Chapter 5

Technology and Technology Transfer

March 2014

This chapter should be cited as
ERIA and OECD (2014), 'Technology and Technology Transfer' in ERIA SME Research Working Group (ed.), *ASEAN SME Policy Index 2014-Towards Competitive and Innovative ASEAN SMEs*, ERIA Research Project Report 2012-8, pp.81-108. Jakarta: ERIA and OECD.

Chapter 5

Technology and Technology Transfer

1. Introduction and Assessment Framework

ERIA's research on innovation (Intarakumnerd and Ueki (2009)) confirms that the improvement of innovation capability of local firms in the region depends on how successfully they have leveraged their internal and external resources. The study shows how firms have improved their innovation capabilities through the university-industry linkages locally available to them. The role of universities has evolved from traditional activities of education and basic research to a third mission, technology transfer and commercialization. The external resources from universities, public research institutes, industrial associations, governmental and private sector intermediaries and others can help local firms develop innovation capabilities through a variety of technology transfer and knowledge-sharing activities.

One major obstacle that prevents firms from doing innovations and building up absorptive capacity is their perception of the costs and risks being too high. Another obstacle for innovation is the lack of technological facilities like testing, quality assurance, and calibration centers. These facilities require a lot of investment, and market mechanism alone may not provide them sufficiently.

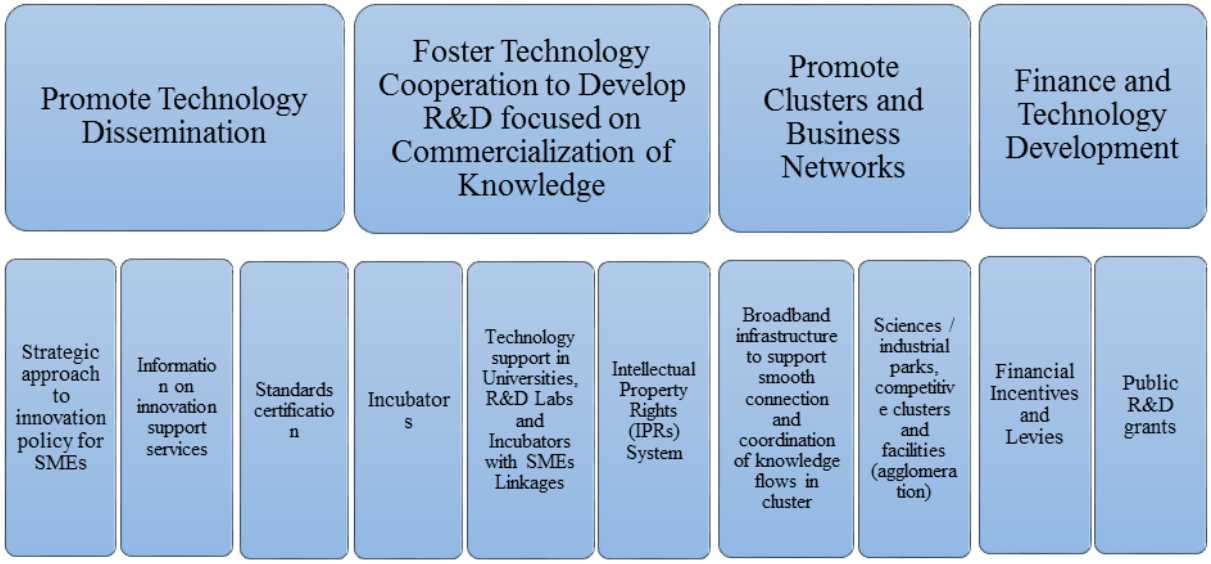
Strengthening the 'absorptive capacity' of local firms is a key success factor in gaining benefits both from within- and across-agglomeration linkages. Governments can help firms mitigate this obstacle through several policy options, ranging from tax incentives to technical support for the provision of technical infrastructure.

Policies to invite the business operation of multinational corporations (MNCs) are also warranted. MNCs encourage the locally owned firms to gain technological knowledge and capability through various channels or ways connecting MNCs to the local firms. These policies fit very well with the policy to create or strengthen the institutions to promote agglomeration/clustering effects. They can also screen particular

clusters and identify bottlenecks, gaps and weaknesses to ease, address and ameliorate these problems. Such problems can take the form of lack of critical basic infrastructure, high tech infrastructure, or supplier firms. Government can step in by creating testing, quality assurance, and calibration centers for the common uses of firms in the industry (Rasiah, 2012).

In measuring the upgrade of technological capability and transfer, there are four key policy sub-dimensions as indicated in Figure 13:

Figure 13: Assessment Framework for Technology and Technology Transfer



(i) Promote technology dissemination which includes strategic approach to innovation policy for SMEs, information on innovation support services, and standards certification.

Overall, it is necessary for a country to have a strategic approach for innovation policy in general and for SMEs in particular. Government, in collaboration with technology-based institutions, should maintain a database on technology and provide information and advice on best prospects for technology commercialization for SMEs. The standards testing and certification instruments are critical for SMEs to solve collective action problems on having their products and services certified to be able to penetrate export markets.

(ii) Foster technology cooperation to develop R&D focused on commercialization of knowledge through the development of incubators, technology support in universities, R&D labs and incubators with SME linkages, and the promotion and protection of intellectual property rights (IPRs);

The role of incubation centers, run by both public and private research institutions, in supporting the development of start-up companies should also be strengthened. To overcome resource constraints faced by SMEs in undertaking R&D activities, closer and proactive collaboration between SMEs and research institutes and universities should be undertaken to take advantage of opportunities arising from the dissemination and commercialization of research findings on technologies and products.

Measures towards more effective collaboration include: making R&D programs of these research institutes and universities more market-driven to meet specific needs of SMEs, with emphasis on innovation; and upgrading resource and institutional capacities of these research institutes and universities to enable the provision of more effective advisory services and the commercialization of more research findings.

To ensure that the 'rules of the game' facing firms are fair, legal statutes must be enacted and strengthened to protect intellectual property and develop national innovation systems to ensure that they act as an inducement rather than a deterrent in both the development and dissemination of new technology. This is vital for the development of a high tech economy so that knowledge of the highest stage/level may be generated and appropriated. Incentives can be important to encourage SMEs to access training and skill upgrading, to commercialize potentially viable R&D results, and to buy or license technologies or intellectual properties.

(iii) Promote clusters and business networks by developing broadband infrastructure to support smooth connection and coordination of knowledge flows in clusters, sciences/industrial parks, competitive clusters and facilities (agglomeration)

SMEs are known to perform well when clustered around the critical supporting organizations and numerous other firms. Clusters are defined here as regionally or locally networked set of economic agents (firms and institutions) that connect all critical economic agents necessary to drive learning, innovation and competitiveness. Clusters

are considered to produce the most synergies when all the requisite institutions needed to drive learning, innovation and competitiveness are developed with strong connectivity and coordination among them. This would drive innovation and competitiveness through circular and cumulative causal processes

Building basic infrastructure in clusters, science or industrial parks and broadband network are important not only to attract and organize firms but also to promote dynamic knowledge flows, knowledge exchanges and efficient logistics, and to accommodate a data-intensive system in modern manufacturing and services industries. Policy emphasis should target the development of broadband infrastructure either nationwide or in export processing zones to offer SMEs strong connectivity and coordination for effective networking with other firms, supporting organizations and government bodies.

Governments can create or strengthen the institutions to promote clustering effects. They can also screen particular clusters and identify and resolve problems. Given the problems of information asymmetries between government and firms, intermediary organizations such as chambers of commerce, training institutions and R&D labs often help resolve collective action problems. Interdependent relationships that are driven by the discipline of the market, participation of government when public goods are involved, and complementation through trust and loyalty to get the social commitment from the people are all vital for the development of competitive clusters. Stakeholder coordination (e.g., through industry, government, consumer and labor coordination councils) often helps secure and expand social capital.

(iv) Financial incentives for technology development through levies, public R&D grants

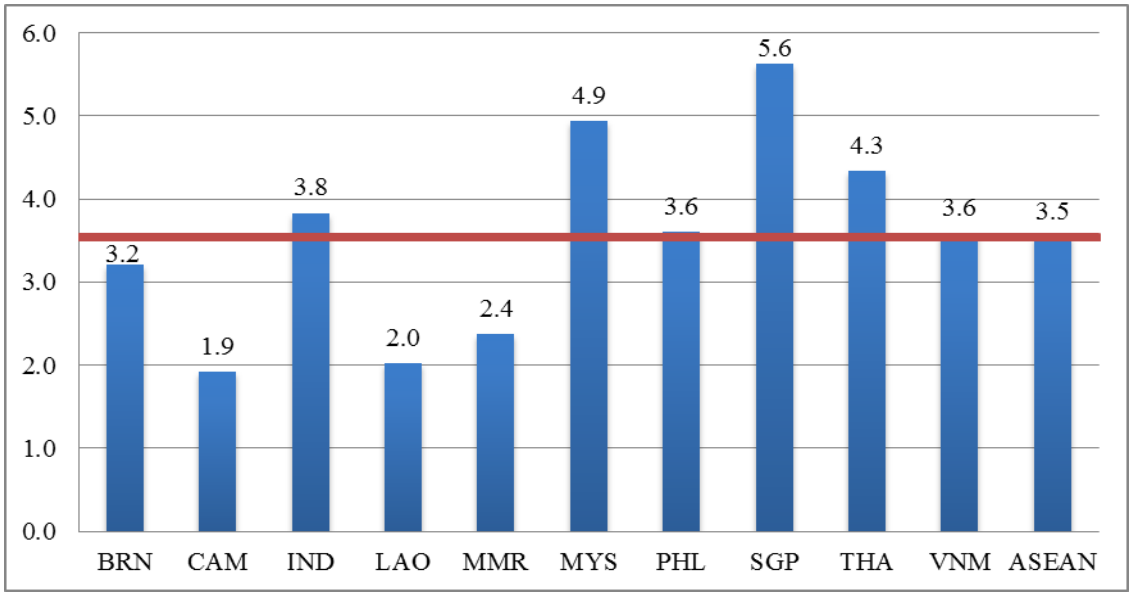
Specific programs (matching) should be implemented to nurture local SMEs as R&D partners to tap the opportunities of R&D outsourcing by MNCs. Measures should also be undertaken to encourage collaborative ventures among MNCs and SMEs to facilitate technology transfers and skills development.

Financial incentives such as grants, loans and tax breaks should be introduced. However, stringent vetting, monitoring and appraisal ex post are critical to ensure that the implicit subsidies these rents create are not dissipated

5.1 Assessment Results

The results suggest that the biggest gap is in the policy to promote technology and technology transfer between the poorer AMSs and their advanced counter parts. The gap is due to the lack of a strategic approach to innovation policy for SMEs, poor provision of information on innovation support services, limited access to standard certification services, lack of technology support in universities, R&D labs, incubators, and little linkages with SMEs. Poor protection and low promotion of intellectual property rights (IPRs), lack of broadband infrastructure, underdeveloped science/industrial parks and competitive clusters, and insufficient financial incentives for technology development and R&D activities are also the causes of the gap as inferred from the scores listed in Figure 14 and Table 6.

Figure 14: Overall Scores for Technology and Technology Transfer



- **Singapore**

There is a strong recognition in the Singapore economy that innovation and invention are the key activities to maintain and sustain competitiveness in the economy. The national innovation policy is given by the Research, Innovation and Enterprise (RIE) 2015 plan that sets out the key initiatives for R&D to meet the medium- and long-term

visions of research-intensive and innovative-based entrepreneurial and knowledge-based economy. The RIE plan indicates a budget of around S$16.1 billion from 2011-2015. There are several mechanisms in place to coordinate the R&D activities among the public, private and educational institutions. Although there are overall plans and strategies for them, the SMEs' role is not explicitly indicated and strategies not clearly highlighted in the RIE plan.

There is plan to provide the database of innovation support service and providers to the firms but as of this date, it is not yet available to the public. There is also a strong requirement for standard and certification with sufficient infrastructure and institution to provide and verify the standards. Singapore is a member of the four international standard bodies and supports the adoption of international standards. SMEs are required to meet the standard certification and there are several Conformity Assessment Bodies (CABs) that provide conformity assessment services.

There are several incubators to assist technology start-up companies in Singapore which are financially supported by the government and public donations. Incubator Development Programme (IDP) is a SGD 30 million programme that provides incubators and venture accelerators a grant to enhance capability development programmes for innovative start-ups. The government also supports the development of a network for incubators and there is a strong presence of universities and the private sector in incubator programmes (NUS Enterprise Support Services). However, there is a limited role for SMEs in this network as it is generally focused on technology-based and targeted SMEs.

There is also a strong enforcement of Intellectual Property Rights (IPR) in the Singapore economy. The IPR services are available nationwide and the Intellectual Property Office of Singapore (IPOS) is a one-stop place for the filing and registration of patents, trademarks, designs, and plant varieties. The government provides the institutional framework for conducting hearings and mediation for IP disputes and it also provides copyright-related services such as copyright tribunal.

There is a strong broadband infrastructure and strong drive to develop technology and innovation centers by the government. The government has also set up the institution to regulate the broadband infrastructure with strong cyber laws. The government has invested in several science parks located close to and within the universities to create strong linkages and spillovers in invention and innovation. The Biopolis science park located close to the National University of Singapore (NUS) is hosting several multinational biomedical research and development companies in close collaboration with the universities. There is a strong network to link up the technology centers with the private and public sectors with a strong presence of international organizations.

There are several financial support services for innovative projects from grants, subsidies, seed funding and venture capital funds. The Technology Enterprise Commercialization Scheme (TECS) is a competitive grant in which proposals are ranked on the basis of the evaluation of both technical and commercial merits by a team of reviewers, and wherein the best are funded. In 2012, 5,600 projects were funded under this scheme. The government also provides public grants for innovative activities for companies with strong monitoring and evaluation system.

- **Malaysia**

The Government of Malaysia has officially supported technology development in SMEs since the introduction of the Industrial Master Plan in 1986. The government formed the Agensi Inovasi Malaysia (AIM) in 2011 which was targeted at assisting Malaysian SMEs to move up the value chain through innovation by taking advantage of novel methodologies, policies and outcomes. In addition, the SME Master Plan has identified innovation and technology adoption as one of the most important performance levers for SMEs with two high impact programmes specifically designed to promote SMEs in this area, namely, the Technology Commercialisation Platform and Inclusive Innovation.

In terms of information on innovation support services, SME Corp. and various ministries and agencies, including AIM, have taken measures to disseminate information on innovation support services. The SME innovation support system is

available through the SME Info portal that has comprehensive information for various support systems.

SME Corp. works closely with the Standards and Industrial Research Institute of Malaysia (SIRIM) to help SMEs in Malaysia attain product certification internationally. SIRIM, which is Malaysia's national standard development agency, is actively involved in international standards development with participation in over 80 ISO Technical Committees and Subcommittees. SIRIM is well equipped with testing facilities and equipment to help SMEs.

Various incubator facilities, specifically business and technology incubators, are available in Malaysia. As of 2010, there were around 106 incubators in Malaysia. In 2012, SME Corp. initiated a study on enhancing the effectiveness of incubation centers in Malaysia and found that there were a total of 103 active incubation centres hosting close to 1,000 companies in the country. More than 50 percent of these companies were able to develop commercially viable products with reasonable sales values.

However, technological support and linkages between universities and SMEs still require further development. Despite the efforts, more is needed to encourage better linkages between universities and industry research activities. Although the schemes are available, collaborative research between universities, research labs, and technology centres is still lacking to promote innovation and research activities among SMEs.

In Malaysia, the intellectual property (IP) system is well established. The Malaysian government has taken the necessary action to strengthen the IP environment in Malaysia with a well-established legislation and patent system implementing agency.

Malaysia enjoys broadband penetration at 60 percent nationwide. The Government has formulated the National Broadband initiatives with the objectives of deploying high speed broadband rollout of more than 10Mbps in strategic areas with high economic impact and of developing cloud computing facilities for SMEs. However, clustering has yet to reach its full potential in terms of connectivity and coordination between firms and firms, and firms and meso-organisations.

The Malaysian Government has given considerable attention to industrial infrastructure development for the broadening of SME activities, expansion of SME industrial parks in key locations, grant of soft loans to develop industrial estates and special SME parks, and building of business premises and office space at strategic locations. Networking links among innovative companies are still low, especially among SMEs. Nevertheless, the recent assessment of industrial estates by the Economic Planning Unit (EPU) shows that there is an oversupply of industrial parks in Malaysia, yet many did not meet the requirements of the investors.

There is a wide range of funding systems for the promotion of technological development and capability building, and commercialisation for the SMEs. Financing to support R&D and commercialisation, including funding to encourage women entrepreneurship, is provided by several organisations. Government funds for commercialisation are provided through the Malaysian Technology Development Corporation (MTDC), Commercialisation of R&D Fund, Technology Acquisition Fund, and the Multimedia Development Corporation (MDeC). The Ministry of Science, Technology and Innovation (MOSTI) provides innovation funding through the Enterprise Innovation Fund.

Despite the availability of a wide array of incentives and grants, they have not achieved full maturity because of a lack of proper evaluation procedures to assess their effectiveness. A mechanism to evaluate the performance of R&D funds is currently being deliberated by the government. However, the agencies and ministries involved in providing funding undertake an evaluation at the end of each 5-year Plan. For instance, MOSTI evaluates its public R&D programmes for every Malaysian Plan and the assessment is reported in the succeeding Malaysian Plan.

- **Thailand**

The National Science, Technology and Innovation Act 2008 serves as the foundation for science, technology and innovation (STI) policy in Thailand. The goal is to unify STI commitments among public agencies and strengthen the collaboration with and among

the private sector, academics, and research institutes. The coverage is designed to network knowledge from the grassroots community level up to the international cooperation level. To implement the challenges, the National Science Technology and Innovation Policy Office (NSTIPO), an autonomous public agency chaired by the Prime Minister, was established. The office operates in compliance with policy guidance from the National Science, Technology and Innovation Policy Committee.

The current ten-year National STI Master Plan (2012-2021) marks the new policy directions for STI in Thailand. It also provides mechanisms to enrich the innovation system from national to regional and local levels. Strategies, measures, and budgets are mapped out to develop vital factors leading to human capital development. The NSTIPO is the agency responsible for policy formulation and overseeing the implementation of the National STI Master Plan. The office also coordinates with the industries, government, academia and local communities. Collaborative networking is an essential part of the Office's mandate and is emphasized by the creation and promotion of active collaboration through strong linkages with local and international partners. However, Thailand's strategic approach to innovation policy for SMEs may not be well coordinated. Funds available for innovation programs are still inadequate.
Certifying product standard is operated by the Thai Industrial Standard Institute (TISI) under the Ministry of Industry (MOI). The TISI has been participating as member body in the ISO since 1965. It takes 43 days to get product certification. The independent agency under the MOI--the Management System Certification Institute of Thailand (MASCI) -- provides ISO certification, product inspection, coaching and training, and climate change services (validate and verify CDM projects). However, the supporting schemes to give SMEs easy access to testing and standard services have so far been limited as yet.

The University Business Incubator (UBI) program was coordinated by the Office of Higher Education Commission and universities. The current UBI has established 9 university networks covering 56 universities around the country. About 10 university incubators can foster technology through the "Technology Licensing Office" channel, which handles technology licenses created under the universities and promotes public-

private partnership. Although Thailand has several incubators and networks with universities, less than half of the participating universities can provide high quality services. Connectivity and coordination among universities, R&D labs and incubators are limited and not well developed.

Thailand has several acts covering seven types of intellectual property rights (IPR). Protection of the IPR system in Thailand is done under the Department of Intellectual Property (DIP) of the Ministry of Commerce. The DIP also provides one-stop support centers (patent office) for IPRs, which provide patent application, search system on patent, product design, patent decree, trademarks, copyright, trade secret and general information. However, lack of effective enforcement of IPR protection leads to lower participation in IPR registration. In addition, the time-consuming patent registration procedure and its limited use for domestic protection hinder the Thai IPR system.

Thailand's broadband infrastructure is available nationwide with high quality. In Thailand, there are several types and areas of business clusters and facilities such as science parks and industrial estates created to promote networking among companies. To date, however, Thailand has only one Science Park in operation under the management of the National Science and Technology Development Agency. It aims to be the hub for the private sector's industrial R&D activities and provides services ranging from technology transfer from universities and technology centers, to financial assistance and business incubation.

Industrial estates in Thailand are governed by the Industrial Estate Authority of Thailand (IEAT), a state enterprise under the MOI. It is responsible for the development and establishment of industrial estates where factories for various industries are orderly and systematically clustered together. Currently, there are 46 industrial estates in operation across 14 provinces, 11 of which are operated by IEAT and 35 are jointly operated with developers. Some industrial estates provide incentive schemes for SMEs to locate into the facilities.

Innovation support services for Thai SMEs are provided by two main organizations: Industrial Technology Assistance Program (iTAP) and the National Innovation Agency (NIA). The iTAP is an organization aimed at providing assistance in research and development to Thai SMEs in the production sector. The NIA, meanwhile, supports national innovation in the form of new business models to create new products, new technology, new services, and new processes. NIA provides both technical and financial support to the private sector.

Thailand has established many channels to provide financial incentives or support schemes for SME innovative projects. However, in 2011, Thailand spent 20,107 million THB or only 0.22 percent of GDP on R&D. About half comes from the government budget.

- **Indonesia**

In Indonesia, the innovation strategy elements are included sporadically in some policy documents without a consistent approach. Each ministry has its own plan. There is neither synergy nor a system uniting all the strategy elements in the country. Currently, the government has a plan to introduce a presidential regulation that can be an "umbrella" to integrate and synchronize all the existing regulations.

SMEs are explicitly mentioned in most of the government programs on innovation. For example, the Ministry of Cooperatives and SME (MoCSME), together with the Ministry of Education and Culture (MoEC), and Ministry of Research and Technology (MoRT), introduced a joint regulation on National Movement for the Development of Business and Technology Incubator Aimed to Develop Innovative Entrepreneurship. Moreover, there is also currently a plan to issue the new Presidential Regulation on Incubator for Innovative Entrepreneur.

The databases on information about innovation support service providers are still fragmented in several agencies and institutions although they are available to enterprises. The government has also provided information on innovation support services through websites and brochures. The website of the National Innovation

System provides a database of innovation service providers and contains many types of innovation support programs. Since it is just being launched, the information is still incomplete. However, each institution has its own website containing valuable information.

The Indonesia government has also established the National Standardization Agency (Badan Standarisasi Nasional (BSN), a non-departmental government institution that has the main responsibility to provide guidance and develop as well as coordinate national scope activities focusing on standardization. SMEs have access to certify their product. However, in reality, only a few SMEs certify their products. Since most SMEs produce small scales of outputs, certifying their products would be too costly for them.

The government has provided funds for universities to establish business incubators but the incentives are not large. In Indonesia, there are currently only around 30 incubators, many of them being part of universities and located in big cities such as Jakarta, Bogor, Bandung, Yogyakarta, Malang, and Medan. The operations of these incubators are funded mostly from the government budget and government continuously evaluates the existing incubators. These incubators linked a network of incubators called the Association of Indonesian Business Incubators (Asosiasi Inkubator Bisnis Indonesia (AIBI)). However, there are only a small number of people/SMEs enjoying the benefit of incubators since the number of incubators is only few. Furthermore, there is no virtual incubator in the country.

Meanwhile, the Directorate General of Intellectual Property Rights under the Ministry of Law and Human Rights (MoLHR) is the authority to manage the IPR system in Indonesia. This agency acts as a one-stop support center on IPR in Indonesia. The coverage of one-stop support centers is nationwide, as it is also part of the MoLHR which has representative offices across the nation. This agency provides various services related to IPRs, including raising the awareness on IPRs, providing information, patent applications, and licensing, among others,

In Indonesia, broadband connections are already available nationwide or in special economic zones/clusters. Nevertheless, the broadband connection quality is still not mature as the speed is not stable, depending on the area. Some areas have very good connection but others do not. Meanwhile, the facilities to promote networking among innovative companies are also already in place, represented by the establishment of six "science parks". These parks though are still at their infancy stage and cannot be categorized as truly techno-parks. The industrial components are still missing in much of these parks. Moreover, the full capacity is not yet fully developed. These facilities are linked with universities and other innovation and technology research centers as graduates from the business incubators owned by universities are set to continue their business operation in the science parks.

There are various programs and projects provided to give financial incentives or support schemes for innovative SMEs. The fund for these financial support schemes mainly comes from government budget. The financial incentives or support schemes take several forms, including grants, subsidies, seed funding to venture capitals, private equity funds and loans. While the monitoring and evaluation process for these incentives and levies are already in place, the processes are mostly conducted by internal institutions. Furthermore, it is still unclear whether the M&E brings better management of the projects in the future.

The Indonesian government has also provided public grants to support R&D activities with a commercial orientation. The public grants for SMEs are disbursed via several government agencies, making it difficult to quantify the total amount of the grants. The most recent government project to support R&D for SMEs is through the LPDP (Institute for Management of Educational Fund). The government provides IDR 1-2 billion (US$ 100,000 – US$200,000) for each innovative SME project. There are also monitoring and evaluation systems for these on-going projects. However, the effectiveness of the funding allocation is still unclear as the institution is still new.

- **Philippines**

The Philippine Development Plan states that the government shall continue to implement the national innovation strategy called "Filipinnovation". The Plan explicitly identifies science, technology & innovation as an area of support to be provided to potential, new and existing MSMEs. The strategy is also subsumed under the productivity & efficiency strategy of the Philippine MSME Development Plan for 2011-2016. The innovation policy and strategy have been developed and integrated into the Philippine Development Plan and the MSME Development Plan. The strategy also includes programs for SMEs. There are also monitoring mechanisms in place. However, for some programs, the budget has not yet been released.

There is no database of innovation support services. The DTI-BMSMED compiles all programs and services for MSMEs provided by government agencies, private sector organizations, academic institutions, and MSME organizations. This is published as a handbook. The DTI-BMSMED's handbook could form the baseline information for the creation of the database on innovation services and programs that MSMEs can readily access online. The DTI-BMSMED could coordinate with the government agencies and other providers of MSME services in creating, maintaining and regularly updating this common database.

The Bureau of Product Standards (BPS) under the Department of Trade and Industry (DTI) is the Philippine national standards body. BPS is mandated to develop, implement, and coordinate standardization activities in the Philippines. Aside from standards development, BPS also ensures the implementation and promotion of these standards to raise the quality and global competitiveness of Philippine products and to protect the interests of consumers and businesses.

There are incentives and support schemes to establish incubators and networks of incubators all over the country. Services provided include data centers, video conferencing, matching with venture capitalists (as an exit strategy), intellectual property management assistance, R&D funding assistance, and recreation facilities. Currently, there are three incubator networks in the Philippines. Locators and start-up

firms are satisfied with the services of these incubators. Exit strategies available include venture capital arrangements and referrals to new locations.

There exists networking and coordination activities between technology development activities in universities, R&D labs and incubators, the Department of Science and Technology (DOST) and SMEs. The Technology Application and Promotion Institute (TAPI) of the DOST is tasked to promote the commercialization and transfer of technologies and to market the services of other operating units/agencies of the DOST. These programs should be further promoted, strengthened, and expanded to reach out to more SMEs, universities, and research institutions.

The Philippines has a strong legal framework and made substantial improvements in its intellectual property protection. The Intellectual Property Office (IPOPHIL) oversees and enforces the overall implementation of intellectual property rights, trademarks and patents. IPOPHIL has 10 satellite offices and 63 Innovations and Technology Support Offices (ITSO). These offices provide information and awareness services.

Broadband connections are available nationwide through major telecommunication companies like PLDT and Globe Telecom. These firms offer independent, nationwide data networks and have announced significant new investments in infrastructure to support domestic demand (primarily mobile voice and data services) as well as commercial requirements. These services are also available in economic zones and clusters. However, the quality of connection and speed depends on the location. Further development of the required infrastructure to address the connectivity deficit in the Philippines and to increase broadband coverage should be pursued.

The Philippine Economic Zone Authority (PEZA) of the DTI is the agency responsible to promote investments, extend assistance, register, grant incentives to and facilitate the business operations of investors in export-oriented manufacturing and service facilities inside special areas designated as PEZA special economic zones. Currently, there are 17 agro-industrial economic zones, 178 IT parks/centers, 65 manufacturing economic zones, 2 medical tourism parks, and 15 tourism economic zones. The DTI Regional

Operations and Development Group is implementing the National Industry Cluster Capacity Enhancement Project (NICCEP), a 3-year technical cooperation project funded by the Japan International Cooperation Agency (JICA). The project aims to develop and mobilize pilot industry clusters nationwide.

There are science/industrial parks, clusters and facilities in the Philippines. Basic supporting infrastructures for the facilities are in place. These are operated with an average of more than 50 percent of the capacity with limited linkages with universities and other innovation and technology centers.

There also appears to be weak evidence of linkages between firms and the intellectual community, i.e., universities and public and private research institutes. Firms tend to rely more on their own experience and knowledge combined with information from suppliers, customers, and clients. Firms consider institutional sources such as government or public research institutes to be of lowest significance in terms of their sources of innovation-related knowledge and information.

There is seed funding available in the Small Enterprise Technology Upgrading Program (SETUP) of the DOST and in others which include Venture Financing Program, Technology –Based Enterprise Development Assistance Program, Tax and Duty Exemption Assistance Program, Testing Assistance, Invention-Based Enterprise Development Program, and Invention Guarantee Fund. These programs and funds, however, are still limited and accessed by only a small number of firms. The government still needs to increase funding (in terms of amount and number of schemes) available for these innovative projects in partnership with private sector investors.

- **Brunei Darussalam**

In order to encourage the development of innovation and knowledge-based start-ups and enterprises in Brunei Darussalam, the Brunei Economic Development Board (BEDB) is currently establishing a three-phased development of the Anggerek Desa Technology Park. The objective is to promote and attract a diversity of technologies reflective of the

varied technology capabilities of the local enterprises. The three-phased development includes: Establishment of the iCentre, Establishment of the Knowledge Hub, and Phase 3 which is still under evaluation. All information relating to innovation support services are available at the BEDB. There is still no database set up for innovation service providers.

Standard certification is under the National Standard Centre (NSC), Ministry of Industry and Primary Resources. Brunei Darussalam has developed its own Halal Certification standards. The NSC has a subsidy scheme under the Standards and Quality Certification Programme to ensure that products manufactured comply with required standards required for export and that locally manufactured products are safe for use or consumption. The recipient company can get full funding to obtain certification and the expenses covered include consultancy, training and Standard Certification (ISO, GMP and HACCP).

As part of the BEDB's three-phased development, the iCentre was established in 2008. The iCentre is Brunei Darussalam's first ICT incubation centre that 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. The iCentre has incubated 15 local ICT companies. Through its mentorship and networking programmes, the iCentre provides its incubatee access not only to professional advices but also to potential partners and clients, both locally and internationally.

There are legislations in Brunei Darussalam to provide the legal mechanism for the protection of IPR. The IPR system is administered by the Patents and Industrial Designs Patent Registry Office at the BEDB.

For broadband infrastructure to support smooth connection and combination of intellectual currents in business clusters, the existing broadband capacity needs to be upgraded to improve the broadband connectivity and reduce down time. In view of the above, the government is embarking on a "Fibre To The Home" (FTTH) project to

ensure that all residents and businesses are connected. This will ensure a better connectivity with very little or minimal downtime.

The Science and Technology Park has not yet been developed in Brunei Darussalam. For the existing industrial sites, there are no special networks or dedicated networks allocated for these industrial sites.

The Brunei Research Incentive Scheme is a Grant Scheme that is administered by the Brunei Economic Development Board. The Grant is a cost-sharing grant to support private sector research and development activities and to attract foreign companies to conduct R&D activities in Brunei and set up laboratory facilities in Brunei Darussalam.

- **Viet Nam**

In Viet Nam, the innovation strategy is included in some legal documents but scattered without consistent approach among ministries, localities and other state agencies. The technology innovation policies are basically developed and associated with action plans, budgets and time frames. In the SME Development Plan 2011-2015, a number of technological innovation programs are included.

There are also many programs meant to support SMEs in enhancing their innovation and technology capacity. The MoST and local governments also develop plans and allocate funds to support SMEs in applying quality management systems (ISO) and other international standards. Policies that prioritized SMEs in participating in incubators were also issued in spite of inconsistencies and lack of capital.

Other programs have also been implemented such as: (a) the program supporting the development of intellectual property of enterprises. However, the total fund of this program by the end of 2011 was modest at only around US$ 3.7 million;(b) the Development and Application of Standards and Technical Regulations" project which is one of the national programs meant to improve productivity and product quality of Viet Nam’s enterprises towards 2020; and (c) the "Promotion of Activities on Productivity

and Quality" project which is another project meant to improve productivity and quality of Vietnamese enterprises.

In terms of financial policies and mechanisms to encourage enterprises to invest in scientific and technological activities, the following developments have taken place. From 2007 up to the present, the total guaranteed loans of around US$ 1.7 million have been provided to 54 projects using energy savings and efficiency in 53 units. Currently, through the National Fund of Scientific Development and Technology, enterprises, scientific and technological institutions can get loans with preferential interest rates to apply the outcomes of research projects, innovations and technology transfers for economic and social development.

The government has likewise approved the plan for providing information on innovation support services to enterprises in general and SMEs in particular. In this regard, the National Agency for Science and Technology Information was established to provide, among others, information on innovation support services. At the provincial level, the Department for Science and Technology takes on this function.

The Directorate for Standards, Metrology and Quality (STAMEQ) is an agency for product standards certification. This organization has been equipped with modern equipment to perform certification for a variety of different products. There have been supporting schemes for SMEs to easily access certification services for their products when STAMEQ established two SME Development Support Centers to support SMEs in improving the standards, quality and access to certification of their products.

In Viet Nam, a number of technology incubator models have also been developed. They include technology incubators in universities and in enterprises. Many incubators have innovative activities and have gained important initial results. As of mid-2012, Viet Nam had 47 technology incubators, of which several incubators are in operation outside of the experimental phase and provide basic services. There is provision of high quality services and existence of exit strategies. However, most incubators are in the process of development and they have to raise their funds themselves to survive and

develop, thereby making their performance and effectiveness modest in both quantity and quality. The Viet Nam Technology Incubation Network was established to connect the research and development in the field of science and technology with commercial and investment activities. Some incubators have performed effectively and reached out internationally, participating in the International Association of Incubators.

Vietnam has a policy framework to support technological development in universities, research and development laboratories and technological incubators. These policies are associated with the development of SMEs in the technological universities, research and development laboratories and technological incubators. Viet Nam has already had a network of linkage and coordination among technology development activities.

Viet Nam also has grants or incentives related to supporting activities. However, linkage amongst universities, R&D labs, incubators and SMEs in technology development, connectivity and coordination is not strong enough to form close relations amongst them because universities and R&D labs do not meet all the demands of enterprises.

There is a Law on Intellectual Property and a patent system with an implementing agency, namely, the National Office of Intellectual Property (under the MOST) which is the only organization authorized to grant IPR license. It has representative offices in big cities. There is also an online registration for new trademark. Viet Nam has a one-stop center to support the protection of intellectual property (the Supporting and Consulting Center managed by the Department of Intellectual Property). This Center provides services on awareness, information, registration of patents, licenses and other services and the scope of its services is nationwide.

Telecommunication and Internet development strategies often refer to building the information society based on a modern nationwide broadband network infrastructure to meet the economic, political, national security and welfare needs of the society. Recently, ten enterprises have been granted licenses to build network infrastructure. However, in practice, only two major groups (i.e., Viettel and VNPT) have built

telecommunications network infrastructure on a national scale. These networks are interconnected with each other. Therefore, it can be said that the broadband connections are already available nationwide. The broadband connection quality has significantly improved although at times, it is still unstable or suffers breakdown, depending on the location.

Viet Nam has science /technology parks and industrial clusters operating in competitive and other favourable conditions to encourage the connection between innovation and research companies. For existing facilities, their coverage rate averaged 46 percent of their capacity by the end of 2010 and there are linkages with universities and other innovation and technology centers. The network of facilitates and linkages, however, are limited in terms of geographical area (mostly in Ho Chi Minh City) or industry (software sector). Incentive schemes for qualified SMEs were set to locate in the facilities. In general, the clusters have been widely known and attractive to businesses and foreign countries that have higher innovation capabilities.

Viet Nam has likewise made efforts to establish some financial channels for technological innovation in the form of funds such as the National Fund for Science and Technology Development, Funds for Science and Technology Development at provincial levels, and the Fund for Science and Technology Development in enterprises, especially the National Fund for Technology Innovation, to support part or the whole of the enterprises' costs for R&D in new technology, advanced technology or high technology. The government also allows enterprises to keep 10 percent of pre-tax profits for R&D.

In Viet Nam, investment for R&D activities account for only 0.7 percent of GDP (equivalent to approximately US$ 700 million), of which 70 percent comes from the government. Most SMEs use out-of-date technologies that are 2 to 3 generations behind the world average level. In practice, due to limited resources and capital shortage, most enterprises focus on technology innovation rather than on R&D activities.

- **Lao PDR**

Development technology and promotion of technology transfer is one of the important elements in Lao PDR's 7th Socio-Economic Development Plan (2011-2015). The Ministry of Science and Technology (MoST) has the Development Strategy of Science and Technology (2013-2020) which supports technology and technology development for SMEs.

While innovation strategies are included in the enterprise policy, industrial policy, human capital development policies, or education and research policies, no consistent approach nor indication of implementation actions has been observed. A database is available to enterprises for limited sets of services and fragmented set of information on innovation support service providers. Government has established a legal and policy framework to support standards organizations.

There are incentives and support schemes to establish incubators associated with universities and/or research centers. Government has also established a legal and/or policy framework to support technology development in universities, R&D labs and incubators but few one-stop support centers on IPRs exist.

The laying of broadband connections is underway either nationwide or in special economic zones/clusters. Facilities at industrial parks are operated with an average of more than 50 percent of the capacity.

Financial support schemes are limited and funded by government, donors and/or other organizations. Tailored services are provided to link innovative companies to sources of financing. There are pilot public funds supporting R&D activities with a commercial orientation with limited allocation.

- **Myanmar**

Like financing, technology development has become a critical activity for promoting SMEs in the country. Unfortunately, the innovative activities are generally lacking in

Myanmar due to ineffective support by the government, low level of education, lack of encouragement and incentive, and finally insufficient capital to invest in R&D.

There is no strategic innovation policy in Myanmar, with the approach on stimulating, initiating and coordinating innovations being incoherent and inconsistent. However, some ideas and activities that are aimed at promoting innovative activities are sporadically found like the grant of awards to the most innovative firm. There is neither coordinated approach nor annual budget allotted for these sporadic activities though and local SMEs are not explicitly mentioned in said programs.

There is no plan for providing information on innovation supporting services either on the part of the government or other private service providers. However, the SME Centre is now designing an information portal for providing SME-related information to all stakeholders. When completed, the portal will provide some information on innovation supporting services.

There are some agencies that specialize in certifying products for their standards in the country. Most of them focus on health and safety standards for agricultural and marine products that are being exported.

Regarding business and technological incubators, 22 technological incubators have already been established under the Ministry of Science and Technology. However, business incubators to nurture local entrepreneurs of any kind have not been established so far. The availability of services from these incubators for SMEs in the private sector is still quite limited since they are accessible mainly for state-owned enterprises and to support the works of their Ministry.

There are no coordinated and coherent policy frameworks to support technology developments in universities, R&D centers, laboratories and incubators. As of this date, there is no government plan that can be seen to coordinate their activities. These universities and research centers are operating under different ministries that makes it difficult for them to coordinate with each other. There are no other grants or incentives

to provide innovation support services to these organizations and there are also no monitoring mechanisms for this purpose.

Myanmar has legislations on protecting IPR although enforcement in this area is still weak. A Patent Office has been established with the aim to protect trademark and copy rights but there is no specialized support center for protecting IPR.
Regarding the promotion of clusters and business networks, a broadband infrastructure is available in special economic zones and most of the major areas of the country. A government plan is now underway to make available broadband networks in all the remaining areas. The speed of broadband network is slow at present but on a positive note, breakdowns hardly occur.

There are two industrial parks specially dedicated for information and communication technology. However, there is no linkage between the firms in these parks and universities and other R&D institutions located outside of these facilities. There are also no other linkages among universities and research centers.

For financing to support activities for technology development, there are no direct government grants or incentives. Most of the support comes from foreign funding agencies, particularly for training. There are no public grants for SMEs to support innovative and R&D activities of commercial orientation. There is also no explicit plan to facilitate this kind of activities in the current policy framework. Technology development and innovation is one area that has been overlooked by policymakers in Myanmar up to now.

- **Cambodia**

Cambodia scores low in terms of technology and technology transfer. Although the government made some progress in promoting technology dissemination, challenges nonetheless remain daunting in areas of R&D, technology cluster and finance and technology.

Science, technology and innovation (STI) policy has been drafted by two different ministries. One is being drafted by the National Committee for Science and Technology under the Ministry of Industry. The other is being drafted jointly by the Ministry of Planning and KOICA called the Cambodia National Science Master Plan (2014-2020). The master plan includes: (1) the national integrated governance system for science and technology in Cambodia, (2) the establishment of an S&T specialized organization in the Cambodian government, and (3) the establishment of an R&D Action Plan of Industry. The coverage is designed to network knowledge from the grassroots community level up to an international cooperation level.

The Ministry of Industry provides information on innovation support services to the public. However, the information are not well constructed and are fragmented. Certifying product standard is done by the Institute of Standard of Cambodia (ISC). The ISC issues standard certificates to food and beverage companies such as soy sauce, fish sauce and chili sauce. However, this institute is understaffed and equipped with little modern equipment.

The Technology Incubator Center (TIC), funded by the ADB, was set up in 2008 and started functioning in September 2009 to: 1) carry out R&D activities in the food industry; 2) develop and disseminate new technologies and know-how to private enterprises through technical trainings and onsite consultations; and 3) build capacity of internal staff in the area of R&D from external technical experts. At the same time, the government also formulated the Project Economic Diversification Program to fund SMEs in testing chemical substance in food, soft drinks, beer and others. Moreover, under a public-private partnership (PPP) initiative partly funded and designed by the German Organization for Technical Cooperation (GTZ), now the GIZ, five enterprises producing mineral water, ice and soy sauce, have been selected to upgrade their manufacturing facility, machinery and technology. Unfortunately, the TIC has no linkage with university R&D labs. Furthermore, there is no formal framework to support technology development and R&D labs and incubators in universities. However, the Institute of Technology of Cambodia has a small technology incubator center for students to conduct research and pilot test, as well as to provide service for

private companies if requested. Protection of IPR for small and medium industries (SMI) is operated by the Cambodian Innovation Creativity Center under the Ministry of Industry. The center provides one-stop support services (patent office) for IPRs, which include patent application, patent license, product design, technology of production, and IPR protection.

Private companies provide 3G broadband connections in some major urban areas and special economic zones with high quality across the country. Regarding policy, the National Information Communications Technology Development Authority (NIDA) has prepared a broadband policy to promote broadband infrastructure. In addition, a draft of cyber law is under preparation by NIDA with the support of the United States, Sweden and the European Union.

Technology development is mainly conducted through foreign assistance. JICA and GIZ provided financial support schemes and technical assistance for SMEs involved in food processing. ADB supported entrepreneurial training for micro-business. Meanwhile, the International Finance Corporation - Mekong Private Sector Development Facility, the IFC-MPDF is funding the development of a 36-hour training course and self-study workbooks in Khmer on production management, marketing, human resource and operations management. In terms of public R&D grants, on the other hand, the government has allocated insignificant amounts in the budget to support R&D.

Table 6: Technology and Technology Transfer

		BRN	CAM	IND	LAO	MMR	MYS	PHL	SGP	THA	VNM	ASEAN
5.1	**Promote Technology Dissemination**	**3.0**	**2.5**	**4.0**	**2.3**	**2.7**	**5.0**	**3.5**	**5.0**	**4.5**	**3.5**	**3.6**
5.1.1	Strategic approach to innovation policy for SMEs	3.0	2.0	4.0	2.0	1.0	5.0	4.5	5.0	4.0	4.0	3.5
5.1.2	Information on innovation support services	3.0	2.5	3.0	2.0	2.0	4.0	1.0	5.0	4.5	2.0	2.9
5.1.3	Standards certification	3.0	3.0	5.0	3.0	5.0	6.0	5.0	5.0	5.0	4.5	4.5
5.2	**Foster Technology Cooperation to Develop R&D focused on Commercialization of Knowledge**	**4.3**	**1.7**	**4.8**	**2.0**	**3.3**	**4.5**	**4.2**	**6.0**	**4.3**	**3.8**	**3.9**
5.2.1	Incubators	4.0	1.0	4.5	2.0	4.0	4.5	4.0	6.0	4.5	3.5	3.8
5.2.2	Technology support in Universities, R&D Labs and Incubators with SME Linkages	5.0	1.0	4.0	1.5	3.0	3.5	3.5	6.0	4.5	3.5	3.6
5.2.3	Intellectual Property Rights (IPRs) System	4.0	3.0	6.0	2.5	3.0	5.5	5.0	6.0	4.0	4.5	4.4
5.3	**Promote Clusters and Business Networks**	**3.0**	**1.8**	**3.5**	**2.3**	**2.5**	**5.5**	**3.8**	**6.0**	**5.0**	**4.0**	**3.7**
5.3.1	Broadband infrastructure to support smooth connection and coordination of knowledge flows in clusters	4.0	2.5	5.0	3.0	2.0	6.0	4.5	6.0	5.0	3.5	4.2
5.3.2	Science / industrial parks, competitive clusters and facilities (agglomeration)	2.0	1.0	2.0	1.5	3.0	5.0	3.0	6.0	5.0	4.5	3.3
5.4	**Finance and Technology Development**	**2.5**	**1.8**	**3.0**	**1.5**	**1.0**	**4.8**	**3.0**	**5.5**	**3.5**	**3.0**	**3.0**
5.4.1	Financial Incentives	3.0	2.5	3.0	2.0	1.0	5.0	3.0	5.0	3.5	3.0	3.1
5.4.2	Public R&D grants	2.0	1.0	3.0	1.0	1.0	4.5	3.0	6.0	3.5	3.0	2.8
	Average	**3.2**	**1.9**	**3.8**	**2.0**	**2.4**	**4.9**	**3.6**	**5.6**	**4.3**	**3.6**	**3.5**