UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Science, technology and innovation parks development in Mongolia

Assessment and policy issues

Technical cooperation outcome

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Abbreviations

AOIs	Areas of Innovation
CAM	Computer-Aided Manufacturing
CAREC	Central Asia Regional Economic Cooperation
CSR	Corporate Social Responsibility
ECA	Europe and Central Asia
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GERD	Gross Expenditure on Research and Development
GII	Global Innovation Index
IASP	International Association of Science Parks and Areas of Innovation
ICT	Information and Communication Technology
IDs	Innovation Districts
IPR	Intellectual Property Rights
ITPs	Industrial Technology Parks
ITRI	Industrial Technology Research Institute
KSP	Knowledge Sharing Program
LLs	Incubators and Living Labs
MSMEs	Micro, Small and Medium-Sized Enterprises
NGO	Non-Governmental Organization
OIS	Organized Innovation Spaces
PPP	Public-Private Partnership
PRO	Public Research Organizations
R&D	Research and Development
SBL	Science–Business Linkages
SME	Small and Medium-sized Enterprises
STEM	Science, Technology, Engineering and Mathematics
SIPs	Science and Innovation Parks
STI	Science, Technology and Innovation
STP	Science and Technology Park
TBI	Technology Business Incubators
UNCTAD	United Nations Trade and Development
VAT	Value-added tax
WIPO	World Intellectual Property Organization

Executive summary

This report examines the role of science, technology and innovation (STI) parks in Mongolia as instruments for economic diversification and technology-driven growth. The economy remains heavily reliant on natural resources, posing challenges for sustainable development. STI parks have been introduced as a strategic approach to fostering innovation, supporting entrepreneurship and strengthening linkages between academia, industry and government.

Findings indicate that while Mongolia has established a comprehensive framework to support STI-driven growth, challenges persist in funding, commercialization of research and university-industry collaboration. Despite a growing number of university graduates, research and development investment remains low, business engagement in innovation is weak and high-tech manufacturing is limited. Industrial technology parks seek to enhance value chain capacities but are hindered by inadequate infrastructure. Similarly, science and innovation parks, designed to promote new technology-based industries, face obstacles related to insufficient funding and commercialization. While start-up incubators and accelerators play a critical role in Mongolia's national innovation system by providing infrastructure and mentorship to early-stage businesses, many remain underutilised due to funding constraints and a shortage of skilled personnel. The broader national innovation system also faces inclusivity challenges, with limited support mechanisms for marginalised groups to access STI resources and opportunities.

To strengthen the STI park ecosystem and enhance the effectiveness of STI parks, the report recommends the establishment of robust public-private partnerships to mobilize private sector investment and ensure long-term financial sustainability. The development of comprehensive R&D and innovation funding mechanisms is crucial. University-industry collaboration should be enhanced to align academic research with industry needs, accelerating technology adoption and fostering firm-level innovation. Additionally, sector-specific STI policies should be developed to provide targeted support to high-potential industries and drive long-term economic growth. Strengthening gender-responsive policies within STI parks can promote greater diversity and maximize the socio-economic impact of STI initiatives.

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I. Introduction to STI Parks

Mongolia's economy remains heavily dependent on natural resources, making economic diversification a priority for long-term sustainable development. Science, technology and innovation parks have emerged as a strategic policy instrument to foster innovation, strengthen linkages between academia and industry and support the growth of technology-based enterprises. However, the effective implementation and impact of STI parks depend on the broader STI policy environment, the national innovation system and industry capabilities.

This report examines the state of the science, technology and innovation policy environment and STI parks in Mongolia. It highlights challenges, gaps and opportunities for the further development of STI parks as instruments for socio-economic development.[1]

The report is structured as follows:

- **Section II** provides an overview of STI parks as an instrument for supporting technology-based growth, drawing on international experiences and policy frameworks.
- **Section III** discusses the imperatives for technology upgrading in Mongolia, highlighting key developmental features, structural constraints and opportunities for economic diversification.
- **Section IV** analyzes Mongolia's national innovation system, including the STI policy framework, key actors and R&D funding mechanisms.
- **Section V** assesses the current state of STI parks in Mongolia, examining different models, operational challenges and policy interventions.
- **Section VI** presents key findings and policy recommendations to strengthen STI parks.

By providing a comprehensive assessment of Mongolia's STI environment and the role of STI parks, the report aims to inform policymakers, industry stakeholders and development partners on strategies to enhance innovation-led economic growth.

[1] In this report, science and technology parks, incubators, innovation hubs, accelerators and similar organizations are collectively referred to as STI parks, given their shared objective of stimulating innovation. It is understood that incubators and accelerators are typically instruments used by STI parks to achieve their mandates.

II. STI Parks as a Development Instrument

STI parks foster innovation by linking research institutions with businesses, driving knowledge transfer and technological development. They play a crucial role in economic growth but require strong innovation capacity and effective management to succeed.

STI parks are a specific organizational form of science–business linkages, in addition to contract research, which may range from joint development, collaboration or external support in commercializing new technologies to consultancy services in testing, certification and problem-solving.

It is essential to understand that STI parks are one specific form of what recent literature defines as Organized Innovation Spaces (OIS) (Sanz L. et al., 2023). They should be distinguished from 'areas of innovation,' which include virtual and physically unconstrained spaces. The International Association of Science Parks and Areas of Innovation (IASP) defines these as a dynamic and innovative mix of policies, programmes, quality space, facilities and high value-added services (IASP, 2024).

According to IASP, areas of innovation:

a) stimulate and manage the flow of knowledge and technology between universities and companies

b) facilitate communication between companies, entrepreneurs and technicians

c) provide environments that enhance a culture of innovation, creativity and quality

d) focus on companies and research institutions as well as on people, including entrepreneurs and knowledge workers

e) facilitate the creation of new businesses via incubation and spin-off mechanisms and accelerate the growth of small and medium-sized enterprises

f) work in a global network that gathers thousands of innovative companies and research institutions worldwide, facilitating the internationalization of resident companies

OIS encompasses a diverse range of areas dedicated to fostering innovation. This category includes six primary physical manifestations: science and technology parks (STPs), innovation districts (IDs), industrial innovation campuses, areas of innovation (AOIs), incubators and living labs (LLs).

The distinction between an industrial co-innovation campus and a science park lies in their primary actors. While a science park typically revolves around a university, an industrial co-innovation campus is often led by a large company, which may also serve as its initiator. At the heart of these campuses, innovation centres are physical spaces or teams established by organizations within global tech hubs. They aim to capitalize on the start-up, industry

STI parks link science and business, supporting tech commer-cialization, innovation

and academic ecosystem these hubs offer (Sanz et al., 2023).

An alternative but also recent classification of OIS by Galan-Muros et al. (2021) distinguishes between industrial parks, business parks, science parks, technology parks and innovation districts. IASP does not differentiate between 'technology park,' 'technopole,' 'research park' and 'science park' and uses the acronym STP (science and technology park) to refer to these expressions.[2] According to IASP, a science park is an organization managed by specialized professionals whose main aim is to increase the wealth of its community by promoting a culture of innovation and the competitiveness of associated businesses and knowledge-based institutions. IASP further underscores the importance of fostering an environment where science parks facilitate knowledge and technology exchange among universities, research institutions, enterprises and markets. They support the establishment and expansion of innovation-driven businesses through incubation and spin-off initiatives while also offering value-added services alongside well-equipped facilities and high-quality workspaces (IASP, 2024).

STI parks are key hubs within national innovation systems

IASP defines 'areas of innovation' as specially curated locations designed to attract entrepreneurial-minded individuals, skilled talent, knowledge-intensive businesses and investments. These areas integrate infrastructural, institutional, scientific, technological, educational and social assets, bolstered by value-added services to drive sustainable economic development and community prosperity.

The term 'areas of innovation' (AOIs) encompasses various models, from citywide or regional initiatives with innovation spread across different locations to more focused projects such as innovation districts or knowledge quarters. However, a common feature among them is the presence of a management team entrusted with executing strategies to foster innovation within the area. AOIs fall under OIS, possibly because they encapsulate elements crucial for nurturing a knowledge-based economy. They may include entities such as STPs, incubators, living labs, universities, technology centres and public agencies, all contributing to the area's economic development (Sanz et al., 2023).

An innovation district is an existing urban area characterized by a vibrant mix of knowledge institutions, companies and start-ups focused on innovation. Unlike STPs, innovation districts lack a specific sectoral focus and often undergo urban restructuring. These districts combine business, recreational, retail and residential functions (Sanz et al., 2023).

Another type of OIS is the living lab. Living labs are user-centred, open innovation ecosystems that employ systematic user co-creation approaches. They integrate research and innovation processes within real-life communities and settings, fostering innovation in diverse contexts (Sanz et al., 2023).

STI parks have been used in many economies, from developed to low-middle-income, to promote innovation-based growth. They are part of a broader policy approach that underscores the importance of knowledge-based entrepreneurship and the linkages between R&D organizations and the commercial sector. The analytical framework that inspired this policy shift is the 'Triple Helix'[3] (Etzkowitz and Leydesdorff, 2000). Although initially developed in the context of developed economies, this approach has been widely accepted. In particular, it is relevant for natural resource-based economies, such as Mongolia, as it aims to reduce dependence on commodity-based sectors and restructure towards technology-intensive activities.

[2] The analytically derived classification of 82 science parks in the literature differentiates between 'research', 'cooperative' and 'incubator' type parks.

[3] The Triple Helix model refers to interactions between academia (the university), industry and government to foster economic and social development.

This study will use the term science, technology and innovation parks (STI parks), which includes science parks, incubators, accelerators, innovation hubs, innovation centres and technology transfer offices.[4] Industrial or business parks that promote STI in the country are also included. As a physical entity, STI parks include land, infrastructure and real estate facilities, with clear and well-defined boundaries. Industrial or business parks are not necessarily linked with R&D organizations.

All definitions of STI parks highlight their most important characteristic: they revolve around R&D, innovation and technology-based business, which may be new to the country but not necessarily new to the world. Science parks are usually designed to bring R&D organizations and companies or local entrepreneurs closer together. The extent to which this happens is generally lower in low-middle-income economies such as Mongolia. However, all definitions of STI parks emphasize links with tertiary educational institutions or other research organizations, such as the World Bank's definition of "collaboration between the research system and firms to stimulate innovation based on research and development" (UNCTAD), or the European Commission's description of STI parks as "science-based growth poles to stimulate economic diversification away from declining industries" (European Commission, Joint Research Centre).

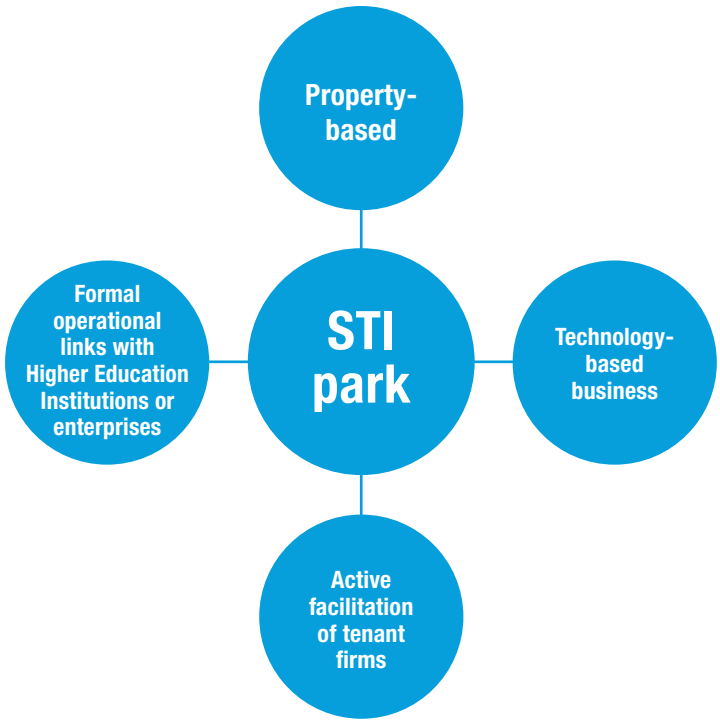
STI parks link R&D, innovation and technology-driven enterprises

The majority of definitions refer to four core components of STI parks:

- a property-based initiative
- formal operational links with a higher education institution or an enterprise
- the aim is to support the formation and growth of technology-based businesses among firms residing on-site
- active management function engaged proactively in assisting start-ups to grow

The four components of STI parks are presented graphically in Figure 1.

Figure 1
Four key components of an STI park



[4] For a comprehensive overview of different definition categories, see the Annex in Galan et al. (2021).

STI park success depends on management complementing external innovation drivers

The success of an STI park depends on the effective integration of these four components, which may not always be equally developed. The property-based nature of STI parks implies that they must generate a specific rate of return to repay investments in physical assets. Returns may vary significantly depending on real estate market conditions in different economies. Technology-based businesses will develop depending on endogenous R&D capabilities. In a low-middle-income economy such as Mongolia, technology-based companies tend to be local market-oriented pioneers but often face the challenge of adapting and assimilating foreign technologies. The presence of formal or informal links between R&D organizations and local enterprises largely depends on the technological capabilities of the business sector and the quality of research in external R&D organizations, such as universities and public research institutions. Whether tenant firms receive active support in their growth will depend on how proactive park management is.

However, three other factors will ultimately constrain even the most engaged park management. In essence, STI parks indirectly support technology-based firms. They provide the organizational framework expected to facilitate the emergence and expansion of domestic technology-based businesses. However, their success is not determined solely by internal operations but also by the broader national innovation system in which they function, particularly the technological capabilities of local firms and the R&D capacity of universities and public research organizations.

The multi-component nature of STI parks and their role in directly supporting technology-based firms make their assessment as an innovation policy mechanism complex. As demonstrated by the case studies presented in the annex to this report, there is often a considerable gap between policymakers' expectations of STI parks and their actual impact.

The review of conceptual and definitional aspects and assessments of STI parks suggests that identifying the factors critical to their success is challenging. These factors are internal and external and their effectiveness depends on complementarity. According to Zieliński et al. (2014), the Polish Agency for Enterprise Development has identified the following key success factors based on international experiences:

- Proximity to a university that actively promotes entrepreneurship and fosters strong links with scientists
- A collaborative environment between local administration, business and academia
- Community support for innovation-driven enterprises and alignment with local development plans
- Capable and engaged management with a clear long-term strategy and a skilled team
- Access to venture capital
- Well-planned infrastructure with the potential for expansion and spaces designed to encourage creativity, interaction and innovation
- Availability of enterprise support services and specialized pro-innovation services
- Active networking at multiple levels, with mechanisms to assess its effectiveness and facilitate technology firm clusters
- Strategic selection of tenants to create synergies, meet their needs and provide access to networks and services
- High standards of technology and transportation infrastructure, along with an attractive living environment
- A technology incubator connected to a university's pre-incubation programmes and other forms of start-up support
- A strong public image, effective marketing strategies that enhance the park's attractiveness and the promotion of tenant firms' success stories

These factors are rarely present in a single case. This is particularly evident in emerging economies, where the capabilities of firms often do not align with those of universities, where recruiting skilled personnel to manage STI parks is challenging and where venture capitalists and angel investors tend to avoid such parks (Torres de Oliveira et al., 2022).

Proactive and entrepreneurial STI park management alone is not enough. Successful STI parks tend to be found in large, diverse and well-established economies with a strong research base, an entrepreneurial culture and engaged stakeholders, such as universities or research centres that champion and contribute resources to their development (Mian et al., 2005; Mian et al., 2020). In emerging economies, institutional and business culture factors (such as weaker intellectual property protection, limited opportunities for business growth and knowledge diffusion and a smaller, less sophisticated national market) also hinder the development of STI parks (Comins and Rowe, 2008).

These are factors within the direct STI park ecosystem. They should be distinguished from what can be called broader ecosystem-specific factors of success. Based on an extensive literature review, Poonjan and Tanner (2020) have identified five regional factors that play a role in STI parks' performance: university and research institutes, industrial structure, institutional settings, financial support and urbanization.

The design and assessment of STI parks should consider indigenous and external factors and understand how they influence each other. From this, it is evident that there is no simple blueprint for this task. The character of the tenants in STI parks often reflects the STI park ecosystem in which the park is located. Within that system, two key factors influence knowledge transfer or opportunities for STI park-assisted technology upgrading:

- The level of regional demand from firms for knowledge produced by universities and public research organizations (PROs) in the same region
- The supply of knowledge from universities and PROs with potential commercial applications

When these two factors align, they can positively influence the development of successful STI parks. Conversely, if they are misaligned, STI parks may encounter structural challenges in fulfilling their bridging role (Eun et al., 2006). STI parks serve as intermediaries in science–business linkages (SBL), evolving in response to the capabilities of firms, universities and the broader R&D system (Albuquerque et al., 2015). However, research on China indicates that science–business linkages are primarily shaped by firms' characteristics rather than by the intensity and quality of research conducted at PROs and universities (Atta-Owusu et al., 2021).

The most common science–business linkage policies and STI park models are rooted in the Triple Helix framework, which focuses on the commercialization of knowledge from public R&D, particularly in knowledge-based industries and knowledge-intensive services. The aim is to facilitate direct links with the industry to maximize the capitalization of knowledge. The close integration of public R&D with the industrial world should be stimulated by establishing STI parks, technology transfer offices and other intermediary organizations. Also, tax incentives and other regulatory measures should be geared toward this objective. The extent to which this approach is relevant for emerging economies depends on the level and quality of R&D in the public sector and the scale of knowledge-intensive industries and services.

Successful STI parks depend on research strengths, entrepreneurial culture and engaged stakeholders

STI parks foster science-business linkages, evolving with economic development

Academic research values openness and scientific excellence, while the business sector values commercial relevance and proprietary technology. These different imperatives require distinct institutional arrangements and strongly limit the hybridization of R&D under the Triple Helix approach. Unless the two sectors are distinctly organized and valued, R&D will be short-term and only applied-oriented. In the long term, this will erode the excellence of public R&D. On the other hand, the business sector may find R&D knowledge in the public sector irrelevant, limited or inappropriate to its needs. However, academic research has found that in developed country contexts, a shift towards industry has not undermined basic research (Grimaldi et al., 2011). This can be explained by the developed R&D capabilities of firms that benefit from basic and applied research at universities and PROs. Still, university spin-out companies can emerge only if there is a strong support mechanism at universities and available venture capital.

Science–business linkages (SBLs) depend on the capabilities of firms, public research organizations (PROs) and universities. As these capabilities evolve, so should the models of STI parks and SBLs. For example, the Chinese model has shifted from close integration to gradual separation between academia and industry in less than two decades (Eun et al., 2006; Lee, 2022).

For lower-middle-income economies such as Mongolia, policies focused on commercializing the results of public R&D and integrating (hybridizing) academic and commercial R&D may be appropriate in certain niche areas. However, this approach disregards the weak absorptive capacity of local firms, which primarily deploy foreign technologies and whose productivity is driven by production and investment rather than by R&D capability (Fedyunina and Radosevic, 2022).

The prevailing approach of commercialization via patents reflects a narrow view of SBLs, overlooking alternative commercialization and knowledge transfer mechanisms. Informal professional networks, the movement of graduates from universities to industry, joint R&D, research and consultancy contracts, conferences and exhibitions are often far more significant than commercialization via patenting (Bradley, Hayter and Link, 2013). This is particularly relevant for emerging economies, where expectations for increased patenting of publicly funded research are unlikely to materialize given the low level of public R&D funding, the teaching orientation of universities and the growing role of information technology, for which conventional intellectual property rights (IPRs) are not an effective incentive (So et al., 2008).

Different modes of SBLs and models of STI parks correspond to the various stages of economic development and the evolving capabilities of firms in each country (Lee and Kang, 2010). In the initial stages, firms face significant challenges in production and management and require consultancy services and problem-solving support rather than R&D. In the middle stages, firms begin to develop in-house R&D capabilities and seek external assistance through contract R&D or joint projects. At this stage, SBLs tend to be the most developed. Only in mature stages do firms establish strong in-house R&D capabilities, reducing their reliance on direct assistance from public research organizations (PROs) and universities. However, the extent to which SBL will develop depends on the R&D capabilities of PROs and universities, their academic or practice orientation and policy support. SBLs also depend on the size and structure of firms within the economy. Larger firms are often more likely to collaborate, whereas smaller firms require more significant support from intermediary organizations such as industry associations, innovation or productivity centres and PROs. Ultimately, the most important factor influencing SBLs is whether firms engage in continuous R&D.

When the capabilities of firms, PROs and universities are underdeveloped, SBLs tend to be weak and STI parks often remain "empty places." This situation characterizes

many emerging economies, where linkages are primarily in the form of consultancy services provided by PROs and universities. In such cases, firms tend to rely on foreign knowledge through licensing, foreign direct investment (FDI), joint ventures or reverse engineering. Evidence from India demonstrates that the mere existence of research capabilities in PROs and universities does not guarantee engagement in SBLs or commercialization (Ravi and Janodia, 2020). Several factors contribute to this, including a lack of adequate resources and infrastructure, a strong teaching orientation, the dominance of publication metrics as the primary measure of academic excellence and weak technology transfer mechanisms.

Nevertheless, science–industry linkages and STI parks are critical in economic development and firms' technological upgrading. China provides an illustrative example of the importance and evolving nature of SBLs. In the early stages, Chinese universities actively established their own start-up companies, as even leading industrial firms had limited capacity to absorb R&D results from PROs and universities. This gap prompted the Government to advance technology transfer from PROs (Chen et al., 2020).

Early engagement by PROs was a key catalyst for the development of technology-based industries, laying the foundation for contemporary global technology firms such as Lenovo, Founder, Tsinghua Tongfang and Dongruan. Financial pressures on universities and research institutes also played a role in this process. However, as Chinese firms improved their absorptive capabilities and the academic system shifted towards scientific excellence, the intensity of SBLs relatively declined (Lee, 2021).

As firms upgraded their technological capacity, the modes of technology transfer also evolved. Initially, joint R&D projects were undertaken with local governments and firms. This was followed by PROs incubating technologies and firms. The most recent shift has been towards PROs establishing technology and research infrastructure platforms that are open to enterprises (Chen et al., 2022).

Weak science-business linkages render STI parks ineffective in emerging economies

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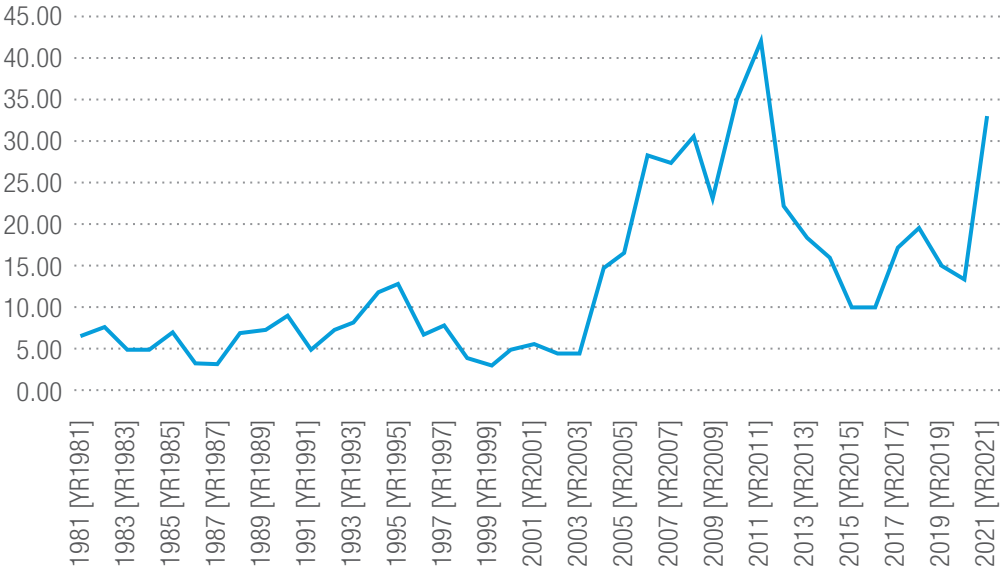
III. Imperatives for Technology Upgrading in Mongolia

Mongolia's path to technology upgrading requires diversification beyond the mining sector and strengthening innovation capabilities. While education investment is relatively high, misalignment with labour market needs and limited R&D funding hinder progress. Enhancing industry-academia collaboration, expanding ICT services and fostering specialized skills in key technology fields will be essential for sustained economic transformation.

The economy of Mongolia is heavily dependent on natural resources (see Figure 2) and is characterized by low population density and a small domestic market, with a population of 3.348 million in 2021. As a lower-middle-income economy, Mongolia has significant growth potential and offers various strategies for achieving a high-income status.

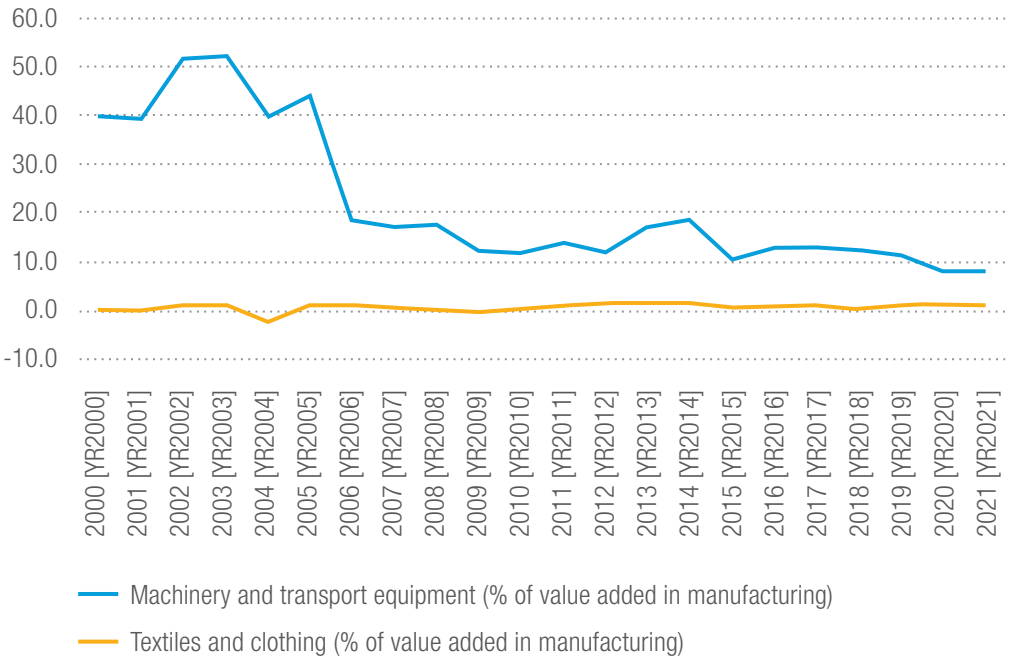
Figure 2
Share of total natural resource rents of Mongolia, 1981–2021



Source: World Bank Development Indicators database December 2023.

Diversification beyond the mining sector is challenging, as a strong national currency makes exporting initially non-competitive new products and services more expensive. This limits diversification towards technology-intensive sectors. Figure 3 shows that the share of machinery and transport equipment in manufacturing value added has stagnated over the past decade. This marginal share indicates little or no progress towards technology upgrading.

Figure 3
Shares of machinery and transport equipment and textile and clothing in manufacturing



Source: World Bank Development Indicators database.

Mongolia's technology upgrading **depends on diversification and differentiation** across industries

Mongolia's prospects for technology upgrading should be pursued through both diversification or the establishment of new product areas and differentiation or the creation of niches within existing export areas. These two dimensions apply to both resource-based industries and other sectors. Natural resource industries have traditionally been considered isolated enclaves with limited linkages to the broader economy. However, this is increasingly unlikely (Marin et al., 2015). Information and communications technology (ICT) has enabled small knowledge-intensive companies to innovate across sectors, including resource-related industries (Marin et al., 2015). Nanotechnologies, biotechnologies and new materials have also transformed the innovation landscape in resource-based industries.

The new policy framework promotes the development of entire networks of natural resource-related activities, encompassing downstream linkages. One example is MERA LLC (MERA, 2024), an engineering company that provides professional drilling and blasting services for the mining and infrastructure sectors. It manufactures a range of explosives and blasting equipment domestically and supplies them to customers.

Parliament has already adopted a diversification policy through the Mongolia Sustainable Development Vision 2030, which initially identified energy and infrastructure as priority sectors and emphasized agriculture,

light industry, food production, construction materials, copper refining, coal, petro-chemicals, iron production, tourism and mining. Opportunities for diversification are particularly strong in agriculture, including cashmere, meat, vegetables and other food products. However, diversification alone may not be sufficient without a corresponding differentiation of production activities.

The education system also plays a crucial role in technology upgrading. Mongolia has a fee-based education system does not always align with the skills required by the labour market (Helble et al., 2020). Public universities receive minimal government support, while private institutions rely entirely on student tuition fees. The lack of collaboration between the private sector and the government results in weak collective action to establish networks of certified laboratories and facilitate access to foreign markets.

Regardless of whether Mongolia pursues intra-sectoral or inter-sectoral upgrading, strengthening the foundation for techno-logy-based growth will be essential.

Innovation in Mongolia

The Global Innovation Index (GII) is a widely recognized metric for assessing innovation capacity. The latest edition of the GII 2023 (WIPO, 2023) highlights several strengths and weaknesses in Mongolia's national innovation system.

Key strengths:

- High expenditure on education as a percentage of GDP (6.5 per cent) (12th)
- High gross capital formation as a percentage of GDP (42.8 per cent) (4th)
- A large share of firms offering formal training (66.2 per cent) (3rd)
- A relatively high proportion of females employed with advanced degrees (23.9 per cent) (23rd)
- High foreign direct investment (FDI) net inflows as a percentage of GDP (14.8 per cent) (7th)
- Strong intellectual property activity, including:
    - Patents per billion PPP GDP (2.5) (29th)
    - Trademarks per billion PPP GDP (445.2) (1st)
    - Industrial designs per billion PPP GDP (32.4) (1st)

Key weaknesses:

- No global brands among the top 5,000 companies
- Low intangible asset intensity (-42.5 per cent) (77th)
- No unicorn companies of global relevance
- Low gross expenditure on R&D (GERD) by businesses as a percentage of GDP (0 per cent) (85th)
- Low value of patent families per billion PPP GDP (0 per cent) (95th)
- Low share of high-tech manufacturing (3.8 per cent) (106th)
- Low share of creative goods exports (0 per cent) (129th) (WIPO, 2023)

However, these rankings must be considered within the specific Mongolian context. While high education expenditures appear positive, the quality of education remains a significant challenge. The National University of Mongolia, the country's top-ranked university, is ranked 3,151st globally (Webometrics, 2024). Moreover, as noted earlier, the fee-based education system does not align with labour market demands (Helble et al., 2020), forcing firms to compensate with in-house international training. As a result, the proportion of firms offering formal training in Mongolia is more than twice the average in Europe and Central Asia (66.2 per cent vs 29.04 per cent) (World Bank, 2025).

Mongolia's strong performance in patents, trademarks and industrial designs reflects domestic innovation that is primarily disconnected from global technology frontiers. This is evident in weaknesses such as low-value patent families, a small high-tech manufacturing sector, weak firm R&D investment and a lack of creative

Mongolian firms innovate, but weak global ties limit technological impact

goods exports. Nonetheless, firm-level R&D investment in Mongolia is highly variable but remains twice the rate of firms in the Europe and Central Asia (ECA) region. However, given the low overall share of business-sector R&D in GDP, these activities appear to be intermittent rather than sustained.

Mongolia's ICT exports grow but trail behind similar-sized peers

Importantly, Mongolian firms are innovating, though not necessarily through R&D-based mechanisms. The Business Environment and Enterprise Performance Survey (BEEPS) shows that 44.5 per cent of Mongolian firms engage in innovation, of which 91.2 per cent produce products or services new to their primary market. At the same time, the share of firms with an internationally recognized quality certification is low (4.3 per cent compared to 22.3 per cent in the ECA region). The share of firms using technology licensed from foreign companies is at the ECA average (1.7 per cent vs 1.8 per cent), suggesting limited linkages to global markets.

The aggregate Global Innovation Index (GII) rankings for Mongolia, covering market sophistication (101st), knowledge and technology outputs (88th) and infrastructure (81st), indicate that the foundation for technology-based growth remains relatively weak.

ICT services represent a new technological area with low barriers to entry and many Central and Eastern European and former Soviet Union economies have made significant progress, particularly in exports. The export of ICT services from Mongolia has steadily increased from 2.3 million US dollars in 1992 to between 30 million and just over 59 million US dollars over the past five years. However, this remains significantly lower than that of aspirational peers of similar size, such as Estonia, Georgia, Armenia and Croatia (see Table 1).

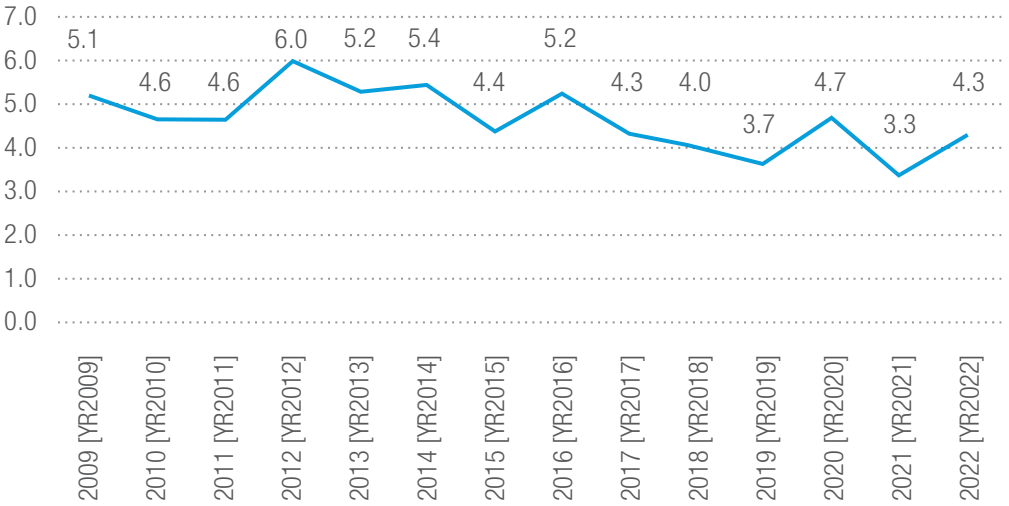
Table 1
ICT service exports by balance of payments, current US dollars

Country	ICT service exports, current million United States dollars, 2023
Mongolia	59.37
Georgia	891.97
Estonia	2,972.53
Croatia	1,868.30
Armenia	1,073.97

Source: International Monetary Fund (IMF), Balance of Payments Statistics Yearbook and data files, 2025.

The key input in ICT services is the development of professional skills, which in turn depends on the quality and relevance of education. Although Mongolia ranked 12th in the Global Innovation Index (GII) for education expenditure, the trend in education investment is declining. Since 2012, the share of government spending allocated to education has gradually decreased (see Figure 4).

Figure 4
Government expenditure on education, total (per cent of GDP)

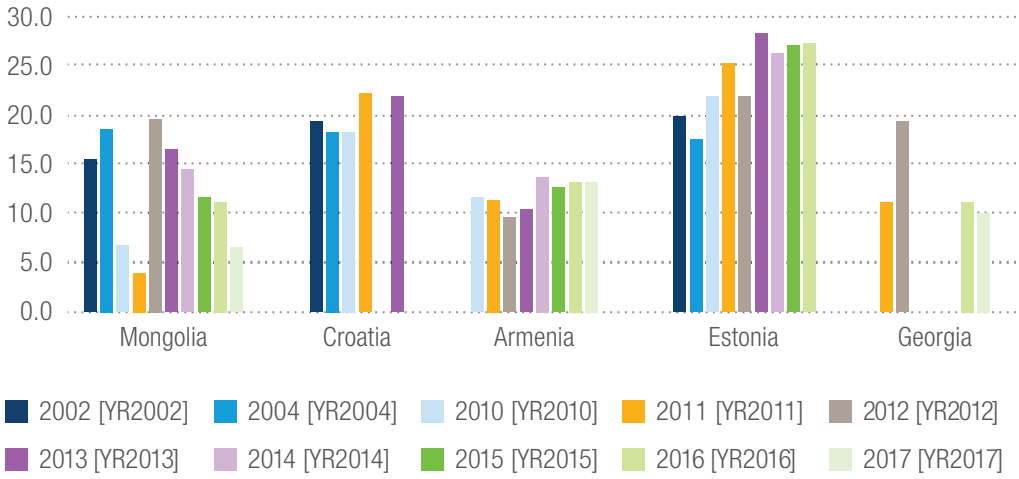


Source: World Bank Development Indicators database.

The latest available data indicates that within this declining share, the proportion allocated to higher education fell from 19.6 per cent in 2012 to only 6.4 per cent in 2017 (see Figure 5). Of even greater concern is the professional distribution of graduates.

Fields such as engineering, mathematics, computer science, natural science, agriculture, forestry and fishery produce a limited number of graduates, making it difficult to establish a critical mass of competencies in key technology areas.

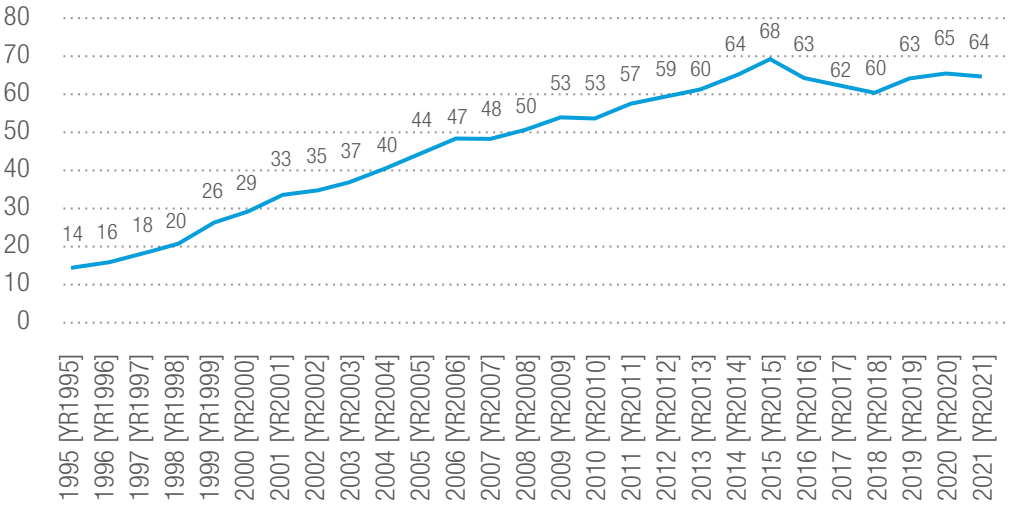
Figure 5
Expenditure on tertiary education (per cent of government expenditure on education)



Source: World Bank Development Indicators database as of 2 September 2024.

Up to 2015, there was a sharp increase in the number of higher education institutions and student enrolment (see Figure 6). However, the potential for further growth in the number of graduates appears to be stagnating, as the tertiary enrolment rate has levelled off at approximately 65 per cent, following a steep rise from 14 per cent in 1995 to 68 per cent in 2015.

Figure 6
School enrolment, tertiary (per cent gross)



Source: World Bank Development Indicators database, 2 September 2024.

Moreover, there is a structural imbalance between the demand and supply of graduates by professional field (see Table 2). In 2023, only about 13.9 per cent of graduates specialized in engineering, mathematics, computer science, natural science, agriculture, forestry and fishery. However, a strong pipeline of highly skilled graduates is essential for technology-based growth.

Table 2
Graduates of universities, institutes and colleges, by professional field, 2023

Professional fields	2023	
Total	*28,696*	*100%*
Education studies and pedagogy	4,229	14.7%
Humanity	1,759	6.1%
Fine and applied arts	946	3.3%
Law	2,989	10.4%
Social science	1702	5.9%
Commercial and business management	5,827	20.3%
Public information and journalism	252	0.9%
Mathematics and computer science	1,133	3.9%
Service	1,277	4.5%
Natural science	471	1.6%
Medical science	4,779	16.7%
Engineering	2,119	7.4%
Architecture and urban planning	942	3.3%
Agriculture, forestry and fishery	271	0.9%

Source: Mongolian Statistical Information Service.

IV. Mongolia's National System of Innovation

Mongolia has a well-established STI policy framework and a growing network of industrial and technology parks supported by incentives to attract investment and drive innovation. However, limited R&D funding, weak commercialization of research and unclear intellectual property rights restrict its capacity to generate high-value innovation.

The national innovation system functions as a structured framework that defines both the opportunities and constraints within which science, technology and innovation (STI) parks establish their configurations and develop business models and strategies. Some key characteristics of the national system of innovation in Mongolia are outlined below.

STI Policy Framework

Although the science and technology (S&T) system in Mongolia remains in the early stages of development in terms of financial resources and output, it is institutionally well-established and fully operational (Mongolian Foundation for Science and Technology, n.d.). The Ministry of Economy and Development is responsible for formulating and implementing STI policies and directly supervises some of the 59 research institutions and 21 universities. Around 20 public and private research institutions fall under the supervision of other ministries, while 16 institutes operate under the Mongolian Academy of Sciences. Responsibility for funding research and development (R&D) lies with the Science and Technology Foundation. According to the Science and Technology Act (2024), the National STI Committee is responsible for innovation policy.

The following legal instruments provide the foundation for technology-based growth in Mongolia. Recently, a law on intellectual property (2020) and a government policy on priority areas for innovation (2020–2025) were adopted:

1. Technology Transfer Act (1998)
2. Patent Act (2006)
3. Science and Technology Act (2024)
4. Small and Medium-sized Enterprises (SME) Act (2007)
5. Law on the Legal Status of Industrial and Technological Parks (2022)
6. Asset Pricing Act (2010)
7. Agricultural Commodities Exchange Act (2011)
8. Innovation Act (2012)
9. Investment Act (2013)
10. Intellectual Property Law (2020)

Mongolia's S&T system is established but still developing

Vision 2050 seeks a competitive STI system and economic diversification

As in many other countries, the ownership of intellectual property rights (IPRs) generated in public organizations is not always clear, which poses challenges in commercializing public R&D. Technology transfer offices and technology licensing offices are still in the early stages of development and the legal basis for their establishment remains a work in progress (Asian Development Bank, 2023).

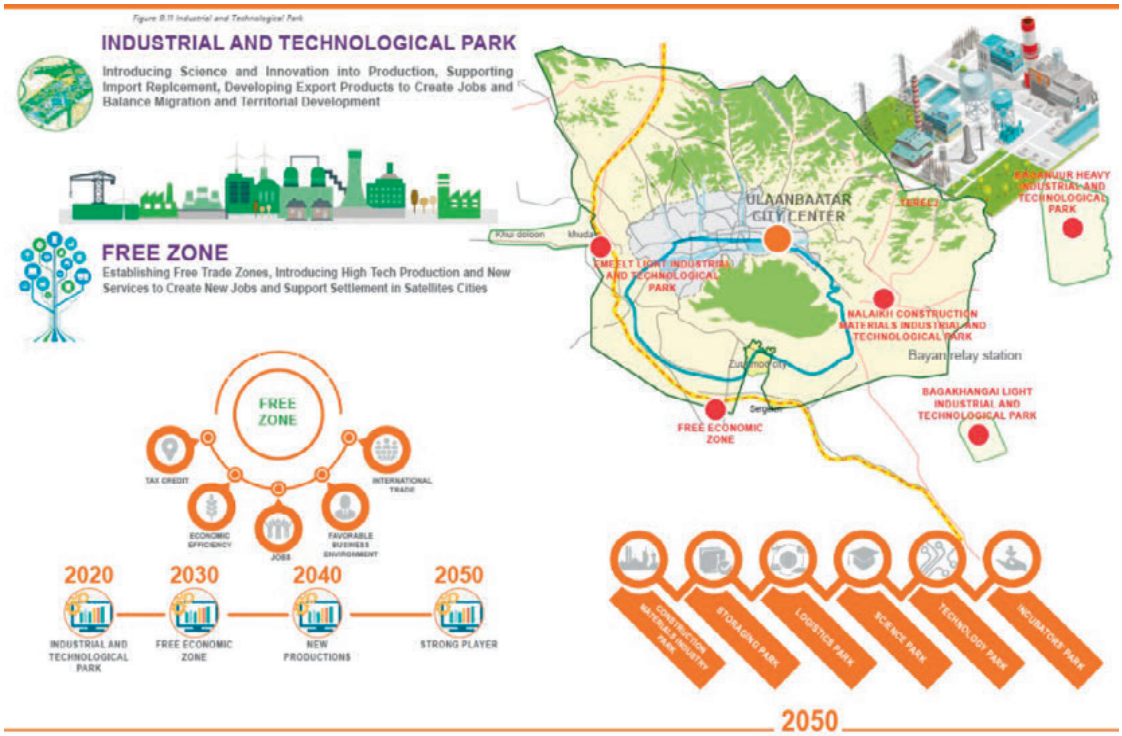
The national innovation strategy is integrated into the long-term development policy Vision 2050 (Mongolia's long-term development strategy). Among its objectives, Vision 2050 aims to develop an internationally competitive STI system, support the growth of micro, small and medium-sized enterprises (MSMEs), increase employment and establish an internationally recognized wealth fund to promote economic diversification, innovation, human development, new technology and green growth.

Vision 2050 identifies the following key industries for development:

1. Heavy industry, light industry, food manufacturing and processing
2. Mineral mining and mineral processing
3. Logistics and transportation
4. Tourism

The strategy also identifies four industrial and technology parks and one free economic zone as mechanisms for implementing the national innovation strategy (see Figure 7).[5] A total of 11 industrial technology parks (ITPs) in Mongolia have already been granted special status.

Figure 7
Industrial and Technology Parks in the Vision 2050



Source: Vision 2050.

[5] The exact number of licences for the development of industrial technology parks (ITPs) remains to be clarified. For example, the Government of Mongolia has issued special licences for the development of more than 10 ITPs to promote mining and heavy industry (KSP, 2022/3).

Industrial-technology parks (ITPs) benefit from various incentives designed to encourage their development and attract investment. These include:

- **Land lease fee exemption**: ITP developers and resident companies are exempt from land lease fees for ten years.
- **Corporate income tax deduction**: When investing in ITP infrastructure, the investment amount is deducted from the corporate income tax base.
- **Real estate tax exemption**: ITP management companies are exempt from real estate tax on buildings and other real estate within the ITP for five years, with a 50 per cent reduction for the subsequent five years.
- **Import duty and VAT deferrals**: ITP management agencies and resident companies importing infrastructure and equipment that cannot be supplied domestically benefit from deferred payment of import tariffs and value-added tax (VAT) for up to four years.
- **Special customs zones and bonded factories**: ITPs allow for establishing special customs zones and bonded factories to facilitate trade and production.
- **Support for foreign experts**: Assistance is provided for foreign professionals involved in the education and training of ITP production workers.
- Investment stabilization certificates: Support is available for investment contracts by issuing investment stabilization certificates.
- **Tax exemption for small-scale leasing**: Small-scale leasing of space and services within ITPs or incubators is exempt from real estate tax and corporate income tax.
- **Preferential financing**: ITPs benefit from low-interest overseas loans through the establishment of ITP funds as well as preferential access to aid funds.

These incentives support the growth of ITPs, strengthen industrial development and enhance the overall investment climate (KSP, 2023).

Mongolia's industrial parks **offer tax breaks, incentives and trade support**

STI Actors in Mongolia

The national innovation system in Mongolia consists of a comprehensive network that integrates knowledge generation, exchange and application. The Ministry of Education and Science leads efforts in knowledge creation, setting policies in education and science in alignment with national development priorities. Supporting this mission is the Mongolian Academy of Sciences, which oversees 16 research institutes and eight universities with 37 affiliated research institutes and centres.

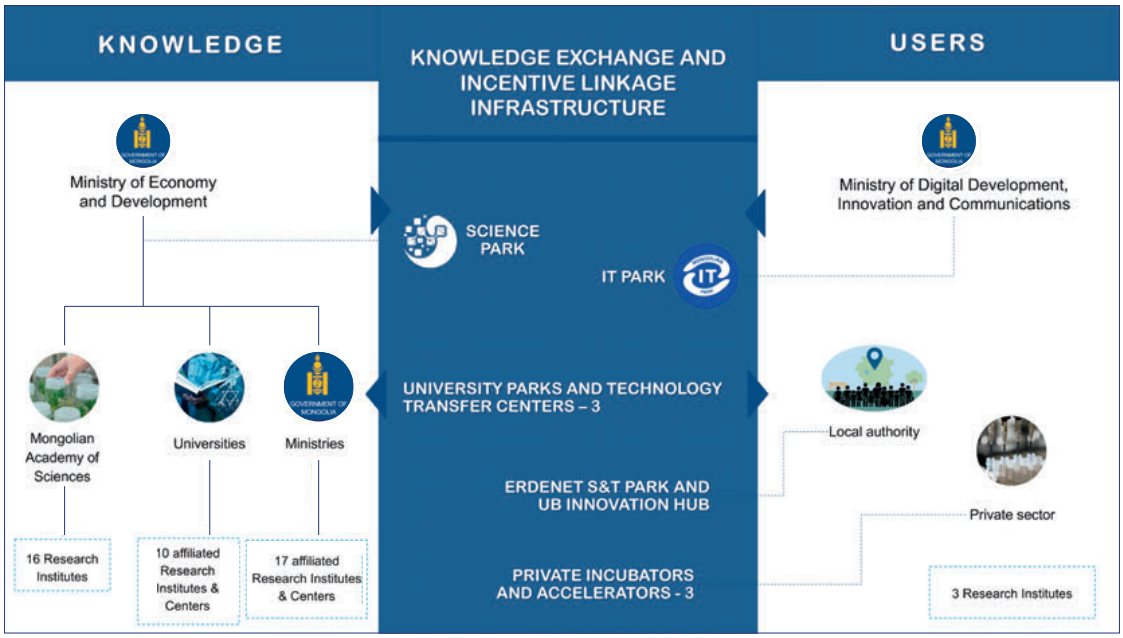
Bridging knowledge generation with practical application are key infrastructures such as the Science Park, IT Park, two university parks and technology transfer centres, Erdenet Science and Technology Park and the Ulaanbaatar Innovation Hub, as well as three private incubators and accelerators. These include Mstars, InnoHub and Socratus startup studio.

The Ministry of Digital Development, Innovation and Communications coordinates the application of STI outputs to end users, such as local authorities and the private sector and manages the operations of the IT Park. This ensures that innovative solutions are effectively leveraged for governance, service delivery and industrial development. The private sector is further supported by six industry-focused research institutes that drive technological advancement.

Mongolia's STI ecosystem **integrates knowledge generation, exchange and application**

The Ministry of Economy and Development plays a crucial role in enhancing Mongolia's social and economic potential by providing an integrated methodology and management framework for developing, planning and implementing long-, medium- and short-term development policies. Within this ministry, the Department of Innovation Policy is responsible for formulating and coordinating policies that promote innovation across various sectors, thereby strengthening the STI framework in Mongolia.

Figure 8
Knowledge exchange and incentive usage infrastructure



Source: Ministry of Economy and Development of Mongolia.

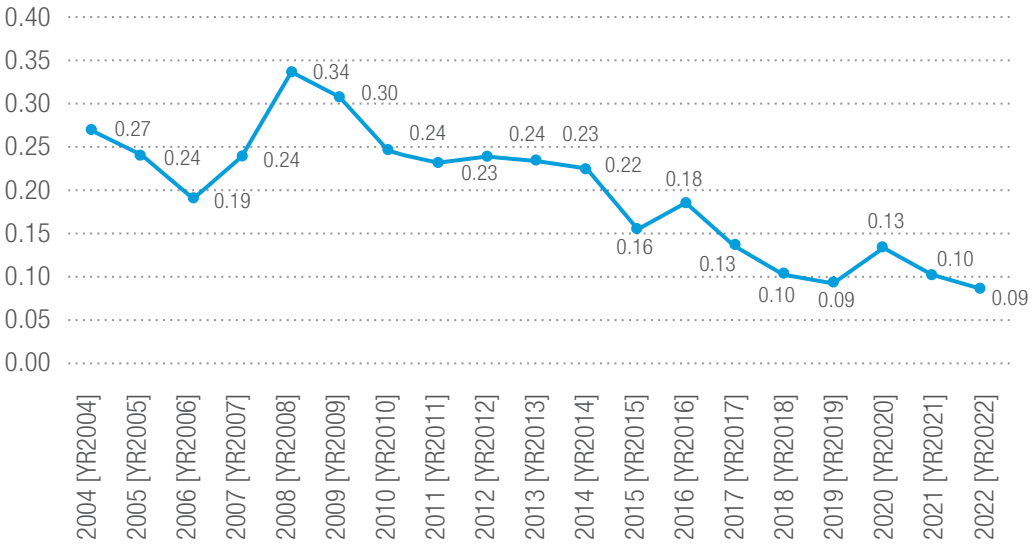
Research and Development Funding and Research Outputs

The science and technology (S&T) sector in Mongolia remains in the early stages of development. The share of R&D expenditure in gross domestic product (GDP) has declined from an already low level of 0.2–0.3 per cent to approximately 0.1 per cent (see Figure 9). At this level of expenditure, countries are unable to follow the technology frontier and R&D activities primarily focus on absorbing foreign research and technological developments. This stands in sharp contrast to the Europe and Central Asia region, where gross domestic expenditure on R&D (GERD) has increased from approximately 0.5 per cent to nearly 0.88 per cent of GDP.[6]

The limited investment in R&D has resulted in a growing number of publications, but their overall output remains low. In 2020, Mongolia's publication count exceeded 200 for the first time. Based on the cumulative number of publications between 1996 and 2023, Mongolia ranked 119th in the Scopus database (SJR, 2025). The small number of publications is accompanied by a similarly low number of patents (see Figures 10 and 11). Patent filings peaked in 1997 and have since declined, falling below 100 in recent years. However, data from 2018–2021 indicate that the number of international patent applications filed under the Patent Cooperation Treaty by Mongolia often exceeded the number of domestic applications (Mongolian Statistical Information Service, 2025). This suggests that there are pockets of international S&T excellence, likely linked to the country's unique geophysical and natural features.

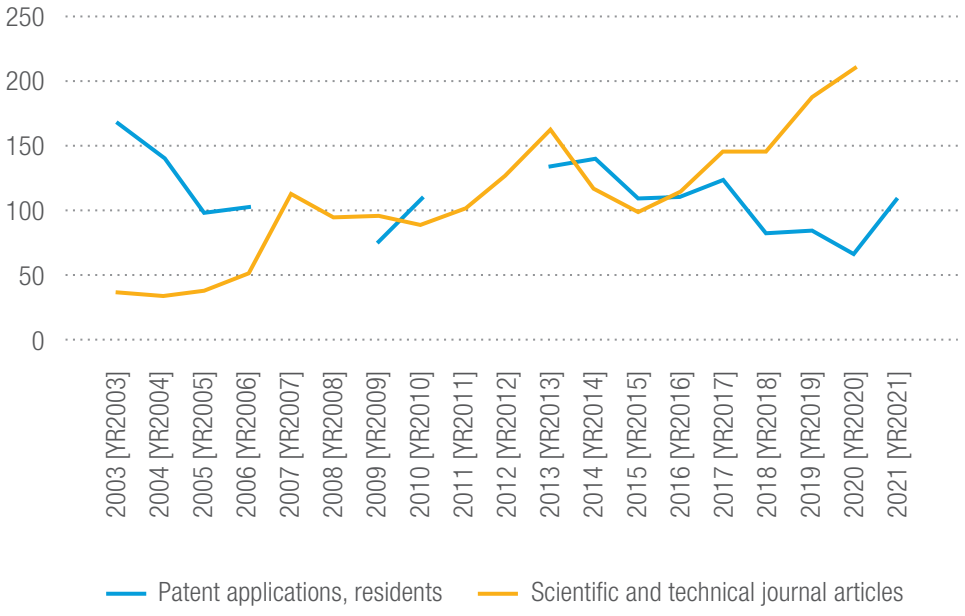
[6] However, official data should be interpreted with caution, as they do not account for business sector expenditures on research and development (R&D). The UNESCO (2007) Master Plan cites a survey of five major private R&D investors, indicating that their combined R&D expenditure in 2004 was 14.5 per cent higher than the state budget allocation for R&D in 2003. This challenges the perception that Mongolia's science and technology sector is funded exclusively through government resources.

Figure 9
Research and development expenditure (per cent of GDP)



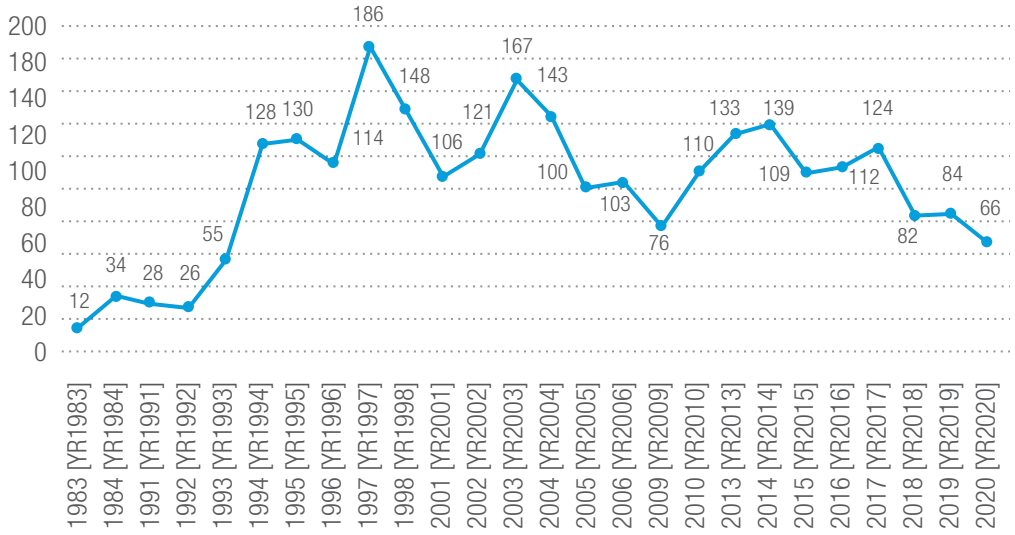
Source: World Bank Development Indicators database.

Figure 10
Science and technology journal articles and patents by residents



Source: World Bank Development Indicators database.

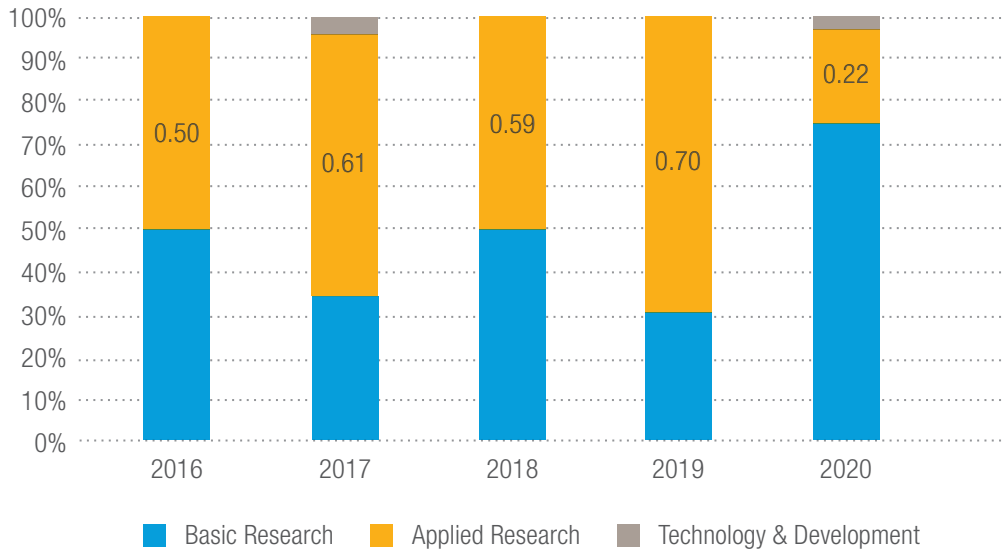
Figure 11
Annual resident patent applications in Mongolia



Source: Ritchie H, Mathieu E and Roser M (2023).

Given the scale of R&D investments, it is unsurprising that technology and development activities account for a marginal share of total R&D efforts. Development activities are typically the most expensive and in Mongolia, R&D is dominated by basic and applied research (see Figure 12). This reinforces the view that Mongolia's R&D sector primarily focuses on assimilating and adapting foreign-generated knowledge rather than generating high-value innovation domestically.

Figure 12
Structure of research and development expenditures



Source: Mongolian Statistical Information Service.

V.
Science, Technology and Innovation Parks in Mongolia

Mongolia's innovation and economic upgrading strategies leverage three key pathways: industrial technology parks for value chain upgrading in resource-based industries, science and innovation parks for economic diversification into technology-based sectors and private-sector-led incubators and accelerators for corporate diversification and entrepreneurship. While policies support these initiatives, implementation challenges persist, particularly in infrastructure development, financial sustainability and commercialization of research.

Given the specific natural resource-based characteristics of the economy of Mongolia and ongoing efforts in diversification and technology upgrading, three related but distinct pathways for upgrading through technoparks can be identified:

1. Industrial technology parks for value chain upgrading – advancing from raw material extraction in resource-based industries to processing and higher value-added activities.
2. Science and innovation parks for economic diversification – expanding into new technology-based products and services.
3. Start-ups, accelerators and incubators for corporate diversification – supporting entrepreneurship and new business development.

Industrial Technology Parks for Value Chain Upgrading

Although Vision 2050 was adopted in 2020, the National Assembly of Mongolia had previously adopted the Comprehensive National Development Policy based on the Millennium Development Goals of Mongolia in 2008 (Resolution 01-31, No. 12). This policy includes provisions for implementing regional development programmes and establishing industrial and technological parks. It also references several planned industrial and technological parks and business incubators, which are reaffirmed in Vision 2050.

These include:

- Airservice International Park
- Darkhan Industrial and Technological Park in Nalaikh, Bagahangai and Baganuur districts of Ulaanbaatar
- Selenge Industrial and Technological Park in Sukhbaatar
- Altangovy Development Park
- Sea Production and Technology Park
- Erdenet Production and Technology Park
- Kharkhurem (Kharkhorin) Training and Science and Technology Park
- Khovd, Uliastai and Daykhaan Production and Technology Parks

Industrial technology parks **upgrade Mongolia's value chains in key industries**

Industrial and technology parks are conceptualized as a mechanism to promote national industries through value chain upgrading, particularly in natural resource-based industries. Rather than exporting raw ore, the priority is increasing ore value through additional processing stages, including intermediate products.

Value chain upgrading is also highly relevant to light industries. This includes shifting from raw cashmere and wool to processed textile products or developing products based on unique Mongolian plants.

In some industries, despite the small size of the Mongolian market, diversification towards import-substituting production may be justified in sectors where transportation costs account for a high share of expenses, such as construction materials. For instance, MERA LLC demonstrates successful value chain upgrading through its specialized drilling and blasting services for mining and infrastructure (MERA, 2024).

Mongolia's industrial technology parks **add value beyond raw material exports**

To increase the number of companies that can upgrade within existing value chains, the government has initiated industrial and technology parks in Khovd and Darkhan-Uul provinces (News.mn, 2022). The aim is to establish facilities in collaboration with foreign partners to process raw hides and skins and produce value-added end products. The Darkhan projects include the construction of a Leather Industrial Complex, consisting of 13 tanneries with an annual processing capacity of 10 million skins and hides (Saraway, 2019).

The government has also initiated three industry and technology parks: Emeelt Light Industry and Technology Park, Nalaikh Industry and Technology Park for Civil Construction and Baganuur Industry and Technology Park (Baganuur, 2025). The Baganuur Industrial and Technology Park will consist of four industries and provide approximately 5,000 jobs (ADB, 2022).

The government has also initiated the establishment of the Bagakhangai Industrial and Technology Park, which will consist of light and renewable energy industries. The park has five zones, including a technology transfer centre and a high-tech industrial zone (Baganuur, 2025). Additionally, the government approved Erdesplasm LLC for a five-year licence to operate an industrial and technology park for the production of glass and glass products. At full capacity, the park is expected to create over 380 jobs and manufacture products substituting more than USD 50 million worth of imports annually (Montsame News, n.d.).

Industrial technology parks appear to be the main mechanism for industrial policy and technology upgrading in Mongolia. This assumption is based on three key factors: the longevity of this policy, which dates back to 2008; the number of industrial technology parks that have been issued licences; and their prominent role in Vision 2050.

Compared to science and innovation parks, industrial technology parks are all downstream-oriented, meaning they build on the existing raw material base and aim to add new value chain activities of higher value. New technology plays an important role in this modernization process, but the objective is not innovation per se, rather the mastery of production capabilities related to established technology and practices. The main evaluation criteria are economic value added, cost competitiveness, employment and export potential.

Most industrial technology parks appear to be focused on the light and food industry rather than heavy industry (see Figure 13). This may be due to the higher capital and technological capability requirements necessary for value chain diversification in downstream activities in the mining and minerals sectors. An exception is Erdenet Industrial and Technology Park, which is linked to Erdenet Mining Corporation and the construction of a copper concentrate smelter, representing a case of downstream diversification.[7]

Table 3
Status of industrial technology parks in Mongolia

	Name	Industry type	Ownership type	Year licensed	Remarks
1	Zavkhan ITP	Light industry	Privately owned	2013	Expired
2	Baganuur ITP	Light, food, heavy, plant nanobiotechnology	Locally owned	2016	Expired
3	Nalaikh construction materials ITP	Construction materials	Locally owned	2017	Expired
4	Emeelt light industry ITP	Light industry	Locally owned	2017	Expired
5	Erdenet food samo ITP	Food industry	Privately owned	2017	Expired
6	Darkhan ITP	Light industry	Locally owned	2017	Expired
7	Zuunmod development park	Light, food, construction	Privately owned	2020	–
8	Khovd ITP	Light industry	Locally owned	2020	–
9	Bagakhangai glass and glass products ITP	Glass industry	Privately owned	2021	–
10	Erdenet ITP	Mining-metallurgy-chemical industry	State owned	2021	Needs to change status
11	Erdenet Technopark ITP	Mixed industry	Privately owned	2021	Expired
12	Sainshand ITP	Heavy industry	State owned	N.A.	–
13	Altanshireet ITP	Heavy industry	Privately owned	N.A.	–
14	Tavantolgoi ITP	Heavy industry	State owned	N.A.	–

Source: KSP (2023).

Mongolia continues to experience difficulties in implementing industrial and technology parks beyond the policy stage. KSP (2023) reports that no industrial technology parks are operating as planned. Despite receiving special permissions, only seven parks have progressed to the stage of infrastructure development. However, the special permit periods have expired for these corporations, requiring them to conduct feasibility studies again. This has resulted in increasing budgetary expenditures without corresponding progress. The Science Park Pre-Feasibility Study (KSP, 2023) also

[7] The future of Erdenet will be more secure through the construction of a copper concentrate smelter (Mining Insight Magazine, 2023).

highlights that more than a dozen industrial technology and scientific parks have begun operations or are being established, but their development has been slow due to financial and other constraints.

STI Parks for Economic Diversification

While industrial technology parks (ITPs) focus on production and downstream activities, science and innovation parks (SIPs) emphasize upstream, innovation-related activities, products and processes. This path of technology upgrading differs qualitatively from the predominantly production-based upgrading that takes place in industrial technology parks. It relies more on research and development (R&D) capabilities and aims to diversify the economy into new, unrelated or related activities based on unique expertise and knowledge.

Mongolia's science parks **foster innovation but lack national funding**

The market for SIP-related activities is typically international or involves the localization and adaptation of foreign technologies. However, the commercialization of locally developed technologies or endogenous knowledge faces significant technological and market barriers. Moreover, the employment, export and broader economic impacts of SIPs are often less immediate and discernible compared to production-based upgrading. Nevertheless, this path of upgrading is critical as a complement to value chain upgrading, as it fosters the development of specialized and niche suppliers needed by companies operating in industrial technology parks.

Several SIPs and technology transfer centres have been established in line with this upgrading strategy (UNCTAD, 2023):

1. Science Park at the National University of Mongolia
2. Erdenet Science and Technology Park, established by the Erdenet City Administration
3. Technology Transfer Centres at the National University of Mongolia, Mongolian University of Science and Technology, Mongolian National University of Medical Sciences, Mongolian University of Life Sciences, Mongolian National Defence University and the Information Technology Park
4. The HUB Innovation Centre, established in 2018 by the Ulaanbaatar City Administration, which provides incubator services, coworking spaces and prototype lab facilities. It is located next to the Capital City's Business Innovation Agency
5. The Science Park Administration of the Ministry of Education and Science, tasked with establishing and managing the Science Park

The Science Park Administration of the Ministry of Education and Science, Erdenet Science Park and university technology transfer centres are managed by government employees. The HUB Innovation Centre operates through a public–private partnership (PPP).

The Science Park at the National University of Mongolia and the technology transfer centres at various universities are funded by their respective institutions. The city government funds the HUB Innovation Centre. Although there is a planned budget for establishing and operating SIPs, no national-level funding has been allocated for incubators, science parks, accelerators, technology transfer centres or innovation hubs under the National Innovation Strategy.

Like industrial technology parks, SIPs benefit from various incentives under the Law of Innovation. These include tax exemptions, loans, loan subsidies, public procurement opportunities, accelerated depreciation through amortization, grants, vouchers, awards and participation in events. However, it was only recently that some of the tax benefits were enacted (UNCTAD, 2023).

Based on fieldwork, two publicly supported SIPs exemplify Mongolia's evolving national innovation system. The Information Technology Park is the longest-established SIP, having developed organically and now serving as a model of a successfully operating entity with experienced management.

Box 1
Information Technology Park (IT Park, 2025)

The Information Technology Park (IT Park) was established in 1972 and functioned as a public organization promoting the development of the information society and IT sector in Mongolia until 2002. During this period, its primary focus was on IT services and activities related to the digital transformation of the state and society. Since 2002, while it remains a state-owned enterprise, IT Park has shifted its role to supporting IT-related companies.

IT Park currently employs 43 staff members, equally divided between technical services and the management and support of tenant companies. The facility is located in a two-floor building with sufficient space and a convenient location.

IT Park hosts IT companies and carries out two main activities:

- Renting office space, which generates 30 per cent of its revenue
- Incubation and training programmes, which account for 70 per cent of its revenue
- Companies can be incubated for up to two years. Successful firms often remain onsite beyond the incubation period, benefiting from rental rates that are lower than market prices.

At present, IT Park hosts 20 incubating companies. Since its transition in 2002, it has incubated a total of 120 companies. Interviews with management indicate that IT Park is well-managed, has a clear strategic direction and operates independently without ministerial interference.

Companies that enter and remain in IT Park share common motivations:

a) Lower rental costs compared to Ulaanbaatar's competitive commercial property market

b) Convenient location

c) Established reputation and credibility, which facilitate engagement with business partners

d) Networking opportunities, particularly for firms developing products or applications for the public sector, where the park's management may provide useful connections

e) A focus on localization, with all resident companies serving the domestic market rather than engaging in high-tech or knowledge-intensive activities, except in the creative industries

Mongolia's IT Park **supports firms with incubation, training and offices**

IT Park serves as a successful example of a financially viable model for facilitating economic diversification. However, a key question remains: would this development have occurred independently, even without public sector involvement?

Box 2
Ulaanbaatar Innovation HUB

Ulaanbaatar Innovation Hub offers start-ups mentorship, co-working and city links

The Ulaanbaatar City Business Innovation Agency established and manages the HUB Innovation Centre, a large and centrally located incubation centre and coworking space. The facility includes incubation rooms, training rooms, meeting rooms and spaces equipped with 3D printing and CAD/CAM functionalities.

The HUB is housed in a two-story building. The first floor, covering 1,500 square metres, accommodates start-ups, while 7,000 visits were recorded in the coworking space during the reporting period. A portion of the Hub is also designated for self-directed work. Recognized within the city as an incubator, it has become a key space for fostering entrepreneurship and creative industries.

At present, the Innovation Hub hosts 25 start-ups. Since its launch in 2018, a total of 86 companies have been incubated. The HUB Innovation Centre was closed for two years due to the COVID-19 pandemic. The incubation programme lasts one year, with an annual theme that attracts start-ups addressing specific urban challenges. In 2023, the focus was on pollution and traffic, two priority issues for Ulaanbaatar. Each year, the Hub organizes seven to eight networking and training events.

The Hub provides three key services:

- Mentorship for start-ups
- Access to coworking spaces
- Facilitation of connections with public organizations in the city

The latter is a unique advantage, given that the Hub is part of the city administration.

The Hub's rental rates are three to four times lower than those in the commercial property market, making it a highly attractive option in a city with a severe shortage of affordable workspace. It also provides a stable and high-speed 5G internet connection. The high demand for space is evident; in December 2023, the Hub received 150 applications for a single space. To address this demand, a hackathon was organized and the winning team was awarded the space.

Unlike private technology parks, the Innovation Hub does not require equity from start-ups and provides free training, offering greater flexibility and independence to resident companies.

The Hub does not maintain a fixed portfolio of companies, as the profile of incubated businesses varies based on annual themes and competition criteria.

The HUB Innovation Centre supports the development of new IT services in the city. However, many of the companies it hosts may have limited longevity. The role of the HUB Innovation Centre is primarily to enhance creative and entrepreneurial search processes. Its overall value added is not highly distinctive in terms of start-up growth. However, it serves as a socially, culturally and financially attractive space for start-ups in creative and knowledge-based services.

The envisaged Science and Innovation Park represents a major shift in the country's research and development (R&D) sector. If realized, its planned scale, ambition and potential impact on the Mongolian R&D landscape could be significant.

Box 3
Science & Innovation Park (Science Park Mongolia, nd)

Science and Innovation Park **modernizes infrastructure and fosters industry collaboration**

The Science and Innovation Park (SIP) spans 4.2 hectares of developed land, with four high-level buildings in the advanced stage of completion. However, the SIP concept has not yet been fully developed and a preliminary feasibility study has been produced. This study is not considered a comprehensive feasibility study, as it does not thoroughly address the potential benefits, disad-vantages, barriers and constraints that could affect the park's viability. In particular, it does not assess the financial, legal and market feasibility of the project. Additionally, the study does not examine supply and demand mismatches in research, technology and development or how the SIP could address them. Still, it provides a valuable first step in the process. The study itself describes its role as "a preliminary study to facilitate the development of a feasibility study."

Objectives and Rationale

The SIP aims to physically concentrate around half of Mongolia's R&D capacity. This major shift is driven by two main factors:

1. The existing public research organizations (PROs) lack adequate facilities and relocating them to the SIP could be a cost-effective way to modernize infrastructure.
2. The SIP seeks to improve networking and collaboration among key stakeholders in Mongolia's R&D system, including universities, research institutions, government and the business sector, by providing common facilities to generate a critical mass of interactions and knowledge exchanges.

Strategic Role in Mongolia's national innovation system

The SIP is envisioned as a bridge between public science and industry. According to the executive director of the Science Park Administration, the SIP has three main objectives:

1. Strengthening coordination between research institutions, universities, government and the private sector
2. Enhancing an innovation system with a favourable R&D, investment, tax and legal environment
3. Advancing high-tech start-ups and investment for science, technology and innovation (STI) development

Beyond its role as a research and innovation hub, the SIP is expected to act as a catalyst for technology-based growth by offering tax incentives to attract investment in infrastructure development. The Law on the Legal Status of Science Parks provides for the following tax incentives:

- Corporate income tax exemption
- Value-added tax (VAT) exemption
- Customs duty exemption

Box 3
continued

Long-Term Vision and Expansion Plans

The SIP is considered the first step toward establishing the Education-Research-Industry Complex, also known as the Khushig Khundii Complex. This complex will span 65 hectares and will include:

- An innovation centre
- Laboratories
- An incubation centre
- A dedicated R&D centre

This complex is planned for development near Chinggis Khaan International Airport, approximately 40 km from Ulaanbaatar.

Integration into Mongolia's Development Policy

SIP activities are aligned with Vision 2050, Mongolia's Long-Term Development Policy. One of the strategic directions outlined in Vision 2050 is establishing a science park and an innovation tax-free zone, which are considered essential for developing the national innovation system. The ongoing construction of the SIP is regarded as the pilot stage of this broader national initiative.

Infrastructure and Facilities

The STI park will host the following:

- Institute of Physics and Physical Technology
- Institute of Chemistry and Chemical Technology
- Institute of Biology
- A technology business incubator, technology transfer and innovation centre (housing R&D labs for public, private and collaborative projects, as well as a prototype development centre)
- A business support centre
- A large botanical garden, which could further support research in plant biology.

The pre-feasibility study envisions that the SIP infrastructure unit will have 22 personnel responsible for developing core activities, including:

- The Centre for Innovation and Development
- A business incubator
- A technology transfer centre

The extent to which SIP organizations will engage in basic research or commercialization (e.g., prototype development) remains undefined. This uncertainty is primarily due to financial constraints, particularly regarding funding options from public sources versus private capital. While the preferred approach is to rely on public-private partnerships (PPP), discussions with potential investors are still at an early stage.

The government's priority areas for innovation include information technology, new materials technology, biotechnology, industrial technology, renewable energy technology, cultural innovation with national characteristics and creative industries. The pre-feasibility study indicates that the Science Park could focus on developing information technology, biotechnology and industrial technologies within these sectors.

At the initial stage, the SIP is expected to undertake innovation-related activities. However, the actual supply and demand for innovation activities in the business sector have not yet been quantified or structurally assessed. The overall success of the SIP will largely depend on the demand of the business sector and its capacity to engage in collaborative innovation.

The scale of investment in the SIP necessitates parallel reforms in Mongolia's research and development (R&D) system. This would require:

- Expanding the third function of universities and R&D institutes to include innovation and technology transfer
- Strengthening the R&D capacity of the business sector
- Establishing mechanisms and instruments for collaboration between public research organizations (PROs) and businesses
- Integrating scientific research conducted by public research institutions with MSc and PhD-level education

Findings from the fieldwork carried out in the context of this report indicate that IT Park and the HUB Innovation Centre do not fully align with the traditional SIP model, which emphasizes commercializing public-sector R&D. Most firms in these two parks operate in ICT services-related fields and primarily serve local market demand. While these firms are not yet international innovators, they represent a growing entrepreneurial sector, forming part of an emerging, bottom-up-driven national innovation system.

The planned SIP aspires to take a step further by facilitating the commercialization of research outputs from domestic R&D institutions and fostering collaborative innovation with domestic businesses. Achieving this ambitious goal will require the following:

- International technical assistance
- Long-term government commitment to increasing investment in both public and private R&D

Start-ups, Accelerators and Incubators for Corporate Diversification

Science, technology and innovation parks are increasingly considered business opportunities for private entrepreneurs. However, diversification through privately run start-ups, accelerators and incubators remains uncommon in low- and middle-income economies. This form of technology upgrading is attractive to private entrepreneurs only when there is a favourable taxation and legal framework that mitigates the costs associated with failures.

Mongolia presents an interesting case in this context, as several private sector accelerators and incubators, such as Mstars Hub and Socratus, have been established. These innovation hubs do not yet benefit from public incentives but are privately operated by large Mongolian conglomerates. These companies use parks and accelerators as potential sources of corporate diversification, where successful start-ups may be integrated into their operations, while simultaneously supporting the broader national innovation system. We examined two such accelerators and business parks (see boxes 4 and 5):

Success of Mongolia's SIP depends on business demand and collaboration

Mongolia's accelerators and incubators spur corporate diversification and innovation

Socratus Startup Studio **fosters innovation through incubation, venture funding**, mentorship

Box 4
Socratus Startup Studio

Socratus is a multifunctional space operating as an incubator, accelerator, seed funding organization and networking and mentorship hub. Established in 2018, it hosts 22 companies engaged in various sectors, including education, food and travel. The facility covers 700 m^2 and is owned by Gund Investment LLC, a holding company. Socratus is a privately run business park with a well-defined strategy that aligns with the broader corporate strategy of its parent company.

The Socratus business park accepts applications for tenancy four times a year. The selection criteria include:

- Innovative idea
- Founders' leadership quality
- Team composition
- Previous experience

Once accepted, tenants collaborate with the park's management to develop a business plan. Socratus takes an equity share of between 15 and 49 per cent, but never a majority stake. Developing the business plan and model takes approximately two months, while market entry typically takes one year. The incubation programme lasts two years. One of the key challenges identified by Socratus is the lack of investors in the post-incubation stage. In addition to incubation, Socratus also runs an accelerator programme, which was launched last year.

The park also considers projects with established products that require capital and expansion strategies. In this respect, Socratus functions as the venture capital arm of Gund Investment LLC. Since it is part of a holding company, the park serves as a corporate venturing mechanism, facilitating diversification within the group.

To date, five incubated companies have been successful, six have failed and 11 remain in the incubation process. The six failed start-ups incurred losses of approximately $200,000. Of the five successful ventures, three were established from scratch, while two had existing products that required capital and management support for expansion. Interviewees noted that many companies fail due to a lack of the "right mindset" among founders.

The park's management possesses broad business knowledge rather than technology-specific expertise. However, this is not considered a limitation, as the park engages external experts from various companies, universities and other institutions. Mentors must have relevant technological expertise and are compensated per hour, with an additional fee upon successful company outcomes. Socratus organizes regular networking events to strengthen and expand its mentor network.

Currently, business parks like Socratus do not receive specific government incentives in Mongolia. However, the government is in the process of developing a Law on Science Parks to stimulate the growth of such initiatives. Under the new law, which is set to be implemented in 2024, Socratus will become eligible for tax exemptions, contingent upon an agreement with the Ministry of Education and Science. Seven technology transfer centres, including the National University of Mongolia's technology transfer centre (see annex), are also expected to receive these benefits.

Box 4
continued

According to interviewees, two of the most promising markets in Mongolia are food and education. In education, a particularly strong demand exists for platforms that facilitate language learning and the acquisition of additional skills and related certifications.

Socratus has a professionally managed team has produced a manual on company management within the park and a publication on Mongolia's national innovation system. The park is also actively working to internationalize its operations and has signed a memorandum of understanding with the Korean Start-up Fund.

Box 4 offers an example of a privately led model of incubation and acceleration, integrating investment and mentorship within a structured framework. Another example of an accelerator and business park with a distinct approach is presented in Box 5.

Box 5
Business Park of MCS Group

Technopark was established in 1993 as an energy consultancy during Mongolia's transition from socialism to democracy. It is part of MCS, one of the largest business conglomerates in Mongolia, which operates leading companies in engineering, energy, communication, property, mining, health, telecommunications, retail, beverages, banking, fintech and hospitality. MCS employs 13,000 people and emphasizes its contributions through competitive wages, procurement from domestic businesses and regular tax payments. The MCS Group has around 50 companies under its holding structure, including MCS Ventures.

The MCS Business Park hosts two types of companies:

- External start-ups
- Internal start-ups, supported through corporate venturing

The park has developed a structured start-up programme with distinct stages, including pre-seed, seed, reinvestment and IPO activities. The programme follows a methodical approach, consisting of:

- One month of onboarding and validation
- Two months of execution
- One month of investment
- One month of pitch and delivery

Start-ups receive office space and initial grants at no cost. Additionally, they can access services and inputs at discounted rates through MCS's partners. Grants typically range between USD 8,000 and USD 10,000. Mentorship is a key component of the programme, with a pool of approximately 50 mentors, including both lead and expert mentors.

MCS Park **nurtures start-ups with funding, mentorship and corporate ties**

Box 5
continued

MCS has also established a six-month accelerator programme. The estimated failure rate is around 20 per cent. Since its inception, the park has accelerated 22 companies; currently, 28 companies are participating in the programme. MCS Ventures holds a 10 per cent share in all companies it funds after six months of incubation.

Companies benefit from a hands-on approach, incorporating learning by doing, mentor feedback, strong connections with PR companies and various perks, such as discounted services from the MCS Group, which can amount to up to GBP 35,000 annually.

The main advantages of the park include high-quality mentoring and the potential for successful start-ups to be rapidly integrated into the MCS system.

We do not see significant differences between companies located in publicly (IT Park and HUB Innovation Centre) and privately supported parks (Socratus, MCS). In both publicly and privately run parks, most companies are local market-oriented and localizers. Start-ups are attracted in both cases by lower prices for renting space, which is a significant attraction in the congested real estate market in Ulaanbaatar.

In privately run parks, start-ups may expect better possibilities to raise capital for growth but are also faced with losing control. Networking possibilities seem similar, though the nature of networks seems to be different between public and private parks.

Compared to ITP and SIP, the specificity of private parks is that they do not have a priory mandate to generate employment or attract innovative businesses. Their main criteria seem to be market opportunities and if opportunities are high, such start-ups may become part of holding portfolios. In that respect, this type of organization complements the other two types of parks well.

Firms in public and private parks are part of the emerging start-up ecosystem in Mongolia. In that respect, both types of parks can be considered facilitators of the growth of the start-up ecosystem. According to the global start-up ecosystem monitor, Mongolia is 79th globally (from 77 in 2022), 14th in Asia and 5th highest ranked in the Central Asia Regional Economic Cooperation (CAREC) business region. Ulaanbaatar is the only ranked city in Mongolia, climbing up 24 spots to 448th city globally (StartupBlink, nd). Based on the Startup CAREC database, Mongolia has 62 start-ups, nine coworking spaces and two accelerators (Start Up CAREC, nd). An in-depth analysis of the Mongolian start-up ecosystem (Zanabazar and Jigjiddorj, 2023) suggests that the country had 109 start-up businesses in 19 clusters. They have generated a total revenue of $18mn and 1318 jobs (ibid). Factors that describe the growth of the start-up ecosystem are the openness of the economy to trade and FDI, a favourable environment for business through tax exemptions, tax credits, longer terms to possess land, the increased quota of foreign employees and simplified visa arrangements.

VI.
Findings and Recommendations

Mongolia's STI ecosystem faces significant challenges, including a limited enabling environment, low innovation capability and weak university-industry synergies. The underdeveloped innovation landscape, poor private sector linkages and inadequate coordination among stakeholders underscore the need for improved collaboration and policy implementation to foster growth.

Findings

1. Mongolia is a natural resource-based economy seeking to diversify into knowledge-based activities in priority sectors such as mining and agrifood.
2. The country is strongly committed to deploying technoparks as an economic development tool. It has initiated policies to incentivize the formation of technoparks, but implementation remains in the early stages. Strategic gaps, operational difficulties and regulatory inefficiencies have delayed progress.
3. Mongolia currently has three types of technoparks:
   - Industrial technology parks focused on production upgrading
   - Public science and innovation parks aimed at fostering innovative businesses
   - Privately run business parks supporting start-ups and accelerators

   These three paths to technology upgrading and diversification complement each other. Each faces significant challenges in becoming an effective and impactful transformation mechanism from a dominantly natural resource-based economy to a knowledge- and technology-based economy. For now, these mechanisms are still mainly in the realm of policy commitments and licences issued for their formation or have just started operations. There is a significant gap between policy commitment and results.
4. A growing economy has stimulated the growth of start-up firms that exploit emerging market opportunities, primarily in new, dominantly local market niches. Many of these are in the area of local ICT services. This opportunity has been recognized by both private entrepreneurs and public sector organizations, which have established what can best be described as incubator-based business parks. Both public and private parks have established themselves as viable organizations that can promote new firms in the knowledge-intensive business, especially if they are related to Internet and ICT services.

Mongolia's technoparks drive diversification but lack strategic execution

Strategic action must connect Mongolia's technopark policies to impact

5. When strategically approached and well managed, these organizations, both in the private and public sectors, are financially viable and can contribute to the diversification of the economy. A specific feature of Mongolia is the presence of business parks established by large holdings, which operate as places for corporate venturing or diversifying holdings into new areas when start-ups open new profitable market niches.
6. Industrial technology parks are a production capability upgrading mechanism linked to large enterprises in natural resource-based industries (mining, food, raw material) and represent value chain upgrading. They face significant constraints regarding capital requirements, difficulties accessing foreign markets and difficulties establishing technology collaborations with foreign partners.
7. The country does not yet have an articulate innovation policy but has started developing a science or R&D policy. Its R&D system is malnourished and has very limited science and technology outputs. As part of its vision to boost investment in R&D and ensure its local relevance, Mongolia aims to establish a science park as an instrument of knowledge-based development. For that purpose, the country has conducted a pre-feasibility study and is building facilities for an STI park in Ulaanbaatar. So far, the focus is on the physical relocation and grouping of STEM institutions under the Academy of Sciences, concentrating almost half of the country's R&D potential in a single location. However, the process is still in the early stages and the administration of the future science park is in strong need of foreign technical assistance.
8. Overall, there is a large gap between the policy aim to enhance the R&D or technology-push profiles of STI parks and the reality on the ground, which indicates that successful parks are demand-led and local market-oriented. Mongolia must develop a more strategic approach to match its ambition to use science, technology and industrial parks as economic development tools.

The policy on the ITPs faces the biggest challenges in converting conceptual ideas into reality. This is due to their large capital requirements, difficulties accessing foreign markets and establishing technology collaboration with foreign partners. Publicly-funded innovation parks have established themselves as viable organizations that can promote new firms in the knowledge-intensive business, especially if they are related to Internet and ICT services. Private business parks are feasible forms of supporting start-ups and valuable mechanisms for corporate venturing.

Common to all three types is the lack of strategic approach, commitment and management capabilities, as well as the weak internationalization required to establish different technoparks as mechanisms of economic development. The central and local governments have not followed their normative commitments by budgets and by legal and institutional support for technopark developers to attract necessary funds.

The current situation is that many policy commitments remain uncertain regarding their implementation.[8] For example, the revised Science and Technology Law includes a plan to offer fiscal incentives to support R&D in both public and private R&D organizations or enterprises. Specifically, there is an intention to provide tax deductions for R&D activities conducted by business enterprises. Additionally, there

[8] A survey of tax and credit incentives shows that at present there are only a few incentives which directly facilitate diversification of the economy (PWC, 2005)

is a commitment to introduce an import tax exemption for instruments and materials essential to research and development efforts.

Although a system exists to provide grants for new technology-based firms (start-ups) to implement their innovation projects, no concrete cases have been identified of firms that have benefited from it. Furthermore, procedures for providing loans and loan subsidies to support innovation projects are still under development.

Recommendations

Policy and Governance Framework for STI Parks

Challenge: Central and local governments have not fulfilled their commitments to provide adequate budgets and legal support for STI park development. This public policy gap affects STI parks' ability to operate effectively.

Recommendation: The government should establish an agency to oversee publicly funded STI parks, ensuring they receive adequate financial, legal and institutional support. A comprehensive legal framework is needed to promote technology start-ups and commercialization, particularly for privately managed STI parks.

Key actions:

- Implementing a management responsibility system for park operators, training professionals in STI park management, securing financial resources and providing legal and institutional backing
- Conducting periodic stakeholder consultations, including representatives from the private sector, academia and civil society, to ensure policies remain responsive to evolving needs
- Creating a long-term roadmap for STI park development with measurable milestones and timelines

Enhancing STI Park Management, Operations and Governance

Challenge: The management of technoparks lacks clear governance structures and defined goals, leading to inefficiencies in their operation and development.

Recommendation: Establish a structured park management system with clear governance policies and a well-defined responsibility framework for companies running the parks. This should involve training professionals in STI park management and securing necessary financial and human resources for effective operation.

Key actions:

- Developing training programmes for park managers and ensuring accountability through formal management contracts
- Adapting governance structures to suit specific park types and industries while maintaining consistency
- Conducting regular performance reviews of STI park operators to ensure adherence to governance standards and operational goals

Financial Mechanisms for Innovation Support

Challenge: Fiscal incentives for R&D are underutilized due to unclear implementation and accessibility issues. Few firms have benefited from these incentives and the actual implementation remains uncertain.

Recommendation: Create a transparent system for grants, loans and tax incentives to support R&D and innovation within STI parks. Develop a structured framework that ensures financial mechanisms are well-communicated, accessible and effectively implemented.

Key actions:

- Establishing a clear and accessible system for grants, loans and tax incentives aimed at supporting R&D activities and innovation projects within STI parks

Enhanced governance and funding crucial for effective STI park development

- Developing targeted financial instruments such as micro-loans, grants and tax incentives for start-ups led by women, youth or marginalized groups, ensuring their participation in innovation-driven growth
- Enhancing transparency in accessing financial support by simplifying application processes, publishing clear eligibility criteria and establishing an independent evaluation body
- Developing sector-specific financial incentives to support high-growth potential industries such as ICT, agritech and renewable energy
- Ensuring continuous assessment of financial mechanisms through monitoring and evaluation frameworks to measure their impact and improve accessibility

Stronger industry-academia ties unlock Mongolia's innovation potential

Collaboration Between Academia, Industry and Society

Challenge: Mongolia's R&D system is underdeveloped, with limited outputs and weak linkages between research institutions, industry and society. This restricts the potential for innovation and knowledge transfer. The lack of structured collaboration mechanisms between academia and industry hinders the commercialization of research and the development of market-driven innovations.

Recommendation: Strengthen collaboration between STI parks, academic institutions and the private sector to enhance R&D outcomes and ensure alignment with market demands. This should include structured initiatives such as joint research projects, internships, technology transfer programmes and innovation clusters. Establishing a Technology Transfer Fund could provide financial support for commercializing research outputs, while partnerships with civil society organizations could foster inclusive innovation benefiting marginalized communities.

Key actions:

- Establish a Technology Transfer Fund to support commercialization efforts, particularly for research with market potential
- Develop structured internship and apprenticeship programmes connecting university students with STI parks and resident companies to enhance industry-relevant skills and workforce development
- Expand collaboration to include civil society organizations, ensuring that innovations address social and economic challenges faced by marginalized groups
- Facilitate industry-academia partnerships through co-funded research projects and public-private R&D initiatives
- Enhance university-based innovation hubs and incubators to support student-led start-ups and spin-off companies
- Develop a national knowledge transfer strategy to align academic research priorities with industry needs and emerging technological trends

Infrastructure investment is key for Mongolia's inclusive, thriving innovation ecosystem

Infrastructure and STI Park Ecosystem Development

Challenge: The current infrastructure of STI parks limits their ability to attract and support innovative firms. Inadequate facilities and lack of essential services hinder collaboration, knowledge-sharing and commercialization of new technologies.

Recommendation: Invest in infrastructure improvements to create an enabling environment for innovation within STI parks. Ensure that facilities are designed to support collaboration and are accessible to all, including persons with disabilities. Provide spaces for community engagement and youth-led initiatives to foster a more inclusive and dynamic national innovation system.

Key actions:

- Ensure facilities are accessible to all, including persons with disabilities and incorporate spaces for community engagement and youth-led initiatives
- Develop energy-efficient and sustainable infrastructure to lower operational costs and promote green innovation
- Ensure reliable access to high-speed internet and other digital infrastructure to support advanced R&D activities and attract high-tech firms

Monitoring, Evaluation and Adaptive Learning

Challenge: There is a gap between policy objectives and actual implementation, with limited mechanisms to assess the impact of STI parks on innovation and economic diversification.

Recommendation: Establish a robust monitoring and evaluation framework to measure STI parks' effectiveness in fostering innovation. Regular assessments should inform policy adjustments and ensure that STI parks remain aligned with national development priorities.

Key actions:

- Introduce periodic reporting requirements for STI parks to track progress against established benchmarks
- Utilize independent third-party evaluations to ensure objectivity and accountability in assessing STI park performance
- Develop an adaptive learning approach to integrate lessons from evaluation results into future policymaking and STI park operations

Encouraging Private Sector and Community Engagement

Challenge: Greater private sector participation is required to enhance the sustainability and impact of STI parks. Currently, publicly funded innovation parks are viable, but stronger private-sector involvement is needed for long-term success.

Recommendation: Create incentives for private sector participation in STI parks by supporting technology commercialization and R&D activities. Establish systems that facilitate private sector partnerships while ensuring a clear legal and financial support framework for STI parks.

Key actions:

- Introduce corporate social responsibility (CSR) incentives for companies to mentor or fund start-ups led by underrepresented groups
- Facilitate private sector partnerships in STI park governance to encourage co-ownership and accountability
- Organize industry-specific innovation forums to showcase STI park capabilities and attract private investment

Gender, Youth and Marginalized Group Inclusion

Challenge: Women, youth and marginalized groups face systemic barriers to participation in STI initiatives, including limited access to education, training and funding opportunities.

Recommendation: Develop comprehensive strategies to ensure the inclusion of women, youth and marginalized groups in STI park operations, from governance to entrepreneurship. Strengthen educational pathways and financial support mechanisms to enhance participation in STI-related activities.

Key actions:

- Launch scholarship programmes targeting women and youth in STEM education
- Partner with NGOs to support grassroots innovation benefiting marginalized communities
- Develop mentorship programmes to support women and youth entrepreneurs
- Introduce financial instruments, including micro-loans and grants for start-ups led by women, youth and marginalized groups
- Expand collaboration with civil society organizations to develop targeted innovations for marginalized communities
- Ensure STI park facilities are accessible to persons with disabilities and include spaces for community engagement and youth initiatives
- Establish inclusion indicators to measure the participation of women, youth and marginalized groups in STI park activities

Empowering marginalized groups is vital for an inclusive innovation ecosystem

Digital Transformation and Future-Ready Skills

Challenge: Many STI park tenants and surrounding communities lack access to advanced digital infrastructure and training in emerging technologies. This limits their ability to leverage Industry 4.0 technologies.

Recommendation: Invest in digital infrastructure and capacity-building initiatives to ensure STI parks and local communities are equipped with the necessary skills to engage in the digital economy.

Key actions:

- Provide targeted support for underrepresented groups to access Industry 4.0 technologies and training
- Facilitate partnerships with global technology firms to deliver training programmes on artificial intelligence (AI), the Internet of Things (IoT) and other emerging technologies
- Establish digital innovation hubs within STI parks to promote experimentation, prototyping and collaboration using advanced technologies

Annex.
Selected Cases of STI Parks in Different Economies

The role of science and technology parks in fostering innovation and economic growth has been widely studied and debated globally. This annex presents selected case studies that may offer useful insights for Mongolia.

This overview underscores that while S&T parks can contribute to business incubation and technology transfer, their effectiveness in driving innovation and economic diversification varies widely. Key success factors include strong linkages with universities and research institutions, the availability of highly skilled labour, the entrepreneurial orientation of small and medium-sized enterprises (SMEs) and well-designed policies and incentives that support research and development (R&D) and innovation.

Kazakhstan's Technoparks

A study on Kazakh technoparks (Radosevic and Myrzakhmet, 2009) found that firms located in technoparks are not necessarily more innovative than those outside. Most technopark firms operate in traditional sectors and focus primarily on the local market, with stronger external than internal linkages. The main motivations for locating in a technopark include lower rents and improved access to finance. While Kazakh technoparks have been relatively successful in facilitating business incubation, they have been less effective in fostering innovation and economic diversification.

European Union Business Incubators (2002)

The first comprehensive analysis of European Union business incubators, conducted in 2002, found that:

- Many incubators could cover 40 per cent of their costs through tenant fees, while the remaining 60 per cent required public subsidies.
- Business incubators added value in four key areas: entrepreneurial training (especially in the pre-incubation stage), business advisory services, financial support (usually through external partnerships) and technology assistance.
- A key challenge was balancing a high occupancy rate with selective admission criteria, including clustering and networking considerations.

United Kingdom and Australian Science Parks

Westhead and Storey (1995) surveyed 35 United Kingdom science parks and found that firms with university linkages had higher survival rates. They concluded that science parks play a critical role in supporting high-tech small firms.

Phillimore (1999) evaluated the Western Australian Technology Park using firm interactions as a criterion. He found that companies in the park often formed networks, reinforcing the importance of interactions among resident firms.

Incubators have been shown to contribute to tenant firms' growth and survival, making them a viable mechanism for nurturing new technology-based firms. According to one study, nearly half of firms assigned significant value to office services, although business assistance services were used less frequently. Business plan assistance, however, was used at inception by 67 per cent of respondents (Mian, 1996).

Hsinchu Science-Based Industrial Park

Hsinchu Science-Based Industrial Park in Taiwan, Province of China, is often cited as a success story (Xue, 1997). Key features include:

- Standard factory buildings leased to industrial investors to support small and medium-sized enterprises
- A strong emphasis on demand-driven R&D, with product development and process improvements shaped by market demands and manufacturing needs
- Incentives and programmes to encourage firms to increase their R&D investments and upgrade their activities, shifting from adapting imported technologies to developing new products and processes

Several unique factors contributed to Hsinchu's success (Xue, 1997):

- A highly skilled labour supply from two technically oriented universities
- A strong presence of entrepreneurially oriented SMEs
- A selective admission process ensuring that only technology-based firms aligned with the park's industry focus were admitted
- Investment policies geared toward knowledge-intensive industries
- Targeting industries at a stage where upgrading to R&D and knowledge-intensive activities was necessary
- A crucial role played by the Industrial Technology Research Institute (ITRI), a government institute focused on industrial R&D, technology integration and improving manufacturing processes

Hsinchu demonstrates the importance of external factors in shaping an economy's innovation ecosystem. Unlike many STI parks focusing on technology push models or R&D commercialization, Hsinchu was primarily built on demand-driven R&D and manufacturing activities.

STI Parks in China

STI parks in China represent one of the most prominent cases of successful technology upgrading. Their uniqueness stems from the country's scale, efficient policy implementation and global economic influence.

One defining feature of STI parks in China has been their emphasis on large-scale technology acquisition through foreign investment rather than fostering indigenous innovation. Sutherland (2005) notes that early STI parks primarily imported foreign technology through inward investment rather than supporting domestic firms and technological development. In 2000, a quarter of China's industrial output growth came from the 53 trial high-tech parks and two-thirds of all high-tech exports originated from these zones. The share of high-tech zone exports in total national exports nearly doubled, from 15 per cent in 2006 to 28 per cent in 2016 (Walcott, 2021).

Econometric studies show that firms located in STI parks significantly increase their R&D investments. Moreover, firms outside the parks also increase R&D spending due to competitive pressures from in-park firms (Xue and Zhao, 2023). These effects are particularly pronounced in highly competitive industries, suggesting that STI parks promote industry-wide innovation through market competition.

Initially, the definition of "high-tech" was loosely applied in selecting firms for STI parks. Instead of fostering indigenous technological innovation, Chinese STI parks initially focused on attracting foreign direct investment and facilitating large-scale production. Policies favoured export-oriented production and technology transfer from foreign firms was prioritized over domestic R&D (Sutherland, 2005). Research-industry-education linkages remained relatively weak and the volume of patents granted based on indigenous R&D was modest (Walcott, 2021).

However, in recent years, Chinese STI parks have begun shifting towards supporting indigenous innovation. New firms are increasingly formed based on domestic technological efforts and universities are playing a larger role in fostering native firms through information networks and entrepreneurship training (Walcott, 2021). This shift toward endogenous innovation presents new challenges. For example, econometric evidence suggests that technology business incubators (TBIs) do not accelerate economic convergence across Chinese regions. However, non-state-owned and specialized TBIs can facilitate convergence, whereas state-owned and diversified TBIs do not significantly impact regional economic development (Hong et al., 2017).

Key Takeaways for Mongolia

The international experiences of STI parks provide valuable insights for Mongolia. Successful STI parks require more than just infrastructure; they depend on strong management, effective university-industry linkages, targeted policies and a focus on both local and global innovation dynamics.

Lesson from international cases suggest that Mongolia should consider the following when designing its STI parks:

- Develop strong academic-industry linkages. Successful STI parks, such as Hsinchu, demonstrate the importance of integrating universities and research institutions into the national innovation system.
- Ensure demand-driven innovation. Hsinchu and Chinese STI parks highlight the importance of fostering market-led R&D rather than solely focusing on academic research commercialization.
- Provide targeted financial and policy incentives. Support mechanisms, such as tax incentives, R&D grants and venture capital support, play a critical role in creating a thriving national innovation system.
- Develop mechanisms for international technology collaboration. Chinese STI parks benefited from foreign technology transfer, which played a key role in industrial upgrading. Mongolia could explore similar opportunities for integrating into global technology networks.
- Encourage private sector participation. Private-sector-led STI parks, such as those in China, have proven highly effective in driving technological advancement and commercialization.

By applying these insights, Mongolia can strengthen its STI park strategy and enhance its broader efforts toward innovation-led economic development.

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