Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific Tech Monitor

Vol. 36 No. 4 Oct - Dec 2019

Promotion of technology-based startups in the Asia-Pacific Policies and strategies

Plus

- Technology News and Events
- Tech Ventures & Opportunities
- Business Coach

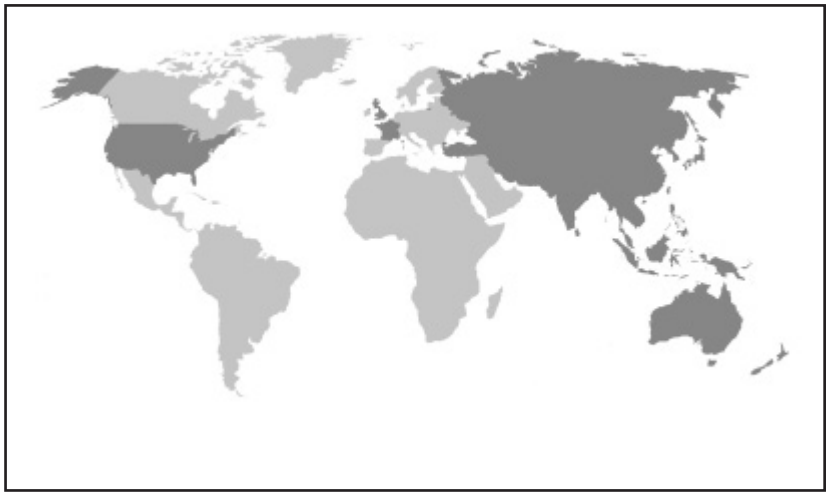
APCTT
Asian and Pacific Centre for Transfer of Technology

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

The **Asian and Pacific Centre for Transfer of Technology** (APCTT), a subsidiary body of ESCAP, was established on 16 July 1977 with the objectives to: assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology; improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region.

The Centre will achieve the above objectives by undertaking such functions as:

- Research and analysis of trends, conditions and opportunities;
- Advisory services;
- Dissemination of information and good practices;
- Networking and partnership with international organizations and key stakeholders; and
- Training of national personnel, particularly national scientists and policy analysts.



The shaded areas of the map indicate ESCAP members and associate members

Asia-Pacific
Tech Monitor
Vol. 36 No. 4 ❖ Oct-Dec 2019

The **Asia-Pacific Tech Monitor** is a quarterly periodical of the Asian and Pacific Centre for Transfer of Technology (APCTT) that brings you up-to-date information on trends in technology transfer and development, technology policies, and new products and processes. The Yellow Pages feature the Business Coach for innovative firms, as well as technology offers and requests.

Web: www.techmonitor.net

ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY
C-2, Qutab Institutional Area
Post Box No. 4575
New Delhi 110 016, India
Tel: +91-11-3097 3700
Fax: +91-11-2685 6274
E-mail: postmaster.apctt@un.org
Website: http://www.apctt.org

ISSN: 0256-9957

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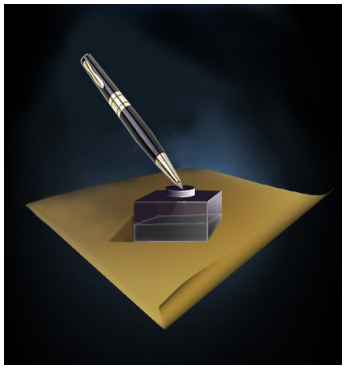


Introductory note

Technology-based start-ups are the key players to transform innovative ideas into innovation. Such technological innovations offer immense potential to support sustainable development and to help countries to achieve the United Nations Sustainable Development Goals. Governments could support creation and growth of such start-ups by adopting enabling national policies, strategies and support mechanisms.

In comparison to larger firms, the start-ups often face challenges to access finance from the traditional financial institutions. To address this problem, countries are adopting innovative financing tools to support their start-ups. Examples are tax concessions, soft loans with interest subsidies, seed finance, grants and incentives for start-ups. New and alternative financing models through Fintech or digital finance, that go beyond traditional bank credit, have been effective for some technology-based start-ups. This issue covers examples of online supply chain finance and marketplace or peer to peer lending in China; IoT device-controlled vehicle loans in the Philippines, and equity crowdfunding in Malaysia.

Increased digitalization and adoption of advanced technologies can enhance the competitiveness of start-ups through reducing cost of production, and bringing new products and services to the market. Challenges of rapid urbanization and impacts of climate change also require countries to promote green entrepreneurship and start-ups. Readers will find innovative examples on: IoT-based smart lighting solutions by *gridComm* in Viet Nam; coastal planning and resource management by *IdeaSpace* in the Philippines; and ICT-driven smart solutions for renewables, buildings, agriculture transportation and manufacturing by *Powerstart* in India in this issue.

To fuel the growth of local start-ups, it is also argued that countries may encourage the entry of foreign start-ups, innovators and investors to help in technology transfer and encourage competition. Provision of start-up visa is a suggested policy tool to attract foreign talent, increase investment and flow of technology into the domestic market. The Asia-Pacific countries which have a start-up or entrepreneur visa provision are Australia, China, Japan, New Zealand, Singapore, the Republic of Korea, and the Philippines.

This issue of *Asia-Pacific Tech Monitor* discusses the challenges, opportunities, strategies and best practices to promote technology-based startups in the Asia-Pacific countries.

Michiko Enomoto
Head, APCTT-ESCAP

ASIA-PACIFIC

CHINA

Innovation Index in 2018

The China Innovation Index, the barometer of the country's innovation capability, rose at a faster pace in 2018, official data showed. The index surged 8.6 percent to 212 points last year, the highest growth rate since the calculation was introduced in 2005, according to data from the National Bureau of Statistics (NBS).

Comprising four sub-indices, the index measures the innovation environment, input, output and effects. The sub-index for the innovation environment jumped 10.9 percent to 225.8. The country raised fiscal expenditure on science and technology by 13.5 percent year on year to 951.8 billion yuan (about 134.5 billion U.S. dollars) last year and cut taxes for relevant enterprises.

The innovation input index stood at 194.1, surging 6 percent from the previous year. The research and development (R&D) intensity, or the proportion of R&D expenditure to GDP, reached 2.19 percent, 0.04 percentage points higher than the previous year. Spending per researcher on fundamental research rose 6.3 percent to 358,000 yuan in 2018, while the total R&D expenditure of enterprises reached 1.52 trillion yuan, up 11.5 percent year on year.

The innovation output saw a robust growth of 11.7 percent to 264.1. The number of domestic patents granted last year surged 37.5 percent to 2.34 million, while 346,000 were invention patents. The sub-index for the innovation effects increased 4 percent to 164.1 points last year.

One indicator of the effects relates to the sale of high-tech products. In 2018, the export of high-tech products expanded rapidly, with the trade volume up 10.8 percent to 743.04 billion dollars, accounting for 29.9 percent of the total exports of goods.

Another indicator is energy consumption as innovation promotes green development. Last year, energy consumption per unit of GDP declined 3.1 percent. The consumption of coal accounted for 59 percent, edging down 1.4 percentage points, while that of clean energy such as natural gas, hydropower and nuclear power went up 1.3 percentage points to 22.1 percent.

The index readings reflect the success of China's innovation-driven development strategy, said Deng Yongxu, an NBS chief statistician, noting that the continued improvement in the innovation capability and efficiency has refined the quality of the Chinese economy.

http://www.xinhuanet.com

Patent filings in 2018

China's intellectual property office received a record number of 1.54 million patent applications in 2018, making it the biggest filer and accounting for 46.4 % of the total patent filings globally as the country pushes ahead with a self-reliance drive in core technology. Patent filing activity in China grew by 11.6% last year and its number of filings was roughly equal to the combined total of countries ranked two through 11, as the country seeks to fend off US pressure over trade and tech.

The US came in second with 597,141 filings, followed by Japan (313,567), South Korea (209,992), and the European Patent Office (174,397), according to a report published by the World Intellectual Property Organization (WIPO).

China has three types of patent: invention, utility model, and design. There were 1.39 million domestic invention patent applications in 2018, making up about 90% of total patents filed last year, according to an annual report published by China's National Intellectual Property Administration (CNIPA) in May. Tech companies had the most invention patents granted last year, based on CNIPA's report.

Chinese telecommunication gear provider Huawei Technologies ranked No. 1 with 3,369 invention patents granted. Other tech companies in the top 10 were Chinese smartphone maker Oppo, LCD panel maker BOE Technology, appliance manufacturer Gree Electric Appliances, computer maker Lenovo Group, gaming giant Tencent Holdings, and telecom equipment maker ZTE Corp. The other two companies on the list were state-owned Sinopec and PetroChina. Although the filing numbers do not necessarily correspond with dramatic advances in innovation, the rising total indicates that the country is taking its leadership's call for greater self-sufficiency in core tech seriously.

https://www.techinasia.com

Spending on research and development

China's spending on research and development rose by 11.8 per cent last year to 1.97 trillion yuan (US$275 billion), its third consecutive double-digit annual rise, Beijing said. Businesses were the main driver of the growth, accounting for more than 77 per cent of the total, followed by the government and its affiliated bodies, and universities, according to a report published on Friday by the National Bureau of Statistics (NBS) and the ministries of finance, and science and technology.

Despite the strong headline growth figure, spending as a proportion of the country's gross domestic product – known as the "intensity" – increased only marginally in 2018, to 2.19 per cent, from 2.15 per cent a year earlier. Faced with slowing economic growth, Beijing in March set a target to increase the intensity figure to 2.5 per cent this year as it seeks to reduce its dependence on manufacturing and heavy industry, and become a centre for hi-tech under the "Made in China 2025" plan.

Spending on basic research (11.8 per cent), applied research (18.5 per cent) and experimental development (10.9 per cent) all rose significantly in 2018, the report said. On a geographical level, the provinces of Guangdong and Jiangsu topped the spending charts, followed by Beijing municipality in third.

The report said that because of its slower economic growth in the year, China's research and development (R&D) intensity figure actually rose in 2017 – to 2.13 per cent from 2.11 per cent a year earlier – but continued to lag the average (2.37 per cent) for the group's 36 member nations. Based on recent trends, "China would no longer be converging in R&D intensity with the OECD average within the next

decade," it said. Nonetheless, the country overtook the combined intensity figure for the 28 members of the European Union in 2013 and was closing in on France, it said.

https://www.scmp.com

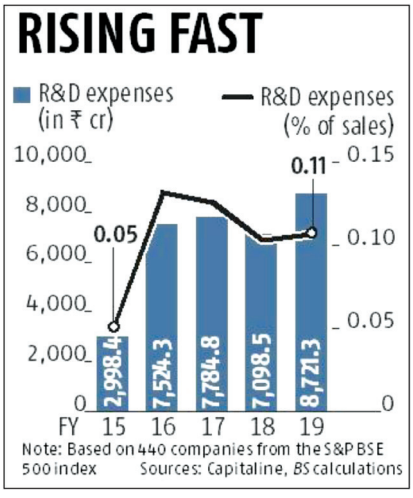
INDIA

R&D spending in FY19

Research and development (R&D) spending by India Inc increased in 2018-19 (FY19) over the previous years (led by automobile and pharmaceutical sectors). But, it was still a small percentage of the total sales. In FY19, India Inc spent Rs 8,721.3 crore under the R&D head — nearly a fifth more than the amount in 2017-18 (FY18), which was Rs 7,098.5 crore.

The details of these expenses are available in the annual reports of companies, usually published by the end of the second quarter of the next financial year. This analysis looked at 440 companies for whom the continuous data is available for the past 10 years. Even though the R&D expenditure has increased, it is still a small percentage of the total sales.

The total R&D spending is about 11 basis points (bps) as a percentage of net sales. It was 10 bps in FY18. It was about 13 basis points in FY16 and FY17 for the sample under consideration, showed the data. Also, a large part of it is driven by a single company which accounted for nearly half (48.4 per cent) of the total expenditure for the companies in the sample.



The biggest spender was Tata Motors, with Rs 4,224.6 crore assigned under the R&D head. That's about 1.4 per cent of its net sales. A lot of it is because of its foreign subsidiary.

"I'm not surprised that Tata Motors tops the charts among all the companies. It is largely due to Jaguar Land Rover. The company has been pumping large amounts into the subsidiary," said Mahantesh Sabarad, head of retail research at SBICAPS Securities.

Since acquiring JLR in 2008, Tata Motors has been incurring a capital expenditure in excess of £S2.8 billion every year (over Rs 25,000 crore at the current exchange rate). Of this, a big chunk is accounted for by R&D.

Tata Motors' focus areas include developing clean technology vehicles and implementing required safety features, as well as emission standards under Bharat Stage VI (BSVI), said the company in a response to an email.

The health care sector has been amongst the biggest spenders on R&D traditionally. The sector spent Rs 1,740 crore in FY19. Biocon is among them. It spent Rs 320.6 crore this year. It is up 67.2 per cent over the previous year. It had spent Rs 191.8 crore in FY18.

https://www.business-standard.com

INDONESIA

Regulation on R&D tax deductions

The Finance Ministry is in the process of writing up regulations for the implementation of tax deductions for research and development (R&D) and labor-intensive industries. The head of the state revenue department at the Finance Ministry's Fiscal Policy Agency, Syarif Ibrahim, said in Jakarta on Tuesday that the ministry should carefully formulate the regulations to ensure companies would not use loopholes to avoid paying taxes. "We have to be careful to avoid a moral hazard," he told the press. He expressed hope the drafting of the R&D regulation could be completed by next year. Meanwhile, a ministerial regulation on tax deductions in labor-intensive industries will also be issued by year-end.

The tax incentives, which policymakers refer to as super tax deductions, are stipulated in Government Regulation (PP) No. 45/2019 on the calculation of taxable income and income tax payments in the current year, which was issued in June, this year.

Under Article 29A of the regulation, investors who open a new business or expand their existing businesses in labor-intensive sectors are allowed to offset 60 percent of the capital they invest from their taxable net income.

Under Article 29B, companies that provide training programs, internships and/or educational activities to develop human resources in certain competencies can cut the their taxable gross income by up to 200 percent of the funds they spend on the activities.

Meanwhile, under Article 29C of the new regulation, companies that conduct R&D in Indonesia are allowed to cut their taxable income by up too 300 percent of the cost of their R&D activities. Such deductions would significantly reduce their tax payments.

https://www.thejakartapost.com

MALAYSIA

R&D investment

A joint report by Malaysia's Ministry of Education, Department of Higher Education, Elsevier, a global information analytics business specializing in science and health, and QS Quacquarelli Symonds shows that Malaysia's Gross Expenditure on Research & Development (GERD) has increased by nearly $4 billion USD to reach over $12 billion in 2018, representing 1.4 percent of the country's GDP in that year. From 2014 to 2018, Malaysian researchers produced a cumulative research output of over 150,000 publications – articles and reviews – which grew at a five-year CAGR[1] of 4.9 percent.

The volume of Malaysia's top 10 percent most-cited publications grew at an even faster pace – with a five-year CAGR of 12.7 percent – accounting for a relatively high

number of top 10 percent publications produced per million of GERD dollars. Taken together, the findings suggest that Malaysia is realizing a return-on-research investment dollars and is one of the most productive nations in comparison to five other Asian nations and territories analyzed in the report.[2]

In the QS World University Rankings (WUR), Malaysian universities have registered improvement in academic performance: one university is ranked amongst the world top 100; four amongst the top 200; and seven amongst the top 500. Overall, Malaysia's higher education institutions have shown positive trends across all indicators in the three recent editions of the QS WUR.

https://www.prnewswire.co.uk

NEPAL

National Innovation Centre inaugurated

National Innovation Centre, a centre to promote entrepreneurship among youths and carry out research and development works, commenced its official operation from Friday. Established under the initiation of Mahabir Pun, a social activist, the centre aims to help capitalise entrepreneurial ideas of youths, work in research and development activities and contribute to national economy. Pun said the centre, along with promoting entrepreneurship and innovation works in the country, will also give due priority to expanding internet services across rural parts of Nepal.

Set up at the premises of Tribhuvan University with an investment of almost Rs 80 million, the centre is currently working on 20 different projects. Pun, who is also the chairman of the centre, said he was able to establish the centre through donations and financial support from public and some foreigners.

https://thehimalayantimes.com

PAKISTAN

New startup portal

The Securities and Exchange Commission of Pakistan has launched an exclusive startup portal to encourage technology innovation in Pakistan. It was inaugurated by SECP Information System and Technology Commissioner Shauzeb Ali during the *'Startup Grind Pakistan'* conference in Islamabad, according to a press statement issued by the commission on Tuesday. The portal features a list of startups, simplified user experience for registration, access to mentors and incubation centres, online guides and video tutorials for startup companies.

"The SECP startup portal will be a gateway to information and collaboration hub, for the facilitation and uplifting of the existing and future entrepreneurs to connect and excel," Ali was quoted as saying in the press statement. It said he hoped that the portal will evolve with time as an important part of the startup ecosystem in Pakistan. A large gathering of entrepreneurs, innovators and technologists attended the conference to share their stories and inspire young entrepreneurs.

"SECP has instituted various reforms to develop a comprehensive and coherent industry policy to shape regulatory thinking and promote a conducive Fintech environment in Pakistan. This will help attract local and international innovators," the statement read. Ali spoke about the role of SECP and other public sector organisations in encouraging investment and fostering economic growth and prosperity in Pakistan.

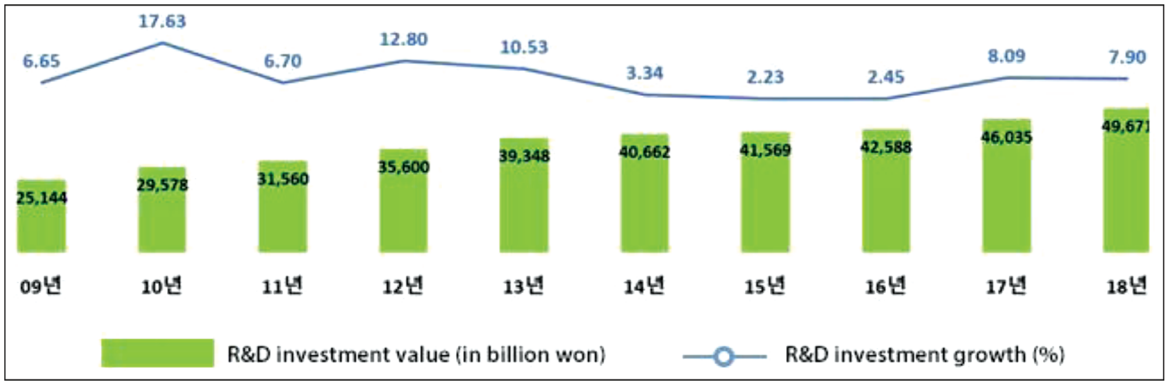
https://www.samaa.tv

REPUBLIC OF KOREA

R&D spending

Spending on research and development (R&D) by major Republic of Korean companies gained nearly 8 percent year on year in 2018, with the top eight players contributing over 60 percent of the total, a state think tank said. R&D expenditures by the country's top 1,000 companies in terms of sales came to 49.7 trillion won ($42.5 billion) last year, up 7.9 percent from the previous year, according to the Republic of Korea Institute for Advancement of Technology. The combined operating profit of the 1,000 firms reached 117.16 trillion won, up 0.1 percent from a year earlier.

The institute said R&D spending against sales by the top 1,000 businesses has steadily risen over the past decade, hitting 3.76 percent last year after surpassing 3 percent for the first time in 2013. R&D expenditures by companies with a workforce of 1,000 or more came to 42.8 trillion won, accounting for 86.3 percent



[Source: Korea Institute for Advancement of Technology]

of the total. The corresponding figure for companies with a workforce of less than 100 amounted to 614 billion won.

R&D spending by manufacturing companies, which account for 77.2 percent of the 1,000 companies, stood at 44.8 trillion won, or 90.2 percent of the total. Samsung Electronics and eight other leading companies spent more than 1 trillion on R&D and their combined R&D expenditures came to 30 trillion won, accounting for 60.4 percent of the total. Samsung was by far the largest R&D spender, followed by SK Hynix, LG Electronics, Hyundai Motor, Samsung Display, Kia Motors, LG Display and LG Chem. The country's top 100 R&D spenders invested 42 trillion won in total, accounting for 85.0 percent.

https://pulsenews.co.kr

SRI LANKA

National innovation bill

The National Innovation Agency Bill, which received House approval this week, is expected to pave the way for the private sector to support local innovation and contribute to national research. The bill provides for the establishment of the agency and incorporation to seek private sector support for innovation, to contribute to national research, and to identify barriers to innovation. The National Innovation Agency is administered by a governing council and the chairperson of the council will be the Secretary to the President.

Other members of the council include high ranking officials from the Development Strategies Ministry, Director General of the National Planning Department or his nominee, Director General of the Intellectual Property Office of Sri Lanka, representatives from the Science, Technology and Research Ministry. The council will also include a high ranking official from the International Trade Ministry and the Chairperson or his nominee of the Sri Lanka Institute of Nanotechnology.

The Governing Council will act in accordance with the directions of the President from time to time. Also, the President can make orders on matters contained in this Act. Every order will be published in the Gazette and presented to Parliament for approval within three months.

The agency will be responsible for maintaining a national innovation environment in line with the innovative entrepreneurship strategy, facilitating high technology enterprises generated by research and technology interchange, and coordinating with the private and public sector.

http://www.ft.lk

THAILAND

Innovation venture fund

Thai Union is committing US$30 million (910 million baht) to a venture fund for food tech innovations like alternative proteins, functional nutrition and value chain technology. The fund has invested in Flying Spark, an Israeli startup that makes food for human consumption out of sustainable larval insects. The company promises technology that enables easy and low-cost cultivation and processing, with almost no waste. Thai Union plans to invest further in entrepreneurs and will partner with these companies to support and accelerate their development.

Thai Union previously opened an incubator and accelerator for food tech startups called Space F alongside Thailand's National Innovation Agency and Mahidol University.

https://www.bangkokpost.com

Thailand windfarm green bond

The Asian Development Bank (ADB) will invest 3 billion Thai baht ($98.7m) in Energy Absolute's maiden green bond issuance, proceeds from which will help support the long-term financing of the company's 260 MW Hanuman windfarm in Thailand. The investment will contribute to Thailand's renewable energy objectives and its ongoing efforts to reduce carbon emissions.

The bond will have a total issuance of 10 billion Thai Baht. It will only be the second Climate Bonds Standard-certified bond issued by a Thai energy company and the first green bond for a wind power project in Thailand. Proceeds from green bonds are used to fund, in part or in full, new or existing projects that deliver environmental or climate-related benefits.

The agreement was signed in Bangkok by deputy director general of ADB's Private Sector Operations Department Mr. Christopher Thieme and Energy Absolute's deputy chief executive officer Mr. Amorn Sapthaweekul on the sidelines of a knowledge-sharing event—the Capital Market Research Forum: Development of Green Bonds in Thailand.

https://www.powerengineeringint.com

VIET NAM

2019 Global Competitive Index

Viet Nam's business environment continues to improve according to the recently released 2019 Global Competitive Report produced by the World Economic Forum. The report covers 141 countries accounting for 99 percent of global GDP. The report measures several factors and sub-factors, including institutions, infrastructure, ICT adoption, macroeconomic stability, health, skills, product market, labor market, financial system, market size, business dynamism, and innovation capability. A country's performance is rated on a progressive score on a 1-100 scale, where 100 represents the ideal state.

The report noted that despite a decade of low productivity, Vietnam with a rank of 67 improved the most globally and jumped 10 places from last year's standings. It further added that East Asia is the most competitive region in the world followed by Europe and North America. Singapore came out on top, beating the US.

Vietnam ranked best in terms of its market size and adoption of information and communications technology (ICT). Market size is defined by GDP and import of goods and services. ICT adoption is measured by the number of internet users and subscription to mobile-cellular telephones, mobile broadband, fixed internet, and fiber internet.

https://www.vietnam-briefing.com

INTERNATIONAL

New organic solar cells

A research team from Nuremberg and Erlangen has set a new record for the power conversion efficiency of organic photovoltaic modules (OPV). The scientists from Friedrich-Alexander Universität Erlangen-Nürnberg (FAU), the Bavarian Center for Applied Energy Research (ZAE), and the Helmholtz Institute Erlangen-Nürnberg for Renewable Energy (HI ERN), a branch of Forschungszentrum Jülich, in cooperation with the South China University of Technology (SCUT), designed an OPV module with an efficiency of 12.6 percent over an area of 26 square centimeters. The former world record of 9.7 percent was exceeded by 30 percent.

This is the highest efficiency value ever reported for an organic photovoltaic module. It was confirmed by a certified calibrated measurement under standard testing conditions by the independent certification laboratory of Fraunhofer ISE (Freiburg) in September 2019. The multicell module was developed at the Solar Factory of the Future at the Energie Campus Nürnberg (EnCN) in a coating laboratory with a unique megawatt pilot line for thin-film photovoltaics, which was designed and implemented with financial support by the Bavarian Ministry of Economic Affairs.

Organic solar cells usually consist of two different organic components, possessing the necessary semiconductor properties. In contrast to conventionally used silicon, which is manufactured by energy-intensive melting processes, organic materials can be applied directly from solutions onto a carrier film or glass carrier. On the one hand, this reduces manufacturing costs, on the other hand, the use of flexible, lightweight materials allows for new applications, such as mobile devices or clothing, even if the efficiency is not yet comparable to that of traditional silicon solar cells.

"This milestone in organic semiconductor research shows that the latest performance developments with certified cell efficiencies of over 16 percent are not limited to the laboratory scale, but ready to be scaled up to the level of prototype modules," explains Prof. Christoph Brabec from FAU, director at HI ERN, and scientific director of the Solar Factory of the Future, a research group of ZAE Bayern.

Due to their design, the efficiency of complete photovoltaic modules is always slightly lower than that of individual cells. A part of the module area, for example, is always inactive since it is used for the interconnection of the individual cells. With an increasing module area, the losses caused by the electrodes' electrical resistance increase as well.

The record module consists of twelve serially connected cells and has a geometric fill factor of over 95 percent. This part of the module area actively contributes to the power generation. With respect to its active area, the module even achieves an efficiency of 13.2 percent. The minimization of inactive areas was achieved through high-resolution laser structuring, as developed and optimized in recent years at the "Solar Factory of the Future."

https://scitechdaily.com

ASIA-PACIFIC

CHINA

Efficient perovskite solar module

Chinese perovskite cell maker Microquanta Semiconductor says its research team achieved a 14.24% conversion efficiency record for a large-area (200x800cm^2) perovskite solar module. The device has reportedly passed testing by the European Solar Test Installation agency. The latest record comes just two months after Microquanta achieved an 11.98% landmark for a large module.

Hangzhou-based Microquanta was established in 2015 by three students returning from periods abroad. Chief executive Jizhong Yao graduated from Zhejiang University and the University of New South Wales before gaining his PhD at Imperial College, London. The business has focused on perovskite cell and module R&D from day one. In June last year, Microquanta achieved a lab conversion efficiency record of 17.9% (17.3% stable rate) with its perovskite solar module, and the company then turned to large-area devices.

Yao and his team initially secured private funding for the business and were then helped by their local government and China's key R&D funding program. In April, state-owned energy company the China Three Gorges Corporation made a strategic investment in Microquanta aimed at perovskite technology research and commercializing perovskite solar.

https://www.pv-magazine.com

Giant offshore wind turbine

China has developed a giant offshore wind turbine with a 210-meter rotor diameter, which will be put into production soon, according to the science and technology bureau of southwest China's Chongqing Municipality. The wind turbine, coded H210-10MW, has a unit capacity of 10 megawatts and is China's first to have a rotor diameter of more than 200 meters. It was developed by HZ Windpower, a subsidiary of the state-owned China Shipbuilding Industry Corporation.

Han Huali, director of the research institute at HZ Windpower, said once put into operation, each H210-10MW turbine unit could generate about 40 million kWh of electricity annually, double the unit energy production of 5-MW turbines currently in use. The turbines will be installed at wind farms in the coastal provinces of Fujian and Guangdong after rolling off the production line.

The institute now aims at R&D of wind turbines with larger rotor diameters of up to 230 meters, Huang added, noting they are expected to be used in the eastern provinces of Jiangsu and Zhejiang, where average wind velocity is lower.

http://www.xinhuanet.com

INDIA

Process to improve solar cell efficiency

A novel process to improve the performance of Dye-Sensitised Solar Cells (DSSC)

has been developed by researchers at the Indian Institute of Technology (IIT) Hyderabad. Dye-sensitised solar cells hold a lot of promise because of possible cost and environmental benefits. But, they have low light-to-power conversion efficiency. The new process, published in the journal *Solar Energy*, promises to enhance the efficiency. "A dye molecule absorbs the light energy in DSSC and causes electrons in the dye to jump to titania and then to the external circuit, which causes a flow of electrons, leading to a current," said Jammalamadaka Suryanarayana, who led the research team.

The first-generation silicon-based cells with energy harvesting efficiency of about 26 per cent continue to be costly. Second-generation thin film solar cells based on semiconductors like cadmium-telluride and cadmium-selenide have comparable efficiencies, and not much lower cost. The third generation of dye-sensitised solar cells can significantly lower costs of solar cells while being environment-friendly. But, their efficiencies need improvement to translate to practical products.

In the study, the researchers initially tried introducing holmium oxide, a powerful paramagnetic material, into the anode of the cell and by applying external magnetic fields. The experiment showed an enhancement in efficiency. However, application of external magnetic field can be power-consuming because electromagnets themselves require energy for their functioning. The team consequently replaced holmium oxide with iron oxide magnetic nanoparticles since it produced a magnetic field internally. The result was as good.

https://www.downtoearth.org.in

Solar technology for indoor

As the conventional solar technologies may not be a suitable choice for indoor environments in near future owing to the high costs involved, researchers from a Central lab, based in Kerala, have developed an indigenous semi-automatic fabrication unit for manufacturing dye-sensitized solar cell (DSC) based modules.

DSCs contain synthetic dyes and harvests light by mimicking photsysthesis and are an efficient third generation indoor light harvesting technology, said researchers from the National Institute of Interdisciplinary Science and Technology (NIIST) which has developed the equipment. NIIST is one of the labs of the Council of Scientific and Industrial Research under the Union Science and Technology Ministry.

By developing indoor light harvesting photovoltaic cells, self-powered sensors can be realised and the battery life can be extended, pointed out an official from the Ministry. Their advantage lies in their ability to generate power from low levels of exposure to light including indoor lights like CFl, LED etc. Installed at CSIR-NIIST lab, the equipment has been selected on the Prime Minister Office's high priority implementation category, he said.

The indigenous unit has been developed with the support of the Department of Science and Technology (DST) under the Ministry. The entire equipment which was developed by the CSIR-NIIST partnering with Elixir Technologies, Bangalore has helped reduce cost of fabrication equipments to more than 60 per cent leading to true import substitution, said the researchers. They said the fabrication process, molecules and materials were optimised keeping in mind end user requirements and applications thereby developing international competency in this photovoltaic sector.

The cell can be used in powering internet of things (IoT) smart devices, smart meters, water and energy management, smart parking, self-powered sensors, portable devices like those integrated in phones, tablets, mobile charging stations, backpack, in clothes and also solar power windows or aesthetically beautiful power producing glass windows.

https://www.dailypioneer.com

EUROPE

SPAIN

Radiative cooling of solar panels

Spanish scientists claim to have created a new, two-dimensional material which can reduce heat in electronic devices which suffer critical heating during operation, such as solar modules.

The paper *A Self-Assembled 2D Thermofunctional Material for Radiative Cooling,* published in *Small*, describes the material as an inexpensive solution made of a single layer of silica microspheres self-assembled on a soda-lime glass. The material, developed by researchers from the Catalan Institute of Nanoscience and Nanotechnology and the Instituto de Ciencia de Materiales de Madrid, is said to significantly reduce heat as it cools the surface on which it is placed. The cooling occurs, the scientists say, without energy consumption or gas emissions.

The researchers claim their translucent thermal emitter has enabled them to reduce the daytime temperature of a silicon wafer by around 14 degrees Celsius and added, the reduction can reach 19 degrees Celsius if the structure of the material is backed with a silver layer. According to the scientists, the emissivity of the single-layer colloidal structure of the material, and its radiative cooling power, can also be increased by using an f-SiO2 (silicon dioxide) bulk substrate.

Without the new material, such cooling tops out at 5 degrees Celsius, according to the scientists who developed it. "The cooling power of this simple radiative cooler under direct sunlight is found to be 350 W/m^{-2} when applied to hot surfaces with relative temperatures of 50 K above the ambient," states the paper.

Radiative cooling is the principle all objects on Earth tend to emit part of the heat they receive from the sun's infrared radiation. The atmosphere pushes that heat back to Earth, except for infrared wavelengths, which can escape the atmosphere. What the scientists claim to have created is a material that emits infrared wavelengths. "The sand grains in deserts are among the major contributors to this phenomenon, which keeps the average temperature of our planet stable as long as we do not consider human activities," the Spanish team said.

Research into radiative cooling of solar cells has increased in recent years. A recent

study on the matter stated investigating the effect of enhanced radiative cooling on solar cells used in commercial PV was imperative.

https://www.pv-magazine-india.com

UK

Biofuels from seawater bacteria

Researchers from the University of Manchester are using synthetic biology to explore a more efficient way to produce the next generation of biobased jet fuels—partly made from a type of bacteria that grows in seawater. The Manchester research group, led by Professor Nigel Scrutton, director of the Manchester Institute of Biotechnology (MIB) and supported by the prestigious US-based international maritime research agency Office of Naval Research Global (ONR), is using synthetic biology to help identify a more efficient and sustainable method to make biofuel than the one currently used.

Scientists have discovered that the bacteria species called *Halomonas*, which grows in seawater, provides a viable "microbial chassis" that can be engineered to make high value compounds. This in turn means products like bio-based jet fuel could be made economically using production methods similar to those in the brewery industry and using renewable resources such as seawater and sugar.

The breakthrough behind this approach is the ability to re-engineer the microbe's genome so to change its metabolism and create different types of high value chemical compounds which could be renewable alternatives to crude oil. Benjamin Harvey and his team of researchers at the world-leading Naval research facilities in China Lake, California, USA, have pioneered this exciting work on converting biological precursors to relevant jet fuels.

Following on from this research, Professor Nigel Scrutton explained, "Effective biofuels strategies require the economic production of fuels derived from a robust microbial host on a very large scale—usually cultivated on renewable waste biomass or industrial waste streams—but also with minimal downstream processing and avoids use of fresh water. With *Halomonas* these requirements can be met, so minimizing capital and operational costs in the production of these next generation biofuels."

http://biomassmagazine.com

Renewable energy storage device

Researchers have developed a new dielectric capacitor -- a device that stores energy like a battery -- taking inspiration from how the French pastry, croissant, is made by folding multiple layers of dough. The researchers, including those from Queen Mary institute of London in the UK, found that by pressing and folding a polymer film capacitor (a capacitor with an insulating plastic film), they were able to store 30 times more energy than the best-performing commercially available dielectric capacitor.

According to the study, published in the journal *Nature Communications*, this is the highest energy density ever reported in a polymer film capacitor -- an advance that may pave the way for efficient, low-cost, and environment friendly electric energy storage systems for wind and solar sources.

"Storing energy can be surprisingly tricky and expensive and this is problematic with renewable energy sources which are not constant and rely on nature. With this technique we can store large amounts of renewable energy to be used when the sun is not shining and it is not windy," said Emiliano Bilotti, lead researcher of the study from the Queen Mary University of London in the UK.

The study noted that dielectric capacitors generally have ultrahigh power density making them suitable for technologies such as motor drives, and space vehicle power systems which require accumulating energy over a period of time and then releasing it very quickly.

"This finding promises to have a significant impact on the field of pulse power applications and could produce a step-change in the field of dielectric capacitors, so far limited by their low energy storage density," Mike Reece, co-author of the study from the Queen Mary University of London. The researchers said that the newly developed technique of processing, pressing and folding layers to make the dielectric capacitors is unique for its simplicity, record-high energy density, and the potential to be adopted by industries.

https://www.indiatoday.in

NORTH AMERICA

USA

Novel solar energy system

UCLA researchers looked to nature to develop a new material that could capture more solar energy than previous technology. Ximin He, a materials science and engineering assistant professor at UCLA, has spent more than three years working on SunBOTs, which bend toward the sun to harvest solar energy, similar to sunflowers. She and her team's research was published in November in Nature Nanotechnology.

SunBOTs have the potential to harvest double the amount of energy that a stationary solar panel could harvest, He said. "We found, on a day like (a) spring and autumn day, we know where the sun is shining on the earth at Los Angeles' latitude, we (could) harvest double the sunlight for LA," He said. When sunlight shines at oblique or indirect angles, solar energy capture is almost fourfold in SunBOTs compared to solar panels, He added. For example, when sunlight shines 75 degrees away from a perpendicular line to the surface, SunBOTs harvest 90% of its energy whereas solar panels just receive 24%, He said.

Some current solar panels are mechanically repositioned toward the sun throughout the day. However, this requires additional machinery and energy, He said. A mechanical system would also not work for mobile surfaces like cars because they would be constantly changing direction, she added.

He and her team took on the challenge of creating an intelligent synthetic material

that could independently detect light and orient toward it, using nature for the answer, specifically phototropism. "Phototropism means the plants are able to detect where the light comes from and autonomously … move their head or their leaves toward light (in) real time," she said. "This inspired us to try to create similar intelligence in man-made material."

Todd Lynch, a principal project planner for UCLA Capital Programs, works on integrating solar power in campus buildings. Lynch said one of the challenges with solar energy is that a large surface area is required to capture a small amount of energy, and solar panels have to be positioned at just the right angle in order to harvest energy efficiently.

SunBOTs' unique abilities come from their structure and material, He said. Their symmetric shape mimics a plant's stem, which allows for light to be captured at any area of the SunBOT and makes it easier for the SunBOT to orient itself toward a light source, He added. SunBOTs are composed of hydrogel and photoabsorbers. Hydrogels, cross-linked polymers similar to Jell-O, are used in household products such as diapers and contact lenses, He said.

https://www.eletimes.com

Highly efficient solar cells

A new type of material for next-generation solar cells eliminates the need to use lead, which has been a major roadblock for this technology. Now a team of scientists and engineers led by Letian Dou, assistant professor of chemical engineering at Purdue University, have developed a sandwich-like material incorporating organic and inorganic materials to form a hybrid structure that doesn't use lead and has much improved stability.

"These structures are very exciting," Dou said. "The sandwich structures are like semiconductor quantum wells that are widely used today in many electronic and optoelectronic devices, but they are much easier to produce and more tolerant to defects," The research was published in the journal *Nature Chemistry*.

In a paper published in the *Journal of the American Chemical Society* in September, the scientists had incorporated the material into an essential component of many electronic devices, a field effect transistor. Yao Gao, lead author of both research papers and a postdoctoral fellow in Dou's research group, said the new organic-inorganic hybrid perovskite materials are cheaper and perform better than a traditional inorganic semiconductor. Also, Gao said, the new material's design strategy could serve as a blueprint for many other functional hybrid materials.

https://www.sciencedaily.com

Breakthrough in perovskite solar cells

Rice University scientists believe they've overcome a major hurdle keeping perovskite-based solar cells from achieving mainstream use. Through the strategic use of the element indium to replace some of the lead in perovskites, Rice materials scientist Jun Lou and his colleagues at the Brown School of Engineering say they're better able to engineer the defects in cesium-lead-iodide solar cells that affect the compound's band gap, a critical property in solar cell efficiency.

As a side benefit, the lab's newly formulated cells can be made in open air and last for months rather than days with a solar conversion efficiency slightly above 12%. The Rice team's results were published in *Advanced Materials* , November 4, 2019.

Rice postdoctoral researcher and lead author Jia Liang and his team built and tested perovskite solar cells of inorganic cesium, lead, and iodide, the very cells that tend to fail quickly due to defects. But by adding bromine and indium, the researchers were able to quash defects in the material, raising the efficiency above 12% and the voltage to 1.20 volts.

As a bonus, the material proved to be exceptionally stable. The cells were prepared in ambient conditions, standing up to Houston's high humidity, and encapsulated cells remained stable in air for more than two months, far better than the few days that plain cesium-lead-iodide cells lasted.

https://scitechdaily.com

Hydrogen from seawater

A new study could help solve that problem by showing how hydrogen can be extracted from seawater using an electric current. The study, which was published in the journal *Nature Communications*, explains that water-splitting technologies have come a long way when it comes to getting hydrogen from freshwater, but producing the same results with seawater has presented a greater challenge.

The study was conducted by researchers at the University of Houston. They applied electric currents to water, using a process called electrolysis, with a device made of "non-noble metal nitrides." The problem with splitting seawater to extract hydrogen has been that this kind of device would typically free compounds like chlorine, calcium and sodium in the water while you're trying to get the hydrogen out. Once these compounds are freed, they attach themselves to the device and make it unusable.

To solve this problem, the researchers had to make sure the electrode was at a voltage that was high enough to separate the hydrogen but not high enough to release a compound like chlorine, which requires a voltage that is closest to the amount required to separate hydrogen. This meant keeping the voltage above 1.23 volts and below 1.73 volts, which is a bit of a challenge.

The researchers were able to do this successfully on a consistent basis and believe their methods could be used to change the hydrogen production space, since there's a lot more seawater on the planet than freshwater.

https://www.inverse.com

Financing Technology-based Startups and SMEs

POLICY ACTIONS IN ASIA

Shigehiro Shinozaki
Economist, Economic Research and Regional Cooperation Department
Asian Development Bank
Philippines, Manila
E-mail: sshinozaki@adb.org

Abstract

Knowledge- and technology-intensive startups and SMEs need more affordable access to long-term financing options to invest in R&D, human capital, and technology adoption to maximize their ability for innovation. The long-term national development policy requires more holistic approach for sustainable growth in developing Asia, addressing the balanced interventions in technology, finance, and SME development. The Fourth Industrial Revolution, FDI inflows, and global value chains can help create more technology-based startups and SMEs, but they need diversified financing models that go beyond traditional bank credit to survive and grow further. Fintech brings more opportunities for them to access low-cost financing and highly contributes to reducing financing gap in the region. Modernizing financial systems with depth and stability is key for developing Asian countries to obtain innovation capability with moderate investments in R&D by tech-enterprises.

Introduction

Technology is a critical driver of sustainable economic growth at the national level. Solow and Swan (1956) created a theoretical foundation of economic growth, addressing capital accumulation, size of labor force, and productivity growth supported by technological change as growth drivers. Romer (1986) developed a theory of endogenous economic growth, addressing the importance of knowledge and innovative ideas that stimulate technological change as an input for productivity growth and as a driver for long-run economic growth. Since the 1980s, many academic studies have argued and agreed that technological change determines the rate of sustainable economic growth as a key driver, directing policymakers' attention to a knowledge-based economy.

Finance is also a critical driver of economic growth. Empirical evidence suggests that financial sector development plays a vital role in facilitating economic growth and poverty reduction (Zhuang et al, 2009). Sound financial system can help ensure sustainable but quality and resilient growth of national economy. Thus, it is crucial for countries to establish a robust financial system with high level of financial depth and stability so that they can timely and appropriately respond to unexpected events such as financial crises and natural disasters whose risks are gradually rising due to the global economic uncertainties and the side effects of growth such as climate change.

In developing Asia, small and medium-sized enterprises (SMEs) are a backbone of the resilient national economy. They stimulate domestic demand through job creation, innovation and competition. Thus, SME development is a key policy agenda toward inclusive growth in the region. Developing Asian countries have taken several measures to promote SME development in recent years, e.g., support for market access, business development, technology adoption and commercialization, and access to finance; however, constraints that SMEs have faced for business development have yet to be eased well in most countries despite various government measures launched.

There are roughly two reasons behind this condition: (i) a lack of policy coordination among central bank, SME agency, and line-ministries including departments of industry, commerce, and science and technology; and (ii) a lack of holistic policy framework covering both finance and non-finance areas affecting SME development with clear targets of priority SME groups.

SMEs are a large mass of enterprises different from sector to sector and size by size, which include sole proprietorships and slower growing or zero-growth firms. The majority of SMEs belong to the retail and wholesale trade sector in most developing Asian countries. They are typically stability-oriented businesses that operate for minimum or moderate needs with no interest in growth, but those are not a group for leading the country to sustainable economic growth. Policymakers should more focus on growth-oriented SMEs in their national development policies or inclusive growth strategies. They are high-end SMEs or small but growing venture firms that explore new business opportunities with innovative technology and ideas (Shinozaki, 2012).

Poor access to financial services is one of the critical factors constraining the growth cycle of SMEs. Knowledge- and technology-intensive startups and SMEs need more affordable access to long-term financing options to invest in research and development (R&D), human capital, and technology transfer and commercialization to maximize their ability for innovation. Hence, the long-term policy framework for national economic development needs to be further elaborated with a holistic approach, addressing the balanced interventions in areas of technology, finance, and SME development, with

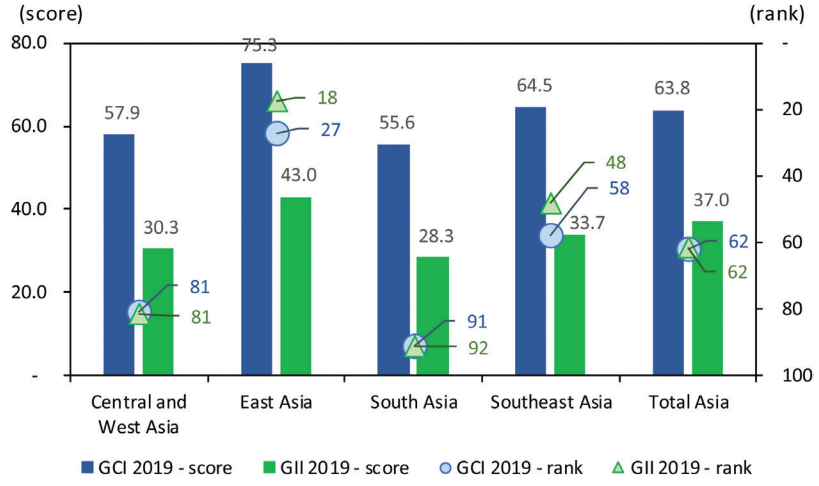
policy coordination among all stakeholders including private sectors in developing Asia.

With the perception mentioned above, this article discusses: (i) how financial sector development is important for countries to enhance innovation capability for future growth; (ii) what opportunities and constraints technology-based startups and SMEs have faced for business development; (iii) what structural issues lie in traditional financing models and what innovative financing models can be explored for technology-based startups and SMEs; and then draws (iv) the policy implications in developing Asia.

Innovation and finance for future growth

Technological change arises from intentional investment decisions made by profit maximizing agents in the endogenous growth theory (Romer, 1990), where a well-functioning and modernized financial system is prerequisite to encourage investments in technology and materialize innovation. The Global Competitiveness Index (GCI) and the Global Innovation Index (GII) draw the extent of competitiveness and innovation in Asia (Figure 1). There is the large competitiveness gap among Asian economies from Singapore ranked the top to Lao PDR ranked the 113 out of 141 economies in the GCI 2019. By region, East Asia including Japan, Republic of Korea and China made high performance in competitiveness measured by enabling environment, human capital, market sophistication, and innovation ecosystem in 2019, followed by Southeast Asia including Singapore, Central and West Asia, and South Asia. The GII 2019 follows the same trend as GCI 2019. This indicates that high-income advanced and emerging economies have taken the good position for global competitiveness and innovation.

Figure 2A illustrates the correlation between the financial system sophistication and innovation capability in Asia, based on data from the GCI 2019. It explains that countries with sound financial system holding high level of financial depth and stability demonstrated high innovation capability. Developing Asian economies with less modernized financial system, especially in Central and West Asia and South Asia, were reconciled to the condition of low innovation capability. Figure 2B explains this situation from different angle. It suggests that countries with high business dynamism – denoted by appearance and growth of innovative companies with disruptive ideas – have relatively large investment size in R&D, such as high-income advanced and emerging economies and China. Developing Asian countries have low investment in R&D overall, suggesting a lack of appropriate financing venues and options in these countries, which may increase risks on impeding future growth.



Notes: Central and West Asia (Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Pakistan, and Tajikistan); East Asia (China; Hong Kong, China; Japan, Korea, Rep of; Taiwan, China; and Mongolia); South Asia (Bangladesh, India, Nepal, and Sri Lanka); Southeast Asia (Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, and Viet Nam). Score refers to 0-100 (optimal). Rank refers to the rank out of 141 economies for the global competitiveness index and 129 for the global innovation index.

Sources: Recomposed from World Economic Forum (2019), The Global Competitiveness Report 2019; Cornell University, INSEAD, and WIPO (2019), The Global Innovation Index 2019.

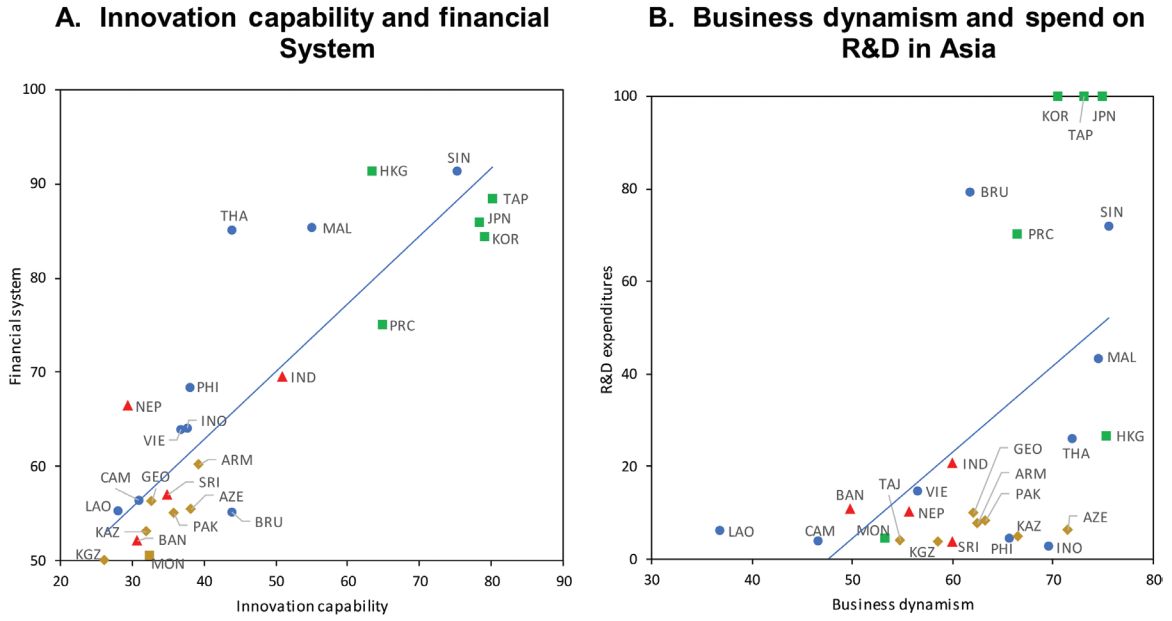
Figure 1: Competitiveness and innovation in Asia, 2019

Technology and innovation for SMEs

Technology and innovation can contribute to: (i) prevention from the downside risks of economic growth by strengthening dynamics of SMEs; and (ii) connection of investment needs to growth-oriented SMEs to boost national productivity.

Asia's continuous economic growth has helped reduce poverty and allowed many countries to transform into middle-income economies. Although developing Asia shows moderate economic growth, global economic uncertainty accelerated by trade tensions and protectionist measures has increased the downside risks to the region's growth. Potential slower growth in Asia requires the development of a new growth model that minimizes the adverse impact but maximizes opportunities arising from changing external environment to create a resilient base at the national level, which can be realized by innovative SMEs including seed firms, startups, and young entrepreneurs holding disruptive ideas.

Economic expansion in Asia has the potential to create a foundation of growth-oriented SMEs that contribute to boosting national productivity. Such a foundation has yet to materialize in developing Asia due to a number of factors such as a lack of SMEs' access to appropriate markets and finance. Meanwhile, growth in Asia has created a group of high net worth individuals with ample capital available and interest in investment opportunities that support new and innovative businesses, but due to several factors such as a lack



Source: Recomposed from World Economic Forum (2019), The Global Competitiveness Report 2019.
Note: Figures refer to score (0-100 [optimal]).

Figure 2: Innovation and finance in Asia

of appropriate investment venues make it difficult for them to find suitable SMEs to invest in. New technology and innovative ideas, such as fintech and digital solutions, can facilitate the connection of unmet investment needs to growth-oriented SMEs to boost productivity.

The Fourth Industrial Revolution, represented by emerging technologies such as artificial intelligence (AI), robotics, and Internet of Things (IoT), has been dramatically changing business environment including SMEs. New technology, as an enabler of innovation, is a key survival tool for growth-oriented SMEs including seed and startup companies. While this fourth revolution may bring negative impact of reducing workforces mainly from large and established firms, it can create more technology-based SMEs, which accompanies further job creation. Nowadays, for instance, several e-commerce platforms (e.g., Alibaba in China), mobile payment services (e.g., GCash in the Philippines), mobile-based ride-hailing services (e.g., Grab in Singapore), and cleantech startups (e.g., renewable energy and smart grid businesses) are actively operating in Asia. Digital technologies enable people to start new businesses with low cost.

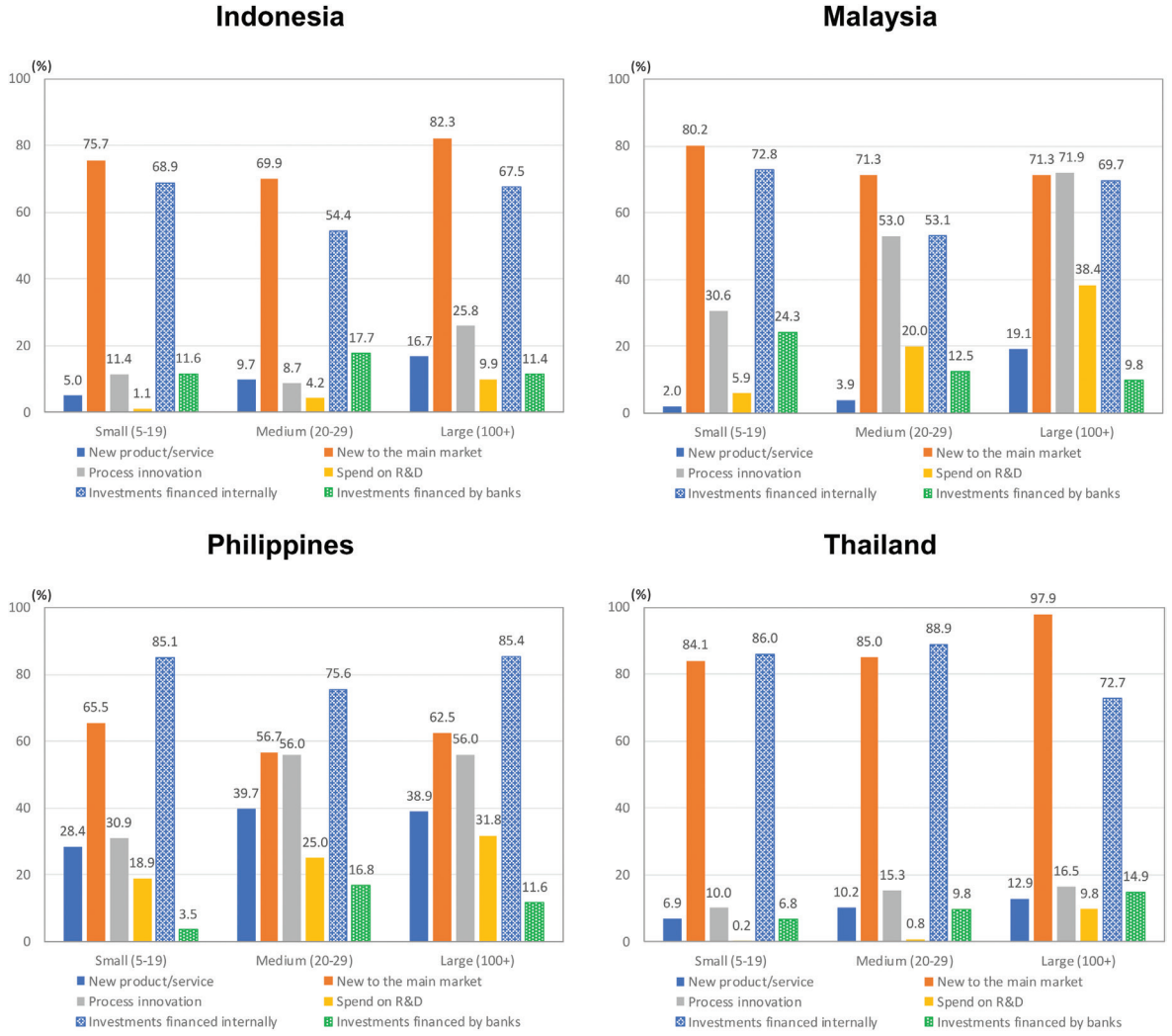
Technology-based SMEs can play an important role of increasing national productivity, benefitting from foreign direct investment (FDI) and active participation in global value chains. They are seeking long-term financing options to invest in R&D, human capital, and technology transfer and commercialization to develop and maintain their innovative business. However, a lack of available long-term finance models is a critical barrier for technology-based SMEs to make such investments. The diversification of financing models that go beyond traditional bank credit is vital for SMEs, especially technology-based startups.

Figure 3 shows the extent to which SMEs in selected four countries – Indonesia, Malaysia, the Philippines, and Thailand – have engaged in product and process innovation, and how they make investments. On the whole, SMEs that introduce new products and services are very small in number as compared to large enterprises. But once they introduced new products, such products are mostly new to the main markets, meaning that their innovation capabilities are potentially high. SMEs' spend on R&D is quite small in scale, although even large enterprises spend little. Investments made by SMEs are mostly financed internally, not relying on external finance. Limited use of external finance or a lack of available long-term financing sources will be one of the contributing factors on low investment in R&D, and this makes SMEs' innovation capability remain weak; hence small number of SMEs introduce new products and services.

Opportunities for technology-based SMEs

Since the 1990s, the global economy has been supported by high growth of labor productivity in Asia. However, the growth pace of productivity in the region has been slowing since the 2008/09 global financial crisis (GFC), contributing to global economic slowdown. Meanwhile, foreign direct investment (FDI) inflows to Asia have been sharply increasing since the GFC. Although the pace for increasing capital inflows has been slowing recently, capital flows from China, Japan, and Republic of Korea have still accelerated intraregional FDI in the region.

It is expected that increased entry of large multinational firms into developing Asia creates new demands for domestic products and services from SMEs, especially in



Note: First four items: % of firms; last two items: proportion of investments (%).

Source: Recomposed from various World Bank Enterprise Surveys data. Indonesia (2015), Malaysia (2015), Philippines (2015), Thailand (2016).

Figure 3: Innovation and finance for SMEs in developing Asia

the supporting industry or parts and components suppliers, and accordingly will improve labor productivity if SMEs actively participate in global value chains. Global value chains bring several benefits to SMEs, for instance, increased competitiveness, enhanced product quality by technology transfer, business expansion, and job creation. Technology-based startups and SMEs that can respond to demand on high quality and premium products would further benefit from these opportunities.

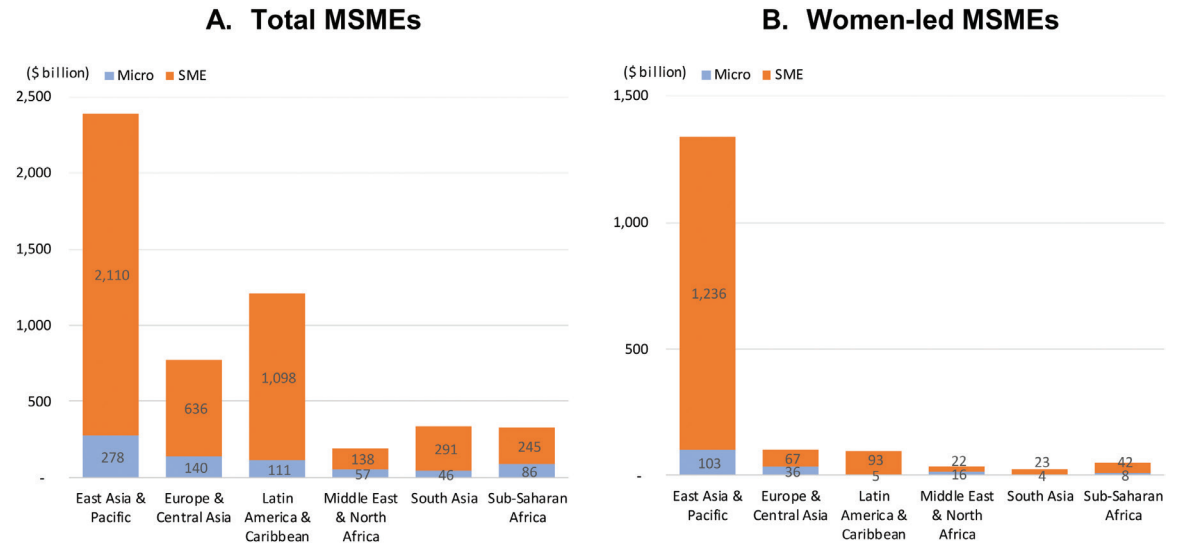
The liberalized trade and investment brought by economic integration and expansion and the advent of advanced technologies is promoting the structural change of SME business model from being domestically focused to being globally competitive. This shift requires new policy solutions for emerging growth-oriented SMEs. A rapidly changing external environment, as accelerated by the Fourth Industrial Revolution and FDI inflows, will create more opportunities for SME business in developing Asia, but appropriate design of evidence-based policy support measures is needed for such opportunities to materialize.

Constraints for business development

Opportunities are there, but SMEs have faced several critical constraints for their business development. Limited technical skills and knowledge for innovations are such a critical constraint for SMEs. Among others, however, limited access to finance, especially a lack of long-term financing options, is a big barrier for SMEs to invest in R&D and obtain and maintain technologies for sustainable business innovations. Thus, the diversified financing options besides traditional bank credit is needed for technology-based startups and SMEs.

Challenges in traditional financing models

As discussed, poor access to finance by SMEs constrains their growth cycle. The IFC report (2017) estimated that financing gap from formal micro, small, and medium-sized enterprises (MSMEs)



Source: recomposed from IFC (2017), MSME Finance Gap.

Figure 4: MSME Finance Gap in Developing Economies

in developing economies amounts to $5.2 trillion or 19% of the global GDP. In particular, Asia-Pacific region accounts for 46% of the total financing gap or $2.4 trillion (Figure 4A). Women-led MSMEs have faced much difficulty in getting finance. Their financing gap is estimated to be $1.7 trillion, 81% of which are from Asia-Pacific region (Figure 4B).

In many developing Asian countries, enhancing access to finance for SMEs is a policy priority as part of their national financial inclusion strategies. Governments launched several measures to ease financial access for SMEs, such as public credit guarantees and secured lending legal reforms, but huge financing gap still remains in developing Asia. The question is, why SME finance gap never disappear despite several government efforts. This suggests that limited SME access to finance is a structural problem in most of the countries.

Figure 5 is the result of ADB SME surveys conducted in eight countries (China, India, Kazakhstan, Malaysia, Papua New Guinea, the Philippines, Republic of Korea, and Sri Lanka). SMEs surveyed indicated several supply-side barriers. Collateral and guarantee requirements for loans are the top barrier they identified, which is followed by high lending rates and complicated procedures to borrow money from financial institutions. Meanwhile, SMEs surveyed recognized their own problems; a lack of knowledge in available financial services and their insufficient management and human resources. These make their access to finance so limited. Interestingly, around 20% to 30% of SMEs surveyed answered no demand for raising funds from formal financial institutions, which is partly caused by their hesitation to going to banks due to their lack of knowledge. This indicates that traditional bank lending have faced critical challenges to servicing SMEs.

Regulator side may also create a contributing factor for limited SME access to finance. In developing Asia, many countries have planned or introduced Basel capital accord-based financial regulation and supervision, which requires tighter risk management as well as greater capital and liquidity for commercial banks. This international standard for banking supervision may negatively affect banks' lending attitude to SMEs.

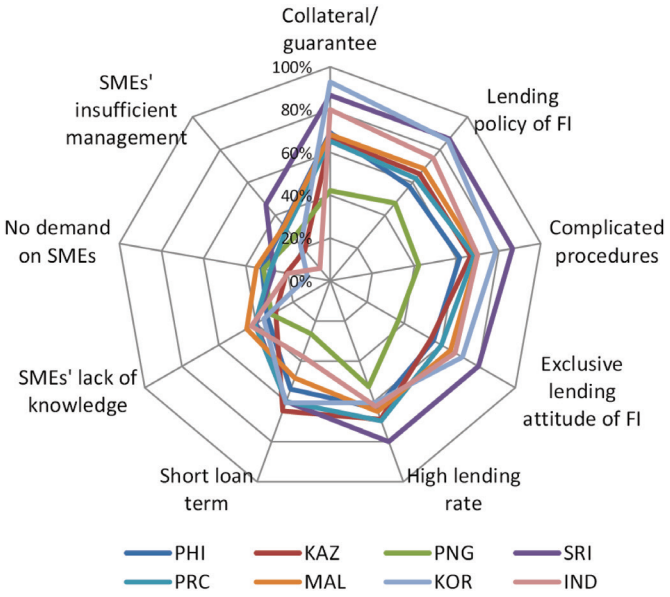
Exploring innovative financing models

The advent of financial technology or fintech has been sharply changing the financial sector architecture and landscape. Given the structural problem on traditional lending models, SMEs are considered main beneficiaries of fintech. Fintech can be a conduit for their survival and growth, offering fast, easy, safe, and low-cost financing to support developing their innovative business models.

Besides traditional lending markets, new players such as telecom companies, mobile network operators, and cash-in cash-out agents have been emerging in the financial markets, bringing new and alternative finance products and services such as marketplace or peer to peer (P2P) lending, e-commerce finance, online supply chain finance, and equity crowdfunding. P2P lending generally refers to lending flexible amount of money to borrowers without going to physical bank branches, with no collateral requirements. P2P lending is very active in China. E-commerce platforms such as Amazon, eBay, and Alibaba are now offering working capital loans for SMEs using these platforms for selling their goods. Digital finance can create long-term, seamless, and affordable financing options for technology-based startups and SMEs.

Mckinsey (2016) estimated that digital finance can create $2.1 trillion in new credit and $4.2 trillion in new deposits globally (Figure 6A). By region, except for China, South Asia has the highest potential of benefits from digital financial services, estimating the new credit of $753 billion and new deposits of $1.1 trillion created by digital finance. Southeast Asia ranked

fourth in the impact of digital finance, estimating the new credit of $295 billion and new deposits of $368 billion created by digital finance. Also, another Mckinsey study (2018) shows that digital transactions are 1.6 to 5 times as frequent as bank branch transactions in Asia (Figure 6B). This implies that the banking sector also needs to elaborate digital finance services solutions, changing their traditional business models, given the huge positive impact of digital finance.



Notes: Percentage as the share of SMEs that answered yes plus somewhat yes from five scale scores (yes, somewhat yes, neutral, somewhat no, and no) about barriers to access finance. Valid samples: the Philippines (PHI): 63; Kazakhstan (KAZ): 98; Papua New Guinea (PNG): 19; Sri Lanka (SRI): 15; People's Republic of China (PRC): 303; Malaysia (MAL): 60; Republic of Korea (KOR): 28; India (IND):40.

Source: Author's compilation.

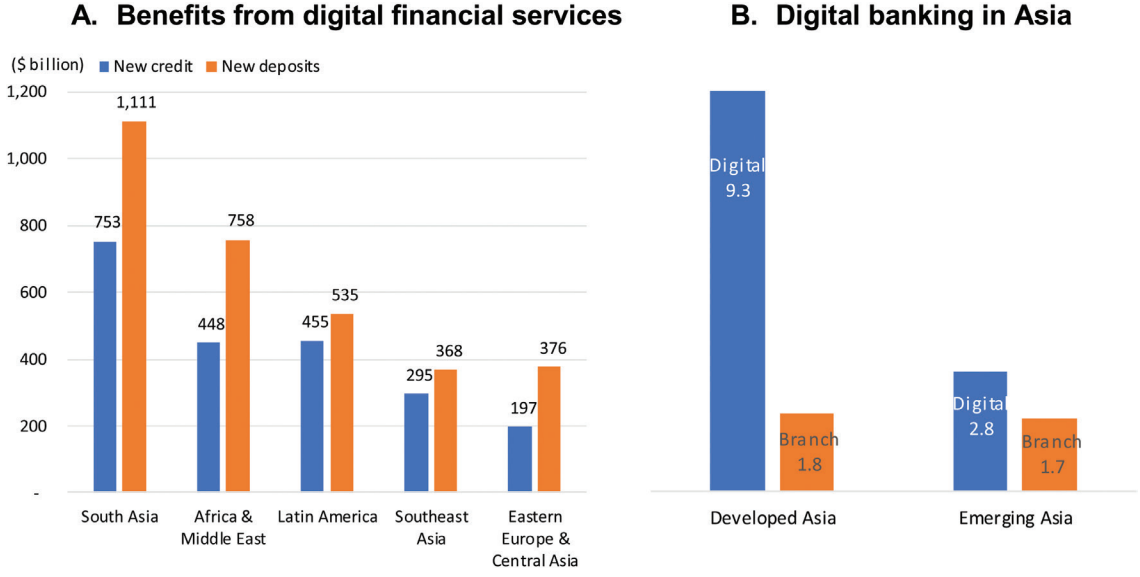
Figure 5: Barriers to accessing financial institutions

Figure 7 shows the ADB study conducted in four Asian countries – Cambodia, Indonesia, Myanmar, and the Philippines. According to this study, digital finance will have the significant positive impact on promoting access to finance for low-income households, women, and SMEs. In Indonesia, for instance, unmet demand for payments, credit, and savings accounted for 65%, 36%, and 26% of each total demand. Against such unmet demand, digital finance services solutions will contribute to closing gaps by 37%, 20%, and 35% in payments, credit, and savings respectively.

Alternative SME finance models

This section explores alternative financing models that technology-based startups and SMEs can tap, indicating three cases for brainstorming.

First is online supply chain finance as a case of short-term financing for MSME suppliers of goods and services by using online platform. Figure 8 explains the simplified business flow. Online supply chain finance offers earlier payment of invoices at a discount for the SME supplier. SME supplier firstly uploads its invoice to the specialized online platform through accounting software (e.g., QuickBooks).

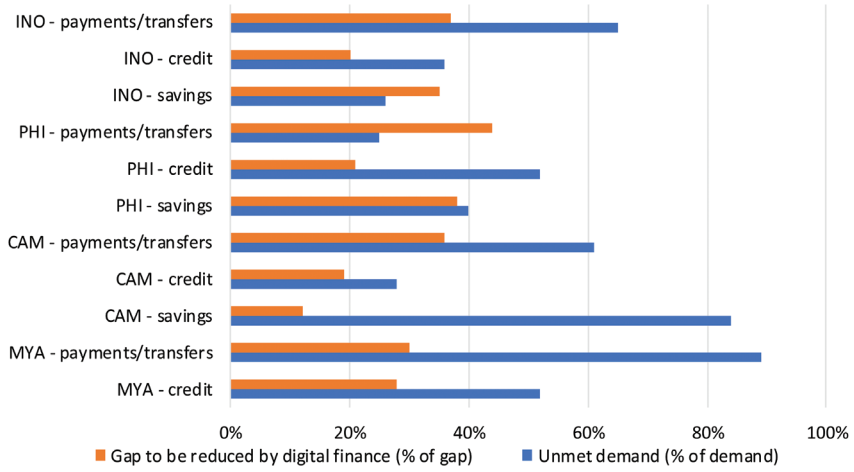


Source: Recomposed from Mckinsey Global Institute (2016), Digital Finance for All.

** data for average transactions per customer per month.*

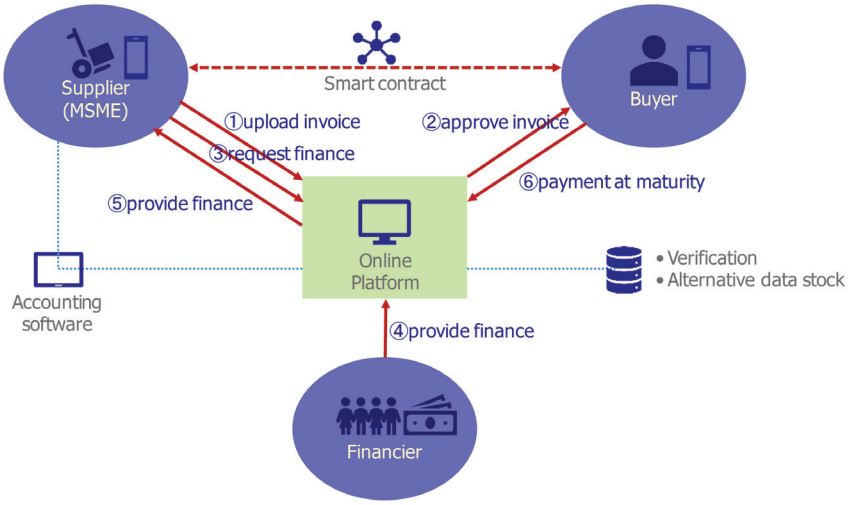
Source: Recomposed from Mckinsey&Co. (2018), Asia's digital banking race: Giving customers what they want

Figure 6: Potential of Fintech



Source: Recomposed from ADB, 2017. Accelerating Financial Inclusion in Southeast Asia with Digital Finance. INO=Indonesia, PHI=Philippines, CAM=Cambodia, MYA=Myanmar.

Figure 7: Potential impact of digital finance on access to finance in Asia



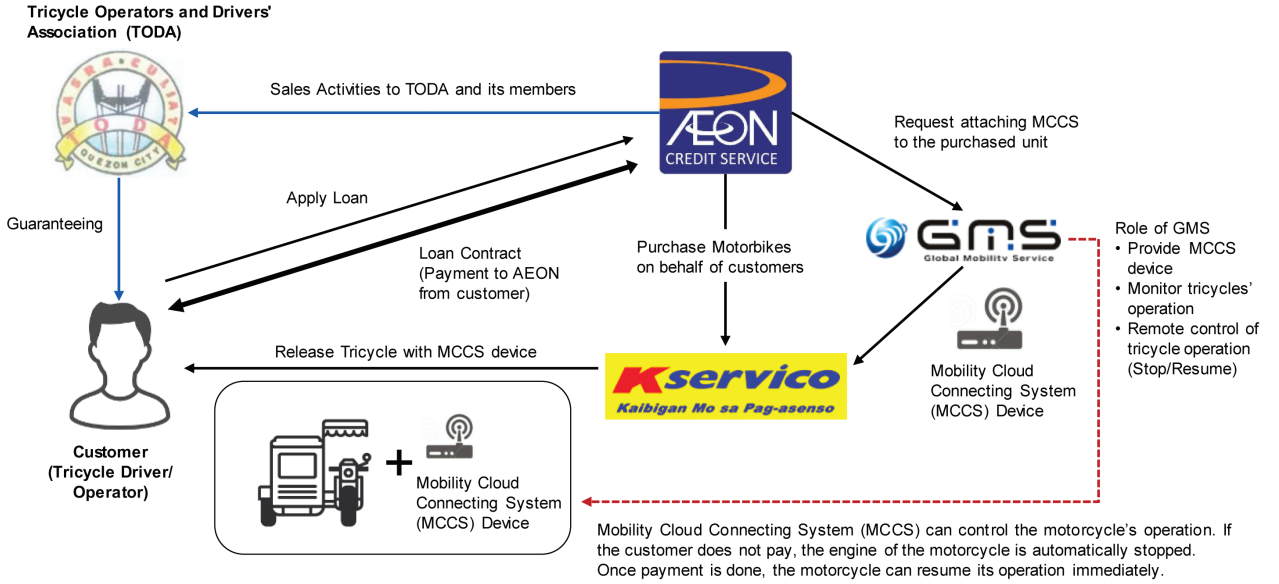
Source: Author's compilation.

Figure 8: Online supply chain finance

Once the buyer approved the invoice via online platform, the supplier requests finance through the platform. After the verification of the supplier's identity based on the analysis of alternative data or cloud data, the investor (individual and institutional) or the financier provides finance at discount for the supplier via the platform before the maturity date; then the platform collects the face value of the invoice from the buyer at maturity. If this scheme is combined with smart contract, financing speed is much faster as the smart contract can immediately verify and settle the contract between the seller and the buyer without the third-party intermediary by using blockchain technology.

The second case is Japan's large retailer AEON's fintech-based tricycle loans in the Philippines. Tricycle is a three-wheeled vehicle and popular for public transportation in developing Asian countries. ADB has prepared the impact evaluation on this AEON's fintech-based loan scheme to assess how financial technology can improve living standard and social welfare of tricycle drivers and how it supports the development of regional economies in the Philippines. Since 2017, AEON Credit Service Philippines has offered an innovative loan scheme for tricycle drivers to purchase motorcycles, which uses the remote control IoT device that is able to deactivate motorcycle's engine when the driver doesn't repay. This has resulted in near-zero nonperforming loans so far. Japan's fintech firm Global Mobility Service (GMS) is a partner for introducing the GPS tracking system in tricycle loans and monitors data including route of tricycles. There is also a potential to use such GPS-tracked data for solving traffic jam in the Philippines, as an idea. So, fintech has greater potential to solve not only access to finance problems but also other nonfinancial policy agendas.

The third case is a conceptual long-term and seamless financing model for the target groups of SMEs including



Source: Nomura Research Institute, Ltd. Citation from presentation by Shinozaki prepared for the ADBI–CBT Seminar on Innovative Finance for Growth, Session VIII, 18 April 2019, Istanbul.

Figure 9: AEON's business scheme of tricycle loans with MCCS device

technology-based startups, which is based on the public-private sector collaboration, by making the best use of all possible resources in the financial sector with technology. This model aims to create a market mechanism that incubates "smaller but growing" firms that will eventually tap the exchange market.

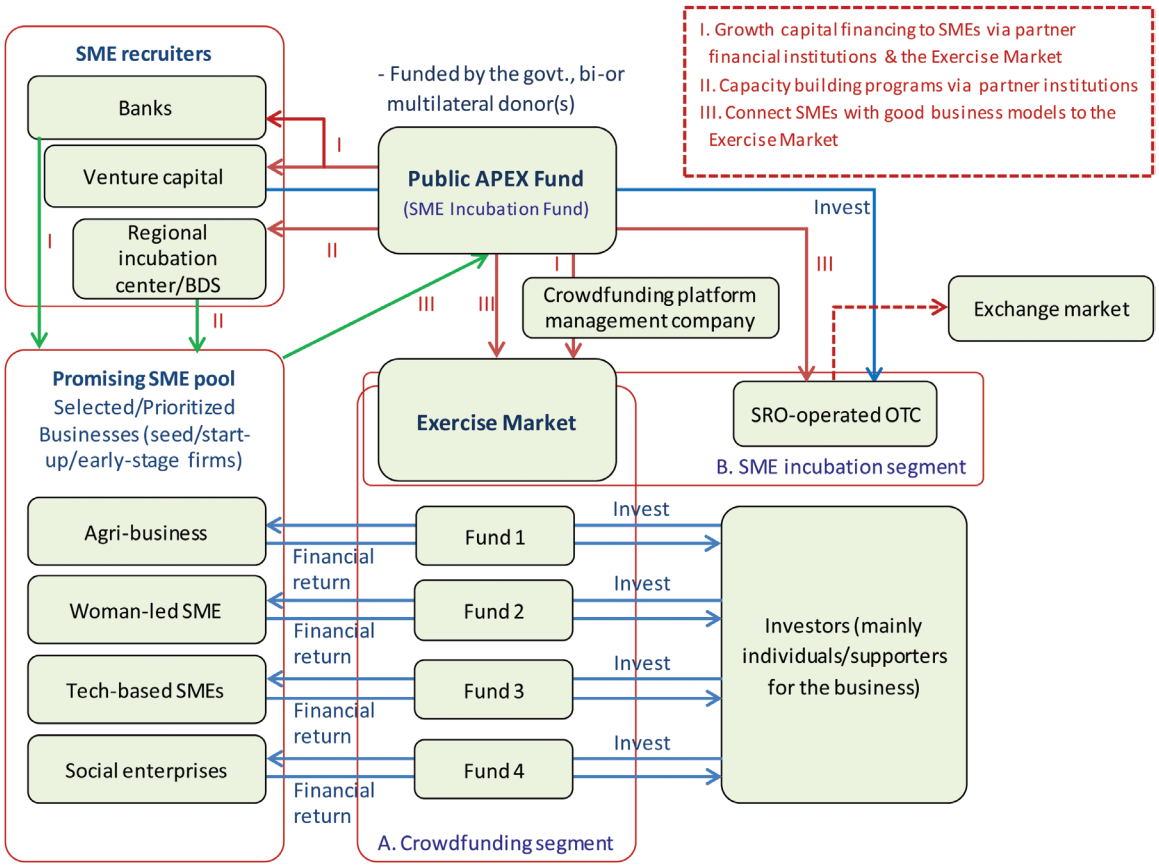
There are roughly two steps to create this infrastructure. First is to set up the public APEX Fund invested by the government and bilateral or multilateral donors. Second is to set up the exercise equity market comprising two financing channels; the crowdfunding segment and the self-regulatory organization (SRO)-operated over-the-counter (OTC) market. The public APEX Fund provides credit lines to partner banks and venture capital companies servicing SMEs to finance growth capital to viable SME segments such as agri-business, women-led entrepreneurs, and technology-based startups, and at the same time provides capacity building programs through existing regional incubation centers or business development services. Through these practices, the APEX Fund creates the pool of promising SMEs with data stock. The Exercise Market creates a crowdfunding platform managed by a private sector and an OTC market segment operated by SRO such as the securities and dealers association. The APEX Fund selects SMEs with good business models from the SME pool and connects them to either the crowdfunding segment or the OTC market segment. The crowdfunding segment supports investment and working capital finance of SMEs, connecting them to individual investors and their business supporters, while the OTC market segment provides a chance for SMEs to learn more market rules and obligations, such as disclosure, before tapping the exchange market, and support to improve their corporate culture and mindset of SME managers through learning the importance of increased "corporate value" for growth.

Policy implications in developing Asia

What should be addressed by policymakers responsible for SME access to finance is to timely provide financing opportunities for SMEs according to their needs with flexibility and innovation. As discussed, fintech brings more opportunities for SMEs to access low-cost financing. Several studies proved that digital finance will reduce financing gap and rather create new demands in financial services. To move forward, policy actions are required to encourage the shift from the traditional financing models to digitally innovative financing models, which includes the support for infrastructure development such as a national payment switch, digital identity, and open application programming interface (API). Also, developing the methodologies to secure quality and reliable data for analysis, product design, and risk management is crucial to this end. Regulation should be an enabler for innovative finance products and services. Enhancing digital finance literacy among SMEs is a critical component to reduce their knowledge gap and make trust in new financial services, where the national government plays a pivotal role for providing capacity building training. Tech-based startups and SMEs can reap benefits from access to digitally innovative financing models and effectively develop and maintain their innovative business by investing in R&D, human capital, and technology adoption through digital solutions. A holistic approach is needed to design extensive policy measures to encourage the shift to digital in SME financing space in developing Asia.

Conclusion

Knowledge- and technology-intensive startups and SMEs need more affordable



Source: Author's compilation.

Figure 10: Public-Private sector collaboration and digital solution

access to long-term financing options to invest in R&D, human capital, and technology transfer and commercialization to maximize their ability for innovation. The long-term national development policy needs to be elaborated further with a holistic approach, addressing the balanced interventions in areas of technology, finance, and SME development in developing Asia.

Countries with sound financial system demonstrate high innovation capability and develop business dynamism with relatively large investment size in R&D. They are mostly high-income advanced and emerging economies. Developing Asian countries with less modernized financial system and low investment in R&D may increase risks on impeding future growth.

Technology and innovation can contribute to prevention from the downside risks of economic growth by strengthening dynamics of SMEs and channel unmet investment needs to growth-oriented SMEs to boost national productivity. The Fourth Industrial Revolution, FDI inflows, and global value chains can help create more technology-based startups and SMEs and generate more jobs, but it has not yet happened in developing Asia. Investments made by SMEs are mostly financed internally, not relying on external finance, due to a lack of affordable financing options, causing low spend on R&D and making their innovation capability remain weak.

SMEs in developing Asia, especially women-led SMEs, have faced the highest financing gap in the world. Collateral and guarantee requirements are the top barrier for SME access to finance. Basel capital accord that requires tighter risk management may negatively affect banks' lending attitude to SMEs, suggesting the limitations of bank credit for growth capital financing to startups and SMEs. Thus, the diversified financing models that go beyond traditional bank credit is needed for technology-based startups and SMEs.

Fintech or digital finance brings more opportunities for SMEs to access low-cost financing and highly contributes to reducing financing gap in developing Asia. Online supply chain finance, IoT device-controlled vehicle loans, and exercise equity market concept are examples of digital finance services solutions. Modernizing financial systems with high level of financial depth and stability is key for developing Asian countries to obtain their innovation capability with moderate investments in R&D by tech-enterprises, where the role of government policies comprehensively covering technology, finance and SME development is critical toward resilient and sustainable economic growth with strengthened dynamics of technology-based startups and SMEs.

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Asia-Pacific as a Technology-based Start-up Hub

Potential, Issues and Way Forward

Arpita Mukherjee[a] and Angana Parashar Sarma[b]

[a]Professor, Indian Council for Research on International Economic Relations (ICRIER), Plot No.16-17, Institutional Area, Sector-6, Pushp Vihar, New Delhi-110017, India. Tel: +91-9810189326, +91-11-43112400; Fax: +91-11-2462 0180; E-mail: arpita@icrier.res.in; Linkedin: https://www.linkedin.com/in/drarpitamukherjee

[b]Research Assistant, ICRIER, Plot No.16-17, Institutional Area, Sector-6, Pushp Vihar, New Delhi-110017, India. Tel: +91-8860206126; E-mail: asarma@icrier.res.in

Abstract

In the past decade, there has been a growth of technology-based start-ups in both developed and developing countries. The Asia-Pacific region, which is the home to more than two-thirds of the world population, has emerged as a key destination for start-ups – both domestic and foreign. Existing studies show that start-ups in the region are growing at a fast pace due to conducive policies, increased digitisation, internet and smartphone penetration, greater adoption of newer technologies, increase in income, rapid urbanisation, and focus on higher education, among others.

This paper, based on secondary literature review and policy mapping, presents an overview of the growth of start-up ecosystem in the Asia-Pacific region, especially technology-based start-ups. It examines and presents a cross-country comparison of policy measures adopted by countries in the region. It analyses the barriers faced by start-ups and make recommendations to accelerate the growth and make Asia-Pacific a start-up hub, which will in turn lead to high quality jobs, investment in innovation and research and development, enable (a) the developed countries of the region to further improve their productivity and efficiency and (b) the developing countries to harness the benefits of technology for sustainable and equitable growth.

Introduction

"Start-up is an organisation designed to search for a repeatable and scalable business model." - Steve Blank (Renowned Entrepreneur)

In the past decade, there has been a surge in entrepreneurial activity and growth of technology-based start-ups in both developed and developing countries (Stangler, 2019; Start-up Genome 2019).[1] A recent survey of 170 countries, show that during the period 2016 and 2018, start-ups created a value worth US$2.8 trillion, which is over 20 percent increase from the preceding period - 2014 to 2016 (Start-up Genome 2019). This growth in start-ups has been supported by advent of new technologies such as cloud services, data analytics, artificial intelligence (AI), the internet of things (IoT), 5G telecommunications, Big Data, advanced robotics, to name a few (Ernst and Young, 2019; Roy, 2018). These new technologies, which have paved way for the Fourth Industrial Revolution (4th IR), are bringing fundamental changes in production, distribution and consumption, while transforming current modes of trade and investment across countries (World Economic Forum, 2017).

Today, an increasing percentage of the global companies are technology-driven (Marmer, 2018). For instance, there was only one tech-based company (i.e., Microsoft) among the top ten companies in the world in 2008 (Startup Genome, 2019). By contrast in 2018, among the top ten companies in the world, 7 were tech-based companies including Apple Incorporated, Google, Facebook, and Microsoft. Firms, both large and small, are increasingly spending on innovation and technology, to sustain their market share. Big Data market revenues for software and services are projected to increase from US$42 billion in 2018 to US$103 billion in 2027, attaining a compound annual growth rate (CAGR) of 10.48 percent.[1] The worldwide spending on AI systems is expected to reach US$35.8 billion in 2019, an increase of 44 percent over the amount spent in 2018.[2]

Studies have shown that technology-based start-ups have more growth potential as compared to other start-ups, both in terms of creating employment opportunities and in terms of generating revenue as the innovations have a clear competitive edge in the global market (Wu and Atkinson, 2017).

Among the major start-up hubs across the globe, the Asia-Pacific region is growing fast with increased digitisation, internet and smartphone penetration, greater adoption of newer technologies, increase in income, rapid urbanisation, and focus on higher education, among others. Asia-Pacific region[3] stretches from China to New Zealand, and is home to more than two-thirds of the world population with a higher proportion of young people and a large consumer base in a number of countries like India and China. A number of economies in the region including Australia, Singapore and the Republic of Korea are offering various fiscal and non-fiscal incentives to promote start-ups. Some of

[1] Extracted from https://www.statista.com/statistics/254266/global-big-data-market-forecast/ (last accessed October 13, 2019)

[2] https://www.idc.com/getdoc.jsp?containerId=prUS44911419

[3] The Asia-Pacific countries that we have considered for this study are Indonesia, Malaysia, Myanmar, Brunei, Cambodia, India, Sri Lanka, Bangladesh, Philippines, Laos, Vietnam, Thailand, Singapore, Taiwan, Australia, New Zealand, Republic of Korea and China.

these incentives are specifically designed to attract foreign start-ups to their markets. For example, countries such as Philippines, Australia, China, and Japan have come up with start-up visas to attract foreign start-ups.

Given this background, the objective of this paper is to present an overview of the growth of start-up ecosystem in the Asia-Pacific region, with select examples of diffusion of innovative technologies through start-ups. It also presents a snapshot of various policy measures adopted across these countries such as fiscal and non-fiscal incentives, policies on data privacy and protection, e-commerce, electronic transaction, start-up visa, etc., which have an impact on the growth of start-ups. Further, the paper identifies some key challenges faced by start-ups in this region, specifically technology-based start-ups, and provides a way forward on what steps can be taken to accelerate the growth and make Asia-Pacific a start-up hub.

Start-up ecosystem

The Asia-Pacific region has one of the most vibrant start-up ecosystems in the world, characterised by high development of local start-ups.[4] A number of these home-grown start-ups have provided tough competition to several foreign start-ups. For example, China's e-commerce platform Alibaba is competing equally with Amazon. Among all the countries in the region, China has the highest number of technology-based start-ups and tech-hubs. As per Startup Genome Report (2019), among the top 20 global start-up hubs, two are in China- Beijing (ranked 3rd) and Shanghai (8th). In fact, Beijing alone has around 9000 tech-companies, mostly start-ups (for example, Bytedance, Baidu, Sina Corp, etc.).[5] Other start-up hubs from the region, which are among the top 20 start-up ecosystems, include Singapore (ranked 14th) and Bengaluru (18th), India.

Start-ups in Asia-Pacific countries are also increasingly using advanced technology to meet social objectives (such as addressing inequality and gender issues) and sustainable development goals, thereby leapfrogging the process of development (Akhtar, Hahm and Stone, 2016). For example, the Philippines based healthcare start-up, Zennya aims to make personal healthcare more accessible, affordable, and consumer-driven by making use of AI, Global Positioning System (GPS), and Telematics to provide clients easy access to professional therapists and healthcare nurses through an app-booking process.[6]

Start-ups are using technology to analyse consumer demand and offer more customised products and services. Japan's New Rope is an AI-driven fashion start-up, where its product, CBK Scnnr takes photos of instagrammers, models, and other fashionistas and automatically analyses their outfits and then proceeds to finds similar items that one can purchase.[7] Overall, start-ups have spread across a wide range of sectors from urban mobility to financial inclusion and agriculture. Some examples of technology-based start-ups across various countries and sectors in the Asia-Pacific region are highlighted in Table 1. Some of

Table 1: Select technology-based start-ups across Asia-Pacific countries

Countries	Select technology-based start-ups
Indonesia	GO-JEK (Ride Hailing); Tokopedia (Online Retail)
Malaysia	iFlix (Online Movie Streaming); DahMakan (Online Food Delivery)
Philippines	Zennya (Healthcare); Coins (Financial Services)
Singapore	Trax (Online Retail); MyRepublic (Telecom)
Thailand	Ling Farm (Agritech); Hip Flat (Real Estate)
Vietnam	Momo (Mobile Wallet and Payment); Sendo (Online Retail)
India	Zomato (Food and Beverages); PayTM (Online Payment); Ola (Online Ride Hailing); Cropin (Agri-Tech)
Laos	Alo Technology (Business Solutions); XY Mobile (Electronics Services)
Myanmar	Curiosity (Social Media Platform); Burmese Hearts (E-Learning Platform)
Cambodia	Direxplay (Gaming); Morakot Technology (Finance)
Bangladesh	Buckets Engineer (E-Learning Platform); Parallax Logic (Online Retail)
Sri Lanka	Liveroom (Entertainment); Senzmate (Agritech)
New Zealand	Robotics Plus (Agritech); Upside Biotechnologies (Life Sciences)
Australia	Canva (Graphic Design); Smart Sparrow (E-learning Platform)
China	17zuoye (E-Learning Platform); Irealty China (Real Estate)
Republic of Korea	Medibloc (Healthcare); Zigzag (Online Retail)
Japan	New Rope (Online Fashion); Bonx (Electronics)
Taiwan	Aprinoia Therapeutics Incorporated (Healthcare); Appier (Advertising)
Brunei	Cubebox (IT Services); Essentials.ai (Insurance)

Source: Compiled by Authors

[4] https://innmind.com/articles/757 (last accessed October 13, 2019)
[5] https://www.scmp.com/tech/start-ups/article/2185092/asian-cities-are-competing-woo-tech-start-ups-incentives (last accessed October 13, 2019)
[6] https://doingbusinessinthephilippines.com/top-10-tech-startup-companies-in-the-philippines/ (last accessed October 13, 2019)
[7] https://www.techinasia.com/jp-funding-03-07-2018 (last accessed October 13, 2019)

these start-ups are growing and exploring other markets outside the Asia-Pacific region. For example, Indian online ride-hailing start-up Ola has been able to expand its presence in the United Kingdom.

Start-ups in different countries have developed based on certain comparative advantages and/or socio-economic needs. For example, New Zealand has comparative advantage in agriculture and allied sectors (dairy, meat, etc.) which have resulted in growth of a number of agro-based start-ups.[8] In Tokyo (Japan) and Taipei City (Taiwan province of China), a number of start-ups have come up in the use of robotics in manufacturing, to address the issues of labour shortages and high cost of labour. Australia's strength in education services has made the edu-tech sector among the fastest growing start-up segments of Melbourne (Australia).[9] In case of the Republic of Korea, online gaming related start-ups account for one of the highest share in terms of revenue generation (US$5.6 billion in 2018), as the country has the highest smartphone penetration rate in Asia[10] and has established itself as a gaming hub. Fin-tech is one of the major start-up segments in cities like Bengaluru (India), Jakarta (Indonesia) and Manila (Philippines).[11] These have been outsourcing destinations for global financial companies.

Policy landscape and the business environment

Successful growth of a start-up depends on factors such as conducive environment for innovation and research and development (R&D), ease of starting a business, availability of funding, access to accelerators and incubators, infrastructure and digital networks like high speed and 24X7 electricity supply. It is also dependent on (a) government policies like the vision of the government to digitalise the economy or to ensure on-line payment mechanism; (b) appropriate policies, incentives (tax break/subsidies) and institutional mechanisms to facilitate entrepreneurship; and (c) conducive regulatory environment to support the growth of start-ups, for example, data protection and privacy policy. Countries may have a start-up specific policy through which they can give tax break/subsidies and other incentives to start-ups or they may have general polices and/or incentives (for example, incentive for digitalisation or policies for digital transmission). The Asia-Pacific countries vary in terms of their adaptation of policies (Table 2). For example, while countries such as Australia, Singapore and India provide tax concessions for start-ups, there are no specific tax benefits for start-ups in Viet Nam and Thailand.

Table 2 shows that majority of the countries have a policy specific to e-commerce or electronic transactions, except in case of India and Cambodia, where the policies are in the draft stage. In terms of data protection and privacy, 14 out of 19 countries have a data protection or privacy regulation. In case of India and Thailand, it's in the draft stage while in Sri Lanka and Myanmar, it is under consideration. Twelve out of 19 countries have a start-up specific policy.

Countries in the Asia-Pacific region are providing incentives such as tax concessions, grants, funding assistance, incentives for foreign start-ups, easing procedures to

Table 2: Snapshot of presence of policies across Asia-Pacific countries for growth of start-ups

	Startup specific policy	Data protection and privacy	Electronic commerce/ transaction
Indonesia	√	√	√
Singapore	√	√	√
Malaysia	×	√	√
Philippines	√	√	√
Vietnam	√	√	√
Myanmar	Under Consideration	Under Consideration	√
Brunei	×	√	√
Cambodia	×	×	In the Draft Stage
Laos	×	√	√
Japan	√	√	√
Republic of Korea	√	√	√
Thailand	√	In Draft Stage	√
India	√	In Draft Stage	In the Draft Stage
China	√	√	√
Australia	√	√	√
New Zealand	√	√	√
Bangladesh	×	√	√
Sri Lanka	×	Under Consideration	√
Taiwan province of China	√	√	√

Source: Compiled by Authors

[8] https://www.forbes.com/custom/2019/04/09/new-zealand-its-closer-than-you-think/ (last accessed October 13, 2019)
[9] https://startupgenome.com/reports/global-startup-ecosystem-report-2019 (last accessed October 13, 2019)
[10] https://venturebeat.com/2019/04/28/south-korea-is-a-mobile-gaming-haven-even-for-western-studios/ (last accessed October 13, 2019)
[11] https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2018-ccaf-global-fintech-hub-report-eng.pdf (last accessed October 13, 2019)

register a business, etc., which is supporting the growth of start-ups. Some of these are given below:

Tax Incentives: One of the important factors for starting a business is the rate of corporate tax. In the Asia-Pacific region, many countries provide tax incentives for the start-ups. For example, in Singapore, tax exemptions for start-ups include concession of 75 percent on the first earned S$100,000 and 50 percent on the next earned S$100,000.[12] In Indonesia, while the corporate tax rate is 25 percent, it is 12.5 percent for a local start-up with revenue up to IDR 50 billion.[13] In Taiwan province of China, the first earned revenue of TWD$120,000 by a start-up is tax free.[14] The Australian government offers refundable and non-refundable R&D tax incentives of 43.5 percent (for companies with aggregated turnover of less than AU$20 million) and 38.5 percent (for companies with aggregated turnover over AU$20 million).[15] In India, under the Startup India Initiative, there is a provision of 3 year income tax concession for new start-ups.[16] Further, through the Startup India Vision Document 2024, tax incentives are provided for investments in startups and exemption of angel tax on all investments by alternate investment funds.[17] In New Zealand, a 15 percent tax credit is given to start-ups for investing in R&D.[18]

Funding: A number of start-ups in the Asia-Pacific region have been successful in gaining support from the government through provision of various funding initiatives. For example, major cities in China such as Beijing and Shanghai have various government funds for promoting start-ups.

Table 3: Start-up/Entrepreneur visa in select Asia-Pacific countries

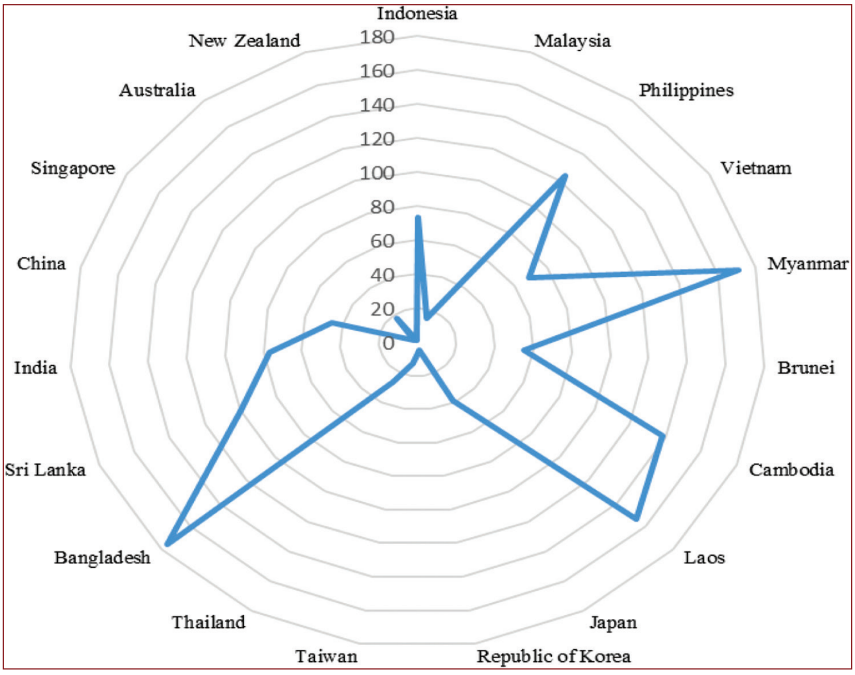
Countries	Startup Visa/ Entrepreneur Visa
Australia	Startup Visa Business Innovation and Investment Visa (Provisional) Business Innovation and Investment Visa (Residence) Business Talent (Migrant) Visa
China	Shanghai Private Residence Permit (Business Startup Visa)
Japan	Startup Visa (a part of the "Business manager" Visa, currently available at select National Strategic Special Zones such as Tokyo, Fukuoka City, etc.)
New Zealand	Entrepreneur Work Visa
Singapore	Singapore EntrePass
Republic of Korea	Technology-Based Startup Visa (D-8-4)
Philippines	Innovative Startup Visa

Source: Compiled by Authors

In Shanghai, depending on the size of the start-up and the number of employees, investors can be compensated up to 60 percent of their initial capital funding. In Singapore, the government announced funding worth US$2.86 million in 2018 for funding in various technology-based start-ups involved in AI, virtual reality, etc. Further, the National Research Foundation invested US$7.4 million in 2018 in corporate venture capital funds. In 2017, the government of the Republic of Korea has set up a venture fund worth US$9 billion to support start-ups, along with creation of the Ministry of Small and Medium-sized Enterprises and Startups (Yang, 2019).[19] In Taiwan province of China, the National Development Council had invested around US$83 million in 2015 in four venture capital funds to promote the growth of local start-ups.[20] Australian government provides grants worth up to 50 percent of the required capital for initiating a start-up, with a maximum grant worth $250,000.[21] In India, the government in 2019 had announced a Startup Fund with an initial amount worth INR1000 crore, for funding high-tech and cutting-edge start-ups in the country.[22] The National Entrepreneurship Fund of Cambodia has a funding of US$5 million for supporting entrepreneurs with engendering mindsets.[23]

Incentives for foreign start-ups: In terms of attracting foreign talent, many Asia-Pacific countries have come up with start-up or entrepreneur visa to enable immigrant entrepreneurs to launch innovative ventures, thus helping in technology transfer and creating employment opportunities. The purpose of these visas is different for dif-

[12] https://www.guidemesingapore.com/business-guides/taxation-and-accounting/corporate-tax/singapore-corporate-tax-guide (last accessed October 13, 2019)
[13] https://home.kpmg/content/dam/kpmg/xx/pdf/2018/09/indonesia-2018.pdf (last accessed October 13, 2019)
[14] https://www.valuechampion.sg/best-countries-asia-pacific-startups (last accessed October 13, 2019)
[15] https://www.ey.com/sg/en/services/tax/ey-tax-incentives-in-asia-pacific-australia (last accessed October 13, 2019)
[16] https://www.startupindia.gov.in/content/sih/en/startupgov/startup-recognition-page.html (last accessed October 13, 2019)
[17] https://m.economictimes.com/small-biz/startups/newsbuzz/dpiit-proposes-startup-india-vision-2024-proposes-tax-sops-for-new-ventures/articleshow/69043102.cms (last accessed October 13, 2019)
[18] https://www.business.govt.nz/news/r-and-d-tax-incentive-2019/ (last accessed October 13, 2019)
[19] https://www.scmp.com/tech/start-ups/article/2185092/asian-cities-are-competing-woo-tech-start-ups-incentives (last accessed October 13, 2019)
[20] https://topics.amcham.com.tw/2015/03/taiwanese-startups-making-up-for-lost-time/ (last accessed October 13, 2019)
[21] https://www.smartcompany.com.au/startupsmart/advice/startupsmart-funding/five-top-government-grants/(last accessed October 13, 2019)
[22] https://m.economictimes.com/news/economy/policy/government-plans-rs-1000-crore-fund-for-startups-in-priority-areas/articleshow/69450803.cms (last accessed October 13, 2019)
[23] https://static1.squarespace.com/static/56a87acd05f8e263f7b16c7f/t/5c9b0762085229887ba9af72/1553663849501/Cambodian_Tech_Startup_Report_Final_250319.pdf (last accessed October 13, 2019)



Source: Compiled from Ease of Doing Business Rankings, 2019, available at https://www.doingbusiness.org/en/rankings

Figure 1: Ease of Doing Business rankings (2019) across Asia-Pacific countries

ferent countries. For example, in Australia, the start-up visa is given to attract skills that are in short supply in areas such as quantum computing, artificial intelligence and virtual reality. While in some countries the start-ups visa is not location specific others like Japan have allowed such easier entry into selected region and/ or cities. Some of the countries in the Asia-Pacific region which have a start-up or entrepreneur visa are presented in Table 3.

Apart from start-up or entrepreneur visa, some countries also have special provisions to attract foreign talent. For example, the Startup SG hub programme of Singapore provides entrepreneurs with a launch pad and a platform to connect them to the global stage and access to local support initiative.[24] In China, foreign companies are provided a break on provisional income tax on profits.[25] The Peacock Initiative, which is a programme started by the Shenzhen Municipal Government, attracts high-level foreign talent in the field of entrepreneurship and innovation.[26] Through this program, subsidies are made available for foreign startups in areas such as information technology (IT), robotics, and aerospace engineering.

Key challenges

The Asia-Pacific region depicts huge variation across countries, as it consists of developed, developing and even least developed countries. While start-ups, especially technology-based start-ups are growing, there are several barriers that are impeding their growth potential. Some of these barriers are discussed in the following section.

Barriers to starting a business: A lot of reforms have been introduced in the Asia-Pacific region in the last couple of years to ease the process of starting a business or a start-up. However, there are still barriers in majority of the countries, especially developing countries, in terms of complex documentation and regulatory procedures, low level of contract enforcements, lack of efficient dispute resolution processes, access to credit, etc. (World Bank, 2019). As per the World Bank's Ease of Doing Business Report, 2019,[27] majority of the Asia-Pacific countries (excluding the developed ones such as Singapore, Australia, Japan, Republic of Korea and New Zealand) had a low rank in ease of doing business (Figure 1). There is wide variations in terms of time required to start a business - while it takes only 1 day in New Zealand and 3 days in Australia, it takes around 99 days in Cambodia and 174 days in Laos.[28] In developed countries, such as Singapore and Japan, while the infrastructure and regulations are well in place for growth of technology based start-ups, the cost of living and operating a business is often high, compared to the developing countries.[29]

Low level of spending in research and development: While countries such as Singapore, the Republic of Korea, Japan and China have invested in R&D, the overall level of R&D spending has been low (below 1 percent of the country's GDP) in majority of the Asia-Pacific economies. For example, in Indonesia, the R&D spending in 2015 was recorded at 0.24 percent of the GDP and in Philippines, it stood at 0.14 percent in 2013.30 Thus, the R&D spending is highly concentrated in a select few economies in the region. The low-level of R&D spending in developing and least-developed countries leads to lower adoption of technologies and patents.

Lack of a comprehensive policy framework for data protection: The rapid growth of technology is making it difficult

[24] https://www.crunchbase.com/organization/startup-sg (last accessed October 13, 2019)
[25] https://www.reuters.com/article/us-china-economy-investment-tax/china-temporarily-exemptsforeign-firms-from-taxes-for-reinvested-profits-idUSKBN1EM0GI(last accessed October 13, 2019)
[26] https://www.china-briefing.com/news/incentives-shenzhen-attracting-foreign-talent/ (last accessed October 13, 2019)
[27] The Ease of Doing Business Rankings were based on 190 countries
[28] https://data.worldbank.org/indicator/IC.REG.DURS (last accessed October 13, 2019)
[29] https://www.valuechampion.sg/best-countries-asia-pacific-startups (last accessed October 13, 2019)
[30] http://uis.unesco.org/en/news/rd-data-release (last accessed October 13, 2019)

for the governments to regulate technology, to prevent its misuse and to ensure consumer protection and privacy. However, without comprehensive policy framework for securing data generated by technology companies and start-ups, there arises threats of cyber-attacks and misuse of data. In majority of the Asia-Pacific countries, while there is privacy or data protection law (see Table 2), the regulations are not comprehensive as in the case of the European Union's General Data Protection Regulation (GDPR), where data is regulated on the basis of general data protection principles across industry sectors without distinction. In countries such as China, data protection regulation (Cyber Security Law) is more sector-based, focused on sectors such as financial services and telecommunications.31 Also there are restrictions on cross-border sharing of data with a trust, which restriction collaborations. Further, in a number of countries, the laws and policies seem to be overlapping each other. For example, in India, both the Draft E-commerce Policy and the Draft Data Protection Bill (both pending approval) have provisions to regulate various aspects of data. The Asia-Pacific region also has its own data protection policy called APEC Privacy Framework, however, not all the countries in the region are part of it.

Digital divide: While a number of technology-based start-ups are coming up, digital infrastructure has not improved equally across the Asia-Pacific countries. In terms of internet penetration,32 most of the developed countries have a high-rate of penetration as compared to developing and least developed economies. For example, Australia has a penetration rate of 87 percent, New Zealand (91 percent), and Singapore (88 percent). However, countries such as Sri Lanka has a penetration rate of 34 percent, Bangladesh (15 percent), Laos (26 percent), are struggling to reduce the digital divide.33 Similarly, in terms of smartphone penetration, the rate is high in countries such as the Republic of Korea (70.4 percent), while it is quite low in countries such as Bangladesh (18.5 percent).34 Further, in terms of know-how necessary to discover, understand and build new technologies; overall context that ensures the development of digital technologies and level of preparedness to exploit digital transformation, some countries lag far behind than some others in the Asia-Pacific region.35 As per the Global Digital Competitiveness Index (2019), which ranked 68 countries on the basis of the above-mentioned parameters, countries such as India (ranked 44th), Indonesia (ranked 56th) and Philippines (ranked 55th) ranked far behind other developed economies such as Singapore (ranked 2nd), the Republic of Korea (ranked 10th) or Australia (ranked 14th).

Issues with financing: In spite of there being a number of government-backed funding support available to the start-ups in the region, it is still inadequate to support the businesses and start-ups, especially during their inception stage. In the initial stages, start-ups suffer from lack of funding which mainly comes from angel investors, venture capital funds and other businesses. Studies show that in countries such as Vietnam, 80-90 percent of the start-ups fail in the initial stage as they lack funding to move into the expansion stage.[36] In China, early stage venture capital funding constituted only 3 percent of the total venture funding received for all the stages in 2018.[37] Further, in the initial stages, start-ups also face funding issues in terms of getting access to institutional finance. For example, in Philippines, almost 50 percent of the small businesses or start-ups lack access to formal loans.[38]

Way forward

The Asia-Pacific region have rapidly grown into a vibrant start-up ecosystem with a number of start-ups increasingly embracing new technological advancements. However, there exists wide variation in terms of development of start-ups, adoption of technology and availability of government support and funding. Countries such as Singapore, the Republic of Korea, Australia, etc., have already developed into major start-up hubs while countries such as India, Indonesia and Philippines are emerging as potential hubs for technology-based start-ups, owing to recent growth in innovation and entrepreneurial activity.

In order to make the Asia-Pacific a technology start-up hub, the policies, infrastructure and government support in terms of providing funding and incentives need to develop, especially in the emerging markets such as India, Indonesia, Malaysia, etc., which have a higher potential to grow as regional hubs for technology-based start-ups. With increased demand for adopting digitalisation, digital infrastructure needs to be improved in terms of access to internet connectivity, affordable smartphones, higher upload speeds, among others. Improved access to digital infrastructure increase consumer's interaction with the digital economy, creating greater demand for tech-products and services, thereby encouraging growth of start-ups. Moreover, with increased digitalisation and adoption of advanced technology by the start-ups, protection of data has become increasingly important today.

This calls for greater collaboration and cooperation among the countries of the region, sharing of best practices and formation of comprehensive policy frameworks for data protection and security that can address issues such as transfer of personal data, ownership of data generated by

[31] https://www.hoganlovells.com/en/publications/data-protection-and-breach-notification-legislation-strengthens-across-the-asia-pacific-region (last accessed October 13, 2019)
[32] Individuals using the internet as a percentage of population
[33] https://data.worldbank.org/indicator/IT.NET.USER.ZS (last accessed October 13, 2019)
[34] https://newzoo.com/insights/rankings/top-countries-by-smartphone-penetration-and-users/ (last accessed October 13, 2019)
[35] https://www.imd.org/globalassets/wcc/docs/release-2019/digital/imd-world-digital-competitiveness-rankings-2019.pdf (last accessed October 13, 2019)
[36] https://www.retailnews.asia/vietnam-startups-lack-government-support-when-it-matters-most/ (last accessed October 13, 2019)
[37] https://news.crunchbase.com/news/after-frenetic-start-chinas-vc-ecosystem-cools-in-late-2018/ (last accessed October 13, 2019)
[38] https://www.entrepreneur.com/article/338931 (last accessed October 13, 2019)

government and businesses, etc. The provisions of the APEC Privacy Framework may be harmonised in line with EU's GDPR in terms of providing a unified regulatory framework on privacy and data protection across the countries in Asia-Pacific.

In terms of R&D spending, the governments at national level need to allocate increased amount of money as part of their budgets for undertaking technical research and development to promote innovation and entrepreneurial activity. There should be higher investment in tertiary education and in development of state-based accelerators and incubation centres to promote technology-based start-ups. Private investment needs to be encouraged for creation of knowledge parks for developing technology start-ups in sectors where the specific city or country has a comparative advantage. For example, fin-tech being one of the promising start-up segments in cities such as Jakarta (Indonesia) and Manila (Philippines), fin-tech knowledge parks can be created. Further, the governments should engage in cross-country collaborations in developing R&D centres of excellence and in promoting technology transfer through development of joint start-up hubs. Bilateral partnerships can also be developed for deploying high-quality solutions and cutting-edge technologies, supported by innovative financing, across different sectors such as agriculture, healthcare, education, among others. For easing the business processes for a start-up, although various reforms have been undertaken, it has not been at the same scale across all the countries in the Asia-Pacific region. Country-specific reforms need to be undertaken such as – Bangladesh needs to reduce the cost of registering a new business, Cambodia needs to reduce the complex documentation processes so as to reduce the time taken to start a business, Indonesia needs to reduce the minimum capital requirement for starting a business, etc. In terms of addressing the financial issues for the start-ups, the institutional finance mechanisms need to be strengthened, so that small businesses and start-ups can gain easy access to credit, especially in the initial stages when funding requirement is very crucial for later expansion. Further, start-up events and meet-ups need to take place at regular intervals at select start-up hubs to provide a collaborative platform for new start-ups and businesses to gain ideas and funding.

With increased digitalisation and adoption of advanced technologies across countries, new consumer markets are evolving. This has provided plenty of room for start-ups to flourish, especially in the Asia-Pacific region owing to the presence of a huge consumer market, increased economic growth, low cost of labour in countries such as India and Indonesia, development of entrepreneurial culture, among others. To fuel this growth, countries need to encourage the entrance of foreign start-ups, innovators, investors, etc., to help in technology transfer and to provide a competitive environment for the local start-ups to be more innovative. Countries can explore the idea of start-up visas to attract foreign talent, increase investment and technology flows and create employment opportunities in the domestic market. To conclude, the countries in the region should realise their potential and the regions potential to develop as a start-up hub. They should also realise that technology based start-ups will lead to high quality jobs, investment in innovation and research and development, enable (a) the developed countries of the region to further improve their productivity and efficiency and (b) the developing countries to harness the benefits of technology for sustainable and equitable growth. However, this can be achieved only through right policy initiatives in the domestic front and greater collaboration and cooperation at international level.

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Technology-based Start-ups in the Asia-Pacific Region

Policies and strategies of selected countries

H. Purushotham[a] and Shashank Sonal[b]

[a]Chairman and Managing Director
Tel: +91-11-29241212, Mob: 9599229217, E-mail: cmdnrdc@nrdc.in

[b]Technology Transfer Analyst
Tel: +91-11-29240401 (EPBAX- 440), Mob: 9015918565, E-mail: shashankkv@nrdc.in

National Research Development Corporation (NRDC)
20-22, Zamroodpur Community Centre, Kailash Colony Extension, New Delhi-110048, India

Abstract

Start-up ecosystem invariably builds upon a range of stakeholders which include the higher education institutions, incubators, accelerators, seed funding and venture capitalists, government, co-working spaces, networking events, media apart from a general business culture. A healthy ecosystem develops when all or most of these sub-systems are supportive of the entrepreneurship and topped up by a healthy economic growth. APAC region has a geographical discontinuity but many of its economies share widespread trade and commerce relations with multiple global value chains integrated amongst themselves. The on-going Regional Comprehensive Economic Partnership (RCEP) negotiations also seek to bind many of these economies into a close-knit policy framework and needless to say innovation ecosystem and IPR form an important aspect of the negotiation talks. It becomes critical then to have an overview of the varying level of innovation in general and startup ecosystem and policies to evolve synergies in the region. To see where synergies can be built is an important exercise in greater integration of the region. Start-ups drive economy and as a World Economic Forum report argues that 'not all start-ups make it big but those that do greatly impacts society by way of new technology, services and increased employment'. This review article explores the initiatives taken in the economies of the Asia-Pacific to promote the growth of innovation, start-up and entrepreneurial ecosystem and suggests a few areas where more efforts could be made in the coming years.

Introduction

The Asia-Pacific (APAC) region is made up of a bunch of countries located in or in the vicinity of the Western Pacific Ocean. The region came to occupy the imagination of the world as an entity in the late 1980s when issues of politics, economy and security in the region came to be discussed more often in the international arena.

There are different interpretations of the meaning of the Asia-Pacific region, and they vary by context. However, for most purposes the APAC region includes countries throughout East and South Asia, Southeast Asia and Oceania (Figure 1).

Asia-Pacific region is fast emerging as the economic power house of the world with many leading emerging economies like China, India, ASEAN, and other developed nations like Australia, Japan and the Republic of Korea as part of this region. Economic growth in this region, as elsewhere, is also being led by innovation driven companies including new age technology start-ups. Truly, 21st century being the age of innovation, many technology based start-ups in this region are globally recognised and at par with many established companies. National and provincial governments in many of these nations also recognise the important role being played by the start-ups in the economic growth and employment generation and hence are increasingly devising supporting policy frameworks for the unbridled progress of start-ups. Throughout this article, it is being tried to present an overview of the policies of the national governments and state of start-ups in some of these countries and also list out some strategies in the form of recommendations based on our own experience of the start-up ecosystem in India.

Start-up ecosystems in the Asia-Pacific region

Japan

The start-up culture in Japan picked up in the late nineties with the increasing penetration of internet and driven largely by online ventures. The amount of investment in start-ups has been steadily growing since then and has reached to USD 3.5 Billion in 2018 from a mere USD 586 Million in 2012. The current growth is led by sectors like FinTech, HealthcareTech and Artificial Intelligence with flagship start-ups like Japan Taxi (taxi hailing app), Folio (asset management) and Freee (Autonomous book keeping service) leading the funding rounds (Ikuo, 2019).

Amongst major Japanese cities, Tokyo leads in having 77% of the investment agglomerations. Others like Osaka and Fukuoka are also trying to catch up. A recent trend has been the emergence of deep tech start-ups through leading universities like the University of Tokyo and the University of Keio. Start-ups like WealthNavi (asset management through robotics) and LPixel (life science and image analysis) are university born and have raised good investments.

Ministry of Economy, Trade and Industry (METI), Govt. Of Japan is presently running a new initiative called the J-Start-up from June, 2018 under which it aims to create an enabling ecosystem for internationally competitive Japanese start-ups through

Figure 1: Asia-Pacific Region [Image Source: Media Convergence Asia Pacific (Google Images)

intensive incubation support. It is also part of the Government of Japan's goal of creating 20 start-up ventures with a market capitalisation of over USD 1 Billion (unicorns) by 2023 (METI 2018). The support includes J-StartUp Certification, invitation to global events like GITEX FUTURE STARS, WebSummit, SLUSH, Consumer Electronics Show; free use of Global Accelerator Hub at JETRO's overseas arms; business matching with potential enterprises; preferential incentives in terms of financing and regulation etc. (Jopus, 2018)

The government of Japan has also started a new start-up visa scheme for foreigners to stay upto 1 year in Japan for starting their businesses in order to bring in more foreign investment into the Japanese economy. The scheme is sponsored by the Tokyo Star Bank Limited (Ikeda, 2018)

Promoting separate identity/branding for start-ups by protecting their core technology/idea in the form of Intellectual Property Protection is a key requirement in helping the start-up to scale up and forge collaboration with other businesses both nationally and internationally. Towards meeting this end, the Japanese Patent Office (JPO) has started a program titled IPAS (IP Acceleration Program for Start-ups) whereby it will initially support 10 businesses in their IP protection and scaling (Ministry of Economy, Trade and Industry, Japan).

Republic of Korea

The Republic of Korea is one of the leading regional and global players as far as promotion and nurturing of start-ups is concerned. It has the highest per capita government spending on start-up support ecosystem. The government of the Republic of Korea invested almost USD 3 Billion in 2015 in the start-ups and has further announced a plan in 2018 to set up a USD 9 Billion venture fund on public-private partnership model (Guttman, 2018). Ministry of SMEs and Start-up was established in 2017 to operationalise the dream of a creative economy (Nina, 2018). Its major policy directives are preparing for a start-up boom, promotion of technology startups, creation of a regulation free regime for new businesses/start-ups, professional training for creation of skilled workforce and support like revival of promising start-ups under duress among others (Nina, 2018; Ministry of SMEs and Start-ups, the Republic of Korea) has a mission to create a vibrant ecosystem culture modelled on the style of Israel's Tel-Aviv. The government has started programs like the K-Start-up Grand Challenge to attract foreigners with flight allowances, office space and stipends to foreign founders. Domestic entrepreneurs are supported to take advantage of the country's vibrant R&D ecosystem with encouragement like re-absorption in the companies if their ventures fail to take off. The major advantages of the Republic of Korea in this segment are its primarily urban population and a large educated middle class. The internet penetration is as high as 97% with the Republic of Korea also amongst the top in the list of most innovative countries (Guttman, 2018).

The size of the start-up sector has also been growing over the years with the absolute number of start-ups increasing from a mere 2000 in the year 2000 to over 30000 in 2015. Major cities which are hub of start-ups are Gangnam and the capital Seoul.

China

As far as China is considered, the country is largely driven by the innovation aspiration

in recent years shedding its proclination for traditional businesses. The R&D spending on newer technologies has been increasing massively over the years and this is helping China to shift from a predominantly labour-intensive manufacturing economy to the new age technology driven economy. The number of awarded patents is growing as are the number of scientific technology demonstration parks and zones. Online technology- particularly ecommerce, social media and internet banking are driving key changes in the Chinese market. Companies like Alibaba, Baidu and Tencent have become global role models. China also houses the major decacorns (start-ups worth more than USD 10 billion) like Bytedance and Didi Chuxing. Culture of start-ups and entrepreneurship is ever increasing and newer funding landscapes like crowd funding are also being explored widely. However, seamless growth is restricted by the presence of a certain degree of bureaucratic red-tapism, market fragmentation, local protectionism, entry barriers in some monopolistic sectors, which hinder SMEs from proper growth (WEF, 2016).

China has taken many market oriented reform initiatives like tax benefits to the startups, and widening the business activities eligible for deduction from Corporate Income Tax. China has a network of more than 2300 mass entrepreneurship spaces and more than 3000 technology incubators/accelerators. For giving a legal regime for intellectual proparty rights (IPR) protection, IPR courts have been setup in many areas like Beijing, Shanghai and Guangzhou.

The 'Made in China 2025' plan signals a fundamental shift from heavy industries and manufacturing to services and innovations. Government, both central and provincial are taking to funding enormously the early stage start-ups (Livemint, 2018).

Australia

Australia has a National Innovation and Science Agenda (NISA) worth USD 1.1 Billion which includes a USD 200 Million for CSIRO Innovation Fund, tax incentives for early stage investors etc. among others. This agenda has been tailor made to suit the enabling environment needed by the start-ups in their early blooming stage (Koehn, 2019).

Accordingly, an independent statutory body called Innovation and Science Australia (ISA) was created with the mandate to provide government policy directions on science, research and innovation matters. The ISA Board is also tasked with the oversight of the government programmes on tax incentives for R&D, venture capital partnerships and funding, Entrepreneurs support ecosystem, Biomedical Translation Fund and Cooperative Research Centres (Innovation and Science Australia, 2016).

The Business Research and Innovation Initiative (BRII) is a USD 19 Million fund to support entrepreneurs to create new products that meet the government needs with the resources to provide for IP Rights and right to commercialisation. An Entrepreneurs' Program funds grants based support to prospective entrepreneurs running over USD 100 Million. The Australian government is also seeking to improve its labour regulations making it attractive for starting entrepreneurs to manage their workforce.

Australian government is also promoting innovation in indigenous communities through initiatives like Indigenous Entrepreneurs' Package of over USD 115 Million.

Singapore

Start-up ecosystem in Singapore is currently led by the Start-up SG initiative for start-ups launched in the year 2017. It is basically an umbrella term for all the policies framed for start-ups covering financing, funding and capacity building. Start-ups in Singapore are being facilitated to harness local resources as well as connect with their global peers to build their businesses. Apart from providing mentorship through Accredited Mentor Partner (AMP) to first-time entrepreneurs, early stage funding to companies for commercialising proprietary technologies, funding support to incubators and accelerators, in-house R&D support to start-ups, loans to start-ups and SMEs, the government also takes equity investment in promising start-ups along with third-party investors. The SPRING Seed Capital (SSC) leads this equity investment initiative of the government with a focus on deep tech start-ups and Advanced Manufacturing and Engineering (AME) startups (Singapore Company Incorporation).

Singapore also welcomes global talent through their EntrePass work scheme with several relaxed evaluation parameters over the years. The number of start-ups has significantly grown in Singapore with more than 50000 registered start-ups in 2019 as compared to around 22000 in 2013. It has the sixth highest percentage of immigrant start-up founders in the world as well as third highest level of global connectedness even higher than the Silicon Valley (Singapore Company Incorporation).

The government backed Global Innovation Alliance (GIA) is building a chain of entrepreneurial network across the countries of the world to enable co-creation of ideas and information based economies. The start-ups based in Singapore can thus access major innovation hubs which are part of the GIA to find more partners, create new businesses etc (Singh, 2018).

Singapore's core strength in the start-up ecosystem stems from its strong government initiatives and one of the strongest IPR regimes in the world. The corporate tax rates are amongst the lowest in the world and the government also offers several tax incentives to new businesses in the country. Singapore also acts as the gateway to other ASEAN economies for the rest of the world tapping a market worth 600 million people and many emerging economies among them. Thus, global start-ups find it an attractive preposition to base themselves in the country (Start-up India Portal, Ministry of Commerce & Industry, Government of India)

Other ASEAN members

Other nine ASEAN economies also share a demographic profile that is ripe to support start-up ecosystem in the region. Almost 70% of the population of these nations is younger than the age of 40, making them

adept to take risks that come associated with the start-up business. The internet usage is fourth highest in the world with an ever increasing presence of online population (90% of under 30 population has access to internet and is tech savvy).

After Singapore, Indonesia and Malaysia have the most promising start-up ecosystem. Malaysian start-ups have been relatively successful in terms of exit successes from initial investment in their businesses. Indonesia also has an emerging start-up ecosystem in terms of increasing number of centaurs (> USD 100 Million valuation).

According to Start-up Genome (USA) report of 2017, Kuala Lumpur has the third highest start-up growth index globally with some 350-650 start-ups thriving in the country. Its global connectedness, women entrepreneurship and talent access and cost parameters are fairly high amongst the ASEAN economies. Other nations like Thailand, Viet Nam, Cambodia and Philippines have a relatively nascent start-up ecosystem in the ASEAN Member States' cohort. The Global Entrepreneurship Index (GEI) prepared by the Global Entrepreneurship and Development Institute (GEDI) also highlights that a mindset change in terms of attitude and not ability is needed in most ASEAN economies to promote innovation and start-up ecosystem which currently lags behind their global peers (Malaysian Global Innovation and Creativity Centre, 2017). A thrust on collaborative platforms tied to the local lifestyle may just be the way forward to appeal to the senses of the people in the short and medium term.

Sri Lanka

Sri Lankan start-up ecosystem is concentrated in and around Colombo. Most of the start-ups are tech oriented due to the easy availability of a technically qualified workforce. However, the concept of 'match-to-market' is missing in many product developers as highlighted by GSMA Ecosystem Accelerator report. Start-up growth enablers like availability of debt capital on easier terms, access to online payment systems, supportive regulatory environment; all are in relatively nascent stage of development thus restricting the full growth of start-up ecosystem and entrepreneurial culture in Sri Lanka. Most of the Sri Lankan start-ups are early age tech start-ups in expansion phase with growing revenues (Start-up Sri Lanka report 2016). SLASSCOM 1000 StartUp Program by 2022 has been recently started as means to generate more business growth and provide employment in a saturated job market. Sri Lanka however needs many more initiatives like external funding for startups, accessible and affordable incubation spaces, more open and collaborative business culture (participation in global start-up events, branding of Sri Lankan start-ups, media coverage, government procurement support etc.), building skill sets of the workforce in new age technology areas, simplification of regulatory requirements for start-ups to really foster the growth of start-ups in the country.

Policy interventions like the National Policy Framework for Small Medium Enterprise (SME) Development seek to support the start-up ecosystem.

Bangladesh

Bangladesh is relatively new to the start-up world with the number of start-ups in the country pegged at around 280 according to a techinasia report (Imran, 2017). The majority startups are concentrated in software development and ecommerce spaces. With a growing middle class population and internet penetration in the country, the start-up businesses are poised to grown in the coming years. There are government run programs like the Digital World Initiative (for promoting digital services and internet in the country) and Idea (working spaces and other assistances to selected startups) which are pushing the growth of start-ups in the country. However, some issues like lack of innovation and knowledge gap, infrastructure constraints and lack of start-up finance holds back the proper growth of start-up ecosystem in the country.

New Zealand

As per the Start-up Genome's 2019 report, New Zealand fares quite well in Agrotech and new food start-ups as well as life sciences based start-ups. Since 2013, more than 40 agtech start-ups have been founded in the country tapping into the thriving dairy and meat industries of New Zealand. New Zealand's top position in the ease-of-doing business index makes it relatively easy to start a business there, which goes as low as half a day. Other factors like refundable tax credits upto 15% for businesses investing in R&D and start-ups creates an ideal funding scenario for many start-ups. Many local start-ups have built a significant number of offshore customer base compared to other start-up ecosystems around the globe (Nzentrepreneur, 2017).

Some of the prominent start-ups of the Asia-Pacific region have been shown in Figure 2.

India

The latest statistics show that till August 2019, there are more than 393 unicorns (start-ups valued more than USD 1 billion) around the world and India houses 26 of them, including firms like Ola Cabs, Hike, Quikr, One97 Communications, ReNew Power Ventures, Delhivery, Oyo Rooms, Rivigo, Policy Bazaar, Swiggy, Zomato, Ola Electric, Byju's etc (Figure 4 depicts their current market valuation in billion USD). New entrants like Byju's have fetched massive investment and valuation in the edtech category in recent years and with the exit of Flipkart after acquisition by global giant Walmart, the Indian start-up ecosystem has given signs of maturing. India thus currently ranks third after the USA and China in having largest number of unicorn start-ups as well as the size of its start-up ecosystem.

The Start-up India website also shows 22813 recognised start-ups operating in the country as of September 2019, clearly showing the progress that the country has made in the last five years on this front. The total number of Indian unicorns also more than tripled to 26 with 16 start-ups added to this list within a year and half itself. After the launch of the flagship scheme Startup India and others like Standup India, Mudra Yojanas, Make in India, Fintech schemes, JanDhan-Aadhar-Mobile (JAM) trinity, etc. the start-up ecosystem in the country has

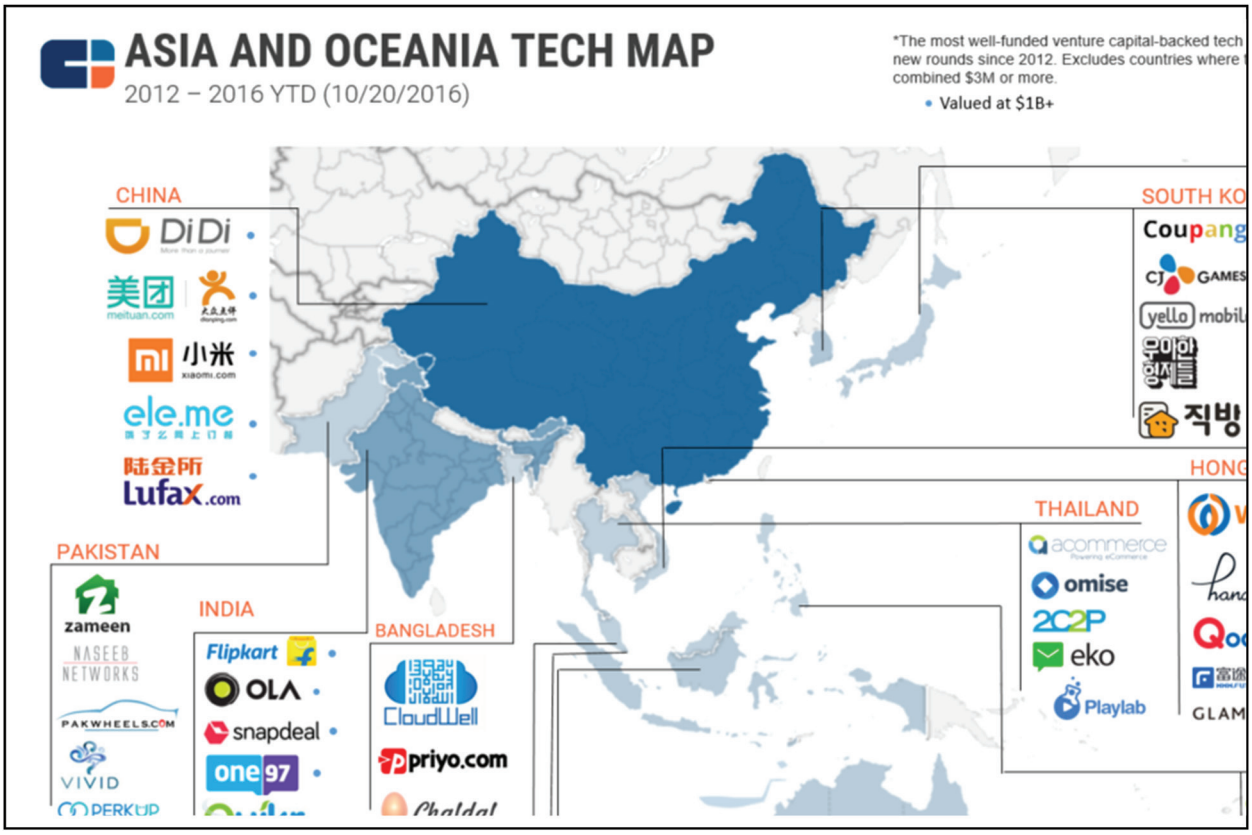

Figure 2: Major startups in Asia and Oceania [Source: CBINSIGHTS Research Brief]

seen a major boost. A year-on-year growth of 12-15% is happening in the number of new start-ups that are being formed in the country as per a NASSCOM-Zinnov Start-up Ecosystem Report, 2018. Advanced technology areas like Data Analytics, AI and IOT are also seeing maximum number of start-ups. The investment between 2014 and 2018 (till June) also amounts to more than USD 35.3 Billion with more than half of this investment coming in or after 2017. The incubator/accelerator ecosystem in India also continues to be third largest in the world after China and USA, with over 210 of them active across corporate, academia and the government. Amongst the Indian start-up hubs region-wise, Delhi-NCR leads the country in having more than 7000 active start-ups followed by Bengaluru (5234), Mumbai (3829), Hyderabad (1940), Pune (1593) and Chennai (1520) as per the latest TiE-Zinnov 'Turbocharging the Delhi-NCR Startup Ecosystem' report published in September 2019. Delhi-NCR also has the largest no. of unicorn start-ups (10 no.) valued at more than USD 1 Billion

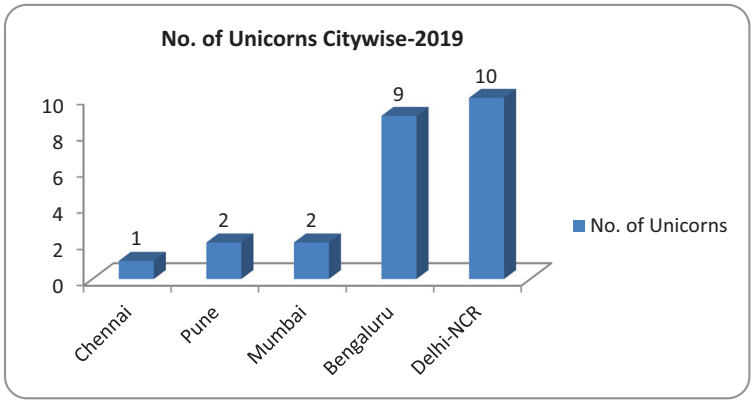

Figure 3: Number of unicorn start-ups in Indian cities

(Figure 3) and a cumulative valuation of all its start-ups averaging at USD 50 Billion. The report also says that Delhi-NCR has the potential to become one of the top five global start-up hubs with 12000+ startups, 30 unicorns and cumulative valuation of over USD 150 Billion by 2025 with appropriate policy interventions (TiE Delhi NCR-Zinnov, 2019).

If the case of entrepreneurial demographic profile and background is considered, entrepreneurs with strong education and professional experience with understanding of business and networking are traditionally more successful in India, also demonstrated by the skewed share of start-up founders in the 31-40 year age group, a period known to be marked with both maturity and the zeal to start one's own business (Figure 5)

The Government of India launched its flagship scheme Startup India in January 2016 comprising a broad Start-up India Action

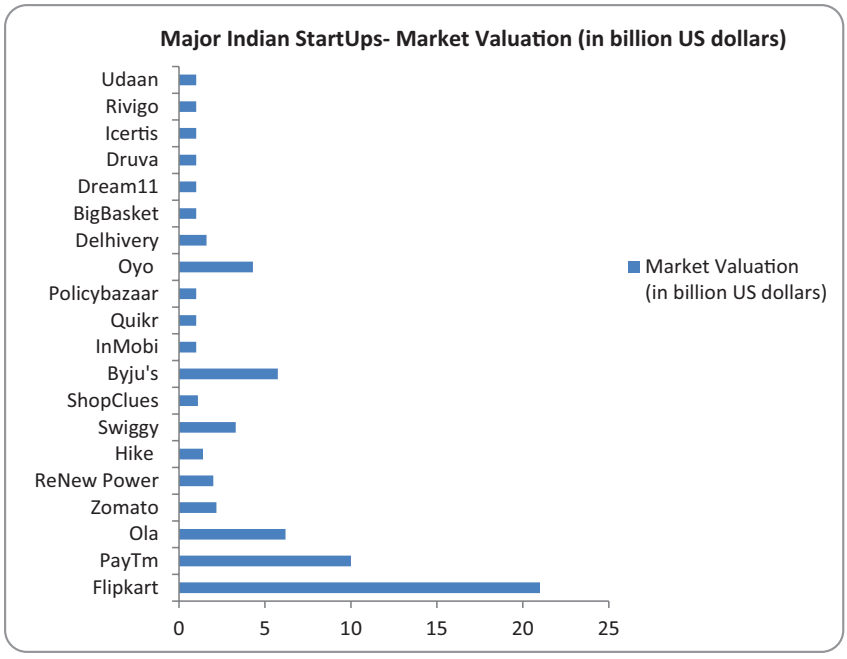

Figure 4: Market valuation of major Indian/Indian origin startups (Source: CBInsights)

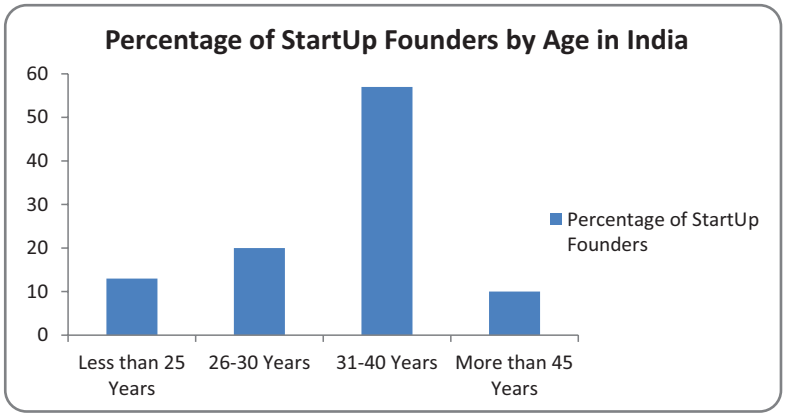

Figure 5: Age-wise breakup of startup founders in India

Plan. This initiative of the government aims to strengthen start-up movement in India and empower start-up growth through design and innovation. Taking forward from the initial action plan, the government has introduced several incentives for start-ups as highlighted in the Table 1.

In the recent years, Indian public sector entities have also started to invest heavily in promoting innovation and commercial R&D in the country through start-up funding schemes. The Ministry of Petroleum & Natural Gas, Government of India started a program for startups in October, 2017 through its 10 oil and gas companies and set-up a corpus fund of Rs. 320 crore for a period of three years to support innovations in the energy sector. This program started following the already running schemes of Oil and Natural Gas Corporation (Rs. 100 crore fund corpus) and Indian Oil Corporation (Rs. 30 crore revolving fund corpus). National Research Development Corporation has been a proud partner of the Indian Oil Corporation's start-up scheme since 2017 and is presently monitoring and mentoring 23 startups over two rounds of funding.

Start-ups founded in India are serving a host of different areas starting initially with marketplace and e-commerce players like InMobi and Flipkart and now well rounded to cover FinTech, Health-tech, Edtech, Social, Agrotech and Advanced technology areas as highlighted in Table 2.

Thus, India is well poised to gain significantly in the start-up ecosystem and turbo-charge its economy through start-ups in the coming years. However, there is the need of continuous incremental policy and systemic support to the start-ups. Asia-Pacific remains one of the most important regions to benefit from the start-up revolutions happening in its major economies and can become the engine of growth and prosperity for the world in the 21st century. A few recommendations have been provided in the next section towards achieving this goal in terms of thrust areas and policy interventions.

Conclusions

1. All the major economies of the region have atleast one major national programme that is exclusively focused on promoting start-ups and nurturing entrepreneurship. This shows that they realise the important role played by the start-ups in economic growth and job creation in these markets.

2. There is a general policy shift happening towards providing government incentives like tax exemption, favourable IP regime for start-ups and setting up of government supported incubators and accelerators.

3. Countries like China are focusing more on deep tech start-ups to gain a proportionate market advantage in this sector. Academic research is being re-moulded to suit the need of the economy and industries. The potential of deep technologies like AI-ML, Robotics, AR-VR, Drone technologies to fetch greater values in the longer run is already realised here as is the scenario in technology leaders like the USA.

4. Relatively smaller economies like Philippines and Viet Nam are yet to adopt the start-up culture as evident by their lower rankings in the global start-up rankings. Thus, there is a lot of scope in these countries to learn from their peers.

Table 1: Major initiatives and incentives for start-ups in India (Source: StartUp India Status Report, 2018)

- **Simplified and broader definition of startups** – As per the latest revision, any entity shall be considered as a startup for upto 10 years from the date of its incorporation/registration. Also, scalable business models with high potential of wealth creation or employment generation can be recognised as startups now.
- **Recognition for startups** – The government has done away with the need for a letter of recommendation from an incubator/industry association for recognition or availing tax benefits, thus setting up a self-certification based regime. Till date, 22813 startups have been recognised by the Department for Promotion of Industry and Internal Trade (DPIIT)
- **Startup India Hub** – This hub was operationalized on April 1, 2016 for resolving queries of startups and providing them hand-holding services. It has mentored more than 800 startups with incubation, funding support, business pitch etc.,
- **IPR Filing Benefits** – Startups are provided benefits like faster processing of applications and also rebate in the statutory fee for filing applications.
- **Incentives in Government Procurement** – Various norms like prior experience and prior turnover are exempted for public procurement from MSMEs and startups as per several government notifications. GFR 2017 has incorporated rules which provide for relaxation of conditions of prior turnover, prior experience and exemption from submission of Earnest Money Deposit (EMD) for Startups.
- **Tax Incentives** – Government of India provides tax incentives like tax exemption to certified eligible startups for 3 years in a block of 7 years, tax exemption on capital gains as well as exemption from angel tax for investments above Fair Market Value of the startups.
- **Fund of Funds for Startups** – A INR. 10000 crore Fund of Funds (FoF) has been setup to promote innovation driven startups. This fund is being managed by SIDBI and till date has committed more than 1600 crores to 32 Alternative Investment Funds (AIFs) which have invested in more than 200 startups.
- **Learning Services** – Startup India portal offers an interactive free online learning and development module to aspiring startups and entrepreneurs.
- Establishment of Incubators, Tinkering Labs, and Research Parks to drive innovation at grass root level under the Atal Innovation Mission banner.
- **Startup India Yatras** – More than 12 states including Gujarat, Odisha, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Telangana, Maharashtra, Andhra Pradesh and Jharkhand have successfully organised these Yatras till date which aim to help entrepreneurs, especially from non-metro cities and rural areas to realise their startup dreams.
- **Faster Exit for Startups** – Startups shall now be able to wind up their business within a period of 90 days from making an application for the same as compared to the 180 day period for other firms, as per the revised norms under the Insolvency & Bankruptcy Code (IBC), 2016.
- **State Startup Policies and State Startup Ranking** – These have been formalised to promote state led growth of startups as well as foster a culture of mutual competitiveness among states.

- Apart from this, several government ministries and departments run schemes for startups like the Venture Capital Scheme (VCS) for startups by the Ministry of Agriculture to provide interest free loans to setup up agribusiness projects, Biotechnology Ignition Grant (BIG) by the Biotechnology Industry Research Assistance Council (BIRAC), Pradhan Mantri Mudra Yojana by Ministry of Finance to provide micro-loans to entrepreneurs and SHGs, Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) scheme by Department of Scientific and Industrial Research, Credit Guarantee Schemes run by Ministry of Micro, Small and Medium Enterprises, Export Promotion Development scheme for startups and MSMEs by Ministry of Commerce and Industry, etc. among others.

5. Countries which have been spending heavily on R&D, promoting incubation centres and providing seed/venture funding and other ecosystem support are the ones where strong global start-ups are thriving, like China, Singapore and the Republic of Korea.

Some steps thus can be taken to further support the start-up ecosystem in the region which are being suggested below:

1. Identifying the sector specific core areas which need to be promoted to build a collaborative multi-axle (inter-nation) hub and spoke (intra-nation) model. Strengths of one nation can be matched to the strength of other nations. Some of the promising sectors are consumer products, next gen e-commerce, travel & hospitality, education & edtech, food & foodtech, financial services, logistics and supply chain, and mobility where cooperative structures can be built.

2. Increasing structured institutional support frameworks for early-stage start-ups (pre-seed to series A funding stage) to facilitate their integration into global markets.

3. Predictable and supportive policies for growth of start-up ecosystem. Preferably government procurement support to start-ups to build their capacities, while at the same time increasing government access itself to disruptive innovations brought about by the start-ups. Government supported startup hubs should be created and nurtured.

4. More thrust on deep-tech start-ups and leveraging academic networks to support technology based innovation. World class start-up ecosystem having required infrastructure support like affordable co-working spaces and centres of excellences should be created.

5. Policy support in the form of prototype development and validation, testing, certification, global benchmarking, networking, marketing and IPR filing for start-ups (Purushotham, 2019).

Table 2: Major sectors served by Indian start-ups

Major sectors served	Number of startups
Advanced Technology (Data Analytics, IOT, AI, VR, AR, Block Chain etc.,)	1200+
FinTech	2000+
Marketplace/E-commerce	2000+
Health Tech	2550+
Ed. Tech	400+
Social	400+
Agri-Tech	450+

6. Outcome-based assessment of technology incubators and accelerators. While, there is an increasing number of incubators/accelerators across these economies, many lag behind in having access to quality mentors, training programs for managers and staff and tool kits to make their programs successful.

7. Building enabling framework for foreign investments as they shall bring the required money and technology to fill the existing gaps in these emerging economies.

8. Developing human capabilities in higher order skills which are the driving engines for most technology based start-ups.

9. Leveraging the RCEP forum to put in place a joint structured mechanism to nurture and promote startups in the member nations. Many of these nations have growing unemployment as a major issue and start-ups can be one way to solve the same.

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Innovation Landscape

GREENING THE ASIA-PACIFIC'S START-UP FORCE

Renz Homer Cerillo

Project Assistant
ICLEI – Local Governments for Sustainability
Southeast Asia Secretariat
Units 3 and 4 Manila Observatory Building
Ateneo de Manila University, Loyola Heights,
Quezon City, 1108, Philippines
TeleFax: (632) 426-0851
E-mail: renz.cerillo@iclei.org

Abstract

The Asia-Pacific is a region characterized by diverse economies that have been flourishing for the past half-century. This unprecedented economic growth also came with bigger and more complex problems that demand inventive solutions. Rapid urbanization and the expanding impacts of climate change are all relatively new environmental issues, hence, require a new wave of solutions. Green start-ups offer creative technologies and services that could mitigate, if not completely address such problems. And even if the road to success is paved with roadblocks and bureaucracy, the region understands the value of innovation and its role in supporting green start-ups. Recognizing the gap between industrialized nations and emerging economies, this article touches on the role of innovation in the green entrepreneurship community, and how the region is supporting its green start-ups through an array of promising initiatives and programs.

Home to 60% of the global population, the Asia-Pacific region spans from some of the most populous countries - China, India, and Indonesia – up to the smallest island states. The region's diversity, coupled with increasing urbanization, skyrocketing demands for resources, and deteriorating environmental conditions, has heralded challenges that beg impactful solutions. This compels governments to design policies that do not only support viable economic growth, but also respond to the call of the poorest and most vulnerable. But is this enough?

With national governments falling short on many counts and corporations wreaking havoc to the environment, more and more green entrepreneurs have started entering the picture, offering a much-needed vitality and ushering a new age of approach to saving the planet.

And their timing is perfect. Despite risks and uncertainties, the market is ripe for green entrepreneurs and is even expected to grow for the years to come. There is huge potential for green businesses, technologies, and services that address both the causes and impacts of climate change and other environmental challenges. The Organization for Economic Cooperation and Development (OECD) estimates that green businesses could account for 10% of the global market capitalization come 2030,[1] while the United Kingdom Department of Business, Energy and Industrial reports that Asia, compared to its neighbors, owns the biggest value of green sales in absolute terms and per unit of GDP.[2] In other words, Asia is turning more verdant than it has ever been.

Due to an exploding population, the demand for sustainable food systems is higher than ever. With increasing human mobility, low carbon transportation is much needed than before. These are some of the challenges that green startup force can address. The challenge lies in the field where they operate in. Do their governments set up policies that allow them to flourish? Or are they rather crippling and restrictive? This article touches on the broader innovation and business landscape, and looks at a number of local, regional, and global initiatives that shape the green start-up community in the Asia-Pacific. In essence, it aims to understand the driving forces, opportunities, and structures that could either make green start-ups either flourish or perish.

Defining start-ups

Due to a lack of a clear-cut definition, the term "start-up" has been thrown around loosely, conjuring images of the Silicon Valley, human-like robots, self-driving cars, blockchain technology, and any space-age gadget designed by technocrats. But simply put, start-ups are fledgling businesses. Similar to any enterprise, they seek to make a profit in exchange for their services and products.

A vital element of any start-up is innovation, a terminology startups themselves know very well. Innovation is a mindset of adding value to what currently exists. It is putting something out there to make people's lives easier or to address a pressing social or development problem. Taking the form of a process, a system, or an actual product born from ingenuity and necessity, innovation offers a new fashion of doing things to encourage efficiency, reduce cost, or generally increase the value of an organization. But innovation alone does not cut it.

[1] Organization for Economic Cooperation and Development. (February 2019). Innovation and Business/Market Opportunities associated with Energy Transitions and a Cleaner Global Environment. Retrieved on September 25, 2019 from http://www.oecd.org/g20/summits/osaka/OECD-G20-Paper-Innovation-and-Green-Transition.pdf

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A dimension that sets green start-ups apart is their mission to help the environment, putting "emphasis on innovation toward sustainable development."[3] Their business model operates not only to earn money and make a living, but perhaps even more importantly, to give back to the environment either through their sustainable business practices, green supply chains, or their actual products that are geared towards solving an environmental problem or two. With their added value, they supersede conventional products for their "newness and greenness."[4]

The good news is that green start-ups, as a matter of fact, are disrupting the market. The United Nations Environment Programme has reported that green start-ups have received a total of $148 billion of venture capital investment last year – an all-time high.[5] It has also reported that more than 40 companies with venture-capital support have reached billion-dollar valuations.[6] By radicalizing products and processes and pushing unsustainable and environmentally damaging ones to the side, green start-ups have gained traction worldwide. But are they gaining it fast enough? Or are they fraught with challenges, slowing down the green enterprise movement?

The Fourth Industrial Revolution and green enterprises

UN Environment Programme (UNEP) Acting Executive Director Joy Msuya stated that "the fourth industrial revolution offers a real opportunity to create cleaner, greener and more efficient solutions to sustainable development."[7] She is right in many respects, of course. Through efficient machines, assembly lines, and mass production, earlier waves of industrialization have revolutionized the way people live.

But the fourth industrial revolution presents a brand-new vista defined by unprecedented technologies, ubiquitous access to information, and an unparalleled level of connectivity to the digital world. This dynamic arena could drastically shape how green entrepreneurs maneuver through the intricacies of the market.

With the plethora of information and knowledge right under their noses, start-ups are in a strong position to scope the world for its environmental ills. Organizations have stronger data gathering and processing capacity, which perpetuates the cycle of data creation even more. IBM estimates that come 2020, the information available now will have grown 300 folds compared to what is available in 2005.[8] The era of big data provides valuable insights for innovation, and these analytics play a critical role as well in the preservation of the environment through sustainable entrepreneurship.

The height of social media likewise aided their understanding of development challenges, even bringing them closer to their target end-users. There are countless developments that were not possible before but are now due to the ubiquity of information and connectivity as brought about by the fourth industrial revolution.

At the end of the day, while it comes with its own sets of challenges, this period in human civilization is an opportune time for green startups to breakthrough markets and create lasting impacts on the environment, even to the point of restoring natural ecosystems to their original conditions.

Having said this, to flourish in the era of the fourth industrial revolution, it is imperative for start-ups to learn to navigate the space they work in – the arguably the most important of which is their immediate innovation ecosystem.

How does Asia-Pacific fare with the rest of the world?

The Global Innovation Index (GII) is an international yardstick that ranks 129 economies based on five pillars related to agents that facilitate innovation (institutions, human capital and research, infrastructure, market sophistication, and business sophistication), and two pillars relevant to outputs as a result of innovation (knowledge and technology outputs, and creative outputs).[9] This is summarized in the following GII framework (Figure 1).

In its 12th edition, the GII report looks at parameters such as international patent applications, R&D investments, new business creation, cultural and creative services exports, environmental performance, knowledge-intensive employment, and university and industry research collaboration, among many others that make up the 80-metric criteria.[10]

There are two reasons why the GII is worth discussing in this article.

First, it has been established that start-ups, much like any national economy, place a huge premium on innovation. Without it, they will be left behind. Hence, considering its exhaustive assessment

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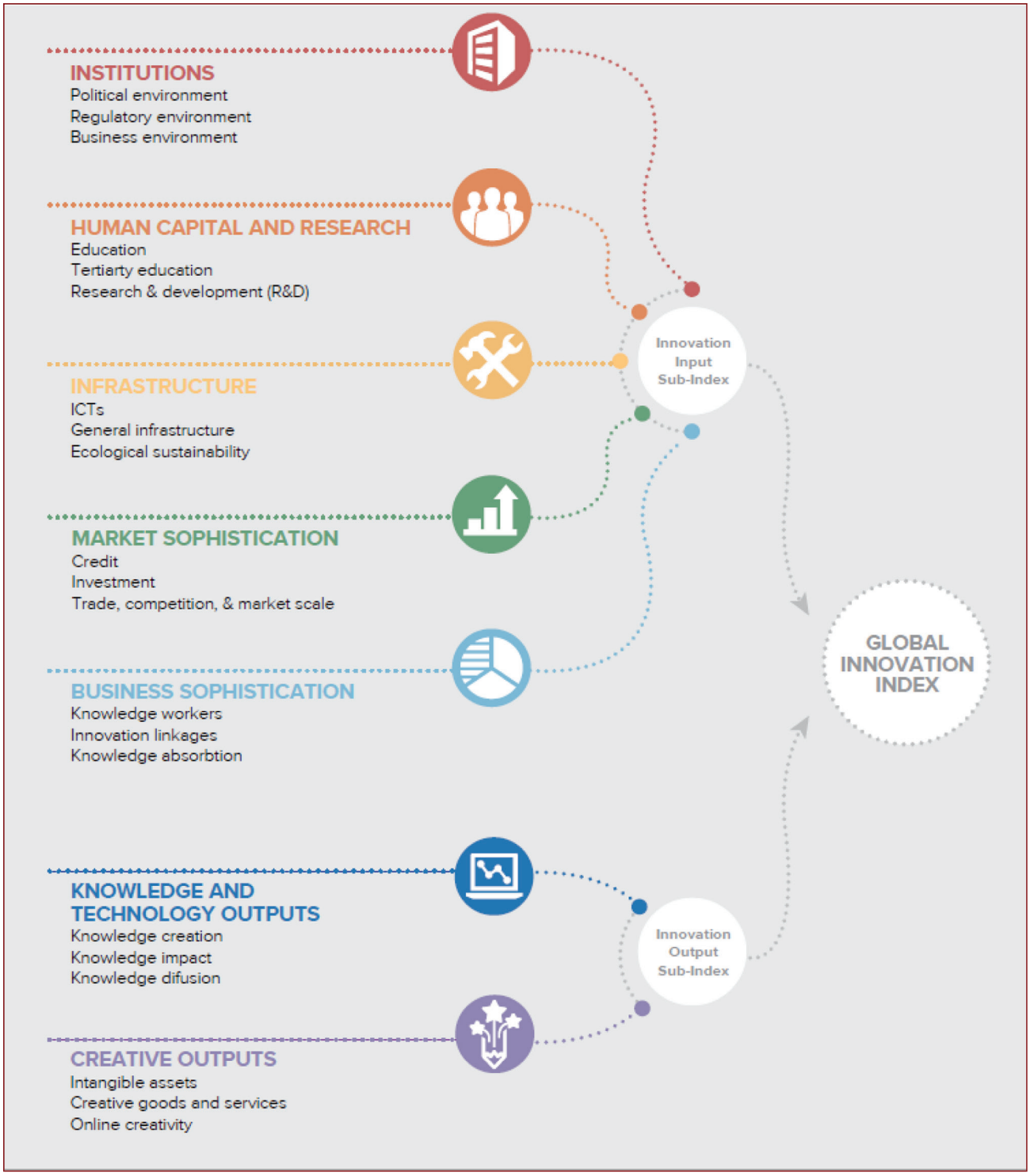


Source: Image accessed from
The Global Innovation Index 2019, 12th Edition, FIGURE A-I.1, page 207

Figure 1: Global Innovation Index 2019 Framework

which now includes more contemporary measures such as mobile-phone app creation and high-tech exports, *the GII provides a rich, evidence-based portrait not only of the country's innovation capacity, but also that of the start-up ecosystem that lives within.* A more innovative country is more conducive to the growth of start-ups and businesses.

Source: Image accessed from https://sustain.wisconsin.edu/sustainability/triple-bottom-line/

Figure 2: Triple bottom line framework

New Zealand, for instance, tops the list for ease of doing business. Setting up shop requires processes that are often tedious such as property registration, tax payments, contract enforcement, and the likes, making it difficult for aspiring entrepreneurs to even begin. But reducing bureaucracy, condensing the business application to half a day, and maximizing the advantages of digital platforms have helped New Zealand create a business landscape that incentivizes locals to start, create profit, and contribute to the national economy later on.

GII's recognition of New Zealand's business ecosystem, and those of other innovative countries, reinforces the idea that the innovation environment is key to a successful start-up. And this is true for their green counterparts as well, noting that there could be extra layers of processes required for any green enterprises. This extra layer of integrating environmental consciousness in a startups' product, service, or processes, reflected in what is called the *triple bottom line,* presents the complete cost of doing business for green entrepreneurs (Figure 2).

For instance, incorporating greenness to a functional and market-ready product could require more research alone, and alleviating the business processes required of them could significantly help green entrepreneurs give extra emphasis on their product's ecological punch instead.

The second reason GII has a place in this discussion is that *it helps policymakers and leaders understand how their economies stack up against the rest of the world*. The GII shows how a country's innovation performance in reference to its region and to the world. For example, it shows how many places a country has advanced or lost in terms of their innovation capacity. This is a crucial ingredient to the decision-making calculus of policymakers, business leaders, and key stakeholders, in understanding their countries' innovation progress annually. It helps them understand which areas can be adjusted and where to facilitate enhancements. As the GII also tells which countries are excelling in what specific dimensions, it helps stakeholders learn from the experiences of other economies, how they are doing it, and prompt them to localize these best practices if possible. Ultimately, the GII is an excellent benchmark that could aid decision-makers in channeling investments and driving reforms.

The Philippines is a good case in point in the Asia-Pacific. From ranking 73rd in 2018 and 2017, the emerging economy soared 19 notches to 54th place in 2019. Categorized as an "innovation achiever", the country has demonstrated dramatic improvements in its innovation capacity. Apart from market sophistication, the island-nation has scored above-average in all innovation dimensions, and even ranked first in high-tech net exports among 15 economies in Southeast Asia, East Asia and Oceania. It ranked third in creative goods exports and the number of women employed with advanced degrees. On the other end of the spectrum, some of the country's weak areas include ease of doing business, expenditure on education, and ease of getting credit.

These assessment points are what the Philippine government can take a look at when reforming innovation policies or designing new ones. Policymakers can then investigate the factors for the increase in points and therefore encourage these variables, and identify the roadblocks inhibiting innovation and be able to target them. For instance, the Philippine government may look at the example of New Zealand and how it has developed a robust and competent system of doing business.

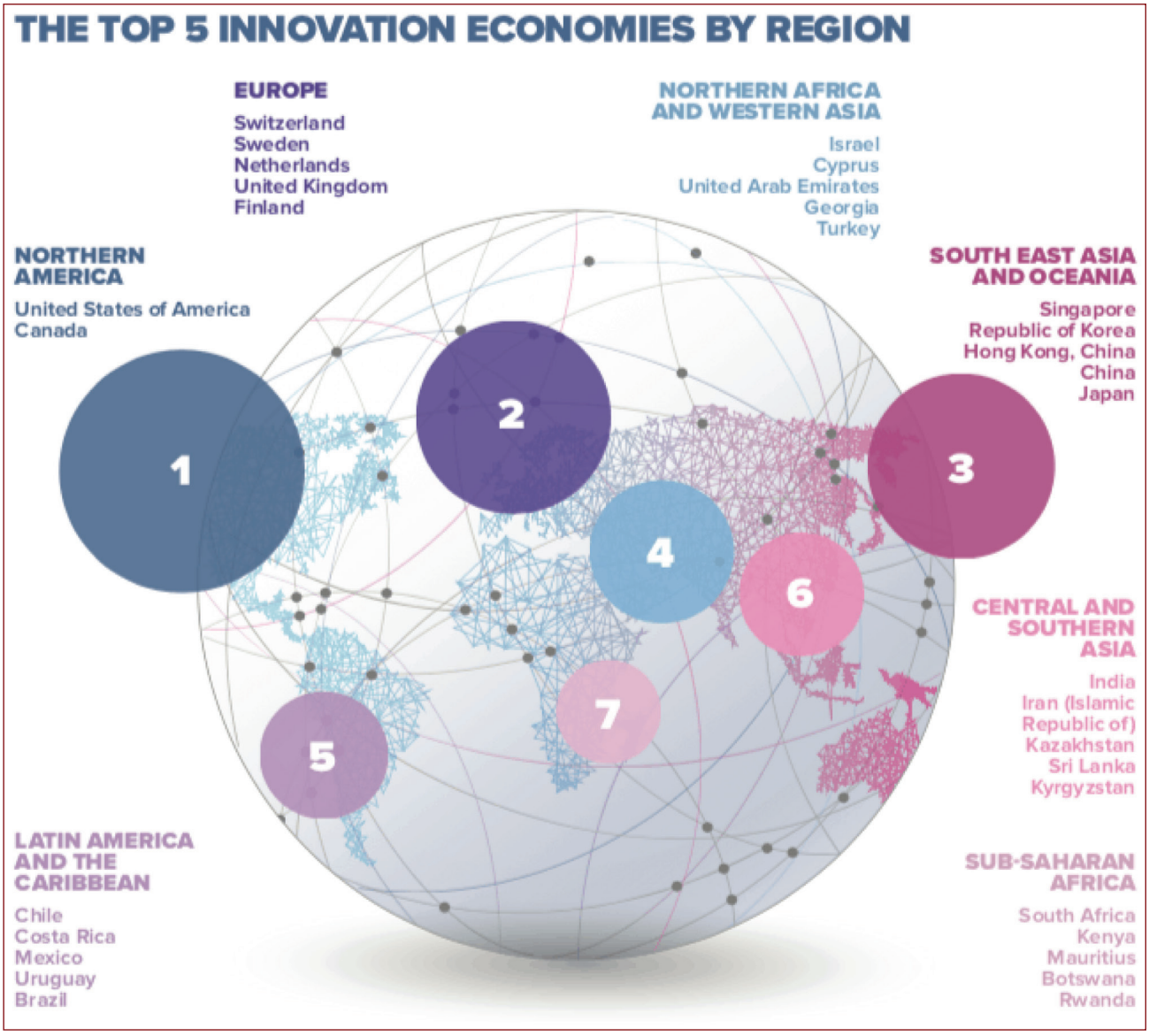
This form of evaluation could be scaled into the regional level. It goes without saying that East Asia is innovative altogether, noting that almost all of these economies have high innovation ranking in the GII. But on the flip side, South Asia, albeit making remarkable grounds, still has work to do to be collectively categorized as innovative. Both sub-regions are in the Asia-Pacific broader landscape, *but what causes this innovation disparity within the region?* One way or the other, the GII with its multifaceted and sophisticated calculation, can help provide the answer and pinpoint the gaps. This wide-ranging understanding of the innovation capacity of countries and sub-regions is pivotal to determine how further can the Asia-Pacific support its green entrepreneurs. Linkages between the two regions can even be made to facilitate learning, accelerate economic growth, and strengthen lagging startup peers.

How is the region supporting start-ups?

Having contextualized the GII, it is of interest that several Asia-Pacific countries made it to the top 25 list, and this includes Singapore (8th), Republic of Korea (11th), Hong Kong (China) (13th), China (14th), Japan (15th), Australia (22nd), and New Zealand (25th). And while these innovative countries hail from the Asia-Pacific, the region is also home to economies that fare poorer than their neighbors such as Indonesia (85th), Sri Lanka (89th), Cambodia (98th), Pakistan (105th), and Bangladesh (116th). This is to say that a level of disparity still exists in the region- a gap that demands regional effort. Understanding both polars of the global innovation spectrum, *how then is the region aiming to close that gap?"*

One prominent action is the *Pilot Asia-Pacific Climate Technology Network and Finance Center (CTNFC)*. Led by the Asian Development Bank, the Pilot Asia-Pacific CTNFC aims to catalyze innovation and strengthen clean technology transfer to Asian countries by supporting green entrepreneurs and high-impact technologies.

Albeit in its pilot stage, the tech network and finance center envision to fortify



Source: Image accessed from https://www.crowdfundinsider.com/2019/07/149846-innovation-nations-global-innovation-index-ranking-places-switzerland-in-top-spot/

Figure 3: Top five innovation economies by region

national and regional institutions, which in return could help facilitate cleantech transfer more extensively. The center also seeks to look at the creation of policies that can help promote clean technologies, and channel significant investments and funding for climate technology projects across the region.

Through joint efforts from the ADB and UNEP, and their funding collaboration with the Global Environment Facility (GEF), the governments of Japan and Republic of Korea, and VITO-Flemish Institute for Technological Research NV, the center shall establish a finance center in Manila and a climate technology network secretariat in Bangkok. While the ADB-based finance center helps in siphoning investments to high-caliber and impactful clean technologies, the climate secretariat in Thailand shall roll out three sets of activities as follows:

1. Facilitating a network of national and regional technology centers, organizations, and initiatives
2. Building and strengthening national and regional climate technology centers and centers of excellence
3. Designing, developing, and implementing country-driven climate technology transfer policies, programs, demonstration projects, and scale-up strategies

In the long haul, this initiative shall increase the capacity of the market and entrepreneurs themselves in bringing their technologies to their intended

users, promoting a culture of knowledge sharing, strengthening linkages between public and private entities, and fortifying the key institutions in the climate and innovation sector.

Similar to the Pilot Asia-Pacific CTNFC, the *Asia Climate Partners Fund* is another initiative in the region that contributes to the thriving startup community. Likewise managed by the ADB, together with Robeco, and ORIX Corporation, and under the auspices of the British Government, the *Asia Climate Partners Fund* is the region's first private equity funding that is focused on clean technology and climate solutions, with specific concentration in the People's Republic of China, India, and Southeast Asia. Since 2015, the fund has been investing in privately held companies that benefit from the robust economic performance in Asia, present clear environmental and societal impacts, and have the capacity to generate profits to investors.

But ultimately, the fund is intended to increase financial flow, capacity, and capital in low-carbon sectors in developing areas of Asia-Pacific, with the purpose of reducing GHG emissions from the region and accelerate RE markets within.

Also coursed through the Asian Development Bank, the *Mekong Business Initiative or MBI* is another regional effort that aims to bring sustainable development through investment and entrepreneurship. A joint collaboration between the ADB and the Australian Government, MBI zooms in on Cambodia, Laos, Myanmar, and Viet Nam, and explores opportunities to fast-track businesses in the Mekong region through sustainable practices.

The MBI is grounded in three themes, the first of which is *business advocacy*. The initiative recognizes that the private sector is a key player to the success of a thriving business environment, hence, it links government institutions to private entities and encourages dialogs and holistic policy formulation.

Familiar with the limitations of conventional banking services, the MBI enhances *accessibility to finance*, works with financial service providers with the intention of discovering alternative financial tools such as venture capital, angel investment, and fintech, and devices means to bring them closer to lower-income populations.

And thirdly, the MBI capitalizes on the raw talent of young entrepreneurs and believes *support for innovation* is the key to access that skill base. It does this through supporting business incubators, promote knowledge sharing among young entrepreneurs, and bring business models to pilot.

But beyond this, the MBI has also devised a number of activities that have sparked creativity and innovation within the Mekong region. One is the *Global Smart City Innovation Challenge for Vietnam,* a competition that gathers startups and entrepreneurs around the world who have technology solutions that are ripe for the market and are targeted at Vietnam's urban development challenges.

The first placer of the competition, *gridComm*, provides the seemingly panacea solution to a city's growing demand for lighting, and more. Its smart light solution connects residents and establishments to the city's power lines and reduces power costs by as much as 40%, and leverages on this power connectivity through Internet of things (IoT) sensors. Linking sensors to these power nodes, *gridComm* services could also collect data on weather, pollution, and traffic, among other environmental data, all done in real-time. This data provides a basis for preventive maintenance, resource efficiency, and smart lighting operations. *gridComm* ultimately is one driver of smart urbanization in Vietnam, which could cascade virtually anywhere.

But beyond these inventive technologies and the platforms that allow them to materialize, the role of women is another dimension in any successful innovation landscape.

The support of the Australian Government and the Asian Development Bank and cooperation of the Swiss EP and Sai Gon Innovation Hub led to the establishment of the *Women's Initiative for Startups and Entrepreneurship or WISE.*[11] As the only business accelerator designed by women, owned by women, and geared for women in Viet Nam, it creates more opportunities for women to penetrate the business and innovation sector.

Although not directed towards green start-ups, this accelerator advances women entrepreneurship in the Southeast Asian country, which is critical in attaining sustainable and inclusive growth. The innovation sector is no exception to the rule in terms of gender inequality and sexism. Through WISE, incredible strides have been made to balance the scale and create an enabling environment for women entrepreneurs. WISE provides leverage for the larger women groups who aim to bring their businesses to the next level, and at the same time, could also support women entrepreneurs who have promising technologies and business that could aid in preserving the environment.

Home-grown incubators and accelerators

The region also has a thriving community of country-grown incubators. Believing innovation is a critical factor in the growth of the Philippine economy, *IdeaSpace Foundation* has supported a good number of Filipino entrepreneurs. *Antipara* is an excellent example of a successful venture that has received support from the non-profit incubator. One of its taglines – "We survey the seas" – is an accurate description of what this start-up does.

Antipara's services include a *coastal atlas survey* which provides high-resolution imaging of coastal, marine, and other underwater ecosystems that could serve as baseline data for smart and effective coastal planning and resource management. This technology is used in the

[11] Flynn, Gerry. (March 8, 2019). WISE Women Innovation Accelerator 2019 Launches Today. Retrieved on October 1, 2019 from https://mekongbiz.org/2019/03/08/wise-women-innovation-accelerator-2019-launches-today/

management and protection of marine resources, with spillover impacts such as protection of fish stocks, reef restoration, and biodiversity management.

Another venture supported by IdeaSpace Foundation is *Stream Energy* – a green startup that provides micro-hydroelectric technology for building establishments. As Asia-Pacific accounts for nearly half of the global greenhouse gas emissions, together with accelerating urbanization, there is a pressing need for electricity sourced from renewable sources. *Stream Energy* does that as it "enables buildings to generate their own supplemental electricity from existing water consumption." In other words, electricity can be generated from the water flow that is already being consumed by the buildings in the first place.

Meanwhile in South Asia, *Powerstart India* is accelerating green start-ups too. The pioneer Bangalore-based accelerator explores the link between information and communications technology and clean technologies and works on five key thematic areas: (1) smart renewables, (2) smart buildings, (3) smart agriculture, (4) smart transportation, and (5) smart manufacturing.

The accelerator provides entrepreneurial mentorship to budding and intermediate entrepreneurs in a two-month boot camp where they get down and dirty in piloting their innovations and even co-designing solutions with their target users. Afterward, *Infuse Venture* will offer seed funding amounting to less than $40,000 to the two most auspicious ventures. The platform recognizes that while clean technology is growing, there are advantages to the marriage of cleantech and ICT. Capital needed for IT-cleantech startups are significantly lower, compared to the conventional green tech ones.

One of these successful ICT-cleantech ventures is *Karma Recycling*. India ranks third in terms of international shares of mobile devices in the market, and is in fact, becoming the global front liner for device commerce, re-commerce, and recycling. Likewise, the startup recognizes the problem of proper disposal of electronic wastes and opportunities in refurbishing or recycling such wastes, which are otherwise heading towards landfills. Karma Recycling provides the services that address these problems, with the philosophy that one's wastes impact oneself and others too, one way or the other, like karma itself.

Moving east, TusStar is a top angel investor firm that is also responsible for a good number of successful start-ups in China. From business conception to IP application, the firm guides startups in a seven-step process, which has been allowed them to succeed in their industries. It also links start-ups to external funding, providing a financial boost for them to disrupt the market.

With a focus on mobile internet, cleantech, healthcare, education, intelligent hardware, and sustainable consumption, among many other broad development areas, TusStar leverages its network of professionals, tech experts, and business mentors, allowed it to support more than 300 startups and counting.

It is accelerators like TusStar that have shaken the markets of both China and the world. China's utter size and economic prowess, on top of its government's amplifying push for green growth, make it a key global power even in the realm of green entrepreneurship. For one, more than half of the world's top green tech companies are from China.[12]

Dialogs and knowledge exchange

Accelerators, business incubators, and other forms of entrepreneurial support mechanisms for start-ups only present half of the picture. Opportunities for knowledge sharing, digital collaboration, and dialogs are also central to the nexus of sustainability and entrepreneurship for green entrepreneurs. And in this regard, it would be remiss to not discuss the United Nations' *Technology Facilitation Mechanism (TFM)*.

With the ultimate purpose of paving the way to the achievement of the UN's Sustainable Development Goals (SDGs), the TFM supports collaboration and partnerships across sectors and stakeholders by facilitating sharing of knowledge, best practices, and policy recommendations among UN member states, the S&T community, and other players.[13] While facilitating technology transfer has rippling impacts across all SDGs, it is directly related to SDG 9 or "Industry, Innovation and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation."

One of the elements of the TFM is the creation of an online platform, which should serve the following purposes:

- Be used to establish a comprehensive mapping of, and serve as a gateway for, information on existing science, technology and innovation initiatives, mechanisms and programs, within and beyond the United Nations.
- Facilitate access to information, knowledge and experience, as well as best practices and lessons learned, on science, technology and innovation facilitation initiatives and policies.
- Facilitate the dissemination of relevant open access scientific publications generated worldwide.

Also worthy of discussion is the UN Science-Policy-Business Forum on the Environment. The forum was initiated at the December 2017 UN Environment Assembly with the idea of encouraging opportunities for tech-driven green investments, invigorating financing mechanisms, and creating facilities that would enable these objectives. It has more than 2,000 member institutions, hailing from the business, academic, scientific, and governance sectors. In the same breadth, the forum offers a dynamic environment for participants to discuss challenges and best practices in

[12] Chandran, N. (December 3, 2015). Guess Where Asia's Fastest-Growing Clean Tech Industry Is. Retrieved on October 7, 2019 from http://www.cnbc.com/2015/12/03/chinese-green-energy-companies-among-asias-fastestgrowing-tech-firms-deloitte-says.html

[13] https://sustainabledevelopment.un.org/tfm

order to accelerate solutions addressing climate change.

Meanwhile, *Innovate4Climate* is another international gathering that convenes experts, technocrats, and leaders whose work involves finance, investments, and markets related to climate effort, with the intention of accelerating the financing of solutions for climate-responsive and sustainable development. This year's Innovate4Climate will deep dive on green finance, efficient battery storage, and green urban designs, among many others.

Challenges and resolutions

There is an extra level of burden that green start-ups have to surmount. On top of shouldering their way through business processes and muddled financial systems, they have to prove that the work they do encapsulates social responsibility, economic value, and environmental impact –mutually known as the triple bottom line. Successful green entrepreneurs should be able to address the complete and actual costs of doing business – which is a remarkable feat on its own.

But despite these challenges, the green startup community in the region has made incredible strides in their entrepreneurial journey. And this is made possible by several structures and initiatives in the Asia-Pacific.

Firstly, innovation is king. The roadmap from brainstorming ideas to translating them to inventive solutions will be a prime mover of green businesses. As the GII has described, "*innovation is important for driving economic progress and competitiveness – both for developed and developing economies* (p.205)."

The GII framework provides a macro lens that can help leaders in the region understand how to innovate better by dissecting the innovation equation and to plug-in solutions that can improve their country's innovation capacity. Supporting their broader start-up communities is crucial but driving their green entrepreneurs forward is arguably more noteworthy given current environmental conditions. In other words, celebrating innovation in the developing areas of the Asia-Pacific is a must to inspire leaders and entrepreneurs to strengthen green markets.

And while bureaucratic and administrative challenges lie ahead, the opportunities for green start-ups to market are plenty. Innovation in the green enterprise community could help the transition to a low-carbon and sustainable economy. Structures, financing institutions, and digital platforms such as the Asia-Pacific CTFN, the Mekong Business Initiative, and the TFM, are present out there to channel financial support and to support the exchange of information and policy advice among business leaders, policymakers, and green entrepreneurs. These are particularly helpful to the Asia-Pacific, considering that cleantech entrepreneurs only account for 2% of the total start-ups within its borders. In other words, despite the rapid transformation in the innovation capacity of the region and its resulting development and economic impacts, much has to be done to bring these opportunities closer to burgeoning green start-ups that need them the most.

Country specific incubators also play an important role in the picture. The sheer vastness of the Asia-Pacific makes it impossible to come up with a one-size-fits-all solution to the challenges in its green startup sector. Hence, locally sound and innovation-driven support systems are crucial to the success of green enterprises. Without groups like IdeaSpace Foundation, PowerStart India, and WISE, the regional innovation landscape would have been entirely different. These organizations can offer bespoke capacity building and local business mentorship, which can help start-ups on the ground enhance their products and even scale up globally. They also help amplify their business visions by connecting them to the wider international networks, which in return, could provide them additional funding. Although the ADB reports that there are less than 5% of cleantech-focused incubators and accelerators in developing Asia, it is inspiring to note that similar to the movement in the entrepreneurial arena, such incubators, accelerators, and other business platforms are expanding to greener territories and are exemplifying environmental values.

While it is evident that there is no shortage of opportunities to discuss solutions, channel green finance, and support exchange knowledge and best practices in the realm of green entrepreneurship, a call to action is needed still. At the end of the day, the Asia-Pacific is in the right path and would need to continue towards this direction. The gap between the urbanized countries and emerging economies in terms of the robustness of cleantech communities and support systems should be addressed. It is only then that the Asia-Pacific, and the entirety of countries that belong in it, can be truly called green. ■

Tech Events

2020

Jan 8-10, Mumbai, India

South Asia Conference on Social Enterprise
Contact: Tata Institute of Social Sciences
V.N. Purav Marg, Deonar, Mumbai-400088, India
Tel: +91(22)25525000
Fax: 91-22-2552 5050

Jan 29 - 31, New Delhi, India

WORLD SUSTAINABLE DEVELOPMENT SUMMIT 2020
Contact: DSDS Secretariat, New Delhi, India
Tel: +91 11 24682100; Fax: +91 11 24682144
E-mail: dsds@teri.res.in

Feb 12-14 Bangkok, Thailand

FUTURE ENERGY ASIA 2020
Contact: FUTURE ENERGY ASIA Secretariat
Email: info@futureenergyasia.com
Web: https://www.futureenergyasia.com

Feb 13-14 Nur-Sultan (Former Astana), Kazakhstan

Central Asia Renewable Energy Summit 2020
Contact: Karen Zhou l Marketing - Central Asia, Renewable Energy Summit 2020
Tel: +86 21 6667 0558 ext. 801
Mob: +86 186 2156 5342
E-mail: karen@peakevents.org
Web: http://www.renewableasia.org

Feb 20-21 Kuala Lumpur, Malaysia

15th World Convention on Waste Recycling and Reuse
Contact: Waste Recycling and Reuse Event Contact Desk,
Conference Series LLC LTD Conferences,
47 Churchfield Road, W3 6AY, London, UK
Tel: +44-203-7690-972
E-mail: recyclingsummit@asiameets.com

Feb 25-26 Singapore

EmTech Asia
Contact: Secretariat
Tel: +(65) 6500 6700
E-mail: emtech@koelnmesse.com.sg
Web: https://emtechasia.com/

Feb 26 - 28 Tokyo, Japan

BIOMASS EXPO 2020
Contact: Reed Exhibitions Japan Ltd.
18F Shinjuku - Nomura Building,
1-26-2 Nishishinjuku, Shinjuku - ku
Tokyo 163-0570, Japan
Tel: +81 (0)3 3349-8501
Fax: +81 (0)3 3349-8599
E-mail: info@reedexpo.co.jp

Mar 31 - Apr 02 Kuala Lumpur, Malaysia

ASIAWATER EXPO & FORUM 2020
Contact: United Business Media (M) Sdn Bhd
Suite 5-01, Level 5, Sunway VISIO Tower
Lingkaran SV, Sunway Velocity,
55100 Kuala Lumpur, Malaysia
Tel: +603 9771 2688; Fax: +603 9771 2799
E-mail: info-my@ubm.com

May 25 - 27 Shanghai, China

SNEC - PV POWER EXPO 2020
Contact: Shanghai Follow Me Exhibition Service Co., Ltd, Room711, No.1525
West Zhongshan Rd., 200235,
Shanghai, China
Tel: +86 21 64278273; Fax: +86 21 64642653
E-mail: service@snec.org.cn

Jun 11-13 Bangkok, Thailand

ASEAN Sustainable Energy Week
Contact: Ms. Supanna Anantarurdee
UBM Asia (Thailand) Co., Ltd.
Ari Hill 18th Floor, 428 Phahonyothin Road.
Samsen Nai, Phayathai, Bangkok 10400,
Thailand
Tel: +66 2 036 0500; Fax: +66 2 036 0588
E-mail: asew-th@informa.com
Web: http://www.asew-expo.com

June 17 - 19 Seoul, Republic of Korea

ENVEX 2020
Contact: KEPA (Korean Environmental Preservation Association)
Seoul CCI Bldg., 497-66, Dapsimni 5 Dong
Dongdaemun-Ku, Seoul, Republic of Korea
Tel: +82 2-2249-5265; Fax: +82 2-2249-5267
E-mail: dkepa@chollian.net

July 05 - 09 Singapore

CLEANENVIRO SUMMIT SINGAPORE (CESS) 2020
Contact: Singex Exhibitions Pte Ltd
#01-01, 11 Tampines Concourse
Singapore 528729
Tel: +65 6403 2100; Fax: +65 6782 9108
E-mail: enquiries@singex.com

Sep 16-18 Bangkok, Thailand

7th International Tradeshow for Bio Business & Investment in Asia Exhibition
Contact: Anucha Parnphichate
Project Manager / Head of Science & Technology Unit
Tel: +662 670 0900 ext. 202
E-mail: anucha@vnuexhibitionsap.com
https://www.bioinvestmentasia.com

Sept 18 - 20 Noida, India

RENERGY -RENEWABLE ENERGY INDIA EXPO 2019
Contact: Exhibitions India Group Pvt. Ltd.
217-B, Okhla Industrial Area, Phase - III
New Delhi -110020, India
Tel: +91 11 4279 5000; Fax: +91 11 4279 5098
E-mail: exhibitionsindia@vsnl.com

Sept 22 - 24 Jakarta, Indonesia

POWER-GEN ASIA 2020
Contact: Clarion Events Ltd
Bedford House, 69-79 Fulham High Street
London SW6 3JW, United Kingdom
Tel: +44 (0) 121 767 3769
Fax: +44 (0) 121 767 2880
E-mail: info@clarionevents.com

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http://www.smecorp.gov.my

How certification benefits us

Reference to certification such as Malaysian Standards brings immense benefits to all stakeholders in achieving:

1) **Consumer protection and public welfare**
   - Standards provide a basis for legislation for controlling quality, protecting consumers and ensuring health and safety
   - Standards ensure the fitness for the intended purpose of products and services
   - Standards specify the minimum requirements of quality, health and safety including areas involving the environment and occupational safety and health
   - Conformance to standards provides an assurance of safety, reliability and quality to consumers·
   - Standards ensure compatibility, interchangeability and interoperatibility to benefit consumers
   - As consensus documents, standards reflect the requirements at national and international levels
2) **Industrial efficiency and development**
   - Terminology and symbol standards help in better understanding
   - Product standards help in ensuring good design and improvement in quality of product
   - Product standards encourage economic efficiency through variety rationalization and interchangeability of components, materials and practices
   - Process standards provide the means for improving manufacturing processes
   - Codes of practice establish good practices in all fields of installation, construction, etc.
   - Testing standards set recognized levels of repeatability and reproducibility
   - Standards being a rich source of current technologies can act as vehicles for technology transfer
   - Standards promote better understanding between the purchaser and seller and provide solutions to recurring problems
   - Standards facilitate communications
   - Use of standards provide the essential key to organizing industrial development
   - Use of standards lead to direct and indirect economic benefits
   - Standards help in import substitution and export promotion

The adoption of certification such as Malaysian Standards assures consumers that their safety is taken care of, and ensures that the quality of products and services is worth their money. To industries, it contributes to the reduction of operational costs thereby assuring a rise in profits.

Product certification scheme

Product Certification Scheme Product Certification is offered to manufacturer who wishes to have its product certified to the requirements of a Malaysian or International Standard. Participation in this scheme is voluntary for most products. However, government regulatory authorities may require mandatory certification for certain products. After successful application, the applicant is given a license to mark the certified product with the "MS" certification mark. However for most regulated products, it is mandatory to affix the SIRIM labels on the products. The presence of the Label attests that the product meets quality requirements of the specified standard or specification. It also provides consumer an assurance of performance, safety and reliability as well as it demonstrates an effective system for production processes.

Other product certification category

Chain-of-Custody

The Chain-of-Custody Certification is an independent third party verification that the wood products purchased are actually derived from forests which have been certified to have met the requirements of an agree forest management standard. The standard used is the PEFC International Chain-of-Custody standard, Annex 4 of the PEFC Council Technical Document: Chain-of-Custody of Forest Based Products – Requirements. A wood product which has been certified under this scheme is eligible to use the MTCC as well as the PEFC logos which are recognized in the member countries of the PEFC.

Product Listing Scheme

This scheme is operated along similar lines to the Product Certification Scheme. However it offers a cost-effective in the absence of a national or international standard for the product. In this case, the product can be certified to association or industry standards as well as acceptable customer specifications. Pre Application fee of RM200 is payable upon application to Product Listing Scheme. Acceptance into this scheme has to be approved by SIRIM QAS International's Certification Panel.

Modular Coordination Verification Scheme

This is a concept of coordination of dimension and space, in which, buildings and components are dimensioned and positioned in terms of basic unit or module, known as '1M' which is equivalent

to 100 mm. It is internationally accepted by the International Organization for Standardization (ISO) and many other countries including Malaysia.

Batch Certification Scheme

This Scheme provides third party certification of products and is based on the ISO certification system no. 7, where a batch of product is sample tested and a certificate of conformity and/or labels are issued to the batch. The certification is based on a Malaysian Standard, an International Standard, an International Standard or a foreign standard of a national standards organisation.

IECEE CB Scheme

The electrical and electronic is Malaysian largest export revenue earner netting more than half of total export. As good and services flow across borders, business partners and government agencies may require assurance that they measure up to standard, regulations and other requirements.

IECEE CB scheme is one of the multilateral recognition agreement schemes that reassure industrial users and consumer that the product they buy conform to the criteria of an IEC international standards and require no further testing or evaluation. SIRIM QAS International Sdn. Bhd. is now an Issuing and Recognizing National Certification Body (NCB) of the CB Scheme. The Product Certification Section is designated as the NCB and the Electrotechnical Testing Section as the Certification Body Testing Laboratory (CBTL).

The aim of the CB Scheme is to provide manufacturers seeking worldwide third party certification marks, the most economic and cost effective procedures within the best certification time frame.

Fire Listing Scheme

Currently, certification on several passive fire protection products such as fire resistant door sets and roller shutters is being carried out by SIRIM QAS International Sdn. Bhd. These products are certified as a system which includes components such as the door leaves, frames and ironmongeries. Due to this "system" certification, the products certified must be sold with the exact same components or of equivalent or better grade than those used during testing.

Electromagnetic Compatibility Certification Scheme

Ensuring that electrical and electronic products/equipment are safe and do not interfere with the normal operation of other equipment is the basis of the emc Scheme. With the Scheme, which can be best demonstrated through independent third-party certification, manufacturers will be able to apply the emc-mark.

Sirim Eco-Labelling Scheme

Eco-labelling is a means of communicating product's environment information to consumers and business. This information provides consumers and business the associated environmental benefit and enables purchaser to make decision based on environmental attributes. Under SIRIM QAS International Eco-Labelling Scheme, a product will be independently tested and verified against preset criteria before the organisation is allowed to use SIRIM QAS International's Eco-Labelling mark on its product, packaging and promotional materials.

SIRIM QAS International's Eco-Labelling mark is an effective marketing tool which will enable a company to position its product as an environmentally-friendly product. This, in turn, will give the product a competitive edge over other similar products in a consumer market that is increasingly becoming more environmentally conscious.

Product certification process

1. Enquiry
   - o The applicant should complete the Questionnaire in the Application Package and submit to SIRIM Qas International Sdn. Bhd. Based on the Questionnaire, a question will be prepared and sent to applicant for consideration. The quotation should provide an estimate of the total cost for certification.
2. Application
   - o Upon agreeing to the quotation, the applicant is required to submit the application form (PCS/FOR/01-2), Declaration for Approval from Relevant Authority (for Malaysian manufaturers only), Declaration for Approval for Trade Mark Registration/ Brand Name (PCS/FOR/01-3-1), accompanying product information + fees + test report (if available)
3. Document evaluation
   - o SIRIM QAS International will conduct standard/product design Evaluation
4. Factory audit
   - o Inspection conducted to examine Quality Control plan adequacy, test equipment and calibration and record keeping system.
5. Sample selection & testing
   - o Sample of product will be randomly selected and sent to accredited testing laboratory for testing
6. Recommendation and approval process
   - o The Certification Panel reviews and approves the recommendation for certification under the authority of the Certification Advisory Committee
7. Surveillance
   - o Planned inspection and re-tests conducted to monitor continuing compliance. Samples selected from production or open market will be retested.
8. Renewal
   - o Approval for renewal on satisfactory inspection reports and payment of fees.

Technology incubation and development of entrepreneurs

Ministry of Electronics & Information Technology, Government of India
http://meity.gov.in

The Department of Electronics and Information Technology (DeitY), Government of India is implementing a scheme titled "Technology Incubation and Development of Entrepreneurs (TIDE)". Initially launched in 2008 the scheme has been revised and extended till March 2017. As per the scheme provision, 27 centres are being supported at academic institutions across India. TIDE has a multipronged approach in diverse areas of Electronics, ICT and Management. It aims to assist institutions of higher learning to strengthen their Technology Incubation Centers and enable young entrepreneurs to initiate technology startup companies for commercial exploitation of technologies developed by them.

TIDE Incubation Centers provide a gamut of services to new enterprises and facilitate linkages congenial for their survival and growth. The centres network with Angel Investors and Venture Capitalists who provide mentoring and financial support to the startups and enable tenant companies to mature over a period of 2-3 years and ultimately graduate to a commercial place to transact actual business.

DeitY is providing financial and policy support for strengthening technology incubation activities on the premise that this would in the long run result in indigenous development of products and packages in the ICTE sector.

Scope

Recognizing the importance of Technology Incubation, many institutions of higher learning have already taken initiatives to nurture this activity. These include policy measures, infrastructure support, entrepreneurial training, IPR facilitation, and create a framework to nurture technology incubation. The incubation centers provide a host of services to new enterprises and facilitate linkages that are congenial for their survival and growth. The centre also network with Angel Investors and Venture Capitalists who provide mentoring and financial support to the startup companies and enable the tenant companies to mature over a period of 2-3 years and graduate to a commercial place to do the actual business. The involvement of the faculty of the institute in the technology start-up activity reinforces teaching and research, strengthens linkages between education and industry, and also better aligns education to meet market requirements.

It is proposed to support such initiatives by providing financial and policy support for strengthening technology incubation activity. This would nurture technology innovation and, in the long run, enable local development of Electronics and IT products and packages.

The TIDE Center

The TIDE centre is generally set-up by the Host Institute (HI) as a Society or Section 25 company, or Other Legal entity with a mandate to nurture and support technology startup companies. This entity can receive funds from the Government and non-Government bodies and financial institutions including VCs and Angel Investor Groups, give loans to startup companies, hold financial instruments (such as shares) in the companies, and plough back the revenues/funds received for the objects of the center.

The TIDE centre will provide operating space to the selected companies, nurture them and mobilise technical / mentoring / managerial / financial / administrative / legal and other support as required by them.

Benefits

The expected benefits from the proposed scheme are:

- The technology incubation will become a nurturing ground for technology startup companies. This would also enhance the relevance of Education and Training to meet the market requirements;
- This would foster innovation in academic institutions and more indigenous products would emerge;
- The industry would be encouraged to become product oriented rather than service oriented; and
- Strengthen the academia – industry interaction.

Registration of licensing agreement in Thailand

Department of Intellectual Property, Thailand

http://www.ipthailand.go.th

Consideration criteria

Licensing Agreement to use the patent is the contract, with which the patent/petty patent owners grants the specific right to the licensee. The permission shall not exceed the protection period as prescribed by law.

- The protection period of invention patent lasts 20 years.
- The protection period of petty patent lasts 6 years, or upon the petty patent renewal application according to Article 65 paragraph 2 of the laws.

Conditions of application submission

1. To register a licensing agreement, the applicant shall submit the form as determined by the Director-General, together with a licensing contract to use the invention patent/petty patent.
2. Authorization
   - 2.1 In case the applicant of the patent does not reside in the Kingdom of Thailand, he shall authorize the patent agent/patent attorney registered with the Director-General of the Department of Intellectual Property to act on his behalf. In this regard, the power of attorney shall be presented to the Director-General in accordance with the following regulations;
     - (i) If the authorization is done outside the Kingdom of Thailand, the signatures in the authorization letter or power of attorney shall be certified by the authorized official of the Thai embassy or consulate or Director of the office of the Ministry of Commerce located in the country where the principal or power grantor resides, or the person authorized to act on behalf of the said officials or the person authorized to certify the signature according to the law in that country, or
     - (ii) In case the authorization is done in the Kingdom of Thailand, the applicant shall submit a copy of passport or temporary residence certificate of the principal or power grantor, or any evidence indicating that at the time the authorization was made, the principal or power grantor was in Thailand.
   - 2.2 The Power of Attorney shall be attached with the revenue stamp of 30 Baht/patent agent or patent attorney/application.

Proceeding according to the official's instruction

1. In case that the official finds a correctable defect in the application, the official shall notify the applicant or his patent agent/patent attorney for the correction. The applicant shall finish the correction within 90 days of the notification reception date. After such period, without the correction, the applicant shall be deemed to have abandoned the application, except the Director-General extends the period for correction as deemed appropriate due to any necessity.
2. After the applicant corrected the application, the applicant shall submit the correction application and the fee to the Department of Intellectual Property or the provincial office of the Ministry of Commerce. The corrected application shall enter the consideration and initial inspection processes respectively, similarly to the re-submission of the application.
3. In case of application submission via the website of the Department of Intellectual Property, the inspecting official shall check the completeness of information and details in the patent/petty patent application, request or other applications based on information and details appearing in the e-patent filing system. In this regard, the applicant shall present the application and supporting documents to the Department of Intellectual Property within 15 days of application number reception date and patent/petty patent application filing date via internet. The inspection of application submitted via internet shall be in accordance with the Notification of the Department of Intellectual Property Re: Principles and conditions for submission of patent/petty patent application, requests or other applications via internet.

Notes:

1. The working process starts after the inspection of the documents is completed, as specified in the manual of the public service.
2. In case the application or documentary evidence is not correct or incomplete, the official shall record the defect of the document or indicate the required additional documentary evidence (Record of conditions on application reception). The applicant shall correct the document and/or submit the additional document within 90 days of the application filing date. If the applicant fails to submit all additional documents within the specific period of time, the applicant shall be deemed to have abandoned the application. The official shall return the application to the applicant and inform the reason of the return and his appeal right.
3. Any person fee paid to the Department of Intellectual Property shall not be refunded in all cases, except
   - (i) The law stipulates that the fee must be refunded, or
   - (ii) The applicant double-paid or overpaid the fee, by which the faulty payment resulted from the mistake of the state

official, not the payer. In this regard, the Department of Intellectual Property shall consider the refund case by case.

4. In case the applicant is required to submit many additional documentary evidences, the applicant shall submit all additional documentary evidences in the same time.
5. In case the applicant submits the copy of the documentary evidence, the applicant shall certify the copy of the documentary evidence.
6. In case the applicant submits the document in foreign language, the applicant shall submit the document with Thai translation and the correct translation certification of the translator.
7. In case the applicant or the authorized patent agent/patent attorney does not submit the application by himself, and granted power to the other person to submit the application, the application submitter shall present a sub power of attorney or temporary power of attorney, so that he is eligible to submit the application and sign in the record of conditions on application reception. If it appears that the application and the documentary evidence is not correct or incomplete, and the application submitter is not authorized to sign on the said record, the official shall not receive the application.
8. The working period does not include the time period when the applicant follows the official's instruction or corrects the application, or the period of temporary suspension of registration.

Relevant laws

- The Ministerial Regulation No.25 (B.E. 2542) issued by virtue of the Patent Act B.E. 2522 (Dated 24 September 1999).
- The Patent Act B.E. 2522 as amended by the Patent Act (No. 2) B.E. 2535 and the Patent Act (No. 3) B.E. 2542

World Intellectual Property Report 2019

The 2019 edition of WIPO's World Intellectual Property Report analyzed millions of patent and scientific publication records across several decades to conclude that innovative activity has grown increasingly collaborative and transnational, while originating in a few large clusters located in a small number of countries. Some 30 metropolitan hotspots alone accounted for 69 percent of patents and 48 percent of scientific activity during the 2015-2017 period. They are mostly located in five countries – China, Germany, Japan, the Republic of Korea and the United States of America (U.S.).

The report finds that innovation has become more collaborative. In the early 2000s, teams of scientists produced 64 percent of all scientific papers and teams of inventors were behind 54 percent of all patents. By the second half of the 2010s, these figures had grown to almost 88 and 68 percent, respectively.

Collaboration has also become more international in nature. The share of scientific collaborations with two or more researchers located in different countries grew to around 25 percent in 2017. For patents, the share of international co-inventions increased to 11 percent until 2009, but has since slightly fallen, partly because of rapid growth in domestic collaborations in certain countries. Most international collaboration takes place among the top metropolitan hotspots. The largest ten of them – San Francisco-San Jose, New York, Frankfurt, Tokyo, Boston, Shanghai, London, Beijing, Bengaluru, and Paris – account for 26 percent of all international co-inventions. The U.S. hotspots emerge as the most connected ones in the world.

The report delves deeper into the global innovation landscape of two industries undergoing profound change. One is the automotive sector, where the adoption of autonomous vehicles technology is causing disruption. New entrants – from within the automotive industry and from the information technology (IT) industry – are challenging established players.

Patent data suggest that traditional automakers and their suppliers are at the forefront of autonomous vehicles innovation. Ford, Toyota and Bosch – accounting for 357, 320 and 277 of AV patent families, respectively – are the top three autonomous vehicles patent applicants. However, non-automakers also feature in the list of top patent applicants. Google, and its autonomous vehicles subsidiary Waymo, are in eighth position with 156 patents, ahead of traditional automakers like Nissan, BMW, Toyota and Hyundai. Tech companies Uber and Delphi each have 62 AV patents and are jointly ranked 31st.

For more information, contact:

News and Media Division
World Intellectual Property Organization (WIPO)
Tel: (+41 22) 338 81 61 / 338 72 24
Web: https://www.wipo.int

Voluntary licensing of patents in the Philippines

The Intellectual Property Office, Philippines

http://ipophil.gov.ph

REPUBLIC ACT NO. 8293

SECTION 85. Voluntary License Contract — To encourage the transfer and dissemination of technology, prevent or control practices and conditions that may in particular cases constitute an abuse of intellectual property rights having an adverse effect on competition and trade, all technology transfer arrangements shall comply with the provisions of this Chapter. (n)

SECTION 86. Jurisdiction to Settle Disputes on Royalties — The Director of the Documentation, Information and Technology Transfer Bureau shall exercise quasi-judicial jurisdiction in the settlement of disputes between parties to a technology transfer arrangement arising from technology transfer payments, including the fixing of appropriate amount or rate of royalty. (n)

SECTION 87. Prohibited Clauses — Except in cases under Section 91, the following provisions shall be deemed prima facie to have an adverse effect on competition and trade:

87.1. Those which impose upon the licensee the obligation to acquire from a specific source capital goods, intermediate products, raw materials, and other technologies, or of permanently employing personnel indicated by the licensor;

87.2. Those pursuant to which the licensor reserves the right to fix the sale or resale prices of the products manufactured on the basis of the license;

87.3. Those that contain restrictions regarding the volume and structure of production;

87.4. Those that prohibit the use of competitive technologies in a nonexclusive technology transfer agreement;

87.5. Those that establish a full or partial purchase option in favor of the licensor;

87.6. Those that obligate the licensee to transfer for free to the licensor the inventions or improvements that may be obtained through the use of the licensed technology;

87.7. Those that require payment of royalties to the owners of patents for patents which are not used;

87.8. Those that prohibit the licensee to export the licensed product unless justified for the protection of the legitimate interest of the licensor such as exports to countries where exclusive licenses to manufacture and/or distribute the licensed product(s) have already been granted;

87.9. Those which restrict the use of the technology supplied after the expiration of the technology transfer arrangement, except in cases of early termination of the technology transfer arrangement due to reason(s) attributable to the licensee;

87.10. Those which require payments for patents and other industrial property rights after their expiration, termination arrangement;

87.11. Those which require that the technology recipient shall not contest the validity of any of the patents of the technology supplier;

87.12. Those which restrict the research and development activities of the licensee designed to absorb and adapt the transferred technology to local conditions or to initiate research and development programs in connection with new products, processes or equipment;

87.13. Those which prevent the licensee from adapting the imported technology to local conditions, or introducing innovation to it, as long as it does not impair the quality standards prescribed by the licensor;

87.14. Those which exempt the licensor for liability for non-fulfilment of his responsibilities under the technology transfer arrangement and/or liability arising from third party suits brought about by the use of the licensed product or the licensed technology; and

87.15. Other clauses with equivalent effects. (Sec. 33-C (2), RA 165a)

SECTION 88. Mandatory Provisions — The following provisions shall be included in voluntary license contracts:

88.1. That the laws of the Philippines shall govern the interpretation of the same and in the event of litigation, the venue shall be the proper court in the place where the licensee has its principal office;

88.2. Continued access to improvements in techniques and processes related to the technology shall be made available during the period of the technology transfer arrangement;

88.3. In the event the technology transfer arrangement shall provide for arbitration, the Procedure of Arbitration of the Arbitration Law of the Philippines or the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL) or the Rules of Conciliation and Arbitration of the International Chamber of Commerce (ICC) shall apply and the venue of arbitration shall be the Philippines or any neutral country; and

88.4. The Philippine taxes on all payments relating to the technology transfer arrangement shall be borne by the licensor. (n) cdt

SECTION 89. Rights of Licensor — In the absence of any provision to the contrary in the technology transfer arrangement, the grant of a license shall not prevent the licensor from granting further licenses to third person nor from exploiting the subject matter of the technology transfer arrangement himself. (Sec. 33-B, R.A. 165a)

SECTION 90. Rights of Licensee — The licensee shall be entitled to exploit the subject matter of the technology transfer arrangement during the whole term of the technology transfer arrangement. (Sec. 33-C (1), R.A. 165a)

SECTION 91. Exceptional Cases — In exceptional or meritorious cases where substantial benefits will accrue to the economy, such as high technology content, increase in foreign exchange earnings, employment generation, regional dispersal of industries and/or substitution with or use of local raw materials, or in the case of Board of Investments, registered companies with pioneer status, exemption from any of the above requirements may be allowed by the Documentation, Information and Technology Transfer Bureau after evaluation thereof on a case by case basis. (n)

SECTION 92. Non-Registration with the Documentation, Information and Technology Transfer Bureau — Technology transfer arrangements that conform with the provisions of Sections 86 and 87 need not be registered with the Documentation, Information and Technology Transfer Bureau. Nonconformance with any of the provisions of Sections 87 and 88, however, shall automatically render the technology transfer arrangement unenforceable, unless said technology transfer arrangement is approved and registered with the Documentation, Information and Technology Transfer Bureau under the provisions of Section 91 on exceptional cases. (n)

Publications on SMEs competitiveness

Innovation and SME Financing in Selected Asian Economies

This publication highlights the different policy measures taken by the governments of seven Asian economies to stimulate innovation among SMEs. It contributes to the current discourse on the importance of financing innovations to create a conducive environment for long-term SME growth.

Contact: Asian Productivity Organization, Leaf Square Hongo Building, 2F, 1-24-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan. Tel: 81-3-3830-0411, Fax: 81-3-5840-5322, E-mail: apo@apo-tokyo.org, Web: http://www.apo-tokyo.org

Exchanging Value - Negotiating Technology Licensing Agreements: A Training Manual

The manual provides an introduction to some of the basic issues that arise in technology licensing negotiations and offers useful insights into how they may best be handled. In a highly competitive and dynamic marketplace, technology licensing is a useful option for companies seeking to maintain their competitive advantage and a healthy balance sheet. It covers a wide range of basic issues that arise during technology licensing negotiations and offers useful insights into how they may best be handled in practice.

Contact: Media Relations and Public Affairs Section, WIPO. Tel: + 41 22 338 8161 or 338 95 47, E-mail: publicinf@wipo.int, Web: http://www.wipo.int

Globalization and Performance of Small and Large Firms

The report examines whether and how globalization has differential effects on small and (or versus) large firms and aims at identifying policy issues to be addressed to achieve stronger and more resilient economic growth in East Asian countries. Globalization in this research is broadly defined to include trade and foreign direct investment (FDI) liberalization, trade (exports and imports), international capital flows, outsourcing and traded intermediate goods. The research conducted 10 country studies for 8 countries in the Asia-Pacific region, namely, China, Indonesia, Japan, Korea, Malaysia, Philippines, Thailand, and Viet Nam.

Contact: Economic Research Institute for ASEAN and East Asia, Sentral Senayan II , 6th floor Jalan Asia Afrika No.8, Gelora Bung Karno, Senayan, Jakarta Pusat 10270, Indonesia. Tel: (62-21) 57974460, Fax: (62-21) 57974463, E-mail: contactus@eria.org, Web: http://www.eria.org

Guidelines on equity policy and foreign investment in Malaysia

Malaysian Investment Development Authority (MIDA), Malaysia

http://www.mida.gov.my

Equity policy in the manufacturing sector

Malaysia has always welcomed investments in its manufacturing sector. Desirous of increasing local participation in this activity, the government encourages joint-ventures between Malaysian and foreign investors.

Equity policy for new, expansion, or diversification projects

Since June 2003, foreign investors could hold 100% of the equity in all investments in new projects, as well as investments in expansion/diversification projects by existing companies, irrespective of the level of exports and without excluding any product or activity.

The equity policy also applies to:

- Companies previously exempted from obtaining a manufacturing licence but whose shareholders' funds have now reached RM2.5 million or have now engaged 75 or more full-time employees and are thus required to be licensed.
- Existing licensed companies previously exempted from complying with equity conditions, but are now required to comply due to their shareholders' funds having reached RM2.5 million.

Equity Policy Applicable for Existing Companies

- Equity and export conditions imposed on companies prior to 17 June 2003 will be maintained. However, companies can request for these conditions to be removed and approval will be given based on the merits of each case.

Protection of foreign investment

Malaysia's commitment in creating a safe investment environment has attracted more than 8,000 international companies from over 40 countries to make Malaysia their offshore base.

Equity ownership

A company whose equity participation has been approved will not be required to restructure its equity at any time as long as the company continues to comply with the original conditions of approval and retain the original features of the project.

Investment Guarantee Agreements

Malaysia's readiness to conclude Investment Guarantee Agreements (IGAs) is a testimony of the government's desire to increase foreign investor confidence in Malaysia. IGAs will:

- Protect against nationalisation and expropriation
- Ensure prompt and adequate compensation in the event of nationalisation or expropriation
- Provide free transfer of profits, capital and other fees
- Ensure settlement of investment disputes under the Convention on the Settlement of Investment Disputes of which Malaysia has been a member since 1966.

Malaysia has concluded IGAs with the following groupings:

- Association of South-East Asian Nations (ASEAN)
- Organisation of Islamic Countries (OIC)

Convention on the Settlement of Investment Disputes

In the interest of promoting and protecting foreign investment, the Malaysian government ratified the provisions of the Convention on the Settlement of Investment Disputes in 1966. The Convention, established under the auspices of the International Bank for Reconstruction and Development (IBRD), provides international conciliation or arbitration through the International Centre for Settlement of Investment Disputes located at IBRD's principal office in Washington.

Kuala Lumpur Regional Centre of Arbitration

The Kuala Lumpur Regional Centre for Arbitration was established in 1978 under the auspices of the Asian-African Legal Consultative Organisation (AALCO) - an inter-governmental organisation cooperating with and assisted by the Malaysian government.

A non-profit organisation, the Centre serves the Asia Pacific region. It aims to provide a system to settle disputes for the benefit of parties engaged in trade, commerce and investments with and within the region.

Any dispute, controversy or claim arising out of or relating to a contract, or the breach, termination or invalidity shall be decided by arbitration in accordance with the Rules for Arbitration of the Kuala Lumpur Regional Centre for Arbitration.

Development finance and access to finance in Sri Lanka

Central Bank of Sri Lanka

https://www.cbsl.gov.lk

The Central Bank of Sri Lanka (CBSL) on behalf of the Government of Sri Lanka (GOSL), contributes to enhance Access to Finance with the intention of achieving balanced growth and financial inclusiveness in the country. To achieve these objectives, the CBSL coordinates, facilitates and implements various refinance schemes, interest subsidy schemes and credit guarantee schemes while delivering credit supplementary services through Regional Development Department (RDD) of the CBSL.

The strategic objectives of the RDD include the enhancement of regional growth, reduction of poverty, creation of income generating activities and employment opportunities, provision of skills development and training, facilitation of formal financial services, strengthening economic activities in the lagging regions and enhancement of production of essential food items including organic food to ensure food security and food safety.

Financial assistance

The RDD provides affordable finance for beneficiaries in the Agriculture, Animal Husbandry and Micro, Small and Medium scale Enterprises (MSMEs) in the country through a network of Participating Financial Institutions (PFIs) which are mainly Licensed Commercial Banks and Licensed specialized Banks. The funds are made available to the needy people and business ventures at concessionary terms and conditions through PFIs with a view to ensuring those beneficiaries are well geared to meet the challenges ahead. These schemes are funded by the GOSL, the CBSL, Donor Agencies and PFIs. Through these schemes, RDD serves the beneficiaries in a wide spectrum of sectors including Agriculture and Animal Husbandry, Microfinance and Micro, Small and Medium Enterprise (MSME) sectors, by providing affordable finance facilities.

Implementation of GOSL funded Schemes

At present, RDD implemented 05 schemes funded by the GOSL including 4 refinance loan schemes and 1 interest subsidy schemes. "Sarusara"- New Comprehensive Rural Credit Scheme (NCRCS) which is funded by the GOSL, serves as an interest subsidy scheme and a credit guarantee scheme as well.

Implementation of CBSL funded schemes

In view of the strategic importance of regional development for balance and inclusive economic growth of the country, CBSL continues to fund two main schemes of RDD, namely, the Saubagya Loan Scheme and the Commercial Scale Dairy Development Loan Scheme (CSDDLS), which is a refinance loan scheme and an interest subsidy scheme.

Implementation of Donor funded Schemes

International Fund for Agriculture Development (IFAD) serves as the main Donor Agency by contributing millions of rupees towards 6 refinance loan components under Smallholder Agribusiness Partnership Programmes (SAPP) which has been implemented in mid 2018. SAPP is introduced in lieu of the National Agribusiness Development Programme (NADeP), another IFAD funded project which was successfully concluded at the end of 2017. RDD manages the Credit Component of SAPP which includes issuing Operating Instructions to the PFIs and providing refinance to them.

Credit guarantee

The RDD implements Credit Guarantee schemes with a view to mitigate credit risk of the loans granted by the PFIs for specific sectors. Under these schemes, loans granted by the PFIs are guaranteed in case of defaults, to a certain extent. To implement this process which supports PFIs to lower their credit risk, RDD issues Operating Instructions to the PFIs, specifying the terms and conditions applicable under each scheme, including issuance of guarantees and indemnity payments, etc. To be eligible under the scheme, PFIs are expected to pay a premium, specified in the Operating Instructions of the particular scheme.

Interest subsidy

Under the Interest Subsidy Schemes implemented by the RDD, PFIs are eligible to receive interest subsidy for the loans granted by them through a relevant interest subsidy scheme. These schemes are implemented to compensate the cost of funds of PFIs while encouraging them to grant loans to the specific priority sectors of the economy.

Public awareness

CBSL conducts a series of awareness building and skill development programmes, especially for those who are have not accessed the formal financial sector, through RDD. These programmes mainly focus on financial management, entrepreneurship development, Training of Trainers (TOT) and workshops on entrepreneurs, mainly to promote financial inclusiveness of the country. In addition, RDD take efforts to enhance public awareness on Access to Finance and Financial Inclusiveness, using print and electronic media. Moreover, RDD takes necessary policy measures in line with the contemporary developments in the economy.

Area-based innovation in Thailand

National Innovation Agency, Thailand

http://www.nia.or.th

Area-Based Innovation strategy has been developed to accelerate innovation potential in certain residential areas and generate the co-creation of communal innovation opportunities for people via the Yothi Innovation District project, emphasizing mainly on the development of medical innovation, e-Government, and area-based innovation.

The National Innovation Agency (NIA) has determined to maximize people's innovation potential at an area-based level, leading to the Innovation Corridor, Innovation City, and Innovation District. In other words, the increase of innovation potential will focus mainly on three developmental aspects, consisting of promoting infrastructure development conforming to the advancement of an innovative ecosystem, managing vital resources to stimulate area-based innovation, and fostering community involvement.

Innovation Corridor

The GMS Southern Economic Corridor possesses an approximate distance of 1,320 kilometers that strategically connects Thailand, Myanmar, Cambodia, and Vietnam together.

In fact, the area-based innovation has taken into account the efficiency of being exposed to geographical strengths and natural resources in certain communities, expecting to stimulate economic and social development in various living areas. Key strategies used for driving economic and social progress consist of communal industry, infrastructure, human resources, and advances in science and technology. The economic and social development plan generally focuses on the advancement of infrastructure and investment. However, the plan still faces extreme difficulty due to a lack of knowledge-based and technological support.

The NIA has recognized the importance of advancing area-based innovation based on the development of overall aspects. The NIA, in collaboration with the Geo-Informatics and Space Technology Development Agency (Public Organization) (GISTDA), the Designated Areas for Sustainable Tourism Administration (Public Organization) (DASTA), the Industrial Estate Authority of Thailand (IEAT), and Rayong Provincial Governor's Office, has launched the "Area-Based Economic Innovation to ASEAN" project, while signing a Memorandum of Understanding with the mentioned organizations to support the acquisition and completion of statistical data, climatological information, details of potential raw materials used for production, and facts on potential investments generated by the public and industrial sectors, as part of the goal to get the required data processed and analyzed complying with the government's policy on the Special Economic Development Zones. In order to make such ideas achievable, the NIA has hence invited experienced innovation-based business providers and new startup entrepreneurs to work together to create a potential innovation cluster, emphasizing on the development of infrastructure, tools, and mechanisms required for successful business operations and a better quality of life for people in different communities. This helps encourage people to create productive ideas towards the progress of innovation, promote the co-creation of innovation through innovative concepts, and foster knowledge sharing among agencies, businesses, and people in various communities.

Initially, the NIA will implement development by focusing on the government's policy of the Special Economic Development Zones in accordance with the GMS Southern Economic Corridor (EWEC), with a distance of approximately 1,320 kilometers. The GMS Southern Economic Corridor has been developed to strategically connect Thailand, Myanmar, Cambodia, and Vietnam together, and is considered a crucial land transportation route that can greatly facilitate the shipment of goods along the entire distance between the Andaman Sea and the Pacific Ocean, while unveiling mainstream cultures and core knowledge of innovation reflected in business operations and daily routines. However, value chain analysis is required to pinpoint desirable strategies in driving the area-based innovation to the ASEAN Economic Community (AEC), with the NIA's ambitious goal to help Thailand achieve all innovation aspects, including those of industry, tourism, commerce, transportation, and agriculture.

Innovation District

The NIA has upgraded its strategic policies to accelerate greater infrastructure development in line with the creation of an innovation ecosystem, while encouraging people's community involvement in promoting the "Innovation District" strategy, considered a new city planning and design concept that has been fostered based on a development strategy to attract larger innovation-based business providers. Therefore, it is required to generate effective development of infrastructure, tools, and mechanisms that can facilitate innovative businesses as well as enhance people's quality of living, with the aim to generate seamless connectivity between smart people and their innovative ideas. There is an important mechanism developed to promote co-creation and knowledge sharing among people of innovation. The NIA has also underlined the significance of strengthening its innovation competency by initiating the Yothi Innovation District project serving as Thailand's first-ever innovation district model that focuses on three development aspects, including Medical Technology (MEDTECH), Government Technology (GOVTECH), and City Technology (CITYTECH).

Catalyzing digital innovation ecosystems in Malaysia

Malaysia Digital Economy Corporation Sdn Bhd, Malaysia

https://www.mdec.my

The future lies in innovation, and at Malaysia Digital Economy Corporation (MDEC), we believe that being ahead of the technology curve is the way to future-proof businesses. Big Data Analytics (BDA), the Internet of Things (IoT), E-Commerce, and Data Centre & Cloud are our key focus areas that have been identified as catalysts that will kickstart and sustain an ecosystem of digital innovation, keeping us at the forefront of technology.

Big Data Analytics (BDA)

Malaysia is one of the few countries with a structured Big Data Analytics (BDA) roadmap to untap the value of big data. At the turning point of digital revolution, the powers of big data can be used to describe a problem, assess a situation, forecast results, and prepare solutions. Business owners, government, and citizens all stand to gain from Malaysia's vision as ASEAN's leading BDA solution hub.

To make this vision a reality, MDEC is spearheading this platform to lead efforts and create conversations. MDEC works to encourage and increase BDA adoption across all sectors by developing talent in the field of data science and enabling strategic partnerships, while introducing upskilling efforts and spurring integrated initiatives.

Our strategic initiatives are:

- Generating (Increasing) the usage of BDA in private sectors.
- Catalysing the adoption and usage of BDA in public sectors.
- Building the BDA industry in Malaysia.

To propel MDEC forward as an industry leader in ASEAN, we have set up the ASEAN Data Analytics eXchange (ADAX), a regional platform that brings together innovative talent development models and showcase the latest BDA technologies. A national initiative to benefit Malaysia, ADAX has the unique opportunity to serve a greater national agenda. This aspiration can only take flight by building a Big Data community through shared values, skills building and collaboration around a robust data analytic ecosystem.

By piloting advanced data analytics use cases for the ASEAN region and providing a co-working location for BDA start-ups and accelerators, ADAX has a unique opportunity to catalyse the migration of traditional organisations to become Data Driven Organisations.

Data centre & cloud

Malaysia's Data Centre & Cloud industry is marked by broad trends of expansion, efficiency, and consolidation. Rising above comparisons like China, Indonesia, and India, Malaysia holds the advantage in attracting potential clients and investors thanks to a climate of politcal stability, location that is free from natural disasters, and competitive real estate market. With a year-over-year growth of over 20% in the last five years in Malaysia, the field of digital data management has never been more ripe for the picking.

The main strategy for the proliferation of data centre and cloud is to cement Malaysia's position as the epicentre for technology-driven delivery of digital content and services in the region, with centres spanning 5 million sq ft by 2020. MDEC works to position Malaysia as a regional hub for data centre and cloud services by leveraging on various factors such as cost efficiency, availability of skilled workers, and a strong foundation of data governance laws.

Local data cloud players are strengthened through MDEC's initiatives by priming their high-value services to be regionally competitive. This is done by facilitating the growth of data centre parks in strategic locations through world-class physical and soft infrastructure.

International businesses also stand to gain from MDEC's FDI policy as it offers an attractive portfolio of incentives for Cloud/Internet Giants to invest and set up facilities in Malaysia.

E-commerce

We live in a time where half the population are digital buyers, which is why e-commerce is an important stepping block to 'future proof' existing businesses while opening up market access. However, the eCommerce ecosystem development in Malaysia is still at an early stage.

According to A.T. Kearney findings under the National E-Commerce Strategic Roadmap, Malaysia is at a turning point of e-commerce growth which must be sped up through government involvement. Issues that need to be resolved are lack of offerings, poor fulfilment experience, low adoption and awareness and lack of supporting ecosystem.

For Malaysia to move beyond the early stage, it needs a strong support and focused government intervention to drive it forward to the growth stage. Through efforts such as #MYCYBERSALE which started in 2014, we have achieved RM67 million Gross Merchandise Value (GMV) in 2014 and RM117 million in 2015. This was made possible by close cooperation with our eCommerce ecosystem players, thereby transforming Malaysia's e-commerce landscape.

In addition to programmes like #MYCYBERSALE, #MYGlobalExport, and eTRADE, the National e-Commerce Strategic Roadmap

was developed to double the eCommerce growth rate from 10.8% to 20.8% by the year 2020. This is done through specific government interventions along these Six Strategic Thrusts:

- Accelerate seller adoption of e-commerce
- Increase adoption of e-Procurement by businesses
- Lift non-tariff barriers
- Realign existing economic incentives
- Make strategic investments in selected e-commerce player(s)
- Promote national brands to boost cross-border e-commerce

Internet of Things (IOT)

In the world of rapid digital interaction, IoT gives insights on how consumers integrate technology in their daily lives, a valuable information that can be used in various ways. The growing need for internet-related products and services is driving this transition, not only globally but also here in Malaysia.

In 2015, the Ministry of Science, Innovation & Technology Malaysia launched the National IoT Strategic Roadmap, which forecasted opportunities to reach RM9.5 billion in 2020 and RM42.5 billion in 2025. This is all done to create a national ecosystem to make IoT a new source of economic growth with its industrialisation and proliferation of use.

The National IoT Strategic Roadmap outlines 3 national goals:

- Malaysia as the Regional Development Hub for IoT
- Create a conducive IoT industry ecosystem
- Strengthen technopreneur capabilities in Apps & Services layer

The 3 long-term strategies for IoT are:

- Open Innovation Framework
- Open Community Data Framework
- IoT Malaysia

MDEC has been tasked to lead the IoT industry developmental charter called IoT Malaysia. With this mandate, we have focused our efforts on key verticals that will not only increase the digital adoption and growth of IoT in Malaysia, but also digitalize the way they operate, which include Smart Manufacturing, Smart Agriculture and Smart Transportation.

- Industry Development – to raise critical mass and competitiveness of IoT companies to drive demand
- Digital Transformation – to facilitate IoT adoption and proliferation through public-private partnership for business, government and citizen
- Ecosystem Development – to facilitate the development of IoT ecosystem and enabling environment

Digital Economy Report 2019

The rapid spread of digital technologies is transforming many economic and social activities. While creating many new opportunities, widening digital divides threaten to leave developing countries, and especially least developed countries, further behind. A smart embrace of new technologies, enhanced partnerships and greater intellectual leadership are needed to redefine digital development strategies and the future contours of globalization.

This first edition of the *Digital Economy Report* – previously known as the *Information Economy Report* – examines the scope for value creation and capture in the digital economy by developing countries. It gives special attention to opportunities for these countries to take advantage of the data-driven economy as producers and innovators – but also to the constraints they face – notably with regard to digital data and digital platforms.

Digital advances have already led to the creation of enormous wealth in record time, but this is highly concentrated in a small number of countries, companies and individuals. Meanwhile, digitalization has also given rise to fundamental challenges for policymakers in countries at all levels of development. The Report presents recent trends and discusses key policies for value creation and capture in the digital economy, notably with regards to entrepreneurship, data, trade, competition, taxation, intellectual property and employment.

The Report provides valuable insights and analyses to support policymakers at the national and international levels to ensure that no one is left behind by the fast-evolving digital economy.

For more information, access:
https://unctad.org/en/PublicationsLibrary/der2019_en.pdf

Green ratings in India

Small Industries Development Bank of India (SIDBI), India

http://smallb.sidbi.in

Green rating is an estimate of an industry's environment friendliness. It assesses the adverse impact on environment caused by an industry's activities and methods adopted by an industry to minimize the damage. This assessment is done by a credible third party evaluator. The rating is arrived at after considering industry's current processes and technology and their impact on the environment, adoption of clean technology and various processes adopted for mitigating adverse impact on environment.

Relevance of green rating around the world

Rapid industrialization and the associated global warming have placed a question mark on the sustainability of the planet's delicate ecological balance. The "United Nations Framework Convention on Climate Change (UNFCC)" and more particularly the "Kyoto Protocol" have placed stringent and legally binding Green House Gas (GHG) emission norms on developed / industrialized countries. Countries like the USA and those within the EU have also imposed carbon taxes on fossil fuel based industries.

The increased awareness about environmental degradation is making environmental regulations more stringent the world over. The MSME sector cannot remain insulated from this trend. Exporting MSMEs may soon see themselves set against trade barriers such as the impending imposition of carbon taxes by European countries. In order to position themselves as responsible corporate citizens and as a preventive measure against probable censure from environmental organizations like Green Peace, MSMEs will feel the need for Green Ratings in near future.

Green rating in India

Green Rating initiatives in India are spread across various sectors ranging from buildings to manufacturing industries.

Green building initiative

In order to create more energy efficient and eco-friendly buildings, the Ministry of New and Renewable Energy in collaboration with The Energy and Resource Institute (TERI) initiated Green Rating for Integrated Habitat Assessment (GRIHA), the National Rating System for Green Buildings in India. GRIHA rating system consists of 34 criteria categorized under various sections such as site selection and site planning, conservation and efficient utilization of resources, building operation and maintenance, and Innovation points. For further details, visit GRIHA.

Green rating project

It is a non-government initiative launched by Centre for Science & Environment (CSE) in 1995 to guide Indian industries to improve their environmental performance. The project mainly relied on voluntary participation of companies and depended up on the company's eagerness to avoid bad publicity as these ratings are released for public. Along with the assignment of Green Rating, the initiative charted out steps need to be taken by each industry to improve their performance. In majority of the cases, the companies have implemented the road map provided by CSE. The industries covered in this project are paper and pulp, cement, automobile and the chlor alkali sector. For further details visit Green Rating Programme. A larger proportion of companies rated for green credentials under this programme are large enterprises.

SMERA green ratings

In India Green Rating of enterprises is offered by SME Rating Agency of India Limited (SMERA). Green Rating is a joint initiative of SMERA and SIDBI. The Energy and Resource Institute (TERI) acts as a Knowledge Partner. SIDBI promotes and facilitates the process by offering credit at concessional rate to Green Rated companies. The Government of India (GoI) has urged lending institutions to encourage borrowing MSMEs to go for "Green Rating".

SMERA is only agency that exclusively caters to Indian MSMEs' "Green Rating" needs. Read extract on Green Ratings from OPTIMiSM (SIDBI bi-monthly magazine).

Benefits of green rating

- **An independent third party evaluation about environment friendliness:** It indicates that the MSME is conscious about its duty towards environment and society at large
- **Credit at concessional rate:** It will help a MSME to obtain credit at a concessional rate from lenders like SIDBI
- **Mitigation of environmental risk:** It reduces the risk associated with the stringent environmental norms that is becoming stricter
- **Confidence among value chain partners:** The rating assures lenders, buyers, collaborators, JV partners that the MSME is a responsible corporate citizen and does not adversely impact ecology
- **Self-assessment tool:** Green Rating is a self-assessment tool that can be used to identify areas of improvement
- **Creating awareness:** Green Rating awarded by an independent agency improves the visibility of MSME in the eyes of various stakeholders like buyers, suppliers, collaborators/JV partners etc

Green Technology in Malaysia

Malaysian Investment Development Authority, Malaysia

http://www.mida.gov.my

In line with Malaysia's aim to become an inclusive and sustainable advanced nation by 2020, Green Technology (GT) has been identified as one of the drivers of the future economy for the nation that would contribute to the overall Green Growth and Sustainable Development. Under the National Green Technology Policy, the cross-sectoral GT focuses on four sectors namely energy, building, waste management and transportation.

Renewable energy

Malaysia is emphasizing greater importance for Renewable Energy (RE) generation through specifically formulated policies and initiatives to spur the growth of the sector as a major step towards green economy. Other than the Feed-in-Tariff (FiT) mechanism, the Net Energy Metering (NEM) and Large Scale Solar (LSS) Photovoltaic plant schemes were introduced in 2016 to boost RE generation. NEM benefits users in terms of savings in electricity bill through lower electricity usage and energy credit from solar power generation while LSS allows developers to produce renewable energy in larger capacities.

In 2016, a total of 111 projects in renewable energy with total investments of RM1.9 billion were approved incentives. Out of the total, RM1.7 billion (88%) were from domestic sources and RM233.8 million (12%) were from foreign sources. These projects are expected to create 615 employment opportunities in this sub-sector.

The approved investments include 81 projects (RM588.8 million) that will generate energy from solar power, 12 projects (RM145.7 million) from biogas, 10 projects (RM806.6 million) from mini-hydro and six (6) projects (RM343.6 million) from biomass as the sources of energy generation.

Energy efficiency

As price of energy steadily increases over the years, there is a need to adopt energy efficiency measures to ensure productive use of energy and minimize waste. The use and adoption of energy efficiency systems and technology is encouraged through introduction of incentives and import duty exemptions on qualified machines and components. Consecutively, energy efficiency activities also open up opportunities for energy service companies (ESCOs) to provide energy efficiency services to potential clients.

In 2016, a total of 19 projects in energy efficiency with total investments of RM248.5 million were approved incentives. Investments were mainly from domestic sources i.e. RM235.6 million (95%) meanwhile RM12.9 million (5%) were from foreign sources. These investments are expected to provide 142 employment opportunities in the sub-sector.

Green technology incentive

Under the provision of Budget 2014, tax incentives for Green Technology in the form of Green Investment Tax Allowance (ITA) for the purchase of green technology assets and Income Tax Exemption (ITE) on the use of green technology services and system were introduced to further strengthen the development of green technology.

Application for incentive is to be submitted to MIDA for green technology projects and services, and to Malaysian Green Technology Corporation (MGTC) for purchase of green technology assets as listed in MyHijau Directory, by 31 December 2020. Projects which qualify for this incentive are renewable energy; energy efficiency; integrated waste management and green building / green data centre. In addition, eligible services activities include system integration of renewable energy; energy services; services related to green building / green data centre; green certification of products, equipment & building; and green township.

ASEAN Renewable Energy Integration Analysis

In support of the development of the ASEAN Power Grid (APG), the International Energy Agency (IEA) has undertaken a quantitative assessment of the impact of regional power system integration in ASEAN to accommodate the growing share of variable renewable energy (VRE), which consists of solar and wind generation.

The analysis explores the impact of multilateral power trading (MPT) and expanded cross-border interconnectors as well as the value of flexibility resources for the APG from economic, operational, environmental and policy-related perspectives. Cross-border interconnectors with MPT in ASEAN can promote effective asset utilisation and resource sharing that benefits regions. This will enhance the flexibility of the ASEAN power sector to accommodate an increasing share of renewables, particularly solar and wind, in a cost-effective, reliable, and environmentally sustainable manner.

For more information, contact:
International Energy Agency
9 rue de la Fédération
75739 Paris Cedex 15
France
Tel: +33 (0)1 40 57 65 00; Fax: +33 (0)1 40 57 65 09
E-mail: info@iea.org
Web: https://www.iea.org

HUNGARY

Central venous catheter system

A Hungarian medical research institute has developed a central venous catheter system for subclavial or jugular vein puncture. The kit contains the following items: insertion needle with the patented two-way valve system, syringe to check if the catheter is in place, the catheter itself, wrapped in sterile package and plastic adaptor to lock the catheter securely after the removal of the needle. The patented "HunCath" catheter system is a novel alternative to a safer catheter which can be widely used in techniques, such as pacemaker electrodes.

Area of Application

Medical technologies

Advantages

Among all catheters currently used this product bears with the lowest risk for the patient and the easiest use for the physician.

Development Status

Commercial prototype

Legal Protection

Patent

Technical specifications

- Requires fewer changes of grip during introduction of the catheter into the vein; therefore, accidental withdrawal of the catheter is less likely.
- The "HunCath" can be inserted into the vein

Transfer Terms

- Subcontracting
- Technology licensing

Contact:

Laser Consult Ltd
H-6701 PO Box 1191, Szeged, Hungary

INDIA

Solvent tolerant bacterial lipase

We could offer a technology to sysntheize bacterial lipase that has potential applications in the food industry. Brief description of the process / product / technology developed- se to various polar and non-polar organic solvents for 2 h elucidates that the enzyme was stable to all organic solvents tested. The highest relative activity was achieved with chloroform (400%) followed by toluene (250%) and 1-The present invention provides an extra cellular bacterial lipase from Pseudomonas mendocina M-37 (MTCC 7054) with high stability and substrate specificity. The bacteria were isolated from oil industry effluent showing high activity on olive oil. The substrate specificity of Pseudomonas mendocina M-37 lipase shows that the lipase was especially more active towards the synthetic triglycerides and fatty acids esters that possesses butyryl group like benzyl butyrate (1120% relative activity), tributyrin (744%) and amyl butyrate (550%) respectively. The stability of lipase in organic solvents offers Advantages for ester synthesis. Exposure of M-37 lipaoctanol (215%).

Area of Application

The bacterial lipase showing high activity in organic solvents and substrate specificity for butyrated esters has possible significant applications in food industry for ester synthesis. The esterification reactions in food industry are carried out in organic solvents and uses butyrated substrates. Pseudomonas mendocina lipase has possible applications in synthesis of flavour and fragrance esters; for organic synthesis and modification of fats and oils

Advantages

Pseudomonas mendocina lipase possessing high stability in organic solvents, high substrate specificity mainly for butyrated esters has possible significant applications in food industry for ester synthesis.

Environmental Aspects

Environment friendly

Development Status

Laboratory model

Legal Protection

Patent

Transfer Terms

- Consultancy
- Technical services
- Technology licensing

A novel compound with leishmanicidal activity

One new unsaturated amide named as Piplamide, N-isobutyl-19-(3',4'-methylenedioxyphenyl)-2E,4E-nonadecadienamide, was isolated from the fruits of the Indian medicinal plant Piper longum by bioassay guided fractionation and isolation, using an in vitro promastigotes assay against of Leishmania donovani. The structure was elucidated on the basis of spectroscopic analysis. a) piplamide shows a very good antileishmanial activity against Leishmania donovani promastigotes

Area of Application

- Piplamide could be evaluated as prospective enzyme inhibitor and could provide lead structure for further optimization of activity for use in antileshmanial drug developement.
- Piperlongimin A and piperlongimin B could provide lead structures for the development of novel anticancer therapeutics.

Environmental Aspects

Environment friendly

Development Status

Laboratory model

Legal Protection

Patent

Transfer Terms

- Consultancy

Technology Offers

- Technical services
- Technology licensing
- Research partnerships

For the above two offers, contact:

Amity University
Sector-125, Noida, Distt Gautam Buddha Nagar 201303
Uttar Pradesh, India

Herbal termite killer formulation

This is a herbal formulation for instant termite killing. The patent application is pending for the formulation. It holds the potential to wipe-off existing products and hold monopoly in the market. IT is equally good in fields and with furniture etc.

Area of Application

Woodwork, furniture, agriculture, house, offices.

Advantages

Non-toxic, cheap and highly effective

Environmental aspects

Cleaner production

Development Status

Commercial prototype

Legal Protection

Patent

Transfer Terms

Technology licensing

Contact:

Intellectual Property Lab, 2/11, Vishwas Khand-2,
Gomti Nagar, Lucknow - 226010, India

Retort pouch technology

The technology relates to a ready-to-serve fish curry in retortable pouch. The technology provides a method for preparing the ready-to-serve fish curry in retortable pouch with excellent storage stability and quality with a shelf life of more than one year at ambient temperature.

Area of Application

Food, meat, fish processing

Advantages

- The technology provides a method for preparing the ready-to-serve fish curry in retortable pouch with excellent storage stability and quality
- The ready-to-serve fish curry is thermal processed and do not require any further processing before consumption.
- The thermal processing conditions have been standardized for this product in order to make it safe for consumers

Environmental Aspects

Energy efficiency

Development Status

- Pilot plant
- Fully commercialized

Transfer Terms

- Consultancy
- Technical services
- Technology licensing

Virgin coconut oil

Virgin Coconut Oil (VCO) is the oil obtained from fresh, mature endosperm (kernel-meat) of the coconut by mechanical or natural means, with or without use of heat, no chemical refining, bleaching or de odorizing and maintain the natural aroma and nutrients.

Area of Application

Many potential applications in food, health and cosmetics sectors.

Development Status

- Pilot plant
- Commercial prototype

Transfer Terms

- Consultancy
- Technology licensing

Chitin and chitosan

Chitin and chitosan are important byproducts form the shell of shellfishes. Chitin is the most important organic constituent of the exoskeletal material of invertebrates and the important economical source of this material is the shrimp processing industry. Chitin and its derivatives, chitosan find various industrial applications like, biotechnology, food processing, pharmacy and medicine.

Area of Application

Various industrial applications like biotechnology, food processing, pharmacy and medicine.

Advantages

Chitin and its derivatives, particularly chitosan find industrial application in various fields namely flocculation, paper making, textile printing and sizing, ion exchangechromatography, removal of metal ions from industrial effluents, manufacture ofpharmaceuticals and cosmetics and as an additive in food industry.

Environmental aspects

Waste utilization

Development Status

- Pilot plant
- Fully commercialized

Transfer Terms:

- Consultancy
- Technology licensing

For the above three offers, contact:

Central Institute of Fisheries Technology
CIFT Junction, Matsyapuri, Willingdon Island
Cochin - 682029, India

Health care wheat flour

Health care wheat flour produced from wheat under a new mechanical and very hygienic process contains high percentage of fiber and vitamin – E. Around 400 grams of flour can be produced out of one kilogram of wheat. The rest of wheat can be used to produce maida. The health care wheat flour can be used to prepare chapatti and similar items. Chapatti made with health care flour will be soft, tasty and bowel friendly. The flour is free from additives and preservatives.

Area of Application
Food processing

Advantages
A product very rich in fiber and vitamin – E. Hygienically produced after perfectly cleaning wheat.

Environmental Aspects
Cleaner production

Development Status
Commercial prototype

Transfer Terms
Turnkey

Target Countries
India

Contact:
Department of agriculture
Innova Reserach Centre Pvt Ltd
Ochanthuruth, Kochi, 682508, India

POLAND

Decortication of fibrous plants

Technology allows for extraction of bast fibers from straw by so called decortication process without prior drying of the straw which considerably influences the price of the fiber and simplifies the process resulting in energy, labor and cost reduction. The key elements of the technology are decorticating device allowing for processing of non-retted hemp and flax stems and cleaning unit. High efficiency machines produce a "green" fiber of quality suitable for pulp or composite materials production. Produced fiber is baled in 300 kg bales by hydraulic press.

Area of Application

Bast fibrous plants processing industry; Farm cooperatives focused on bast fibrous plants production

Advantages

- High output
- Energy savings
- Purity of end-product (fiber)
- Straw can be processed without prior drying

Environmental aspects

- Cleaner production
- Waste utilization
- Energy efficiency

Development Status

Fully commercialized

Legal Protection

Patent

Technical specifications

- Processing capacity: 1.5 t of straw/h
- Energy consumption: 110 kw/h
- End purity of produced fiber: 10-15%
- Service requirements: 3 people

Transfer Terms

Technology licensing

Contact:

Institute of Natural Fibres and Medicina
ul. Wojska Polskiego 71B, Poznan, Poland
Zip/Pin Code: 60-630

THAILAND

Kitozan biofertilizer

We have five years' experience to produce Kitozan which we helped people to save environment and produce organic friuts and vegetable to feed people.

Area of Application

Biotechnology

Advantages

It can be used with any chemical and fertilizer. It can mix with water and feed for animal. It can change bad soil tobe good soil also.

Environmental aspects

- Cleaner production
- Waste utilization
- Energy efficiency
- Systems integration

Development Status

Fully Commercialized

Legal Protection

- Trade mark
- Copyright

Transfer Terms

- Turnkey
- Others

Target Countries

Worldwide

Contact:

Aloe Life Co. Ltd Thailand, 24/548 Vibhawadee Road Donmuang
Bangkok 10210, Thailand

Technology Requests

INDIA

Ethanol production plant

We are looking for a potential partner who can provide small scale Ethanol production plant.

Area of Application

Ethanol from Sweet shorgum/Sugarcane

Studies

Techno Feasibility Report

Project Type

New idea

Target Countries

India

Assistance from Partner

Complete plant on turnkey basis and equity partner

Contact:

Yugal Green Urja Solution private Limite
F-103, IRWO Classics, Rail Vihar, Sector 57
Gurgaon 122004, India

Syringe making plant

An Indian firm is interested in setting up a Syringe making plant. They need consultancy and price quotes for this project.

Area of Application

Pharma industry

Project Type

Start-up

Contact:

Mr. M.K. Sharma
Shree Cement Limited
Bangur Nagar, Beawar - 305901
Tel: +91 - 01462 - 228101 to 05; Fax: +91 - 01462 - 228117 to 19
E-mail: sharmamk@shreecementltd.com

PERU

White asparagus

A Peru based firm is interested in acquiring technology for production of White Asparagus. They need technology providers consultants and price quotes for this project.

Area of Application

Agriculture industry

Project Type

Start-up

Contact:

Mr. Antonio Donayre
Inversiones, Tacala SAC, Lima, Peru
E-mail: tacalasac@gmail.com

THAILAND

Biotechnology for wastewater treatment system

We are a wastewater service provider and we also research and develop new technology for water, wastewater and waste treatment. We need new idea of technology to develop our strenght in this watewater field, include cleaning canel, remove sediment in waterway, biogas, microbiology detecter and treated system quality.

Area of Application

Biotechnology, Engineering, New technology

Studies

Environmental Impact Studies (EIA/EIS)

Project Type

Expansion/Modernisation

Target Countries

Worldwide

Assistance from Partner

Any kind of new technology to develop on the waste

Contact:

Utility Business Alliance
21 Tst Tower 16th floor., Viphavadee-rangsit rd., Jompol, Jatujak
Bangkok 10900, Thailand

Shoe manufacturing system or machine

We are looking for the technology that can help us to produce shoes. We also want to know detail of the technology such as, specification, price, etc.

Area of Application

Textile industry, Manufacturing industry, Shoe manufacturing industry

Transfer Terms:

Consultancy

Joint venture

Equipment supply

Project Type

Start-up

Target Countries

Worldwide

Contact:

Textile Development Co., Ltd.
43/43 Moo 2 Soi Prompian 6, Tambol Bansuan, Muang
Chonburi
Thailand 20000

Asia-Pacific Tech Monitor

Readers are requested to complete the Response Form to the best of their knowledge/opinion and return it to APCTT by fax or email. We look forward to your cooperation to serve you better.

Technology Intelligence
Asian and Pacific Centre for Transfer of Technology (APCTT)
C-2 Qutab Institutional Area, New Delhi -110016, India
Fax: +91) (11) 26856274, Email: sahus@un.org, dasm@un.org

I read Tech Monitor

☐ Always ☐ Often ☐ Sometimes ☐ Never

1. **I find the design and layout of the Tech Monitor**

   ☐ Excellent ☐ Very Good ☐ Good ☐ Not Good

2. **I find the language used in the Tech Monitor**

   ☐ Easy to understand ☐ Little difficult to understand ☐ Difficult to understand

3. **I find the Tech Monitor**

   ☐ Very valuable ☐ Generally valuable/interesting ☐ Somewhat valuable/ interesting

   ☐ Little value ☐ No value

   I read Tech Monitor because I appreciate

   ☐ Technology Market Scan ☐Technology Scan ☐ Special Feature (articles)

   ☐Tech Events ☐Technology Opportunities ☐Business Coach

4. **I find the following sections**

	Very useful	**Useful**	**Less useful**	**No use**
Technology Market Scan	☐	☐	☐	☐
Technology Scan	☐	☐	☐	☐
Special Feature (articles)	☐	☐	☐	☐
Tech Events	☐	☐	☐	☐
Technology Opportunities	☐	☐	☐	☐
Business Coach	☐	☐	☐	☐

5. **Tech Monitor facilitated/contributed to:**

☐ Understand issues related to technology development and transfer
☐ Enhance my knowledge on latest technological developments and events
☐ Identity technology/business partners
☐ Negotiate technology/business transactions
☐ Establish contact with institutions/authors/experts
☐ Conclude a technology transfer
☐ Acquire a technology
☐ Selling a technology
☐ (Any other, please specify)

6. **To get similar information, I read other periodicals like:**

7. **I would like Tech Monitor to cover the following:**

About Myself

Name:

Gender: ☐Female ☐Male

Nationality:

Profession:

☐ Policy Maker ☐ Small and Medium-sized Enterprise (SME)

☐ Consultant ☐ Financier ☐ Researcher

☐ Professor/ Teacher ☐ Student ☐ Others (Please specify)

Contact details:

Organization:

Designation:

Street Address:

P.O Box:

Country:

Telephone:

Fax:

E-mail:

Website:

Note: *The survey results would be used for APCTT's internal purposes only.*

Selected Analytical Reports and Technology Platforms & Databases of APCTT

Analytical Reports (available online)

1. National Assessment Framework on Enabling Environment, Technology Innovation Ecosystem for Making Sustainable Energy Options Affordable and Accessible (For Indonesia and Lao People's Democratic Republic), January 2014

   http://apctt.org/nis/sites/all/themes/nis/pdf/National-assessment-framework_-final_ESCAP.pdf

2. Report on the National Assessment Framework of Enabling Environment and Technology Innovation Eco-system for Making Sustainable Energy Options Affordable and Accessible – Indonesia, May 2014

   http://apctt.org/nis/sites/all/themes/nis/pdf/Indonesia_Report-on-National-Assessment-of-Sustainable-Energy_optimized.pdf

3. Indonesia National Sustainable Energy Strategy Report on Enabling Environment and Technology Innovation Ecosystem for Affordable Sustainable Energy Options, May 2014

   http://apctt.org/nis/sites/all/themes/nis/pdf/Indonesia-National-Strategy-Report_final.pdf

4. Report on the National Assessment Framework of Enabling Environment and Technology Innovation Ecosystem for Making Sustainable Energy Options Affordable and Accessible - LAO PDR, May 2014

   http://apctt.org/nis/sites/all/themes/nis/pdf/Lao_Report-on-National-Assessment-of-Sustainable-Energy.pdf

5. Lao People's Democratic Republic National Sustainable Energy Strategy Report on Enabling Environment and Technology Innovation Ecosystem for Affordable Sustainable Energy Options, May 2014

   http://apctt.org/nis/sites/all/themes/nis/pdf/Lao-National-Strategy-Report_final.pdf

6. National Innovation System (NIS) training manual - "NIS Diagnosis and STI Strategy Development to Achieve National Sustainable Development Goals", 2016

   http://apctt.org/nis/sites/all/themes/nis/pdf/NIS%20Training%20Manual.pdf

Technology Platforms and Databases

1. APCTT's Technology4SME Database

   The Technology4SME Database serves as an online platform for information exchange on the availability and sourcing of technologies for small and medium enterprises in countries in the Asia Pacific region.

   http://apctt.org/technology-transfer

2. Renewable Energy Technology Bank

   The primary objective of the Renewable Energy Cooperation-Network for the Asia Pacific (RECAP) established by APCTT is to facilitate technology transfer cooperation among countries in the Asia-Pacific region in the area of renewable energy. RET-Bank provides tested and proven renewable energy technologies (RETs) initially in the areas of solar, biomass, wind, mini-hydro power and geo-thermal energy.

   http://apctt.org/recap/renewable-energy-technology-bank

3. Global Technology Databases

   APCTT has compiled a list of global as well as country-wise technology databases that deal with the technology transfer related services for SMEs and entrepreneurs.

   http://apctt.org/aptitude/

Techmonitor.net

The website for you to

- Network with your potential technology partners
- Explore technology and business opportunities
- Know latest technological developments in
  - Biotechnology
  - Waste Technology
  - Non-Conventional Energy
  - Food Processing
  - Ozone Layer Protection
- Read articles on
  - Technology Trends
  - Technology Markets
  - Technology Transfer
- Gain knowledge on
  - Start-up venture creation
  - Venture financing
  - Innovation management
  - Technology transfer
  - Green productivity

Website managed by

Value Added Technology Information Service
Asian and Pacific Centre for Transfer of Technology
New Delhi, India