



# *Feasibility Study on* **Technology Transfer Models** for Projects Related to SDGs



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## **Executive Summary**

The progress of Science, Technology and Innovation (STI) has profound impacts on modernization and civilization of human history. In the last few decades, the discovery of scientific and technological breakthroughs has led to economic leapfrog and significant poverty reduction of many countries, particularly starting from the first industrial revolution in the 18<sup>th</sup> century of England. Technology transfer has played a significant role in economic development of many countries and enable the catch up to happen all around the world, and it will continue to do so in many more decades, if not centuries, to come. As ASEAN thrives to prosper together as a whole community, collaboration is more crucial than ever to promote sharing of resources, expertise, and technologies to achieve sustainable and inclusive development and effectively address the challenges. In this regard, The Committee on Science, Technology, and Innovation (COSTI) has been established to facilitate and promote STI collaboration among the member states in the region. The ASEAN COSTI has many initiatives including promoting R&D, supporting innovation and entrepreneurship, and enhancing human capital development in STI to promote sustainable development and regional integration.

This study aims to understand the current situation, regulatory and policy frameworks of ASEAN Member States (AMS) on technology transfer, identify the gaps and barriers, and finally propose the best suitable model and mechanisms through the thorough and comprehensive analysis under the co-creation and design framework, involving government officials and experts from all AMS. ASEAN action plans promoting STI and technology transfer has been holistically scrutinized, and the relevant policies and initiatives to promote technology transfer and the responsible institutions in all 10 AMS were reviewed and identified to gain insights into the current status and the comparative level of technology transfer level in the region. Gaps and barriers were then identified including lacking of common legal framework for intellectual property rights, limited collaboration between academia and industry, limited access to international networks, language barriers, cultural differences, limited access to financing, infrastructure and technological readiness.

To address the challenges and promote technology transfer in the ASEAN region, this study reviewed the existing models available around the world, and the suitable model and mechanisms of technology transfer are then proposed to be implemented in the regional scale including:

- **Regional Technology Management Hub:** A centralized platform that serves as a control center for managing various aspects of technology infrastructure within ASEAN.
- **National Technology Transfer Taskforce:** A group of experts and stakeholders from the public and private sectors tasked with identifying and promoting the transfer of technology and knowledge from government agencies to the private sector.
- **Regional Technology Transfer Center:** A facility that provides a range of services and resources to help accelerate the transfer of technology from government research to commercialization in the private sector. The center serves as a hub for innovation, providing a centralized location for industry, academia, and government agencies to collaborate and share ideas.
- **Regional Business Council:** An organization that brings together business leaders from various industries and sectors within a particular region to promote economic growth and development.
- **National Technology Transfer Alliances:** Partnerships between government agencies, academic institutions, and industry organizations that work together to promote technology transfer and commercialization.
- **Regional University Consortium:** A collaborative organization that brings together multiple universities and colleges within a particular region to advance research, education, and economic development.
- **Regional Incubator Center:** A facility designed to support the development and growth of new and emerging businesses.
- **Regional Public Private Partnership:** A collaboration between government entities and private businesses to jointly develop and deliver public services and infrastructure.
- **Regional Joint Venture:** A business partnership between two or more organizations to promote the combine and share resources, expertise, and capabilities to achieve common goals, such as developing new products, entering new markets, or reducing costs.
- **Regional Research Collaboration:** Partnerships and collaborations between academic, research, and industry organizations within a specific region to conduct research, share knowledge and expertise, and develop solutions to regional challenges.

- **Staff and Talent Exchange Program:** The exchange of personnel between organizations within a specific region to promote collaboration, knowledge sharing, and skill development among organizations, while also addressing talent shortages and enhancing the region's economic competitiveness.

It is very fortunate that we are living in the era of scientific and technological advancement, where innovative solutions could help us achieve sustainable and inclusive growth, and collaboration could bring about positive change and tackle the challenges on the regional and global scale. Technology transfer enables nations to access to the source of indigenous and emerging technologies and tap into the global knowledge. However, to achieve the promising result, steadfast commitment is required to promote technology transfer for the prosperous ASEAN, as embodies in the slogan “One Community, One Destiny”.

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## Abbreviation List

AEC	:	ASEAN Economic Community
AIIP	:	ASEAN-India Innovation Platform
AMS	:	ASEAN Member States
APASTI	:	ASEAN Plan of Action on Science, Technology, and Innovation
APCTT	:	Asian and Pacific Centre for Transfer of Technology
ASCC	:	ASEAN Socio-Cultural Community
ASEAN	:	Association of Southeast Asian Nations
BAS	:	Business Advisory Services
BEDB	:	Brunei Economic Development Board
BPTT	:	Bureau of Patents, Trademarks and Technology Transfer
BRISc	:	Brunei Research Incentive Scheme
CATTC	:	China-ASEAN Technology Transfer Center
COSTI	:	Committee on Science, Technology, and Innovation
CPTPP	:	Comprehensive and Progressive Agreement for Trans-Pacific
CSDG	:	Cambodian Sustainable Development Goals
DOST	:	Department of Science and Technology
DTI	:	Department of Trade and Industry
GDP	:	Gross Domestic Product
GDSTI	:	General Department of Science, Technology & Innovation
GFRI	:	Government Funded Research Institutes
GNI	:	Gross National Income
GRI	:	Government Research Institutes
IA	:	Intangible Assets
ICP	:	Industrial Collaboration Policy
ILO	:	Industry Liaison Office
IP	:	Intellectual Property
IPI	:	Intellectual Property Intermediary
IPOS	:	Intellectual Property Organization of Singapore
IPRs	:	Intellectual Property Rights

IT	:	Information Technology
JICA	:	Japan International Cooperation Agency
LEs	:	Large Enterprises
LNCCI	:	Lao National Chamber of Commerce and Industry
MIL	:	Myanmar Investment Law
MISTI	:	Ministry of Industry, Science, Technology & Innovation
MITA	:	Myanmar Innovation and Technology Accelerator
MOSTI	:	Ministry of Science, Technology and Innovation
MRANTI	:	Malaysian Research Accelerator for Technology and Innovation
MSDP	:	Myanmar Sustainable Development Plan
MyIPO	:	Intellectual Property Corporation of Malaysia
NPSTI	:	National Policy on Science, Technology and Innovation
NRIA	:	National Research and Innovation Agency
NSDP	:	National Strategic Development Plan
NSTA	:	National Science and Technology Authority
NSTDA	:	National Science and Technology Development Agency
NSTIPO	:	National Science Technology and Innovation Policy
NTTA	:	National Technology Transfer Alliances
NTTO	:	National Technology Transfer Office
NTU	:	Nanyang Technological University
NUS	:	National University of Singapore
NXPO	:	National Higher Education Science Research and Innovation Policy Council
ORTT	:	Office of Research & Technology Transfer
PCT	:	Patent Cooperation Treaty
PPP	:	Public Private Partnership
R&D	:	Research and Development
RBC	:	Regional Business Council
RCEP	:	Regional Comprehensive Economic Partnership
RIE	:	Research, Innovation and Enterprise
RS-IV	:	Rectangular Strategy Phase IV



RTTC	:	Regional Technology Transfer Center
SDG	:	Sustainable Development Goals
SIPS	:	Singapore Intellectual Property Plan
SMEs	:	Small and Medium Enterprises
SMU	:	Singapore Management University
STEM	:	Science, Technology, Engineering, and Mathematics
STI	:	Science, Technology, and Innovation
TAPI	:	Technology Application and Promotion Institute
TBI	:	Technology Business Incubators
TC	:	Technology Commercialization
TCELS	:	Thailand Center of Excellence for Life Sciences
TPM	:	Technology Park Malaysia
TRIPS	:	Trade-Related Aspects of Intellectual Property Rights
TVET	:	Technical and Vocational Education and Training
UBD	:	University Brunei Darussalam
UNESCAP	:	United Nations Economic and Social Commission for Asia and the Pacific
UNIDO	:	United Nations Industrial Development Organization
WIPO	:	World Intellectual Property Organization

# 1. Introduction

## 1.1. Background

Throughout human history, technology has profound impacts on national modernization and civilization, as well as human lives, whether people want it or not, and whether they are prepared for it or not. Business and firm leaders always seek ways to deploy technologies developed around the world for their profitability and growth (Ramanathan, 2012). One fundamental process that has influenced the economic performance of nations and firms for many decades is technology transfer. Technology transfer can be achieved by two ways: (i) developing it through R&D, also known as vertical technology transfer, and (ii) purchasing it from other places, referred as horizontal technology transfer. When we talk about technology, it can encompass both hard elements, including machine, equipment, devices etc., and soft elements, process, software, management or marketing strategies. Hence, technology transfer is the process by which those elements are transferred from one individual or firms to another (Sudha Rani et al., 2018). Economic development, at least in the recent decades, is inseparable from the progress of scientific knowledge and technical know-how and skills, as they can enhance the innovation capability and competitiveness of a nation in the global arena. In fact, technology has played a pivotal role in economic development from 1950s by turning many countries from agrarian and labor-intensive economy to an industrial economy, and research and development (R&D) has subsequently exponentially accelerated the transition to an innovation-driven and knowledge-based economy of many developed nations as we see today. Even the middle-east countries have now been bridging an oil-based economy to a globally competitive high-tech economy.

To strengthen scientific knowledge and technological know-how, technology transfer stands at the forefront in tandem with other prerequisites in the innovation system for economic development. Technology transfer is not a new thing; this kind of process has been traced back thousand years ago since pre-history of humankind through the transfer of tacit knowledge from one generation to another. One phenomenal historic event occurred when the industrial revolution happened in England in the eighteenth century. And not long after that, we saw this also happened in many other countries in Europe and the United States (US). After World War II concluded, the progress in scientific and technological capabilities has been drastically increased, especially in the US, as the consequences of the transfer of knowledge from research activities and commercialization of research products that the many national governments, especially the US, invested in R&D. After that the speedy economic recovery from war and boost of economic development very fast has been observed in both allies and axis countries such as Russia, Germany, Japan and later to other countries in Asia such as South Korea, Hong Kong, Taiwan and Singapore. In recent decades, the rise of China and India is the

evidence of the catch up of scientific and technological capabilities to the US and the West, which used to be the unchallenged countries in science and technology for many decades. These boost in economic recovery and development and catch-up happened on the ground that technology and knowledge were transferred cross-borderly from one country to another. These spillovers occurred due to many factors including globalization and cross-border collaboration. This brought about many opportunities for firms as well as the economy as a whole; many firms especially SMEs use technology transfer to strengthen their capacity and overcome challenges posed by globalization (Mayer, S., & Blaas, W., 2002)

In the Association of Southeast Asian Nations (ASEAN), the Committee on Science, Technology, and Innovation (COSTI) has been established to facilitate cooperation and collaboration in Science, Technology, and Innovation (STI). COSTI's initiatives include promoting R&D, supporting innovation and entrepreneurship, and enhancing human capital development in STI. The work of COSTI is guided by the ASEAN Plan of Action on Science, Technology, and Innovation (APASTI), which is a strategic framework that guides ASEAN's efforts to use STI to support sustainable development and regional integration. APASTI aims to support the ASEAN Economic Community (AEC) blueprint by fostering innovation, increasing productivity, and enhancing competitiveness in the region. Its priorities include enhancing human capital in STI, promoting R&D, facilitating technology transfer and commercialization, and strengthening STI governance and infrastructure.

Regional collaboration has become more necessary than ever to enable technology transfer and diffusion in all member countries. The ASEAN region, with the market size of more than 2 trillion USD, should embrace this opportunity to take full advantages of the existing stock of knowledge and technology available to make a good use of it with strong collaboration to solve common challenges and for mutual economic benefits among its member states. This will form a conglomerate of nations to attract the flow and transfer of knowledge and technology from the outside and diffuse it in all ASEAN member states. Hence, ASEAN should have a regional platform and mechanism for technology transfer to achieve its sustainable and inclusive development goal.

## **1.2. Objective**

The objectives of this project are to:

- Understand the current situation, practices, government initiatives, law and regulatory frameworks, gaps, challenges and barriers on technology transfer in ASEAN member state.
- Explore and scout the existing models and best practices of technology transfer available in the world.

- Propose the best suitable model and mechanisms of technology transfer applicable to all ASEAN Member States (AMS) to promote sustainable and inclusive development.

### 1.3. Approach

This feasibility study has been undertaken using a holistic approach under co-creation and multi-stakeholder mechanism, as explained follow:

- **Desk review:** The assessment of the current situation of Technology Transfer in ASEAN has been thoroughly conducted. A literature review has been extensively searched and reviewed on existing documentation on policy and regulatory frameworks in AMS to get to understand the current state of art of technology transfer practiced in AMS.
- **Expert Inception:** Set the basis for the Technology Transfer Framework. This stage consists of in-depth discussions and consultation processes with experts and highly related people in the field to formulate the conceptual framework, methodology and set basis for technology transfer mechanism for ASEAN region. This stage also involves the consultation with experts from World Intellectual Property Organization (WIPO), an international consultant group for this project, to fine-tuning the conceptual framework and methodology for this project.
- **Co-creating the technology transfer mechanism for SDG:** This stage engages many key stakeholders and experts in the field from various sector including government agencies, universities and research center, intellectual property (IP) bodies, technology transfer offices and units from all AMS to come on board, and co-define the goals, challenges, gaps on technology transfer, and co-develop the mechanisms for technology transfer suitable for all AMS to promote sustainable and inclusive development and to ensure that no member state is left behind.
- **Validation and consensus building:** This stage involves all AMS and experts to make a consensus on the mechanism of technology transfer proposed in this project for not only to increase buy-in and share ownership of this initiative, but also to ensure the successful implementation of this project.

## **2. Current Status in ASEAN country**

### **2.1. ASEAN's STI Related Action Plan Supporting Technology Transfer**

When we talk about Technology Transfer, it is very necessary to look into the progress of STI as the latter is the main catalyst to enable and boost the former to happen and diffuse widely in the market. Hence, this section will discuss about STI, and Technology Transfer specifically, action plan of ASEAN. STI is an integral component of all economies in ASEAN, regardless of the economic status of the nation. Every economy is driven by some form of production, be it the production of goods or services, ranging across sectors such as agriculture, energy, education, finance, manufacturing, or tourism. Technology transfer is an important channel for firms in developing countries to get access to new technology and initiate innovation. The geographical pattern of technology transfers in the form of buyer-provided training in domestic and international production networks. As such, the integration and cooperation agenda of the STI is driven by the common vision of every AMS to leverage on the use of STI to share knowledge and research developments, and to translate the research outputs into implementable solutions that address the real-life problems faced by its citizens.

There is an existing plan of action which strengthens strategic collaboration among academia, research institutions, networks of centers of excellence, and the private sector to create an effective ecosystem for capability development, technology transfer and commercialization. Under the consistent with the relevant characteristics of the ASEAN Economic Community (AEC) 2025, as well as the ASEAN-Socio-Cultural Community (ASCC) Blueprints 2025, APASTI 2016-2025 is accompanied by an implementation plan that will include the priorities; targets/deliverables; specific actions; timelines; indicators, to be derived from the work plans of various Sub-Committees under the purview of COSTI. STIs are necessary contributors to socio-economic development and in accordance with the S&T Ministers' directive, this APASTI implementation plan includes activities that are supportive of both social and economic developments.

The current APASTI is the fifth one covering 2016 till 2025. The Plan of Action is mapped out along four big thrusts. The first thrust targets public-private collaboration and seeks to strengthen strategic collaboration among academia, research institutions, networks of excellence, and the private sector to create an effective ecosystem for capability development, technology transfer and commercialization. The second thrust aims to address talent mobility, people-to-people connectivity, and inclusiveness. This is achieved by enhancing the mobility of scientists and researchers, people-to-people connectivity and strengthening the engagement of women and youth in STI. The third thrust addresses support for enterprises. This is achieved by establishing innovative systems and smart partnership with dialogue and other partners to nurture Science,

Technology & Innovation enterprises to support micro, small and medium enterprises (SME), nurture knowledge creation and STI applications to raise competitiveness. The final thrust seeks to create public awareness and STI enculturation to enhance ASEAN science and technology cooperation.

When looking with existing dialogue partners within the region which are working on technology transfer platforms, there are the Asian and Pacific Centre for Transfer of Technology (APCTT), ASEAN-India Innovation Platform (AIIP) and China-ASEAN Technology Transfer Center (CATTTC), are shown in summary in **Table 1**. APCTT is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) servicing the Asia-Pacific region. APCTT supports the capacity-building of member countries to strengthen STI policy for fostering technology-based sustainable development. APCTT focuses on creating an enabling environment for the development and transfer of innovative technologies so that member countries can meet development challenges in today’s globalized world. AIIP is a major element of the enhanced the ASEAN-India S&T Development Fund, which is a part of ASEAN-India Science & Technology Collaboration, by undertake other tasks like selection and validation of technologies through expert committees for identifying the potential technologies for transfer in ASEAN members to Indian entrepreneurs and vice versa; to perform need analysis of technological requirements by organizing annual meets in India of ASEAN members; follow-up meets to update and review; and organizing capacity building training program on Technology and IP management. CATTTC has a technology transfer collaboration network covering China and ASEAN. Its members include ASEAN countries' technology transfer centers, service intermediaries, supporting service agencies, and China-ASEAN Technology Transfer Industry Alliance.

**Table 1:** Summary for the Dialogue Partners who established Plan of Action with COSTI on Technology Transfer

Dialogue Partners	Focused on specific areas
<p><b>EU</b> - ASEAN-EU Plan of Action (2018-2022)</p>	<ul style="list-style-type: none"> <li>• To provide a comprehensive online platform to accelerate research, catalyze innovation, foster knowledge sharing and promote technology transfers in ASEAN</li> <li>• To create initial awareness and platforms for dialogues on Technology Markets &amp; Innovators to promote EU-ASEAN Technology Cooperation and Transfer</li> </ul>

	<ul style="list-style-type: none"> <li>To support the establishment of the ASEAN Technology Management Hub (TMH) as per 2022 COSTI Annual Priority</li> </ul>
<b>China</b> - ASEAN-China Plan of Action on a Closer Partnership of Science, Technology and Innovation for Future (2021-2025)	<ul style="list-style-type: none"> <li>Build up human capital in technology transfer and commercialization through training programme such as ASEAN-China Technology Manager Training Workshop</li> <li>Promote technology transfer and information exchange through the CATTTC and its joint partners</li> <li>Facilitate the access of start-ups to innovations and technologies by enhancing the partnership with CATTTC through the Forum on China-ASEAN Technology Transfer and Collaborative Innovation</li> </ul>
<b>Russia</b> - ASEAN – Russian Federation Plan of Action on Science, Technology and Innovation (ARPASTI) 2016 – 2025	<ul style="list-style-type: none"> <li>Establish a policy framework for collaboration and technology transfer among centers of excellence</li> <li>Promote transparency</li> <li>Collaborate on the improvement of capability on S&amp;T foresight</li> <li>Promote scientific best practices and data sharing</li> <li>Build the legal supporting network for ASEAN countries in science and technology field through the transfer of experience and knowledge sharing;</li> <li>Transfer technologies to the ASEAN countries with a view to develop the work force in the field of agriculture.</li> </ul>
<b>India</b> - Plan of Action to Implement ASEAN-INDIA Partnership for Peace, Progress and Shared Prosperity (2021-2025) - AIIP	<ul style="list-style-type: none"> <li>To support the ASEAN Community building and integration process, including the ASEAN 2025: Forging Ahead Together, for a politically cohesive, economically integrated, socially responsible and a truly people-oriented, people-centered and rules- based ASEAN, narrowing the development gap and enhancing ASEAN Connectivity</li> </ul>
	<ul style="list-style-type: none"> <li>Creation of extensive database/research work and Intellectual properties</li> <li>Creation of a single platform to access the technologies developed in India and ASEAN countries</li> <li>Facilitation of technology seekers and technology owners through an interactive and dynamic portal</li> </ul>

	<ul style="list-style-type: none"> <li>• Bridging the technological gap between inventor, industry, manufacturers &amp; academia of ASEAN countries</li> <li>• Helping the member countries in networking with people to share ideas, experiences, problems faced and their solutions</li> <li>• To work as a single source of Information for ASEAN countries about inclusive innovation, sectors such as health, education, food and agriculture, environment and natural resources, science and technology etc. are the thrust areas</li> <li>• Helping at networking the industries of ASEAN and India with the IP knowledge bases for employment and wealth creation</li> </ul>
<p><b>ROK</b></p> <ul style="list-style-type: none"> <li>- ASEAN-Republic of Korea Plan of Action to Implement the Joint Vision Statement for Peace, Prosperity and Partnership (2021-2025)</li> </ul>	<ul style="list-style-type: none"> <li>• To implement webinar series with Technology, Innovation, and Entrepreneurship in the Post-Pandemic Economies main themes</li> <li>• To enhance STI policy and technology transfer capabilities in the ASEAN region and helping bridge gap in technology transfer and R&amp;D capabilities among the ASEAN member states</li> </ul>
<p><b>Canada</b></p> <ul style="list-style-type: none"> <li>- Plan of Action to Implement the Joint Declaration on ASEAN-Canada Enhanced Partnership (2021-2025)</li> </ul>	<ul style="list-style-type: none"> <li>• Support the implementation of the ASEAN Plan of Action on Science, Technology and Innovation (APASTI) 2016-2025 and encourage cooperation in science technology and innovation (STI)</li> <li>• Strengthen existing networks of Science and Technology (S&amp;T) centers of excellence to promote cooperation, sharing of research facilities and workforce towards joint research and technology development, technology transfer, and commercialization</li> <li>• Support the application of science, technology, and innovation for green growth and sustainable development, including through the implementation of collaborative projects to support green growth</li> </ul>



<p><b>Pakistan</b></p> <ul style="list-style-type: none"> <li>- ASEAN-Pakistan Sectoral Dialogue Partnership: Practical Cooperation Areas (2019-2021)</li> </ul>	<ul style="list-style-type: none"> <li>• Explore cooperation on science, technology and innovation in the areas of mutual interests aligned to the implementation of ASEAN Plan of Action on Science, Technology and Innovation (APASTI) 2016-2025</li> </ul>
<p><b>Australia</b></p> <ul style="list-style-type: none"> <li>- Plan of Action to Implement the ASEAN-Australia Strategic Partnership (2020-2024)</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage cooperation and cross-sectoral collaboration in science and technology, including but not limited to joint research and development projects, and support implementation of the ASEAN Plan of Action on Science, Technology and Innovation (APASTI) 2016-2025</li> </ul>
<p><b>UK</b></p> <ul style="list-style-type: none"> <li>- Plan of Action to Implement the ASEAN-United Kingdom Dialogue Partnership (2022-2026)</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage cooperation and cross-sectoral collaboration between ASEAN and the UK in science, technology and innovation, including but not limited to developing connections between researchers and innovators and joint research projects; support implementation of the ASEAN Plan of Action on Science, Technology and Innovation (APASTI) 2016-2025</li> </ul>
<p><b>New Zealand</b></p> <ul style="list-style-type: none"> <li>- ASEAN-New Zealand roadmap document: Plan of Action to Implement the ASEAN-New Zealand Strategic Partnership (2021-2025)</li> </ul>	<ul style="list-style-type: none"> <li>• Promote closer cooperation and support the efforts of ASEAN in implementing sustainable agricultural practices to encourage economic growth and sustainable agricultural productivity, food security, and accessibility of ASEAN and New Zealand products to regional and global markets through capacity-building, technology transfer, education and training, food safety and standards, agriculture innovation, and facilitating agribusiness and agriculture trade</li> </ul>
<p><b>Turkey</b></p> <ul style="list-style-type: none"> <li>- ASEAN-Turkey Sectoral Dialogue Partnership: Practical Cooperation Areas (2019-2023)</li> </ul>	<ul style="list-style-type: none"> <li>• Explore the possibility of sharing experiences and best practices on standardization, conformity assessment and metrology</li> <li>• Explore the possibility of sharing experiences and best practices on digital transformation of the manufacturing industry</li> </ul>

	<ul style="list-style-type: none"> <li>• Explore the possibility of sharing experiences and information and explore the possibility of developing cooperation concerning the high-performance growth of ASEAN economies in the Global Innovation Index</li> <li>• Promote cooperation on research and development in the field of Science and Technology in the areas of mutual interests and benefits, including support to the implementation of ASEAN Plan of Action on Science, Technology and Innovation (APASTI) 2016-2025</li> <li>• Promote cooperation on research and development in the area of information and communication technology (ICT)</li> </ul>
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Technology transfer is the process of transferring technology from research academia to industrial fields. It involves transferring knowledge and innovation from basic research to commercial use. This can occur within a country or across regions and sectors, and even at an international level. Factors that drive technology transfer include R&D expenditure, the number of researchers and industries, market size, and access to finance. Technology commercialization is the process of using intellectual property for commercial purposes. This can include licensing, cession of rights, and internal use by think tanks and manufacturing units.

Technology transfer in ASEAN is influenced by factors such as market size, access to finance, strong intellectual property rights regimes, and government incentives. These factors help increase technology transfer from public funded research academia to the industrial field.

Technology transfer in ASEAN can generate revenue for research academia through commercialization of technology. It accelerates the transformation of scientific discoveries into industrial applications and disseminates existing technologies across regions and producers in public and private sectors. It also helps create new jobs and maintain competitiveness in the R&D sector. Technology transfer promotes national and international competitiveness, corporate profit, and economic growth in the long-term.

## 2.2. Overview of Technology Transfer in ASEAN

### Brunei Darussalam

#### a. Policy and Regulation Framework

##### *National Development Plans:*

Brunei Darussalam has developed her national strategic plans outlining the country's strategic priorities to provide guidance for national efforts towards economic diversification and sustainable development. One of the most standout national plans is Brunei Vision 2035 which is the country's vision for achieving sustainable economic growth and transform Brunei into the knowledge-based and diversified economy by 2035 where the progress of STI can be the driving force to promoting diversification in the new priority sectors including tourism, halal industries, digital economy, and downstream oil and gas industries.

##### *Patents Order, 2011:*

Based on Patents Order (WIPO, 2011), the Order establishes an independent patent system for the receipt, processing and grant of patents by a new Registry of Patents and facilitates the international filing of patents after Brunei has acceded to the Patent Cooperation Treaty (PCT) and the Budapest Treaty. This Order, consisting of 115 sections divided into 20 parts, and made under article 83(3) of the Constitution, establishes the requirements to be met in order to register inventions or intellectual properties used for any industrial application or in any kind of industry, including agriculture. Brunei does not have any specific legislation on technology transfer activity.

##### *Other STI related initiatives:*

- Brunei has made an effort in developing its technology by establishing Anggrek Desa Technology Park to foster innovations as an integral component of technological development. The country has also analyzed strategies and schemes to attract investors, such as strengthening the Brunei patents system and offering incentive schemes, including a cost-sharing grant to support private sector R&D and infrastructure (e.g., laboratories), in the hope of attracting foreign firms to conduct R&D in Brunei (MUHAMAD, 2019).
- To encourage the development of innovation and knowledge-based start-ups and enterprises in Brunei Darussalam, the Brunei Economic Development Board (BEDB) is currently implementing a three-phased development plan for the Anggrek Desa Technology Park. The objective is to promote and attract a diversity of technologies that reflect the varied technological capabilities of local enterprises. The three phases include the establishment of the iCentre, the

establishment of the Knowledge Hub, and Phase 3, which is still under evaluation. All information related to innovation support services is available at the BEDB. However, there is currently no database set up for innovation service providers.

- As part of the BEDB's three-phase development plan, the iCentre was established in 2008. It is Brunei Darussalam's first ICT incubation center, focuses on nurturing ICT entrepreneurs to develop Made-in-Brunei products and applications through a well-structured and effective incubation programme. The iCentre is currently managed by KR Consulting, a business unit of the National University of Singapore (NUS). To date, the iCentre has incubated 15 local ICT companies. Through its mentorship and networking programs, the iCentre provides its incubatees with access not only to professional advice but also to potential partners and clients, both locally and internationally.
- The Brunei Research Incentive Scheme is a grant scheme administered by the Brunei Economic Development Board. It is a cost-sharing grant to support private sector R&D activities and attract foreign companies to conduct R&D activities in Brunei and establish laboratory facilities in Brunei Darussalam (ERIA and OECD, 2014).
- Universities in Brunei Darussalam are also making efforts to transfer technology. Examples of collaboration between universities and enterprise can be found in University Brunei Darussalam (UBD). UBD has developed "UBD Expert Directory" and the "University and Industry (U&I) Platform" to facilitate communication between industries and UBD. Through the U&I platform, industries can inform UBD their problems or issues seeking for solutions or developing new inventions and their services/training needs (UBD, 2023).

## **b. Institutions in Charge of Technology Transfer**

There are several agencies and institutions in Brunei Darussalam that are responsible for overseeing and promoting technology transfer activities and other similar tasks, including:

The BEDB, agency under the Ministry of Finance and Economy, was established as a 'One-Stop' agency facilitating and supporting investors in their pursuit of business opportunities in the country. The BEDB's key focus areas include attracting investments, increasing R&D and innovation, enhancing the value of innovation, strengthening local businesses, and delivering infrastructure projects. Relevant strategies aimed at facilitate technology transfer and managing IP assets in Brunei include the Brunei Research Incentive Scheme (BRISc), the IP Clinic, and other IP support activities (BEDB, 2014).

Brunei Research Council (BRC), operated under the Ministry of Education, plays a crucial role in supporting research and development activities in Brunei. This agency is the main body to provide funding and grants for research projects and activities in Brunei, and

promotes collaboration between researchers and industries, and facilitates technology transfer and research commercialization.

Brunei Intellectual Property Office (BrulPO) is in charge of overseeing the country of Brunei's intellectual property laws and enforcing them. The protection of intellectual property rights is ensured by BrulPO, which also issues patents, trademarks, and copyrights. By protecting intellectual property, BrulPO promotes the transfer of technological knowledge to Brunei.

Darussalam Enterprise, also known as DARE, an agency under the Ministry of Finance and Economy, is responsible for encouraging entrepreneurship and fostering the expansion of start-ups and small- and medium-sized enterprises (SMEs). To promote innovation and facilitate technology transfer, DARE offers a variety of programs, including technology-focused projects.

National Technology Transfer Office (NTTO) aims to facilitate technology transfer from the Government Research Institute (GRI) and National R&D project to Industry (BEDB, 2014). To initiate technology transfer in an effective, NTTO needs to:

- Manage Intellectual Property Rights (IPRs) at the national level
- Facilitate technology transfer to local innovators' markets
- Manage technology transfer for whole R&D activities
- Valuate technology value and identify key technologies for the industry using Patent Map Analysis
- Manage patent subsidies for potential local innovators
- Manage royalty through IP licensing for government R&D projects
- Share information with technology transfer abroad.

## **Cambodia**

### **a. Policy and Regulation Framework**

The concept of technology transfer is relatively new in comparison to other AMS. However, this idea has been incorporated in many national and sectoral policies, such as:

#### *Rectangular Strategy Phase IV:*

The Rectangular Strategy Phase IV (RS-IV), promote Growth, Employment, Equity and Efficiency, is the national core policy aim to accelerate the national efforts to accomplish Cambodia's Vision 2030 and 2050. The RS-IV has been developed with four main rectangles: (1) human resource development; (2) economic diversification; (3) private

sector and job development; and (4) inclusive and sustainable development. This RS-IV has the ambition to reach four strategic goals: (1) An annual growth of seven 7 per cent and enhancing competitiveness; (2) improving the quality and quantity of jobs in particular for the youth; (3) reduce poverty below the 10 per cent threshold; and (4) strengthen public institutions' governance and capacity. The RS-IV has defined mechanisms to diversify the economy through enhancing and modernizing industry capability and to promote research.

#### *The National Strategic Development Plan (NSDP) 2019-2023:*

NSDP has been established to effectively support the implementation of the RS-IV and achieve the Cambodian Sustainable Development Goals. The main objectives of the strategy include: (1) Acceleration of governance reform; (2) overarching environments for implementing the strategy; (3) human resource development; (4) economic diversification; (5) private sector and job development; and (6) inclusive and sustainable development. One of the paramount actions of this strategy is to enable effective and efficient research system and promote the national innovation system to accelerate the economic diversification at the national level. The strategy outlines the provisions to promote research, transfer of technologies from abroad, and the establishment of research funds. Moreover, the strategy foresees the strengthening of research institutions, the implementation of research programs, and the commercialization of research results.

#### *Cambodia Sustainable Development Goals Framework 2016-2030:*

The Cambodia Sustainable Development Goals Framework for 2016-2030, together with the RS-IV, set the foundation for the NSDP 2019-2023. The framework establishes 18 Cambodian sustainable development goals – the 17 global goals and an additional one related to mine action and other explosive remnants of war (ERWs). It contains 105 targets, two of which have a research component. One of the targets aims to increase investment in agricultural research to “end hunger, achieve food security, and promote sustainable agriculture” (CSDG 2). The second target is to enhance scientific research, increase the number of researchers, and promote public and private research to achieve CSDG 9: “Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation”.

#### *The National STI Policy 2020-2030*

The National STI Policy, approved in 2019, aims to strengthen the national STI capabilities, including institutions and human resources, and improve the STI ecosystem. The strategies developed in the framework of the policy seek to:

- Develop STI human resources in terms of quantity, quality, and composition while accounting for ethics and gender equality;
- Develop an STI environment that maximizes the potential of human resources;
- Promote efficiency and effectiveness of R&D by adapting the use of technologies to the Cambodian needs and by learning from technologies being developed abroad;
- Develop a dynamic and robust innovation ecosystem able to synthesize technologies and engineering in priority industries; enable businesses to participate in international markets; and enhance productivity;
- Develop an STI culture to increase trust in the application of national technologies.

*Cambodia Science Technology and Innovation Roadmap 2030:*

The STI Roadmap 2030, developed by the Ministry of Industry, Science, Technology & Innovation (MISTI) and enacted in 2021, aims to support the implementation of the National STI Policy. The roadmap is based on five pillars, with one focusing specifically on research. The five pillars include:

- Enhancing the governance of the STI system;
- Build human capital in STI;
- Strengthening research capacity and quality and improving research quality in public and HEIs;
- Increasing collaboration and networking between different actors of the innovation system;
- Fostering an ecosystem for building absorptive capacities in firms through promoting technology transfer and IPRs in Cambodia and attracting investments in STI.

In addition to these overarching policies, the Cambodian government is currently drafting the law on technology transfer to promote the transfer of knowledge, technology, skill sets, know-how, as well as to attract talented people to the Kingdom.

**b. Institutions in Charge of Technology Transfer**

As previously mentioned, technology transfer has been new in Cambodia. As a result, there were no specific institutions overseeing technology transfer activities in the country. Before 2020, institutions worked in fragment or silo. For example, the Ministry of Education, Youths and Sport, in charge of higher education and research activities, and Ministry of Industry and Handicraft who oversee the industry and SME sectors in Cambodia, barely worked together and had little connection between research and industry or SME.

However, everything has been completely changed in 2020. During the covid-19 pandemic, the Royal Government of Cambodia (RGC) fully realized that to achieve its ambitious vision to becoming a higher middle-income country by 2030 and a high-income country by 2050, as well as to undergo digital transformation, the kingdom needed to embrace and enhance the power of STI as the driving force to accelerate economic structural transformation and strengthen local industries, SMEs, firms, and startup through vertical and horizontal technology transfer.

As a result, MISTI has been given birth by the wise leadership of the RGC during the pandemic time to oversee science, technology and innovation. One of MISTI's key mandates is to coordinate and moderate among relevant line ministries and key actors in the national innovation system. MISTI works closely with key ministries such as the Ministry of Education, Youth and Sport (responsible of R&D and higher education), the Ministry of Labor and Vocational Training (responsible for TVET institutions in Cambodia), and the Cambodia Development Council (responsible for foreign direct investment and ODA fund to Cambodia) to strengthen Cambodia's scientific base and leverage its technological innovation capabilities through technology transfer mechanism.

MISTI has the General Department of Science, Technology and Innovation (GDSTI) that serves as its main body to overseeing STI. The Department of Technology Transfer is a supporting unit of GDSTI that promotes technology transfer in Cambodia.

## **Indonesia**

### **a. Policy and Regulation Framework**

*Patents Law No. 14 of 2001:*

In Indonesia, according to Patents Law No. 14 of 2001 (PRESIDEN, 2001), a patent is a temporary monopoly granted by the State for an invention. The patentee, or owner of the patent, has exclusive rights and a monopoly to exploit or use their patent commercially, either individually or by giving consent to other to make, sell, lease, deliver, use, or supply for sale or lease the products for which patent has been granted. This law failed to create technology transfer for Indonesia.

*Law no. 13 of 2016 on Patents, the replacement of Patents Law No. 14 of 2001:*

Due to Indonesia's acceptance of an international agreement and the rapid growth of technology, industry, and commerce, Law No. 13 of 2016 on Patents was created to safeguard innovators. Additionally, legislation must provide inventors with reasonable protection while fostering fair competition and considering the interests of the general public. Law No. 13 of 2016 focuses on the rules that will make it possible for Indonesia to



undertake technology transfer operations between domestic and foreign parties in a more realistic manner (Riswandi, 2021).

#### *National Medium-Term Development Plan:*

The National Medium-Term Development Plan is Indonesia's strategic development framework for the medium term. It outlines the country's development priorities and goals, including innovation and technological advancements. The plan emphasizes the need for technology transfer to increase competitiveness, productivity, and economic growth.

#### *Industrial Research and Development (R&D) Roadmap:*

To encourage R&D efforts in important areas, Indonesia has developed an Industrial R&D Roadmap. The plan highlights partnership between business, academia, and research organizations and specifies key areas for technological advancement. It strives to improve technological understanding, promote knowledge exchange, and ease technology transfer.

#### *Masterplan for the Acceleration and Expansion of Indonesia's Economic Development*

The Masterplan for the Acceleration and Expansion of Indonesia's Economic Development is a framework that highlights Indonesia's economic development priorities and targets that Indonesia thrives for. It emphasizes the development of strategic sectors and the creation of technology-based industries. The plan aims to attract investment, enhance competitiveness, and facilitate technology transfer through the establishment of industrial clusters and economic zones.

The government provides tax allowance for firms which have research collaboration with local ST-institutions. Furthermore, techno-entrepreneurship has been encouraged to build collaboration with researchers in technology business incubators (TBI). Young entrepreneurs entitle access to discuss their problems in the production process related to certain technologies. Business coaching and training are also provided by TBI which is facilitated by governmental funding (Maludin et al., 2019).

The role of private enterprises in the technology transfer process is still limited. Most manufacturing sites do not have an R&D division. The business principal provides equipment, supplies, and production manuals for a manufacturing process that maintains the supply stability and product standards. However, in some cases, this closes the opportunity for collaboration with domestic research institutes.

Indonesia is considered to have a growing market that follows the increasing number of middle-class. Technology-based products such as automobiles and smartphones are in

sufficient demand, but this demand has not been followed by the development of an internal research division (Maludin et al., 2021).

## **b. Institutions in Charge of Technology Transfer**

In Indonesia, inter-ministry departments, local government, and government ministries typically carry out government-initiated knowledge and technology transfer. The Ministry of Science and Technology, the Ministry of Cooperation and Small to Medium Businesses, the Ministry of Industry, and the Ministry of Trade are examples of government ministries that are relevant to the work of technology transfer of SMEs in Indonesia. Government-initiated programs for the transfer of knowledge and technology have given SMEs access to training materials, knowledge transfer, and physical equipment (machines and tools). For SMEs to make the best use of it, the government has offered training facilities and continuous support. On top of that, large enterprises (LEs) were discovered to be actively participating in the knowledge and technology transfer to Ceper and Pasuruan (areas in Indonesia) SMEs (Tambunan, 2006). Employees of SMEs have received highly focused training from LEs. Through increased competency, SMEs were able to offer these larger enterprises products that met the necessary quality standards thanks to these training programs, which have, for instance, tried to stimulate greater capabilities in product standardization among SMEs (Handoko et al., 2019).

In Indonesia, GRI are responsible for implementing technology transfer through two channels including the public domain and commercial domain. In the public domain, the technology transfer is conducted in stages. This transfer will be from research institutions to government agencies that will spread the technology to the end users. For example, agricultural technologies from research institutions will communicate with extension agencies, and deliver them to farmer groups as end users (Jamal et al., 2016). At the same time, the commercial domain cooperates with different parties. Commercial domain has two models including the technology incubators and approach to work closely with the private sector (commercialization through license). This cooperation is implemented through various forms including research collaborations.

Technology incubator development has the same development as the entrepreneur incubator. Targets of the incubator development include:

- Emerging of new entrepreneurs and strengthening the capacity of start up
- Creating the new business
- Increasing the value added on the management of the economic potential
- Increasing the capacity and expertise for strengthening the incubator management
- Improving access to human resources, institutional, financing, markets, information, and technology

Commercialization through license will go through a selection process on technology that is ready for promotion to the private sector. When technology is ready for commercialization, it will be promoted to private sectors. After that, it will be known as a forerunner of technology and become research institutions to gain the rights for licensing.

In Indonesia, the National Research and Innovation Agency (NRRIA) was established for the purpose of carrying out research, development, assessment, and implementation, as well as nationally integrated inventions and innovations and monitoring, controlling and evaluating the implementation of tasks. The NRRIA leads all government R&D institutions, including those under the technical ministry and local governments, consisting of many areas including nuclear power; aviation and space; technology assessment and application; life sciences; earth sciences; engineering science; social sciences and humanities; marine and fisheries; archeology; metrology; religion; language and literature; environment and forestry; governance and community welfare; agriculture and livestock; health (Maludin et al., 2021).

Government Funded Research Institutes (GFRI) has a significant role in the technology transfer process. The responsibility of GFRI in the technology transfer system is to plan, conduct and develop technology and process the policymaking by providing information and policy recommendations (Maludin et al., 2021).

Universities contribute significantly to the technology transfer system supported by both the quality and quantity of new students. Research in the university begins in laboratories or classes with joint work between lecturers and students. Youth programs to create entrepreneurs are introduced to students, including financial incentives, business coaching, and the privilege to access research facilities on campus including an expert in a particular field (Maludin et al., 2021).

## **Lao PDR**

### **a. Policy and Regulation Framework**

Laos has also implemented sectoral and local policies and strategies to support technology transfer. These policies and strategies are designed to address the specific needs and challenges of different sectors and regions within the country.

One sector that has received significant attention in terms of technology transfer is agriculture. Agriculture is a key sector in Lao, accounting for a significant portion of the country's gross domestic product (GDP) and employing a large percentage of the population. To support technology transfer in agriculture, the Lao government has implemented various policies and strategies, including the Agriculture and Forestry Extension Strategy 2016-2025. This strategy aims to promote the adoption of new

technologies in agriculture through the establishment of demonstration farms, the provision of training and capacity building activities, and the promotion of collaboration between research institutions and farmers.

Another sector that has received attention is the health sector. The Lao government has implemented various policies and strategies to support technology transfer in the health sector, including the National Health Sector Strategy 2016-2025. This strategy aims to promote the adoption of new technologies in health care through the development of e-health systems, the establishment of telemedicine services, and the promotion of collaboration between health care providers and research institutions.

The Lao government has also implemented local policies and strategies to support technology transfer in different regions of the country. One example of this is the Luang Prabang Provincial Development Strategy 2016-2020. This strategy aims to promote economic development in the Luang Prabang province through the promotion of tourism and the adoption of new technologies in agriculture, handicrafts, and renewable energy.

The Lao PDR government has developed a number of laws and regulations to promote technology transfer in the country. One of the key pieces of legislation in this area is the Law on Science and Technology, which was first introduced in 2007 (Saengnil et al., 2016) and revised in 2017. This law outlines the principles, policies, and mechanisms for the development and implementation of science and technology in Lao. The law promotes the transfer of technology through the establishment of technology transfer centers, the creation of an IP protection system, and the promotion of R&D activities.

Another important piece of legislation is the Investment Promotion Law, which was introduced in 2016 (LAO PDR, 2016). This law provides incentives to investors who engage in technology transfer activities. The law allows for tax exemptions, import duty exemptions, and other benefits for investors who transfer technology to Lao or who participate in joint ventures with Lao partners to develop technology.

In addition to these laws, the Lao government has also developed a number of policies to support technology transfer. One such policy is the National Science and Technology Development Strategy 2011-2020, which aims to promote the development of science and technology in Laos. The strategy includes a focus on developing technology transfer centers, promoting collaboration between research institutions and industry, and strengthening IP protection.

The Lao government recognizes the importance of technology transfer in driving economic growth and has put in place various laws, policies, and institutions to support this process. These measures include the establishment of technology transfer centers,

the promotion of R&D activities, the strengthening of IP protection, and the provision of incentives for investors who engage in technology transfer activities.

## **b. Institutions in Charge of Technology Transfer**

The National Science Technology and Innovation Policy Office (NSTIPO) is the primary national body in charge of technology transfer in Laos. It is responsible for formulating policies and strategies to promote the transfer of technology from R&D institutions to the industry and society.

At the local level, the Department of Science and Technology (DOST) in each province is responsible for coordinating and implementing technology transfer activities. DOSTs work closely with local research institutions, universities, and industry associations to identify potential technologies and facilitate their transfer to the local industries.

Additionally, the Lao National Chamber of Commerce and Industry (LNCCI) plays an important role in promoting technology transfer by providing a platform for businesses to exchange knowledge and expertise. The LNCCI also facilitates partnerships between local and foreign companies to enhance technology transfer and promote innovation.

## **Malaysia**

### **a. Policy and Regulation Framework**

The Malaysian government has introduced several national policies over the years to facilitate industrialization and technology development in the country. Technology transfer has been used as a means to transform Malaysia from a developing country into a developed nation, by enabling its participation in high-value-added activities. These national policies mainly focus on the development of industries in Malaysia, particularly the upgrading of technology and local capabilities.

#### *The Industrial Master Plan 2020:*

The Industrial Master Plan was formulated with the objectives of strengthening industrial linkages in the manufacturing sector and creating more value-added activities. The third Industrial Master Plan, covering the period from 2006 to 2020, was developed to create a more competitive manufacturing and services sector in the long term. The action plan outlined in this plan has become the main driver for local SMEs to utilize technology transfer and compete in the market (MITI, 2006).

#### *Offset Policy (1980s to 2014):*

The offset program was initiated early in 1983 as a countertrade program under the Ministry of International Trade and Industry. Based on the treasury circular and subsequently updated to the Industrial Collaboration Policy (ICP) in 2014, a mechanism was put in place for government procurement that requires a mandatory technology transfer program. The concept of the offset program is that it leverages government procurement to obtain technology transfer, market access, research, and development in collaboration with the original equipment manufacturer. The Offset Policy has facilitated several different technology transfer models, from the dissemination model to the interrelationship model.

#### *Intellectual property corporation of Malaysia (amendment) act 2018 (Act A1560):*

In order to comply with its obligations under the Trade-Related Aspects Intellectual Property Rights (TRIPS) Agreement, Malaysia has established the Intellectual Property Corporation of Malaysia (MyIPO) to manage an online system that offers easy access to patent, trademark, industrial design, and Geographical Indication (GI) search and filing services. This system also provides applicants with real-time updates on their application status. As a minimum standards agreement, the TRIPS Agreement enables members to extend greater protection for IP if they choose to do so. MyIPO's efforts help to enhance Malaysia's IP protection and promote innovation and creativity in the country (PNMB, Laws of Malaysia Act 2018, 2018).

#### *Trademarks Act 2019:*

The new Trademarks Act 2019 officially came into force in Malaysia. The Act repealed the Trade Marks Act 1976 and introduced a number of substantial changes to align Malaysia's trade mark legislation with international standards and procedures. The Trademarks Regulations 2019 are also now in force (PNMB, Laws of Malaysia Act 815, 2019).

#### *Copyright (Amendment) Act 2022:*

Malaysia issued the Copyright (Amendment) Act 2022, introducing provisions on statutory damages, and prohibiting recording inside a cinema (anti-camcording) and the circumvention of technological protection measures. The amendments further regulate the liabilities of internet service providers and the owners' right to submit a takedown notice when they have detected copyright infringements on the internet (PNMB, Laws of Malaysia Act A1645, 2022).

### *Patents (Amendment) Act 2022:*

The Amendment Act in Malaysia was implemented to align the country's patent laws with international standards and improve protection for the patent community and trade. The amendments were made to comply with Malaysia's obligations under international agreements, such as the TRIPS Agreement, Regional Comprehensive Economic Partnership (RCEP), Comprehensive and Progressive Agreement for Trans-Pacific (CPTPP), and the Budapest Treaty. Additionally, the Act introduces new provisions to enhance the competitiveness of Malaysia's patent landscape. There are two types of patents in Malaysia - Patents and Utility Innovations. Utility Innovations are exclusive rights granted for minor inventions and enjoy a faster examination process than patents. They can be registered for new products or processes, or any new improvement of a known product or process capable of industrial application, with only one claim allowed in an application (PNMB, Laws of Malaysia Act A1649, 2022).

### *Industry 4WRD (National Policy on Industry 4.0):*

Industry 4WRD is Malaysia's national policy on Industry 4.0, which was launched in 2018 by the Ministry of International Trade and Industry. The policy aims to transform Malaysia into a high-income nation and a regional leader in Industry 4.0 by 2025. The policy focuses on four main pillars: (1) technology adoption and innovation; (2) human capital development; (3) infrastructure development; and (4) regulatory framework and incentives (MITI, National Policy on Industry 4.0, 2019).

### *National policy on Science, Technology & Innovation (NPSTI) 2021-2030:*

The National Policy on Science, Technology and Innovation (NPSTI) 2021-2030 is Malaysia's 10-year plan to drive the country's economic growth through innovation and technology development (MOSTI, 2021). The NPSTI 2021-2030 aims to achieve the following objectives:

- Accelerate the country's transition to a high-income and knowledge-based economy.
- Foster an innovation-driven culture and mindset among Malaysians.
- Drive the development of strategic and high-potential sectors in the country.
- Enhance the effectiveness and efficiency of Malaysia's STI ecosystem.
- Promote international collaboration in STI to position Malaysia as a regional and global player in innovation.

### *Malaysia Technology roadmaps:*

MOSTI launched five technology roadmaps to develop Malaysia's robotics, advanced materials, and AI industries as described as following:

- Electricity and Electronics Roadmap: Technology Development 2021-2030
- National Blockchain Technology Roadmap 2021-2025
- Artificial Intelligence Roadmap 2021-2025
- National Advanced Materials Roadmap 2021-2030
- National Robotics Roadmap 2021-2030

### **b. Institutions in Charge of Technology Transfer**

There are several institutions in charge of technology transfer in Malaysia, including:

#### *Ministry of Science, Technology and Innovation (MOSTI):*

MOSTI is responsible for the development and promotion of STI in Malaysia, and oversees several agencies involved in technology transfer and commercialization. Its mission is to create a science, technology, and innovation-led economy that promotes sustainable development and enhances the well-being of Malaysians. To achieve this mission, MOSTI focuses on key areas such as driving STI policy and planning, promoting STI development, building STI infrastructure, enhancing STI talent, and promoting international STI collaboration (MOSTI, TeD1 Guidelines, 2021).

#### *National technology and innovation sandbox (NTIS):*

The National Technology and Innovation Sandbox (NTIS) was first announced as part of the Short-Term Recovery Plan (PENJANA), a program that allows researchers, innovators, and entrepreneurs to test their products and services in a live environment and qualify for grants to bring those products and services to market. NTIS relaxes certain regulatory requirements to accelerate the development of innovation from the R&D stage to being commercially ready. NTIS has missions to improve the country's commercialization rate, increase GDP/Gross National Income (GNI), enhance the participation, investment, and collaboration in research by the private sector, drastically reduce dependency on foreign labor, and increase employment opportunities for Malaysians<sup>1</sup>.

#### *Technology commercialization accelerator (TCA) – Malaysia research accelerator for science and technology (MRANTI):*

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<sup>1</sup> <https://sandbox.gov.my>



The Malaysian Research Accelerator for Technology and Innovation (MRANTI), a recently launched agency under the MOSTI, has laid out its mission to drive higher "return on ideas" in the R&D to commercialization space. MRANTI will galvanize the country's technology and commercialization landscape through its strong network branching across diverse industries and a solid foundation rooted in technology and innovation to elevate Malaysians to the global stage. Additionally, MRANTI will draw learnings from the NTIS, which currently supports 139 companies in terms of technology and market validation, regulatory facilitation, funding, and more through the sandbox<sup>2</sup>.

*Technology Park Malaysia (TPM):*

Technology Park Malaysia (TPM) is a Malaysian institution established in 1996 that provides various facilities and services for technology transfer and R&D activities to over 300 companies and organizations, including multinational corporations, local companies, research institutions, and government agencies. TPM offers incubation services, technology commercialization programs, training and consultancy services, as well as infrastructure and facilities for R&D activities. Its mission is to support the development of technology-based industries in Malaysia and contribute to the country's economic growth.

*SME Corporation Malaysia:*

SME Corporation Malaysia is the central coordinating agency (CCA) under the Ministry of Entrepreneur & Cooperatives Development (MECD) that coordinates the implementation of development programmes for SMEs across all related ministries and agencies. It acts as the central point of reference for research and data dissemination on SMEs and entrepreneurs, as well as provides business advisory services for SMEs and entrepreneurs throughout the country<sup>3</sup>.

## **Myanmar**

### **a. Policy and Regulation Framework**

The government of Myanmar has recognized the importance of technology transfer for economic development and has taken steps to promote technology transfer through policies and regulations.

*The Myanmar Sustainable Development Plan (2028-2030):*

The Myanmar Sustainable Development Plan (MSDP), launched in 2018, serves as a comprehensive roadmap for the country's sustainable development. A key objective of

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<sup>2</sup> <https://mranti.my>

<sup>3</sup> <https://www.smecorp.gov.my/index.php/en/>

the MSDP is to foster technological development and adoption across sectors such as agriculture, industry, and energy. This objective is to be achieved through promoting partnerships and collaborations between government, private sector, and academic institutions, all aimed at facilitating technology transfer and innovation. The MSDP also prioritizes the development of a skilled workforce with STEM education and knowledge necessary for technological innovation. In addition, the plan includes provisions for improving the country's infrastructure, including ICT infrastructure, to facilitate and accelerate technology transfer and innovation (MOPF, 2018).

*The National Science, Technology and Innovation Policy:*

The National Science, Technology and Innovation Policy in Myanmar aims to create a knowledge-based economy through the promotion of science, technology, and innovation. The policy has four main objectives: driving economic growth and social development, enhancing research and innovation capabilities, encouraging partnerships and collaborations, and addressing societal challenges. To achieve these objectives, the policy includes strategies such as increasing investment in R&D, promoting private sector investment in R&D and technology transfer, strengthening IPRs, developing human capital through education and training, establishing science and technology parks and innovation centers, and fostering international cooperation and partnerships.

*The Science, Technology and Innovation Law 2018:*

Myanmar released a new Science, Technology and Innovation Law in 2018, following an older law called the Science and Technology Development Law which was enacted in 1994. The objectives of the Science, Technology and Innovation law including developing science, technology, and innovation to enhance products and services that contribute to socioeconomic development; improving R&D for the efficient extraction and usage of energy, minerals, and resources while ensuring environmental conservation and worker safety; utilizing research findings to increase domestic production and global competition through technology transfer; providing consistent training for professionals in science, technology, and innovation; working with research organizations, universities, businesses, and other organizations to promote and develop human resources in these sectors; acknowledging and protecting the IP of intellectuals and innovators; utilizing the fund for science, technology, and innovation to support human resource development and research that encourages innovation and market economy; and planning exhibitions, contests, and presentations in various institutions based on scientific, technological, and innovative topics.

This law also stated that the outcomes of research, knowledge, and innovative technology developed by R&D departments, manufacturing industries, domestic and international investments, universities, degree-granting institutions, colleges, and institutes may be

transferred. Furthermore, technology can only be transferred through contracts registered with the Department of Research and Innovation (DRI); unregistered contracts may be void. The policy recognizes technology transfer as an essential component of the innovation ecosystem and calls for the establishment of a supportive legal and regulatory framework to promote technology transfer activities<sup>4</sup>.

#### *IP Laws in Myanmar:*

In 2019, four laws, including the Trademark Law, the Industrial Design Law, the Patent Law, and the Copyright Law, based on the WIPO Model Law, were promulgated, marking significant progress in the protection of IPRs in Myanmar. This new IP law will more effectively protect the rights of IP owners. However, the implementation and subsequent enforcement of the aforementioned legislation require considerable preparatory work. This includes restructuring and reallocating responsibilities between different ministries and governments, such as the establishment of the Department of IP under the Ministry of Commerce, which is now responsible for all trademark registration<sup>5</sup>.

The Patent Law provides protection for IPRs, including patents. The law allows inventors and innovators to protect their inventions and commercialize them through licensing and transfer agreements. The Trademark Law provides protection for trademarks, service marks, and trade names. The law allows businesses to protect their brands and prevent others from using similar names or logos. The Industrial Design Law provides protection for industrial designs. The law allows designers to protect their designs and prevent others from copying or imitating them. The Copyright Law provides protection for literary, artistic, and scientific works. The law allows creators to protect their works and prevents others from copying or reproducing them without permission.

#### *Myanmar Investment Law 2016:*

A new Myanmar Investment Law (MIL) was unveiled by the government of Myanmar in 2016. On October 18, 2016, the MIL went into effect, consolidating and replacing the preceding Foreign Investment Law of 2012 and the Citizens Investment Law of 2013. The MIL is the primary law governing foreign investment in Myanmar. The law provides a legal framework for technology transfer and outlines the procedures for obtaining licenses and permits for the transfer of technology. The law allows foreign investors to transfer technology to Myanmar, subject to approval by the Myanmar Investment Commission.

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<sup>4</sup> <https://www.servicetrade.gov.mm/service/law-detail/the-science-technology-and-innovation-law>

<sup>5</sup> <https://eurocham-myanmar.org/2021/01/22/recap-of-intellectual-property-rights-and-trademark-law-in-myanmar-what-do-businesses-need-to-know-and-understand-online-discussion/>

## **b. Institutions in Charge of Technology Transfer**

### *Department of Research and Innovation (DRI):*

The main institution in charge of technology transfer in Myanmar is the DRI, which operates under the Ministry of Education. The DRI's mission is to promote research, innovation, and technology transfer in Myanmar, with the aim of supporting economic development and improving the lives of the country's citizens. The department provides a range of services to support technology transfer, including technology scouting, licensing, and commercialization, as well as support for startups and entrepreneurs.

### *Private sector organizations:*

In addition to the DRI, there are also a number of private technology transfer organizations and initiatives in Myanmar, such as the Myanmar Technology Transfer and Innovation Center (MTTIC) and the Myanmar Innovation and Technology Accelerator (MITA). MITA is a private sector initiative that provides incubation and acceleration services to startups in the country. Another organization, the Myanmar Angel Network (MAN), connects startups with investors and provides mentorship and networking opportunities. Several private sector organizations in Myanmar work to promote and commercialize technology. These organizations include business incubators, accelerators, and venture capital firms that invest in technology startups and provide support services to help them grow and succeed.

### *Universities:*

Some universities in Myanmar, including Yangon Technological University, Mandalay Technological University, and Myanmar Aerospace Engineering University, have established partnerships with international organizations, such as Japan International Cooperation Agency (JICA), United Nations Industrial Development Organization (UNIDO), and Rostec, to promote innovation and technology transfer and provide training and support services to entrepreneurs and startups, as well as to develop technology and manufacture aircraft components in Myanmar.

## **Philippines**

### **a. Policy and Regulation Framework**

The Philippines is currently working relentlessly to upgrade local firms' capacity and promote the startups and entrepreneurship activities in the Philippines. Technology transfer is placed in the central role to support this government's initiative and endeavor

to support local firms, SMEs, startup and entrepreneur ecosystems in the Philippines. Those initiatives including:

*Executive Order 128:*

Executive Order No. 128, on January 30, 1987, reorganized the National Science and Technology Authority (NSTA) into the DOST and remained the Advanced Science and Technology Institute as one of the cores of the Department's R&D institutes.

*Republic Act 7459 or 1992 Inventors and Invention Incentives Act of the Philippines Republic*

This law establishes precedence for invention and its application to the nation's economic systems and way of life as national policy. To this end, the government offers incentives to innovators and safeguards their exclusivity rights, especially when the invention benefits the populace and advances the development and progress of the country.

This legal framework developed the following mechanism to support and incentivize inventors and innovators through DOST-TAPI

- Cash Rewards and Awards for Inventions
- Tax Incentives and Exemptions
- Invention Development Assistance Fund
- Invention Guarantee Fund

Loan assistance was offered by government banks for the product commercialization purpose of the invention and innovation, either for local use or for export and certified by the Philippine Inventors Society and the Screening Committee, that said invention satisfies the requirements that would enhance the economy of the country such as productivity, profitability and viability, earning capacity, and job creation opportunities for the Philippines citizens.

*Act 8293 or the Intellectual Property Code of the Philippines of 1998*

The “Intellectual Property Code of the Philippines” was officially passed into law on June 6, 1987 and enacted into effect on January 1, 1998. The Department of Trade and Industry's Bureau of Patents, Trademarks, and Technology Transfer (BPTT) was eliminated by the aforementioned legislation. An Act establishing the IP Office, prescribing the IP Code, defining its responsibilities, and serving other objectives.

*Republic Act 10055 or the Technology Transfer Act of 2009:*

This Act provides mechanism and support system for the ownership, management, use, and commercialization of IP produced by public funded R&D.

The scope and objectives of the Act covers the following:

- Technology Transfer as Strategic Mission of R&D Institutions (RDIs)
- Transfer of Technology through Management of IPR and private Sector Collaboration
- Access to Technologies and Data

This Law highlights the thorough rules and guidelines for the use of state-funded technologies, specifically for the use of the following key provisions on:

- IP Ownership
- Rights and Responsibilities of the Government Funding Agencies and R&D Institutes
  - o Fairness Opinion Report
  - o Research Funding Agreement
  - o Protection of Undisclosed Information
  - o Disclosures
- Management of IPs from R&D performed by government RDIs through their own budget revenue sharing
- Commercialization by the researcher and establishment of spin- off firms
- Use by government, compulsory licensing and assumption of potential IPRs
- Use of income, establishment, and maintenance of revolving fund for R&D and Technology Transfer
- Institutional mechanism

## **b. Institutions in Charge of Technology Transfer**

The DOST is the key governmental body overseeing the promotion of technology transfer in the Philippines. There are many supporting agencies/units to be in charge of promoting science and technology in different areas in the Philippines such as sectoral councils, advisory boards, RDIs, Service institutes and DOST regional offices located in different areas in the Philippines.

Technology Application and Promotion Institute (TAPI) was officially established by the executive order 128 on January 30, 1987 to serve as implementing body of the DOST in fostering the commercialization of technologies, marketing the services of the other operating units within the Department, and assisting new and emerging projects with grants and/or venture financing.

The "Inventors and Inventions Incentives Act of the Philippines," or RA 7459, was officially passed into law on April 28, 1992, and it expands the role, mandate, and responsibilities of DOST-TAPI by allowing it to offer technical and financial support, as well as other incentives, to inventors and their organizations for invention-related activities like patenting and licensing in order to encourage invention and innovation and make commercialization easier.

## **Singapore**

### **a. Policy and Regulation Framework**

There are various policies, strategies, and laws in Singapore for an inclusive growth and one of highest human capital development countries in the world.

#### *Research, Innovation and Enterprise (RIE) 2025 Plan:*

Singapore's transformation into a knowledge-based, innovation-driven economy and culture is credited in large part to the RIE. The RIE plays a significant role in expanding development opportunities and boosting Singapore's economic viability. Additionally, it leads to scientific discoveries that satisfy social demands and enhance Singaporeans' quality of life. The RIE 2025 has three strategic focus areas: (1) Extend the RIE mission to address a wider range of national requirements; (2) Strengthen the scientific foundation; and (3) Scale up platforms to promote technology translation and boost business innovation capacities. Prime Minister serves as the head of the RIE Council (RIEC), which was established in 2006. The Singapore Cabinet seeks advice from the RIEC on national research and innovation policies and plans.

#### *R&D Strategy:*

R&D are critical to Singapore's well-being and long-term viability. It adds value and allows Singapore to jumpstart new sectors and economic possibilities. It promotes innovation and increases our economic edge. The Economic Strategies Committee (ESC) Subcommittee on Growing Knowledge Capital recommended in February 2010 that Singapore become a major global R&D hub and Asia's innovation capital. R&D strategy of Singapore required three main actions for its strategic investments in R&D: (1) Select areas that are beneficial not only to Singapore but also to the rest of the globe; (2) Focus on research that will improve Singapore's competitiveness; and (3) Translate scientific finding into commercial and societal worth. Singapore will continue to expand its R&D skills and support innovation and enterprise in the future.

#### *Singapore IP Strategy 2030:*

The Singapore IP plan (SIPS) 20306 is a national plan that assists businesses and the broader creative community. It will help to strengthen Singapore's place as a global-Asian node of technology, innovation, and business, as well as support the RIE goals. Intangible assets (IA) and IP are also key components of Singapore's economic and industry transformation plans, as outlined by the Future Economy Council and Emerging Stronger Taskforce. There are three main focus areas, each addressing a different aspect of Singapore's economy such as supporting international activities, growing local enterprises, and building a high-calibre workforce.

Singapore has made significant progress in developing an IP environment that promotes innovation activities and is well-connected to global marketplaces since the 2013 IP Hub Master Plan. Simultaneously, the global economy has evolved considerably, with IA and IP gaining importance as economic development drivers. As a consequence, businesses must be equipped with the tools and know-how to successfully manage their IA/IP in order to thrive.

These developments provide a chance for Singapore to expand on its solid roots as a legal, financial, and contemporary services center, while also leveraging IA/IP to drive the next frontier of value creation and growth.

In term of law, IP Law, Technology, Media and Telecoms Laws are more relevant laws supporting technology transfer in the country.

#### *Intellectual Property Law:*

Singapore provides a very comprehensive legal framework and supporting infrastructure for facilitating of registration (excluded copyrights) and protecting patents, copyrights, trademarks, and other types of IP. Below is an overview of IP law which considering as framework for supporting the technology transfer in the country.

Based on the Intellectual Property Organization of Singapore (IPOS), Patent is “a right granted to the owner of an invention that prevents others from making, using, importing or selling the invention without his permission”. The inventive designs and processes in Singapore is protected through the Patent Act<sup>7</sup> and it is protected after registration internationally under the PCT. Patent registration can be conducted via Domestic application when applicants wishing to apply for a patent in Singapore only can file with the Registry of Patents, which is part of IPOS, in person or online, or International application when applicants wishing to apply for a patent in multiple countries can do so under the PCT using Singapore's Registry of Patents as the receiving office.

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<sup>6</sup> <https://www.ipos.gov.sg/manage-ip/singapore-ip-strategy-2030>

<sup>7</sup> <https://sso.agc.gov.sg/Act/PA1994>



Copyright refers to the bundle of rights that is granted by statute in respect of original works and other subject-matter for limited periods of time and subject to certain permitted exceptions. In Singapore, that statute is the Copyright Act<sup>8</sup> which was passed by Parliament on 13 September 2021 and assented to by the President on 28 September 2021. In Singapore, unlike with patents, there is no registration procedure for copyright. The copyright starts when the work is created; merely having an idea is not enough. In order to establish ownership of a work, a person must first demonstrate that he or she produced it.

A trademark refers to a brand name or logo which a business/company uses for their proper products or services. There are two possible ways to register a trademark in Singapore included, Trade Marks registration to protect under Trade Marks Act and Trade Marks registration without registering it under common law action for passing off. The registration can be conducted via IPOS online or in person. The registration for many products or services at the same time is allowed and it is also possible to register only in Singapore or internationally by designating Singapore through the Madrid Protocol, WIPO's international registration system of trademarks. In Singapore, there is also a statutory protection for well-known trademarks under the Trademark Act for foreign businesses/companies even without registration.

Protection of industrial designs is available under the Registered Designs Act (Cap 266, 2005 Rev Ed) (the "RDA"). This Act is modelled on the UK Registered Designs Act 1949 (as amended in 1988), and therefore many fundamental concepts in this regime of protection are traceable to English registered design law<sup>9</sup>. Registration can be obtained in two ways: (1) through a domestic application filed with IPOS Registry of Designs, or (2) through an international application filed in accordance with the Geneva Act of the Hague Agreement Concerning the International Registration of Industrial Designs, designating Singapore as a country where protection is sought.

#### *Technology, Media, and Telecom Law:*

In Singapore, ICT is one of the key sectors. To address the ensuring issues arising from technology uses and to stay in the frontline as technological country, the regulatory agency of Singapore created the info communications media development authority (IMDA) which in charge of regulating and promoting of ICT and media regulators, represents the confluence of information technology and media.

Technology law stipulated the e-commerce, electronic evidence, digital tax, data protection, cybersecurity, sector specific regulations, domain names, and technology

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<sup>8</sup> <https://sso.agc.gov.sg/Acts-Supp/22-2021/Published/>

<sup>9</sup> [https://www.corporateservices.com/singapore/ip-protection-in-singapore/#other\\_types\\_of\\_ip](https://www.corporateservices.com/singapore/ip-protection-in-singapore/#other_types_of_ip)

export controls. Export control in Singapore is managed by the Strategic Goods (Control) Act, SGCA. The SGCA regulates the transfer and brokering of strategic goods, strategic goods technology, and goods and technology capable of being used to develop, produce, operate, stockpile, or acquire weapons capable of causing mass destruction, as well as missiles capable of delivering such weapons, and for related purposes. Under the SGCA<sup>10</sup>, “technology means information (including information comprised in such documents as specifications, blueprints, plans, manuals, models, diagrams, formulae, tables and designs) that is necessary for the development, production or use of any goods, and includes software”.

There are also regulations concerning the intangible transfer of technology. This usually refers to the transfer of technology via electronic mail, phone, internet transfer, or fax. It also includes the act of making technology accessible on a computer or server in Singapore in such a way that a person in another country can access it. In general, any intangible transfer of technology will necessitate a permit.

## **b. Institutions in Charge of Technology Transfer**

In Singapore, Technology Transfer Offices are available in universities, polytechnics, and public agencies (Yap, A., & Chua, A, 2019). Universities consist of their own individual offices for liaising with industry players to commercialize inventions such as the NUS Industry Liaison Office, the Singapore Management University (SMU) Office of Research & Technology Transfer, and the Nanyang Technological University (NTU)'s NTUitive Pte Ltd (NTUitive).

The NUS Industry Liaison Office (ILO)<sup>11</sup>: is the NUS's arm for technology transfer and commercialization. The NUS ILO plays essential role for NUS with a very successful output of getting more than 720 patents granted and more than 110 technology-based companies spun off from the university. The NUS ILO offers funding, connections, and expertise to students, researchers, and professors through innovation programs delivered in a customer-centric manner, whether they are looking to start a spin-off company or partner with established industry players to bring their innovations to market.

The SMU Office of Research & Technology Transfer (ORTT)<sup>12</sup>: is the university office which in charge of supporting and overseeing a variety of research-related matters. The SMU ORTT works with the various SMU's organizations, and other University administration offices to provide support to researchers across the research project life cycle in the areas of (1) technology transfer & IP management; (2) research contracting;

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<sup>10</sup> <https://sso.agc.gov.sg/Act/SGCA2002>

<sup>11</sup> <https://www.nus.edu.sg/ilo/about>

<sup>12</sup> <https://research.smu.edu.sg/about/introduction-office-research>

(3) planning, policy & reporting; (4) grants administration; and (5) outreach & engagement.

The NUSitive Pte Ltd<sup>13</sup>: is the Innovation and Enterprise (I&E) Company of NTU which plays a pivotal role as University Technology Transfer office. NTUitive connects ideas, technology, and people to create a lively business environment, and they are always searching for ambitious individuals who want to turn their ideas into reality. NTUitive administers the University's IP, encourages innovation, fosters entrepreneurship, and aids in the commercialization of research.

Beside Singapore's universities, the polytechnics also have their individual technology transfer offices such as the Nanyang Polytechnic's (NYP) Research & Technology Transfer Office and Temasek Polytechnic's Research and Technology Development Department<sup>14</sup>.

The Singapore's public agencies that working on the technology transfer between private and private sectors included, the Intellectual Property Intermediary (IPI) and the Agency for Science, Technology and Research (A\*STAR)'s A\*cceletrate.

The IPI: is a catalyst for invention that enables businesses to expand beyond their current limits. As a subsidiary of business Singapore, IPI accelerates business innovation by providing access to its worldwide innovation network and consulting services.

The A\*STAR's A\*cceletrate<sup>15</sup>: is the commercialization arm of A\*STAR, assisting it in changing the economy through innovation and monetization of research results. A\*cceletrate's purpose is to assist A\*cceletrate researchers in taking innovations from the lab to the market, to assist companies in creation, and to link A\*STAR and industry for R&D.

## **Thailand**

### **a. Policy and Regulation Framework**

Thailand has several laws and policies in place to support technology transfer and promote innovation.

*National Science and Technology Development Agency Act (2008):*

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<sup>13</sup> <https://www.ntuitive.sg/about-us/our-dna>

<sup>14</sup> <https://www.tp.edu.sg/research-and-industry/research-technology.html>

<sup>15</sup> <https://www.mti.gov.sg/en/Newsroom/Speeches/2018/11/Speech-by-SMS-Koh-Poh-Koon-at-Accelerate-at-Fusionopolis-One>

The National Science and Technology Development Agency Act was passed in 2008 to establish the National Science and Technology Development Agency (NSTDA) as a statutory body responsible for promoting science and technology development in Thailand. The act outlines the role and functions of the NSTDA, which include promoting the transfer of technology and knowledge from research institutions to industry. The NSTDA is also responsible for providing technical assistance and support to SMEs and promoting the commercialization of technology.

*Patent Act (1979):*

The Patent Act was enacted in 1979 to provide legal protection for inventors and encourage innovation in Thailand. The act outlines the procedures for filing patent applications and the criteria for patentability. The act also includes provisions for compulsory licensing, which allows the government to grant licenses for patented inventions in certain circumstances, such as public health emergencies.

*National Innovation Agency Act (2011):*

The National Innovation Agency Act was passed in 2011 to establish the National Innovation Agency (NIA) as a government agency responsible for promoting innovation in Thailand. The act outlines the role and functions of the NIA, which include supporting R&D activities, promoting technology transfer and commercialization, and providing funding and support to start-ups and SMEs.

*Board of Investment (BOI) Promotion Measures:*

The Board of Investment offers several promotion measures to encourage investment in R&D activities and technology transfer. These measures include tax incentives for companies that invest in R&D, as well as expedited processing of investment applications for companies that transfer technology to Thailand.

Thailand has several laws and policies in place to support technology transfer and promote innovation. These include the National Science and Technology Development Agency Act, the Patent Act, the Technology and Innovation Support Centers, the National Innovation Agency Act, and the Board of Investment promotion measures. These laws and policies provide a supportive environment for technology transfer and encourage collaboration between research institutions and industry.

Thailand has implemented several sectoral and local policies and strategies to promote technology transfer and encourage innovation.

#### *Thailand 4.0:*

Thailand 4.0 is a government initiative aimed at transforming Thailand into a value-based economy driven by innovation, creativity, and high technology. The initiative focuses on ten target industries, including next-generation automotive, robotics and automation, biofuels and biochemical, and digital industries. The initiative aims to promote technology transfer and encourage collaboration between industry and research institutions to drive innovation and competitiveness in these industries.

#### *Cluster Development Policy:*

The Cluster Development Policy is a government policy that aims to develop industrial clusters in strategic sectors to promote competitiveness and technology transfer. The policy focuses on promoting collaboration between companies, research institutions, and local government agencies to encourage innovation and technology transfer. The policy provides financial support and incentives to companies that participate in cluster development projects.

#### *Eastern Economic Corridor (EEC) Policy:*

The Eastern Economic Corridor (EEC) Policy is a government policy that aims to develop a high-tech industrial zone in the eastern region of Thailand to promote technology transfer and attract foreign investment. The policy focuses on ten target industries, including aviation, digital, and bio-based industries. The policy provides financial incentives, such as tax exemptions and investment privileges, to companies that invest in the EEC.

#### *Smart City Policy:*

The Smart City Policy is a government policy that aims to develop smart cities in Thailand to promote sustainable development and improve the quality of life of citizens. The policy focuses on using technology to improve urban planning, transportation, public services, and environmental sustainability. The policy encourages collaboration between government agencies, the private sector, and research institutions to promote technology transfer and innovation in smart city development.

#### *Research and Development Policy:*

The Research and Development Policy is a government policy that aims to promote R&D activities in Thailand to drive innovation and competitiveness. The policy provides financial support and incentives to companies and research institutions that engage in R&D activities, including tax exemptions, grants, and investment privileges. The policy

encourages collaboration between research institutions and industry to promote technology transfer and commercialization of research results.

These policies and strategies provide a supportive environment for technology transfer and encourage collaboration between industry and research institutions in strategic sectors to drive innovation and competitiveness.

## **b. Institutions in Charge of Technology Transfer**

Thailand has several national and local bodies that are responsible for promoting technology transfer in the country.

### *National Science and Technology Development Agency (NSTDA):*

The National Science and Technology Development Agency (NSTDA) is a government agency responsible for promoting and developing science and technology in Thailand. The agency's mission is to support the country's economic and social development by promoting R&D activities, technology transfer, and innovation. The NSTDA is involved in various initiatives related to technology transfer, such as the creation of technology parks and incubators, the promotion of PPP, and the establishment of technology transfer offices.

### *Office of the National Higher Education Science Research and Innovation Policy Council (NXPO):*

The Office of the National Higher Education Science Research and Innovation Policy Council (NXPO) is a government agency responsible for setting policies related to science, technology, and innovation in Thailand. The NXPO's mission is to promote R&D activities, technology transfer, and innovation in the country's higher education institutions. The agency works with universities and research institutions to develop research and innovation programs and facilitate technology transfer activities.

### *Technology Licensing Office (TLO):*

The Technology Licensing Office was established under the National Science and Technology Development Agency Act to manage the IP of research institutions and facilitate technology transfer to industry. The TLO is responsible for identifying potential commercial applications of research results, negotiating licensing agreements, and supporting the development of start-ups and spin-offs based on research results.

### *Technology and Innovation Support Centers (TISCs):*

The Technology and Innovation Support Centers were established by WIPO in collaboration with the Thai government to provide support and services related to IP and technology transfer. The TISCs provide training and education programs on IPRs, assist with patent searches and applications, and facilitate technology transfer and licensing.

In Thailand, the sectoral body in charge of technology transfer is NSTDA, which operates under the Ministry of Higher Education, Science, Research and Innovation. NSTDA is responsible for developing, promoting and transferring technology, as well as supporting research and innovation in Thailand. In addition to NSTDA, there are also several local bodies responsible for technology transfer in Thailand, including:

### *Science and Technology Parks (STPs):*

These are physical locations where R&D activities take place, and are designed to foster collaboration between businesses, universities and government agencies.

### *Thailand Institute of Scientific and Technological Research (TISTR):*

TISTR is a research institute that focuses on technology transfer and commercialization of research findings. It also provides technical services to businesses and government agencies.

### *Office of Knowledge Management and Development (OKMD):*

This is a government agency that focuses on knowledge management and technology transfer. It provides support for technology transfer activities and helps businesses access R&D resources.

## **Viet Nam**

### **a. Policy and Regulation Framework**

Technology transfer creates a great deal of value for transactions in any country, and in Vietnam, the government is keen to see useful and advanced technologies transferred into the country and used to promote the development of industry and services. The ability to contribute technology as capital in an enterprise in Vietnam is also an important method for building startups with an international element or of luring in major manufacturers who might need to transfer technology to a subsidiary in Vietnam for the purpose of conducting high-technology manufacturing. In either way, Vietnam has proper technologies transferred into the country and will, surely, continue to provide incentives for the same. There are several lists of law, decree, decision and regulation including:

### *Technology transfer law:*

In 2017, Vietnam enacted a new Technology Transfer Law, which came into effect on July 1st, 2018. This law replaced the previous one from 2006. The goal of this new law is to develop Vietnam's legal system and framework in order to encourage the transfer of advanced technologies and patents. At the same time, it aims to eliminate the importation of outdated and hazardous technologies. By doing so, the law hopes to improve the ability of local businesses to conduct research and development activities, which in turn will boost technology transfer within the country.

### *Agriculture and rural development incentive policies:*

Decree No. 57/2018/ND-CP dated April 17, 2018 of the Government on incentive policies for enterprises investing in agriculture and rural development sector. This decree outlines additional incentives for investment and procedures for granting incentives to enterprises that invest in agriculture and rural development. One of the incentives mentioned in the decree is the provision of subsidies on research, transfer and application of hi tech to agriculture to implement scientific research themes or acquire patents, technologies or scientific research and technological development findings for generating new products or innovating technology. The decree also provides subsidies for technologies that minimize environmental pollution and save materials, fuels, and energy.

### *Supporting industry policies:*

In recent years, the Vietnamese government has paid special attention to the development of the supporting industry. To promote this industry, the government has issued several legal documents such as Decree 111/2015/NĐ-CP and Resolution 115/NQ-CP in 2020. These documents outline policies and measures to support the development of the supporting industry. In addition to these specific legal documents, other relevant laws such as the Investment Law, the Law on Supporting Small and Medium Enterprises, and tax laws also contain provisions that support auxiliary enterprises. These policies and conditions are intended to create a favorable environment for the development of the supporting industry in Vietnam.

### *Promoted transfer of foreign technologies policies:*

Decision 138/QĐ-TTg is a revision of Decision 1851/QĐ-TTg issued in 2018, which approves a project to promote the transfer, mastering, and development of foreign technologies to Vietnam in prioritized industries and fields until 2025 with an orientation towards 2030. The goal of this project is to promote the transfer of foreign technologies to Vietnam and to develop the country's ability to master these technologies. To achieve these goals, training courses will be provided to technicians and administrators in



businesses and organizations on how to seek, decode, master and transfer technologies. The number of trained individuals is expected to reach 4,000 by 2025 and 10,000 by 2030. Additionally, a network of international technology partners will be established, with the goal of having 200 partners by 2025 and 500 partners by 2030.

In Viet Nam, the technology transfer means the transfer of the ownership or the right to use a given technology from the party with the right to transfer such technology to the technology transferee. Subject matters of technology to be transferred comprise:

- Technical know-how and technological know-how;
- Technology plans or processes; technical solutions, parameters, drawings or diagrams; formulae, computer software and databases;
- Solutions for rationalizing manufacture and renovation of technologies; and
- Equipment and machinery accompanied by one of the above-mentioned subject matters.
- The government encourages the transfer of high technologies; accompanying machinery/equipment of high technologies the transfer of which is encouraged under regulations of the High Technology Law; advanced technologies, new technologies and clean technologies that are suitable for socio-economic conditions of Vietnam.

## **b. Institutions in Charge of Technology Transfer**

There has a clear statement on responsibility role for state management agencies for technology transfer in Viet Nam. Technology Transfers may only be made subject to a technology transfer agreement. All technology transfers which are not restricted must be registered with the Ministry of Science and Technology of Vietnam (the "MOST"), and the transferee is responsible for such registration. There are several institutions in charge of technology transfer in Viet Nam, including:

### *Responsibilities of the Government:*

In performing the state management of technology transfer activities, the Government has the following responsibilities to perform the unified state management of technology transfer activities, to direct the formulation, promulgation, and organization of implementation of, strategies, plans, programs, mechanisms, policies and measures to promote technology transfer and renewal activities suitable to each period of national socio-economic development; and to direct and inspect the observance of the law on technology transfer to communicate, disseminate and educate the law on technology transfer. And to adding up, they also to assign and decentralize the state management of technology transfer activities; to promulgate a list of technologies encouraged for transfer, a list of technologies restricted from transfer and a list of technologies banned from

transfer; and to conduct examination and inspection, settle complaints and denunciations, and handle violations of law in technology transfer activities.

*Responsibilities of the Ministry of Science and Technology (MOST):*

For restricted technologies, approval must first be obtained from the MOST prior to entering into the technology transfer agreement. Fees such as royalties, training fees, and technical assistance fees are subject to the foreign contractor tax and must be withheld by the transferee of the technology. In the process of international integration, science and technology in Vietnam play an important role in strongly developing production forces, reforming growth models, improving the quality of people's lives and consolidating national defense and security. In performing the state management of technology transfer activities, the MOST has the following responsibilities:

- To be answerable to the Government for the performance of state management of technology transfer activities; to promulgate legal documents on technology transfer according to its competence;
- To assume the prime responsibility for, and coordinate with ministries, ministerial-level agencies and government-attached agencies in, formulating strategies, plans, measures, mechanisms and policies to promote technology transfer and renewal activities, then submit them to the Government for promulgation;
- To draw up a list of technologies encouraged for transfer, a list of technologies restricted from transfer and a list of technologies banned from transfer, submit them to the Government for promulgation, and organize the implementation thereof;
- To grant and revoke technology transfer licenses for technologies on the list of those restricted from transfer, and certificates of registration of technology transfer contracts;
- To publicize the list of technologies created with the state budget in accordance with law;
- To make technology transfer statistics in accordance with law;
- To conduct inspection and examination; settle complaints and denunciations, and handle violations of the law on technology transfer;
- To perform other tasks authorized or assigned by the Government.

*Responsibilities of ministries and ministerial-level agencies:*

In performing the state management of technology transfer activities, ministries and ministerial-level agencies have the following responsibilities are to coordinate with the MOST in drawing up a list of technologies encouraged for transfer, a list of technologies restricted from transfer and a list of technologies banned from transfer; to formulate strategies, plans, programs, measures, mechanisms and policies to promote technology

transfer and renewal activities; and to organize the implementation of the national technology renewal program in their assigned domains. Moreover, they also have responsibilities to create favorable conditions for the transfer of technologies, especially those encouraged for transfer, and the transfer of technologies to regions and geographical areas where technology transfer is encouraged; to communicate, disseminate and educate the law on technology transfer; and to perform other tasks authorized or assigned by the Government.

*Responsibilities of People's Committees of all levels:*

Building firm capabilities should be a priority for promoting access to new technologies. Firm capabilities matter for improving innovation and technology adoption in Vietnam. Successful adoption of a new technology is not just about purchasing machinery, but requires integrating that machinery into the full production and business processes of the firm. This is particularly important for SMEs, which must be able to adjust rapidly to evolving markets and changing circumstances but are often limited by knowledge, expertise and financial constraints. Support to SMEs thus needs to start with improvement of more basic managerial and organizational practices, which will enable them to use and adapt new processes, and to proceed to more sophisticated technological knowledge associated with Industry 4.0 further along. Bridging the capabilities gap is just as important for the absorption of new technologies in manufacturing processes as it is for the development of digital services. In performing the state management of technology transfer activities, People's Committees of all levels have the following responsibilities are at the Provincial-level People's Committees shall perform the state management of technology transfer activities in their localities according to the Government's decentralization and People's Committees of all levels shall, within the ambit of their tasks and powers, create favorable conditions for technology transfer activities in their localities.

### 3. Technology Transfer Gaps and Barriers

The ASEAN is a regional intergovernmental organization comprising 10 countries in Southeast Asia. ASEAN has a combined population of over 650 million people and a total GDP of around \$3 trillion, making it one of the world's largest economies. Technology transfer is an important driver of economic growth and development in the ASEAN region. However, there are several barriers that can hinder the effective transfer of technology across borders. In this paper, we will discuss the technology transfer and barriers in ASEAN in greater detail. The following are some of the key barriers to technology transfer in ASEAN:

#### *Lack of Common Legal Framework for IPRs:*

One major barrier to technology transfer in ASEAN is the lack of a common legal framework for IPRs. Each ASEAN member state has its own laws and regulations governing IPRs, which can make it difficult for companies to protect their inventions and ideas when operating across borders. This lack of a common legal framework can lead to confusion, legal disputes, and a lack of investment in R&D. This is a particular challenge in Myanmar, Cambodia, and Vietnam, where weak intellectual property protection frameworks can discourage foreign investment and technology transfer.

#### *Limited collaboration between academia and industry:*

Collaboration between academia and industry is key to effective technology transfer, but there is limited collaboration between the two sectors in many ASEAN countries.

#### *Limited access to international networks:*

Access to international networks and partnerships is critical for effective technology transfer, but ASEAN countries can face challenges in developing and sustaining these relationships.

#### *Language Barriers:*

Language barriers can also hinder the effective transfer of technology in ASEAN. Many ASEAN countries have multiple official languages, and it can be challenging to find common ground in terms of language when conducting technology transfer. This can lead to misunderstandings, miscommunication, and a lack of effective collaboration between researchers and businesses in different countries.

#### *Cultural Differences:*

Cultural differences can also pose a barrier to technology transfer in ASEAN. Different countries in the region may have different cultural norms, values, and expectations when it comes to technology transfer. This can lead to misunderstandings and a lack of trust between researchers and businesses in different countries.

*Limited Access to Financing:*

Limited access to financing is another barrier to technology transfer in ASEAN. Many businesses in the region, especially MSMEs, struggle to access financing to support R&D activities. This can limit their ability to innovate and develop new technologies, which can hinder the effective transfer of technology in the region. This issue is particularly acute in Lao PDR, Myanmar, and Cambodia, where limited access to funding options for startups and early-stage companies hinders technology transfer.

*Infrastructure and Technological Readiness:*

Limited infrastructure and technological readiness also present challenges to technology transfer in the ASEAN region. Many countries in the region lack adequate infrastructure for R&D, as well as the necessary physical infrastructure for the transfer of technology, such as transport and communication networks. This can make it difficult for researchers and businesses to collaborate effectively across borders. This is a challenge in Lao PDR, Cambodia, and Myanmar, where limited research and development infrastructure and capacity can limit innovation and development.

Addressing these barriers will require a coordinated effort between governments, businesses, and other stakeholders to create an enabling environment for technology transfer to take place. This could involve measures such as harmonizing IP laws, investing in infrastructure, providing access to financing, and developing education and training programs focused on developing the skills necessary for technology transfer.

## 4. Models and Proposed Model

Many studies on technology transfer models have received a lot of attention since they can efficiently and thoroughly guide technology transfer initiatives that can support socio-economic development. Many other models have been put forth. After World War II, typical technology transfer models were developed to oversee the execution of technology transfer and its commercialization (Tenkasi et al., 1995). Following that, research began to shift their emphasis toward "the economic international trade approach" in order to create a linear model of technology transfer (Bessant, J., & Francis, D, 2005). The effectiveness of the particular technology being transmitted, which generally occurs within a larger framework of economic development, has been stressed in research on technology transfer in recent decades (Hope, 1983). In order to facilitate the transfer of technology, the 1990s approach placed a strong emphasis on the importance of learning at the organizational level (Figueiredo, 2001). Following a discussion of the current models in this part, relevant models and mechanisms for ASEAN will be suggested.

### 4.1. Existing Models

#### *The appropriability model*

The appropriability model is a framework which is frequently used in technology transfer that helps explain how organizations can harness the power of their innovations through various means of IP protection. This model was first proposed by Richard Nelson in the 1950s and has since been widely used in the field of innovation and technology management. The appropriability model suggests that organizations must choose the appropriate mechanism of IP protection scheme based on the type of innovation, the competitive landscape, and the market demand. By selecting the most appropriate IP protection mechanism, organizations can capitalize the potential of their innovations and generate a return on their investment in R&D.

#### *The dissemination model*

The dissemination model is basically an approach that guides the sharing and communication of information, knowledge, or innovations to various key stakeholders, such as policymakers, practitioners, researchers, or the public. These models are often used to facilitate the adoption, implementation, and scaling up of new practices, policies, or technologies. Some key characteristics of dissemination models including Linear model (assumes that knowledge or innovations flow), Interactive model active engagement of stakeholders in the dissemination process), Diffusion of innovations (explains how new ideas, practices, or technologies spread through a social system), Community-based participatory research model (collaborative approach to research that

involves the active participation of community members), Knowledge translation mode (emphasizes the integration of research evidence into practice and policy decision-making). Organizations can tailor their dissemination strategies to the needs and preferences of different audiences, facilitate the adoption and implementation of new practices or policies, and enhance the impact of research and innovation on society.

#### *The knowledge utilization model*

The knowledge utilization model is known with the aims to explain how knowledge is developed and transfers by individuals and organizations to others in the different context. The model emphasizes the importance of understanding the different factors that influence the uptake, application, and impact of knowledge in real-world settings. The knowledge utilization model consists of five main stages starting from problem identification, knowledge acquisition, knowledge application, implementation and monitoring and evaluation. Knowledge Utilization Model focuses on the necessary of a systematic way of knowledge and technology transfer, and emphasizes the need of continuous monitoring and evaluation and review, revise and finetuning to achieve the expected results.

#### *The communication Model*

The communication model is also relevant in the context of technology transfer, which involves the exchange of knowledge and resources between different stakeholders to facilitate the commercialization or adoption of new technologies. In the technology transfer process, effective communication is crucial for ensuring that the knowledge and resources are transferred accurately and efficiently. By applying the communication model in technology transfer, stakeholders can improve their communication strategies and increase the likelihood of successful knowledge transfer and commercialization. Effective communication can also help to build trust and foster long-term relationships between stakeholders, leading to further collaborations and innovations in the future.

There are some other models of technology transfer currently deployed in the recent decades. Those models are, but not limited to:

#### *The Bar-Zakay Model*

The Bar-Zakay Model is a conceptual model that explains the transfer of knowledge between experts and novices in a workplace setting. This model was developed by Yoram Bar-Zakay, an Israeli organizational psychologist, in the early 2000s. The Bar-Zakay Model consists of five stages, which are as follows: Knowledge Acquisition: Knowledge Sharing, Knowledge Integration, Knowledge Application, Knowledge Transfer. The Bar-Zakay Model emphasizes the importance of interpersonal communication, active

participation, and reflection in the knowledge transfer process. It also highlights the role of the expert in facilitating the transfer of knowledge and ensuring that the novice is able to integrate and apply the new knowledge effectively. By understanding the stages of knowledge transfer, organizations can develop effective training and development programs that support the growth and development of their employees.

#### *The Behrman and Wallender Model*

The Behrman and Wallender Model is a conceptual model used in the field of international development to understand the process of technology transfer in developing countries. This model consists of 5 stages: Invention, Innovation, Diffusion, Adoption, Implementation. The Behrman and Wallender Model emphasizes the importance of understanding the specific context and needs of the developing country in order to effectively transfer technology. By understanding the different stages of technology transfer, policymakers and practitioners can design more effective programs and interventions that promote economic growth and development in developing countries.

#### *The Dahiman and Westphal Model*

The Dahiman and Westphal Model is a conceptual model used to understand the process of technology transfer in the context of multinational corporations. It was developed by Nabil Dahiman and James D. Westphal in the early 2000s. The Dahiman and Westphal Model identifies four stages of the technology transfer process: Discovery, Selection, Adaptation and Implementation. The Dahiman and Westphal Model emphasizes the importance of understanding the different contexts and needs of subsidiary and partner organizations in order to effectively transfer technology.

#### *The Schlie, Radnor and Wad Model*

The Schlie, Radnor and Wad Model is a conceptual model used to understand the process of technology transfer in the public sector. It was developed by Carsten Schlie, Zoe Radnor, and Peter Wad in the early 2000s. The Schlie, Radnor and Wad Model identifies four stages of the technology transfer process: Awareness, Evaluation, Adoption and Implementation. The Schlie, Radnor and Wad Model emphasizes the importance of engaging with stakeholders and understanding the organizational context in order to effectively transfer technology within the public sector. It also highlights the role of leadership and management in driving the process of technology transfer and ensuring that the technology is aligned with the organization's strategic objectives. By understanding the different stages of technology transfer, public sector organizations can develop effective strategies and processes for adopting and implementing new technologies to improve their services and operations.



### *The Chantramonklasri Model*

The Chantramonklasri Model is a conceptual model used to understand the process of technology transfer in the context of international development. It was developed by Krittee Chantramonklasri in the early 2000s. The Chantramonklasri Model identifies five stages of the technology transfer process:

- Pre-transfer stage: In this stage, the potential benefits and risks of the technology transfer are assessed. This may involve conducting market research, analyzing the economic, social and political context, and identifying potential partners.
- Negotiation stage: The transfer arrangements and agreements are negotiated with the partners involved in the transfer process. This may include IPRs, licensing agreements, and technology transfer contracts.
- Implementation stage: In this stage, the technology is implemented in the target location. This may involve adapting the technology to the local context, providing training and support, and establishing new processes and procedures.
- Monitoring and evaluation stage: The performance of the technology is monitored and evaluated to ensure that it is achieving its intended outcomes. This may involve conducting impact assessments, tracking performance metrics, and making adjustments as necessary.
- Sustainability stage: Finally, the technology transfer process is institutionalized and sustained over the long term. This may involve capacity building, establishing local ownership, and developing sustainable business models.

The Chantramonklasri Model emphasizes the importance of understanding the local context and engaging with local partners in order to effectively transfer technology in the context of international development.

There are also some other Qualitative Models of Technology Transfer such as Gibson and Slimoar Model, a conceptual model used to understand the process of technology transfer in the context of SMEs, Sung and Gibson model, model used to understand the process of technology transfer in the context of university-industry collaborations, Rebentisch and Ferretti model used to understand the process of technology transfer in the context of innovation ecosystems, emphasizing the importance of collaboration, innovation, and ecosystem thinking in the technology transfer process, and many others that partially derive and extend other models.

## **4.2. Proposed Model for Technology Transfer for ASEAN region**

### *Regional Technology Management Hub*

A centralized platform that serves as a control center for managing various aspects of technology infrastructure within ASEAN. The hub's primary function is to provide a unified view of an organization's technology landscape, identify areas for improvement, and implement solutions to optimize technology performance and drive business growth within that region. One of the key functions of a regional TMH is to monitor and analyze technology systems in real-time. The platform can identify potential issues and provide alerts to IT teams, allowing them to take proactive measures to prevent problems before they occur. The hub can also perform automated diagnostic checks to identify and resolve common problems automatically, freeing up IT staff to focus on more complex issues. Another critical function of a regional TMH is to facilitate collaboration among different IT teams within the region. The platform provides a centralized location for teams to share information, collaborate on projects, and coordinate efforts across different technology systems. This collaboration can help IT teams to work more efficiently and effectively, reducing the risk of errors and improving overall system performance within the region. A regional TMH can also support strategic decision-making by providing IT managers with access to valuable data insights specific to the region. By analyzing trends and patterns in technology usage within the region, the hub can provide insights into where the organization should be investing in new technology, where to optimize existing systems, and where to retire outdated technology. These insights can help IT managers to make informed decisions that support the organization's business objectives within the region and drive regional growth. Finally, a regional TMH can provide support and training to IT staff within the region. The hub can offer training on new technology systems, provide support for troubleshooting, and offer advice on best practices for technology management. By providing support and training to IT staff, the hub can help to ensure that the organization's technology infrastructure is managed effectively within the region.

#### *National Technology Transfer Taskforce*

A group of experts and stakeholders from the public and private sectors that is tasked with identifying and promoting the transfer of technology and knowledge from government agencies to the private sector. The goal of the taskforce is to foster innovation, create jobs, and spur economic growth by accelerating the commercialization of government-funded R&D. One of the primary functions of the National Technology Transfer Taskforce is to develop policies and strategies to support the transfer of technology from government agencies to the private sector. This includes identifying best practices, developing guidelines and standards, and establishing incentives and programs to encourage collaboration and partnership between government agencies and the private sector. The taskforce also works to promote awareness and understanding of the benefits of technology transfer among government agencies, private sector companies, and other stakeholders. This includes developing outreach programs, providing training and education, and conducting research and analysis to identify opportunities and barriers to

technology transfer. Another key function of the National Technology Transfer Taskforce is to facilitate the transfer of technology and knowledge from government agencies to the private sector. This includes developing and implementing mechanisms for licensing IP and other technology assets, as well as providing support and resources to help companies commercialize government-funded R&D. The taskforce also works to promote collaboration and partnership between government agencies and the private sector to accelerate the transfer of technology and knowledge. This includes creating networks and forums for sharing information and best practices, and facilitating partnerships and joint ventures between government agencies and private sector companies.

#### *Regional Technology Transfer Center (RTTC)*

A facility that provides a range of services and resources to help accelerate the transfer of technology from government research to commercialization in the private sector. The center serves as a hub for innovation, providing a centralized location for industry, academia, and government agencies to collaborate and share ideas. The primary function of an RTTC is to promote economic development by fostering innovation and technology transfer. This is achieved through a variety of services and resources, including technology assessments, IP evaluations, and technology marketing. The center also provides training and education programs to help entrepreneurs and small businesses learn about the technology transfer process and how to commercialize new technologies. One of the key functions of an RTTC is to help facilitate partnerships between government agencies and private industry. The center serves as a liaison between the two, helping to identify and match government technologies with industry partners who can bring them to market. The center also assists with negotiating licensing agreements and other contracts to ensure a smooth technology transfer process. Another important function of an RTTC is to provide access to specialized facilities and equipment. These resources are often too expensive for small businesses to acquire on their own, but are critical to developing and testing new technologies. RTTCs may provide access to specialized laboratories, testing facilities, and equipment, as well as expert technical assistance. Finally, an RTTC can play an important role in promoting entrepreneurship and business development. The center can provide guidance and support to entrepreneurs and start-ups who are looking to commercialize new technologies, helping them navigate the complex process of technology transfer and develop successful business strategies.

#### *Regional Business Council (RBC)*

An organization that brings together business leaders from various industries and sectors within a particular region to promote economic growth and development. The primary objective of an RBC is to provide a platform for businesses to collaborate, share ideas, and work together to overcome common challenges facing the region's economy. The

functions of an RBC can vary depending on the specific needs and priorities of the region. However, some of the key functions of an RBC include:

- **Advocacy:** RBCs can play an important role in advocating for policies and regulations that support the growth and development of businesses within the region. This can involve lobbying elected officials, working with government agencies, and advocating for funding and resources.
- **Networking:** RBCs provide a platform for businesses to connect and build relationships with other businesses within the region. This can help to foster collaboration, facilitate partnerships, and promote business development.
- **Education and training:** RBCs may offer a range of educational and training programs to help businesses develop the skills and knowledge needed to succeed. This can include workshops, seminars, and mentoring programs.
- **Economic development:** RBCs may also play a role in promoting economic development within the region. This can involve attracting new businesses and investment, supporting entrepreneurship and innovation, and promoting job creation.
- **Community engagement:** RBCs may also engage with the local community to promote social and environmental responsibility, encourage philanthropy, and support charitable causes.

#### *National Technology Transfer Alliances (NTTA)*

National Technology Transfer Alliances (NTTA) partnerships between government agencies, academic institutions, and industry organizations that work together to promote technology transfer and commercialization. The primary objective of an NTTA is to leverage the resources and expertise of multiple stakeholders to accelerate the adoption of new technologies by industry and promote economic growth. NTTAs bring together a diverse group of stakeholders, including government agencies that conduct R&D, academic institutions that provide scientific expertise and research facilities, and industry organizations that have the resources and expertise to commercialize new technologies. By working together, these stakeholders can overcome the barriers that often prevent technology transfer and accelerate the development and commercialization of new products and services. The functions of an NTTA can vary depending on the specific needs and priorities of the participating organizations. However, some of the key functions of an NTTA include:

- **Technology assessment:** NTTAs conduct assessments of new technologies developed by government agencies and academic institutions to determine their commercial potential and identify opportunities for technology transfer.

- IP evaluation: NTTAs provide expertise in IP evaluation and licensing to help government agencies and academic institutions protect their innovations and negotiate licensing agreements with industry partners.
- Industry outreach: NTTAs work to identify potential industry partners and promote the adoption of new technologies by industry. This may involve marketing new technologies, providing technical assistance to industry partners, and facilitating partnerships between government agencies, academic institutions, and industry organizations.
- Training and education: NTTAs may provide training and education programs to help entrepreneurs and small businesses learn about the technology transfer process and how to commercialize new technologies.
- Advocacy: NTTAs may also advocate for policies and regulations that support technology transfer and commercialization, working with government agencies and industry organizations to promote innovation and economic growth.

### *Regional University Consortium*

Regional University Consortium is a collaborative organization that brings together multiple universities and colleges within a particular region to advance research, education, and economic development. The primary objective of a Regional University Consortium is to promote collaboration and resource sharing between participating institutions to support regional development. The functions of a Regional University Consortium can vary depending on the specific needs and priorities of the region. However, some of the key functions of a Regional University Consortium include: Research Collaboration, Curriculum Development, Student Exchange Programs, Community Outreach, Advocacy. To this end, the main function of a Regional University Consortium is to promote collaboration and resource sharing between participating institutions to advance research, education, and economic development within the region. By leveraging the collective resources and expertise of multiple universities and colleges, Regional University Consortia can help drive innovation and create new opportunities for students, businesses, and the wider community.

### *Regional Incubator Center*

Regional University Consortium is a facility designed to support the development and growth of new and emerging businesses. The primary objective of a Regional Incubator Center is to provide entrepreneurs with access to resources, expertise, and facilities that can help them start and grow successful businesses. The functions of a Regional Incubator Center can vary depending on the specific needs and priorities of the region. However, some of the key functions of a Regional Incubator Center include:

- **Business Incubation:** The primary function of a Regional Incubator Center is to provide incubation services to start-up businesses. This may include office and laboratory space, access to equipment and technology, mentorship and coaching, and networking opportunities with other entrepreneurs.
- **Access to Funding:** Regional Incubator Centers may help entrepreneurs access funding from a variety of sources, such as angel investors, venture capitalists, and government grants. They may also provide assistance with developing business plans and pitches that can help attract investment.
- **Business Development Services:** Regional Incubator Centers may offer a range of business development services to help entrepreneurs grow and scale their businesses. This may include marketing and sales support, assistance with hiring and human resources, and access to legal and financial expertise.
- **Industry Partnerships:** Regional Incubator Centers may also partner with industry organizations and businesses to provide entrepreneurs with access to expertise and resources in their specific industries. This can help start-ups to better understand market trends, develop products and services that meet industry needs, and establish valuable partnerships.
- **Community Engagement:** Regional Incubator Centers may engage with the local community to promote entrepreneurship and economic development. This may include partnering with local schools and universities to promote entrepreneurship education, supporting community-based business development initiatives, and hosting events that showcase the region's entrepreneurial ecosystem.

### *Regional Public Private Partnership (PPP)*

Regional Public Private Partnership (PPP) is a collaboration between government entities and private businesses to jointly develop and deliver public services and infrastructure. The primary objective of a Regional PPP is to combine the strengths and resources of both the public and private sectors to deliver high-quality services and infrastructure that benefit the region and its residents. The goal of a Regional PPP is to bring together the strengths and resources of the public and private sectors to deliver high-quality services and infrastructure that benefit the region and its residents. By promoting innovation, risk-sharing, and economic development, Regional PPPs can help drive growth and create new opportunities for the region and its residents.

The functions of a Regional PPP can vary depending on the specific needs and priorities of the region. However, some of the key functions of a Regional PPP include:

- **Infrastructure Development:** Regional PPPs may work together to develop and finance infrastructure projects, such as transportation networks, water and sanitation systems, and energy infrastructure. By pooling resources and expertise,

PPPs can deliver these projects more efficiently and effectively than traditional government procurement processes.

- **Service Delivery:** Regional PPPs may also work together to deliver public services, such as healthcare, education, and public safety. Private sector partners may bring expertise in service delivery, technology, and innovation that can help improve the quality and efficiency of these services.
- **Risk Sharing:** Regional PPPs involve a sharing of risks between the public and private sectors. Private sector partners may take on some of the financial risk associated with delivering public services or infrastructure, while governments may take on some of the operational and regulatory risk.
- **Innovation:** Regional PPPs can promote innovation in service delivery and infrastructure development. Private sector partners may bring new technologies and ideas to the table that can help improve the efficiency and effectiveness of public services and infrastructure.
- **Economic Development:** Regional PPPs can also help drive economic development within the region. By improving the quality of public services and infrastructure, PPPs can attract new businesses and industries to the region, create new jobs, and promote overall economic growth.

### *Regional joint venture*

Regional joint venture is a business partnership between two or more organizations. The main objective of a regional joint venture is to combine resources, expertise, and capabilities to achieve common goals, such as developing new products, entering new markets, or reducing costs. The functions of a regional joint venture can vary depending on the specific needs and priorities of the partnering organizations. However, some of the key functions of a regional joint venture include:

- **Resource Sharing:** Regional joint ventures involve the sharing of resources, such as capital, technology, and expertise, between partnering organizations. By pooling their resources, the partners can access new markets and opportunities that would be difficult to achieve independently.
- **Risk Sharing:** Regional joint ventures involve the sharing of risks between partnering organizations. By spreading the risk across multiple partners, the joint venture can reduce the potential impact of any individual risk factor.
- **Market Development:** Regional joint ventures can facilitate the development of new markets within the region. By combining the market knowledge and expertise of the partnering organizations, the joint venture can identify new market opportunities and develop effective strategies for entering these markets.
- **Product Development:** Regional joint ventures can also facilitate the development of new products and services within the region. By combining the technological

expertise and resources of the partnering organizations, the joint venture can develop innovative products and services that meet the needs of customers within the region.

- **Economic Development:** Regional joint ventures can contribute to the economic development of the region by creating new jobs, generating new revenue streams, and attracting new investment. By promoting collaboration between organizations within the region, the joint venture can create a more competitive and innovative business environment.

The main function of a regional joint venture is to promote collaboration, resource sharing, and risk sharing between partnering organizations within a region. By combining their resources and expertise, the partners can achieve common goals, develop new products and services, and contribute to the economic development of the region.

### *Regional Research Collaboration*

Regional research collaboration refers to partnerships and collaborations between academic, research, and industry organizations within a specific region to conduct research, share knowledge and expertise, and develop solutions to regional challenges. The main objective of regional research collaboration is to promote scientific discovery and innovation, and to accelerate the translation of research outcomes into practical applications that benefit the region and its residents. The functions of regional research collaboration can vary depending on the specific needs and priorities of the region.

Regional research collaborations involve joint research projects between academic, research, and industry organizations within ASEAN. These collaborations may focus on a wide range of topics, such as healthcare, energy, agriculture, and environmental sustainability. By working together, researchers can pool their expertise and resources to tackle complex challenges and achieve breakthroughs that would be difficult to accomplish individually.

- **Knowledge and Technology Transfer:** Regional research collaborations may facilitate the transfer of knowledge and technology between academic institutions and industry partners. This can help to accelerate the translation of research outcomes into practical applications that benefit the region and its residents. The sharing of research data, materials, and facilities can also support this process.
- **Capacity Building:** Regional research collaborations may also focus on capacity building, such as training programs for researchers, industry partners, and students. These programs may include workshops, seminars, and internships that provide participants with new skills, knowledge, and expertise.



- **Funding Opportunities:** Regional research collaborations may also offer funding opportunities for researchers and industry partners to conduct collaborative research projects. These funding programs may be designed to support research that addresses regional priorities, promotes innovation, and enhances economic development within the region.
- **Outreach and Communication:** Regional research collaborations may also engage with the broader community through outreach and communication activities. This may include public lectures, workshops, and events that promote awareness of research activities and their potential impact on the region.

### *Staff and Talent Exchange Program*

Staff and Talent Exchange Program refers to the exchange of personnel between organizations within a specific region. The primary objective of regional staff and talent exchange is to promote collaboration, knowledge sharing, and skill development among organizations, while also addressing talent shortages and enhancing the region's economic competitiveness.

The functions of regional staff and talent exchange can vary depending on the specific needs and priorities of the region. However, some of the key functions of regional staff and talent exchange include:

- **Skill Development:** Regional staff and talent exchange programs can provide employees with the opportunity to develop new skills and gain valuable experience. Employees who participate in these programs can learn new approaches and strategies, gain exposure to different organizational cultures and work environments, and expand their professional networks.
- **Knowledge Sharing:** Regional staff and talent exchange programs can also facilitate the sharing of knowledge and best practices between organizations. Employees who participate in these programs can bring new ideas and approaches back to their home organizations, and share their knowledge and expertise with their colleagues.
- **Talent Acquisition:** Regional staff and talent exchange programs can help organizations to address talent shortages and recruit new employees. By participating in these programs, organizations can connect with potential candidates, and assess their skills and capabilities before making a permanent hiring decision.
- **Inter-organizational Collaboration:** Regional staff and talent exchange programs can promote collaboration and partnership between organizations. By sharing employees and expertise, organizations can work together to solve common challenges and achieve shared goals.

- Economic Development: Regional staff and talent exchange programs can also contribute to the region's economic development by building a skilled and competitive workforce. By enhancing the skills and capabilities of employees within the region, organizations can improve their productivity and competitiveness, and attract new businesses and industries to the region.

The world has now moved to the stage that the issue is no longer a local issue, but a global one requiring serious collaborative efforts to solve the problems together, and aims to thrive together.

## **5. Conclusion and Recommendation**

### **5.1. Conclusion**

The importance of technology transfer in ASEAN helps publicly financed academic research institutions make income by commercializing the technology. Additionally, it preserves a competitive climate in the R&D business, university interactions, and collaboration between the public and private sectors so that society can get more advantages. Therefore, technology transfer is beneficial for sustaining long-term company profit, economic growth, and national as well as international competitiveness.

This report outlines the following key points: first, the approach of establishing the report; second, the current status in ASEAN nation, consisting of an overview of the action plan on technology transfer, and an overview of technology transfer in ASEAN; third, gaps and barriers in technology transfer; and finally, models and propose models with an emphasis on existing models and proposed model for technology transfer for the ASEAN region.

This feasibility study is established by utilizing the holistic approaches; first, desk reviews the assessment of the current state of technology transfer in ASEAN with regard to policy and regulatory framework; second, expert inception on a thorough discussion and consultation process with experts and other stakeholders to formulate the conceptual framework, methodology, and set basis for technology transfer mechanism; third, co-creating the technology transfer mechanism for SDG on involving government entities, academic institutions, research centers, IP bodies, and technology transfer offices and units from all AMS; co-defining the objectives, challenges, and gaps in technology transfer; co-developing the technology transfer mechanism suitable for all AMS; and finally, validating and building consensus on the technology transfer mechanism involving all AMS and experts.

The study also screens the overview of technology transfer in ASEAN member states by discussing two main areas such as policy and regulation framework, and institution in charge of technology transfer. It is developed to align with COSTI, aimed at promoting R&D; supporting innovation and entrepreneurship; and enhancing human capital development in STI. It is guided by the ASEAN Plan of Action on Science, Technology, and Innovation (APASTI) 2016-2025 and APASTI 2026-2035. Its priorities include enhancing human capital in STI, promoting R&D, facilitating technology transfer and commercialization, and strengthening STI governance and infrastructure. The findings of the feasibility study have been summarized as the followings:

While its S&T indicators like R&D expenditures and the number of researchers per million populations are still very low, Indonesia has a well-defined S&T policy and development

strategy and it has the S&T institutions in place. One of the areas where some attention may be given is the program for technology business incubation. However, the role of private enterprises in the technology transfer process is still small.

Technology transfer policies, strategies and regulation frameworks as well as institutions in charge are in place in all AMS to support the mechanisms of technology transfer such as, law, patents order/act, industrial design rules, trademark rules, protection act, copyright order; technology transfer office/department, technology commercialization accelerator, support centers, etc. The governments, businesses and other stakeholders work collaboratively to establish enabling environment for technology transfer such as investing infrastructure, granting access to finance, and creating education and training initiatives to foster the transfer of technology-related skills. However, the technology transfer environment and practices in some AMS are still weak and ineffective, low of R&D expenditures, limited human resources in the STI field, limited collaboration between enterprises and domestic research institutes. In consequences of these ecological systems for technology transfer, some AMS has been successful in transforming into a knowledge-based, innovation-driven economy and culture through the research, innovation, and enterprise initiatives.

There are some existing models for technology transfer such as, to name a few, the appropriability model, the dissemination model, the knowledge utilization model, the communication model, the Bar-Zakay Model, the Behrman and Wallender Model, the Dahiman and Westphal Model, the Schlie, Radnor and Wad Model, and the Chantramonklasri Model to be consider for adoptions for AMS. However, in order to have a common identity of AMS, several mechanisms have been proposed for Technology Transfer for ASEAN region such as: Regional Technology Management Hub, National Technology Transfer Taskforce, Regional Business Council (RBC), National Technology Transfer Alliances (NTTA), Regional University Consortium, Regional Incubator Center, Regional University Consortium, Regional Public Private Partnership (PPP) and Regional joint venture.

In summary, technology transfer enables the nation to access to the source of many indigenous and emerging technologies in the world. ASEAN shall take full benefits from a regional collaboration to explore the opportunities to improve its productivity capacity, leverage the innovation performance and increase the scientific and technological capability through tapping into the regional existing knowledge and open innovation. Hence, this report, a paramount document underpinning technology transfer, provides insights and mechanism for ASEAN region for achieving regional prosperity and sustainable and inclusive growth together.

## 5.2. Recommendation implications

Technology is constantly moving across borders of nations, regions, businesses, as well as among people. While there are gaps and barriers exist within the transfer of technology, those issues could be solved once an effective solution is found and built. For example, ASEAN is an extremely diverse community with many different cultures and traditions. In order to bridge these differences and bring every country together for efficiency of technology transfer, these recommendations can be made to improve technology transfer in ASEAN countries as the followings:

- Have a high commitment towards technology transfer in the region on the equitable basis.
- Invest in supporting infrastructure to accelerate technology and knowledge transfer exchange.
- Establish broad channels of communication between people and organizations, there may be formalized systems created for the orderly transfer of technology.
- Shall design the strategic plans and develop a necessary mechanism for Successful technology transfer. These mechanisms can be customized technology transfer models for specific regions, Technology Transfer Centre, Regional Technology Management Hub, information exchange networks, or organized projects that utilize special teams to affect the transfer.
- Develop a pool of talents and diaspora through attractively incentivizing mechanism from abroad, especially from high-tech countries.
- Develop a common legal framework for Intellectual Property Rights (IPRs) across ASEAN Member States (AMSs) to make it easier for companies to protect their inventions, innovations and ideas when operating across borders.
- Promote a culture of technology experts for technological and scientific dialogue.
- Harness entrepreneurial and startup ecosystem to promote technology transfer across the region and beyond.
- Combat language barriers, AMSs need to promote language learning programs for researchers and businesses to improve communication and collaboration across ASEAN countries including cultural exchange programs and joint R&D projects.
- Establish a number of shared research infrastructures that can be accessed by renown researchers of ASEAN.
- Increase access to financing, particularly for MSMEs, to support R&D activities and innovation.
- Coordinate efforts between governments, businesses, and other stakeholders to create an enabling environment for technology transfer in the ASEAN region.
- Assign specific tasks for each ministry and designing the platform.
- Initiate Technology Transfer Scheme (University-Enterprise Technology Transfer Scheme, University-Community Technology Transfer Scheme...)

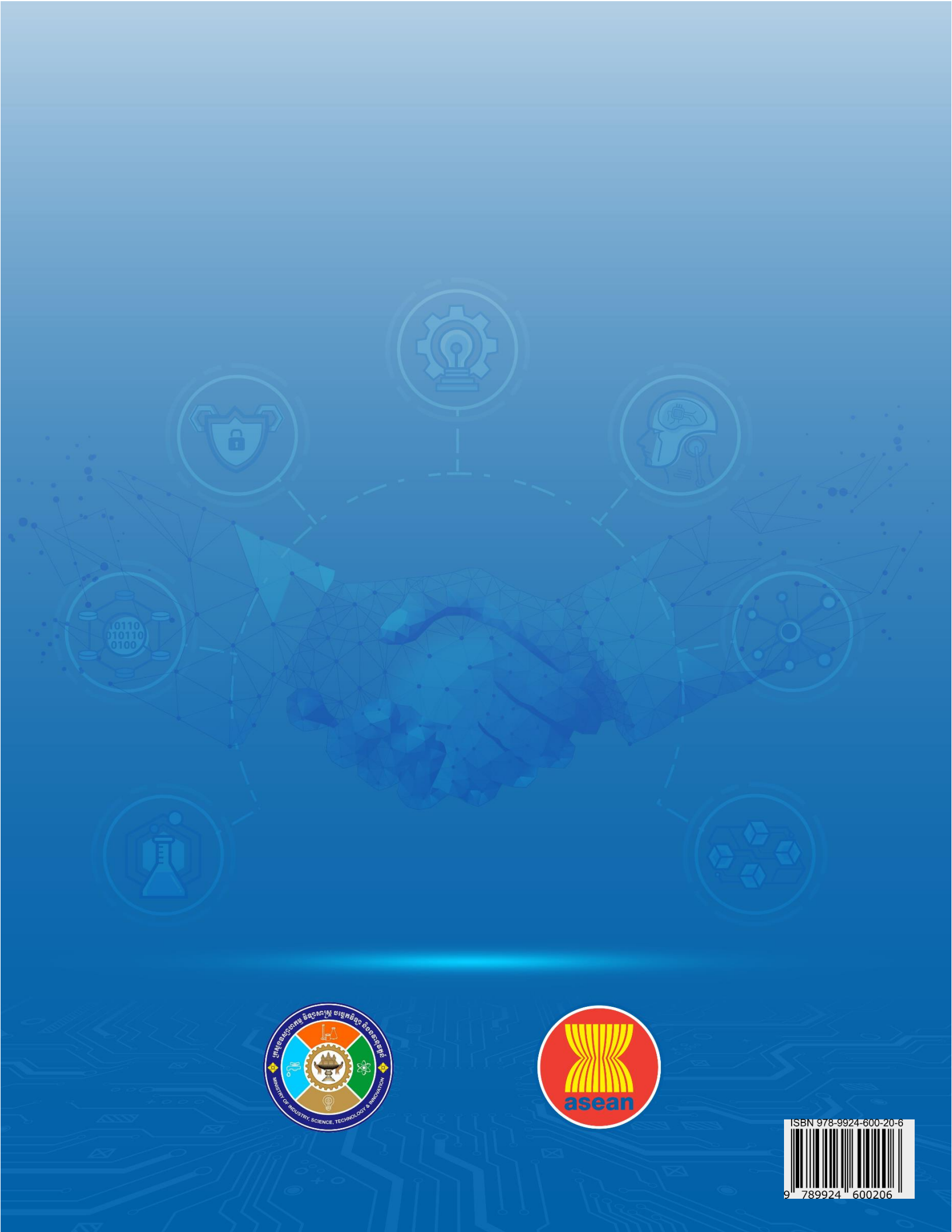
- Establish an M&E system and support its capacity building in each country to ensure the implementation of technology transfer.
- Shall always include the incentive for investors at certain regulatory requirements to accelerate the development of innovation from the R&D stage to be commercially.
- APASTI 2016-2025 and APASTI 2026-2035 should consider in the implementation these proposed mechanisms of technology transfer which are National Technology Transfer Taskforce, Regional Technology Transfer Center (RTTC), Regional Business Council (RBC), National Technology Transfer Alliances, Regional University Consortium, Regional Incubation Center, Regional Public Private Partnership (PPP), Regional joint venture, and Regional Research Collaboration.

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