
- Consulting for research and product development

#### **Development and support of Human resource**

NITP organizes specialized

courses in IT human resource skills development, both independently and in collaboration with academic institutions. The organization also arranges international examinations. It has been involved in this work since 2006 and currently holds the right of 3 international examination centers (see Table 4).

More than 3,500 students have successfully graduated from 9 fields of training, capacity building, and skill development for information technology specialists and have received NITP certificates. NITP participates in the sectoral IS as a consultant, broker, mediator, and resource provider, and it also operates the business incubator, which serves as the main infrastructure element of SIS.

**Table 4. Results of the International Examination of NITP**

№	Examination name	Number of examinations	Number of candidates	Number of certificates
1	Information Technology Engineering Exam (ITEE) (Japan)	32	2,533	367
2	Test of Practical Competency in ICT (TOPCIT) (Republic of Korea)	9	393	1
3	International Certification of Digital Literacy (ICDL) (Singapore)	3	18	11
Total		44	2,944	379

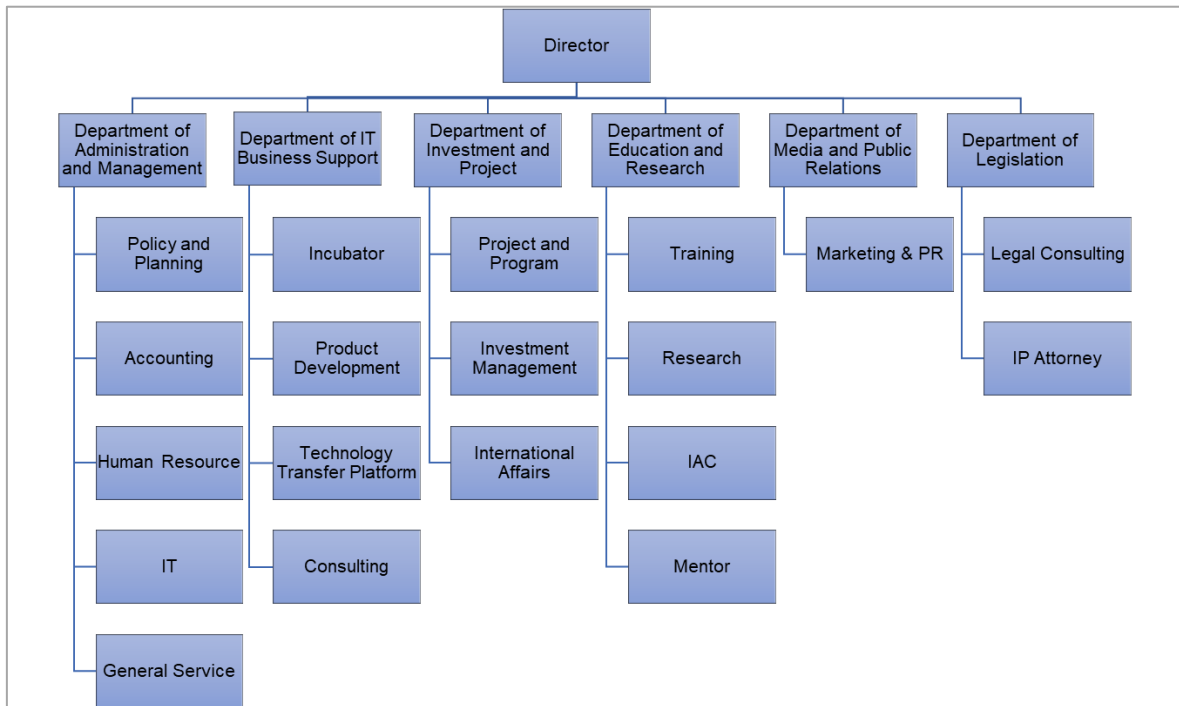
Source: National Information Technology Park

It is a hybrid intermediary organization with a long-term strategy to develop into the Science and Technology Park in the future. According to researcher Howells (Howells, 2006), innovation intermediary organizations perform 10 main functions that include 1) Foresight and diagnostics, 2) Scanning and information processing, 3) Knowledge processing and combination/recombination, 4) Gatekeeping and brokering, 5) Testing and validation, 6) Accreditation, 7) Validation and regulation, 8) Protecting the results, 9) Commercialization, 10) Evaluation of outcomes. Whilst the NITP does not fulfil all functions within the sectoral IS, it does act in researching and analysing development trends, testing product quality, providing proof and assurance, and evaluating of results. Regarding implementing this function, NITP has taken the initiative several times and submitted proposals for projects and programs to the government organization in charge of the sector; however, it has yet to be implemented due to financial and investment constraints.

Since 2002, NITP has actively developed Mongolia's emerging software

production industry. The organization has made valuable contributions by establishing software vendors, developing human resources skills, building innovation networks, co-founding manufacturer associations, and forming partnerships with international organizations in the industry.

It funds its activities using its own generated income or limited resources. Additionally, as it operates as a state-owned enterprise for profit, the intermediary organization faces a significant obstacle in expanding its activities and fulfilling its essential role in the sectoral IS, as mentioned above, due to the need to pay profit and value-added taxes. As a result of the policy and legal reform in Mongolia, the management of NITP and the sectoral intermediaries who participated in the study believed that with the establishment of a standing committee on sector development policy in the State Great Hural (Parliament), and the creation of a ministry responsible for sector development, this establishment would have the potential and possibility to develop the capacity of intermediary organizations in the sector through budget support at the decision-making level.

*Figure 4. The organizational structure of NITP*

Source: National Information Technology Park

Our research has found that Mongolia has seen the establishment and operation of various innovation intermediaries in recent years. It has been observed that only a few organizations are currently focused entirely on pure intermediary activities. There is a need to adjust the successful experience of proper collaboration of public-private intermediary organizations mentioned in global examples to fit the specific characteristics of our country.

It's important to note that newly-established innovation intermediaries are directly involved in innovation activities that they believe/assess they can succeed in, regardless of the sector. This may decelerate the most efficient distribution of resources. This counters the successful international experiences that have focused the limited resources of the

developing country on a specific field. It may require further investigation and revision.

One challenge intermediaries face in connecting IS actors is the lack of key actors, such as the absence of the legislation environment and the underdevelopment of the financial instruments for investment in innovation. In Mongolia, the main issue hindering the successful implementation of policies and strategic plans for developing innovation is the gap of understanding [25] among key IS actors rather than the concentration of the population. The researchers' conclusion in this regard was confirmed by the fact that most innovation intermediary organizations identify cultural differences and mistrust as the main obstacles and problems. Hence, it is feasible to effectively carry out training,

promotion and dissemination activities to disseminate the culture of innovation and bridge the gap in understanding. This should not only target the industry but also reach citizens in an equitable and accessible manner through an intermediary organization with specialized membership in the sector. This could be accomplished by offering long-term policy support and expanding development to MOSA based on the potential of the ICT sector.

Even though NITP is involved in four main types of activities as an intermediary organization, research findings indicate that it faces challenges in fulfilling crucial roles and operations necessary for developing IS in the sector due to financial and investment difficulties. As the researchers mentioned about the international experience in the theoretical part, the fact that public and private intermediaries specialized and played crucial roles in specific fields has been successful; as a country, we have limited resources, so it is advisable to incubate a small number of intermediary organizations in one field with the support of the state. Specifically, for IS and the software industry, the government should provide the necessary financial and investment support for NITP to perform crucial functions. This support will enable the organization to operate independently and establish a stable structure and composition. For this purpose, conducting a comprehensive study to define the intermediary organization's necessities and requirements in developing sectoral IS is crucial. If this can be implemented starting from the development of a representative organization of producers

that includes the majority of manufacturers in its membership, united by a common culture, but without a rigid structure, and in accordance with international standards, the results can be achieved within a short span of time. This will help restore trust between the involved actors and pave the way for further development. MOSA could be a good broker and bridging organization as a practical example of this concept. The collaboration of all software companies and other actors in the sectoral IS may influence MOSA's development as an effective broker and bridging organization.

## CONCLUSIONS

For developing countries, implementing appropriate innovation policies and forming a pragmatic system is an opportunity to overcome negative trends within a short period and develop rapidly. Mongolia as a country with limited resources, vast territory, and small population, it is essential to select a specific production sector based on the low output of new knowledge, lack of skilled workforce, and financial resources to develop the innovation system of that sector. In addition to the basic elements, Mongolia has the experience of the government providing budgetary and financial support to the intermediary organization regarding structure. This organization played a pivotal role in IS, and governmental support continued for a certain period. However, whether the funding provided is sufficient to achieve the desired results within the given time frame is uncertain and it was based on thorough calculation. Therefore, conducting a detailed study and offering



sustainable support based on the results will be crucial in meeting the objectives of our long-term development policy.

Mongolia has a weakly developed cluster in the manufacturing sector, so it should focus on supporting and developing intermediary organizations in the software industry. Rebuilding confidence between intermediaries and actors is crucial for the long-term growth and development of the national IS through the industry.

It is, therefore, vitally important to focus on developing private intermediary organizations, particularly representative organizations of producers, and at the same time, provide budget support for operational costs, developing a methodology and for evaluating the activities of intermediary organizations, consolidating them into a database, and forming a mechanism for providing competitive funding based on the results.

Collaboration among diverse actors, despite their differences, is a fundamental pillar of a country's development success. In this sense, the government's role in stimulating innovation collaboration and expanding interconnected networks is of paramount importance. The successful implementation of its development policy in Mongolia depends on the efficient development and operation of internal coordination and links. Therefore, aligning government and private intermediary organizations is crucial for developing innovations that benefit both the society and the economy. Establishing goals to develop cooperation between public and private intermediary organizations through joint programs, joint funding, and formal partnerships can lead to significant progress.

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