Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific Tech Monitor

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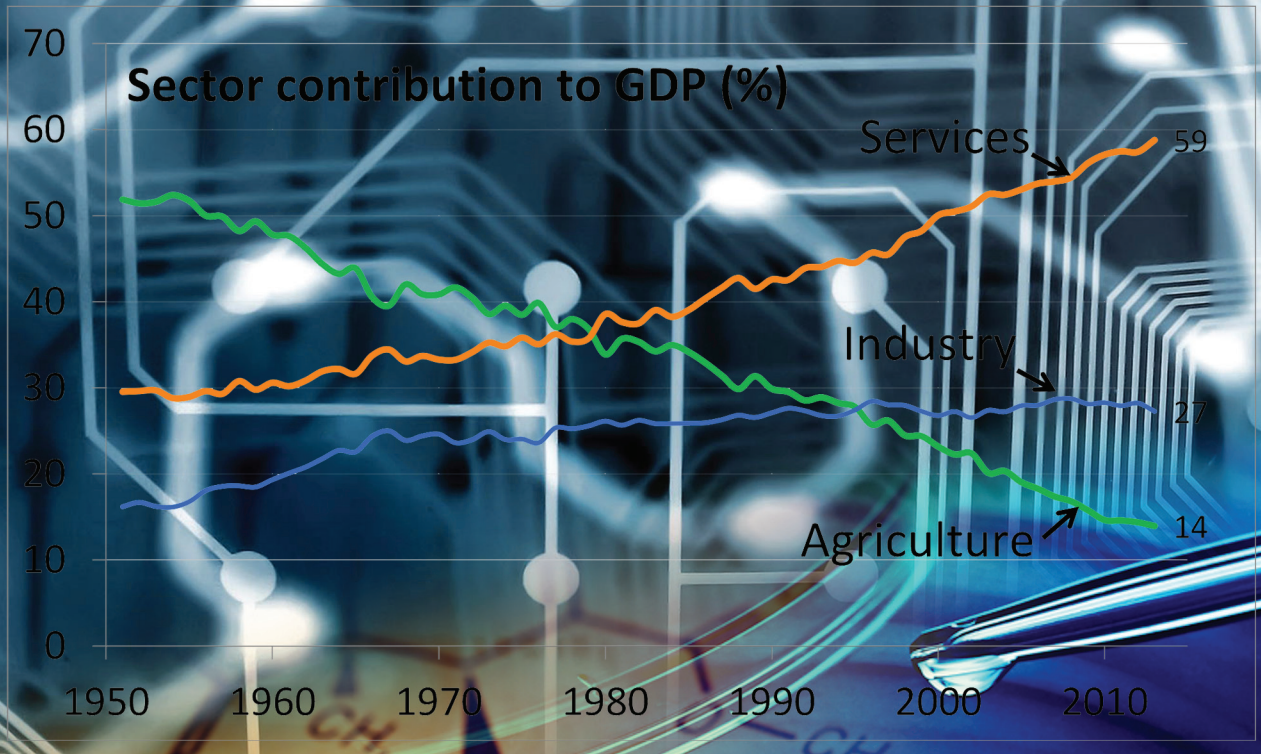
New and emerging science, technology and innovation strategies



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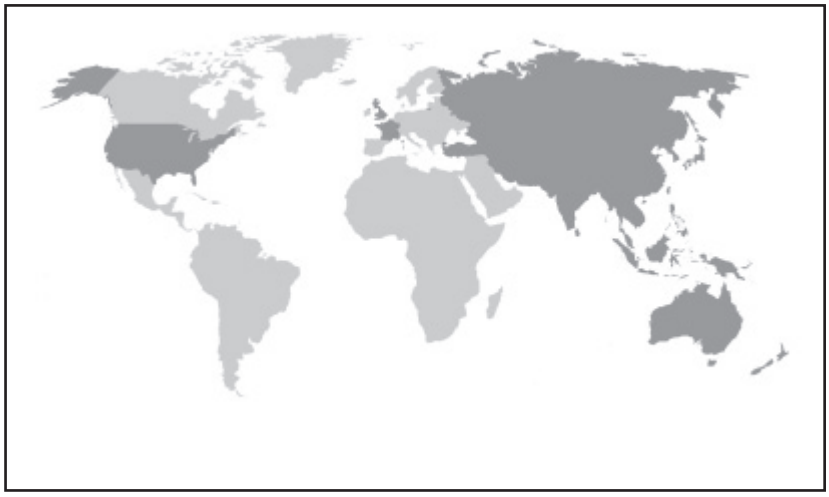
APCTT
Asian and Pacific Centre for Transfer of Technology

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

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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.

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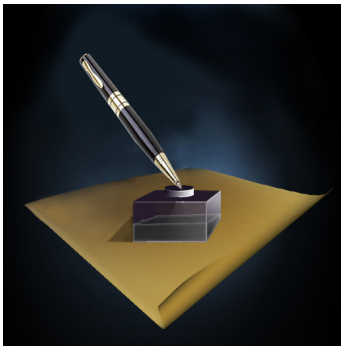


Introductory note

Science, Technology and Innovation (STI) has been recognized as an important way for achieving the sustainable development goals (SDGs) set out as part of the global post-2015 development agenda. In this context, mainstreaming of STI in national policies and programmes is critical to accelerate progress in sustainable development challenges faced by countries in the Asia-Pacific region such as water and sanitation, increasing urbanisation, access to clean energy, food and nutrition, sustainable production and consumption, climate change and sustainable agriculture. Improved national capacities to develop and apply STI to the SDGs can lead to technological solutions which can be scaled up and shared. It is clear that the achievement of the SDGs would require continued innovations and technological advances which, in turn, would require investments in research and development (R&D).

Given the potential of STI as a tool to drive the achievement of the SDGs, it is essential to develop interventions which enhance policies, institutions and processes that increase national capabilities, not only to develop, access and adapt technological innovations, but also to allow technology leapfrogging in new and emerging technologies. STI should therefore figure prominently in the countries' development plans and strategies. Some of the areas where governments can influence the development, promotion and utilisation of STI to achieve their national development goals include education, R&D investment, skill development, R&D in private sector, entrepreneurship development, collaborations and partnerships, mainstreaming of open innovation in STI, intellectual property protection and mainstreaming of gender in STI.

Developing appropriate national STI strategies will require sound analysis of existing national innovation systems (NIS) of countries. This can provide useful information for policymakers in planning for changes and strengthening the existing STI systems and strategies relevant to their national context and development objectives.Therefore, it is essential to diagnose or evaluate the quality and efficiency of a NIS by conducting evidence-based studies to understand the strengths and weaknesses of its components and evolve informed policy decisions and implementation mechanisms.There are several methodologies that are in use for diagnosis of the components of NIS as well as developing STI strategies, each with its advantages and limitations.

Since the SDGs will be the key global indicators of progress in the years to come, it is important that national STI strategies are aligned with the SDGs and that plans for achieving the SDGs take into account STI strategies. Although most countries do understand the importance of STI and higher STI investment, they lack the capacity to translate the outcomes of STI investments in terms of SDG progress. In the Asia-Pacific region, STI capacity development efforts should be particularly emphasised for the least developed countries (LDCs), the land-locked developing countries (LLDCs) and the Pacific island countries (PICs). These efforts would require vital support in terms of enhancing the countries' capacity in training and skill development in a number of technology areas relevant to sustainable development. There is also a need to explore new and innovative mechanisms for financing and implementing STI partnership initiatives for sustainable development projects in LDCs, LLDCs and PICs in the region.

This issue of *Asia-Pacific Tech Monitor* discusses new and emerging STI policies and strategies, institutional support mechanisms, challenges and opportunities for the countries of Asia-Pacific region.

Michael Williamson
Head, APCTT-ESCAP

Technology Market Scan

INTERNATIONAL

UN initiative to boost access to science and technology

The world's poorest nations are one step closer to gaining access to critical science, technology and innovation (STI) that is vital to their sustainable development, poverty eradication, and changing the lives of millions of people who live in some of the poorest segments of the global community, the United Nations has announced. A high-level panel established by the United Nations Secretary-General Ban Ki-moon in November 2014 agreed to prepare a study on the creation of a "Technology Bank", specifically aimed at addressing STI gaps in least developed countries (LDCs).

The state of science and technology is weak in the LDCs and as a result, they face immense challenges in their use of STI to fight poverty and improve the socio-economic conditions of their people. Acquiring new technologies and building a knowledge base to be able to fully understand that technology is critical for the socio-economic transformation of the LDCs. Development of this sector is also expected to bridge LDCs' digital divide and technology gap.

The 11-person panel, made up of representatives from LDCs and development partners, is tasked with ensuring that the proposed Technology Bank is able to effectively address questions relating to technology transfer, including intellectual property rights issues. A key undertaking of the new study will be to identify existing international initiatives to limit duplication of effort, as well as take into consideration streamlined management and costs.

The UN Office for LDCs, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS) will serve as Secretariat to the panel and coordinate the undertaking of the study. The panel is expected to deliver its recommendations on the details of the Technology Bank to the Secretary-General in July 2015.

The genesis of a multilateral effort to advance and accelerate science and technology among LDCs emerged from the Fourth UN Conference on the LDCs which was held in Istanbul, Turkey, in May 2011. The conference called for an evaluation of a proposed Technology Bank, science, and information support mechanism, which would help improve research, promote networking institutions and help LDCs access critical technologies.

http://www.un.org

Leveraging technology transfer for industrial development

A new United Nations Conference on Trade and Development (UNCTAD) study presents cases from Africa, Asia and Latin America, which provide contrasting experiences of the role of technology transfer and absorption in the development of different industries. The report entitled *Studies in Technology Transfer, Selected cases from Argentina, China, South Africa and Taiwan Province of China*, builds on ongoing efforts by UNCTAD to investigate the role of the transfer of technology in economic development. It was prepared under UNCTAD's mandate to undertake research and analysis in the area of STI with a focus on making STI capacity an instrument for supporting national development and helping local industry become more competitive.

The report examines the role of technology transfer in the development of integrated circuits production in Taiwan Province of China, button manufacturing in Qiaotou, China, automobile manufacturing in South Africa and biotechnology development in Argentina. The cases, therefore, cover high-technology activities (integrated circuits and biotechnology), medium-technology activities (automobiles) and low-technology activities (buttons). This approach illustrates the potential for technology transfer to play a role in activities of widely differing knowledge, technology and skill intensities.

These cases represent varying degrees of success in the leveraging of technology transfer and local capability development for industrial development in developing economies. The cases of integrated circuits in Taiwan and buttons in Qiaotou, China, are both highly successful experiences of technological and industrial upgrading that laid the basis for globally competitive industries. In the cases of biotechnology in Argentina and automobiles in South Africa, the results have been more mixed, with slower technological upgrading and a more nuanced picture in terms of the success of industrial upgrading and international competitiveness.

The four studies illustrate the varying approaches that firms and industries in different countries have taken in using international and domestic transfer of technology and combining these transfers with knowledge accumulated through internal effort to build stronger capabilities and improve their innovation performance. They also illustrate the substantial variation in policy frameworks, institutional development, levels of policy intervention and underlying strategies implemented by national and local governments in developing economies in their quest to promote catch-up with more advanced economies by closing the gaps in scientific, engineering, technological and innovation capabilities and performance.

http://unctad.org

ASIA-PACIFIC

Low-carbon technologies for Asia

A new service set-up by the Asian Development Bank (ADB) aims to match buyers and sellers of low-carbon technologies to speed technology transfer to developing Asia. The first-of-its-kind technology exchange was launched on the sidelines of the United Nations Framework Convention on Climate Change (COP20) meeting here.

The pilot service will initially focus on clean energy and energy efficiency technologies with the average transaction size expected to be $2 million–$5 million. Called IPEx Cleantech, Asia, the exchange will broke technology transfers from developed countries to developing Asia and between developing Asian nations, as well as provide a platform for knowledge sharing.

The service will be run by a Singapore-based joint venture comprising DNVGL's Clean Technology Centre in Singapore, part of Norway-headquartered, global advisory

firm DNVGL AS and ReEx Capital Asia, a Singapore clean energy investment banking and consulting firm."We have already pulled together a consortium of partners to join our intellectual property technology transfer marketplace. We are committed to making a positive impact in developing Asia in line with the objectives of ADB through this pilot and beyond," the two private sector firms said in a joint statement.

Asian Development Bank expects buyers of the technologies to include manufacturers, project developers and governments while sellers would likely be innovation design companies, university laboratories and multinational firms selling intellectual property rights. The new mechanism is co-funded by ADB, the Government of Japan, the Global Environment Facility and Belgium-based VITO-Flemish Institute of Technological Research. Over time, the venture is expected to evolve into a full-fledged independent business.

http://www.adb.org

CHINA

R&D spending in 2014

China has spent a whopping $216.8 billion last year on research and development (R&D), a 12.4% increase year on year as the world's second largest economy seeks innovation-led growth, an official report here said today. The Economic and Social Development Report 2014 from the National Bureau of Statistics showed 1.33 trillion yuan ($216.8 billion) was spent on R&D last year, 140.6 billion yuan (over $23.4 billion) more than in 2013.

The expenditure accounted for 2.09% of China's GDP last year, inching up 0.01% points from 2013, when the ratio exceeded 2% for the first time, state-run Xinhua news agency reported. Intellectual property watchdogs accepted 2.36 million patent applications in 2014 and granted 1.3 million patents, it said.

http://economictimes.indiatimes.com

Venture capital fund to support start-ups

China will set up a government venture capital fund worth 40 billion yuan ($6.5 billion) to support start-ups in emerging industries, in its latest move to support the private sector and foster innovation." The establishment of the state venture capital investment guidance fund, with the focus to support fledging start-ups in emerging industries, is a significant step for the combination of technology and the market, innovations and manufacturing," China's State Council, the cabinet, said in a statement.

"It will also help breed and foster sunrise industries for the future and promote (China's) economy to evolve towards the medium and high ends," said in the statement published in the government's website, http://www.gov.cn, referring to sectors which the government is promoting such as technology and green energy.

The cabinet said in the statement that the planned fund would be funded by the government's existing capital designated for expansion of emerging industries and by state corporates while also inviting private partners to participate in. The fund will render public tenders to invite high processional asset managements to operate, with returns giving priority to private investors, it said.

http://www.reuters.com

INDIA

Easing of FDI norms for medical devices

The Union cabinet approved liberalising foreign direct investment (FDI) policy for the cash-starved medical devices sector. The proposal to relax the policy was considered and approved, sources said. This is expected to help attract more investments and boost the domestic manufacturing.

At present, the medical devices sector falls under the pharmaceutical category and is accordingly subjected to FDI limits and other conditions such as mandatory government nods. While 100% FDI is permitted in the pharma sector, the FDI is permitted through automatic route in the case of green field investment or new venture and the Foreign Investment Promotion Board approval is required in the case of brown field investment or in existing companies.

There are several other riders, including FDI in medical devices sector being permitted through the government-approval route and the industry has been demanding it be put under the automatic route.

As per estimates, India imports about 70% of its requirement of medical devices. The industry size in the country is about USD 7 billion. Medical devices include wide range of products such as sutures, implants and surgical instruments.

http://www.business-standard.com

Increasing patenting activity

Patenting activity is witnessing a spurt in India in the recent years, a survey said. "India is an important global innovation hub, with both local and global organisations conducting critical research and development (R&D) activities in India. Patenting activity is growing rapidly and this has a direct impact on the country's economic growth," Thomson Reuters' Managing Director, India, and Head of Global Operation Centres Pradeep Lankapalli said, quoting the `2014 State of Innovation India's report. Among the top 10 patent filers in India, eight are domestic organisations, it added.

This year, for the first time, the computing and control technology sector has drawn level with the pharmaceuticals sector with each taking 17% of the overall share of Indian innovation, the report revealed. Furthermore, polymers and plastics have dramatically increased the share this year, rising to third place from 11th in 2014.

Communications again features prominently in innovation. New areas that have emerged this year are electric power engineering, buildings and construction, semiconductors and electronic components, lighting and heating and engines, pumps and compressors. There is an increase in patent numbers in these industries. High-tech, mechanical engineering and materials sectors have displaced the more traditional chemical and agricultural technology sectors.

http://articles.economictimes.indiatimes.com

Tax on royalty for tech services cut

The government proposed reducing the income tax on royalty fee paid for technical services, which analysts said will not only

help start-ups and small firms but also facilitate technology transfer in the country. Finance Minister Arun Jaitley in his budget proposals reduced the income tax on royal fees paid for technical services from 25% to 10%. "I propose to reduce the rate of income tax on royalty fees for technical services from 25 per cent to 10 per cent," he said presenting the Budget for 2015–2016.

Analysts welcomed the move to cut tax on royalty fees, saying it will also incentivise foreign technology firms to provide more benefits to their Indian clients and can also encourage them to invest in the country. "The proposal to reduce taxes on technical services from 25per cent to 10 per cent with the aim of encouraging tech start-ups is a welcome announcement and will help facilitate technology transfer to India," consultancy firm PwC India Technology leader Sandeep Ladda told PTI. The move eases the process of doing business for IT start-ups, helping breed a new stream of IT companies in emerging technologies such as SMAC, IoT, etc., he added.

Advisory services firm BMR & Associates Partner Mahesh Jaising said the step is a welcome move. "This reduction will help small firms especially in the technology sector," he added. It will also encourage foreign firms, who provide various technical services to these small firms and start-ups, to invest in the country, Jaising said India has emerged as the world's fourth largest hub for start-ups with over 3,100 of them, driven by "hyper growth" in technology and software products in the country, as per the Economic Survey 2014–2015.

http://www.business-standard.com

INDONESIA

Waiver on patent fee to boost innovation

Indonesia plans to waive all fees for filing of patent and copyright applications, as part of efforts to encourage greater domestic innovation and boost the country's competitiveness. Muhammad Nasir, the Minister for research, technology and higher education, said on Tuesday that researchers and inventors had been discouraged from registering their innovations with the government because of the high cost of filing a patent application.

"Inventors have had to pay a lot for the intellectual property rights to their innovations, even as those products have yet to generate [money]," Nasir said during a visit to the Jakarta Globe newsroom in South Jakarta "How can we expect to drive more innovation under such conditions?" Nasir said he wanted to get the private sector more involved in research and technology development and applications, identifying a lack of funding for R&D for Indonesia's dearth of technological innovations. He said research funding in Indonesia, mostly from the government, currently amounted to Rupiah 8 trillion ($631 million) a year, or 0.09% of gross domestic product—far lower than in more competitive economies such as Singapore (2.6%), Malaysia (1%) and Thailand (0.25%).

Nasir said he wanted annual R&D spending in Indonesia to amount to at least 0.5% of GDP by 2019. "We need research to support our efforts to improve our nation's competitiveness, otherwise it will be hard to realise," the Minister said "In the future, I want our higher education sector to conduct research based on orders, not on opportunities. It's much more efficient to conduct research based on commissions from the private sector."

http://thejakartaglobe.beritasatu.com

MALAYSIA

Green technology master plan

The Malaysian Green Technology Corporation (MGTC) is currently drafting a green technology master plan for the Ministry of Energy, Green Technology and Water. The master plan, to be implemented early next year, will detail guidelines and direction for companies to reduce carbon intensity by 40% by 2020.

"The master plan required government and private companies to work together and reach the 40% target in energy, transport, building, waste and water," said MGTC Chief Financial Officer Woon Foo Wen on the sidelines of the International Conference on Green Procurement and Eco-Labelling. Earlier, in his speech, Deputy Minister of Energy, Green Technology and Water Datuk Seri Mahdzir Khalid said Malaysia had reduced carbon emission intensity by more than 33%."The reduction was achieved despite facing difficulties in fulfilling the pledge made in 2009."

http://www.nst.com.my

PHILIPPINES

New Inclusive Business (IB) programme launched

The Philippines is currently accepting applications from companies to participate in its IB programme. The programme is intended to help reduce poverty across the nation by encouraging businesses to set up their operations in areas that have been identified as economically disadvantaged. In return for basing their operations in these areas, businesses will be granted a range of financial and other incentives. The programme will initially focus on the areas of Mariveles (Bataan), Cavite, Mactan (Cebu) and Baguio.

Major international companies are already seeking to take advantage of the new programme. Unilever Philippines has already submitted its application to the Philippine Board of Investment. The company's participation is part of a wider strategy to expand its operations throughout the country, which will include US$120 million upgrade of its manufacturing infrastructure. The upgrades involve importing new equipment, updating existing technology and expanding the asset base.

In order to qualify for the IB programme, businesses must commit to setting up their operations in areas that have been classified as economically disadvantaged. In return for this, and a commitment to sustainable farming of tamarind, tea, cocoa and vanilla, Unilever will receive benefits such as:

- an income tax holiday lasting 4–8 years;
- zero import duties on capital equipment; and
- simplified business procedures, such as reduced paperwork.

Although the IB programme is certainly a step in the right direction *vis-à-vis* the Philippines government's treatment of foreign-invested companies, there are still a number of economic restrictions hindering foreign investors. For example, foreign-ownership continues to be restricted by the 60/40 capital rule, which allows the foreign investor and domestic partner to own 40% and 60% of their enterprise, respectively. In addition, a dividend tax rate of 30% is applied to foreign investors while local companies are only liable for a rate of 15%. Compounding this problem, countries such as Viet Nam have zero dividend taxes for companies.

http://www.cfoinnovation.com

REPUBLIC OF KOREA

Investment on Science, Technology, ICT R&D

This year the Ministry of Science, Information Communications Technology (ICT) and Future Planning (MSIF) will invest 3.9520 trillion won (US$35.78 billion) in R&D on areas of science and technology and ICT.The MSIF announced on January 4 that it has confirmed the "R&D Business Comprehensive Implementation Plan," which invests 2.9037 trillion won (US$2.63 billion) in Science and Technology and 1.0484 trillion won (US$949.12 million) in ICT.

The investment scale this year, which excludes research and operating expenses of the National Research Council of Science and Technology and research institutes under the direct control from its total R&D budget of 6.5138 trillion won (US$5.9 billion), is to grow 7.9% compared to last year.

By sector, technology development accounts for the largest part of the budget with 2.2508 trillion won (US$2.04 billion), following basic research with 744.3 billion won (US$673.88 million), foundation construction with 640.2 billion won (US$579.63 million), commercialization and standardization with 161.7 billion won (US$146.4 million) and science and technology and ICT manpower training with 155 billion won (US$140.33 million).

By project, technology development in ICT will receive the highest funding at 772.3 billion won (US$699.23 million), following basic research at 744.3 billion won (US$673.88 million), source technology development at 562 billion won (US$508.83 million), creation of international science business belt at 440.5 billion won (US$398.82 million), space technology development at 373.8 billion won (US$338.43 million) and nuclear power research development at 314.6 billion won (US$284.83 million).

In addition, the total of 228.1 billion won (US$206.52 million) will be invested in research on nuclear fusion, whereas 143.9 billion won (US$130.29 million) will be invested in foundation construction in the ICT, 118.7 billion won (US$107.47 million) in creating cooperation between academia and industry, commercialization and technical commercialization, 55.8 billion won (US$50.52 million) in science technology globalization and 28.4 billion won (US$25.71 million) in ICT standardization.

http://www.businesskorea.co.kr

Spending on international R&D projects

The Republic of Korea will spend over 50 billion won (US$46.17 million) this year for joint R&D of new technologies and products with other countries, the government said. According to the Ministry of Trade, Industry and Energy, the country will spend 10.6 billion won on bilateral projects with five different countries, including China, Germany and France. An additional 9.7 billion won will be spent on multilateral projects involving two or more other countries. The amount spent on bilateral and multilateral projects will be matched by other participating parties, it said.

Republic of Korea will also allocate 31.2 billion won for joint projects funded solely by the country. These projects are partly aimed at getting technology transfer from advanced nations participating in the joint R&D, the ministry said. The total amount marks a 6.6 billion won increase from a year earlier. The sum set aside for projects funded by South Korea only has been cut by 4.6 billion won, according to the ministry.

"In the past, most of the country's joint R&D projects with other countries were funded by South Korea without any support of other participants as we sought to catch up with advanced technologies of other countries," the ministry said."The rise in the amount of money for jointly funded projects means we now have the technology leadership that allows us to work with other countries on a more equal footing."

http://english.yonhapnews.co.kr

Antitrust regulator puts excessive royalty demands on hold

In the future, non-practicing entities (NPEs) would not be allowed to demand excessive patent royalties in Korea. Moreover, they will be unable to deny the application of FRAND principles or file unfair patent lawsuits. The Korea Fair Trade Commission announced on December 23 that it will implement revised guidelines for its review on the wrongful use of intellectual property rights from December 24. The guidelines are likely to affect patent disputes between Samsung Electronics and Apple. In particular, they are expected to somewhat dispel worries about the transformation of Nokia into an NPE resulting from the merger between Microsoft and Nokia.

The guidelines stipulate five types of abuse that NPEs perpetrate using their dominant position in the market, which includes excessive royalty demands, denial of FRAND principles, wrongful application of principles for standard-essential patents (SEPs), indiscriminate patent lawsuits and business practices that target rival companies.

The country's anti-trust regulator defined SEPs as patents that need the owner's consent to produce or supply services or products using standard technology, specifying that patent violation lawsuits filed by SEP holders without prior negotiation are more likely to be unfair. In addition, it will be illegal to bundle unnecessary patents into needed ones.

http://www.businesskorea.co.kr

VIET NAM

Government bans transfer of 30 technologies

The Government has approved the Decree 120/2014/ND-CP which expands the list of technologies banned from transfer from abroad into Viet Nam. Accordingly, the number of banned technologies will be increased to 30 from the current 16 (stipulated in the Decree 133/2008/ND-CP), applicable from February 1, 2015.The Government will also prolong the list of technologies restricted from transfer from the current 11 to 23.

List of technologies banned from transfer

1. Technology for making up narcotics substances.
2. Technology for human embryo cloning.
3. Technology for printing and typesetting with lead plates.
4. Technology for manufacturing cells by the electrophoresis method.
5. Electrolysis technology using mercury electrodes.
6. Technology using mercury for small-scale gold exploitation.
7. Technology for paints using mercury.
8. Technology for manufacturing two-stroke engines.
9. Technology for manufacturing cars that fails to meet Euro 2 standards.
10. Technology for manufacturing explosive chemical products by manual methods.
11. Technology for manufacturing weapons, military equipment, explosive materials, technical equipment, support tools and devices for nullifying equipment to detect access to computer networks, except for those used for security and defence purposes.
12. Technology for nullifying devices to check and detect weapons, explosive materials, narcotics and other dangerous objects, except for those used for security purposes.
13. Technology for destroying radio waves, except for those used for security and defence purposes.
14. Technology for preventing information recording, deciphering information systems, except for those used for security and defence purposes.
15. Technology for nullifying sound-recording, video recording, measuring, counting and weighing devices and speedometers of means of transport, except for those used for security purposes.
16. Technology for nullifying devices to measure, count and calculate electricity volume.
17. Technology for nullifying devices to record phone call time.
18. Technology for producing televisions and personal computers using electronic rays to create analogue images.
19. Technology for shaft kiln cement production.
20. Technology for rotary kiln cement production by the wet method
21. Technology for manufacturing construction materials using amiang amphibole (blue and brown asbestos)
22. Technology for rotary kiln cement production with the clanker capacity of <2.500 tons per day
23. Technology for Hoffmann kiln clay brick production using fossil fuel (coal, oil and gas)
24. Technology for industrial and medical waste treatment with one-step burning or without exhaust gas treatment system
25. Technology for manufacturing urea-formaldehyde, phenol-formaldehyde glue or products (with formaldehyde class >E2)
26. Technology for production of preservatives for forest products that contain high pentachlorophenol and dichlorodiphenyltrichoroethane
27. Technology for producing NPK compound fertilizer with manual method (e.g., rotary pan granulator)
28. Technology for manufacturing sulphuric acid by the method of single exposure and single absorption
29. CFC and HCFC technology
30. Technology using non-native creatures, including animals, plants and micro-organisms under the list of invasive alien species.

http://english.vietnamnet.vn

New criteria for hi-tech investments

Hi-tech inward investments are expected to surge following the issuing of a new government shortlist of prioritised technologies and hi-tech products and eased criteria for enterprises to enjoy the most preferential incentives. According to the newly approved law on Investment, businesses wanting to be recognised as hi-tech firms will first have to be involved in the production of the listed hi-tech products and conform to the government's energy saving and environmental protection standards. In addition, the businesses must follow other criteria regulated by the Prime Minister.

Prime Minister Nguyen Tan Dung issued a new shortlist of prioritised technologies and hi-tech products following National Assembly approval of the new law on Investment. The new regulation of criteria and shortlist of high technologies actually include significant changes in luring hi-tech investments from foreign companies to Viet Nam, especially multinational companies. Although the new law on Investment replaces all the criteria related to R&D expenditure and ratio of workforce working in the R&D activities regulated by the law on high technology, the new shortlist also replaces the outdated list issued in 2010.

According to the law on high technology, companies would be recognised as a hi-tech enterprise when it satisfied all criteria, including manufacturing hi-tech products listed by the governmen, and spend an average 1% of the total annual turnover on R&D activities in Viet Nam during the first 3 years, and over 1% of its total turnover from the fourth year. For example, if Samsung's plant in the northern province of BacNinh exported $23 billion in value in 2013, the firm would have to spend at least $230 million on R&D activities for the year. In addition, the number of its workers with university or higher degrees personally involved in R&D activities needed to account for at least 5% of the firm's total workforce.

http://english.vietnamnet.vn

ASIA-PACIFIC

CHINA

New organic compound invented to aid sustainability

After 10 years of hard work, Chinese scientists invented a new type of environmentally friendly chemical blowing agent, which is expected to replace the prevailing physical blowing agents that contain ozone-depleting substances and super greenhouse gases. The chemical blowing agent of polyurethane rigid foam, called CFA-A8, was jointly researched and developed by Shandong-based Zibo Zhenghua Foam Materials Co. Ltd. and Shandong University of Technology.

At a technology evaluation meeting in Beijing in February 2014, the new green organic compound was recognized as an international advanced product by academicians from the Chinese Academy of Sciences and Chinese Academy of Engineering. Shu Xingtian, an academic at the Sinopec Research Institute of Petroleum Processing and a member of the evaluation committee, said that the sugar-based chemical produced no ozone-depleting substances and only had 1000th of the global warming potential (GWP = 1) of the physical blowing agent.

He said the CFA-A8 is the first chemical blowing agent for polyurethane rigid foam in the world. "With lower costs and no waste and pollutant emissions, the new chemical is expected to accelerate the phase-out of the current physical foaming agents contain substances such as HFC-245fa and HFC-365mfc and the other kinds of HFCs."

The project received 1.8 million yuan ($293,940) in support from the Multilateral Fund, according to Hou Yong Zheng, the President of the company. The fund, which was established by the United Nations Environment Program in 1991, is allocated to work that helps reverse the deterioration of the Earth's ozone layer.

http://www.chinadaily.com.cn

INDIA

Bio-digester toilets

A simple, low-cost technology for treating human waste – developed by the Defence Research and Development Organisation (DRDO) – can aid in putting an end to open defecation and manual scavenging in the country. The bio-digester technology of DRDO has the potential to give a thrust to the ambitious Clean India campaign, launched by Prime Minister Narendra Modi.

A recent report "Progress on Drinking Water and Sanitation, update 2014", by WHO and UNICEF, estimates that about 597 million people in India resort to open defecation, the highest in the world. The target of Swachh Bharat Abhiyan is to provide each household in India a toilet, both rural and urban, by 2019.

The technology, which uses bacteria to treat waste, was originally developed by the Defence Research Development Establishment, Gwalior, to meet the sanitation requirements of soldiers serving in the high altitudes of Ladakh and Siachen.

The system is built to operate from –20° to +50° and is highly customisable as per the requirements and local conditions. The best feature is that it totally does away with manual scavenging and is low on maintenance and installation cost. "This is the best system of decentralised waste treatment which is made to withstand any geo-climatic conditions of the country. It is also made for stationary or mobile use," said Dr. Lokendra Singh, Director of Life Sciences, DRDO, who was instrumental in the development of this technology.

A major achievement has been its installation in the railways, which are referred to as the "largest open defecation system in the world". Dr. Lokendra Singh added: "Over 15,000 systems have been installed and improvements are being carried out jointly by the DRDO and Indian Railways after which it will be expanded." The railways has also established its own research and development (R&D) for improvement on certain design aspects of bio-digester and for regular maintenance.

http://www.thehindu.com

Technology for safer, faster tyres

Chemical engineering graduates of the Indian Institute of Technology, Banaras Hindu University (IIT-BHU) have come up with a new eco-friendly innovation of extracting green silica from rice husk ash. With this, the carbon used in tyres can be replaced with silica which helps in reducing the rolling resistance and improving fuel economy.

Elaborating about their innovation Nikhar Jain said, "The rice husk ash contains heavy amount of silica which can be used for various purpose. To ensure effective rice husk utilisation through efficient silica extraction, we developed a process to extract advance grade of green silica." Citing advantages, he said, "First and foremost, the cost will be cheaper as no import will be required. Secondly, silica helps in reducing the rolling resistance so if it is used instead of carbon black then the fuel economy too will improve." It also results in 5% reduction in fuel consumption of vehicles and reduction in emission of greenhouse gases, he added.

This technology for silica extraction has been successfully employed at pilot stage by Nikhar Jain, Tanmay Pandya and Abhishek Poddar, who are associated with "Bridge dots Tech services Private Limited", established in 2011 by IIT-BHU alumni. It is a technology solution provider for Chemical & Allied Industries, across the globe, including India, Europe, Middle East, USA and Australia.

The students tested silica extracted from rice husk ash at Malaviya Centre for Innovation Incubation and Entrepreneurship (MCIIE) and are in contact with several multinational companies (MNCs). "Presently, we have received approval from two MNCs and are in talk with a few federal companies for funds," Nikhar Jain, one of the innovators said.

It is currently incubated at the Technology Business Incubator, MCIIE of IIT-BHU, which provides direct access to leading authorities and experts in India and state-of-the-art research infrastructure of the campus. It also has a well-equipped research lab in Noida.

http://timesofindia.indiatimes.com

Hydrogel technology to boost crop yields

A water-absorbing hydrogel, which has helped farmers boost crop yields in areas where water is scarce, developed by the Indian Agricultural Research Institute (IARI) has been transferred to Reliance Industries Ltd, following an agreement with the ministry of science and technology. With the technology transfer to Reliance Industries, Pusa Hydrogel, named after the place where IARI is located in Delhi, is likely to find new applications, according to K. V. S. P. Rao, Chairman and Managing Director of National Research Development Corp. (NRDC), the organisation responsible for licensing the technology.

Apart from strengthening water absorption, the hydrogel also enhances nutrition absorption by the crops. The hydrogel absorbs a minimum of 350 times its weight of pure water at temperatures as high as 50°C. Besides having high absorbency at high temperatures suitable for semi-arid and arid regions, it also improves physical properties of soil such as porosity, aggregate stability and hydraulic conductivity. The hydrogel is less affected by salts in the environment, improves germination of seeds, improves root growth and reduces requirement for fertilizers.

The hydrogel is environmentally safe as it degrades completely into carbon dioxide, water and ammonia within 1 year, according to IARI studies. The NRDC has already executed similar agreements with five companies before the accord with Reliance. "This gel absorbs and retains water for 48 hours and is getting quite popular in farms, and farmers are quite happy. In south India in particular, it has been popular," said Rao of NRDC. "But Reliance has not specified what it will use this technology for, so it can be used for many other value-added products." The liquid absorbing capability of the gel could make for many applications, including diapers and sanitary napkins, according to Rao.

http://www.livemint.com

JAPAN

Hazard map for smartphone users

Smartphone users can now access information about areas at risk of natural disasters using a new map service offered by the Geospatial Information Authority of Japan (GSI).The map, which can be viewed on the entity's new website (*http://maps.gsi.go.jp/*), provides disaster-related information such as active faults, areas susceptible to liquefaction and zones that are at or below sea level.

Users can also check for dangers in their immediate vicinity using the global positioning system on their smartphones, GSI said. The GSI remodelled its online topographic map to make it more user-friendly on smartphones. Information on altitude covers all of Japan. Fault line locations are for urban zones and their surrounding areas. Maps of low-lying land vulnerable to liquefaction are provided for the Osaka and Tokyo areas based on maps of swamps from the early Meiji Era (1868–1912).

http://ajw.asahi.com

Low-cost wastewater recycling

Mitsubishi Electric has developed a water treatment technology that enables industrial wastewater and sewage to be recycled on a low-cost basis. The company says the technology efficiently removes persistent organic substances in wastewater by using hydroxyl (OH) radicals generated through an electric discharge created at a gas–liquid interface. Mitsubishi Electric, aiming to contribute to sustainable water recycling, will apply the technology in an industrial wastewater reuse system that it hopes to commercialize by the fiscal year ending in March 2019.

The system's reactor uses several inclined plate electrodes in humid oxygen over which the wastewater flows. A pulsed corona discharge generated at the interface of the humid oxygen gas and wastewater produces OH radicals, a strong oxidant with an oxidation potential of 2.85 eV, compared to 2.07 eV for ozone. Owing to the OH radical's high reactivity, persistent substances such as surfactants or dioxane decompose into carbon dioxide, water molecules and other inorganic compounds.

The effective generation of OH radicals makes the treatment twice as efficient as conventional advanced oxidation processes, such as the combined use of ozone and ultraviolet irradiation (O3/UV), the company says. Oxygen gas consumption is reduced significantly by up to 90% due to gas recycling. The modularized structure of the discharge units makes the equipment more simple and cost effective than the O3/UV method.

Mitsubishi Electric is now working to apply its technology in practical industrial wastewater and sewage reuse systems that are expected to help realise societies capable of sustainable water recycling. This technology is currently under joint development with Yasushi Minamitani, an Associate Professor at Graduate School of Science and Engineering, Yamagata University.

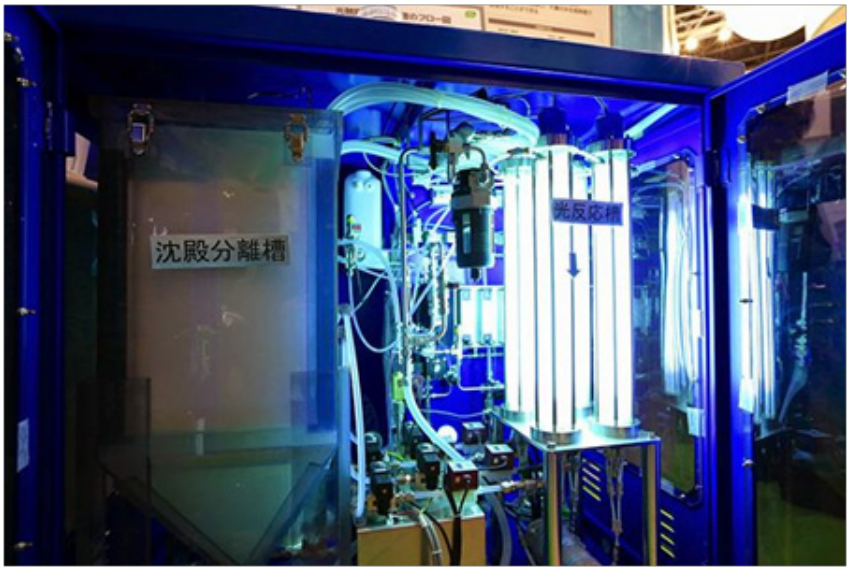
http://www.environmentalleader.com

Sunlight water-purification technology

Panasonic has developed a novel water-purification technology using just the power of the Sun to help developing countries secure access to safe, drinkable water. Capable of removing dangerous pollutants from water at high speed, the technology was introduced at the recent Eco Products trade show in Tokyo.

The system relies on photocatalytical compounds and UV light to remove toxic substances including arsenic, hexavalent chromium, bacteria and various agricultural and pharmaceutical residues from the water. Panasonic has used titanium dioxide as a photocatalyst, distributed in extremely fine particles. When exposed to ultraviolet rays, the photocatalyst forms reactive oxygen molecules to bind the contaminants.

Although highly efficient, the method was previously considered impractical due to



New technology could help developing countries secure access to safe potable water

the difficulty in subsequent removal of such tiny grains from the cleaned water. However, Panasonic designed an improvement in the system by binding titanium oxide to zeolite. Unlike other approaches, this technique does not reduce the activity of the titanium oxide particles. Moreover, since the two particles are bound together by electrostatic force, there is no need for binder chemicals.

http://eandt.theiet.org

PHILIPPINES

Mobile disaster communications service

The Department of Science and Technology together with international and local partners launched and formally turned over the Movable and Deployable ICT Resource Unit (MDRU) to the town of San Remigio, Cebu, one of the municipalities ravaged by Typhoon Yolanda. The donation of the MDRU to the Philippines happened through the efforts of the International Telecommunications Union and the Ministry of Internal Affairs and Communications of Japan (MIC) and the Central Visayas Information Sharing Network Foundation (CVISNet).

The R&D on the Movable Deployable ICT Resource Unit started in response to the Great East Japan Earthquake of 2011 with the support of MIC, Nippon Telegraph and Telephone Corporation (NTT) and other Japanese ICT organisations. It is a unit that can be quickly deployed to restore communications in communities in the aftermath of a disaster. The unit is self-reliant running on its own power source and/or is able to harness other power sources such as power generators or local active power lines.

The MDRU donated by Japan comes in two configurations, the small version is the size of a .5 m ´ 0.5 m box that contains the necessary equipment and software necessary to provide basic voice and data communications within a small area for up to 500 concurrent users, whereas the attached case version of the MDRU can do the same for a much smaller area. The MDRU can also act as a data centre, it is built in with an Evacuee Management System that allows relief workers, using no more that smartphones or tablets to track and tabulate those who have been displaced by a disaster.

http://news.pia.gov.ph

REPUBLIC OF KOREA

Technology for cement-free building construction

A Republic of Korean research team consisting of a college student and a professor has succeeded in developing a technology to make a new material that can replace cement. The material is made from industrial by-products, and thus it can reduce environmental pollution. On top of that, it is economical.

Jeon Dong-ho, a senior in the School of Unban and Environmental Engineering at the Ulsan National Institute of Science and Technology, and his adviser Oh Jae-eun announced on Jan. 15 that they have successfully developed a technique to produce a cement-free binding material with high compressive strength. It is possible by adding chemical activators $Ca(OH)_2$ and Na_2CO_3 to fly ash, a by-product of burning coal in thermoelectric power plants.

The newly developed material can reduce the amount of CO_2 at the 15% level of existing cement by using as much as 85% fly ash. In addition, the price of the material amounts to only 80% of that of Portland cement. It is also possible to put the power-like material in a sack for sale like Portland cement by improving its safety using $Ca(OH)_2$ and Na_2CO_3. They are less corrosive than exiting agents that help with hardening. However, the cement-free binding material easily solidifies. To address the problem, another method to control the time needed for solidification was developed as well, which was patented in the country.

Jeon said, "The use of the cement-free binding material enables people to build concrete structures without utilising Portland cement." He added, "When it comes to countries in Central Asia like Mongolia and Kazakhstan, which mostly import cement, it will be possible to make and supply a cement replacement material from a by-product abandoned in thermoelectric power plants. Therefore, it would be like killing two birds with one stone."

The research findings were published online in the January issue of *Cement and Concrete Research*, a scientific journal published by Elsevier B.V., and two patents were filed for the technology with the Korean Intellectual Property Office.

http://www.businesskorea.co.kr

Technology to change sea water into fresh water

A Republic of Korean research team has successfully developed a technique to change sea water into fresh water using nanotechnology. The method is expected to contribute to solving water shortages around the world. The team headed by Professor Lee Jung-Hyun at Korea University announced on Jan. 26 that they have succeeded in developing a technique to manipulate the structure and performance of separation films using a nanotechnology. The nanotechnology can make several layers of thin films by stacking molecules on top of one another and assembling those stacked molecules afterwards.

In particular, separation films manufactured by this technique can remove the same amount of salt as existing methods with an 80% better water permeability. So far, it has been difficult to enhance the function and durability of separation films, since the physical and chemical structures of those films are hard to control.

Professor Lee explained, "I think that our research can contribute to increasing local technologies' share of the separation films market for seawater desalination and water treatment in the future." The research findings were first published online on Jan. 5 by *ACS Nano*, a monthly scientific journal published by the American Chemical Society.

http://www.businesskorea.co.kr

More efficient, cheaper solar cells

A Republic of Korean research team has successfully developed a technique to produce more efficient and cheaper solar cells by synthesizing an organic–inorganic hybrid material. The team head by Dr. Suk Sang-il at the Korea Research Institute of Chemical Technology announced on Jan. 7 that they have succeeded in developing a method to make organic–inorganic hybrid perovskite solar cells. Those solar cells are made from an easily synthesizable organic and inorganic material. Perovskite is a material with a special structure that shows the characteristics of both non-conductors and semiconductors, along with superconductivity.

The team has successfully made solar cells with 18.4% efficiency using this technique. In particular, the technology can expand the wavelengths of light that are absorbed and increase the stability of its crystal structure based on the method to make a thin perovskite film, which is similar to the structure of the solar cell platform. The new solar cells are easy to manufacture, since they are made by coating low-priced chemical materials at a low temperature.

Dr. Suk Sang-il said, "This technology could overcome the limits of existing crystalline silicon cells and thin-film solar cells, which are manufactured through complex processing using expensive equipment." He added, "Our team will try hard to develop and commercialize highly-stable original and continuous process technologies in the future."

The research findings were first published online on Jan. 7 by *Nature*, a scientific journal published by the Nature Publishing Group.

http://www.businesskorea.co.kr

SINGAPORE

Smart window that can tint or brighten itself

Scientists have created a smart window that not only brightens or darkens as needed, but also acts like a battery. At the Nanyang Technological University (NTU) in Singapore, researchers have developed a smart window that does not require any electricity and has a battery that can be recharged and utilized to power other devices.

Professor Sun Xiaowei, who led the research, highlighted that existing window solutions available to buyers are not smart enough to block or allow light when needed. Unlike the latest smart windows, existing window solutions do not have an integrated power source.

The latest window developed by NTU turns into a blue shade when there is bright light, reducing the penetration of light by 50%. The developers of the smart window suggest that the latest technology is extremely attractive as a "zero-sum consumption smart window."

"Buildings owners and even common households can reap energy savings right from the outset and over the long term. Developers who are looking at construct-

Scientists develop a smart window that can automatically block or allow light when needed

ing environmentally-friendly green buildings will find our technology attractive for their building plans" said Professor Sun. Professor Sun reveals that the window has a battery that is transparent and it turns blue with the presence of oxygen in the electrolyte. The smart window has a liquid electrolyte positioned in between a couple of glass sheets, which has an indium tin oxide (ITO) coating.

The researchers say that ITO is normally used in television displays as a transparent conductive coating. One of the glass sheets also has a coating of a pigment called Prussian Blue, which gives the window a blue tone when fully charged. The other glass sheet has a thin aluminium foil strip attached to it. The researchers suggest that the technology is important as it saves lighting and cooling costs without the need for human intervention. Reduction in lighting and cooling also helps to reduce carbon emissions.

The study was published in the journal *Nature Communications*.

http://www.techtimes.com

EUROPE

SWEDEN

Storing excess green energy into methane

A proof-of-concept power plant using excess energy from renewable resources to produce methane from biomass will be tested in Sweden. Developed by engineers from the Karlsruhe Institute of Technology, the system could help efficiently balance electrical grids strained due to the fluctuation of power production by renewable resources such as wind and solar. The pilot system, called the DemoSNG unit, is mobile and about the size of a conventional shipping container.

The researchers believe producing methane from the excess energy has tangible advantages as the infrastructure for methane and gas distribution already exists. In addition to producing methane from biomass-based carbon dioxide, the surplus energy could also be used to power electrolysis to produce hydrogen.

The DemoSNG unit achieves better results than previous concepts, thanks to the use of a nickel-based catalyst contained in metallic honeycomb-like structures, similar to those used in cars to neutralise exhaust gases. The system produces hydrogen, carbon dioxide and carbon monoxide by gasification of biomass and turns those directly into methane and water. If further green power excess is left after the completion of the methanation, it can be employed to power electrolysis of the resulting water to produce hydrogen.

The team has completed first tests and is about to ship the unit to Köping in Sweden for integration into gas flows of a biomass gasification plant using wooden residues. The team said the system's innovative honeycomb catalyst makes the technology suitable for operations of plants of various sizes including smaller and medium facilities.

http://eandt.theiet.org

UK

New technology provides cheaper solar energy

A new type of photovoltaic device developed by researchers could drastically lower the start-up costs for solar systems and bring renewable energy from the sun to more places than ever before. While the implementation of solar arrays has increased with increased awareness of climate change and CO_2 emission reduction targets, current techniques such as silicon and thin films are still expensive. The team from the University of Exeter discovered that solar cells using the mineral perovskite not only converts sunlight at 9% efficiency, but are also cheaper to produce than current technology.

Although this development is exciting on its own, the study also tested their new device at locations in Brazil, the United States, Spain, China, the United Kingdom and Saudi Arabia, demonstrating that the perovskite-based cells can convert light to power in atmospheric conditions different than direct sunlight. This flexibility will open the doors for even more areas to access clean, renewable energy.

http://www.buildings.com

NORTH AMERICA

USA

Technology that turns waste water into fresh water

Researchers have developed a new technology that turns waste water into fresh water more efficiently than conventional

Scientists develop a smart window that can automatically block or allow light when needed

methods. Dr Jianmin Wang, a Professor from Missouri University of Science and Technology, developed multiple waste water treatment technologies that produce fresh water that is not only cleaner than waste water treated using traditional methods, but also requires less maintenance and energy.

Wang said 0.8% of America's energy use is spent on waste water treatment. Much of that energy is used to aerate the tanks where waste water is treated. The energy is used to feed oxygen to the microorganisms that consume the waste, and traditionally waste water treatment plants maintain an oxygen concentration of 2 mg/l to feed the bugs in the tanks, Wang said.

He has also developed another treatment system called an Alternating Anaerobic-Anoxic-Oxic (A3O) process that "can achieve superior effluent quality since it can remove organic pollutants plus nitrogen and phosphorus nutrients." It does this without chemicals, and its effluent contains only 5 mg/l of total nitrogen and 0.5 mg/l of total phosphorus. It also saves >10% of energy compared to the conventional pre-anoxic process, which has significantly less total nitrogen and total phosphorus removal. With its high performance, high energy efficiency and low operational costs, on a large scale the technology could help curb global surface water eutrophication.

Wang has also developed a self-mixing anaerobic digester, which can effectively convert waste water sludge and other organic waste to biogas energy. It improves environmental quality by removing the sludge and also recovers a useful resource during the process. In addition, his high-rate digester operates itself, without an external energy hook-up. Based on his calculations, Wang said a combination of his technologies can produce a net 10% energy gain in contrast to the 27% net energy use the wastewater industry currently operates on.

http://www.newsx.com

Graphene nanotechnology for efficient desalination

Engineers at Lockheed – Martin recently developed and patented a molecular filtration membrane called Perforene which can desalinate seawater using only 1/100th of the energy of the best existing desalination systems. Perforene is made from graphene, the exciting new nanomaterial which comes in the form of one-atom thick sheets of carbon atoms. Like an overzealous nanotechnology, graphene seems to photobomb itself in as the solution to numerous environmental problems such as, storing electricity, removing air pollution, advanced photovoltaics, high strength materials and now desalinating water.

Under a microscope, this material looks like a mesh net with holes as small as 100 nm. These holes are small enough to block the chlorine and sodium ions in salt water but large enough to allow pure water molecules to pass through. The material was invented by Lockheed engineer. In an interview with Reuters, Stetson said that this new material is 1000 times stronger than steel and 500 times thinner than the best-existing reverse osmosis desalination filter.

http://www.greenprophet.com

Recycling rare earth metals from old electronics

Scientists at the Critical Materials Institute, headquartered at the US Department of Energy's Ames Laboratory, have developed a new two-step process to make recycling rare-earth metals easier and more cost-effective.

Rare-earth metals are valuable ingredients in a variety of modern technologies and are found in cell phones, hard disk drives in computers and other consumer electronics, which are frequently discarded for newer and more up-to-date versions.

Building on previous research work done at the Ames Laboratory, Ott and his research group have developed a two-stage

liquid metal extraction process that uses differences between the solubility properties of different elements to separate out rare-earth metals. "Magnesium has good solubility with rare-earths, particularly with neodymium, and poor solubility with the other components of magnets, like iron and boron," said Ott.

In the liquid extraction method CMI has developed, scrap metals are melted with magnesium. The lighter atomic weight rare-earth metals like neodymium bind with the magnesium and leave the iron scrap and other materials behind. Then the rare-earth metals are recovered from the magnesium through vacuum distillation. In the second step, another material is used to bind with and extract the heavier atomic weight rare-earth metal, like dysprosium.

"Finding the best way to do the second step was the important breakthrough," Ott said. Extraction of the heavier rare-earth metals was always difficult in this process, and those materials are the most valuable. Therefore, finding a way to do that successfully was the key to making it more economically viable as a large-scale recycling method.

http://phys.org

Special Theme for Asia-Pacific Tech Monitor, Apr–Jun 2015

"Renewable/sustainable energy technologies for last mile connectivity"

SCIENCE, TECHNOLOGY AND INNOVATION FOR INCLUSIVE DEVELOPMENT

REORGANISING THE NATIONAL AND REGIONAL SYSTEMS OF INNOVATION

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Abstract

This article aims to discuss on how universities, research institutions and research councils can take a more proactive role in promoting inclusive development within a nation and across borders. The authors argue that there is a need for regional coordination mechanism (RCM) to effectively promote cross-border science, technology and innovation initiatives that align with the national inclusive development agendas. The authros further argue for the reorganisation of the existing RCM for sustainable development agendas. Some lessons were drawn, from case studies, on the features of an effective regional coordination mechanism.

Introduction

The post-2015 agenda on sustainable development has emphasised the role of science, technology and innovation (STI) in promoting sustainable development. Indeed, the agenda is of importance given the rise in the common problems and issues within as well as across the borders. More importantly, cross-border issues such as pollution, climate change, food shortage, clean energy and others require collective efforts and the transfer of technology and know-how. Although STI is seen to play a crucial role in achieving the goals of the sustainable development, the benefits can only be seen if STI is inclusive, be it at national or international level. In other words, inclusion should also be inclusive enough to include the disfavoured and poorer population as consumers of public policies or helping the disfavoured to build their capacity and capabilities through the transfer of know-how and technology. Technological learning as well as capacity building to improve the absorptive capacity has become a crucial part in this process. It implies that it is time for countries to develop national STI policies that promote cross-border initiatives through the promotion of knowledge as well as dissemination and the utilisation of the innovation outcomes in a broader context.

In this article, the authors discuss how universities and research councils can take a more proactive role in promoting inclusive development. Furthermore, they determine issues and challenges faced by universities and research councils in performing their inclusive development agendas. In addition, the authors argue on the need for a regional coordination mechanism (RCM) to effectively promote cross-border STI initiatives to achieve and promote STI for inclusive development. Finally, the authors discuss how the existing regional coordination bodies should be reorganised in promoting inclusive development.

Universities and research councils: innovation for inclusive development

The role of institutions, such as the universities and research institutions, are crucial in providing, sharing and directing their research outcomes for inclusive development. Indeed, such outcomes can only be utilised when they involve the grassroots in the process and if the outcomes are shared among countries to solve common global problems. In this regard, universities and research institutions as well as research councils can play various roles which include:

- industrial and societal capacity development;
- social and cultural development;
- human capital and skill development;
- institutional capacity development; and
- regional innovation development.

In innovation studies, universities and research councils are considered the supply side in the innovation value chain. Universities are mandated to perform three core missions, namely, teaching, research and outreach, whereas research councils are focused on national research and policy agenda setting and funding. Both universities and research councils, in this regard, are important innovation system factors that contribute to development primarily through knowledge creation and to a

Note: The findings of this study are partly based on a larger study sponsored by Canada's International Development Research Centre (IDRC). See Ng et al. (2015) for more details on the effectiveness of the regional coordination mechanism.

certain extent, diffusion through extension services and grant making.

A landmark study on *Science and Technology Innovations for the Base of the Pyramid in Southeast Asia* (iBoP Asia)[1] provides some insights into the innovation for inclusive development (IID) roles among several universities in Southeast Asia (SEA). The study highlighted 11 inclusive development projects that engaged academic institutions at different stages of the innovation process. In general, universities in SEA were able to perform two functions in IID, namely (i) intermediary for innovation project implementer, and (ii) direct innovation project implementer. As intermediaries or partners, universities in SEA mainly played their roles in demand articulation (i.e., scanning and diagnosis), knowledge, technology development and brokering (i.e., matching with demand, dissemination or transfer and communication), and technology assessment. Besides, universities are engaged by the industries and communities to develop research methodologies and tools, conduct laboratory testing and develop and test innovation prototypes. On the other hand, as a direct innovation project implementer, apart from demand articulation and knowledge/technology brokering, universities also engage in innovation management (i.e., execution and monitoring), network brokering (i.e., linking and coordinating with collaborators and capacity-building (i.e., community development and training) (Dator-Bercilla *et al.*, 2012).

IID, in this respect, is understood as a continuous effort in translating the outputs from innovation-related activities to all levels of communities (especially the disadvantaged groups or individuals). Such efforts will eventually catalyse into good progress in both the physical and social well-being of development (Ng *et al.,* 2005). Indeed, IID is the integration of two value-laden concepts – "innovation" and "inclusive development". Innovation refers to a new or significantly improved product (both goods and services) or process introduced to the market. In the literature of innovation studies, obtaining a consensus on the necessary degree of novelty is always an issue in innovation research, especially for those empirical studies which engage in primary data collection. This is because different people with different backgrounds and interests may form different interpretations of the concept of "*new or improved*" in innovation activities. In order to overcome this problem, this article adapted the Oslo Manual (OECD, 2005) postulation that the minimum entry requirement for all innovations is that the product or process should be new or significantly improved at firm level (or communities in the context of this study). In order to obtain a higher impact from IID, it is better that innovation that is disseminated to the society is "slightly" higher (rather than those high-tech innovations) than the existing capabilities of the communities at the bottom of the pyramid. This is to avoid a high learning curve that may hinder the desire for change among the vulnerable communities.

"*Inclusive development*", on the other hand, refers to a progressive community or development that embraces all levels of community. The first part of the term – "*inclusive*" – describes the phenomenon where the needs and welfare of the entire community, especially the vulnerable groups, are well and equally taken care of. In the policymaking process, the principle of inclusion is translated into two forms: (i) the process of decision making that emphasises the equitable distribution of the nation's development outcomes (i.e., the top–down approach), and (ii) the participation of all levels of community in the policy formulation process (i.e., the bottom–up approach). The second part of the term – "*development*" – refers to the progress that takes place in multiple forms and emphasises on both the physical and social well-being, such as basic needs, economy, modernisation, industrialisation and environmentalism.

For universities and research councils, in playing their role more effectively, inclusion of societal needs as well as the regional needs is of importance. Figure 1 shows the interconnection and the interaction among the various actors within the national system and their connection at various regions. Universities and research institutions are the core producers of scientific outputs (knowledge production and transfer), whereas industries are the core producers of technology outputs. Both institutions collaborate for knowledge transfer and research. This collaboration is advantageous for reducing the long lags between new knowledge or discoveries and useful applications derived from the knowledge. The role of the government (the public authorities) is central for development of infrastructures to stimulate science and technological activities. The society/user involvement in the processes of science and technology can range from developers responding to the users' demands without actually involving users (low social involvement to users themselves develops the final product or services – high social involvement).

However, what is evident currently is the missing link to society. Currently, there is a lack of interaction at societal level. As for society engagement with academia, industry and government, the bridging role of NGOs or community leaders are of importance. As such, universities, industries as well as government should proactively engage with NGOs as well as community leaders to bridge the gap and provide the needed solutions to the common problems, which can be social, technology or economic. Second, at regional level, there is limited evidence of commonly established interest especially in promoting STI as the platform to provide solutions to the common problems. Countries lacking capability can learn from others to significantly contribute to inclusive development. A number of mechanisms are available for these purposes. These include advice, a platform to exchange knowledge, promoting best practices, facilitating networks, establishing regional

[1]iBoPAsia ran from 2008 to 2011 with the aim to foster S&T innovation to contribute to the development of affordable solutions to unmet needs, increase productivity and incomes and facilitate the integration of poor and excluded in the formal economy.

intervention programmes and projects, providing funding sources, staff mobility and student participations and sharing innovation outcomes.

In the process of facilitating the relationships, attention should also be paid on how other intermediaries can play a role. The possible intermediaries and their roles are exhibited in Table 1.

SEA also lacks the formal framework for systematic interuniversity, intercountry knowledge management, resource pooling and sharing, and network for IID. Hence, the presence of effective and efficient RCM as one of the important intermediaries between the engagement of these institutions (i.e., universities and research councils) with industries and communities is crucial. Figure 2 shows the basic framework of how the RCM can work with the national level innovation systems including with major factors like the research councils. The roles of RCM, in this context, include industrial and societal capacity development, social and cultural development, human capital and skill development, institutional capacity development and regional innovation development with a focus on inclusive development. As such, nations lacking capability can learn from others to significantly contribute to inclusive development. For instance, regional coordination in fighting avian flu in ASEAN[2] was a success story given that the participating countries were able to share the best practices and information to basically control and eradicate the spread of the flu. Since all the countries had a common interest, this programme was successful. Similarly, in areas of inclusive development, a similar platform can be established. However, there is a significant difference between the case of avian flu and efforts to coordinate the programmes of inclusive development. First, in the case of avian flu, all countries have a common interest; however, in the case of innovation and inclusive development, countries are basically competing to be at the frontier, limiting the utilisation of full cooperation.

Challenges, strategies and lessons learned

Despite having various regional coordinating agencies/bodies in the existing system in SEA, challenges still remain. Ng *et al.* (2015) identified the main challenges and attributed this to the systemic failure of the regional coordination bodies in addressing STI as a platform for inclusive development. Among them include lack of recognition, commitment and appreciation for using innovation in inclusive development agenda, inadequate funding supports, weak coordinating leadership, and lack of engagement with NGOs and business enterprises and absence of coordinating role on IID. Listed below are, among others, key issues in promoting IID at the regional level:

- Limited budget for sending people for programmes, activities and collaboration work;
- Rigid intellectual property regulations that hinder the sharing of knowledge and technology;
- Lack of standard and well-coordinated monitoring and evaluation processes;
- Too much of dependence on the chair and leadership; change of leadership will result in changes in priority and different priorities from different countries;
- No mechanism by which the poor can participate in the process (from the planning to defining the project and the implementation);
- Limited communication to transfer the research benefits to the people; science and technology (S&T) culture not embedded in the psyche of the people; and
- No follow-ups after workshops or trainings which make initiatives unsustainable.

Although university staffs are mandated to undertake teaching, research and outreach activities, the focus of the latter is seldom given attention. Such outreach activities are not accorded emphasis in staff annual assessments. There is no strategic roadmap developed to promote outreach activities among the universities. The varying capacities (such as manpower and financial endowments) among the universities and research councils have thwarted many of them from engaging in such outreach activities. IID issues have not been featured prominently in the agendas of most of the universities and research councils and many of the so-called social engagement programmes are organised in an *ad hoc* and unsustainable manner. As a result, IID-related activities have been seen as a "hobby" of the individual or a group of like-minded researchers or activists. Besides, ASEAN countries are at different stages of development which has witnessed the differing extent in the countries paying attention to IID. In many occasions, there is a lack of bilateral or multilateral projects in the region that is able to establish a network of scientists in addressing the region's common problems in a more effective engagement. This engagement is to provide a platform for a multi-stakeholder dialogue that works in an academic setting and which also takes into account technical merit as well as social development advocacies. In addition, engaging in discussions with targeted groups or beneficiaries at the outset of the project is required to enhance buy-in from the community.

The government should act as a facilitator by providing necessary material and financial support for IID-related programmes. Local champions (such as local leaders or village chiefs) are needed to drive the project and obtain the support of the local community in sustaining the project. For instance, in the case of the Indonesian Sub-national System (or *Sistem Inovasi Daerah*), various efforts have been made to undertake action-oriented policy studies, making available technical assistance for the region's government officials as well as intermediation in the areas of preparing medium- and long-term strategic planning or local regulations to provide an ecosystem conducive for creating and diffusing innovation, as well as promoting industrial clusters for the

[2]Through Asian Development Bank (ADB) projects.

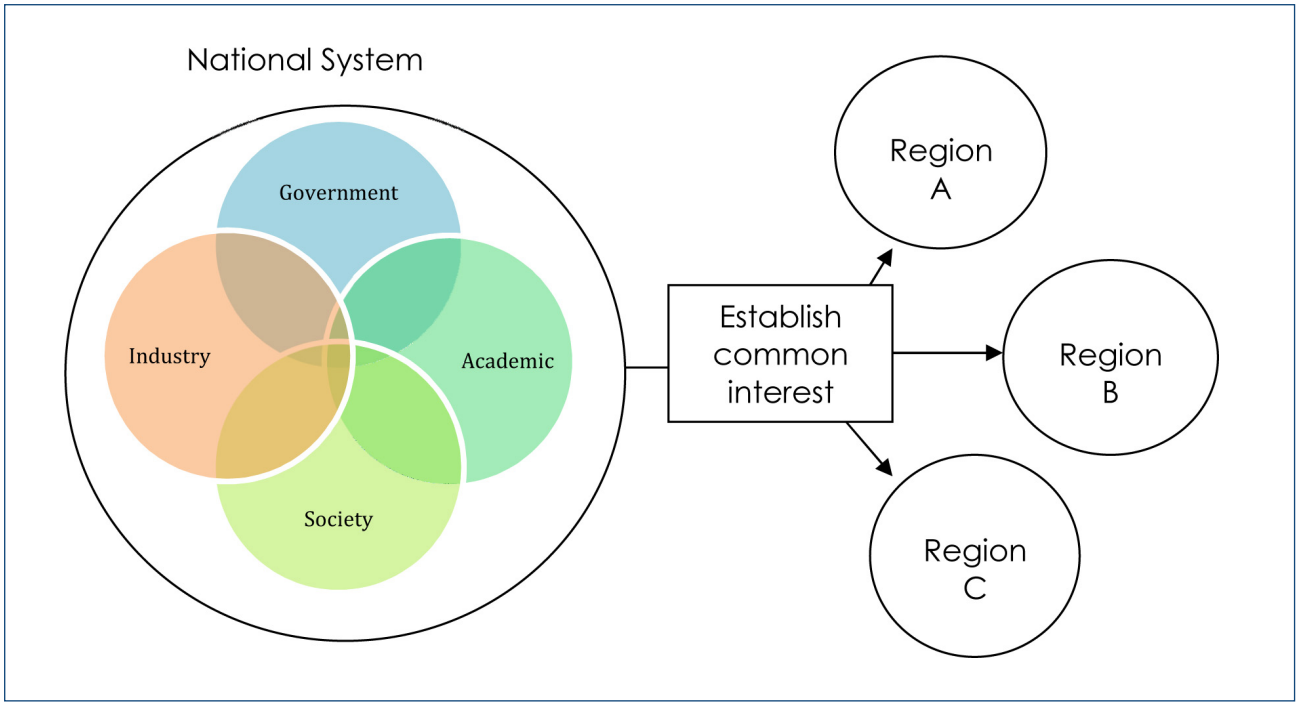


Figure 1: Interaction between government, industry, academic and society and inclusion at regional system

region's primary commodity, and so on. The basic principle that underpins these efforts is that for IID to work, the absorptive capacity of marginalised societies has to be improved as well as the capabilities in disseminating research results and innovation of the "more knowledgeable" group in society. In addition, effective mechanisms in the associated transfer of knowledge and technology must be put in place. This process must be supported by the government in the form of friendly regulations for innovative businesses, good public services and adequate infrastructures (physical and social fabric). The main token is systematic learning.[3]

Indeed, as mentioned in the earlier part of this section, most universities have already initiated and conducted social engagement programmes. However, the main concern is about an effective regional network – how to encourage university members to look at the problem and issue beyond the national model. Many problems and issues are cross-border or "borderless". For example, diseases and environmental problems are not national problems and it is more of a global or regional problems that should be looked at without the prejudices of national commitment or even nationalism. The experiences of the ASEAN University Network (AUN) in fostering collaborative mechanism among its members informed us that a sound regional collaborative mechanism should comprise two strengths, namely, management and value and belief. Even if there are high efficient managerial officers in the system, the regional IID efforts are still unsuccessful in this cross-border collaboration. A community has commitment only if it has the same values and beliefs in doing things together. The AUN success depends on the sharing of beliefs and institutional memory, i.e., the culture of working together within long-term collaboration. As a result of 10–15 years of working together among the members, we have witnessed a strong commitment from AUN's members. Quoting the words from AUN's Deputy Executive Director, "*In eastern culture, I think friendship is more important than formal recognition or formal position*".

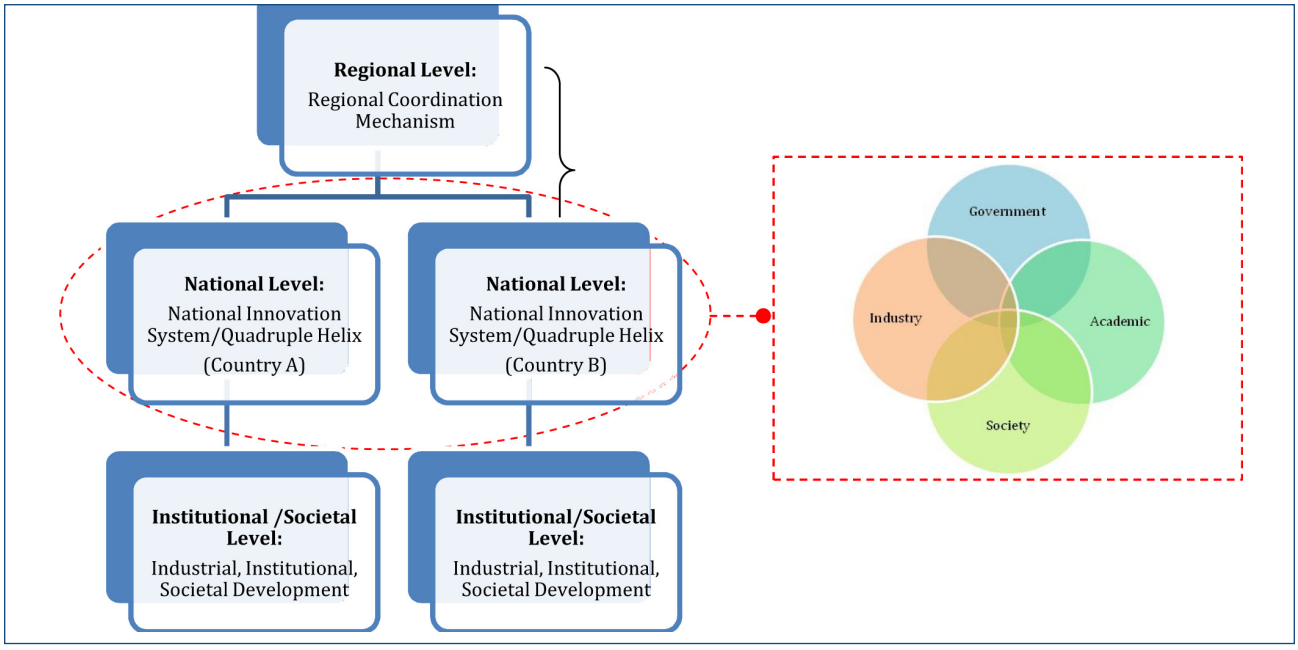
Looking at the experience of AsiaEngage will provide us some lessons as well. AsiaEngage is one of the successful stories of AUN's agenda in promoting a regional coordinating mechanism for IID. AsiaEngage was officially launched in Malaysia on May 7, 2012. AsiaEngage serves as the regional community-industry engagement alliance for the Asia-Talloires Network of Industry and Community Engaged Universities, the AUN Thematic Network for University Social Responsibility and Sustainability and the ASEAN Youth Volunteer Programme. These networks aim to create mutually beneficial partnerships among the research, education and volunteerism missions of higher education with industry and community stakeholders across ASEAN and Asia. The secretariat for the AsiaEngage network is hosted by Universiti Kebangsaan Malaysia (or the National University of Malaysia) through its Office of Industry and Community Partnerships, and its core activities are supported by Malaysia's Ministry of Higher Education as well as the Ministry of Youth and Sports. To date, AsiaEngage's

[3] Communication with Derry Pantjadarma, Agency for the Assessment and Application of Technology, Indonesia.

Table 1: Roles and functions of intermediaries

Types	Terms	Roles and functions
Organisation	Intermediaries/intermediary firms or agencies/intermediary level bodies	• Support technology transfer to small firms
		• Exploitation of technology
		• Formulation of research policy
		• Effect change within science networks and local collectives
		• Adapt solutions available in the market to the needs of the individual user
		• Transfer technology between hosts and users
		• Orient the science system to socio-economic objectives
	Brokers/knowledge brokers/ technology brokers/knowledge intermediaries	• Facilitate the diffusion of new ideas from outside the system
		• Help innovation by combining existing technologies in new ways
		• Fill gaps in information and knowledge in industrial networks
		• Facilitate a recipient's measurement of the intangible value of knowledge received
	Third Parties	• Intervene in the adoption decisions of others
	Consultants as bridge builders	• Bridge
		• Builders in the innovation process
	Bricoleurs	• Develop new applications for new technologies outside their initial development field
	Superstructure organisations	• Facilitate and coordinate the flow of information to substructure firms
	Regional institutions	• Provide "surrogate ties" by serving as functional substitutes for a firm's lack of "bridging ties" in a network
	Boundary organisations	• A boundary organisations in technology transfer and "co-production" of technology
Process/activities	Innovation consultancy services	• Promote innovation; involve a variety of factors including consultancy firms and intermediary agencies
	Technology brokering	• Create new products by making connections between existing solutions in other sectors or technologies
	Innovation bridging	• Provide knowledge or services that are complementary to firms
	Knowledge brokering	• Facilitate the exchange of information about innovation amongst companies

Source: Extracted from Howells (2006)



Source: Authors

Figure 2: Role of regional coordination mechanism in inclusive development

members have undertaken a number of community engagement projects. The key practices and principles drawn from these projects can be summarised as follows:

- Research must be considered as an integral part of engagement with communities, i.e., a research-driven community engagement;
- Academics apply their expertise, but are cognisant of the fact that they are not the sole custodians of knowledge and they work closely with communities to share and gain knowledge, i.e., principles of respect and knowledge exchange;
- Multi-sector partnerships which address and jointly solve problems faced by communities; and
- Develop community champions and build up confidence in the community for them to proceed and progress with jointly developed solutions. This approach will ensure the sustainability of the community project.

In short, the following features are needed for effective RCM of IID:

- Commitments by countries and the regional agendas should be aligned with the priorities of countries;
- Common understanding of issues and needs and funding commitments from countries are critical;
- Networks should be committed to doing research and communicating/advocating effectively best practices across countries, which should go down from national to local levels;
- Regular reporting of the country's performance helps put pressure in the countries to perform better in driving inclusive development;
- S&T is detached from poverty alleviation efforts; and
- Dealing with issues/problems as a collective and articulate it as policy recommendations.

References

✓ Dator-Bercilla, J., Viña, A.G.M.L., Angeles-Mendoza, B.J., Osir, E., and Santos, M.G.P. (2012). *Pathways Out of Poverty: Innovation with the BOP in Southeast Asia*, Manila, Ateneo School of Government.

✓ Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy*, Vol. 35, pp. 715–728.

✓ Ng, B.-K., Thiruchelvam, K., Wong, C.-Y., and Chandran, V.G.R. (2015). Innovation for inclusive development in Southeast Asia: the roles of regional coordination mechanisms. *The Pacific Review*, pp. 1–30, DOI: 10.1080/09512748.2015.1022590.

✓ OECD (2005). *Oslo Manual : Guidelines for Collecting and Interpreting Technological Innovation Data* (3rd ed.). Paris: Organisation for Economic Co-operation and Development.

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Policy advancement in Indonesia concerning industrial technology development and utilisation

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Abstract

This article addresses the intervention of technology and innovation management by the Government of Indonesia throughout Indonesia. As background, in an increasingly complex economic and social environment, high-technology industries are facing accelerating technological development and global technology-based competition. Owing to the critical role of technology in a competitive environment, strategic technology management is important for enterprises in Indonesia. For the long-term success, the nation must develop and sustain their technological capabilities to create internal and external impacts within socio-economic context. As the main stakeholder, Government of Indonesia has the role to determine how the goals should be achieved. To secure the compulsory requirements of the nation's technological capabilities and industrial resources' utilisation, the government has designed an intervention in policy that described in the form of act advancement. Technically speaking, the advancement was the replacement of The Act of Republic of Indonesia Number: 5 (1984) on Industrial Affairs by The Act of Republic of Indonesia Number: 3 (2014) concerning Industrial Affairs. In this article, the discussion is limited to industrial resources, technological development and utilisation aspects. Preparation of the act was made based on the principle of integrated industrial technology and management theories that are universally recognised.

Background

Indonesia is a massive archipelago stretching between the Indian and Pacific oceans and linking the continents of Asia and Australia. It is a diversified country both in terms of its population and in terms of its natural resources. In 2004, Indonesia had a population of ~230 million consisting of ~350 ethnic groups. Most of these groups have their own language and customary (*adat*) laws, regulations and norms. The two largest ethnic groups are the Javanese (45% of the population) and the Sundanese (14%). The population is growing at an annual rate of ~1.5%. The majority of Indonesians (61%) live in Java and Bali, which together have a land area comprising only ~7% of Indonesia. Another 21% live in Sumatra (27% of Indonesia), whereas the remaining 18% inhabit Sulawesi, Kalimantan, Nusa Tenggara, Maluku and Papua – the greater part of Indonesia in terms of land area. The majority of the population is Muslim (88%). Nevertheless, other religions and denominations are represented; protestants comprise 5% of the population, catholics 3% and hindus 2% (Resosudarmo, 2005).

Natural resources

It is well known that Indonesia has abundant natural resources such as oil, gas and minerals as well as rich and very diverse forest and marine resources. Oil and gas are found in Aceh, Riau, South Sumatra and East Kalimantan. Mineral ores such as copper and gold are abundant in Papua, coal in most of Kalimantan and West Sumatra, tin on the island of Bangka and nickel in South Sulawesi and North Maluku. Indonesia's vast rainforests account for ~50% of the tropical forests in the Southeast Asian region and >10% of the world's total tropical forests. In terms of area, the country's tropical forests are third only to those of Brazil and Congo (Zaire), wherein extremely diverse flora and fauna with abundant nutrients and untapped medicinal potential are found. Indonesia also carries the world's largest remaining mangrove forests and has the largest area of coral reefs of any country. Indonesia's waters are among the most productive of all tropical seas. The Banda–Flores Sea, for example, lies at the heart of global marine biodiversity; nowhere else on earth is there a comparable diversity of marine resources (Resosudarmo, 2005).

Forest and marine resources have always been important for Indonesia. At least 20 million Indonesians depend on the forests for their livelihood. Similarly, millions of Indonesians have been, and continue to be, dependent on marine resources in one way or another. Fish stocks in Indonesian waters provide a source of income and livelihood for at least 5 million fishers. Fish provide >60% of the animal protein intake of the average Indonesian and are the only affordable source of protein for the majority of the population (Resosudarmo, 2005).

The exploitation of Indonesia's natural resources intensified greatly after Soeharto came to power during 1966–1967. The President was quick to realise the potential of the country's abundant forests, oil, gas and minerals for development. Realising that large-scale resource extraction could be performed only with the involvement of foreign companies, the President enacted three important laws in the first year of his presidency. These were Law 1/1967 on foreign investment,

which provided clear procedures for foreign operations in Indonesia along with generous tax concessions for foreign companies; Law 5/1967 on forestry, which put all forests under the control of the state and Law 11/1967 on mining, inferring that all lands within the Republic of Indonesia could be used for mining. These three laws effectively made all of the country's natural resources available for extraction by large-scale operations with a foreign investment component (Resosudarmo, 2005).

Soeharto's policy turned out to be effective. Within a few years several multinational companies were carrying out natural resource extraction in Indonesia, their operations protected by his regime, which was then virtually politically unchallenged. During the 1970s, several major foreign companies became involved in oil extraction. During this period, oil became Indonesia's main export commodity and the country's major source of government revenue. In the 1980s, the role of oil in the Indonesian economy declined while that of other natural resource products, such as liquefied natural gas (LNG), copper, gold and timber, increased. By the mid-1990s, Indonesia had become the world's largest exporter of LNG and hardwood plywood, the second largest producer of tin (after China), the third largest exporter of thermal coal (after Australia and South Africa) and the third largest exporter of copper (after the USA and Chile). It also produced significant quantities of gold, nickel and forest products other than hardwood plywood. During the 1990s, oil and gas contributed ~30% of the country's total exports, minerals and related products 19% and forest products 10% (Resosudarmo, 2005).

It is important to note that although natural resource revenues were the main engine of economic growth during the 1970s and remain of critical importance to the Indonesian economy, since the 1980s the non-natural resource-based sector, particularly labour-intensive, export-oriented industry, has taken over as the main generator of economic growth. The Indonesian economy grew at an annual rate of ~7% from the early 1970s to the mid-1990s, whereas the number of people living below the poverty line declined from ~40% in the early 1970s to <15% in the mid-1990s. Nevertheless, these statistics cannot hide the fact that Indonesia remained as a poor nation (Resosudarmo, 2005).

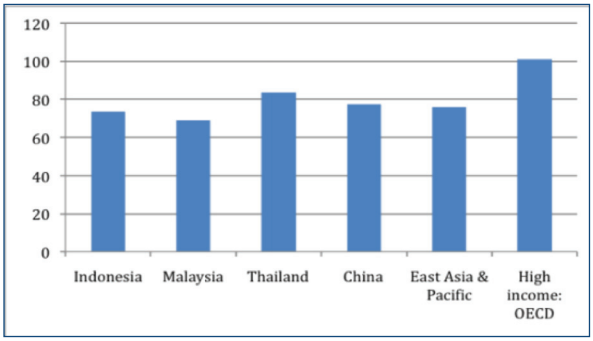
The exploitation of natural resources has not been without problems. One of the major problems concerned the granting of rights to exploit Indonesia's natural resources. Extraction rights were mainly given to individuals or companies that were close to Soeharto and that played a key role in strengthening his regime. The granting of rights was not based on considerations of resource sustainability or of a fair return (of benefits) to the general public. The result was a sharp acceleration in cases of environmental degradation. As the years went by, there was mounting criticism of the government for its failure to ensure that resource utilisation benefited most of the population, for its failure to control the rate of exploitation of mineral reserves and for its failure to protect the interests of future generations. Conflicts between local communities and large natural resource extraction companies increased and intensified as the perception strengthened that although it was local resources and local land that was being exploited, local communities were receiving little or no benefit from these activities (Resosudarmo, 2005).

The exploitation of Indonesia's natural resources has brought economic benefits to the country, but it has often damaged the natural environment and society in resource-rich areas in a way that fosters social tensions and has led to violent conflict. Indonesia needs to manage its natural resources in a way that is fairer and more sustainable than in the past. Although formally legal, this exploitation was often heedless of local communities and the environment and permeated by official corruption and rule-breaking. Indonesia now has an opportunity to develop a less-damaging model of resource management, but instead there has been a rapid upsurge of illegal resource extraction across the country. The major forms of illegal extraction are logging, mining and fishing, and they can be organised by licensed companies who violate the law or by "wild" operators who act outside it. All of these damage the environment, deprive the state of revenues and raise the spectre of future conflict (Resosudarmo, 2005).

In the case of logging, the problem is so serious that it threatens to destroy some of Indonesia's largest forests within a decade. Official figures show more than half of Indonesia's rainforest, the third-largest swath in the world, has been felled in a few years and permission has been granted to convert up to 70% of what remains into palm or acacia plantations. The government renewed a moratorium on the felling of rainforest, but nearly a million hectares are still being cut each year and the last pristine areas, in provinces such as Aceh and Papua, are now prime targets for giant logging, palm and mining companies. Scientists fear that the deforestation could come quickly (Resosudarmo, 2005).

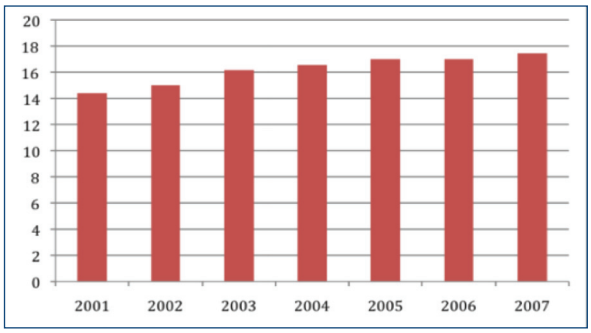
Human resources

Indonesia has made impressive gains in education enrolment at all levels over the past two decades, particularly in primary education. Enrolments have however levelled off in the past few years. At the primary level, net enrolment reached just ~90% in 2003 and has remained near that level since. At the junior secondary level net enrolment is approaching 70%, while at the senior secondary level it is ~45%. Despite these gains, however, Indonesia's gross enrolment rates at the secondary level lag most of its neighbours. Its 2007 secondary gross enrolment rate of 73%, while slightly higher than Malaysia's (70%), was below that of Thailand (83.5%) and China (77%). It also trailed the East Asia and Pacific regional average of 76% and the Organization for Economic Corporation and Development (OECD) average of 101% (Figure 1). Indonesia has made relatively slow progress on increasing enrolments in higher education. The Gross Enrolment Ratio (GER) at the tertiary level has increased gradually over the past several years (Figure 2). In 2001, Indonesia's tertiary GER was 14.4%. In 2004, it was 16.5%, and in 2007, it stood at 17.4%. Like its GER for secondary education, the country's GER for higher education is lower than most its neighbours (Figure 3). Edstats 2007 data indicate that Indonesia's tertiary GER of 17.4% lagged China's (22.9%), Malaysia's (30.2%) and Thailand's GERs (49.5%). Moreover, Indonesian gross tertiary enrolment was below the regional average of



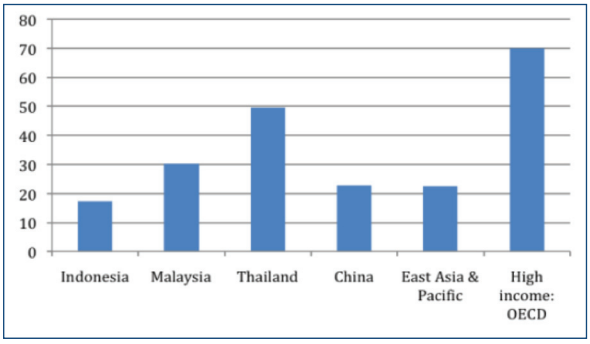
Source: Edstats, 2009

Figure 1: Secondary gross enrolment rates (%) in selected countries, 2007



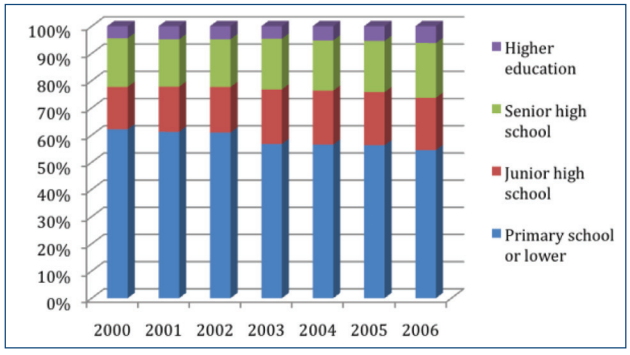
Source: Edstats, 2009

Figure 2: Tertiary gross enrolment rates of Indonesia (%), 2001–2007



Source: Edstats, 2009

Figure 3: Tertiary gross enrolment rates (%) in selected countries, 2007



Source: Nazara and Wicaksano, 2009

Figure 4: Educational attainment of Indonesia's labour force, aged ≥15 years

23% and far below the OECD average of nearly 70%.

Despite progress on enrolment and the increased emphasis on the vocational training sub-sector, the overall educational attainment of Indonesia's labour force remains fairly low. A 2006 analysis of Indonesia's labour force found that ~50% of Indonesia's working population (those aged 15 years who had worked in the past week) had only completed primary education or less. Some 40% of the working population had completed high school, and only 6% of the population had completed higher education (Figure 4).

Perhaps the most striking development in Indonesia's education sector in the last decade is that it has significantly expanded its formal technical and vocational education and training (TVET) offerings. Responding to rising unemployment rates and the lack of appropriate skills among workers, the Ministry of National Education (MoNE), which oversees and administers formal vocational education in the country, has made TVET expansion a priority and has ramped up investments in the formal TVET sub-sector. MoNE has set the formal and ambitious goal of shifting the ratio of students enrolled in general senior secondary education (SMA schools) to vocational senior secondary schools (SMK schools) to 30:70 by 2015. The current ratio is 75:25. In order to meet these targets, enrolments in SMKs will have to rise dramatically over the next decade.

Innovation development

During the 1997–1998 crisis, the industrial sector contracted at about the same rate as the economy as a whole, with import-substituting manufactures being particularly hard hit. Thereafter, industry recovered, but to growth rates a little over half those of the pre-crisis period. Thus, manufacturing has slipped from being a leading sector to a growth rate at about the economy-wide average. Indonesia's industrial growth rate over this period has also slipped to below the East Asian average. Their financial performance is generally poor, and there is little evidence that they play the role of incubator for technological innovation (Resosudarmo, 2005).

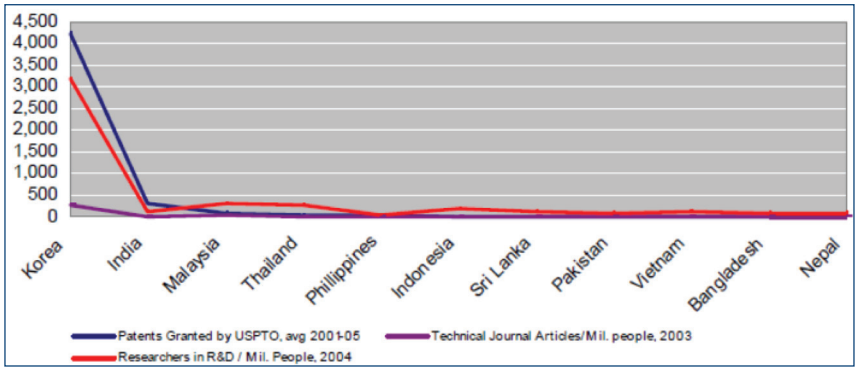
Indonesia's investments in formal research and development (R&D) programmes have always been very small. Total R&D expenditure as a percentage of Gross Domestic Product (GDP) has never exceeded 0.2%. Most of it has occurred in the public sector, as domestic firms have never made any significant commitment to R&D. Moreover, multinational enterprises (MNEs) do not regard the country as a suitable base for R&D activity, owing to the weak skill base, the limited protection of intellectual property rights and the absence of any significant public support for R&D. As noted below, the major government support for R&D prior to 1997 took the form of a series of high-tech projects that collapsed during the crisis and have not subsequently been revived. The Indonesian Institute of Sciences (LIPI, Lembaga Ilmu Pengetahuan Indonesia) is a major government agency, but its fund-

ing and scientific resources are insufficient to support a major research effort. The government's agricultural extension services have responsibility for the dissemination of new technologies and processes, but it is too severely under-funded. Government support for these activities was increasing during the 1990's, but funding was cut sharply during the crisis of 1997–1998, and it has yet to recover.

There is little support for innovation outside these meagre government programmes. None of the country's major conglomerates has neither shown any inclination to support major innovation programmes as, for example, is now occurring in other large Asian developing economies such as China and India, nor the state-owned enterprises (SOE) sector been able to play such role. These firms are typically saddled with uneconomic social responsibilities and subject to extensive political interference. In addition, two sectors where government programmes frequently embody significant if indirect R&D support, defence and health, are under-funded by comparative international norms.

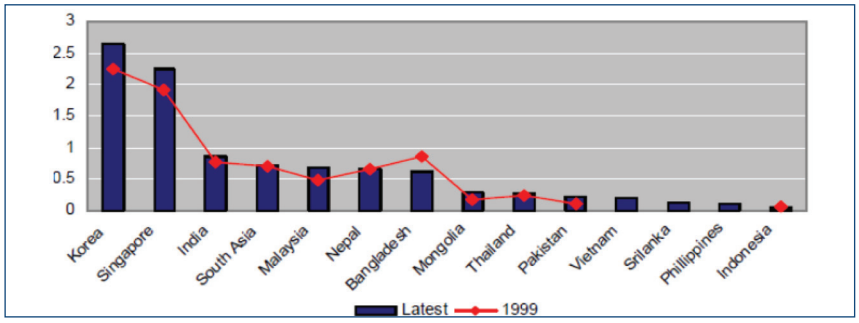
In terms of innovation, available evidence indicates that the higher education system in Indonesia is being outpaced by many of its neighbours. Figure 5 provides information on patents granted, journal publications, and the number of researchers working in R&D in Indonesia and shows that Indonesia is significantly behind the top innovating countries, such as Republic of Korea, as well as its more immediate neighbour Malaysia, particularly in terms of patents granted and number of researchers.

Indonesia also invests in R&D much less than many Asian countries when measured as percentage of GDP. It invests <0.5% of its GDP in R&D. High innovators like the Republic of Korea, on the other hand, invest ~2.5% while Singapore invests ~2%. Indonesia invests less in R&D as a proportion of its GDP than Mongolia, Thailand, Pakistan, Viet Nam and the Philippines (Figure 6). As per information, based on Global Innovation Index 2014, Indonesia ranked 87th position out of 143 countries. In the last 5 years, Indonesia's rank in innovation can be seen in Figure 7. The data indicate that Indonesia has not prioritised R&D as much as some other countries,



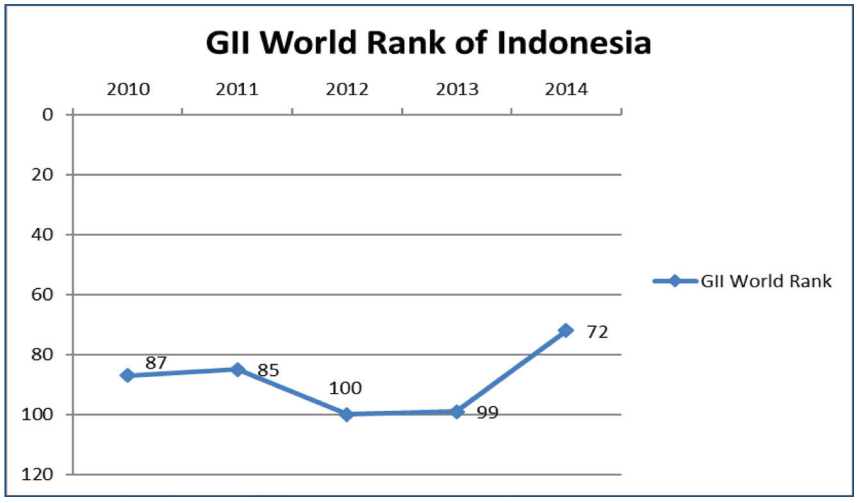
Source: Higher Education Sector Assessment, 2008

Figure 5: Innovation indicators, selected Asian countries



Source: Higher Education Sector Assessment, 2008

Figure 6: R&D expenditure (as % of GDP), selected Asian countries



Source: Global Innovation Index, 2010–2014

Figure 7: Global innovation index rank of Indonesia in the last 5 years

and the recent Higher Education Assessment has called for more investment in this area.

Theoretical approach

During the past decades, competitive, economic and social environment has become increasingly complex due to rapid proliferation of information and accelerating technological development. Especially, in high technology industries, global technology-based competition forms a significant managerial challenge for industries. The fundamental question is how to strategically manage product offering, value system, product technology, competences and capabilities in the rapidly changing business

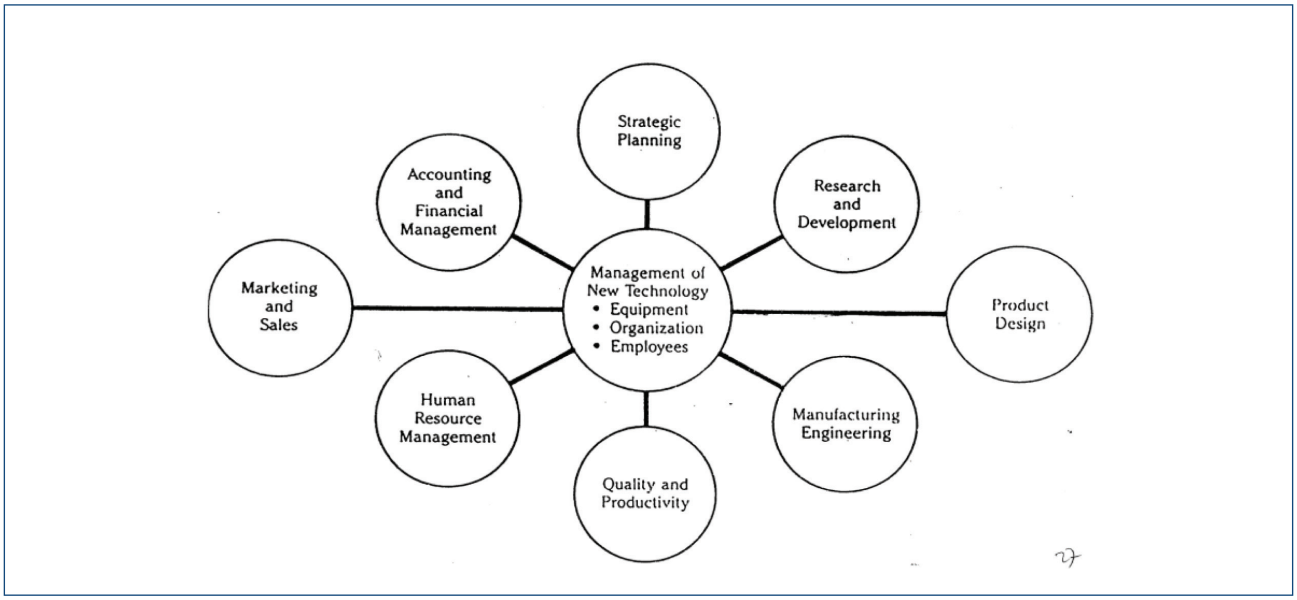


Figure 8: Illustration of technology management task force to link-related aspects

and technological environment. The operating environment is perceived as turbulent and complex, and technology has a significant role in productivity, innovations and business model development. Industries are constantly struggling in adapting to ambiguous technology changes and optimising investments for new opportunities in the marketplace. Therefore, the underlying need for industries is the capability of creating and executing business, innovation and technology strategies for value creation and sustained competitiveness (Shalman, 2010).

Technology is the totality of goods, tools, processes, methods, techniques, procedures and service that are invented and put into some practical use (Khalil and Bayraktar, 1992). As a system, technology has five system characteristics, namely, purpose, system environment, system source, system components and system management. The components of technology as described in Atlas Technology Project (1989) are technoware (tools, machines, integrated facility, etc.), humanware (personal skill, ability, intelligence, leadership, etc.), infoware (data storage, books, documents, drawings, etc.) and orgaware (institution, organisation, stakeholder, etc.) (Ministry of Industry, 2014a).

The task force on management of technology is to link engineering, science and management disciplines to address the planning, development and implementation of technological capabilities to shape and accomplish the strategic and operational objective of an organisation and to bridge between the field of management and the field of engineering and science. The illustration of technology management task force to link the related aspects can be seen in Figure 8 (Ministry of Industry, 2014a).

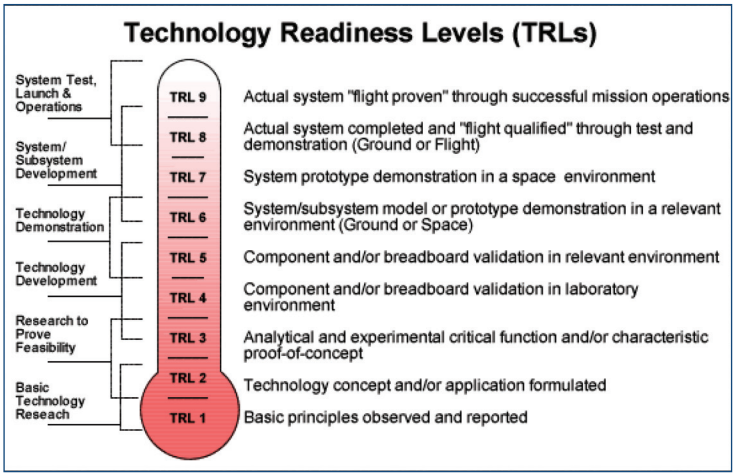
The lifecycle of technology management are as follows (Ministry of Industry, 2014a):

- Technology planning:
  a. Technology forecasting,
  b. Technology assessment.
- Technology provision:
  a. Technology acquisition,
  b. Technology transfer,
  c. In-house R&D.
- Technology selection;
- Technology development.

The fundamental basis of industry is changing with wide options in the field of social networking, business intelligence, cloud computing, software as services and virtualisation. A closer look at these elements will bring out the key common elements, such as innovations and technology, across these futuristic industry needs. Each of these aspects brings out an element of faster turnaround to the market demands and a loosely coupled way of running the business. As industries trying to move up their value chain, the bottom–up approach is through innovations. In case of possibilities of acquisitions and mergers, the approach is again innovation. Innovation can be in varied aspects of running the business. However, for industries to succeed, technological innovation holds substantial benefits in terms of both increased business revenue and reduced costs (Bennet and Vaidya, 2001)

There are primary reasons that drive innovation: market analysis and study, competition and creative thinking. To sum it up, each of those aspects creates a real need for innovation. The first step towards managing innovation is to capture ideas in a formal manner. No idea can be right or wrong, good or bad. An idea is an idea; it is the time and place of the idea that makes it successful or otherwise (Sahlman, 2010).

Once an innovation has been ideated, the next step is to record and store the innovation either for immediate use or for implementation at a later stage. However, often times, the authors have seen most of innovative and creative research products end up only as papers in desk drawer, result of those activities usually stops at laboratory scale only. This condition reflects that, mostly, innovation resulted from research and development activity has not been measured yet regarding its implementation readiness in industrial scale. Therefore, the need of measurement method regarding its readiness level is mandatory. One of the



Source: Sitohang et al., 2013

Figure 9: Technology readiness level (TRL) indicator

methods founded by NASA is technology readiness level (TRL), which has been developed by Agency for Technology Assessment and Application, Indonesia, into a more suitable form to Indonesia's circumstances. Hopefully, TRL could describe the targets of research thoroughly and could give suggestion of how the innovation should be applied. Consequently, it could minimise Indonesia's dependency to the other countries in technology and furthermore could improve competitiveness of the nation. Illustration for TRL mapping that shows indicator of each level is shown in Figure 9 (Sitohang et al., 2013).

Although many early adopters display an element of technology chasing, there are several underlying drivers for adopting new technologies and keeping up with the changing technological landscape. These drivers range from very strategic intentions to sheer tactical or operational imperatives.

The first drivers would be competitive advantage. Firms in various sectors have leveraged technology strategically to gain competitive advantage through cost reduction, creation of differentiated products/services, rapid expansion to gain economies of scale and scope, etc. Eventually firms catch up with each other. The second one would be risk mitigation. There are many tactical or operational imperatives to keep up with new technologies or to swap out old technologies. The imperatives include lack of support from vendor, obsolescence of product lines, poor availability of skilled resources, etc. New tools and technologies are emerging on a regular basis and new products with enhanced capabilities are dotting the technological horizon more rapidly than ever before. This provides the required impetus for incumbient vendors to constantly upgrade their technologies or face the prospect of being swapped out.

Act designation

Based on the urgency explained in the background of this article, supported by the Management of Technology Theory, the Government of Indonesia has decided to review the old act (No. 5 of 1984) considering that the contents of the act is no longer in conformity with current situation. The nation needs more comprehensive and detailed regulation to accommodate industrial technology development and utilisation in this era. After a long, mature and detailed discussion among the technical team in the Ministry of Industry, the designation of the new act finally completed. The corresponding act is the act number 3 of 2014 Concerning Industrial Affairs (Ministry of Industry, 1984 & 2014b).

As for the points that are emphasised by the government regarding the issues happening as mentioned in the background, the main ideas to respond those issues are as follows (Ministry of Industry, 2014b):

1. To prevent excessive exploitation of natural resources, industries that utilise the resources, directly or not, are obliged to implement a proper principle of natural resources exploitation planning. The use of resources has to be carried out efficiently and in a sustainable manner. Efficient utilisation mentioned earlier is based on the principle of:
   - economising,
   - efficient technology application,
   - optimisation of production processes,
   - diversification and conservation of energy, and
   - zero waste.

   Whereas sustainable utilisation based on the principle of:
   - reduce,
   - reuse,
   - recycle, and/or
   - recovery.
2. To maintain the availability of natural resources, export activity of certain raw material is restricted or limited. The Minister has the authority to stipulate the restriction or limitation.
3. Workforce and consultant for industries in Indonesia are required to meet the National Work-Competency Standard. Based on competency, they are divided into two categories which are technical and managerial. Establishment of both can be achieved through:
   - competency-based industry vocational education,
   - competency-based industrial training and school, and/or
   - internship programme in industry.

4. The nationality of workforce and consultant employed in industrial enterprises consist of indigenous and/or expatriate. However, enterprises are obliged to prioritise the employment of indigenous workforce and consultant.
5. Provision of industrial technology in Indonesia has to be carried out comprehensively to reduce or substitute import commodities and improve national competitiveness in global trading.
6. Regarding the development of industrial technology in Indonesia, the provision of technology should be initiated internally from technology research and development activity, research contracts and joint venture technology development, as well as right diversion through technology licensing and acquisition.
7 The government shall conduct risks insurance on the utilisation of industrial technology developed in the country by technology provider. Corresponding risks insurance is applied on untested industrial technology as the result of recent research and development activity. The purpose of risk insurance is to strengthen national competitiveness in global trading, domestic industrial independency and/or environment conservation.
8. In case related enterprise and/or institution are unable to develop industrial technology caused by some issue, technology transfer should be obtained through Turnkey Project. The Turnkey Project includes provision of technology that the technology provider is originated from abroad and/or domestic.
9. Technology obtained from both R&D activity and Turnkey Project should be protected and be strengthened by facilitation of intellectual property right.
10. In the utilisation of industrial technology, control on every aspect is mandatory. The process needs to be carried out by regulating industrial business investment and conducting audit of technology to ensure the effectiveness of industrial technology so that economical, social, environmental and safety risks shall be minimised. Audit of technology evaluates suitability of applied technology to the established regulation systematically and objectively.
11. Provisions regarding audit of technology on industry are as follows:
    a. Audit of technology is mandatory to particular industrial technology, as stipulated by Ministry of Industry, either domestic or imported technology. Execution of the audit conducted periodically.
    b Audit of technology can be requested by industries.
    c. The institution specified as auditor who conduct audit of technology should be competent and appointed by Minister of Industry.

Conclusion

Through implementation of ideas extracted from act number 3 of 2014 concerning industrial affairs, it is desirable to achieve what is defined as national expectation in industrial sector. Indonesia's industrial renaissance vision is to be a tough industrial nation which is characterised by:

- strong, deep, wealthy and equitable national industries structure;
- competitive industries in global level trading; and
- technology and innovation-based industries.

Those ideas, hopefully, are able to accommodate the government to realise national industrial development missions as follows:

- improving the role of national industries as pillar and driver of national economy;
- strengthening and deepening national industries structure;
- improving independent industrial competitiveness and environmental insight;
- assuring entrepreneurship insurance and healthy competition, preventing industrial monopoly by particular group or individual;
- providing significant job opportunities and entrepreneurship expansion;
- improving distribution of industrial development throughout Indonesia; and
- improving society welfare and prosperity in equity.

All of the action plans regarding the improvement of industrial technology development and utilisation are based on the principles of technology management theories. The management technology theories implied in those ideas are expected to enhance the utilisation of industrial research and development products. Furthermore, the management of technology implementation through those ideas implied in action plans is desired to strengthen national intellectual property rights.

References

✓Bennet, D and Vaidya, K. (2001). *Meeting Technology Needs of Enterprises for National Competitiveness,* Vienna Global Forum, Austria.

✓ Khalil, TM and Bayratkar, B.A. (1992). Management of Technology, III, IIE Press, Florida, United States of America.

✓ Ministry of Industry (1984). *Law of The Republic of Indonesia Number: 5 of 1984 on Industrial Affairs, Chapter VI, Article 16,* Jakarta, Indonesia.

✓ Ministry of Industry (2014a). *Diklat Teknis Sistem Industri Aparatur-Kementerian Perindustrian,* Jakarta, Indonesia.

✓ Ministry of Industry (2014b). *Law of the Republic of Indonesia Number: 3 of 2014 concerning Industrial Affairs, Chapter VI, Section Four, Article 36 to 42* (*Unofficial Translation*), Jakarta, Indonesia.

✓ Resosudarmo, B.P. (2005). *The Politics and Economics of Indonesia's Natural Resources*, Indonesia, Institute of Southeast Asian Studies, Singapore.

✓ Sahlman, K. (2010). *Elements of Strategic Technology Management,* University of Oulu, Oulu, Finland.

✓ Sitohang, KH, et al. (2013). *Panduan Teknis Pengukuran Kesiapterapan Teknologi Hasil Litbang Industri (Teknometer),* Agency for Assessment of Climate Policy and Industrial Quality, Ministry of Industry, Indonesia.

✓ Technology Atlas Project (1989), Asian and Pacific Centre for Transfer of Technology, UNESCAP, New Delhi, India.

DIAGNONIS OF NATIONAL INNOVATION SYSTEMS

SELECTED METHODS AND APPROACHES FOR STRATEGY DEVELOPMENT

Compiled by

Asian and Pacific Centre for Transfer of Technology

For proper diagnosis of a National Innovation System (NIS) in terms of quality and efficiency, a consistent methodology should be used. A properly done diagnosis can help in planning for changes and making policies more effective. Although the NISs vary in terms of their components and innovative capacity, diagnosis coupled with a comparative analysis of NISs will provide insights for understanding the dynamics in NISs and their respective strengths and weaknesses. Good analysis of an existing system can provide useful information for policymakers in planning future changes to, or continuation of, an existing system.

The available literature indicates that NIS diagnosis is useful in identifying the weaknesses in NISs and in ascertaining as to which components need to be strengthened. Most often conducting a diagnostic exercise is limited by lack of reliable data, weaknesses in methodology and lack of understanding of all components of NIS. Although innovations in formal sector and public sector research and development (R&D) can be easily identified and quantified, informal sector innovations and private sector R&D are difficult to identify and quantify. When the linkages are not well established and when the capacity to learn or learning by doing is underdeveloped, a diagnosis that misses the critical weaknesses may miss the key shortcomings in NISs if the diagnosis is based solely on available data.

NIS diagnosis methods measure innovation through innovation indicators and score cards. In the recent years, reports that rank nations according to innovation indicators and indices have been published. Science, Technology and Innovation (STI) indicators broadly measure the Gross Domestic Expenditure on Research and Development (GERD), the innovation output in terms of patents, publications and performance of different sectors of a country. Although measuring innovation and developing STI indicators are important and have been pursued since early 1960s, there are many issues that have to be addressed. For example, what are the appropriate indicators for emerging technologies, whether the current STI indicators are relevant for all countries irrespective of the state of their NIS?[1]

Current methods and practices

The most common methods currently in use for NIS diagnosis are as follows:

- Main Science and Technology Indicators (MSTI) of OECD[2,3],
- Global Innovation Index (GII) of World Intellectual Property Office (WIPO).[4]

MSTI

OECD uses MSTI to measure technology innovation and innovative capacity of the country using data related to GERD, patents, technology balance of payments, share of high technology exports and number of researchers per million in population. The OECD's approach is based on Oslo Manual and other methodologies developed by OECD over the years. This approach relies on data and derives indicators from data on science and technology and on industry, trade and commerce. In the STI outlook published every year, OECD publishes analysis of each OECD country using this approach. The chief merit of this approach is that the objective and methodology can be replicated. However, this presupposes availability of data and misses the qualitative dimension in innovation. It cannot capture the dynamic factors in innovation as it is primarily input–output and expenditure and results oriented. The OECD's report covers OECD countries and few other countries and hence many countries in Asia-Pacific are not covered.

[1]For an overview see Sachin Chaturvedi and Krishna Ravi Srinivas (2012). Science and technology indicators: new issues and challenges, Current Science, 102(12), , 1640–1644.
[2]http://www.oecd.org/sti/inno/S_T%20Indicators%20-%202014_2_documentation_e.pdf
[3]http://www.oecd.org/sti/2013_1_documentation_e.pdf
[4] http://www.wipo.int/econ_stat/en/economics/gii/

The OECD MSTI database contains 108 series of indicators concerning resources devoted to research and experimental development, an additional 22 indicators as measures of output and the impact of scientific and technological activities and 11 economic series used to calculate indicators such as growth rates at fixed prices, R&D expenditures as a percentage of GDP or industrial value added, and to convert data into a common currency using comparisons at purchasing power parities.[5]

GII

The Global Innovation Index is published by INSEAD Business School in association with WIPO. The core of the GII report consists of a ranking of world economies' innovation capabilities and results and the GII has established itself as a leading reference on innovation. The GII relies on two sub-indices, the innovation input sub-index and the innovation output sub-index, each built around pillars. There are five input pillars which capture elements of the national economy that enable innovative activities: (1) institutions, (2) human capital and research, (3) infrastructure, (4) market sophistication, and (5) business sophistication. Two output pillars capturing the actual evidence of innovation outputs include: (1) knowledge and technology outputs and (2) creative outputs.

The innovation index is useful as a comparative tool, but its utility is limited because it uses data available and is oriented more towards outputs and infrastructure than the process of innovation. The GII 2014, in its seventh edition this year, is co-published by Cornell University, INSEAD, and the WIPO and has used 81 indicators to assess innovation index of 143 countries.[6]

New and emerging approaches

In recent years, new and emerging methods are being suggested for NIS diagnosis and STI strategy development, as in what follows:

- Global Observatory on Science, Technology and Innovation Policy Instruments (GO→SPIN) of United Nations Educational, Scientific and Cultural Organization (UNESCO)[7]
- The Four Capital (4C) model[8]
- The 3C/3A approach by Science and Technology Policy Institute (STEPI), Republic of Korea[9]

GO→SPIN

UNESCO through its GO→SPIN studies and assesses countries' STI policies and provides an overview of their innovation potential. UNECSO assists countries to prepare national inventories of their science and innovation systems. Once a country has expressed interest in compiling a national inventory, UNESCO sends out a survey for the country to complete. In liaison with UNESCO, the country subsequently describes and analyses the components of its science system: institutions which coordinate and/or perform research and innovation; innovative firms; organisational structure of the governing bodies and the way in which they interact; standard analysis of explicit STI policies; standard analysis of Science, Engineering, Technology and Innovation (SETI) legal frameworks; standard analysis of different types of operational policy instruments and temporal series of various input and output indicators on R&D. The inventory is subsequently entered into an open access database managed by UNESCO, in order to allow broad access, international comparisons and regular updates. In parallel, the inventory is published in book form on UNESCO's portal, within UNESCO's new series of GO→SPIN Country Profiles in STI policy. Each inventory is updated on a regular basis by the country. It serves as a monitoring tool and can also be used to improve governance and for the purposes of training and research.

The 4C model

This approach is still new and being developed conceptually; it does not have wide application. It is very much a qualitative approach and emphasises the importance of contextual understanding. Although it can be applied to a country's NIS scheme, in its current form it is most useful in diagnosing a particular government policy or programme. It does not seem to have an economic focus alone; rather it sees all four forms of capital – Human, Social, Manufactured and Environmental – as equal and argues that developing one of the 4Cs at the expense of another is detrimental to the overall system. The 4C approach has three main intentions. First, it questions the presumption of what capital is and does not treat it as homogenous; rather it works with the presumption that "our total wealth consists of various forms of capital". Second, it "emphasizes the existence and nature of trade-offs"

[5]http://www.oecd.org/sti/inno/S_T%20Indicators%20-%202014_2_documentation_e.pdf.
[6]https://www.globalinnovationindex.org/content.aspx?page=GII-Home
[7]http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/Brochure_SC_Go-Spin_131113_EN.pdf
[8]The 4C model, matrix and accounts by Bojan Radej, Institute for Economic Research, Jubljana, Slovenia, 2007.
[9]http://m.stepi.re.kr/newest/report_view.jsp?cmsCd=CM0012&ntNo=812#

and "cross-sustainability".[10] It does this by describing the linkages and interdependency of each of the 4Cs and by recognizing that "these multiple relations appear as a precondition for balanced sustainable wealth creation". This approach considers each of the 4Cs as of equal value. It argues against one form of capital growing at the expense of another by including the possibility of "critical thresholds" and dismissing the expansion of one capital to the exclusion of another capital as a viable policy option. The application of the 4Cs model thus allows decision makers to apply a crucial test: when is development not sustainable? Finally, it relies primarily on qualitative data from both relevant experts and the public to avoid methodological reductionism.

The 3C/3A approach

The 3C/3A approach has been used by APCTT in partnership with STEPI of the Republic of Korea for NIS diagnosis and strategy development in Nepal and Lao PDR. This approach uses a methodology developed by STEPI to diagnose and prescribe roadmaps to address bottlenecks found in an innovation system and to allow low-income countries to develop their economies.[11] The 3C diagnosis refers to componentisation, contextualisation and conceptualisation. Componentisation involves identifying the different bottlenecks and constraints in the NIS, contextualisation creates an understanding of each component within the framework conditions of the country and conceptualisation forms a plausible explanation of root causes on which stakeholders reach consensus in a coordinated fashion. The second half (3A) of the name refers to "Articulation of Action-oriented Actor-based strategy" which prescribes/provides the solution.

A summary of the five diagnosis approaches are listed in Table 1. ■

Table 1: Summary of the main features of common NIS diagnosis methodologies

Methodology	Characteristics	Coverage of NIS components/criteria/indicators
Main Science and Technology Indicators (MSTI) Database	• Quantitative • Raw data	• Number of researchers as a percentage of the population • Number of women researchers • Amount of R&D funded by the government, industry, higher education institutions and from abroad • Number of patents applied for • Total exports in specific industries such as the computer, electronic and optical industries • Technology balance of payments • Export market share of the computer, electronic and optical industries
Global Innovation Index (GII)	• Primarily quantitative, with qualitative analysis in the narrative style. • Has data on 143 countries	• Institutions • Human capital and research • Infrastructure • Market sophistication • Business sophistication • Knowledge and technology outputs • Creative outputs
Global Observatory on Science, Technology and Innovation Policy Instruments (GO→SPIN)	• Both qualitative and quantitative, written in a narrative style • Needs a large amount of data	• Institutions which coordinate and/or perform research and innovation • Innovative firms • Organisational structure of the governing bodies and the way in which they interact • Standard analysis of explicit STI policies • Standard analysis of SETI legal frameworks • Standard analysis of different types of operational policy instruments • Temporal series of various input and output indicators on R&D.[12]

[10]http://www.oecd.org/site/worldforum06/39264995.pdf
[11]http://m.stepi.re.kr/newest/report_view.jsp?cmsCd=CM0012&ntNo=812#
[12]http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/Brochure_SC_Go-Spin_131113_EN.pdf

Methodology	Characteristics	Coverage of NIS components/criteria/indicators
The Four Capital (4C) model	• Primarily qualitative, written in a narrative style • Still a new and developing approach	• Human • Social • Manufactured • Environmental
The 3C/3A approach	• To diagnose and prescribe roadmaps to address bottlenecks found in an innovation system low-income countries to develop their economies • Analyses NIS by "componentisation, contextualisation, and conceptualisation" • Prescribes solutions by: "articulation of action-oriented actor-based strategy"	• Government • University, Academia • Institutes • Private companies • Industry associations • NGOs

Note: This article has been adapted from the discussion paper prepared for Third Asia-Pacific NIS Forum: Diagnosis of NIS and Development of STI Strategies in the Open Innovation Framework, 8–9 April 2015, Bangkok, Thailand.

Market Validated Technologies Directory

The Market Validated Technologies Directory is a compendium of a tedious and comprehensive market validation exercise on selected R&D outputs from seven public universities. The universities are Universiti Sains Malaysia (USM); Universiti Malaya (UM); Universiti Kebangsaan Malaysia (UKM); Universiti Putra Malaysia (UPM); Universiti Teknologi Malaysia (UTM); Universiti Islam Antarabangsa Malaysia (UIAM) and Universiti Teknologi MARA (UiTM). The exercise started in July 2012 and completed in September 2013. It involved 358 R&D outputs with a two-fold objective: validate market for and marketability of R&D outputs before the products (R&D Outputs) are offered to industry for commercial undertakings. The Market Validation exercise came about as the result of the introduction of Market Validation Fund (MVF) under Budget 2012 initiatives. The Fund's mandate is to "ensure commercial viability of products (R&D outputs) through market validation". By definition, market validation is the process of objectively evaluating the market for an offering and understanding the target market and required features before making the investment to build it and bring it to the market.

The market validation exercise undertakings involve seven steps: Selection of R&D Outputs; Technology assessment; Operational assessment; Capability assessment; Market analysis (both primary & secondary data fieldwork); Model of commercialization including financial modeling, where appropriate and Recommendation for either Market-Go/Conditional Market-Go or No Go. The Market Validated Technologies Directory is the result of such exercise. It provides a brief and a snapshot on what the technology is about, the potential users, market; IP status; start-up requirements; ROI/IRR and recommendation for commercialization. While every effort is made to highlight the salient information in the directory, access to a full report is required. For easy reading, the validated R&D outputs are lumped under the individual university's section. The R&D outputs comprise a universe of subject areas encompassing the complex biotechnology/life sciences; healthcare; medical devices; ICT to the simplest social-science subject. It must be noted that since the exercise took some 15 months to complete, some of the technology under investigation has already been commercialized either by the university or taken up by companies.

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TECHNOLOGICAL DEVELOPMENT STRATEGY FOR FUNCTIONAL UPGRADING OF LOCAL INDUSTRIES

A CASE OF SRI LANKA

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Abstract

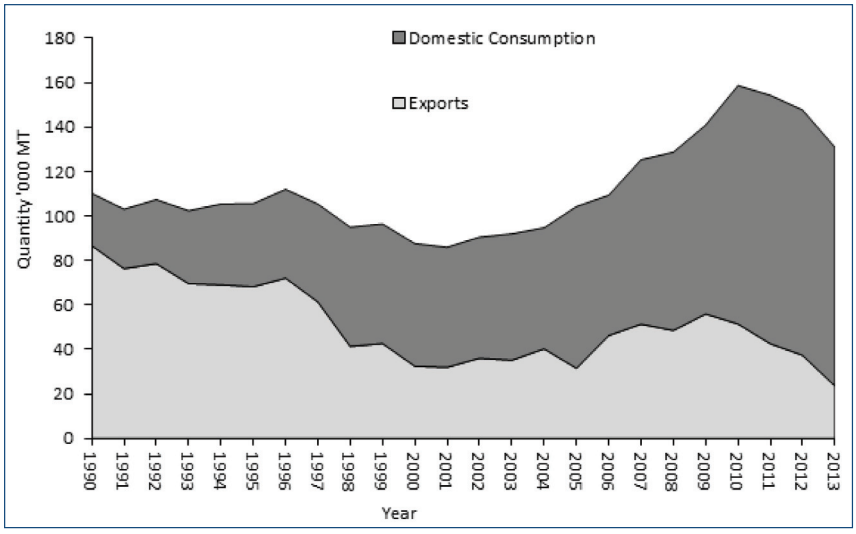
Firms with resource constraints need to be strategic and understand what works best for them in developing their local technological capabilities. External technology acquisition through partnership arrangements and learning by doing has become the most important learning mechanism for firms that do not possess in-house resources to create technology. Lessons on maximising technological benefits and local competence development can be learnt from those who have been successful in benefiting from partnerships and have achieved sustainable technological development. The broad interaction between external knowledge, its internalisation and modification by local firms and diffusion to local industries is conditional to the presence of complementary assets from public and firm level assets such as dynamic local knowledge base, backward links to local research and development (R&D) through public research, foreign technology transfer and appropriate engineering capability among local partner firms for functional upgrading at industry level. Policymakers need to consider the strength of innovation systems and the knowledge infrastructure influencing the focus industries and subsequent effects on technological development approaches including the heterogeneous requirements of innovative firms.

Introduction

Firms with limited resources understandably find it difficult to make expensive investments on in-house R&D activities. Exogenous sources for technology acquisition coupled with local knowledge development activities have been mostly preferred by them as a substitute approach. Given the weak level of development of the national system of innovation, developing economies opt for extending their search for advanced technologies beyond their national borders. An example of such extended approaches is promoting inward foreign direct investment (FDI) for technological development as an intended indirect benefit. However, there is a dominant preference towards science-based innovations reflected in the national innovation policies in practice in many developing economies. Policies focused mainly on science-driven innovation in developing economies limit the opportunities for economic development through alternative approaches (Arocena and Sutz, 2000), and the ignorance of the effects of context specificities can lead to the risk of ending up with a "one size fits all" (Chaminade *et al.,* 2012).

The usefulness of learning by doing in firms has been recognised in the literature. Subsequent investments on human and physical capital, generation of technological changes and building strategic capabilities are needed for sustained competitiveness (Bell and Pavitt, 1995; Dutrénit, 2000). From an outcome perspective, there are limited examples of science-based innovations which have led technological development for generating substantial benefits for upgrading of local industries in developing economies; there is no conclusive evidence for realised benefits of FDI in the extant literature at the same time. There is a limited understanding on the formula for blending these two different approaches of science-based technological development through R&D and the learning by doing approach, for technological development of local industries in developing economies and the conditions that shape those decisions ask for more case studies to understand the complex realities in developing economies. Although it is unlikely that such a direct formula for a mixed approach will ever be developed; there is, however, an opportunity to recognise the successful cases from developing economies and learn by sharing experiences in the forms of strategies, practices and routines.

Based on a study (2008–2011) conducted in the context of Sri Lanka followed by subsequent studies already published by the author, this article presents some lessons from successful cases at firm and industry level to assist practitioners in making informed decisions in designing their technology and innovation strategies and for policymakers to understand the technological development of industries contingent on local conditions. It considers the transformation of the rubber industry and garment industry and focuses on the rubber products and garment accessories manufacturing industries. It identifies that the development of the Sri Lankan rubber product industry has been an aggregation of a local knowledge base and public research capacity on the upstream of the rubber industry value chain, foreign knowledge through the inflow of foreign technology and the capacity of local partner firms to be technologically innovative. However, the extended development of garment accessories industry has been strongly underpinned by the local firms' strategic innovation strategies in the absence of the local knowledge infrastructure specific to the sectoral requirements. Such firm level strategic technology management has been evident in successful rubber product manufacturing firms too. This article also identifies the requirements that extend beyond capabilities of individual firms in the development of sophisticated technology sectors and the need for the



Source: Rubber Research Institute http://www.rrisl.lk/sub_pags/statistics.html

Figure 1: Raw rubber domestic consumption and exports

public–private partnerships for collaborative efforts to make things happen.

Technology acquisition from exogenous sources

Developing economies, in general, attempt to tap technological advancements occurred elsewhere through promoting FDI since FDI comes as a package of assets, including not only capital for investment but also technology, organisational and managerial practices and market access (UNCTAD, 2006). Throughout the history, many governments have promoted FDI through tax holidays and tax exemptions on imports of capital goods and raw materials to receive indirect technology spillover projects. Direct technology transfers to host firms from their foreign parent or subsidiary firms' subsequent technology spillover to local industry has been the macro level benefit for the host economy.

Case studies from East Asia provide a rich source of material for analysing how the transformation from a technology borrower to a technology innovator through technology diffusion management has been possible (Matthews and Cho, 2000). For instance, Kim (1997) analysed the development of the Korean semi-conductor industry from its initial state of assembly industry and showed how Samsung achieved a leap-frogging technological development. Moreover, a case study from Costa Rica found positive externalities generated by Intel's investment to the Costa Rican economy in terms of new training programmes in higher education institutes and the development of supplier industries (Larraín *et al.,* 2000). These findings and lessons are context specific, making it difficult to directly adopt lessons from the emerging economies to developing economies due to the presence of different systemic and firm level conditions.

Local knowledge assets and technological development of a traditional industry

The present understanding from research into how FDI directed towards traditional industries in developing economies might drive downstream developments in the value chain remains limited. An analysis of the transformation of the Sri Lankan rubber industry from raw rubber production to a competitive rubber product manufacturing provides insights into what factors might influence downstream developments in the value chain and sectoral upgrading of the industry as a whole over time.

Sri Lanka has been a successful exporter of raw rubber including ribbed smoked sheets (RSS or sheet rubber), crepe rubber, technically specified rubber (or block rubber) and centrifuged latex that are primary intermediate products, which supply the rubber product industry. RSS is a conventional type of rubber and is the main raw product for the solid-rubber product manufacturing industry. Because of the practical ease of the RSS manufacturing process, RSS manufacturing takes place mainly as a cottage industry in Sri Lanka. Centrifuged latex is the main raw product for the dipping industry and centrifuging factories generally belong to estates and not to smallholders. Being a primary export crop for Sri Lanka, export of rubber as a raw material has contributed to the economy for many years but it was not until the 1990s that the rubber product industry emerged (Nakandala and Turpin, 2011).

According to Figure 1 that presents the raw rubber domestic consumption and exports (1990–2013) and Figure 2 that presents export values of raw rubber and rubber products (1990–2008), the Sri Lankan rubber product industry has been growing over the years with a significant upswing in the early 1990s. Over the last two decades, rubber products, as a proportion of the export market, have been increasing, whereas raw rubber exports show little growth. There is a dependency between these two industries: raw rubber is the input for the rubber product industry and the more rubber products that are manufactured locally, the more raw rubber is consumed locally. The total exports of raw rubber have gradually decreased, but the local consumption of raw rubber has increased since early 1990s. Increasing local consumption of rubber reflects a transfer from raw production to more value-added manufacturing in the rubber value chain within the country. A detailed view on the product specific data revealed that tyres and tubes have significant dominance over other exports since early 2000. The growth rate in tyre and tube exports is steeper than the gradual growth in dipped rubber product exports. As a result, a greater extent of RSS is consumed locally and the demand for RSS is growing rapidly which in turn result in developed integration of rubber in the smallholder system (Nakandala and Turpin, 2011).

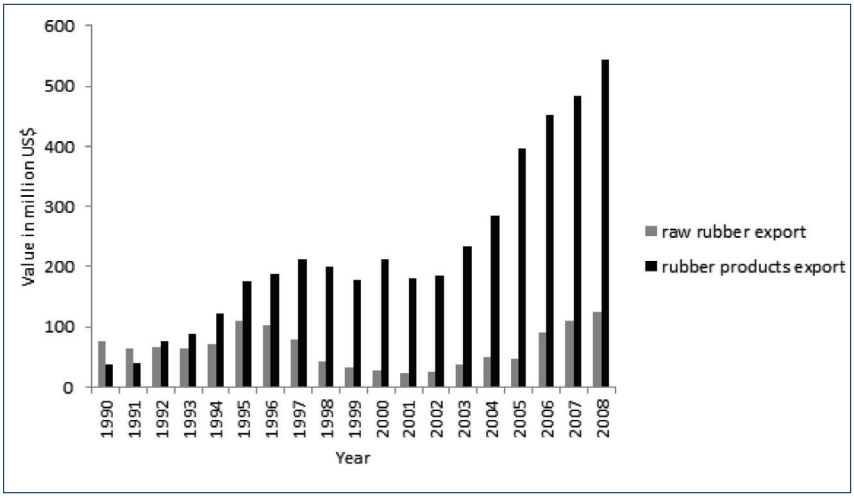
The growth in RSS and centrifuged latex in recent years appears to be an outcome of a stable local market and technological advances for raw rubber processing operations, driven by the Rubber Research Institute which has been contributing to the raw rubber production industry with skill development and technology. The solid rubber

product industry had some presence in Sri Lanka prior to the 1990s: there are several local firms, joint ventures and multinational subsidiaries manufacturing and retreading rubber tyres in the local industry. The presence of a multinational firm, which manufactures its own brand tyres for the international market, and the participation of its competition, another high performer joint investment with a multinational firm, is an example of competition created through technology spillover from foreign multinational firms. In terms of the nature of the industry, the solid rubber product industry is more stable, having mature technologies along the value chain. The challenges lie mainly in the product manufacturing stages. Conversely, the dipped product industry, mainly thin products such as gloves, is sensitive to the quality of latex. Hence, it is important to analyse how foreign presence is involved in stabilising the dipped product industry in Sri Lanka.

Before the 1990s, the latex dipped product industry had a minimal presence in Sri Lanka with a few local firms in glove, balloons and rubberised coir manufacturing. The industry possessed some knowledge in dipped product manufacturing and had several centrifuging plants. However, the foreign presence in the dipped industry was not very significant at that time and some foreign investors, in fact, failed to endure. There was a reported failure of manufacturing latex threads for elastics in garments. The perceived low quality supply of centrifuged latex hampered the growth of the dipped product industry until the complete latex rubber industry was revitalised by a prominent multinational firm in the early 1990s.

The establishment of a multinational firm for manufacturing surgical gloves in Sri Lanka happened in 1990 and its involvement turned around the local rubber dipped product industry. Primarily, the decision of this multinational to commence the operation was a turning point for Sri Lanka as it indicated an acceptance of the Sri Lankan product in the global market. In turn, this opened up markets for locally manufactured glove products and also attracted more foreign investors to glove manufacturing in Sri Lanka.

For the solid product tyre industry, the mechanism was technology spillover through competition effects and skill mobility in the industry. This raised the level of competition. In the glove industry, multinational investment in 1990 projected a global image of good quality for natural rubber from Sri Lanka. Moreover, technology transfer down the value chain produced a spillover to the supplier industry benefitting both the centrifuging industry and the glove manufacturing industry. The pressures from multinational firms to improve supplier operational standards resulted in new practices and standards among their registered local suppliers. This ultimately spilled over to the other players in the local industry. Consequently, the local centrifuging industry became more disciplined and standardised. Technological development through the presence of these multinational firms went beyond the supplier industry development to the product manufacturing industry. The knowledge and experience of local engineers employed by the multinational firms were high. They were familiar with operational standards, work practices and tests, trials and experiments in an advanced technological environment in multinational firms benefited from those developed skills with the tacit knowledge transfer through skill movement within the industry. The presence of local knowledge and a strong public research system in raw rubber production has underpinned the development of downstream rubber product manufacturing. In contrast, garment accessories manufacturing as a non-traditional industry lacked such public knowledge base.



Source: Export Development Board, Sri Lanka

Figure 2: Export values of raw rubber and rubber products

Building technological capabilities in a non-traditional export industry

The garment manufacturing industry is not one of Sri Lanka's traditional export industries, rather it emerged from a small, relatively domestically oriented industry after the liberalisation of the economy in 1977 (Kelegama and Foley, 1999; Weerakoon and Wijayasiri, 2000). The development of the garment industry presumably had the potential to create and develop other types of local firms through backward or forward linkages. However, there were several constraints. Even though the garment industry shifted to low-cost countries from the main markets in the USA and Europe, upstream functions such as the fabric industry continued to exist in wealthy countries (Knutsen, 2004). There were local factors too. In a study explaining weak backward linkages in the garment industry, Kelegama and Foley (1999) compared the experiences of Sri Lanka's low level of development in the fabric and garment accessories industry to other countries in Asia. They identified several technical and economic impediments, which had resulted in less successful backward linkages in the late 1990s. However, despite initial barriers, the garment accessories industry was gradually established and at the end of May 2008, there were 68 FDI fabric and garment accessories firms according to unpublished data from the Board of Investment, Sri Lanka.

Management strategies and practices for sustained technological development

For industries where the accumulated knowledge base and knowledge infrastructure is limited and the systemic support for innovation is weak, firms have to be very strategic in managing their technology development process. Technological capability development is viewed as a staged process in much of the literature. Zahra and George (2002) identified dynamic capability development as acquisition, assimilation, transformation and exploitation of knowledge. Dutrénit (2000) noted firms in developing economies follow three stages in the technological capability development process: building the minimum requirements for an essential knowledge base, transition process and building strategic capabilities. An empirical research study by Nakandala and Turpin (2013) investigated how some successful firms in joint venture partnerships with foreign firms acquired their technology, how they developed local technological capability, how they sustained their technological development and how their strategic partnership requirements evolved in the context of Sri Lanka. Based on this analysis of case firms from the rubber product manufacturing industry and garment accessories manufacturing industry, they argued that the local technology managers of the successful local partner firms in joint venture partnerships with foreign firms recognised and clearly understood the level of development in their firms and matched their partnership arrangements appropriately – based on each firm's skills and capabilities, the organisational dominance of the foreign partner firm in the partnership and the potential for technological contribution from the foreign partner firm.

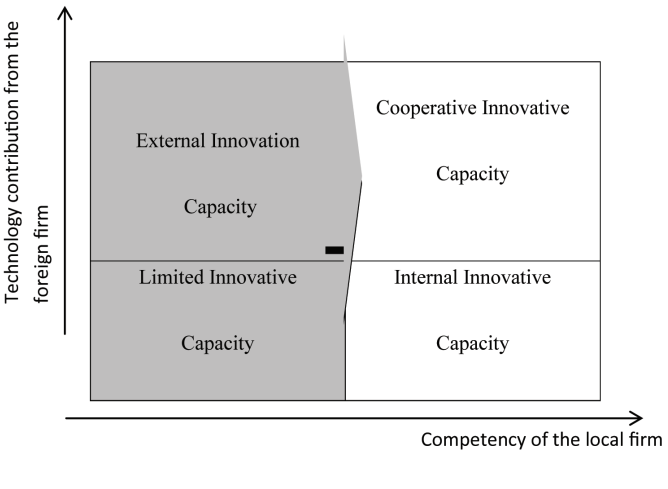
Unless firms generate technological changes at an internationally competitive rate after the transfer, the technological gap between partnering firms continues to widen. In this process, some firms keep a variety of technology sources for responding to the need of continued access to technology. In-house technology creation requires investing and exploiting their own internal capabilities in innovation, and external technology acquisition requires strategic selection of partner firms and management of the technology transfer process for internal capability development. The choice between these two options is conditional. In a comparatively less challenging industry, firms with adequate skills and capabilities may not face extreme challenges for survival. In contrast, in a dynamic industry with frequent changes in the market and in applicable technologies, firms must regularly update and upgrade their knowledge, skills and technologies. In such a scenario, firms need to assess their internal innovative capability and decide whether they are able to innovate at the rate of change of the industry. Some firms may seek to acquire innovation capabilities externally at this stage if they find upgrading internal capabilities is too challenging, especially when the rate of acquisition demanded to synchronise with the innovation dynamics of the specific industry is too great.

Figure 3 identifies technology management strategies based on the level of technological contribution from the foreign partner firm and the level of local competency of the local firm. "Cooperative Innovative Capacity" represents an effective strategy in a partnership between a local firm with high local innovative capacity and a foreign partner firm, which is capable of and willing to contribute technologically. This strategy can yield progressive technological developments in the local firm. "External Innovative Capacity" represents an effective strategy where a foreign firm contributes technologically to the local firm that has a low competency or is unable to mobilise its internal skills and resources. These local firms depend completely on the foreign partner for technology means, i.e., the technological development. In contrast, "Limited Innovative Capacity" is when the foreign firm is unable to contribute technologically to the development of a local firm which has low technological competency that can result in an ineffective status due to the impossibility of generating either local innovation capability in the local firm or external innovation capability from the foreign firm. "Internal Innovative Capacity" represents a firm possessing high skills and capability, which makes local innovations possible even without any technological contribution from the foreign partner firm.

According to the empirical study by Nakandala and Turpin (2013), the progression of local firms in technological development can take various forms. Some local firms continue to benefit significantly from the technological contribution of the foreign partner and operate in the "Cooperative Innovation Capacity" quadrant. Several others have ceased their technological partnerships with foreign partners, choosing to exploit their internal capabilities by choosing to operate in the fourth quadrant of "Internal Innovative Capacity". Some firms have moved away from the first partnership, formed another joint venture partnership and now benefit from the technological contribution of the new foreign partner. Hence, they operate in the first quadrant of "Cooperative Innovation Capacity" but are closer to the "Internal Innovative Capacity" quadrant. Although "Internal Innovative Capacity" is the preferred status for local firms, the need for continuous upgrading of innovative capacity through local generation of knowledge could put the local partner firm into a struggling position in dynamic market and technology conditions. The effectiveness of this status may vary according to external environmental conditions and the level of innovative capacity to respond to its external conditions. Successful firms tend to dynamically generate partnerships with partner firms with more advanced technological competences and move back to either "External Innovation Capacity" or "Cooperative Innovation Capacity" levels or progress towards "Internal Innovation Capacity". Hence they tend to continuously shift between different quadrants with the goal of reaching the "Internal Innovation Capacity" in every technological partnership.

There have been effective strategies and practices that enabled successful technology acquisitions from the foreign counterpart. Throughout the technology transfer process the involvement of the local teams was active; the local teams acquired installation, commissioning and operational skills through working with expatriate technical teams in the installation stage and mastered production technologies through operating

and sharing skills internally with new hires by allowing them to work with experienced local technical staff as well as learning by implementing and testing changes in the process and machineries. For internal capacity development, local teams develop skills and capabilities through production operation, accumulate innovative capabilities and realise them through internal innovations. Embedding innovation management capabilities in management practices has thrived largely through incremental innovations in operational competences of those firms. Hence, innovation capabilities in those firms are developed as a product of learning by doing and operating technologies in an innovation-conducive culture and management systems.



Source: Developed from Nakandala and Turpin (2013)

Figure 3: Technology management strategies and trajectories for innovation capability development

Public–private partnerships for advanced technology sectors

Although external technology sourcing has been preferred due to resource limitations, not all technologies could be transferred, shared or spilled over into local firms. Multinational investments on advanced technologies sometimes go beyond the capacity of investment by the local industry making imitation practically impossible. For instance, the gamma irradiator plant established by a multinational firm in the rubber product industry costs several million dollars and apparently has excess capacity, but that technology is exclusively for the use of the investor multinational firm. The local industry did not have another gamma irradiator installed and other firms did not locally sterilise their surgical glove products. With the government investment, an irradiator has been built for shared industry use. Its use includes the radiation sterilisation of medical products, food irradiation, polymer modification and radiation vulcanisation of natural rubber latex (Sri Lanka Atomic Energy Board, 2015).

Although some technology infrastructure developed by multinational firms could be exclusive for them, however, irrespective of the restricted use of that technology, the local industry could receive strategic and long-term benefits from that installation. For example, the acceptance of irradiation (earlier rejected by the community and authorities as a threat to the environment and security when the aforementioned multinational firm installed it in Sri Lanka) developed skills with local engineers by involving in the installation, commissioning and operation, and familiarity of local staff with technology makes the next technology transfer less challenging. Hence, exclusive technologies used by multinational firms may not have immediate or direct benefits to the local industry, but they raise the level of local knowledge, thus facilitating future transfer of advanced technologies.

Some reasons that exacerbate technology advancement difficulties encountered by firms in resource constrained contexts are the high-financial investment, access to expertise and the challenges of capturing the value of outcomes. Public–private partnerships have been an approach in practice for advanced technology initiatives with broad benefits applicable across industries. For example, the Sri Lanka Institute of Nanotechnology Private Limited (SLINTEC) was established in 2008 in an unprecedented joint investment between the government and the private sector. It aimed for building a national innovation platform for technology-based economic development by increasing the high-technology value-added exports to 10% by 2015 through commercialisation of nanotechnology, increasing the collaboration between research institutes and universities, introducing nanoaspects of leading technologies and industries to make Sri Lankan products globally more competitive and adding value to Sri Lanka's natural resources, bringing nanotechnology research and business enterprises together and attracting expatriate Sri Lankan scientists by creating a sustainable eco-system. The nanoresearch at SLINTEC focuses on agriculture, rubber, apparel and textile, consumer products and nanomaterials, and therefore its outcomes are applicable to a broad range of industries.

There have been some positive benefits realised from this public–private partnership. Since its establishment in late 2009, SLINTEC has filed five international patents at the United States Patent and Trademark Office; in 2011 and 2012 two further patents were filed. These innovations include a process for preparation of carbon nanotubes from vein graphite, compositions for sustained release of agricultural macronutrients and related processes, a cellulose-based sustained release macronutrient composition for fertilizer application, a process for making reinforcing elastomer–clay nanocomposites, a process for preparation of nanoparticles from magnetite ore, a nanotechnology-based sensor unit, a composition for stain and odour removal from bio-polymeric fabrics and a related process and a composition

and a method for sustained release of agricultural macronutrients, etc. New industry partners have teamed up and new projects have been initiated (SLINTEC, 2015), signalling the continued viability and performance of this partnership.

Conclusion

This article aimed at investigating the successful transformation of a traditional and a non-traditional industry in Sri Lanka which have been influenced by FDI. The development of the rubber product industry suggests that the operation of multinationals can standardise local industries through forced transfers down the backward linkages in terms of new standards, practices and systems. The presence of local knowledge and a strong public research system in raw rubber production has underpinned the development of downstream rubber product manufacturing. This finding suggests that the accumulated local knowledge and R&D infrastructure in traditional industries can create a better opportunity for spillover due to the presence of local absorptive capacity with the industry. In contrast, non-traditional industries lack such formal or informal knowledge bases and supporting infrastructure. When the garment industry was established as an export industry with FDI, there was a gradual progression in manufacturing from less-complex products towards highly specialised products and later spin-off of the garment accessories manufacturing industry.

In both rubber products and garment accessories manufacturing industries, strategic technology management strategies of the local firms in foreign partnerships have immensely contributed for industry upgrading. There are other industries in Sri Lanka as well as in other developing countries, which have failed to leverage foreign partnerships for technological development. Strategic planning requires considering the technology vision of the country, and industry specific conditions such as local knowledge base and knowledge infrastructure including the public research system as well as absorptive capacity and innovativeness of firms, in selecting the sectors to promote FDI for indirect technological benefits. Moreover, the Sri Lankan innovation system must overcome barriers with the complex R&D institutional structure, weak focus on foreign technology diffusion mechanisms, low interactions between industry and the public research system and asynchronism between the industry dynamics and the focus of public research system as exemplified in the rubber research system. The presence of complementary assets from public and firm level assets such as dynamic local knowledge base, backward links to local R&D through public research, foreign technology transfer and appropriate engineering capability among local partner firms is important for industry-level functional upgrading (Nakandala and Turpin, 2011).

At the firm level, there is growing evidence that indicates that innovation capabilities rest on the innovation strategies based on DUI (Doing, Using and Interacting) and firms that have a strong DUI-mode of learning and combine it with elements of the science, technology and innovation mode are often the most innovative (Jensen *et al.*, 2004; Lundvall, 1988). This paper finds that local firms in partnerships require to adopt dynamic technology management strategies based on the level of local competences and the potential technological contribution from the partner firms in the technological development process implying responding to the evolving partnership characteristics along the partnership. In this process, the level of skills and capabilities of the local partner firm, the willingness of the partner firm to contribute for the technological development of the local firm, level of dominance and the contextual factors influence the technological development trajectory of the local firms. The learning process in absorption and assimilation of technology is important (Nelson and Pack, 1999). In that, Figueiredo (2002) suggested that deliberate and effective efforts on knowledge-acquisition and knowledge-conversion processes could accelerate the rates of technological capability accumulation. Moreover, Lundvall (2002) emphasised the importance of having an environment conducive for interactive learning. Hence, learning is pivotal in the technological development process for firms and how local firms learn by engaging with their partner firms and dynamic external linkages during the partnerships depends on the strategic technology management capabilities of the local firm.

References

- ✓Arocena, R. and Sutz, J. (2000). Looking at national systems of innovation from the south, *Industry and Innovation*, Vol. 7, pp. 55–75.
- ✓Bell, M. and Pavitt, K. (1995). The development of technological capabilities, *Trade, Technology and International Competitiveness*, Vol. 22, pp. 69–101.
- ✓Chaminade, C., Intarakumnerd, P. and Sapprasert, K. (2012). Measuring systemic problems in national innovation systems: An application to Thailand, *Research Policy*, Vol. 41, pp. 1476–1488.
- ✓Dutrénit, G. (2000). *Learning and Knowledge Management in the Firm: From Knowledge Accumulation to Strategic Capabilities*, Edward Elgar Publishing, Cheltenham, UK.
- ✓Figueiredo, P.N. (2002). Learning processes features and technological capability-accumulation: explaining inter-firm differences, *Technovation*, Vol. 22, pp. 685–698.
- ✓Jensen, M.B., Johnson, B., Lorenz, N. and Lundvall, B. (2004). Published. Codification and Modes of Innovation, *DRUID Summer Conference*, Elsinore.
- ✓Kelegama, S. and Foley, F. (1999). Impediments to promoting backward linkages from the garment industry in Sri Lanka, *World Development*, Vol. 27, pp. 1445–1460.
- ✓Kim, L. (1997). The dynamics of Samsung's technological learning in semiconductors, *California Management Review*, Vol. 39, pp. 86–100.
- ✓Knutsen, H.M. (2004). Industrial development in buyer driven networks: the garment industry in Vietnam and Sri Lanka, *Journal of Economic Geography*, Vol. 4, pp. 545–564.
- ✓Larrain, F., Lopez-Calva, L.F. and Rodriguez-Clare, A. (2000). Intel: a case study of foreign direct investment in Central America. *CID Working Paper No. 58*, Harvard Kennedy School, Harvard University, USA.
- ✓Lundvall, B.A. (1988). Innovation as an interactive process – from user–producer interaction to national systems of innovation. *In:* Dosi, G., Freeman, C., Nelson,

R., Silverberg, G. and Soete, L. (eds.) *Technical Change and Economic Theory*, Pinter Publishers Limited, London.

✓Lundvall, B.A. (2002). *Innovation, Growth and Social Cohesion – the Danish Model,* Edward Elgar, Cheltanham, UK.

✓Mathews, J.A. and Cho, D.-S. (2000). *Tiger Technology: The Creation of a Semiconductor Industry in East Asia*, Cambridge University Press, Cambridge, UK.

✓Nakandala, D. and Turpin, T. (2011). Downstream developments of a traditional industry through foreign investment and local knowledge and capabilities – evidence from the Sri Lankan rubber industry, *International Journal of Technological Learning, Innovation and Development*, Vol. 4, p. 17.

✓Nakandala, D. and Turpin, T. (2013). Responses of successful local firms to changing foreign partnership characteristics: a model of dynamic technology management strategies, *International Journal of Technology Management*, Vol. 61, pp. 156–176.

✓Nelson, R.R. and Pack, H. (1999). The Asian miracle and modern growth theory, *The Economic Journal*, Vol. 109**,** pp. 416–436.

✓SLINTEC (2015). *Sri Lanka Institute of Nano-Technology (Pvt) Limited* [Online], SLINTEC, Colombo.. Available at: http://slintec.lk/ [accessed 10/12/2014].

✓Sri Lanka Atomic Energy Board (2015). *Sri Lankan Government Owned, First Commercial Scale Multipurpose Gamma Irradiation Facility (Mgif)* [Online], Sri Lanka Atomic Energy Board, Colombo. Available at: http://aeb.gov.lk/ [accessed 20/02/2015].

✓UNCTAD (2006). *Trade and Development Report*, United Nations, New York and Geneva.

✓Weerakoon, D. and Wijayasiri, J. (2000). WTO and the textile and garment sector: implications for Sri Lanka, *South Asia Economic Journal*, Vol. 1, pp. 95–111.

✓Zahra, S.A. and George, G. (2002). Absorptive capacity: a review, reconceptualization, and extension, *The Academy of Management Review*, Vol. 27, pp. 185–203.

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Companies must keep books and follow accounting procedures as specified in the Civil and Commercial Code, the Revenue Code and the Accounts Act. Documents may be prepared in any language, provided that a Thai translation is attached. All accounting entries should be written in ink, typewritten or printed. Specifically, Section 12 of the Accounts Act of 2000 provides rules on how accounts should be maintained:

Accounting period

An accounting period must be 12 months. Unless the Articles of Association state otherwise, a newly established company should close accounts within 12 months of its registration. Thereafter, the accounts should be closed every 12 months. If a company wishes to change its accounting period, it must obtain written approval from the Director-General of the Revenue Department.

Reporting requirements

All juristic companies, partnerships, branches of foreign companies and joint ventures are required to prepare financial statements for each accounting period. The financial statement must be audited by and subjected to the opinion of a certified auditor, with the exception of the financial statement of a registered partnership established under Thai law, whose total capital, assets and income are not more than that prescribed in Ministerial Regulations. The performance record is to be certified by the company's auditor, approved by shareholders, and filed with the Commercial Registration Department of the Ministry of Commerce (MOC) and with the Revenue Department of the Ministry of Finance.

Accounting principles

In general, the basic accounting principles practiced in the United States are accepted in Thailand, as are accounting methods and conventions sanctioned by law. The Institute of Certified Accountants and Auditors of Thailand is the authoritative group promoting the application of generally accepted accounting principles.

Any accounting method adopted by a company must be used consistently and may be changed only with approval of the Revenue Department. Certain accounting practices of note include:

Depreciation: The Revenue Code permits the use of varying depreciation rates according to the nature of the asset, which has the effect of depreciating the asset over a period that may be shorter than its estimated useful life. These maximum depreciation rates are not mandatory. A company may use a lower rate that approximates the estimated useful life of the asset. If a lower rate is used in the books of the accounts, the same rate must be used in the income tax return.

Accounting for Pension Plans: Contributions to a pension or provident fund are not deductible for tax purposes unless they are actually paid out to the employees, or if the fund is approved by the Revenue Department and managed by a licensed fund manager.

Consolidation: Local companies with either foreign or local subsidiaries are not required to consolidate their financial statements for tax and other government reporting purposes, except for listed companies, which must submit consolidated financial statements to the Securities and Exchange Commission of Thailand.

Statutory Reserve: A statutory reserve of at least 5% of annual net profit arising from the business must be appropriated by the company at each distribution of dividends until the reserve reaches at least 10% of the company's authorised capital.

Stock Dividends: Stock dividends are taxable as ordinary dividends and may be declared only if there is an approved increase in authorised capital. The law requires the authorised capital to be fully subscribed by the shareholders.

Auditing requirements and standards

Audited financial statements of juristic entities (i.e., a limited company, registered partnership, branch, representative office, regional office of a foreign corporation or joint venture) must be certified by an authorised auditor and be submitted to the Revenue Department and to the Commercial Registrar for each accounting year.

However, for a registered partnership with registered capital of <5 million baht, total revenue of no more than 30 million baht, and total assets of no more than 30 million baht, financial statement does not need to be certified by an authorised auditor.

Auditing practices conforming to international standards are, for the most part, recognised and practiced by authorised auditors in Thailand.

Preparing your production plan

SME.com.ph, Philippines
http://toolkit.sme.com.ph

What is a production plan?

A production plan is defined as the portion of an intermediate-range business plan that is developed by manufacturing/operations department . The plan describes in general, about the total amount of output that the manufacturing department is responsible to produce for each period in the planning horizon.

The output is usually expressed in terms of pesos or other units of measurement (e.g., tons, liters, kilograms), or units of the aggregate product (this refers to the weighted average of all the products in acompany). The production plan is the authorization of the manufacturing department to produce the items at a rate consistent with thecompany's overall corporate plan.

This production plan needs to be translated into a master production schedule so as to schedule the items for completing promptly according to promised delivery dates; to avoid the overloading or underloading of the production facility; and to efficiently utilize the production capacity and low production cost result.

Why is it important to have a carefully developed production plan?

Production planning is one of the planning functions that a firm needs to perform to meet the needs of its customers. It is a medium-range planning activity that follows long-range planning in production and operations management (POM) such as process planning and strategic capacity planning. Firms need to have an aggregate planning or production planning strategy to ensure that there is sufficient capacity to meet the demand forecast and to determine the best plan to meet this demand.

A carefully developed production plan will allow your company to meet the following objectives:

- Minimize costs/maximize profits;
- Maximize customer service;
- Minimize inventory investment;
- Minimize changes in production rates;
- Minimize changes in work-force levels; and
- Maximize the utilization of plant and equipment.

Activity 1 Determination of requirements

Activity 1 in production planning is the determination of the requirements for the planning horizon. Demand forecasting plays an important role in the conduct of these three tasks. Managers thus need to be aware of the various factors that would affect the accuracy of the demand and sales forecast.

Activity 1 involves the conduct of the following tasks:

Activity 1 tasks	Description
1	Draw up the sales forecast for each product or service over the appropriate planning period
2	Combine the individual product/service demands into anaggregate demand
3	Transform the aggregate demand for each time period into staff, process, and other elements of productive capacity

There are company factors that could influence the level of demand for the firm's products. These internal factors include the company's marketing effort,the product design itself,the strategies to improve customer service,and the quality and price of the product.

There are also external factors or marketplace factors that significantly affect demands such as the level of competition or possible reaction by competitors to a firm's business strategy andthe perception of consumers about the products and the consumer behavior as affected by their socio-demographic profile. Finally, there are random factors that could affect the accuracy of demand forecasts such as the overall conditions of the economy and the occurrence of business cycle.

Activity 2 How to meet the requirements

The next major activity involves the identification of the alternatives that the firm may employ to meet production forecasts as well as the constraints and costs involved. Specifically, this activity involves the following tasks:

Activity 2 tasks	Description
1	Develop alternative resource schemes to meet the cumulative capacity requirements
2	Identify the most appropriate plan that meets aggregate demand at the lowest operating cost

Once the most appropriate plan has been selected, then the firm evaluates the plan and later on finalizes it for implementation. For more efficient and effective planning process, the formation of a production planning team composed of managers from manufacturing, marketing, purchasing, and finance is recommended.

Assignment and licensing of intellectual property in Thailand

ASEAN Intellectual Property Association

http://www.aseanipa.org

The assignment, or license agreements, of intellectual property (IP) objects must be made in writing, contain minimum requirements, and not be contrary to specific prescriptions in regard to the related rules. Most types of IP objects shall be registered with the related authorities to make them valid and enforceable in Thailand. The important rules and regulations in relation to the three main IP objects, i.e., (i) trademark, (ii) patent, and (iii) copyright, are as in what follows.

Trademark

Trademark Assignment—the assignment must be made in writing and registered with the Trademark Office to make it valid and enforceable. The Trademark Office accepts the registration assignment for any pending and registered trademarks, and there is no specific deadline for registering the assignment in Thailand.

An important rule relating to trademark assignment is prescribed under Section 50 of the Trademark Act, whereby all associated trademarks shall be transferred, or inherited, only as a whole.

Trademark Licensing—the license agreement and any sub-license agreement must be made in writing and registered with the Trademark Office to make it valid and enforceable. To register a sub-license agreement, the main license agreement must also be registered. If the license agreement is subject to a renewal, such renewal must be re-registered to maintain its validity.

A registrable license agreement, according to Section 68 of the Trademark Act, shall at least provide the following categories: (i) conditions and terms of the agreement between the trademark proprietor and the person applying to be an authorized licensee, which must actually enable the former to control the quality of the goods manufactured by the latter and (ii) the goods on which the licensed trademark is to be used.

The license agreement can include all pending and registered trademarks in Thailand. However, the Trademark Office will only register the licenses of registered trademarks. The license agreement for pending trademarks can be registered, only after it is granted registration, and without the requirement to enter into a new license agreement. There is no deadline for registering a license agreement in Thailand. The main consequence of a non-registered license agreement is that it is non-enforceable under Thai law, and the use by a licensee is not legitimate to defend against a non-use cancellation action.

Patent

Patent Assignment—the assignment must be made in writing and registered in compliance with the requirements, procedures, and conditions as prescribed by the relevant Ministerial Regulations to make it valid and enforceable. The Patent Office registers the assignment for any pending and registered patents, and there is no specific deadline for registering the patent assignment in Thailand. The application to register the assignment must be separately submitted with the Patent Office, together with the agreement which transfers the patent for each assigning patent.

Patent Licensing—the license agreement must be made in writing and registered in compliance with the requirements, procedures, and conditions as prescribed by the Ministerial Regulations to make it valid and enforceable.

In granting a license, according to Section 39 of the Patent Act: (1) the patentee shall not impose on the licensee any condition or restrictions, or any royalty term which unfairly limits competition. Conditions, restrictions, or terms that tend to unfairly limit competition are prescribed in the Ministerial Regulation No. 25 (B.E. 2542), issued under the Patent Act B.E. 2522, and these include (i) prescribing the licensee to provide material, for use in the production, from the holder of the patent or from the distributor, which the holder of the patent has prescribed or permitted, except where it can be proved that it has to be prescribed so that the product produced gives the result as stipulated under the patent, or it is a material which cannot be acquired from another source; (ii) prescribing conditions or restrictions of the licensee concerning the hire of persons for the production of the invention, except where it can be proved that such has to be prescribed, so that the product produced gives results which are in accordance with the patent; (iii) prescribing that the licensee sells, or distributes more than half of the product produced, to the holder of the patent; (iv) prescribing that the licensee limits the quantity of production, sale, or distribution; (v) prescribing that the licensee discloses the invention, which the licensee has improved, or to allow the patent holder to seek interest from the said invention without prescribing a suitable remuneration for the licensee; (vi) prescribing that the licensee exercises the rights under the patent to pay remuneration for the use of the invention according to the patent, after the patent expires, etc. and (2) the patentee shall not require the licensee to pay royalties for use of the patented invention after the patent has expired. Conditions, restrictions, or terms concerning royalties, which are contrary to this provision, are null and void.

Compulsory licensing of patents in the Philippines

Intellectual Property Officeof thePhilippines(IPOPHL)
http://ipophil.gov.ph

The "Intellectual Property Code of the Philippines" includes a chapter on compulsory licensing of patented inventions. Key provisions of compulsory licensing are presented in what follows.

SEC. 93. Grounds for compulsory licensing

The Director of Legal Affairs may grant a license to exploit a patented invention, even without the agreement of the patent owner, in favor of any person who has shown his capability to exploit the invention, under any of the following circumstances:

93.1. National emergency or other circumstances of extreme urgency;
93.2. Where the public interest, in particular, national security, nutrition, health or the development of other vital sectors of the national economy as determined by the appropriate agency of the government, so requires; or
93.3. Where a judicial or administrative body has determined that the manner of exploitation by the owner of the patent or his licensee is anti-competitive; or
93.4. In case of public non-commercial use of the patent by the patentee, without satisfactory reason;
93.5. If the patented invention is not being worked in the Philippines on a commercial scale, although capable of being worked, without satisfactory reason: providedthat the importation of the patented article shall constitute working or using the patent. (Secs. 34, 34-A, 34-B, R.A. No. 165a)

SEC. 94. Period for filing a petition for a compulsory license

94.1. A compulsory license may not be applied for on the ground stated in Subsection 93.5 before the expiration of a period of 4 years from the date of filing of the application or 3 years from the date of the patent whichever period expires last.
94.2. A compulsory license which is applied for on any of the grounds stated in Subsections 93.2, 93.3, and 93.4 and Section 97 may be applied for at any time after the grant of the patent. (Sec. 34(1), R.A. No. 165)

SEC. 95. Requirement to obtain a license on reasonable commercial terms

95.1. The license will only be granted after the petitioner has made efforts to obtain authorization from the patent owner on reasonable commercial terms and conditions, but such efforts have not been successful within a reasonable period of time.
95.2. The requirement under Subsection 95.1 shall not apply in the following cases:
(a) Where the petition for compulsory license seeks to remedy a practice determined after judicial or administrative process to be anti-competitive;
(b) In situations of national emergency or other circumstances of extreme urgency;
(c) In cases of public non-commercial use.
95.3. In situations of national emergency or other circumstances of extreme urgency, the right holder shall be notified as soon as reasonably practicable.
95.4. In the case of public non-commercial use, where the government or contractor, without making a patent search, knows or has demonstrable grounds to know that a valid patent is or will be used by or for the government, the right holder shall be informed promptly. (n)

SEC. 96. Compulsory licensing of patents involving semi-conductor technology

In the case of compulsory licensing of patents involving semiconductor technology, the license may only be granted in case of public non-commercial use or to remedy a practice determined after judicial or administrative process to be anti-competitive. (n)

SEC. 97. Compulsory license based on interdependence of patents

If the invention protected by a patent, hereafter referred to as the "second patent," within the country cannot be worked without infringing another patent, hereafter referred to as the "first patent," granted on a prior application or benefiting from an earlier priority, a compulsory license may be granted to the owner of the second patent to the extent necessary for the working of his invention, subject to the following conditions:

97.1. The invention claimed in the second patent involves an important technical advance of considerable economic significance in relation to the first patent;
97.2. The owner of the first patent shall be entitled to a cross-license on reasonable terms to use the invention claimed in the second patent;
97.3. The authorized use in respect of the first patent shall be non-assignable except with the assignment of the second patent; and
97.4. The terms and conditions of Sections 95, 96 and 98 to 100 of this Act. (Sec. 34-C, R.A. No. 165a)

SEC. 98. Form and contents of petition

The petition for compulsory licensing must be in writing, verified by the petitioner and accompanied by payment of the required filing fee. It shall contain the name and address of the petitioner as well as those of the respondents, the number and date of issue of the patent in connection with which compulsory license is sought, the name of the patentee, the title of the invention, the statutory grounds on which compulsory license is sought, the ultimate facts constituting the petitioner's cause of action, and the relief prayed for. (Sec. 34-D, R.A. No. 165)

SEC. 99. Notice of hearing

99.1. Upon filing of a petition, the Director of Legal Affairs shall forthwith serve notice of the filing thereof on the patent owner and all persons having grants or licenses, or any other right, title or interest in and to the patent and invention covered thereby as appears of record in the office, and of notice of the date of hearing thereon, on such persons and petitioner. The resident agent or representative appointed in accordance with Section 33 hereof shall be bound to accept service of notice of the filing of the petition within the meaning of this section.

99.2. In every case, the notice shall be published by the concerned office in a newspaper of general circulation, once a week for three consecutive weeks and once in the IPO Gazette at applicant's expense. (Sec. 34-E, R.A. No. 165)

SEC. 100. Terms and conditions of compulsory license

The basic terms and conditions including the rate of royalties of a compulsory license shall be fixed by the Director of Legal Affairs subject to the following conditions:

100.1. The scope and duration of such license shall be limited to the purpose for which it was authorized;

100.2. The license shall be non-exclusive;

100.3. The license shall be non-assignable, except with that part of the enterprise or business with which the invention is being exploited;

100.4. Use of the subject matter of the license shall be devoted predominantly for the supply of the Philippine market: providedthat this limitation shall not apply where the grant of the license is based on the ground that the patentee's manner of exploiting the patent is determined by judicial or administrative process, to be anti-competitive.

100.5. The license may be terminated on proper showing that circumstances which led to its grant have ceased to exist and are unlikely to recur: providedthat adequate protection shall be afforded to the legitimate interest of the licensee; and

100.6. The patentee shall be paid adequate remuneration taking into account the economic value of the grant or authorization, except that in cases where the license was granted to remedy a practice which was determined after judicial or administrative process, to be anti-competitive, the need to correct the anti-competitive practice may be taken into account in fixing the amount of remuneration. (Sec. 35-B, R.A. No. 165a)

SEC. 101.Amendment, cancellation, surrender of compulsory license

101.1. Upon the request of the patentee or the licensee, the Director of Legal Affairs may amend the decision granting the compulsory licenseon proper showing of new facts or circumstances justifying such amendment.

101.2. Upon the request of the patentee, the concerned Director may cancel the compulsory license:

(a) If the ground for the grant of the compulsory license no longer exists and is unlikely to recur;

(b) If the licensee has neither begun to supply the domestic market nor made serious preparation therefor;

(c) If the licensee has not complied with the prescribed terms of the license;

101.3. The licensee may surrender the license by a written declaration submitted to the office.

101.4. The concernedDirector shall cause the amendment, surrender, or cancellation in the register, notify the patentee, and/or the licensee, and cause notice thereof to be published in the IPO Gazette. (Sec. 35-D, R.A. No. 165a)

SEC. 102. Licensee's exemption from liability

Any person who works a patented product, substance and/or process under a license granted under this chapter, shall be free from any liability for infringement: provided,however, that in the case of voluntary licensing, no collusion with the licensor is proven. This is without prejudice to the right of the rightful owner of the patent to recover from the licensor whatever he may have received as royalties under the license. (Sec. 35-E, R.A. No. 165a)

SME Finance Forum

The SME Finance Forum's mission is to accelerate access to finance for small and medium businesses worldwide by promoting knowledge exchange, policy change, and new connections. The SME Finance Forum is a global membership organization that works to expand access to finance for small and medium businesses. The Forum brings together financial institutions, technology companies, and development finance institutions to share knowledge, spur innovation, and promote the growth of SMEs.

For more information, access:

http://smefinanceforum.org

Financial support in India

Ploughing back of profits

Business Portal of India
http://business.gov.in

"Ploughing back of profits" is an important source of internal or self-financing by a company. It refers to the process of retaining a part of the company's net profits for the purpose of reinvesting in the business itself. In other words, the savings generated internally by a company in the form of'retained earnings are ploughed back into the company for diversification of its business. It is actually the amount held back by the entrepreneur after paying a reasonable dividend to the shareholders of the company, and these undistributed profits are used by the company to meet its present and future financial requirements. This reduces their dependence on funds from external sources to finance their regular business needs. Such a source of finance may be used by the company for the following purposes:

- for expansion and growth of the business;
- for strengthening the financial position of the company;
- for meeting various working capital requirements of the company;
- for redemption of old debts; and
- for replacement of obsolete assets and modernisation.

The amount of retained earnings in a company depends on the following factors:-

- The amount of net profits is an important determinant of internal savings. Higher the net profit earned by a company, the greater is its capacity to plough back profits.
- The dividend policy of a company determines the extent to which the profits can be retained for reinvestment in the business. If a company follows a liberal and regular dividend policy, it may end up retaining lesser profits. However, if it follows a conservative dividend policy, it has a chance of building up greater internal savings.
- Another factor is the rate of corporate tax imposed on the company. If the rate is higher,then it may have lesser amount of internal savings.
- The age of a company also influences this amount. New companies are generally unable to retain high profitsbecause of their desire to satisfy the shareholders, although the old companies may distribute smaller portion of their profits to shareholders and thus retain a larger amount of internal savings.
- The future plans of the company regarding modernisation and expansion also affect the amount of retained earnings.

Benefits of ploughing back of profits

- A company with such reserves can face unforeseen contingencies, capital market crisis, and other downturns in the economy with lesser difficulty and ease.
- Such reserves help to stabilise the dividend policy of the company. It thus helps in improving the company's relations with its shareholders. It even helps in appreciating the value of its shares.
- It is the most convenient and economical method of finance and involves no legal formalities or negotiations.
- It helps to keep the financial structure of the company fully flexible and even increases the credit-worthiness of the company.
- Growth and modernisation plans of a company will not suffer because of lack of finance if the company has such retained earnings.

Thus, it is an important beneficial factor in the performance and growth of the company in both short andlong terms. However,a policy of excessive ploughing back of profits may be disadvantageous for the company:

- The heavy reinvestment of such profits, year after year, by a company may cause dissatisfaction among shareholders as they may get lower dividends.
- It may tempt the management to raise bonus shares to the equity shareholders leading to over capitalisation of reserves.
- The company may not always use the retained earnings to promote the interests of the shareholders. Instead, it may be invested in unprofitable avenues or misused by locking them up in those business concerns which are against the interests of the shareholders.
- It may be used to manipulate the share prices of stock exchange. The company may keep the dividend rate very low so as to purchase the shares at lower prices and later by increasing dividend rates; it may reap benefits from higher share prices.

In order to protect the interests of shareholders,the Companies Actcontains rules regarding the payment of dividends by a company:

- The rate of dividends is to be declared at the General Meeting and the rate recommended by the Board must be approved by the shareholders in this meeting. The three preliminary conditions for declaration of dividends are:
  - there must be profits;
  - the Board must recommend the distribution of profits as dividend; and
  - the general body of shareholders must approve the Board's recommendations.
- The main sources of payment of dividends include:
  - current profits after providing for depreciation, or
  - undistributed or accumulated profits of previous years, or
  - out of both of the above, or
  - funds provided by the Central or State Government for payment of dividend in pursuance of a guarantee given by that government.
- Before declaring dividends for any financial year,a certain prescribed percentage of profits will be transferred to the reserves of the company. The company may voluntarily transfer a higher percentage of net profits to reserve.
- If authorised by the articles,a company can pay dividend in proportion to amount paid up on each share.If there is no such provision in the articles,dividend shall be in proportion to the nominal value of the shares.
- Dividend is payable only in cash (or cheque) except where fully paid bonus shares are issued as per the articles,or it is adjusted towards outstanding calls on shareholding.The dividend warrant shall be sent to the registered address of the shareholder entitled to the payment of dividend.
- The dividend must be paid within 30 days of the declaration except:
  - where there is dispute about the right to receive dividend;
  - where it has been lawfully adjusted by the company against any outstanding due from the shareholder;
  - where non-payment is because of certain directions given by the shareholder;
  - where dividend could not be paid because of operation of any law or
  - where failure to pay dividend or post the dividend warrant within 30 days of declaration has been because of a fault on the part of the company.

WIPO launches new multilingual interface for ePCT

The World Intellectual Property Organization (WIPO) has launched the multilingual interface of ePCT, marking a major expansion of its global gateway for online filing and management of international patent applications. In addition to English, the ePCT user interface is now available in the other nine languages of international publication under the Patent Cooperation Treaty (PCT): Arabic, Chinese, French, German, Japanese, Korean, Portuguese, Russian and Spanish. With the addition of these new languages, the web-based ePCT portal is now poised for further growth with an increasingly global user base.

Among the benefits of the ePCT is an automatic checking function during the preparation phase, ensuring the validity of the data provided, and reducing and potentially eliminating errors before filing. After filing, ePCT allows both applicants and patent Offices to manage international applications in a paperless environment, saving time and money.

For more information, contact:

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Finance and working capital to start business

Technology Innovation Management and Entrepreneurship Information Service, India
http://www.techno-preneur.net

To start and set up their business all small-scale industry (SSI) units need monetary support. Before seeking fund, estimate the cost including that of working capital required for a minimum of 6–8 months and always keep a provision for buffer. We can take help of a CA or concerned officials in Entrepreneurship Development Institutes to work out the total financial cost of the project. Decide the form in which we are going to raise the capital, i.e., should it be equity finance, debt finance, loans or a combination of these.

The financial assistance in India for SSI unit is available from various institutions which include:

- SIDBI: Small Industries Development Bank of India (refinance and direct lending);
- SFCs: State level Financial Corporation, e.g., Delhi Financial Corporation (DFC) and Gujarat State Financial Corporation (GSFC);
- National Small Industry Corporation;
- Small Industry Development Corporations of various states;
- Commercial/Co-operative Banks; and
- District Industry Centre.

In addition, large term loans are also available from all India financial institutions such as IDBI, IFCI and ICICI . The Export Import Bank of India and the Export Credit and Guarantee Corporation are federal agencies which provide credit for export/import and EXIM guarantees, respectively.

This need for finance can be classified into following types:

- long- and medium-term loans;
- short-term or working capital requirements;
- risk capital;
- seed capital/marginal money; and
- bridge loans.

Long- and medium-term loans are provided by SFCs, SIDBI and State Industrial Development Corporations. Banks also finance term loans. This type of financing is needed to fund purchase of land, construction of factory building/shed and for purchase of machinery and equipment. The term loans are secured against mortgage of assets such as land, building, machines, equipment and other stocks. The short-term loans are required for working capital requirements, which fund the purchase of raw material and consumable, payment of wages and other immediate manufacturing and administrative expenses. Such loans are generally available from commercial banks.

There is, however, a single window scheme, for SSI units. Under the scheme, an agency, either the bank or the financial institution, funds both the term loan and the working capital requirements. This scheme applies to all SSI projects cost up to Rs. 50 lakhs. The working capital loan is generally secured against:

- pledging of stocks, raw materials and finished goods;
- advances against work-in-progress; and
- advance against bills.

For loans from financial institutions and commercial banks, a formal application needs to be filled. The details of documentation that need to be provided with the loan application are given in what follows:

- documentation for loan application;
- balance sheet and profit loss statement for last three consecutive years of firms held by promoters;
- income tax assessment certificates of partners/directors;
- proof of possession of land/building;
- architects estimate for construction cost;
- partnership deed/memorandum and articles of associations of company;
- project report; and
- budgetary quotations of plant and machinery.

A sanction or rejection letter is issued by bank after its assessment of the application. After receiving a sanction letter, applicants need to indicate in writing their acceptance of terms and conditions laid down by financial institutions or banks.

Subsequent loan is disbursed according to the phased implementation of the project.

Nowadays, there are other choices apart from commercial banks and government-owned financial institutions. These options include venture capital funds and non-government finance companies.

Innovation management perspectives from Malaysia

SME Corporation, Malaysia

http://www.smecorp.gov.my/vn2/node/88

How to develop a culture of innovation

Customer expectations and technology evolution are the most important factors for the business. To remain competitive, creating a business culture that fosters innovation can be imperative.

Although we cannot force creativity, we can apply a few easy changes in our workplace that shifts company's culture. Here are three ways to go from responding reactively to market changes to anticipating and addressing them.

Hire diverse talent

The first step towards creating an innovative culture is to have the right employees in the fold. In addition to workers who are self-motivated and trustworthy, consider striving for a workforce that embraces diversity.

Diversity is often framed in terms of race and gender, but cultivating a diverse workplace is about so much more than that. Seek out employees with different personalities and work backgrounds. If all our employees view our business through the same ideas, we might remain stuck with the status quo.

Seek out workers who bring a new perspective to our business, market conditions and target audience.

Build breathing room into the work day

Once we have a group of trusted and diverse employees, give them time to work creatively. Google spends its employees' time to work on personal initiatives that may not be tied directly to their assigned duties.

Depending on how we structure our business, look for ways to build breathing room into the day or week to let our employees explore new ideas. Being flexible is critical to making this work. If we have an employee who does her best thinking at the local park or while taking a walk – give her an hour to go hash out her thoughts.

Then, create a way to facilitate the sharing of ideas and collaboration between employees. It could be a corkboard with note cards in the break room or a Google doc that the whole office can access.

Have a high tolerance for mistakes

As a business owner, we do not want to waste time and money on initiatives that are going nowhere. However, failure is part of innovation. The Smithsonian notes Thomas Edison had to test more than 1600 materials before he found the right filament for his electric bulb.

Workers should be comfortable knowing that we do not expect every idea to be a home run. If they fear our wrath when a project does not pan out, chances are they would not risk exploring new ideas. That does not mean we should not be smart about new ideas. Look for ways to test initiatives and measure preliminary results before pouring energy into pursuing them. However, keep communication open with our employees, and let them know that we appreciate their efforts, even when they fail.

Creating a company culture that embraces innovation does not have to be hard. It simply requires shifting our expectations and empowering the employees to explore new ideas with our full support.

Importance of innovation in entrepreneurship

The Malaysian economy has not only survived the global economic crises that have prevailed over the past two decades, but also is now going from strength to strength because the key players in our economy have been able to adapt to the challenging times and transform their businesses into innovative, competitive and resilient entities. Small businesses make up the main bulk of the Malaysian economy, and thus play a big role in the strong growth of our economy.

Although big businesses may command many of the headlines, small businesses are really the engine that drives much of our economy. The adage "small businesses are the backbone of our economy" stands true in modern-day economies. Although many small businesses may depend on outsourcing by larger companies, if they did not exist, so would not the big businesses. Although small-sized businesses create more products and services, they also help circulate money in the economy quickly. They are also more enthusiastic and willing to create strong customer relationships and reliability among the employees. They work at the micro-level of economics and create a base for the macroeconomic stage through the multiplier effect. They cater not only to households directly but also to aid multinationals with their products and services. Many huge clients are now turning to small enterprises to contract financially significant projects fascinated with the friendly and reliable work environment.

The growth of innovation, too, is greater in small businesses as innovation is essential to propagate the development and success of business. Entrepreneurs, as drivers of small businesses, are the innovators of the economy.

The importance of innovation in entrepreneurship can be seen in the invention of new ways to produce products or improved

solutions. A service industry can expand with new or improved types of services to fulfil the ever changing needs of their clients. Manufacturers can come up with new products from raw materials and by-products.

Innovation is vital for the durability of any business. Innovation usually begins with a need. Small businesses are generally directly involved in their communities and they know exactly what the communities need and strive to come up with solutions to fulfil those needs. They seize the opportunity to innovate to ease communal problems and make lives more comfortable. Furthermore, these solutions keep getting better, easier and more useful as entrepreneurs and their small businesses come up with improved formulas and solutions. Keeping abreast with current trends and demands is an important factor for entrepreneurs to fuel their creativity and innovation. Manufacturers are constantly innovating to produce more without sacrificing quality.

Small businesses should make innovation as a fundamental part of their organisational development since innovation creates business success. Entrepreneurs must not see just one solution to a need. They should come up with ideas for multiple solutions. It is imperative for all small businesses to encourage growth of innovation among their employees. By coming up with seminars and trainings to keep their employees stimulated to create something useful for others, can, in turn, result in financial gains for the company.

Competition is another factor that elevates the importance of innovation in entrepreneurship. It motivates entrepreneurs to come up with better, improved products and services than their competitors for a higher share of the market.

Innovation in entrepreneurship is without doubt a significant factor in fuelling the economy. By embracing innovation to keep up with the pace of change in the dynamic world of business, entrepreneurs are surging steadily forward with a wealth of creative and innovative ideas that transform into competitive products and services, allowing entrepreneurs and their small businesses to garner financial gains that, in turn, help boost the country's economy.

IP and technology databases

The World Intellectual Property Organization (WIPO) global databases make it easy for anyone, anywhere, to access the wealth of information in the IP system. They are based on our commitment to creating an inter-connected and inclusive knowledge-sharing IP infrastructure to support innovation worldwide.

PATENTSCOPE: Search the technology contained in more than 43 million patent documents, including international patent applications submitted under the PCT.

Global Brand Database: Search brand information from multiple national and international sources, including trademarks, appellations of origin and official emblems.

ROMARIN: Search detailed information, updated daily, on all international marks recorded under the Madrid system, which are currently in force or have expired within the past six months.

Global Design Database: Search industrial design registrations from the Hague System plus participating national collections.

Hague Express: Access details of industrial designs registered under the Hague System.

Lisbon Express: Search appellations of origin registered under the Lisbon system.

Article 6ter: Search for the State emblems, and names, abbreviations and other emblems of IGOs, which have been communicated for protection under Article 6ter.

WIPO Pearl: Use our multilingual terminology database to find accurate IP and technological terms and concepts in 10 languages. Contains over 90,000 terms, each validated by WIPO's terminology experts.

WIPO-administered treaties: Find full texts, summaries and membership of the international IP treaties administered by WIPO.

WIPO Lex: A one-stop search facility for international treaties and national laws on IP. You can also search additional, explanatory information on these laws and treaties.

For more information, contact:

World Intellectual Property Organization

34, chemin des Colombettes

CH-1211 Geneva 20, Switzerland

Web: http://www.wipo.int

Innovation promotion strategy in Thailand

National Innovation Agency, Thailand

http://www.nia.or.th

The National Innovation Agency (NIA) of Thailand has established three strategies aiming to build an effective "national innovation ecosystem":

- Upgrading innovation capability;
- Promoting innovation culture; and
- Building up innovation system.

The innovation strategies are briefly described in what follows.

Upgrading innovation capability

NIA strives to foster awareness and recognition of the importance of innovation to the national economy and provides capacity-building supports for the development of an effective national innovation ecosystem. To accelerate innovation capacity, NIA has established two key development programmes as in what follows.

Strategic innovation programme

The direction of strategic innovation programme is based on the concept of "think outside the box" by analysing the technological situation at global level, prediction of trends, strong points, challenges and possible futures for Thailand. The objective of this programme is to build a national infrastructure to support the production capacity of Thailand's new-wave industry. Considering Thailand's strength in agricultural industry, NIA has set up two areas of strategic innovation programmes: bioplastic industry and organic agriculture business.

Sectoral-industry innovation programme

In the sectoral innovation programme, NIA has established three areas: biobusiness, ecoindustry and design & solutions, which hopes to drive sectoral growth in knowledge-based industries, clusters or entire industrial sectors, thereby expanding the national productivity base

Biobusiness

To enhance competence in biobusiness, the main focus is on promoting the development of innovative technologies and commercialisation of high value-added products in various areas, which help in promoting the development of innovative technologies and commercialisation of high value-added products in biobusiness. Three platforms which we focus on are given in what follows:

- Functional food platform;
- Food safety total solutions platform; and
- Medical tourism platform.

Ecoindustry

We emphasise on the advanced ecofriendly technologies to recognise the rising environmental problems especially the climate change. NIA emphasises the development of alternative energy sources, diversification and renewable sources such as biogas and biomass. Recognising rising environmental problems also calls for innovation in green technologies such as biodegradable plastics and waste management, especially in dealing with garbage, including new ways of reducing and separating garbage as well as recycling of glass, paper, plastic and steel. Two areas which we focus on include:

- Clean industry platform; and
- Ecoproducts platform.

Design & solutions

Combining different areas of knowledge to develop an innovation into a viable commercial product requires design and solutions. Design involves the combination of technology, culture and management to create higher-value products. With the focus on encouraging product creativity, we emphasise on three following platforms:

- Agri-solutions platform;
- Logistics platform; and
- Biomedical industry platform.

Promoting innovation culture

NIA places great emphasis on promoting innovation culture and creating awareness of innovation at all levels of Thai society. NIA employed various means to create an environment conducive to innovation and learning including the activities in what follows.

IMEs—Innovation Management Course for Executives

The main goal is to develop new management skills, improve vision and business skills and facilitate the application of innovation and new technologies in individual business of participants based on using technology to create new products, processes or services. The course also explains how entrepreneurs may access these resources to benefit their own business. This course will help SMEs innovate successfully through accessing research and development (R&D) support for new ideas, and government institutional and financial support services.

IMEs—Innovation Management Course for Executives

This is a Master's Programme in Business Administration initiated by NIA in cooperation with several universities. The program was specifically designed to produce qualified chief innovation officers

and innovation managers with advanced skills in business management of innovation. Graduates will be well equipped to incorporate innovation into a business strategy and more capable of responding to rapid critical changes in a creative way.

The Father of Thai Innovation and National Innovation Day

On June 20, 2006, the cabinet approved NIA's proposal to honour His Majesty the King as the "Father of Thai Innovation" for his achievement in the royal initiative project "Tricking the soil" and to designate the 5th October of every year as the "National Innovation Day." The "Tricking-the-soil" project was implemented in Narathiwat by the Pikun Thong Royal Development Study Centre and has proved immensely successful. The project focused on improving highly acidic soils, turning useless land into valuable agricultural plantations. The improvement in soil quality as a result of the "Tricking-the-soil" project allowed crops to be grown on previously uncultivable land, which helped improve the livelihoods of millions of families. This achievement clearly demonstrated His Majesty's exceptional vision as an innovator who is able to lead the nation to solutions through research and analysis.

National Innovation Awards

This is one of the means through which achievements in innovation that benefit the economy and society are recognised. In this respect, we maintain our broader aim of strengthening the national innovation culture and awareness at all levels of industry in the public sector and academia. The National Innovation Awards were initiated in 2005 and have continued till present. The competition is divided into the economic category and the social development category.

Top Ten Innovative Business

This is the ranking of innovative enterprises based on outstanding marketing, technology, business model and public recognition. The ranking honours Thai entrepreneurs who create and utilise innovation within their business and encourages a climate for innovation investment. The top ten innovative business ranking is announced annually at the end of each year.

Building up innovation system

Future national competitiveness is closely tied to innovation capacity and the ability to exploit new and existing markets, improves value added products and protects innovation. A high degree of coordination and consensus will need to be established at national level between public and private sectors to establish a regulatory framework, capacity building measures and market mechanisms which stimulate innovation.

Thailand's Innovation Park

Innovation is an impetus for sustainable growth and development of Thailand's economy. Based on this viewpoint, NIA continues to work closely with both the public and private sectors to foster, promote and facilitate innovation development in Thailand. This includes establishing suitable infrastructure that will help to propel commercialisation of innovation by Thai entrepreneurs and local companies, particularly in the global arena. NIA's Innovation Park, which is the first of its kind in Thailand, is a crucial part of this initiative and will be a leading institution for incubating and creating international exposures and linkages for local start-up innovative businesses in a wide range of industries. These include the nation's strategic industries such as biobusiness, industrial designs and green industries.

Thailand's Innovation Park, initiated and managed by NIA, is located at the heart of Bangkok within the Ministry of Science and Technology and offers more than 10,000 square metres of first-class facility and supportive resources for entrepreneurs and local companies as may be required. Thailand's Innovation Park is aimed to incubate and support ~100 innovative businesses per year.

Soft Infrastructure Initiatives

Besides developing hard infrastructure such as Thailand's first Innovation Park, NIA also carries out several initiatives to provide services in many areas. NIA's experts work closely with industries, funding sources, companies and entrepreneurs to find the best way to commercialise new technologies and innovation. NIA's resources, networks and collaboration with existing innovation clusters are therefore effectively utilised to facilitate development of innovation projects and also to further enhance innovative capability at the institutional level.

Intellectual Property Management (IPM) Unit

IPM plays a significant role in channelling R&D outcomes to the private sector to facilitate development of intellectual property-based business. IPM offers consulting services in intellectual property protection, valuation, licensing and management to public and private organisations, researchers and technology owners who wish to commercialise their intellectual assets.

IPM has successfully concluded a number of intellectual property licensing projects across a wide range of technology. Uniquely, we have the capacity to conduct an IP valuation of technology and intellectual assets, which is used as a basis for licensing negotiation and IPM. In addition, IPM works with domestic and international partners to raise public awareness with regard to intellectual property and commercialisation of technology, including hosting conferences, trainings and seminars on these topics on a regular basis.

Innovation Ambassador Program

NIA continues to build up a robust network of experts to work with industries to drive innovation development and increase innovative capability of individual business enterprises. Highly renowned and distinguished experts in various fields of technology and management are appointed as Innovation Ambassadors. The Innovation Ambassadors join forces with NIA to drive innovative business by reaching out to industrial sectors and markets.

The Global Cleantech Innovation Program for SMEs

Selected case studies from Asia

The Cleantech Open, USA

http://www2.cleantechopen.org

The Global Cleantech Innovation Program for small and medium enterprises (SMEs) program is focused on enhancing both emerging Cleantech startups in each country and the local entrepreneurial ecosystem and policy framework. A competition-based approach is used to identify the most promising entrepreneurs across a country, whereas a local acceleration program supports, promotes and "de-risks" the participating companies and connects them to potential investors, customers and partners. As the best Cleantech startups progress through the Cleantech platform, they are continuously trained, mentored and assessed. The very best startups from each country are brought together for the finals of the Global Competition in Silicon Valley, California, USA, where they can both compete for the global prize and connect with potential partners, customers and investors from around the world.

Selected case studies on India, Malaysia and Pakistan are briefly presented in following sections.

Promoting clean energy technology innovations in India

This project aims to promote clean energy technology innovation and entrepreneurship in selected SME clusters across India through a Cleantech innovation platform and competition. The MSME sector in India plays a vital role in the Indian economy, contributing 45% of manufacturing output, 40% of exports and employing more than 69 million people. Tackling climate change and seizing the economic opportunity for green industry require increased design, deployment and scaling of innovative clean technologies by SMEs across India.

Through new collaborations across disciplines and sectors, this program will build the national capacity for clean technologies and develop a supportive local entrepreneurial ecosystem for SMEs developing clean and resource efficient innovations. An important aspect of this Cleantech innovation platform is the ability to connect with other synergistic initiatives and entrepreneurs in countries around the world. Through the growing community of national partners in the GEF-UNIDO Global Cleantech Program, selected Indian Cleantech entrepreneurs will be connected to potential partners in Malaysia, South Africa and around the world. The most innovative Cleantech entrepreneurs identified through the program in India will have an opportunity to meet potential partners, customers and investors from around the world at the annual Cleantech Open Global Forum in Silicon Valley.

Accelerating clean technology ventures in Malaysia

In early 2013, the Malaysian Industry Government for High technology (MiGHT) joined the GEF-UNIDO Global Cleantech Program for SMEs to launch the Cleantech Platform in Malaysia. The first year of the program will be a pilot, specifically focused on just one region of the country and a subset of the Cleantech categories (Energy Efficiency, ICT and Agriculture-Water-Waste). The aim of the program in Malaysia is to develop a platform that will nurture and accelerate the next generation of Cleantech entrepreneurs. In doing so, MiGHT will be fulfilling its vision that by 2020 Malaysia will be a major player in the Cleantech industry globally, impacting not just the region, but environmental, energy and economic challenges around the world.

In October 2013, in collaboration with KeTTHA and GreenTech, Malaysia, the GEF-UNIDO Cleantech Program for SMEs* in Malaysia was publically launched in conjunction with the 2013 International Greentech and Eco Products Exhibition and Conference, Malaysia (IGEM 2013) and the Fourth Annual Global Entrepreneurship Summit (GES 2013) with the aim of advancing green growth through global entrepreneurship.

Fostering commercially viable clean technology startups in Pakistan

Given the significance and contribution of small businesses to the promotion of job creation and overall economic development of Pakistan, UNIDO has developed a GEF-funded Cleantech Program for SMEs emphasizing the promotion of innovations in clean technologies. Supported by the Pakistan Council for Science and Technology, National Productivity Organization, Pakistan Institute of Management, as well as the Center for Climate Change and Development, the project has been approved by the GEF Secretariat in September 2013.

The Cleantech Program in Pakistan focuses on fostering emerging and commercially viable clean technology startups for fueling green industrial growth in Pakistan. The project will adopt the GEF-UNIDO Cleantech ecosystem approach which, among others, includes close engagement with the private sector, scaling up the momentum for sustainable industrial development and strengthening the policy framework as required. By working closely with SMEs, national ministries, academia, industrial associations, potential investors, partner agencies and autonomous research centers in the country and abroad, this project will establish an effective awareness campaign and platform to mobilize interest among targeted beneficiaries and ensure the adequate buy-in of SMEs.

"Green Factory"
SME exit strategy in green growth era

APEC SME Innovation Centre, Republic of Korea
http://www.apec-smeic.org

The Republic of Korean government is strongly promoting a low-carbon, green growth policy that minimizes use of resources and environmental pollution while utilizing it as an engine for economic growth.

Green growth is a new paradigm that was suggested to maximize environmental and economic synergy effects by responding to energy and environmental problems, the increasing mandatory climate change burden, high oil prices, exploitation of environmental markets, etc., with economic policies.

The green paradigm transition era requires small and medium enterprise (SME) manufacturing process innovation that coincides with low-carbon green growth, i.e., "Green Factory" management. "Green Factory" means an low-carbon economic era-type facility equipped with eco-friendly design and manufacturing processes that efficiently improve greenhouse gas emission, environmental pollution and energy consumption. In other words, "Green Factory" is a greenizing process, a greenizing workplace and a greenizing product.

First, greenization improves the manufacturing process efficiently and reduces consumption of energy and resources. Second, it also pursues high efficiency in all areas of the manufacturing workplace, installing solar cells on the factory roof, replacing motors with three-phase induction motors and fluorescent lamps with LED lamps, etc. Third, it improves product design in a way that uses less energy when producing and using the products, develops products with a longer life span and facilitates recycling of after-use waste materials.

SMEs, viewed from a green growth perspective, despite being small in scale, are equipped with a centralized power-type organizational structure. Therefore, manager influence is greater and employee participation in low-carbon, green growth is stronger when compared with large enterprises, assuming that communication is smooth.

As for the SMEs that have organic relationships with large enterprises, their active utilization of SCM would facilitate their acquisition of new technologies as well as introduction and establishment of a green management system. Furthermore, as several such companies are collocated in a particular area (industrial complex, etc.), cooperation and strategic alliances between enterprises become easier.

In addition, from an environmental perspective, if their small corporate scale and comparatively simple production facilities are taken into account and the waste minimization programs practiced in the USA, UK, and the Netherlands are applied, SMEs can more easily pursue technological alternatives and secure profit-creating opportunities as well as reduction of wastes. Furthermore, in the green growth era, SMEs should actively respond to changes in competition conditions.

Owing to the characteristics of the green industry, first, dynamic SMEs should pursue a rapid market advance. Second, SMEs should exert utmost efforts for development of core technologies, narrow the technological gap with advanced countries, and accelerate localization of parts. Third, SMEs must secure overseas source technologies and patents and resolve technical barriers.

Fourth, SMEs should secure and nurture excellent manpower through industry-academia-research institute cooperation in line with the green growth era when development of excellent manpower is more important than ever before. Fifth, SMEs have to advance into the world, which has already grown into a large, single market, to secure new outlets for their products and services.

Unlike other growth paradigms, low-carbon, green growth will not develop by itself in response to the market. Therefore, the government should support diverse policies, including designation and cultivation of green-specialized research institutes, cultivation of green technology design centers, supply and technology development of green facilities and equipment, support for global green partnerships, support for green technology information development and exchanges, and cultivation of green production and environmental manpower.

To grow green SMEs equipped with global competitiveness, the government should also establish long-term goals and, in parallel, continuously implement complementary revisions to processes to achieve the goals.

In order for SMEs to develop the necessary competitiveness in the paradigm transition, they must be made aware of the potential and benefits of low-carbon, green growth and management in a low-carbon economy, i.e., "Green Factory" management. (Kiopnara).

Technology Offers

CHINA

Production of human serum albumin in cow's milk

Description

Our project team has accumulated unequalled experience in humanization of bovine serum albumin gene and large-scale production of human serum albumin in cow's milk. Dr. Qin Yangjun has independently designed and tested a number of TALEN/CRISPR carriers and carried out intracellular activity assay. He has long-term technical reserves for humanization of bovine serum albumin gene and large-scale production of human serum albumin in cow's milk. Dr. Du Yubin has been engaged in gene knockout and establishment of transgenic animal models. Breaking through the conventional thinking to design the fastest and the best solution, we can get the desired transgenic animals in short time. We design simple and feasible technology roadmap that differs from the traditional way of gene knockout.

Areas of Application

- Biological product

Advantages

Using this method, milk can be used for production of human serum albumin, whereas bull serum can be used as human serum albumin extraction and cell culture. Conservatively estimated, a cow can produce 50 kg HAS, which values ~$250,000. One hundred cows may produce cumulatively value of hundreds of millions of dollars.

Development Status

Laboratory model

Legal Protection

Patent

Transfer Terms

Technology licensing, Research partnerships

Contact:

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Suzhou, China
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E-mail: devy_gao@joinew.com

EGYPT

Technology for aluminium sulfate

Description

We offer technical assistance for technology transfer aluminum sulfate plant for any capacity. From raw material rich in aluminum content: aluminum trihydrate, kaolin calcined or uncalcined, bauxite. Items covered are uses and applications; specification of final product (liquid & solid); details of raw materials and utilities consumption figures; manufacturing process in details either using kaolin, aluminum trihydrate, or bauxite; quality assurance during production to assure that final product is according to standard specification; quality control procedure for analysis final product; equipments needed for production line based on production capacity and technical specifications; piping specification for handling raw materials and final product; valves specification for product and raw materials; instrumentation needed for the production line; process flow sheet diagram; plant layout; land, building area requirements; feasibility of the project (complete cost economics with profitability analysis); suppliers of plant and machinery and raw materials; breakeven point; assistance for startup.

Areas of Application

Water treatment

Advantages

Effective cheap cost with up-to-date technology

Environmental Aspects

Cleaner production

Development Status

Fully commercialized

Technical specifications

Any capacity according to client demand

Transfer Terms

Consultancy, Technical services, Equipment supply

Contact:

Alsayed Anwar,
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Tel: +20 12 316 68 54; +20 122 316 6854
E-mail: alumsulfate@tedata.net.eg,
elsayedanwar@dataonline.com.eg

HUNGARY

L(–) Malic acid production technology

Description

Malic acid is one of the hydroxy acids that are produced by aerobic organisms in the so-called citric acid cycle (Szent–Gyorgyi–Krebs cycle). As natural organic acid, L(–) malic acid exists in various fruits and vegetables, giving fresh acidic taste. It is recognized as an acidic agent that has high additional value in different foods, from the feature of non-volatility, easy-to-cook, and less hygroscopic nature. According to Fuso Chemical (the biggest producer of DL malic acid in the world) it is known as a result of the panel test of many times that equivalent acidity is left from malic acid of a few quantities as compared with citric acid. Because of its lower melting point, it is preferably prescribed than other food acid for candy manufacture.

Areas of Application

Potential areas of use, food industry, chemical industry, pharmaceutical industry

Advantages

This technology has some significant advantages in comparison with the traditional fermentation and chemical production. First, downstream operations become cheaper by the high conversion rate and lack of bypass products. Second, the very intensive technology decreases the investment expenditures.

Third, it is an environment friendly production, which does not have any effect on human health. There are no environmental risks or contraindications to use this technology, because the genetically modified cells are killed before use. No huge amount of waste water, no bypass salts (e.g., NaCl, $CaSO_4$). The bioreactors are working as enzyme reactors during the process.

Environmental aspects
Cleaner production

Development status
Laboratory model

Transfer Terms
Technology licensing, research partnerships

Novel solar collector

Description

Our partner has designed a specific geometrical shaped and surface treated absorber which provides the most efficient heat absorbance and transfer, including all the benefits of low quantities of heat transfer fluid (1.7 L/1.82 m^2 active absorber surface). According to the TÜV Rheinland certificate at 1000 W/m^2 irradiation its performance is 752 W/m^2. Other collectors available on the market have just maximum 500 W/m^2 performances at the 1000 W/m^2 irradiation. To a 2000 × 1000 × 0.061 mm^3 solar panel, external size associates just 38.6 kg mass. Main advantages are as follows:

- Extreme efficiency: 80% efficiency compared to the 40–60% efficiency gained by other solar collectors available on the market.
- The highest efficiency and lower cost thanks to a number of design innovations.
- There is no mediatory element between the absorber heat transferring surface and the heating medium; therefore, there is no galvanic rusting that would work as an insulation.

Areas of Application
Water heating, back up heating systems and swimming pool heating

Environmental aspects
Energy efficiency

Development status
Fully commercialized

Legal Protection
Design

Transfer Terms
Technology licensing

For the above two offers, contact:
Laser Consult Ltd (Hungary), H-6701 PO Box 1191, Szeged, Hungary. Tel: +36-62-562-782; Fax: +36-62-562-783
E-mail: laserconsult@t-online.hu

Self-standing nanoparticle networks/ scaffolds

Description

A novel process of preparing self-standing, crosslinked networks (scaffolds) of nanoparticles from commonly available materials such as metallic, inorganic, semi-conducting and magnetic particles, organic and polymeric compounds. The scaffolds have controllable mesh size and pore size can range from nano to micro porous. The particle volume fraction is between 0.5% and 50%.

Areas of Application

- Drug delivery – Inorganic/organic delivery scaffolds for nitric oxide – an important bioregulatory agent
- Tissue engineering – Cell seeding scaffolds – Proposed applications of scaffolds
- Cell growth substrate
- Materials for solar cells
- Electrical/thermal insulators
- Catalysis – catalyst support for small sizes available for diffusion of reactant molecules
- Meta-materials* – electromagnetic devices ideally gold nanoparticles
- Electronic devices
- Chromatography

Advantages

- Generic production procedure
- Can be formed in to ordered, structured phase, lamellar, spongy, cubic- preferably hexagonal network
- Has a precisely controllable directionality and pore size ranges from 500 nm to 1 mm

Development Status
Laboratory model

Legal protection
Patent

Transfer terms
Technology licensing

Injectable biodegradable gels for delivery of drugs

Description

The hydrogel developed by National Chemical Laboratory (NCL) scientists can be in situ crosslinked (which makes it suitable for injectable systems), with one or more hydrophobic pocket(s) that can be used to deliver desired drugs with desired release profile (gelation time – 1–30 min; degradation time – 1–30 days; storage modulus from 5 to 110 Kpas). It comprises a polymer backbone, a hydrophobic pocket (moiety being triclosan), and a water soluble crosslinker (paclitaxel solubilized in α-tocopherol).

Technology Offers

Area of Application

- In site specific drug delivery systems/depots (many important drugs are hydrophobic in nature and need to be administered in a solubilized form for the expected therapeutic effect – using our gel system, which has hydrophobic pockets to hold these drugs, the drugs can be delivered directly).
- Biomedicine – cell growing depots for tissue regeneration and protective membranes for the treatment of wounds.
- Tissue engineering – space filling agents, delivery vehicles for bioactive molecules, and tissue formation directing scaffolds.

Advantages

- Overcome the barrier of surgical implantation.
- Does not require solvents as other biodegradable polymers might require which are harmful to the human body/some drugs may become inactive on coming in contact with the solvent.
- In drug delivery applications, drugs can be loaded in the hydrophobic pockets present in the gels.
- Provides precise control over the chain length, sequence and 3D arrangement of the polymer networks in the gels – hence prevents side reactions caused which may influence their performance.

Development Status

Laboratory model

Legal Protection

Patent

Transfer Terms

Technology licensing

For the above two offers, contact:

National Chemical Laboratory, CSIR, A208, PAML Building, Dr Homi Bhabha Road, Pune 411007, India
Tel:+91-20-25902982
E-mail: dt.patel@ncl.res.in

Technology for silk reeling

Description

India being one of the largest producers of silk is forced to import high-grade silk threads from China because of low yields and low-grade silk threads. This technology offers solutions to the existing silk-reeling industry in India. We are looking for potential business and investment partners for a semi-automatic silk thread reeling machine. The technology is open for business collaboration discussions.

Areas of Application

Sericulture industry – silk reeling

Keywords

Silk reeling

Technical specifications

Semi-automatic silk reeling machine producing A4 grade silk threads

Transfer Terms

Technology licensing, others

Contact:

SkyQuest Technology Consulting Pvt. Ltd., B-72, Parshwanath Towers Nr. Subhash Chowk, Memnagar, Ahmedabad 380052, India
Tel: +91 79 40054112
E-mail: projects@skyquestventures.com

New green stove design

Description

An improved wood burning metallic cook stove is presently designed and fabricated. During test, measured thermal efficiency is found to be 28.3%. Smoke emission is also reduced. Wood sticks, twig, etc. can be used as fuel in this stove. Power output rating of the present prototype is 2.5 kw per hour. Cost of the stove is within economical limit.

Areas of Application

For the use in rural area both domestic and community cooking purpose according to the size of the stove.

Keywords

Fuel rest plate

Advantages

- High thermal efficiency with reduced rate of smoke emission.
- In the stove, primary air is supplied throughout the perforated circumferential wall at the lower part of combustion chamber for better mixing with wood fuel during combustion.
- In addition to typical preheating system of secondary air while passes through annular air passage surrounded the combustion chamber wall, primary air is also preheated in this stove while comes in contact with perforated lower circumferential wall of the combustion chamber.
- Ash removal is very easy, just by opening of holding clip of fuel rest plate.
- Sliding cover plate of fuel feed opening prevents entry of outside cold air inside of combustion chamber.

Environmental Apects

Cleaner production, Energy efficiency

Legal Protection

Patent will be applied soon

Technical Specifications

- Cross-sectional area of combustion chamber = 314 cm^2.
- Cross-sectional area of solid fuel rest plate = 346.2 cm^2.
- Cross-sectional area of larger diameter portion of stove = 880.9 cm^2.

Transfer Terms

Consultancy, Joint venture, technology licensing, research partnerships

Contact:

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Tel: +91-9474390725
E-mail: subhradatta611@gmail.com

Technology Requests

INDIA

Micropropagation of potato cultivation

Description
We need technology for micropropagation of potato cultivation.

Areas of Application
Agriculture

Studies Available
Feasibility report

Project
Start-up

Additional information
We are looking for end-to-end solution right from R&D till commercialization

Contact:
ROC, CD 149 Salt Lake, Kolkata 700064, West Bengal, India
Tel: +91-8334006710
E-mail: pradipgamma@hotmail.com

PET polyols

Description
We are a trading-based company planning to go for PET polyster polyols manufacturing. We are planning for a small-scale project. We will procure recycled PET flakes locally. We have readily available land of 28,000 sq. ft. for manufacturing.

Area of Application
Polyols

Project Type
Start-up

Assistance Sought from Potential Partner
Technical

Contact:
Deekay Fluorine Industries, 213-214/1, Phase-2,Naroda GIDC, Behind Arbhuda Estate, Ahmedabad 38004, India
Tel: 07925622111
Fax: +91-7925716580
E-mail: vivekdpatel@yahoo.in

Aluminium sulfate manufacturing

Description
We request potential technology providers to send a detailed project report for manufacturing aluminum sulfate 10 tons per day.

Area of Application
Water treatment plant, power

Studies Available
Feasibility report, others

Project Type
Start-up

Contact:
Mr. Uogesh Dabarkar, Binaki, Mangalwari, Nagpur 440017, India
Tel: 07122223077
E-mail: yogeshdabarkar@gmail.com

UNITED KINGDOM

Scrap tyre recycling technology

Description
Our client is part of a major European group operating throughout the waste-recycling sector. Systematically extending its reach to incorporate all aspects of waste recycling, the company is now seeking partnering and investment opportunities in the tyre recycling sector and in return is offering marketing expertise and capital to help access appropriate markets. We are particularly seeking new product opportunities where our client's recycled rubber crumb material can be a significant component and this will require them to add value to their current product. We will consider niche opportunities across a diverse range of products, markets and applications. The client is keen to find opportunities for markets outside the construction/landscaping industries where rubber crumb is currently used and is considered a commodity product.

Area of Application
Value-added recycled tyre products

Project Type
New idea

Water-saving devices

Description
Our client is keen to find innovative technical devices to reduce water consumption and have focused on applications where consumers use and therefore potentially waste the large amount of water. They are searching for IP-supported, ideally disruptive technology for the following markets: Domestic housing/consumer use; public toilets – hotel toilets/showers/baths; schools/offices/social housing water consumption. The company is focused on gaining access to products that reduce water consumption or assist users in monitoring their water consumption. Our client is part of a multi-million UK company specializing in high quality bathroom products. They have access to extensive design and development facilities and are able to source materials, components, and products worldwide and are thus well-placed to bring new products to market as well as providing a platform for boosting sales of existing products.

Area of Application
Water-saving devices for domestic and commercial use

Project Type
New idea

For the above two requests, contact:
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Tel: 0044-1442860634
E-mail: ashima@strategicallies.co.uk

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