Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific Tech Monitor

Vol. 33 No. 2 Apr - Jun 2016

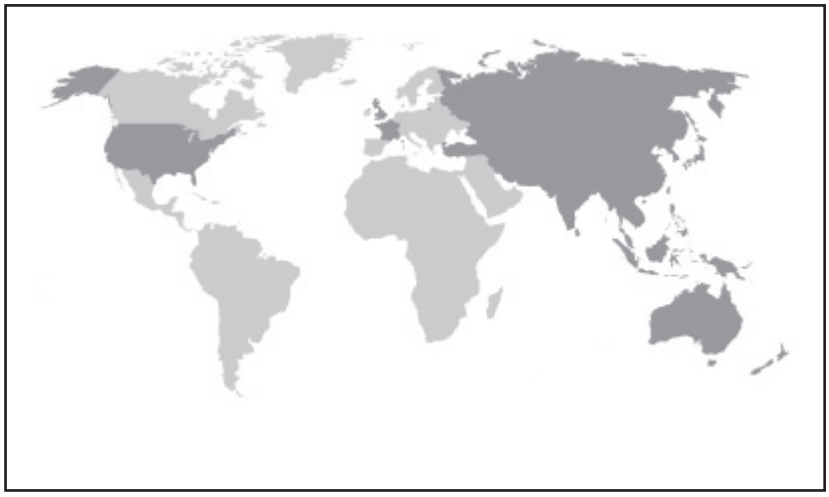
APCTT
Asian and Pacific Centre for Transfer of Technology

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

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

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

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



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

Asia-Pacific
Tech Monitor
Vol. 33 No. 2 ❖ Apr- Jun 2016

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

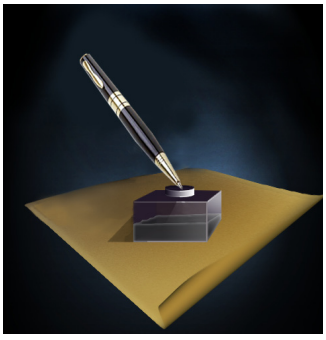
Web: www.techmonitor.net

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

This publication has been issued without formal editing.

ISSN: 0256-9957

CONTENTS



Introductory note

Globalization of technology and production is becoming critical for enterprises to achieve and sustain international competitiveness. One of the important channels of technology globalization is through Foreign Direct Investment (FDI) which not only brings in capital but often also facilitates transfer of advanced technology to the host country firms, thereby generating long-term and sustainable economic growth. FDI often comes with new technologies and innovations and is widely used by the transnational corporations (TNCs) to transfer and diffuse their technologies – including both hard and soft elements – to local firms in the host countries. The process thus helps enhance technological capability of domestic enterprises contributing to the country's productivity and growth

However there are many issues affecting FDI flows such as those related to strategies of the investing firms and the policies and business environment of the host countries. In this context, effective facilitation of FDI-driven technology transfer and diffusion would require proactive policy support that is capable of increasing the flow of knowledge, technology and resources to the receiving countries. The developing countries could effectively leverage FDI as a means to achieve technology transfer and diffusion through establishing an effective national innovation system (NIS) which would provide an interface between TNCs and local firms, support the absorptive capacities of domestic enterprises, and provide an appropriate regulatory framework covering intellectual property aspects. In addition, the countries need to ensure coherence between their FDI and other relevant policies, particularly the science technology and innovation policy, to provide an enabling environment for effective technology transfer and diffusion.

The Leaders of 193 member States of the United Nations have adopted in September 2015 the 2030 Agenda comprising 17 Sustainable Development Goals (SDGs). The 2030 Agenda also provides for a Technology Facilitation Mechanism (TFM) which aims at increasing the creation and use of innovative technologies for achieving the SDGs. Towards this endeavor, FDI could play an important role in facilitating transfer of environmentally sound technologies (ESTs) that are vital for the developing and the least developed countries, particularly in the Asia Pacific. The mandate to achieve SDGs makes it imperative for member States to streamline their FDI policies and other strategies for acquiring ESTs on favourable terms towards meeting their SDG targets. The resulting spillover effects would stimulate wider diffusion of ESTs across manufacturing sectors in the host countries and in the region as a whole.

This issue of *Asia-Pacific Tech Monitor* highlights key challenges, opportunities and strategies to develop and adopt appropriate policies and frameworks for promoting FDI-facilitated technology transfer, acquisition and deployment in the Asia Pacific countries. The special issue also features few country-specific case studies from the region.

Nagesh Kumar
Head, ESCAP South and South-West Asia Office and
Officer-in-Charge, APCTT

Technology Market Scan

INTERNATIONAL

Innovation in breakthrough technologies

Japan and the United States lead a small group of nations that are driving innovation in 3D printing, nanotechnology and robotics, three frontier technologies that hold the potential to boost future economic growth, a new WIPO report shows.

Amid lackluster worldwide economic growth, the World Intellectual Property Report 2015: Breakthrough Innovation and Economic Growth shows how previous game-changing advancements – such as airplanes, antibiotics and semiconductors – sparked new business activity. The report probes today's promising breakthrough innovations, while urging governments and business to step up innovation-related investment.

Relying on an original mapping of patents to fields of innovation, the report shows that Japan, the U.S., Germany, France, the United Kingdom and the Republic of Korea accounted for 75 percent or more of all-time patent filings in the areas of 3D printing, nanotechnology and robotics. Japanese companies are leading innovation in the area of robotics. Eight out of the top ten patent applicants in the area of robotics are from Japan – namely, Toyota, Honda, Nissan, Denso, Hitachi, Panasonic, Yaskawa, and Sony. The two others are Bosch, from Germany, and Samsung of the Republic of Korea.

While U.S. entities file collectively for most nanotechnology patents, Samsung is the top filer and six of the top ten filers are from Japan – Nippon Steel, Toshiba, Canon, Hitachi, Panasonic and TDK. IBM, the University of California, and Hewlett Packard of the U.S. complete the top ten list. U.S. entities also file for most 3D printing patents, with 3D Systems and Stratasys as the top two applicants and General Electric and United Technologies among the top ten. Three German companies – Siemens, MTU Aero Engines and EOS – as well as three Japanese companies – Mitsubishi, Hitachi, and Toshiba – complete the 3D printing top ten list.

China is the only emerging middle-income country moving closer to this group of advanced, industrialized nations. Looking at more recent history – patents filed since 2005 – Chinese applicants account for more than a quarter of patents worldwide in the area of 3D printing and robotics – the highest share among all countries. In the case of nanotechnology, Chinese applicants make up close to 15 percent of filings worldwide – the third largest origin of patents. In contrast to the longer established innovating countries, Chinese patent landscapes show a markedly stronger presence of universities and public research organizations (PROs).

http://www.wipo.int

ASIA-PACIFIC

CHINA

New policies to encourage innovation

China's State Council has announced a string of new policies to encourage innovation as the country seeks to foster new engines for growth. China will set up three new "national innovation demonstration zones" in the provinces of Henan, Shandong and Liaoning, bringing the number of such areas to 14, according to a statement issued after a State Council meeting chaired by Premier Li Keqiang.

The zones, including Beijing's Zhongguancun, known as "China's Silicon Valley," and Shanghai's Zhangjiang high tech zone, have been created to pilot new ideas and development models for use nationwide.

Expansion of the program is aimed at fostering trailblazers for China's economic restructuring and transformation, according to the statement. The State Council will test innovative reforms in China's financial hub of Shanghai over three years, including exploring new financial service models and simplifying foreign investment rules. Government intervention will be further reduced to create an amicable environment for business start-ups and innovation, the State Council pledged.

To boost employment and sustain growth, the Chinese government has stressed the role of innovation and entrepreneurship in its 13th five-year plan. A wide range of measures has been unveiled, including financial support, facility construction and administrative assistance, for start-ups.

http://news.xinhuanet.com

Patent pledge financing

2015 witnessed notable progress in China's IP pledge financing. Some 2,000 enterprises secured 56 billion yuan with patent pledge all through the year. Sampling results on 20 patent pledge projects showed that enterprises involved generated 3.77 billion yuan in sales and 320 million yuan in profits.

According to a representative from Patent Administration Department under SIPO, during the 12th Five-Year plan period, over 5,000 enterprises secured a total of 153.3 billion yuan with annual growth rate of 58% .For example, a Shijiazhuang-based heating equipment company secured a loan of 80 million yuan by pledging 6 patents, effectively easing the pressure on the company's fund which triggered more R&D investment. Meanwhile, the recognition of financial institutions on patented products enhanced the popularity of products and the annual sales volume rose to 120 thousand from 16 thousand, with 360 million yuan in sales, up 650%.

In a bid to speed up the perfection of IP financial service mechanism , SIPO issued Opinions on Further Promoting IP Financial Services in 2015 to strengthen policy and professional guidance on IP pledge financing, improve IP value assessment and analysis and strengthen risk management on pledge and financing. Under the concerted efforts of IP organs at all levels, the development of patent pledge financing tends to be normal and on large scale. Latest statistic revealed that the top 10 provinces and municipalities in terms of patent pledge financing amount are Shandong (8.026 billion yuan), Ningxia (7.146 billion yuan), Guangdong (5.894 billion yuan), Liaoning (4.192 billion yuan), Zhejiang (3.638 billion yuan), Beijing (3.36 billion yuan), Inner Mongolia (3.005 billion yuan), Fujian (2.316 billion yuan), Jiangsu (2.195 billion yuan) and Sichuan (2.04 billion yuan).

http://www.asiaiplaw.com

International patent filings

China's total global patent filings jumped 16% to 29,846 in 2015 from the previous year, Tech In Asia reported, citing data from the World Intellectual Property Organization on filings valid in 148 countries under the global Patent Cooperation Treaty. China smartphone manufacturer Huawei filed for 3,898 patents, making it the world's most active filer for the second year running and exceeding runner-up Qualcomm by more than 60%. Huawei competitor ZTE filed 2,155 patents to come in at third place globally. While the uptick in patent filings does not necessarily translate to an increase in feasible products or innovation, it does suggest China is taking international patents more seriously.

http://www.chinaeconomicreview.com

Patent administrative law enforcement measures amended

Patent Administrative Law Enforcement Measures of China was amended recently and was implemented on July 1, 2015. The amended Measures enhances the function and power of local intellectual property offices against patent infringement and patent counterfeiting, especially in exhibition and e-business field, which involve more and more patent disputes nowadays.

For example, the amended Measures prescribes that a local intellectual property office may order the exhibitor of infringing or counterfeit products to immediately retreat exhibits from the exhibition, destroy or seal related propaganda materials, and change or cover the display boards etc. Once a local intellectual property office found patent infringement or patent counterfeiting on any e-commerce platform, it shall inform the provider of the e-business platform and ask them to delete or disconnect the relevant webpages.

The amended Measures improves the proceedings in actions taken by a local intellectual property office, such as shortening the duration of investigation for patent infringement disputes from 4 months to 3 months with a 1-month extension at most for complicated cases, defining a definite deadline of 5 or 10 working days for file opening for complaints against patent counterfeiting, making it publicly available within 20 working days after administrative decisions on patent infringement or patent counterfeiting.

In China, patent owners may take administrative proceedings against patent infringement or patent counterfeiting. Different from judicial proceedings, patent administrative proceedings are recommended when a simplified, cheap and quick action is preferred against patent infringement or patent counterfeiting. The amendments to the Measures reflect the consistent policy of the government, that is, to strengthen patent protection more efficiently.

http://www.mondaq.com

INDIA

Plans to develop biotechnology sector

A joint action plan has been set into motion in India to help the biotech sector reach $100 billion by 2025. Even as the government is going all out showcasing India's biotech strength and capacity to attract investors, all efforts are being made to strengthen the bio-cluster ecosystem across the country, reports The *Pharma Letter's* India correspondent.

Apart from setting up incubation centers in the state of Karnataka at Dharwad, Belagavi, Bidar and Mangaluru, the government is also keen to promote the creation of the Bengaluru-Boston biotech corridor. The idea came about after a letter of intent was signed to create the US-Indo Life Science Sister Innovation Hub, by the Center for Cellular and Molecular Platform in Bengaluru, and The California Institute for Quantitative Biosciences.

India's Department of Biotechnology (DBT) has called for investments in creating a pool of quality talent. Professor K Vijay Raghavan, Secretary, Department of Biotechnology, said biotechnology in India has crossed significant milestones: "With the experience of 30 years, DBT's endeavor will be to further improve our processes and culture so that we expand our reach and depth effectively," he said.

http://www.thepharmaletter.com

Fund to tackle anti-microbial resistance

In a move to encourage biotechnology start-ups as well as tackle the threat faced by India from resistance to antimicrobial drugs, the Department of Biotechnology (DBT) — through the Biotechnology Industry Research Assistance Council (BIRAC) — has invested an initial $1,00,000 to start an India-focussed seed fund to help groups in India compete for the Longitude Prize. This is a £ 10 million prize offered by Nesta, a U.K. charity, to any individual group anywhere in the world that develops an affordable, effective diagnostic test to detect resistance to microbes.

Renu Swarup, Managing Director, BIRAC, said the collaborations were to encourage more biotechnology start-ups out of India. "BIRAC, since its inception, has supported several social entrepreneurs and we are committed to creating an atmosphere where innovation is encouraged and nurtured," she said. BIRAC is supported by the DBT.

Last December, the DBT laid out a strategy whereby biotechnology would be at the foundation of a $100-billion industry by 2025, rising from the current $7-$10 billion. The National Biotechnology Development Strategy, as it is called, expects to launch four missions in healthcare, food and nutrition, clean energy and education; create a technology development and translation network across India with global partnership.

http://www.thehindu.com

MALAYSIA

R&D and commercialisation grants

The government via Malaysian Technology Development Corp (MTDC) Sdn Bhd has allocated RM60 million as grants for research and development (R&D) and product commercialisation for 2016. Of the amount, RM40

million is for commercialisation of the local R&Dfund, the technology acquisition fund (RM10 million) and business start-up fund (RM10 million). MTDC, a wholly-owned subsidiary of Khazanah Nasional Bhd, is in charge of promoting the adoption of technologies by local companies via commercialisation of R&D or acquisition of foreign technologies.

In the 11th Malaysia Plan, the Government doubled grants for R&D and commercialisation to RM500 million, compared with RM297 million in the 10th Plan. At present, MTDC is managing five government funds involving R&D and commercialisation.

http://www.thestar.com.my

PHILIPPINES

ICT products for health care

Department of Science and Technology (DOST) Secretary Mario Montejo has said the agency's efforts in developing information and communications technology (ICT)-enabled products and systems are among its major contributions to address various health concerns. "ICT has changed the way we live, and healthcare is among the areas that could benefit from its capability," he added.

As these products and services will greatly contribute to the improvement of medical services in the Philippines, Montejo said the DOST saw the opportunity to find innovative solutions to help those in the countryside receive faster and more affordable type of medical services. Montejo cited RxBox as one of these innovative solutions. It is a device capable of storing and transmitting patient data to allow health workers in remote communities to consult with medical specialists in urban areas. The device is equipped with a blood pressure monitor, pulse oxymeter, electrocardiogram, fetal heart monitor, maternal tocometer, and temperature sensor.

Several units of RxBox were already sent to remote areas in the country. According to Montejo, based on collective feedbacks, local officials and health workers consider RxBox as an effective tool in pushing for equitable access to quality healthcare by everyone, regardless of social status.

The DOST chief also noted the eHATID (eHealth TABLET for Informed Decision Making of LGUs) project which was funded by the Philippine Council for Health Research and Development (PCHRD) in partnership with Ateneo de Manila University. A software application for mobile android devices, eHATID LGU offers health information system and decision-making support to local government units (LGUs) through an Electronic Medical Record that generates particular health reports for the Department of Health (DOH) and the Philippine Health Insurance Corp. (PhilHealth).

http://www.manilatimes.net

REPUBLIC OF KOREA

World ranking in R&D spending

The Republic of Korea retained the top country in the world for the second straight year in terms of investment in research and development for its economic size. The Ministry of Science, ICT and Future Planning said that the country spent 4.29 percent of its gross domestic product (GDP) in R&D in 2014, ranking first in the world. In terms of the amount invested in R&D, the United States came in first, dishing out at 456-point-nine billion U.S. dollars in 2014, followed by China, Japan, Germany and France.

The ministry said that South Korea's cumulative spending on R&D is far lower than those of the U.S., Japan and other advanced countries because they invested more than two percent of their GDP in R&D since the 1980s. South Korea did not reach the two percent level until 1994.

http://world.kbs.co.kr

SINGAPORE

SMEs' 2014 R&D expenditure surges

In 2014, SMEs' R&D expenditure rose 38 per cent to a new peak of S$800 million, according to data obtained from the Agency for Science, Technology and Research (A*Star). This means that smaller firms led 2014's growth in private-sector spending on R&D - which surged to an all-time high of S$5.2 billion. This was up 16 per cent from the S$4.5 billion registered the year before.

But for companies such as Biomax Technologies and Addvalue Technologies, R&D expenditure isn't seen as a nice-to-have; it's a need-to-have. The ability to come up with new solutions, they say, distinguishes them from the competition - and enables contract wins that ultimately lift their bottom line. Biomax - founded in 2009 - has developed systems that can convert organic waste (animal manure, food waste, slaughterhouse remains) into organic fertiliser within 24 hours.

http://business.asiaone.com

SRI LANKA

Incubators, innovation centres to be set up

Telecommunication and Digital Infrastructure Minister Harin Fernando said plans are underway to implement 64 new projects for the development of the information and communication technology (ICT) sector. Rs. 10 billion will be allocated for the initial stage of these projects. Fernando made these views addressing the 'Meet the Minister' program ,organized by the National Chamber of Commerce of Sri Lanka. He saidplans are also afoot to implement the one million app strategy and digital classroom strategy in the near future. The government in collaboration with Microsoft, Oracle and Ericsson will soon implement a project to set up innovations centres. Initially, seven innovation centres will be set up and subsequently these centres will have incubators around it," the Minister said.

The government is also planning to secure the service of leading online payment provider 'Stripe'. Stripe is an Irish technology company that allows both private individuals and businesses to accept payment over the internet.

The minister said that the Sri Lankan government had very fruitful and mutual discussion to facilitate Stripe to enter the Sri Lankan market. ICTA will work closely with all stakeholders to conclude the paperwork and approvals.

http://www.dailynews.lk

THAILAND

Panels aim for 'innovation economy'

THE 12 public-private steering committees under the Pracha Rath project have proposed "Thailand 4.0", a master plan to establish an innovation economy within a decade. Under the Thailand 4.0 plan, the country will be turned into a regional innovation hub by developing human resources, research and development, and innovative products, and reforming the educational, legal and other systems. The focus will be on 10 business clusters, Deputy Prime Minister Somkid Jatusripitak said as the steering committees reported their progress to Prime Minister Prayut Chan-o-cha.

The 10 clusters are robots for industry, medical hubs, logistics and aero-industry, biochemical industry, digital industry, alternative auto industry, innovative electronic industry, high value and health tourism, innovative agriculture and biotechnology, and food processing, he said. "They will drive Thailand out of the middle-income trap to become a high-income country in 20 years under the country's strategic-economy master plan," he said.

Prasert Bunsumpun, head of the Pracha Rath steering committee on pushing new "S-curve" industries - new industries aimed at revitalising growth in the Thai economy - said his panel would focus on the petrochemical super-cluster and the bio-economy to serve the "new agriculture". The first phase will push for the development of the Eastern Seaboard as the petrochemical super-cluster by setting up an investment budget worth Bt380 billion from this year through 2020 funded by the private sector. This would need government support in the form of tax incentives and infrastructure.

The bio-economy will provide innovative means to process agricultural projects such as sugar cane and cassava into value-added products such as biodiesel. This will require an investment of up to Bt400 billion by the private sector over 10 years. The government's role will be to establish a database on suitable agricultural locations.

http://www.nationmultimedia.com

Agri sector IT spending to grow 7.02%

Modernization and digitalization of the Thai agricultural sector is driving growth in IT spending to 7.02 percent, research firm IDC reported. Thai government policies focused on smart farming and enabling technology-led innovation to transform traditional agriculture practices are driving the growth.

IDC said agriculture employs 39 percent of the Thai population and is the major source of domestic income. Farming, however, faces many challenges, including land erosion, fertility, and poor labour productivity. The opportunity to build holistic digital capabilities that enable the establishment of smart farming utilizing third platform technologies – cloud, mobility and analytics and particularly enable data-driven insights to drive decision making will deliver big impacts in terms of productivity and yield. There are challenges, however, in the area technology foundations, education, and affordability.

"The issue is not really the technology itself – it is available, it is about building the right ecosystem that serves the requirements of Thai agricultural communities and delivers it in a way that is cost effective and easy to use," said IDC Energy Insights Head of WW Mining, Emilie Ditton.

"Agricultural companies that successfully examine the role and treatment of technology along with the farms, farms metrics, work practice and regional agriculture process will differentiate themselves through superior financial results, attracting talent and investment," she added.

Michael Araneta, Country Manager, IDC Thailand, said the process will be step by step, finding the easiest and fast opportunities to make a difference will be the first steps, ultimatley it will transform farming in Thailand.

http://www.enterpriseinnovation.net

Tax deduction to encourage innovation research

The Ministry of Science and Technology has kicked off CEO Innovation Forum 2016 by announcing a 300 percent tax deduction for companies that support research, development and innovation. Minister of Science and Technology Pichet Durongkaveroj chaired the opening of CEO Innovation Forum 2016, making known that the government will offer 300 percent tax deductions for private companies that invest in research, development and innovation.

On top of the 300 percent tax deduction, the ministry is also offering to limit revenue tax for small and medium enterprises to only 10 percent for 2 payments, to exempt entity taxes for New Growth Engine businesses and to pass out Innovation Coupons, which companies may use as funds when investing in innovation. For the 300 percent deduction, the incentive is available to businesses with revenue under 50 million baht while those exceeding the figure can access lesser deductions. The program will be available for 5 years while the government studies its feasibility, if proven to be effective it may be extended.

http://news.thaivisa.com

VIET NAM

New trend of FDI inflow

The increasing appearance of foreign direct investment (FDI) projects in research & development (R&D) will help Viet Nam accelerate the transformation from a low value-added production economy to a high value-added one. According to the Hanoi municipal People's Committee, Samsung Electronics Vietnam will build a US$300-million R&D centre in Hoang Mai district. The project will replace Samsung's existing R&D centre at PVI Tower in Cau Giay district as the workplace for more than 1,600 engineers and workers. The centre will become Samsung's largest R&D project in Southeast Asia.

Established in 2012, Samsung's R&D centre in Hanoi is now responsible for researching and developing the software market for mobile phones and tablet products in Southeast Asia, accounting for 10% of Samsung's global revenue in this field. Vietnamese software engineers working for this R&D centre have contributed to designing and writing software for the digital writing device S-Pen Montblanc - a cross between

Samsung technology and Montblanc's sophisticated expertise in writing devices.

With US$300 million invested in building a new R&D centre, Samsung Electronics has demonstrated that the group not only considers Vietnam as a place for mobile phone production and assembly, but also a place for research and development of software applications, a field requiring more brainpower and skilled labour. The project will also help increase the added value to made-in-Vietnam products in this field. Samsung plans to raise the number of Vietnamese workers in R&D from 1,600 to 1,800.

Samsung is not the only foreign group expanding its investment in R&D in Vietnam. Apple Inc, a rival of Samsung in the mobile phone and tablet market, is preparing to invest US$1 billion in building a data and R&D centre in Hanoi. The centre will serve Apple operations in Asia, but it is unclear where and when the project will start. In fact, a few years ago, foreign groups began to invest in R&D activities in Vietnam. Hewlett-Packard (HP), one of the world's leading computer manufacturers, invested in building a R&D centre at Quang Trung Software City in Ho Chi Minh City in 2012, HP's first R&D centre in the Southeast Asian region. Italian scooter manufacturer Piaggio also built a R&D centre beside its plant in Vinh Phuc province which serves Piaggio operations in Asia. Other multinational groups including Panasonic, Yamaha and General Electric also have their own R&D centres in Vietnam.

With R&D projects, Viet Nam has the opportunity to move to production with higher added value in addition to a quicker technology transfer process thanks to the increasing presence of Vietnamese workers in large corporations.

http://english.vov.vn

New law drafted to fuel boom in SMEs

Viet Nam is drafting a law on extending support to small and medium-sized enterprises (SMEs). It is part of the Government's determined efforts to promote the development of the business community and double the number of firms to one million by 2020. The planning and investment ministry will submit the draft law to the Government next month and to the second meeting of the 14th National Assembly (NA) for discussion. This will be the first time support for SMEs is legalised in order to provide a comprehensive approach. SME's account for 97 per cent of businesses in Viet Nam, contribute more than 40 per cent to the gross domestic product (GDP) and generate 52 per cent of jobs.

Deputy Minister of Planning and Investment Dang Huy Dong said Vietnamese SMEs were facing several difficulties in loan, land and technology access and market expansion, partly explaining the private sector's modest competitiveness and vulnerability to policy and social vagaries, said Dong. Dong said support policies for SMEs were currently provided by various legal documents, with a majority of them being support for businesses in general, placing SMEs at a disadvantage compared to large firms.

At a three-day consultation conference held by the ministry in HCM City that ended last Saturday, Deputy Head of HCM City's NA Deputy Delegation Tran Du Lich said the draft should turn a spotlight on the strategic significance of SME development in the country's industrialisation process, adding that SME development support would promote social progress and equity. Experts at the conference said the draft should define the roles of local authorities in giving assistance to businesses, as seen in other countries. Business associations also agreed to set up a national SME development council. Vice Chairman and General Secretary of the Vietnam Association of Small and Medium Enterprises To Hoai Nam suggested that the Government should lay out the details of the council's functions, missions and organisational structure. Experts also said support for business households that played an important role in the economy should also be considered.

The ministry's statistics reveal that as of the end of 2015, the outstanding loans of SMEs accounted for just 23 per cent of the total outstanding loans, although they make up 97 per cent of the business community. Dong said legalising support for SMEs was not a subsidy, adding that all forms of support would be compliant with international commitments. While State-owned enterprises (SOEs) were undergoing a thorny restructuring process, Viet Nam has recognised the private sector, mainly comprising SMEs, as an important driver of the nation's economic development.

http://bizhub.vn

SME development fund launched

A fund for small and medium-sized enterprises (SMEs) development with total charter capital of 2 trillion VND (89.75 million USD) was launched by the Ministry of Planning and Investment (MPI) at a ceremony in Hanoi on April 22. Functioning as a state-owned financial organisation under the MPI, the fund is responsible for managing and using financial resources while outlining policies as well as implementing international cooperation activities to support SME development.

SMEs are the backbone and driving force of the economy, however, they have faced tremendous challenges such as an opaque business environment, a shortage of high-quality labourers and a lack of capital for start-ups and business expansion, Deputy Minister of Planning and Investment Dang Huy Dong said at the ceremony. He added that the establishment of the fund reflects the determination of the Government and the ministry to develop the private economic sector, giving momentum to the nation's economy development.

Meanwhile, Hoang Thi Hong, director of the fund, said that the fund is to enhance the competitiveness of enterprises through supporting them in developing competitive and environmentally friendly products, improving technical equipment and fine-tuning business management competence.

SMEs, which are established and operate in Vietnam in line with the country's regulations, are eligible to receive support from the fund. The fund gives commercial banks a mandate to loan to SMEs at a preferential interest rate of 5 percent for short-term borrowing and 7 percent for medium and long-term credits. At the ceremony, the fund also inked a cooperation agreement with mandated commercial banks in 2016.

http://en.vietnamplus.vn

INTERNATIONAL

Nanomaterial helps develop thermophotovoltaic cells

Radical new properties present in a nanomaterial have been discovered by physicists. This discovery provides the potential to develop greatly efficient thermophotovoltaic cells, which in the future will be able to harvest heat in the dark and then convert it into electricity. The team of researchers from the University of California Berkeley and the Australian National University (ARC Centre of Excellence CUDOS) have illustrated a new metamaterial, or artificial material, capable of glowing in a unique way when heated. These findings could help to develop cells that transform radiated heat into electricity. These cells are known as thermophotovoltaic cells. The research is featured in *Nature Communications*.

The metamaterial used by the researchers help to radiate heat in a particular direction. This material is made up of very small nanoscopic structures of magnesium fluoride and gold. It is also possible to adjust the metamaterial's geometry to give out radiation in a particular spectral range, in contrast to conventional materials that give off heat in all directions as a wide range of infrared wavelengths. This allows the metamaterial to be used as an emitter, paired with a thermophotovoltaic cell.

The project commenced when Dr Kruk suggested that the newly developed metamaterial would contain these unexpected properties. The ANU team then collaborated with scientists from the University of California Berkeley. These scientists have unique skills to develop such materials. The metamaterial is known for its exceptional behavior due to its unique physical property of magnetic hyperbolic dispersion. Dispersion refers to how light interacts with materials, and it can be viewed as a three-dimensional surface representing the propagation of electromagnetic radiation in varied directions. For natural materials, like crystals or glass, the dispersion surfaces contain simple forms, ellipsoidal or spherical.

The new metamaterial's dispersion takes a hyperbolic form and is very different. This is due to the material's strong interactions with the magnetic component of light. It is possible to enhance the competence of thermovoltaic cells based on the metamaterial, if a nanoscopic gap is present between the receiver and the emitter. In this configuration, radiative heat can be transferred between them for more than ten times in an efficient manner, compared to the standard materials.

http://www.azonano.com

ASIA-PACIFIC

AUSTRALIA

Nanocones that help solar cells soak up more sunlight

A team of researchers from Australia's Royal Melbourne Institute of Technology (RMIT) created a new type of nanostructure called a nanocone. The new creation integrates the upside-down physics of topological insulators with the simpler plasmonics process, leading to a nanomaterial that has the ability to be used in combination with silicon-based photovoltaics in order to improve their light absorption

Topological insulators are unique for their ability to act as insulators on the inside and conductors on the outside, and plasmonics use the density changes in electrons that are created with photons colliding with a metal surface. Using these two processes, the team created a plasmonic nanostructure with a core-shell that allows it to act as a topological insulator.

The new structure could bolster the light absorption of solar cells focusing incident sunlight onto silicon using the insulating core of the nanocones, which provide a very high refractive index that reaches the near-infrared frequency range. At the same time, its metallic shell ensures a strong plasmonic response and backward light scattering that doesn't exit the visible frequency range. Integration of these nanocone arrays into silicon thin-film solar cells could boost light absorption of the cell by up to 15 percent in the ultraviolet and visible ranges.

The findings were published in the March 25 issue of *Science Advances*.

http://www.hngn.com

CHINA

Solar power breakthrough

Researchers at The Hong Kong Polytechnic University claim they have created the most efficient solar cells of their kind in the world. After three years of research, Professor Charles Chee Surya from the university's Department of Electronic and Information Engineering claimed on Tuesday their hybrid solar cells can convert up to 25.5 per cent of solar energy, beating the previous record of 22.8 per cent set in Switzerland last September. Researchers estimate the efficiency boost can reduce the cost of generating solar power from HK$3.90 per watt to HK$2.73 per watt.

The solar cells could also be used on "wearable" technology and consumer electronics due to the material's flexible nature, and not just on solar panels outside buildings and on rooftops. However, it is still uncertain if the new product will be put on market. Researchers said a timetable on when the technology can go into mass production remains to be seen, owing to numerous problems which have yet to be ironed out. They also stopped short of revealing the cost of the hybrid material, adding it is difficult to work out as the solar cells under trial were produced in small quantities in the laboratory.

Unlike conventional solar cells made from a single material, researchers combined three layers of materials to maximise efficiency. The main layer is perovskite, a mineral composed of calcium and titanium, which absorbs a broad range of the visible light spectrum and conducts electricity well. It is paired with a bottom layer of silicon, a traditional solar panel component which complements perovskite by absorbing a different set of wavelengths.

The research team then worked with the university's Institute of Textiles and Clothing to create a transparent top coat with a texture similar to that of rose petals to help trap more light.

http://www.scmp.com

Rain-powered all-weather solar cells

Scientists from Ocean University of China and Yunnan Normal University, have come up with rain-powered all-weather solar

cells to solve the energy crisis by combining an electron-enriched graphene electrode with a dye-sensitized solar cell stimulated by light and rain drops. Dye-sensitized solar cells are thin-film photovoltaic cells that harness organic dye to absorb sunlight and produce electrons, and react with rainfall thereby creating rain-powered energy.

Ocean University of China Professor Qunwei Tang, the paper's lead author, configured dye-sensitized solar cells –which are thin-film photovoltaic cells that harness organic dye — to absorb sunlight and produce electrons, and can be rain-powered for energy production.

Commonly used solar panels generate the most energy on clear, sunny days, and produce 10 to 25 percent less electricity under overcast conditions. What the Chinese have come up with are rain-powered all-weather panels that can create energy regardless of weather.

The key ingredient in the redesigned solar panel is the "electron-enriched graphene" added to the top layer. This ultra sensitive feature allows the panel surface to react with ions in the rain-drops and generate rain-powered energy. The technology is breakthrough, in its prototype stage of development, and still has to reach the efficiency level of the top solar panels in the market. The rain-powered panels can currently convert about 6.5 percent of the energy they absorb, whereas today's top-of-the-line solar panels can convert up to 22.5 percent.

With its atoms bonded into a honeycomb arrangement, graphene is a two-dimensional form of carbon created by the oxidation, exfoliation, and subsequent reduction of graphite. Unusual electronic properties allow graphene to conduct electricity. What makes graphene bind positively charged ions with its electrons is the abundance of electrons that can move freely across the treated layer, for rain-powered energy creation.

http://www.inquisitr.com

JAPAN

Biofuel with crab shells

Researchers at Kobe University say they have found a possible way to turn bits of crustaceans and insects into ethanol for about the same cost as producing the fuel from corn. Kentaro Inokuma and his research associates discovered among the yeasts that break down xylose, a kind of sugar, one that proved effective at fermenting the chitin-derived sugars to produce ethanol. It works so well that it exceeds the theoretical 70% limit on conversion efficiency, according to the team.

The group reckons that the yeast can be genetically modified to achieve 90% efficiency. At that rate, ethanol would cost 50 yen (44 cents) per liter or less to produce by this method -- about the same as with corn, sugar cane or other more commonly used biomass. Inokuma's team continues working to improve on its idea, using raw materials from seafood-processing plants and other sources. Given enough chitin, producing ethanol in this way can be commercially competitive even amid the current low crude oil prices, the scientists believe.

http://asia.nikkei.com

REPUBLIC OF KOREA

Solar cell with record efficiency

A Republic of Korean research team has achieved record level efficiency in solar cells, using a new formula for mixing perovskite structures. Perovskite is an inexpensive, abundant mineral, and the researchers have found ways to make it even more efficient for solar power applications. The new solar cells are measured at 17.9 percent efficiency, which could mean very big things for this clean alternative energy source.

Researchers at the Korea Research Institute of Chemical Technology and Sungkyunkwan University published their findings in the peer review journal *Nature*. Their new formula involves mixing ingredients just right, and after much experimentation, they believe they have finally settled on the ideal ratio to achieve maximum efficiency. The resulting material was developed specifically for the creation of a high-performance solar cell.

The cost of solar power technology has been steadily decreasing, but it's still not as popular as proponents would like it to be. This boost in efficiency makes the alternative source of energy even more attractive, especially if it will be available at the same lower cost as existing solar panels. Scientists have been working to improve the energy efficiency of silicon solar cells for many years, but have basically reached the limit of that material's capability. This has spurred the research community to investigate other options, and led to using perovskite in solar cells starting in 2009. At that time, however, perovskite structures didn't boost efficiency by leaps and bounds.

http://ecocidealert.com

EUROPE

DENMARK

Sunlight to produce biofuels

Researchers from the University of Copenhagen in Denmark have developed a natural process, reverse photosynthesis, to produce biofuels and energy from sunlight. The process involves breaking down plant biomass using the energy in solar rays combined with monooxygenases enzyme. The resulting product can then be used as chemicals, biofuels or other products. According to the researchers, the monooxygenases, a natural enzyme also used in industrial biofuel production, has potential to multiply their effectiveness when exposed to sunlight.

University of Copenhagen professor Claus Felby said: "This is a game changer, one that could transform the industrial production of fuels and chemicals, thus serving to reduce pollution significantly. "The immense energy in solar light can be used so that processes can take place without additional energy inputs."The researchers expect the method could revolutionize industrial production by increasing production speed and reducing pollution.

Fellow researcher and discoverer Postdoc David Cannella said:"The discovery means that by using the Sun, we can produce biofuels and biochemicals for things like plastics - faster, at lower temperatures and with enhanced energy-efficiency.

http://biofuels-news.com

Multi-rotor wind turbine concept

Vestas has unveiled plans for an innovative wind turbine design, which aims to use four separate rotors to challenge the assumption that the only way to increase wind power output is to build ever-larger turbines. The Danish turbine manufacturing giant announced today it is working with the Technical University of Denmark to install a concept demonstration unit to test the technical feasibility of the multi-rotor design.

"Installing a concept turbine shows that innovation sometimes entails entirely new thinking and new approaches," said Jorge Magalhaes, senior vice president, Vestas Innovation and Concepts, in a statement. "This process of continuous innovation and exploration is extremely important. It provides us with essential knowledge that can help us bring down our products' cost of energy and integrate key technologies to solve our customers' challenges." He added that the company's goal was to assess if it can build "an even more cost-efficient turbine by challenging the scaling rules" that state turbines have to grow in size to increase energy output.

The company said the multi-rotor concept demonstrator is now being erected at the Risø test site near Roskilde in Denmark, where it will be assessed for several years.

http://www.businessgreen.com

UK

Microbial fuel cell

A new fuel cell that could use carbon catalysts derived from various food wastes as a renewable and low-cost alternative to platinum at the cathode to turn urine into electricity is being developed by researchers from University of Bath, Queen Mary University of London and the Bristol Robotics Laboratory. According to the scientists the development could revolutionise the way that bioenergy is produced, particularly in developing countries. The research, published in *Electrochimica Acta*, describes a new design of microbial fuel cell that's smaller, cheaper and more powerful than traditional ones.

Microbial fuel cells are devices that use the natural processes of certain bacteria to turn organic matter into electricity. The technology is said to have the advantage of working at room temperature and pressure, as well as high efficiency, relatively low running costs. The study describes a new design of microbial fuel cell that overcomes two limitations of standard microbial fuel cells: their cost and low power production.

The new miniature microbial fuel cell is said to use no expensive materials for the cathode; instead it's made of carbon cloth and titanium wire. To speed up the reaction and create more power, it uses a catalyst that's made of glucose and ovalbumin, a protein found in egg white. These are typical constituents of food waste.

The researchers tweaked the design to see what would produce more power. Doubling the length of the electrodes, from 4mm to 8mm was found to increase the power output tenfold. By stacking up three of the miniature microbial fuel cells, they were able to increase the power tenfold compared to the output of individual cells.

https://waste-management-world.com

Solar cell material to recycle light

Scientists from the University of Cambridge have discovered that a group of perovskite-based materials can recycle light, a finding that could lead to large gains in the efficiency of solar cells. The group of synthetic materials known as hybrid lead halide perovskites appear to promise a revolution in the field of solar energy, researchers said.

The research shows that perovskite cells have the extra ability to re-absorb these regenerated photons, a process known as "photon recycling". This creates a concentration effect inside the cell, as if a lens has been used to focus lots of light in a single spot.

"Its a massive demonstration of the quality of this material and opens the door to maximising the efficiency of solar cells," said Felix Deschler from the University of Cambridge. "The fabrication methods that would be required to exploit this phenomenon are not complicated, and that should boost the efficiency of this technology significantly beyond what we have been able to achieve until now," said Deschler.

The study involved shining a laser on to one part of a 500 nanometre-thick sample of lead-iodide perovskite. Perovskites emit light when they come into contact with it, so the team was able to measure photon activity inside the sample based on the light it emitted. Close to where the laser light had shone on to the film, the researchers detected a near-infrared light emission.

Researchers also manufactured the first demonstration of a perovskite-based back-contact solar cell. This single cell proved capable of transporting an electrical current more than 50 micrometres away from the contact point with the laser; a distance far greater than the researchers

Multi-rotor wind turbine concept of Vestas

had predicted, and a direct result of multiple photon recycling events taking place within the sample.

The study was published in the journal *Science*.

http://indiatoday.intoday.in

NORTH AMERICA

CANADA

Catalyst offers efficient storage of alternative energy

A group of researchers led by Professor Ted Sargent at the University of Toronto has designed an efficient catalyst for storing energy in chemical form, by splitting water into hydrogen and oxygen, just like plants do during photosynthesis. Oxygen is released harmlessly into the atmosphere, and hydrogen, as H2, can be converted back into energy using hydrogen fuel cells.

This new catalyst facilitates the oxygen-evolution portion of the chemical reaction, making the conversion from H2O into O2 and H2 more energy-efficient than ever before. The intrinsic efficiency of the new catalyst material is over three times more efficient than the best state-of-the-art catalyst.

The new catalyst is made of abundant and low-cost metals tungsten, iron and cobalt, which are much less expensive than state-of-the-art catalysts based on precious metals. It showed no signs of degradation over more than 500 hours of continuous activity, unlike other efficient but short-lived catalysts. Their work was in the leading journal *Science*.

http://news.engineering.utoronto.ca

USA

Clean energy using bacteria-powered solar panel

Researchers Binghamton University have taken the next step in the evolution of bacteria-powered energy. The researchers connected nine biological-solar (bio-solar) cells into a bio-solar panel. Then they continuously produced electricity from the panel and generated the most wattage of any existing small-scale bio-solar cells - 5.59 microwatts.

The current research is the latest step in using cyanobacteria (which can be found in almost every terrestrial and aquatic habitat on the planet) as a source of clean and sustainable energy. Last year, the group took steps toward building a better bio-solar cell by changing the materials used in anodes and cathodes (positive and negative terminals) of the cell and also created a miniature microfluidic-based single-chambered device to house the bacteria instead of the conventional, dual-chambered bio-solar cells.

However, this time the group connected nine identical bio-solar cells in a 3x3 pattern to make a scalable and stackable bio-solar panel. The panel continuously generated electricity from photosynthesis and respiratory activities of the bacteria in 12-hour day-night cycles over 60 total hours.

Even with the breakthrough, a typical "traditional" solar panel on the roof of a residential house, made up of 60 cells in a 6x10 configuration, generates roughly 200 watts of electrical power at a given moment. The cells from this study, in a similar configuration, would generate about 0.00003726 watts.

The findings are currently available online and will be published in hard copy in the June edition of the journal *Sensors and Actuators B: Chemical.*

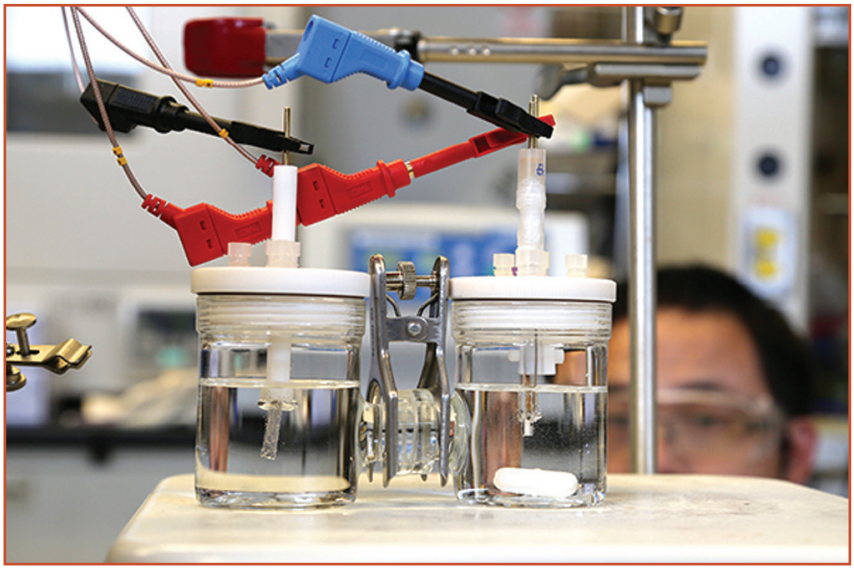
http://phys.org

Oil from sugarcane for biodiesel and aviation biofuel

Under the guidance of University of Illinois scientists, a research team changed the metabolism of sugarcane to transform sugars into oils or lipids, which can then be used to produce biodiesel. The sugarcane usually contains 0.05% of oil. In less than a year of this project initiation, the researchers successfully increased the oil production 20 times, up to roughly 1%.

Currently the oil-cane plants generate 12% of oil, but the team aims to obtain 20%. The group has also introduced additional benefits to the oil cane plants which include more efficient photosynthesis and better cold tolerance. This will result in higher quantities of oil and higher biomass production.

During their study, the researchers considered the technology, land area, and the associated expenses needed to convert oil-cane biomass into a sustainable biodiesel within different oil production situations, from 2% oil in the plant to 20%. This data was evaluated against soybean and standard sugarcane, which can be used to produce ethanol. A major benefit provided by oil-cane plants is that the plant's remaining sugars can be changed into ethanol, offering a dual sources of fuel in one.



Electrolysing device that splits water into its component elements, oxygen and hydrogen

(Credit: Marit Mitchell)

The study also revealed that if oil-cane plants that contain 20% of oil in the stem are cultivated on under-used acres in the southeastern region of the US, over two-thirds of the nation's use of jet fuel and diesel can possibly be replaced.

http://www.biofuelsdigest.com

Waste gas into liquid fuel

Researchers from the Massachusetts Institute of Technology (MIT) have discovered a form of bioconversion that could be used to convert waste gases to biodiesel for transportation. The 'Integrated bioprocess for conversion of gaseous substrates to liquids' report, published in the Proceedings of the National Academy of Sciences (PNAS) journal, describes the process of converting syngas – synthetic gas that predominantly includes a mixture hydrogen, carbon monoxide and carbon dioxide – into liquid lipids that can be used as fuels.

The bioconversion involves two main steps, the first of which processes syngas into acetic acid (concentrated vinegar) in an anaerobic bioreactor using bacteria. The acetic acid is then used as a substrate for an oil-producing yeast, which aerobically converts it into lipids. Scientists say the bioprocess has been trialled successfully at a pilot plant in China. The productivity was found to be 0.19 grammes per litre of acid per hour, although the authors claim that "the system can be further optimised".

MIT owns the patent for the process, and licensed GTL Biofuel to run the pilot plant outside Shanghai from September 2015. A larger 'semi-commercial' demonstration plant, 20 times the size, is now planned for construction.

http://www.onlynaturalenergy.com

Hydrogen through steam reforming of biomass-derived ethylene glycol

Steam reforming biomass-derived compounds is a promising strategy for hydrogen production. To realize the full potential of this approach, scientists must identify which catalyst is optimal for producing the highest yield of hydrogen. To address this question, a team of researchers from Pacific Northwest National Laboratory combined experimental and theoretical methods to study steam reforming ethylene glycol over $MgAl_2O_4$-supported rhodium, nickel, and cobalt catalysts.

Computational work and advanced catalyst characterization were performed at EMSL, the Environmental Molecular Sciences Laboratory, a DOE national scientific user facility. Compared to the highly active rhodium and nickel catalysts which achieve 100 percent conversion of ethylene glycol, the steam reforming activity of the cobalt catalyst was comparatively lower, with only 42 percent conversion under the same reaction conditions. However, the use of the cobalt catalyst rather than the rhodium and nickel catalysts resulted in a three-fold drop in methane selectivity-a measure of the percentage of ethylene glycol converted to methane. Calculations revealed the lower methane selectivity for the cobalt catalyst, as compared to the two other catalysts, is primarily due to the higher barrier for methane formation.

The findings demonstrate that the cobalt catalyst leads to a higher yield of hydrogen, at the expense of methane, compared to the other two. Additionally, the cobalt catalyst was also found to offer enhanced catalyst stability compared with the more conventional nickel and rhodium catalysts. This information could be used to develop efficient methods for converting biomass-derived compounds into hydrogen for petroleum refining, the production of industrial commodities such as fertilizers, and electricity production via fuel cells.

http://phys.org

New solar cell

A team of MIT researchers has for the first time demonstrated a device based on a method that enables solar cells to break through a theoretically predicted ceiling on how much sunlight they can convert into electricity. The findings were reported in the journal *Nature Energy*, in a paper by MIT doctoral student David Bierman, professors Evelyn Wang and Marin Soljačić, and four others.

In the demonstration, the team used a relatively low-efficiency PV cell, so the overall efficiency of the system was only 6.8 percent, but it clearly showed, in direct comparisons, the improvement enabled by the STPV system. The basic principle is simple: Instead of dissipating unusable solar energy as heat in the solar cell, all of the energy and heat is first absorbed by an intermediate component, to temperatures that would allow that component to emit thermal radiation. By tuning the materials and configuration of these added layers, it's possible to emit that radiation in the form of just the right wavelengths of light for the solar cell to capture. This improves the efficiency and reduces the heat generated in the solar cell.

The key is using high-tech materials called nanophotonic crystals, which can be made to emit precisely determined wavelengths of light when heated. In this test, the nanophotonic crystals are integrated into a system with vertically aligned carbon nanotubes, and operate at a high temperature of 1,000 degrees Celsius. Once heated, the nanophotonic crystals continue to emit a narrow band of wavelengths of light that precisely matches the band that an adjacent photovoltaic cell can capture and convert to an electric current. "The carbon nanotubes are virtually a perfect absorber over the entire color spectrum," Bierman says, allowing it to capture the full solar spectrum. "All of the energy of the photons gets converted to heat." Then, that heat gets re-emitted as light but, thanks to the nanophotonic structure, is converted to just the colors that match the PV cell's peak efficiency.

In operation, this approach would use a conventional solar-concentrating system, with lenses or mirrors that focus the sunlight, to maintain the high temperature. An additional component, an advanced optical filter, lets through all the desired wavelengths of light to the PV cell, while reflecting back any unwanted wavelengths, since even this advanced material is not perfect in limiting its emissions. The reflected wavelengths then get re-absorbed, helping to maintain the heat of the photonic crystal.

The next steps include finding ways to make larger versions of the small, laboratory-scale experimental unit, and developing ways of manufacturing such systems economically.

http://news.mit.edu/2016/hot-new-solar-cell-0523

Fostering innovation dynamics among SMEs through foreign technology investment

KyungJin Hyung
Team Head, Technolgy Transfer & IP Financing
Korea Technology Finance Corportion (KOTEC),
Gongjak APT B-901, Yeoidaero 6 gil 17, Youngdeungpogu,
Seoul, Republic of Korea (150-729)
Tel (82)10-5608-8500; Fax (82)0505-020-1620
E-mail: kyungjin.hyung@fuqua.duke.edu

Abstract

From a policy perspective, foreign direct investment (FDI) is cognitively differentiated from other sources of capital movement. Governments expect it to bring in technologies and know-how, as well as capital, which will lead the economy to produce higher value-added products and service. Every country hopes to enhance their economy by adopting more innovation, and FDI serves as a primary channel to diffuse such innovation more quickly. In contrast, many papers argue that FDI actually often results in a disappointingly lower-than-desired diffusion.

By touching upon various issues based on the writer's experience regarding technology transfer in and out of Republic of Korea, this paper proposes that fostering foreign technology investment for smaller ventures is more sensible for policymakers in terms of boosting innovation dynamics in the economy in this era of convergence. This paper suggests four pivotal elements to enhance an environment that could attract foreign technology investments that will produce more effective innovation diffusion, use of certification scheme to select the right kind of enterprises to incentivize, enhancing investment-in-kind through establishing globally acceptable technology valuation standard, designing demand-driven technology matching platform, and cultivation of efficient intermediaries that understand technology in terms of business model.

Challenges in facilitating innovation through FDI

From a policy perspective, policymakers expect FDI to bring in technology and know-how in addition to job creation that would contribute to converting their economy to a higher value-added one.

There are two different dimensions on this perspective. The first dimension, the expectation of which is easily assumable, is a productivity increase in conventional industries through quick learning of advanced process management, systematic training for workers to become highly skilled, and the introduction of sophisticated machinery and equipment.

When such a transfer is made through FDI, the expected diffusion which will narrow down the technology gap often happens slowly because it initially comes within the boundaries of wholly-owned local subsidiaries and joint ventures. It takes time for local firms to absorb it through the channels of competitive hiring of skilled engineers, imitation, and reverse engineering.

Enterprises from advanced economies often try to prevent the leakage of technologies because they are the primary source of competitive advantages to sustain their investment when venturing into a new market. In fact, large-scale multinationals often keep their research and development activities in the home country and try to exploit only cheaper labor costs and incentives provided by the country they are entering. From their perspective, the duration of time such advantage can be exploited will depend upon how long and wide the technology gap can remain.

In addition, international technology transfer that does not involve FDI in emerging countries is simply a one-way introduction of advanced machinery and equipment, solutions or well-systemized production know-how rather than added value through collaboration and convergence of transferor and transferee in regard to co-creation, adaptation or sophisticated localization efforts. With such a practice, which is more or less like trade in capital goods, only a fraction of the policy intention is achieved.

Some countries attempt to make technology transfer obligatory. Although well-intended, such policy often turns out to be ineffective for three reasons. Firstly, there is fierce competition nationally and even at the local level within the same country to attract big multinationals with advanced technologies and brand power. Second, foreign firms can choose what to transfer and thus they may meet the requirements by transferring old technologies that they do not need in their home country. Third, emerging countries are often not capable of learning and absorbing advanced technologies due to lack of experience and limited capacity.

For example, although Viet Nam successfully attracted Samsung Electronics into their country, Samsung tends to bring in Korean vendors rather than sourcing their supply locally, as Viet Nam lacks the capacity locally to supply sophisticated parts and components. It takes time for Viet Nam to build their capacity beyond packaging and basic manufacturing which takes place in stages starting from basic processes like injection molding, which is old technology in the Republic of Korea.

During the Republic of Korea's period of rapid economic growth, a multi-staged policy approach was effective. However, it is now difficult for other developing countries to emulate the Korean approach as unlike in the past, today the old economy and new economy are developing at an asymmetric pace. China is probably one of the last examples of staged economic planning.

Summary of Idea

THE DILEMMA

Policymakers often think of FDI as a primary channel for boosting innovation. However, the expected transfer and diffusion of advanced innovation may not take place even after incentives are provided.

The effect may not be big enough even if it happens. Furthermore, it is hard to plan, execute, and monitor the impact of policy because it is realized over a long period of time.

WHY IT HAPPENS

It is natural for multinational companies to act as *rent seekers* to maximize profit by exploiting policy incentives & low labor costs with limited exposure of new technologies.

Talented entrepreneurs are tempted to practice *avoidance behavior*, that is, seek an easier way to make a fortune in today's fast-paced Internet-and-mobile-driven world rather than choosing incremental learning via a more time-consuming path.

THE TACTICS

While keeping FDI policy at a pertinent level for the purpose of job creation and capital injection, it is necessary to think of another channel in the New Economy for the purpose of learning and recreating foreign-born innovation.

Create an eco-system where foreign technology can easily be invested into smaller business ventures in the *New Economy* by providing proprietary products or services directly to the market rather than being basic suppliers to giant firms.

THE REWARDS

This approach would not guarantee the successful facilitation of innovation culture unless each element of the policy program is executed pertinently.

If the elements work well individually and in line with others, policymakers will secure a higher level of visibility regarding the impact of boosting innovation in a shorter period of time which will lead to better innovation policy planning and execution.

Apple's iPhone is manufactured in large quantities in China and exported to the global market. If the profit margin of the Chinese assembler and Apple in the U.S. are compared, the Chinese assembler gets a much smaller proportion of the overall profit margin. However, China, whose economy grew successfully under staged-planning, from basic industry gradually toward higher value-added ones, can absorb technology and innovation in the end. As a result, domestic producers are now capable of producing high quality smart phones at a reasonable cost. This is not as easy for other countries.

In the twentieth century, each nation consumed goods and services that are in line with the countries' respective levels of economic development. People's desire grew incrementally as their economy did. However, the Internet and mobile technology in combination with globalization in the twenty-first century has brought about the trend that people get to want and consume advanced services beyond the level at which their domestic entities can provide. Moreover, people everywhere share a similar level of information and desire irrespective of degree of their nation's economic development.

This phenomenon proves an incentive to talented local entrepreneurs to become traders rather than *creators*. Few talented entrepreneurs are willing to invest the time and passion over a long period of time to advance their business with innovation like research and business development (R&BD). Rather, they tend to carry things that prove to be popular in the advanced world and sell. Some create wealth quickly in that way, while other entrepreneurs try to copy the strategy. A few will stay in the conundrum of serious innovation. I wish to call this *avoidance behavior*.

Governments in developing countries give incentives for FDI because FDI serves as a primary channel for creating jobs, attracting capital and increasing exports. Economic growth in the short term surely contributes to higher consumption power. Talented domestic entrepreneurs quickly bring in foreign products and services instead of trying to learn advanced technology and innovation. However, if technology and innovation are not diffused locally, quite a large part of the surplus is transmitted back to the advanced world as a result.

In this circumstance, it is very hard for policymakers to design policies that would bear the desired impact in the long run. In addition, FDI satisfies some policy expectations such as job creation as well as an immediate increase in capital investment. Thus, transfer and diffusion of innovation often loses the attention of policymakers when the FDI is completed. That it is difficult to measure the impact of FDI over a long period of time results in policy-makers maintaining their distance from upgrades in innovation capability through international technology transfer through FDI.

On this topic, the vast majority of the studies deal primarily with the relevance of expecting FDI as a primary channel for technology transfer. Many of them argue that technology transfer is relatively effective when such transfers are made vertically (Carol *et al*., 2015). Furthermore, most of the research found that technology diffusion or knowledge spillover is not an automatic process. However, few papers propose advice for policy-makers in shaping predictable and malleable strategy for boosting innovation through foreign investment.

This paper is primarily focused to propose the idea that there is another possible cohort of firms, innovative SMEs, other than big multinationals that is possibly better suited for the purpose of fostering innovation in developing countries through direct interaction. The next chapter will illustrate my reasoning behind this idea. This paper will then address several policy measures that were proved to be successful in enhancing innovation dynamics on SMEs dimension in the Republic of Korea. Finally this paper will draw implications for applying the Republic of Korea's policy programs to facilitating infrastructure for the purpose of drawing the desired kind of international technology transfer to boost innovation.

Rise of the new economy and implications for international technology transfer

We tend to regard motivation for technology transfer in the same light as with the reasons for patenting, freedom to operate in a certain business domain - protection of proprietary products or defense from lawsuit. For big multinational companies active both in developing and acquiring technologies, it is actually true. For many smaller firms, the motivation may be different.

The organization that I work for, Korea Technology Finance Corporation (KOTEC), is a special financial institution dedicated to funding SME business projects driven by technology or other sources of innovation through debt guarantee and equity investment via its own unique proprietary rating and valuation system.

I worked in the international business department from 2012 to 2014, where my primary task was to promote the transfer of establishing KOTEC's rating and valuation system to other countries such as Viet Nam, Thailand, and Hungary, a program which is still going well. The other task was to establish channels and programs for international technology cooperation including technology transfer between tech-related SMEs in the Republic of Korea, KOTEC's client firms, and foreign enterprises from both developing countries and developed ones. The latter task has progressed a lot more slowly despite huge efforts.

In 2014, KOTEC's newly established technology convergence centers designed to provide technology transfer intermediation and IP financing in the Republic of Korea. I was assigned as a team head for the Seoul technology convergence center in January 2015.

In 2015, my team and I, three people in total, closed thirty-one technology transfer deals, namely technologies from universities and research institutes to SMEs in the Republic of Korea. Among the thirty two, eighteen were to identify and execute new business opportunities. Although many technologies were patented, there was no guarantee that transferees could protect their product or service simply by having those patents because most of those technologies were not source technologies, but application technologies that have room for detouring[1].

Ten were to seek R&D partners either for market-based collaboration or for forming strong candidacy for government-backed research projects. The rest were to attain credibility. Small businesses often lack brand recognition and thus, they intended to promote their products with patents under the name of universities or research institutes. This pattern of purpose distribution continues to be the same in 2016 up to when this paper was written.

Although this may not yet prove significant from the perspective of statistics due to a shortage in samples and in observation time, it is proof that there exists a new dimension that is not well considered by policy makers: certain type of technologies and innovative ideas are more easily transferrable and have potential for serving as a catalyst from which new types of innovative enterprises can evolve.

Smaller business ventures that seek an innovative edge would form an industry under the new economy that deserves separate policy attention. When it comes to the new economy, popular misconception may be that these types of business ventures are primarily Internet or mobile driven ones.

Although it is in large part true, the new economy is not limited to the so-called digital economy, but more for convergence between formerly separate industries. Most technology transfers that I recently dealt with had the following three characteristics in common:

- Transferees look for heterogeneous elements to be combined with their existing products for creating/tapping new markets or new demand;
- Those technologies have a relatively short life cycle, which means new application technologies are continuously generated as usage increases; and
- Convergence often comes from direct collaboration between the technology supplier and technology demander.

To better illustrate, I would like to introduce a recent technology transfer case example, IOYS[2] in Republic of Korea. The company was established in 2014 to make 3D figures for consumers. The company figured out how to get high quality 3D real images by allocating 100 DSLR cameras at different angle. Once a person gets into one of their studios, 100 cameras take each shot simultaneously. The image goes through a rendering process. It takes several hours because the software they are using is not perfect in getting full texture, and thus needs the touch of designers. When the image is corrected and filled, the company prints the figure using 3D printers.

Neither the software nor the 3D printer is the company's proprietary technology. The company figured out an innovative way of taking the highest possible quality 3D image by deploying 100 cameras at certain varied angles which reduces the time needed to take a photo compared with currently available 3D image scanners.

The company was initially looking for software technology to reduce time for rendering that includes image correction by human touch. During the course of collaboration with research institutes, the company recognized plenty of other creative ideas for new business models using other heterogeneous technologies. For example, they could develop a 3D image platform where users not only keep their own 3D images, but also create secondary images by blending various digital impacts such as motion data. Users can create video clips by mixing their 3D images with the dancing motions of famous singers.

The other business is mixing artificial intelligence (AI) technology with figures. For example, a woman had a 3D figure of a famous singer she liked made so that she could actually interact with the figure using AI technology with voice and face recognition function. She was able to play with the figure interactively by conversing and asking it to sing a particular song for her. If this figure could be connected with IoT sensors, she could order the figure to do certain tasks such as turning off the light by simply telling it to do so.

Some people may argue that policy to foster technology transfer should aim ulti-

[1]Two cases, one biotechnology and the other inspection technology for organic foods, had strong potential for patent protection; however, these two transfers were also seeking new business opportunities.

[2]See http://www.ioys.co.kr/#!news/uhal2 for reference.

mately at the absorption of the transferred technologies. However, when more value comes from creative application compared to learning how to replicate the element technology as transferees' own and those technologies are evolving on a fast lifecycle, it would be better to foster the creative usage of earned technologies. This is different from simply importing and selling finished products because the practice fosters secondary innovation and ideas for better application which the transferee can then turn into its own proprietary asset.

Most developing countries mention IT as an important strategic industry to nurture. However, few countries show realistic progress in terms of policy execution. This hinges in part on the complexity of IT industry with three different waves.

The first wave of IT, during the 1960s and 1970s, automated individual activities in the value chain, from order processing and bill paying to computer-aided design and resource planning (Michael and Millar, 1985).

The rise of internet, with its inexpensive and ubiquitous connectivity, unleashed the second wave of IT-driven transformation, in the 1980s and 1990s (Michael, 2001). This enabled coordination and integration across individual activities; with outside suppliers, channels, and customers; and across geography. These two waves enhanced productivity gains and growth in efficiency across the economy. The elements in these two waves are easily gained through purchase and external sourcing.

Now, in the third wave, IT is becoming an integral part of the product itself. Embedded sensors, software, and connectivity in products – computers are being put inside products, coupled with a product cloud in which product data is stored and analyzed and some applications are run, are driving dramatic improvements in product functionality and performance.

It is easy to misconstrue that developing countries can gain from merely increasing the production capacity and investment in R&D will lead to development of the IT industry. This is far from reality. For sensors and other hardware elements, some countries may gain a competitive advantage by producing those high-quality sensors at a lower cost. However, the third wave of IT-driven competition is more about a creative service model, while source technologies and key algorithms are already dominated by global giants.

Extensive amounts of new product usage data enable many of those improvements. Producing them will reshape the value chain yet again, by changing product design, marketing, manufacturing, and after-sale service, and by creating the need for new activities such as product data analytics and security. This will drive yet another wave of value-chain-based productivity improvement. The third wave of IT-driven transformation thus has the potential to be the biggest, much bigger than the previous two (Michael, 2014).

In new fields such as Internet of Things, Big Data, Cloud, Artificial Intelligence and Virtual Reality, it is hard to foresee how developing countries could gain an edge by starting from efforts to earn and create source technologies. It doesn't make sense for a country to attempt to sequentially build industries that would buttress these three waves.

For small and medium sized business ventures, value comes largely from generating an innovative service model out of creatively combining smart and connectivity elements into their existing products and services. The good news is, thanks to the advent of the Internet and mobile technology, information is shared in real time all around the world as aforementioned and global sourcing of technology becomes easier.

Using technology or adopting innovation is a habit of entrepreneurs as well as a culture policymakers should look to boost through having the right ecosystem. The next chapter will explore types of innovations and value capturers to infer more predictable and malleable policy target area.

Carving out a realistic policy niche to foster innovation in the new era: Types of innovation and entrepreneurs

Clayton M. Christensen from Harvard Business School conceptually categorized three different types of innovations (Clayton and Bever, 2014):

- Performance-improving innovations;
- Efficiency innovations; and
- Market-creating innovations.

Performance-improving innovations replace old products with new and better ones. They generally create few jobs because they are substitutive. Efficiency innovations help companies make and sell mature, established products or services to the same customers at lower prices. Market-creating innovations transform complicated or costly products so radically that they create a new class of consumers, new applications, or a new market.

Conventional FDI may bring about a productivity increase in the first two categories of innovations. However, it normally has weak ties with the third category.

Figure 1 shows four different types of value capturers that I conceptually discovered. I put those four types into a quadrant by taking the vertical axis as the degree of value creation potential and the horizontal axis as the degree of novelty in original innovation. Here the value creation refers to the whole economy, and novelty represents originality of innovation.

Originators are those who come up with original technologies through R&D or ideation. They have high potential to create value for the economy with innovations possessing a high level of novelty. Adopters are the ones who simply borrow the innovations from originators for the products and services that the innovation is originally designed to address and thus, novelty is maintained.

Convergence catalysts are those who try to figure out new applications of the original innovation in an attempt to create new markets and new consumers. They create and enhance the value of original technologies by integrating them into a disruptive business model or combining them with different innovation. These enterprises are active in undertaking secondary or application-level R&BD activities. Companies that create new markets tend to generate more new jobs.

Traders are those who simply buy and sell products or services created elsewhere only to earn a margin by adding limited value in terms of fostering a national economy to be innovative.

From the perspective of innovation policy, conventional FDI may have an impact on productivity increase by adopting innovation practiced and proven in an advanced economy. Cultivating originators is difficult and requires patient investment in the economy.

Incentivizing talented entrepreneurs to become convergence catalysts by leveraging foreign-born innovations, not trading, is a realistic innovation policy area and may have a bigger impact in creating innovation dynamics in the economy. If such dynamics are created, it also helps to increase qualified originators because their practice of creatively using innovation functions as a feedback loop that provides better inspiration for them to come up with sensible innovations with higher commercialization potential. In short, it fosters a virtuous reinforcing cycle. The next chapter will introduce key elements used in Republic of Korea's ecosystem for promoting innovation dynamics.

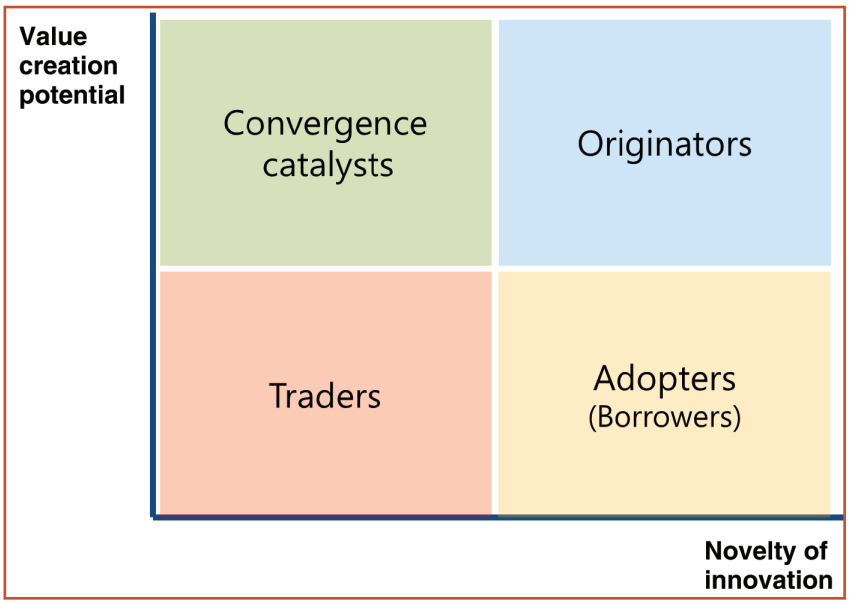


Figure 1: Innovation quadrant

Critical factors to foster FTI

Aligning incentives with the right to-be-innovative enterprises

Most countries have incentive programs for innovative enterprises or R&BD activities under targeted categories like 6Ts[3]. Technology, as well as innovation, is a broad concept, and probably any company could describe itself as innovation-driven or technology-oriented.

The first thing that policymakers should consider before establishing incentive programs is to establish a systematic process of selecting and certifying the right type of entrepreneurs with the right potential, proper willingness and capability to carry out innovation-driven business. When it comes to the selection process, it would be better to do so using standardized evaluation criteria that take granularity into account with the least possible amount of subjectivity.

During the late 1990s, the Korean government initiated the Venture Certification system for venture companies to select the firms with high growth potential from the application of new business ideas or technologies. The venture certification system was designed to prepare for the era of the knowledge-based economy by directing potential entrepreneurs' attention to the concept of the new economy by providing consorted support in accordance with the Act on Special Measures for the Promotion of Venture Businesses (September 1997).

From the early 2000s, the Korean government began to take a more concrete 'choice and focus' approach between general SMEs and ventures in terms of policy treatment. These efforts have shown success with R&D expenditure by SMEs growing fivefold between 1997 and 2006, when it accounted for 24% of all total firms R&D expenditure. By 2006, 43% of all researchers worked in SMEs, up from 24% in 1997[4].

Similar to this example, policymakers in developing countries can establish a certification system for enterprises which have growth-potential by learning and re-creating technologies in advanced economies.

Invigorating investment-in-kind practice

If companies are certified as a venture company, the special law allows the firm to receive technology as capital investment. If the venture hopes to adopt technology from a different entity, the technology is evaluated by credible valuation specialists and the value which is the outcome of such valuation can be treated as equity investment.

If developing countries facilitate such a credible and professional practice using globally admitted methodologies, foreign entities that can provide technologies can have easier access in forming joint ventures or in regard to technology investment. This practice is different from technology licensing which primarily takes a certain proportion of sales revenue whether or not the adopting company is successful or not. In case of investment-in-kind, the technology provider is better off only if the enterprise's equity value goes up, which means the venture will eventually be a success.

Investment-in-kind is widely practiced among venture-certified enterprises in the Republic of Korea and normally fosters a deeper commitment by technology providers and more shared risk.

The pivotal element for an investment-in-kind scheme is to secure credible and globally acceptable valuation practices. In

[3]IT, BT, NT, ST, ET, CT

[4]See p10, Terence O'Donnell (2012). "South Korea SME Innovation Support Scheme", European Commission, April.

the Republic of Korea, KOTEC provides the majority of valuation services for ventures for the purpose of investment-in-kind. The Malaysian government established a standardized valuation methodology in 2014 as a national scheme and seeks to use it for international technology transfer, as well.

Demand-driven information platform

Every country hopes to promote technology transfers. What governments normally do is to establish a technology information platform by collecting and integrating information from technology holders.

In the Republic of Korea, there are plenty of such information platforms. In particular, the National Technology Bank (NTB) is the largest aggregator of transferrable technologies, while other institutions have their own technology database that is easily accessible to anyone. The underlying assumption is that demanders can find and match their needs by browsing such information provided mainly by inventors. However, not every demander is R&D intensive enough to understand the technology described by researchers. To solve this problem, NTB provides a summary written in an easier format, although this too remains insufficient.

At the end of 2014, Korea Technology Finance Corporation established a demand-driven platform named KOTEC Technology Matching System (KTMS). KOTEC is a financial institution dedicated to ventures and other technology SMEs, and it frequently interacts with its 70,000 clients during initial consultation and due diligence for technology business evaluation, and even after funding.

The organization is well-positioned to get to know venture companies' technology demands and thus started to file such demand information. Because KOTEC has the capability to understand both technology and business, their staff is able to better identify, articulate, and communicate demands from ventures. The organization systemized the idea into a platform and technology suppliers were naturally attracted to provide their technology list to the platform. In addition to integrating convenient functions for KOTEC's staff by integrating the function of sending search requests with demand information to a technology holder with one click, KOTEC allowed technology holders to log in and browse demand lists so that two-way matching could take place.

Toward the end of 2015, the platform further evolved in terms of function, as it became able to store a critical mass of demand and supply information. Now, a curation-based recommendation algorithm has been integrated into it so that demand and supply could be matched by keywords and indicators to help users immediately obtain refined information.

It is too early to place statistical analysis on the impact of KTMS precisely. Simply put, KOTEC's total number of technology transfer intermediation soared from 43 cases in 2013 to 262 cases in 2015. In 2016, it is targeting 400 cases.

If a developing country can replicate this type of platform that has well-expressed demand thanks to experts who understand technology and business in English, I believe there will be a plentiful amount of supply technology information to be matched from all over the world. Europe has the European Enterprise Network, while the ASEAN Economic Community will build something like this eventually around technology cooperation. This trend will work favorably toward countries that are prepared for the economic integration of the Asia-Pacific region early on.

My team and I serve WIPO (World Intellectual Property Organization) Green as advisory board members. We advised WIPO to adopt a demand-driven approach by searching demand first for green technologies, as well as aggregating green technology solutions from all over the world, an initiative which is progressing. WIPO Green gathered demand information from Canada and Kenya recently and is experimenting with targeted matching with KOTEC's team and other partner institutions all over the world.

Training the right intermediaries

When it comes to technology transfer, most experts in many countries are patent lawyers or technology specialists. These are the right people for the purpose of conventional technology transfer practice; gathering patents to secure safety against potential lawsuits from third parties, trolling, or multinational buying and bulk selling technologies in accordance with their strategic roadmap.

If technology intermediation is for smaller ventures to seek a distinguished edge through international transfer, the experts should be the ones who understand both technology and business in a balanced manner. When I worked with Vietnam's State Agency for Technology & Innovation (SATI) to foster technology cooperation among SMEs in Republic of Korea and Viet Nam, I frequently heard their experts saying that Vietnamese firms always emphasize their need for technologies, but few can articulate what they need when asked.

I believe this can be solved when the intermediary can better understand each country's pain-points and communicate them in line with business strategy. An intermediary that is capable of helping entrepreneurs realize what they specifically need and convert the need into the right technology language is also a critical part of the FTI scheme's success.

Conclusion

Policymakers in developing countries attempt to attract FDI from advanced economies with the expectation that they can boost innovation quickly by learning as well as creating jobs and injecting capital.

In the past, initial dependence upon FDI made sense because it was easier for policymakers to periodically plan staged growth from basic industries to higher-value added sectors in an incremental manner. However, the advent of the Internet and mobile technology complicated the policy landscape by making it much harder to design and execute a staged growth plan. Now, policymakers are poised to deal with growth in different dimensions simultaneously.

The good news is that disruptive innovation these days often comes not directly from technology per se, but more from the creative secondary use of such technology

by creating convergence or a disruptive service model. Thanks to the Internet, mobile technology and globalization, technology is getting easier to source from elsewhere.

Smaller ventures that try to serve a market directly rather than being a part of the supply chain for a specific global company are the ones that policymakers have to pay sharp attention to. If they could establish an ecosystem that fosters the flow of advanced innovations from foreign countries to be utilized by the right type of local enterprises and direct collaboration around such innovation, this may help an economy have the desired innovation dynamics.

This paper suggested several key elements such as certifying and incentivizing the right kind of enterprises to do such a task by creating a credible and globally acceptable technology valuation practice, establishing a demand-driven platform that can be connected to global technology supply information, and the cultivation of effective intermediaries who can interpret unarticulated business needs into technology demand.

In every strategy planning, predictability and malleability matter and I hope this paper will give a useful insight to policymakers in targeting the right spot in the complex innovation landscape

References

✓ Carol Newman, John Rand, Theodore Talbot, Finn Tarp (2015). "Technology transfers, foreign investment and productivity spillovers", *European Economic Review*, Vol. 76, pp. 168–187.

✓ Amy Jocelyn Glass and Kamal Saggi et al (2008). "The Role of Foreign Direct Investment in International Technology Transfer", *International Handbook of Development Economics*.

✓ Beata S. Javorcik (2010). "Foreign Direct Investment and International Technology Transfer", *Encyclopedia of Financial Globalization*.

✓ Michael Porter and Victor Millar (1985). "How Information Gives You Competitive Advantage", *Harvard Business Review*, July, pp. 149–174.

✓ Michael Porter (2001). "Strategy and the Internet," *Harvard Business Review*, March, pp. 62–78.

✓ Michael Porter (2014). "How Smart, Connected Products are Transforming Competition", *Harvard Business Review*, November, pp. 66–88.

✓ Clayton M. Christensen and Derek van Bever (2014). "The Capitalist's Dilemma," *Harvard Business Review*, June, pp. 60–68.

✓ IDEA WATCH (2014). "The Real Cost of Patent Trolls", *Harvard Business Review*, November, p. 32.

TECHNOLOGY TRANSFER THROUGH FOREIGN DIRECT INVESTMENT

THE IMPLICATIONS OF IPR PROTECTION IN THE ASIA-PACIFIC REGION

Rozilee Asid and Noor Aini Khalifah

School of Economics Universiti Kebangsaan Malaysia
43600 UKM, Bangi Selangor, Malaysia
E-mails: rozilee@ums.edu.my; khalifah@ukm.edu.my
Web: http://www.ukm.my/fep/; http://www.ums.edu.my/fpep/

Abstract

This article explores the issue of technology transfer focusing on foreign direct investment and the possible relationship with the intellectual property rights (IPRs) policy. The article highlights the issue from the perspective of IPR reform suggested within the WTO-TRIPS agreements. The need to reform the policy is nothing less than to facilitate trade and technology transfer. While greater protection or higher patent protection may increase foreign technology to be adopted in the growth process, the argument that IPRs protection may restrict trade and strengthen the monopoly power from the developed countries remain ambiguous.

Introduction

The Asia-Pacific region is a geographically diverse region stretching from the border of China-Mongolia to the north, to Australia and New Zealand in the south. This region covers the spectrum of climate zones of northern temperature and tropical and sub-tropical in the southern hemisphere. Akin to the diverse geographical region, the economic and socio-economic dimensions are also diverse. The emergence of new economic powers such as China, India, the Republic of Korea, Taiwan province of China and Hong Kong SAR of China have made this region offer one of the biggest technological and consumer goods market in the world. Accordingly, the emergence of these new economic powers has attracted more technology transfer in terms of new investment projects from world class multinational companies compared to other regions in the world.

In this article, we will explore various sources or mode of technology transfer and base our discussion on the role of foreign direct investment as one of the methods to achieve such purpose. We include the role of IPR protection into the discussion. The important role of IPRs protection in luring foreign investment from the developed into the developing countries has become a major topic discussed in a number of important literature. Good IPR policy is perceived to improve innovation and at the same time help to secure the *know-how* from being copied freely by unauthorised person or entity. As the new technology is derived through the creation of the mind originating from the developed region, proper IPR protection to secure the intellectual idea become important and crucial in the developing economies.

In the modern era of trade on new technological products, debate on the adequacy of IPRs protection among the developing countries is one that interests developed countries[1]. The term technology basically refers to a new solution to an existing technical problem. IPR protection is the term commonly used to refer to protection of an idea or innovation under a patent. Accordingly, there are three inter-related elements for an invention to be patented, i.e., (i) novelty (newness), (ii) involve inventive steps and, (iii) industrial applicability (useful in a certain industry in which the patent is targeted to produce or manufacture and market a product).

Technology transfer is considered as one of the crucially needed factors for developing countries to achieve higher growth. A large volume of literature acknowledge the role of foreign direct investment, bilateral trade either import or export of capital and intermediate goods, licensing, national income, infrastructure development and other institutional factors such as IPR to directly affect the transfer of technology.

In this article, we discuss the role played by foreign direct investment as one of the sources of technology transfer and explore this relationship within the setup of IPR protection. There are a number of empirical research in the past offered in the literature exploring this relationship[2] either at the group of developing region for example the Asian region, single country such as China or for a group from emerging economies. Details are discussed in the next section.

[1]Reader are encourage to read articles written by Maskus and Penubarti (1995), Smith (1999, 2001, 2002), Rafiquzaman (2002), Catherine (2004), Awokuse and Yin (2010). One specific debate which is most interesting is on how the stringent of IPRs protection affect the import of China. The author (Awokuse and Yin (2010) argue that, China is the best available real example because according to them, while the stringent of IPRs protection has been improved in the country, the recorded incidence of IPRs infringement and counterfeiting cases are also high. The effect of IPRs protection on bilateral trade are ambiguous in the sense that it may induce the *market power or market expansion* effect as a results of higher IPRs protection offered by the trading partners. The *market power* and *market expansion* effect refer to the penetration level impact on bilateral trade i.e., reduces bilateral trade if the *market power* effect exist and increases otherwise.

IPRs in the Asia-Pacific region: An overview

Intellectual property rights have become a major issue in trade negotiations in GATT (General Agreement on Tariffs and Trade) under the Uruguay Round of 1986-1994. The success of the negotiations is then enforced under the TRIPS[3] agreements, an annex agreement enforced within the establishment of the WTO (World Trade Organisation) in January 1995.

The IPRs consist of several protected components i.e., patent, trademark, industrial design, layout design of integrated circuits, geographical indication (with special protection on product based appellation of origin) and copyrights and related rights[4]. Across all field of IPR protection, patent rights protection has acquired an important role in the new knowledge-based global economy. Patent regime regulates the creation and international transfer of new products and processes and changes in the patent rights protection can have profound effects on global economy efficiency and income distribution between innovating and imitating countries.

The current IPR reform enforced in 1995 negotiated under TRIPS require current and future WTO members to adopt and enforce strong non-discriminatory minimum standards of IPRs protection in each of the protected components mentioned above. The institutional revamp of the IPRs legislation generally do reflect this significance. In contrast to developed nations, developing countries have established a weaker form of IPRs protection favouring technological imitation instead of technological diffusion through innovation. Therefore to promote the idea of stronger IPR protection across the globe, the incentive to improve the efforts to innovate needs to be first secured, because for the developed countries, incentives to innovate is important as a majority of new technology and discovery originate from them[5].

Therefore in order to secure a greater return from innovation efforts, securing the harmonisation of patent systems across the globe is crucial and this translates into one of the negotiated terms in many bilateral, regional and international trade agreements between the North and the South afterwards. Developing countries are less enthusiastic on the negotiated terms at the beginning because for them an increase of IPRs protection may raise the prices and royalties payment of acquiring new technology. However, due to the fact that majority of the developing nations rely on imports of new technology from abroad, such concerns have urged them to adopt the standards[6].

For the past three decades, the nature and linkages between patent rights and international trade has been a source of controversy and debate as to whether stronger patent rights protection promotes or discourages foreign investment or trade. However, as the status of patent protection is seen as a form of trade barrier, it becomes an issue of greater global concern since trade in knowledge-based capital is an important source of innovation for developing nations. The issue now is centered on the need for greater protection. While greater protection or higher patent protection may increase foreign technology to be adopted in the growth process, the argument that IPRs protection may restrict trade and strengthen the monopoly power from the developed countries remain ambiguous. The ambiguity effect on trade, investment and growth as a results of higher IPR protection can be observed in many studies[7]. The ambiguity effect of IPR protection may in some aspect benefits countries in the Asia-Pacific region due to developments in the recent free trade agreements. Recent free trade agreements either bilateral or multilateral with the recent example of the Trans Pacific Partnership (TPP) agreement have put a greater emphasis on the IPRs protection into one of the sections. Across the Asia-Pacific region, the improvement on IPRs policy can be observed in two significant periods, i.e., before and after the establishment of the WTO in 1995[8]. In this review, we refer to the index developed by Ginarte and Park (1997) and Park (2008) (GP&P) which cover the development of patent rights index for 120 plus countries starting in 1960. The index of IPRs protection derived by GP&P provides a comprehensive index of both developed and developing countries derived from five standardised components related to patent protection described in the *patent law* enforced in each country[9].

According to Table 1, with the exception of Australia, Japan and New Zealand, the index of patent rights for the remain-

[2]Readers are welcomed to read the article written by Lee and Mansfield (1996). This article is the first empirical research discussing the role of IPRs protection towards foreign direct investment for 14 developing countries. The author argue that the chosen country may shed some light on the controversial issue of weak IPRs protection. The author uses a random sample of 100 major U.S. firms in six manufacturing industries in 1990 for 14 developing countries. The 14 developing countries are Argentina, Brazil, Chile, Hong Kong, India, Indonesia, Mexico, Nigeria,, Philippines, Singapore, South Korea, Taiwan, Thailand, and Venezuela.

[3]Trade related aspect of intellectual property rights.

[4]Trade secret is also considered as one of the component.

[5]For a comprehensive discussion reader are encourage to read article written by Eaton and Kortum (1996, 2001).

[6]There are many empirical evidence highlighted in the literature on how imported capital from the developed nation benefited developing nations in terms of achieving higher growth and productivity. See discussion from Coe et al. (1997) and Henry et al. (2009). Both articles serve as examples of many other written evidence showing that imported capital generated from advanced countries are perceived as imported R&D and is important in improving growth and productivity.

[7]For example, ambiguity on bilateral trade can be found in a series of studies from Maskus and Penubarti (1995), Smith (1999, 2001, 2002), Rafiquzzaman (2002), Co (2004) and latest by Awokuse and Yin (2010a). Generally, the ambiguity effect of IPRs protection on trade is described as *market power* and *market expansion* effect and these two effects are found to off-set to each other. The ambiguity effect on growth is highlighted by Gould and Gruben (1996, 1997) and Falvey et al. (2006).

[8]In this discussion, we use the IPR index developed by Ginarte and Park (1997) and updated by Park (2008) because the authors adopt changes on IPRs directly from the law governing the IPRs across the globe. The issue of whether a country offer *de jure* or *de facto* protection once the current IPRs law is adopted is not the issue.

Table 1: Selected Asia-Pacific country and level of patent rights index, 1990-2010

Id	Code	Country	1990	1995	2000	2005	2010
1	AUS	Australia	3.28	4.33	4.33	4.33	4.33
2	BGD	Bangladesh	1.30	1.70	1.70	1.70	1.58
3	CHN	China	1.33	2.12	3.09	4.08	4.21
4	FJI	Fiji	2.20	2.20	2.40	2.40	2.40
5	HKG	Hong Kong (China)	2.70	2.90	3.81	3.81	3.81
6	IND	India	1.03	1.23	2.27	3.76	3.76
7	IDN	Indonesia	0.20	1.56	2.47	2.77	2.77
8	JPN	Japan	3.88	4.42	4.67	4.67	4.67
9	KOR	South Korea	3.69	3.89	4.13	4.33	4.33
10	MYS	Malaysia	2.05	2.70	3.03	3.48	3.68
11	NZL	New Zealand	2.37	3.68	3.68	3.68	3.68
12	NPL	Nepal	1.79	1.79	1.79	2.19	2.19
13	PNG	Papua New Guinea	0.00	0.00	2.57	2.77	2.77
14	PHL	Philippines	2.36	2.56	3.68	3.88	3.88
15	SGP	Singapore	2.04	3.88	4.01	4.21	4.21
16	TWN	Taiwan (China)	1.26	3.17	3.29	3.74	4.74
17	THA	Thailand	1.21	2.24	2.37	2.49	3.23
18	VNM	Viet Nam	1.13	2.65	2.65	2.78	3.43

Note: Data adopted from Ginarte and Park (1997) and Park (2008)

ing Asia-Pacific country is recorded low before the reform of global IPR policy in 1995[10]. The lowest patent rights index in 1990 is shown by Indonesia with no protection covered in Papua New Guinea.

The improvement on the IPRs index can be observed in 1995 with the exception for Fiji, Nepal and Papua New Guinea. Taking China for example, the index increased from 1.33 in 1990 to 2.12 in 1995, 3.09 in 2000, 4.08 in 2005 and 4.21 in 2010. The improvement of the index signifies the importance of IPR policy to its economy. China has its own history in the protection of intellectual property rights. China joins as a member of the WTO in late 2001 and as a developing country China's reform on the IPR protection is surprisingly significant to attract investment and trade[11].

As highlighted by Awokuse and Yin (2010b), China received a significant amount of foreign investment as a result of harmonising the IPR policy. The authors (Awokuse and Yin, 2010a) also highlight the effective role of China's IPRs in explaining bilateral trade activity. These two channels are only examples among many other factors on how IPR policy may improve or speed-up the process to attract transfer of technology into the developing countries and China is one of the many of the 'real' examples in this respect.

The amended IPRs policy at the international level as enforced in TRIPS is to make the policy more aligned with the standards of developed countries. As highlighted by Co (2004), the agreement will balance two conflicting but legitimate concerns, i.e., the advocates of the agreement (i.e., the developed nations) and the opponents. The supporters concern is that the issue of knowledge creation incentives can only be realised if strong IPR regimes are in place. However those who oppose it are concerned with the speed by which knowledge can be disseminated given strict IPR regimes i.e., a concern over the technology gap. Since developing nations have limited capabilities in closing the (technology) gap, increases in the transfer of technology into the economy perhaps can be done by strengthening the IPR policy. Empirical evidences have highlighted on how the adoption of up-to-date technology positively affects output, productivity, investment and trade.

How IPRs protection relate to technology transfer?

One may ask how IPR protection relates to the transfer of technology into the developing countries and how IPR protection may speed-up the process of such transfer? The relationship between IPR protection and technology transfer is generally known to be positive, i.e., IPR protection will trigger the research and development sector before it fires-up the growth process. The IPRs protection may improve innovation efforts, investment climate and bilateral trade which lay a foundation for a supportive environment on transfer of technology. However, the controversies of stringent IPRs protection may provide the explanation of why *optimal* form of IPR protection is indeed crucial. The issue of *optimal* level of IPR protection is one of the many elements brought in to be implemented within the ambit of the WTO.

A lack of IPRs protection among the developing nations is one that developed nations have great concern. There are a number of articles that discussed this issue in the past. The alarming level of weak protection of IPR and highest level of imitation among the developing countries has called for this reform. The developed countries fight for the IPRs protection reform by proposing and imposing the *standard minimum protection of IPRs* among the signatory members is simply or clearly understood. It has been

[9]There are other studies that measure the IPRs index, see Rapp and Rozek (1990).

[10]Table 1 only cover 18 countries in the region. This is due to unavailable and unobserved patent rights index data. We include the patent rights index beginning in 1990 and this is sufficient to show the discrepancies of patent rights protection before the implementation of TRIPS in 1995.

[11]China has its first patent law in 1985 and has undergone a gradual reform with substantial revision in 1992 and 2000.

argued that a lack of protection on IPRs may delay the development, trade and investment process if developing countries opt for the weak form of its IPR policy. The reason why developed nations ask for the reform is simply related to the request and concern of their multinational corporations. The willingness of big technology players or providers to serve their affiliates in the developing nations depend on the level of the IPR protection provided by the host country Smith (2001).

The role of IPR protection on technology transfer is found to be ambiguous in developing countries as discussed in various theoretical and empirical research on trade and growth. The ambiguity of IPR protection on foreign direct investment is related to the theoretical relationship of IPR protection on protecting technical knowledge or know-how. Without proper protection of IPRs, the process of creating new knowledge or technical know-how may be in jeopardy.

Various empirical studies document this issue in the past. The first empirical study was written by Lee and Mansfield (1996) which finds that IPR protection strength plays a positive role in attracting FDI from the developed countries. The authors investigate the relationship between a developing country's system of IPR and the volume and composition of U.S FDI. The author gathered the information from 300 U.S major listed firms but only managed to compile a random sample of 100 firms regarding the perceptions of how IPR protection in various developing countries might affect their FDI decision into six industries, i.e., chemical, transport equipment, electrical equipment, food, metal and machinery[12]. Only 14 developing countries are reported in their analysis, i.e., Argentina, Brazil, Chile, Hong Kong (China), India, Indonesia, Mexico, Nigeria, Philippines, Singapore, Republic of Korea, Taiwan province of China, Thailand and Venezuela. The authors choose these countries because of their market size and importance in connection with controversies over IPR protection over the past decades.

The controversy of IPR protection and level of imitation activity is also a subject of discussion in an article written by Awokuse and Yin (2010b) when they wrote about the role of IPR protection and foreign investment in China. Awokuse and Yin (2010b) argue that, China is one of the best 'real' examples of this aspect because over the past two decades, China has emerged as one of the biggest recipients of foreign investment among the developing countries and the most popular destination for multinational firms in the world, second after the U.S. Additionally, foreign investment flow into China is highest compared to the entire African continent and just behind all Latin America combined.

The uniqueness of China is that, while China has significant policy reform of their IPR laws since 1992 (the improvement can be seen from Table 1), China also holds the reputation of having strong imitation capability. The finding from Awokuse and Yin (2010b) shows that the strengthening of IPR protection in China has a positive and significant effect in attracting foreign investment. They added that, while other factors such as market size, regional integration, transportation and trade cost are important, the role of IPR to promote technology transfer into China's economy is undeniably significant.

Conclusion

The article explores the connection of IPRs protection to transfer of technology. While technology transfer may be triggered by factors on the international demand side and supportive domestic institutional factors, the effective role of IPRs protection is no doubt significant, as in the case of China. Technology transfer has been and will continue to be one of the main mechanisms to advance the industrialisation process. As for the case of the Asia-Pacific region, the implementation of stringent IPRs policy need to be balanced with other supportive factors. While many empirical studies indicate that IPRs protection has a positive effect on host country's foreign investment inflows, other factors such as economic performance, level of own research and development (R&D), degree of openness (or trade liberalisation) and country risk are also important factors in mediating transfer of technology.

References

✓Awokuse, T. O. and Yin, H. (2010a). Does stronger intellectual property rights protection induce more bilateral trade? evidence from China's imports. *World Development,* Vol. 38, No.8, pp. 1094–1104.

✓Awokuse, T. O. and Yin, H. (2010b). Intellectual property rights protection and the surge in FDI in China. *Journal of Comparative Economics,* Vol. 38, No.2, pp. 217–224.

✓Co, C. Y. (2004). Do patent rights regimes matter? *Review of International Economics.* Vol. 12, No. 3, pp. 359–373.

✓Coe, D. T., Helpman, E., and Hoffmaister, A. W. (1997). North-south R&D spillovers. *The Economic Journal*, Vol. 107 No. 440, pp. 134–149.

✓Eaton, J. and Kortum, S. (1996). Trade in ideas patenting and productivity in the oecd. *Journal of International Economics,* Vol. 40, No. 3-4, pp. 251–278. Symposium on Growth and International Trade: Empirical Studies.

✓Eaton, J. and Kortum, S. (2001). Trade in capital goods. *European Economic Review*, Vol. 45, No. 7, pp. 1195–1235. International Seminar on Macroeconomics.

✓Falvey, R., Foster, N., and Greenaway, D. (2006). Intellectual property rights and economic growth. *Review of Development Economics*, Vol. 10, No. 4, pp. 700–719.

[12]Lee and Mansfield (1996) asked three questions related to the perception regarding transfer of technology into their own subsidiary, possibility of transferring technology through joint venture or transfer of technology through licensing if the country in question has weak IPRs protection to allow them to transfer their technology. Based on their results, there is a consistent proposition that a country's system of IPRs protection influences the volume and composition of U.S. FDI.

✓Ginarte, J. C. and Park, W. G. (1997). Determinants of patent rights: A cross-national study. *Research Policy*, Vol. 26, No. 3, pp. 283–301.

✓Gould, D. M. and Gruben, W. C. (1996). The role of intellectual property rights in economic growth. *Journal of Development Economics*, Vol. 48, No. 2, pp. 323–350.

✓Gould, D. M. and Gruben, W. C. (1997). The role of intellectual property rights in economic growth. In *Dynamics of Globalization and Development*, pp. 209–241. Springer.

✓Henry, M., Kneller, R., and Milner, C. (2009). Trade, technology transfer and national efficiency in developing countries. *European Economic Review*, Vol. 53, No. 2, pp. 237–254.

✓Lee, J.-Y. and Mansfield, E. (1996). Intellectual property protection and U.S. foreign direct investment. *The Review of Economics and Statistics*, Vol. 78, No. 2, pp. 181–186.

✓Maskus, K. E. and Penubarti, M. (1995). How trade-related are intellectual property rights? *Journal of International Economics*, Vol. 39, No. 3-4, pp. 227–248.

✓Park, W. G. (2008). International patent protection: 1960-2005. *Research Policy*, Vol. 37, No. 4, pp. 761–766.

✓Rafiquzzaman, M. (2002). The impact of patent rights on international trade: Evidence from canada. *The Canadian Journal of Economics / Revue canadienne d'Economique*, Vol. 35, No. 2, pp. 307–330.

✓Rapp, R. T. and Rozek, R. P. (1990). Benefits and costs of intellectual property protection in developing countries. *Journal of World Trade*, Vol. 24, No. 5, pp. 75–102.

✓Smith, P. J. (1999). Are weak patent rights a barrier to U.S. exports? *Journal of Inter-national Economics*, Vol. 48, No. 1, pp. 151–177.

✓Smith, P. J. (2001). How do foreign patent rights affect U.S. exports, affiliate sales, and licenses? *Journal of International Economics*, Vol. 55, No. 2, pp. 411–439.

✓Smith, P. J. (2002). Patent rights and trade: analysis of biological products, medicinals and botanicals, and pharmaceuticals. *American Journal of Agricultural Economics*, Vol. 84, No. 2, pp. 495–512.

World Intellectual Property Report 2015: Breakthrough Innovation and Economic Growth

The WIPO report underlines the elements of successful innovation ecosystems: government funding for scientific research and support in moving promising technology from the laboratory to the production stage; competitive market forces that encourage firms to innovate, supported by vibrant financial markets and sound regulation; and fluid linkages between public and private innovation actors. The report also documents how innovation is increasingly linked to research at universities and public research organizations. The 3D printing, nanotechnology, and robotics fields show higher shares of academic patenting compared to the three historical cases of airplanes, antibiotics and semiconductors. Nanotechnology stands out, with academic applicants accounting for around a quarter of patenting worldwide.

The case studies document how innovation flourished as a result of knowledge sharing mechanisms – from the first clubs of amateur airplane inventors to modern open innovation models found in 3D printing and robotics research. The patent mappings carried out for the six case studies show that innovators have overwhelmingly sought patent protection for their inventions in high-income countries plus China, reflecting the large size of these countries' markets, as well as the presence of competitors with frontier technological capabilities.

The World Intellectual Property Report is published every two years, with each edition focusing on specific trends in an area of IP. Previous reports have explored the role that brands play in a global marketplace and the changing face of innovation.

For more information, contact:

Media Relations Section
World Intellectual Property Organization
Tel: (+41 22) - 338 81 61 / 338 72 24
Fax: (+41 22) - 338 81 40
Web: http://www.wipo.int

The role of FDI in fostering growth in the automobile sector in India

Saon Ray
Senior Fellow
Smita Miglani
Research Associate
Indian Council for Research on International Economic Relations (ICRIER)
Core 6A, 4th Floor
India Habitat Centre
Lodi Road, New Delhi – 110003, India
Tel: 91 (11) 43112400, 43112406 (D), 43112427 (D)
Fax: 91 (11) 24620180
E-mails: sray@icrier.res.in, smiglani@icrier.res.in

Abstract

This article examines the automobile industry in India and argues that FDI played a significant role in fostering growth of this industry. Two major waves of FDI occurred in this industry in the years 1983 and 1993. The impact of FDI in the auto industry is examined in terms of output, productivity, technology transfer, exports, R&D and spillovers. Through the three cases of Maruti-Suzuki, Hyundai and General Motors in the passenger car segment, the evolution of the firms in the country is examined. The role of FDI seen in the context of each of these firms will help in understanding how FDI has worked in the country.

Introduction

India's automobile industry is an important cog in the country's growth process. Automobile industry accounts for 7% of GDP, 4% of exports as well as foreign direct investment (FDI) inflows. The cumulative FDI to this sector between 2009 and 2013 was US$ 5.5 billion. This industry employs 2.2 million people directly and 17 million indirectly (Klink et al., 2014).

India's indigenous passenger car industry was launched in the 1940s with the establishment of Hindustan Motors (HM) and Premier Automobiles Limited (PAL). However, the industry saw a very slow paced growth from the 1940s till 1980s. In 1983, the government permitted Suzuki to enter the country in a joint venture with Maruti Suzuki, a state owned enterprise. Till that time, the auto sector in India was protected by high import tariffs and production catered to the demands of local automobile manufacturers. As part of the broader move to liberalise the economy, India opened up the sector to (FDI) in the 1990s and also progressively relaxed import barriers (McKinsey, 2006).

There is a vast literature examining the effect of FDI on a host economy [e.g. Caves (1974), Lipsey (1998)]. One of the major questions that this literature deals with is: What are the roles that FDI plays in development of economies? The socio economic impact of FDI on a given host economy has been examined through wealth creation, economic development, economic growth, improvement in standard of living, improvement in productivity and supply chain benefits in case of sectors like telecommunications and banking. The main conclusion that can be drawn from the literature is that while there are many benefits of FDI, certain preconditions seem necessary in host countries to enable them to reap the benefits. These preconditions range from infrastructure, to environment which includes the nature of human capital, domestic fixed capital formation, government spending, trade orientation of the region, and the legal environment. In the case of innovation, public infrastructure such as educational institutions and publicly funded R&D also add to the absorptive capacity.

This article examines the case of the Indian automobile industry through three cases in the passenger car segment and argues that FDI played a significant role in fostering growth of this industry. In this article we examine which of these channels of FDI worked in India's case and why?

The article is organized in the following way: the next section examines the automobile industry in India, starting from the beginning, followed by the two major waves of FDI in 1983 and 1993, upto the present. The second section examines the impact of FDI in the auto industry in terms of output, productivity, technology transfer and spillovers. The third section examines the three cases of Maruti-Suzuki, General Motors and Hyundai and discusses how that has shaped the evolution of the firms in the country. The fourth section discusses the technology requirements of the sector in future. Policy implications and conclusions are drawn in the final section.

The automobile industry in India

From a modest beginning in 1940s, India's automobile industry has grown considerably. Details are given in Table 1. All the automobile segments have witnessed double-digit cumulative average growth rate (CAGR) in the past decade, and the most has been in passenger vehicles/cars category. This segment has also been a major recipient of FDI inflows in the automobile industry for past few years.

In the passenger car segment, the market share of the various companies is shown in Table 2.

Table 3 shows the major components in systems in passenger cars.

Box 1 shows some of the processes involved in assembling a car.

FDI in auto assembly was allowed in two major waves: in 1983 and in 1993.

Table1: Automobile domestic sales trends (number of vehicles)

Category	1995-96	2000-01	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Passenger vehicles	4,49,6 00	7,17,6 72	15,52,703	19,51,333	25,01,542	26,29,839	26,65,015	25,03,685
Commercial vehicles	2,15,6 38	1,50,3 55	3,84,194	5,32,721	6,84,905	8,09,499	7,93,211	6,32,738
Three wheelers	1,77,0 55	1,98,1 62	3,49,727	4,40,392	5,26,024	5,13,281	5,38,290	4,79,634
Two wheelers	26,58,288	37,45,516	74,37,619	93,70,951	1,17,68,910	1,34,09,150	1,37,97,185	1,48,05,481
Grand total	35,00,581	4,811705	97,24,243	1,22,95,397	1,54,81,381	1,73,61,769	1,77,93,701	1,84,21,538

Table 2: Sales, the market share and models of the passenger car segment

Company	Sales (units)in FY14	Market share (%)	Models
Maruti Suzuki India Ltd.	1155041	37	**Alto** (8), **Swift** (6), Dzire (6), **Wagon R** (5), Omni (2), Ertiga (2), Eeco (1), **Ritz** (1), **M800** (1), **Celerio** (1), **Estilo**, **A-Star**, Sx4, Gypsy
Hyundai Motors India Ltd.	613513	20	**EON** (3), **i10 Grand** (2), **i10** (2), **i20** (2), Verna (1), **Santro** (1), Elantra, Xcent
Mahindra and Mahindra Ltd.	261029	8	Bolero (3), Scorpio (2), XUV500 (1), Xylo (1), Maxximo Max, Quanto, Verito, **Vibe** Rexton (SsangYong)
Tata Motors	205793	7	Innova (2), **Indica** (2), Indigo (1), **Nano** (1), Sumo (1), Safari, Venture
Toyota Kirloskar Ltd.	156087	5	Etios (1), **Liva** (1), Fortuner (1), Corrolla
Honda Siel Cars India Ltd.	139393	5	Amaze (3), Honda City (1), **Brio** (1), CR-V
Nissan Motor India Ltd.		5	Terrano, **Micra**, Sunny, Datsun Go
Ford India Ltd.	132534	4	Ecosport (1), Figo (1), **Fiesta**
Volkswagen	85116	3	**Polo** (1), Vento (1), Jetta
General Motors India Ltd.	80894	3	**Beat** (1), Sail (1), Enjoy (1), Tavera, **Spark**, Cruze
Renault	69131	2	Duster (2), Scala, **Pulse**
Skoda India Auto Pvt. Ltd.	19483	1	Rapid, Laura, **Fabia**, Superb
Fiat India Ltd.	12030	0	**Grande Punte**, Linea
Hindustan Motors	3759	0	Ambassador
Force Motors Ltd.	3493	0	Force Gurkha, Force One
Mitsubishi			Pajero
Total (Domestic + Exports)	3092783		

Source: Authors' compilation based on Edelweiss (2014)

Note: Figure in parentheses in column 4 indicate share of the model in FY14 which has been computed using data for each of the models from Edelweiss (2014). For others the share is less than 1%. Car models marked in bold are small cars, the share of which in the total was 40%. The definition of small cars varies considerably – In India, size of the car is based on the length (SIAM). Cars in this table have been classified as small if they are in the mini and compact category.

Both waves were market seeking – India with two million households that could afford cars was seen as a large and untapped country. In the period 1983-1993, restricted FDI investment occurred in the country. Although there was no formal requirement, most original equipment manufacturers (OEMs) chose to enter the country with a local partner. Suzuki was allowed to enter the country as a minority stakeholder in the government and an investment of US$ 260 million (McKinsey, 2006).

In 1993, the sector was opened to global companies and approximately US$1.6 billion was invested by OEMs till 2000. Despite the 1993 liberalization, the sector was highly regulated and required MNCs to achieve localization within a specific time period among other things.

In the period 1947-1983, the output growth remained limited. The models of cars sold were unchanged for decades and foreign models assembled in the country were primarily European. The number of models manufactured in the passenger car segment was two in 1982-83, this rose to eight in 1994-95 and 28 in 2001-02. Overall, the impact of FDI in the auto industry in India has to be seen in terms

of technology, capital and the managerial practices introduced, all of which could make the industry more competitive.

Output

The impact of FDI has been very positive in terms of output and productivity growth. Output by volume grew at 13% annually in 1983-1993, and 15% in 1993-2000. Currently, India's car penetration is lower compared with other global markets as only 14 people per 1000 persons own a passenger car (compared to 35 in Thailand, 60 in China etc. and over 450 in developed countries). By 2021, it is expected that production in the passenger car segment will reach 10 million units from the current 3 million units.

Productivity

Since FDI is widely believed to be a catalyst that promotes economic development and many countries compete to attract FDI, it becomes important for the policy makers in the country to understand this effect of FDI on productivity. Haddad and Harrison (1993) found that foreign firms exhibit higher levels of total factor productivity (TFP) but their rate of TFP growth was *lower* than that of domestic firms. As the authors note, while there was a *level effect* of foreign investment on the TFP of domestic firms, such an effect was missing for the growth rate of TFP of domestic firms. Studies such as these using micro data have not reached conclusive results that may be valid across countries.

In the case of the Indian auto industry, labour productivity has grown at an annual rate of 20% since 1983. This was partly achieved due to the exit of PAL, a low productivity producer and due to the productivity improvements in HM and Maruti-Suzuki.

Capital

In the two waves of FDI that occurred in the automobile sector in 1983 and 1993, significant amount of FDI flowed into the country. Maruti Suzuki's investment has been discussed before (and was chosen due to its willingness to invest capital). In 1994, Daewoo began production with an investment of US$ 1.3 million. Similarly, General Motors (GM) re-entered with an investment of US$ 223 million and Daimler Chrysler began with an investment of US$ 54 million. In 1995, Honda began with an investment of US$ 120 million, while Hyundai invested US$ 456 million in 1996. Fiat invested US$455 million in 1997 and Ford invested US$ 433 million in 1999. Hence FDI brought in sufficient capital to build modern plants.

Table 3: Major components in system in passenger cars

System	Major components in system
Body-in-white	Passenger compartment frame, cross and side beams roof structure, front-end structure, floor structure, panels
Powertrain	Engine, transmission, exhaust system, fuel tank
Chassis	Chassis, suspension, tires, wheels, steering, brakes
Interior	Seats, instrument panel, insulation, trim, airbags
Closure	Front and rear doors, hood, lift gate
Miscellaneous	Electrical, lighting, thermal, windows, glazing

Source: Edelweiss (2014)

Technology

The literature provides two competing arguments on the effect of FDI on the innovation in an economy (Saggi, 2002). One line of reasoning suggests that inward FDI leads to beneficial outcomes for local firms through knowledge spillovers and increased incentives to compete with the better-endowed foreign entrants. The other line of reasoning casts doubt on the ability of FDI to increase the level of innovation among local firms in the economy, suggesting that the increased competition that arises from the entry of new foreign firms relegates the domestic firms to less innovative market niches. Studies that have examined the impact of FDI on economic growth and absorption capacity of the host country have listed four channels that allow for technological spillovers from FDI to the host country. These are: (1) Transmission of technology through imitation, subject to the legal system, regulations, infrastructure and human capital endowments; (2) Positive spillovers generated through the training of local workers by foreign-owned companies; (3) Increased competition due to the presence of foreign firms, subject to the size of the technology gap between the foreign owned and domestic company, as well as the ease of entry into, and exit from the market; and (4) Vertical or backward spillovers resulting from the increased demand for intermediate goods manufactured by foreign owned companies by domestic companies in the host nation.

In case of the Indian automobile sector, significant infusion of global technology occurred (Tiwari and Herstatt, 2014). The first 192 cars to roll out of the Maruti Suzuki factory in December 1983 were almost entirely Japanese cars, with only tyres and batteries sourced from MRF and Chloride India respectively. This was possible due to the use of imported semi knocked down (SKD) kits, and indigenization was 2.76% and went up to 10% in 1984. However, Maruti Suzuki was committed to 95% indigenization in five years. This was achieved through the policy adopted by Maruti Suzuki towards its vendors which included introduction of a vendor rating system, payment to vendors within 15 days, and entering into JVs with vendors to ensure quality and stability. Maruti Suzuki had imported some SKD kits which were displayed in its premises. The components were divided into two groups, one, where vendors had the manufacturing capability (e.g. tyres, shock absorbers and bulbs). The other group was where the technology would be required and in many of these components Maruti Suzuki helped the vendor find the right collaborator. Localization was facilitated by 40 joint ventures (JVs) which were entered into by Indian vendors and Japanese collaborators (Bhargava, and Seetha, 2010).

Box 1: Major processes in the assembly of a car

High pressure die casting

This facility produces the cylinder block. Aluminium ingots are loaded into furnaces and melted. These furnaces are capable of melting 800kg of aluminium an hour and are unique as they combine both the melt and holding furnace. The dies are then forced together, at which point molten aluminium is poured into the shot cylinder and fired into the dies at around 2.7m/sec. Once casting is complete, the dies open and the cylinder block is transferred to the inspection platform before being passed to Machining.

Low pressure die casting

This is where cylinder heads are produced. The process starts with aluminium ingots being loaded into a furnace where they are melted. The molten aluminium is then fed into the base of a die using low pressure air. The dies are used in conjunction with sand core inserts, which make it possible to cast the complicated internal shapes within the cylinder head that could not be produced using dies alone. Once the cylinder heads are cooled, sand cores are removed and cylinder heads are transferred to a Heat Treatment process to harden. Once complete, the cylinder heads are deburred and inspected prior to being transferred to Machining.

Machining and tooling

Machining

Here the block and head cast components undergo various cutting, milling, drilling, boring, honing and reaming operations. The layout of the Machining Lines is extremely compact, with Computer Numerically Controlled (CNC) machines achieving consistent high-precision results. Although the machines have a number of automatic test features, associates still carry out manual checks at every stage to ensure a consistent level of quality is maintained.

Tooling

Associates maintain and control all the specialist cutting tools used within both head and block machining.

Engine assembly

This is where the machined engine blocks, cylinder heads and clutch and transmission cases meet with the other engine components for the final engine assembly process. First the engine blocks, clutch and cylinder heads are sub-assembled on separate lines. At this stage the pistons, crankshafts, con rods and oil pan are installed into the block and the springs and valves are built into the cylinder heads. Once the sub-assembly process is complete, modules are joined together to form the complete engine. The engine then undergoes a series of in-built process tests before being transferred by overhead conveyor to the Engine Control Centre. This houses a High Speed Server with a fully automated engine storage and retrieval facility.

There were 50 Greenfield investment projects in the automobile sector between 2000 and 2007. Maruti Suzuki paid US$ 397.7 million for royalty in 2010. Accounting for sourcing of raw materials, components and capital goods, the expenditure in terms of foreign exchange paid was US$ 1.3 billion in FY 2010-11 (Tiwari and Herstatt, 2014).

Overall, several studies have cast doubt on the view that FDI generates positive spillovers for local firms. But such findings need not imply that host countries have nothing significant to gain (or must lose) from FDI. The point is that reallocation of resources that accompanies the entry of foreign firms may not be immediate. Resources released in this process will be put to better use by either foreign firms with superior technologies, or efficient new entrants (both domestic and foreign), or by other sectors of the economy. Previous studies analyzing the inflow of FDI into a country are unanimous in that positive spillovers in the host country will occur if there is an environment conducive to the inflow of FDI. These conditions refer to an environment that is adequate in providing human capital, private and public infrastructure, legal protection, and public infrastructure such as educational institutions and publicly funded R&D. This research also discusses the host country factors that are likely to attract export oriented FDI, which involves fragmenting the production process geographically by different stages. The important location factors that are thought to influence this type of FDI are labor costs, infrastructure, trade barriers, exchange restriction and policies favorable to FDI.

The most prominent spillover impact of FDI in India's auto sector has been on the components industry, which more than tripled from 1992-93 to 2001-02. Productivity of the supplier industry increased significantly with FDI. This occurred in two ways: FDI-OEMs co-located suppliers and transferred best practices and FDI-OEMs required their home country suppliers to make FDI investments in India.

R&D

FDI has been a key source of rising R&D investments in developing countries (UNCTAD, 2005). The level of formal R&D

has been low in India's automobile industry. Bhattacharya *et al.* (2005) found that of the total 536 patents granted by US Patent Office to Indian inventors between 1998 and 2002, only four belonged to the motor vehicle category. In 2010, 28 of the 46 members of Society of Indian Automobile Manufacturers (SIAM) were engaged in R&D. In the passenger vehicle segment, 13 of the 20 had had registered R&D activity in India. Cumulative R&D expenditure of the automobile sector was approximately US$ 780 million in 2010-11, with an increase of 27.5% on year on year basis for the 4 wheeler segment (SIAM, 2012). The four wheeler segment accounts for 90% and engine manufacturers contribute 2% to the total R&D in the automobile segment (Tiwari and Herstatt, 2014). There has been a slight increase in the share of R&D done by auto components manufacturers in 2013 over 2003, though more than 50% of the patents filed were by Tier I suppliers.

Exports

The export of passenger cars in value terms increased from US$ 93.7 million to US$ 5.5 billion from 1999-2000 and 2010-11. The share of automobiles in India's merchandise trade increased from 0.25% to 2.2% over the same period (Tiwari and Herstatt, 2014). The major exporters in 2010-11 were Hyundai, Maruti Suzuki and Nissan and small cars formed the bulk of the exported passenger cars. Within the small cars, hatchbacks (A2 or compact) were the dominant export items.

Imports

As firms go through various stages of localization, the import dependence may come down. Prior to 2008, power train components like engine pistons, injectors as well as transmission drives and body components used to be imported. Also items such as glass mirrors, tyres, aluminium bars and electronic components were imported. Currently, galvanized and coated steel, engine component systems, gear boxes and vehicular knock-downs are imported. With improvements in casting capabilities, localized portion of an engine block may also be produced in India. Table 4 shows the various components imported by Indian OEMs.

Table 4: Components imported

Company	Current import content
Maruti Suzuki India Ltd.	Hot rolled/ Cold rolled coils, Galvanized and coated steel and Automotive components
Hyundai Motors India Ltd.	Gear boxes, Engines, Electronic automotive regulator
Tata Motors	Iron and steel
Toyota	Engines, Diesel engines, Gear boxes, other articles of Iron and Steel, Spark Ignition reciprocating or rotary internal combustion piston engines
Nissan Motor India Ltd.	Gear boxes, Engines, Electronic Automatic regulator
Honda Siel Cars India Ltd.	Compression ignition internal combustion piston engines, other Auto components, Automatic regulating or controlling instruments
Volkswagen	Hot rolled/ Cold rolled coils, Galvanized and coated steel and Automotive components
General Motors India Ltd.	Steel sheets and other Auto components

Source: Edelweiss (2014)

Till 2011, component vendors to Maruti Suzuki imported steel and machine tools, and dies from Japan. The firm's import content as a percentage of sales has come down from 23% in 2002 to 6% in 2014 (while its sales volume has increased approximately 2.75 times in this period). Maruti Suzuki's localization strategy involves asking its vendors to use more local materials like steel alloy, emphasis on using local machine tools and components and dies are being designed in India, wherever possible.

Three cases: Maruti Suzuki *versus* Hyundai and General Motors

Maruti Suzuki India Limited (MSIL) is the leader in the passenger car segment. As seen from Table 2, the share of MSIL was 37% in the fiscal year 2014. As discussed, Maruti Suzuki was set up as a joint venture between the Government of India and Suzuki Motor Corporation, with the government holding a majority stake of 74%. Maruti Suzuki has been instrumental in bringing in fresh technology (Narayanan, 1998). Suzuki has created significant R&D capacities in India, both through in-house R&D and also in active cooperation with its component suppliers. The small car for India as well as for global markets were designed and manufactured in India (Bhargava, 2010).

Hyundai Motor India Limited (HMIL) is a subsidiary of Republic of Korea's Hyundai Motor Company (HMC). Hyundai, in the early 1990s sought to globalize its production and selected India (along with China, Malaysia and Turkey) as a centre for diversification. HMC was the first foreign car manufacturer, which was allowed to establish a wholly owned subsidiary in India. HMIL was incorporated in 1996 and it commissioned its first manufacturing plant in 1998. HMIL has achieved the number two slot, behind Maruti Suzuki as seen also in Table 2. HMIL is one of the largest FDI projects in India in the automobile industry (SIAM, 2012). HMIL established a state-of-the art R&D facility, Hyundai Motor India Engineering Private Limited (HMEI) as a subsidiary of HMIL with an investment of US$ 3.18 million in 2009.

GM started its business in India in 1928, assembling Chevrolet cars, trucks and buses but ceased its operations in 1954. In 1994, General Motors India Private Limited (GMIPL) was formed as a 50-50 JV between Hindustan Motors and GM and in 1999, GM bought out the Hindustan Motors interest. In 2003, GMIPL started production of its Chevrolet vehicles from its Halol facility and opened a technical centre in Bangalore. This was for R&D and vehicle engineering activities and vehicle engine and transmission design and engineering activities and

a vehicle design studio were started in 2007. It has mainly specialized in production and assembly of premium and mid-size cars in India as compared to Maruti Suzuki and Hyundai Motors which have largely focused their resources on the small car segment.

Table 5 presents certain facts about the three firms.

As the Table 5 indicates, MSIL, HMIL and GMIPL have followed different paths to reach their current position. MSIL is still the undisputed market leader though HMIL is giving it a fair competition. GMIPL has had a chequered past, but has plans to make India an export hub for global markets. The company exported 984 units in 2014 to Chile and had an export target of 19,000 units in 2015.

Technology requirement going forward

In India, sales of auto components are dominated by power train. Indian vehicles currently lag their global counterparts in terms of power train technology, safety and infotainmnet content (visual safety indicators, electronic stability control, anti- lock brake system, front and side air-bags, snooze alert with hepatitic vibration of steering wheels, driving assist mirror indicators etc). Reducing the weight of a vehicle can help curb emissions and automobile design and use of certain materials/metals can help reducing the 'Curb' weight of a vehicle without compromising its size and performance attributes.

Increasing government stipulations have given rise to developments regarding emissions norms and vehicular safety. The emission regulatory programme in India is modeled on the European emission systems and Bharat Stage (BS) regulation lag Euro emission standards by 10 years. India has a two tier emission norm system with a phase in top 13 cities and a lagged phase for the rest of the nation. The country is expected to Bharat Stage IV emission norms by 2017. This will entail introduction of technology such as common rail system (CRDi) which has higher pressure fuel injection pump and higher pressure (piezzo) nozzle and injectors. Some of the advancement in technology has already occurred through the implementation of the BS emission norms: these include introduction of fuel injection through engine control unit (ECU), Exhaust Gas Recirculation (EGR), oxygen sensor and catalytic convertor. Going forward, ECU might be replaced with On Board Diagnostics (OBD), heated Oxygen sensor for cold start. Gasoline (petrol) engines are less complex than diesel ones and as commercialized share of gasoline direct injection (GDi) increases, the gap in fuel efficiency between diesel and gasoline will reduce (Edelweiss, 2014).

Automobile safety systems can be segregated into active safety systems and passive safety systems. Active safety systems include systems for collision avoidance such as blind spot detection and driver warning indicators as well as vehicle stability systems such as anti-lock braking systems (ABS) and electronic sta-

Table 5: Comparison of MSIL, HMIL and GMIPL in India

	Maruti Suzuki India Limited	Hyundai Motor India Limited	General Motors India Private Limited
Sales (FY14)	1155041	613513	80894
Capacity utilization	Around 80%	Around 80% or more	Around 25%
Average localization share	More than 90%	Upto 90% for volume models	50-60%
Market share	Around 37%	15%	1%
Sourcing strategy	Electronic control module and transmission parts	Electronic parts are imported	Critical components like air bags, ABS controllers/modules, engine controllers, certain relays and switches, electronic modules
Exports	Began in 1987; Exports cars to over 125 countries; 1,20,388 units	Began in 1999; 2,59,811 units	Began in 2014; 2,011 units
Number of models			
R&D (recent)	Yes Moving to 'vehicle design and development' stage from just 'vehicle customisation and manufacturing'	Yes; India is hub for small car R&D; Being upgraded from customisation clinic to a full product development centre	Yes
Employment	12,500	9,500	4,000

Source: Authors' compilation based on industry sources

Notes: (a) Figures pertain to FY 2014-15
(b) The localization percentage varies from model to model, according to cost advantage and flexibility in manufacturing schedules.
(c) Employment figures are approximate

bility control (ESC) systems. Passive driving safety systems protect the driver and the passenger from injury in case of an accident and include seat belts, airbags, whiplash protector etc. Globally, passive safety systems contribute to a larger proportion of the overall global auto safety systems industry since ABS is mandatory in most developed markets and ESC is progressively being made mandatory. In India, making airbags mandatory for all passenger vehicles has been proposed by 2017 by the technical standing committee of the Ministry of Shipping, Road and Transport Highways (Edelweiss, 2014).

Other technologies which are being developed for commercialization in future include automatic manual transmission systems, and other systems for hybrid and electric cars.

Conclusion

India is expected to become the third largest car market in the world by 2025 with 7.4 million vehicles (Goldman Sachs, 2015). FDI has played a crucial role in the growth of this sector in India till now. It will be interesting to see how it plays out in the coming years in light of the factors and trends discussed in this paper. The industry is continually innovating itself to the changing requirements and markets. The automobile are progressing to production of commercial vehicles as the next stage for various reasons. It will be interesting to see whether and to what extent India plays the role of a hub in the passenger vehicle segment.

As part of efforts to reduce emission output, auto makers are working to make their internal combustion engines more efficient and also use lighter and stronger materials such as aluminum and high tensile steel. More R&D will be needed in future to achieve this. The Government and the industry must ensure that FDI transfers result in win-win situations in terms of as many parameters and all stakeholders concerned.

References

✓Caves, R. 1974. "Multinational Firms, Competition, and Productivity in Host-Country Markets." *Economica,* Vol. 41, No. 162, pp. 176–93.

✓Bhargava, R.C. and Seetha, (2010) *The Maruti Story*, Collins Business, New Delhi.

✓Bhattacharya, S., Garg, K. C., Sharma, S. C., Dutt, B., Gupta, R. K., & Das, P., (2005). *Indian patenting activity in international and domestic patent system: Contemporary scenario*. (New Delhi, National Institute of Science, Technology and Development Studies).

✓Edelweiss (2014), *Auto Components: The Future "Mega Trends, Mega Factors"*. Edel Invest Research.

✓Haddad, M. and A. Harrison (1993). "Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco", *Journal of Development Economics*, Vol. 42, pp. 51–74.

✓Klink, G., Mathur, M., Kidambi, R., and K. Sen (2014). *The Contribution of the Automobile Industry to Technology and Value Creation*, ATKearney.

✓Lipsey, R. E. (1998). 'The internationalization of US MNEs and its impact in developing countries',in Kumar, N., J. H. Dunning, R. E. Lipsey, J. P. Agarwal and S. Urata, eds. *Globalization, Foreign Direct Investment and Technology Transfers: Impacts on and prospects for developing countries,(London,* Routledge).

✓McKinsey Global Institute (2006), *New Horizons: Multinational Company Investment in Developing Economies*. New York: McKinsey and Company.

✓Narayanan, K. (1998). Technology acquisition, de-regulation and competitiveness: A study of Indian automobile industry. *Research Policy*, Vol. 27, No. 2, pp. 215–228.

✓Saggi, K. (2002), 'Trade, Foreign Direct Investment, and International Technology Transfer: A Survey', *World Bank Research Observer,* Vol. 17, pp. 191–235.

✓Tiwari R. and C.¬ Herstatt (2014). *Aiming Big with Small Cars: Emergence of a Lead Market in India*. (Switzerland, Springer International Publishing).

✓UNCTAD (2005). World investment report 2005: Transnational corporations and the internationalization of R&D. (New York, United Nations Conference on Trade and Development).

Websites

http://dipp.nic.in/
www.business.gov.in
www.investindia.gov.in
http://www.siamindia.com/
http://www.goldmansachs.com/our-thinking/pages/cars-2025-change-in-the-fast-lane.html ■

Asia-Pacific Trade and Investment Report 2015

The report highlights the challenges posed by slowing regional trade growth and outlines how changing dynamics in the global economy call for a renewed effort to enhance the prospects of export-led growth, both of merchandise trade and in commercial services. The 2015 report also provides analysis on the spread of Global Value Chains (GVCs) in the Asia-Pacific region and evaluates policies that contribute to developing countries participation in GVCs. The Report is aimed at policymakers as well as practitioners and experts, academia, business, international agencies and non-governmental organizations working or interested in these issues in the Asia-Pacific region.

For more information, access:

http://www.unescap.org/resources/asia-pacific-trade-and-investment-report-2015-supporting-participation-value-chains

TRANSFER OF TECHNOLOGY BY FDI TO LOCAL SMEs

A STORY FROM INDONESIA

Tulus T.H. Tambunan
Center for Industry, SME and Business Competition Studies
University of Trisakti Grogol-Jakarta, Indonesia
Tel: 62-21-7375365
E-mail: ttambunan56@yahoo.com

Abstract
Although evidence at the national level is scarce, it generally believed that foreign direct investments (FDIs) are important as a source of technology transfer for local SMEs in Indonesia. It is expected that through subcontracting linkages, FDIs can facilitate SMEs to increase productivity and to improve quality of their products. Based on own previous studies and some other studies, the aim of this paper is to examine this issue. Evidence from these studies does support the view that FDIs are indeed important, although it is hard to generalize it for the whole country as evidence is limited. But, not all local SMEs can be accepted as suppliers to foreign companies due to a number of reasons, and the most important one is lack of basic technology.

Introduction

In Indonesia, since the 'New Order' era under former president Soeharto (1966-1998) up to the present day, the government has been trying to support small and medium enterprises (SMEs) by various means, including technical assistance, training programs and special capital schemes. The government also has been trying to encourage production linkages, especially through subcontracting between SMEs and large enterprises (LEs), including foreign direct investments (FDIs) or foreign companies. This effort was done first with the imposing of a system, called "local content"(LC) rules in the engineering industry, mainly machinery, electronics and the automotive industries, as part of the import substitution policy adopted during that era, and, recently, after the Asian economic crisis in 1997/98, by introducing a regulation on partnership between SMEs and LEs. The main idea behind this regulation is that through partnership, especially with foreign companies, technology or knowledge can be transferred to local SMEs. The main aim of this policy is to encourage industrialization in the country and also to encourage a pattern of industrial development that followed the industrial pyramid model adopted in Japan. In this model, small enterprises (SEs) were at the base to support medium enterprises (MEs), which then the latter supported LEs at the top of the pyramid. Through subcontracting, the LEs (assemblers) would be the dynamic agents of technology transfer to SMEs.

However, unfortunately, industrial development in Indonesia until now has not been so successfully in following the pattern. On the contrary, subcontracting activities in the Indonesian manufacturing industry are still very limited and the local content policy in the 1997/98 pre-crisis period has resulted in a vertically integrated production system within LEs. Although there are some, which can be considered as successful cases, in general, since the introduction of partnership regulation, production linkages in terms of subcontracting arrangements between SMEs and LEs in Indonesia still have not been developed very well especially because of the lack of skills and basic technological capabilities of local SMEs. Hence there is no strong evidence that transfer of technology from LEs, including domestically operated foreign companies, to SMEs has been taken place in Indonesia extensively.

Although national data on how much in Indonesia located foreign affiliated firms do subcontracting with local SMEs are not available, this paper aims to examine how has been the process of technology transfers from FDIs to local SMEs through subcontracting by discussing a number of cases which are Tegal metalworking industry (in the province of Central Java), PT Astra International Tbk.

Technology transfer to local SMEs in Indonesia

Subcontracting between SMEs and LEs

Historically, formal business partnership between SMEs and LEs in Indonesia is not so strong, certainly much weaker compared to countries such as Japan, Taiwan province of China, and Republic of Korea. During the Soeharto period, the government imposed a system of protection of local SMEs by, among other means, issuing local content rules in a number of industries, including machinery, electronics and automotive manufacturers. This local content policy was also part of import substitution policy imposed during this 'New Order' era. In these local content rules all assembling industries should use some components produced locally, and local SMEs should be involved as components and spare parts suppliers. The government decided which products were to get priority in this policy, and introduced fiscal incentives in line with the type of priority recipient products. However, the determination of priorities did not appear to have been based on economic considerations, including the fact that SMEs' capacity for investment and absorption of technology was low. This policy not only failed to generate extensive subcontracting linkages between LEs and SMEs, but it has also not facilitated the use of subcontracting as a means for achieving the domestic diffusion of technology or knowledge.

In general, until the present day, production linkages in the form of subcontracting between LEs (including FDIs) and SMEs have not yet so well-developed and only a small number of SME clusters (all located in Java) has established subcontracting relationships with LEs. Thee (1990, 1997) argues that such production linkages between SMEs and LEs did not develop smoothly during the New Order era because of market distortions and the lack of skills and low technological capabilities of local SMEs. From her own observation of practices of in Indonesia located Japanese affiliated firms, especially in the automotive industry, Sato (2000) states that the more common pattern in Indonesia is for both the assembling companies and SMEs as local suppliers of automotive components and spare-parts though subcontracting are typically shallow, short term and non-exclusive, quite different from those found in Japan. Whereas, TAF (2000) concludes that the lack of success of local contet policy in creating strong interdependence between SMEs and LEs and developing a strong domestic supporting industry was largely due to the government's excessive interference, aimed at replacing the market mechanisms.

Hayashi's (2002a,b) study, on the other hand, implies that the situation where subcontracting ties in Indonesia did not function well in supporting SMEs has been changing recently. Better financial access and business continuity are important in facilitating subcontracting transactions, which can provide SMEs with support necessary for improving productivity. He investigated subcontracting between SMEs and LEs by estimating production functions and calculating indices of total factor productivity (TFP) based on micro-level data from 60 metalworking and machinery firms that supply their products to automobile, motorcycle, agricultural machinery and bicycle manufacturers, and concludes that inter-firm cooperation through subcontracting ties increases productivity of SMEs. This evidence supports the view that subcontracting linkages are an important support mechanism for the development of Indonesian SMEs.

The role of FDI

The interaction between FDIs and domestic firms, including SMEs, in developing countries can result in higher rates of knowledge and technology diffusion, thanks to a number of mechanisms, such as imitation, increased competition, backwards and forwards linkages, training and human resources mobility. The knowledge and technology involved takes many forms, including a wide range of hard and soft elements, e.g. technologies embodied in capital goods, and production, organizational, managerial and other skills (UNCTAD, 2011).

In Indonesia, it is generally expected that because of the resources it brings and the attributes embedded in it, FDI can bolster technology capabilities in local industries through the transfer of technology and spillover effects. Unfortunately, evidence on this role of FDI in Indonesia, especially at the firm level within SMEs, is scarce. Only few studies have been done and mostly in the 1990s, which include Thee and Pangestu (1994), and Harianto (1996). Based on their assess on technological capability of Indonesian textile, garment and electronics industries, Thee and Pangestu found that in an effort to increase technological capability, Indonesian textile and garment manufacturers established strategic alliances with their Japanese counterparts to open up a vital channel of technology transfer. Similarly, they found that business linkages with foreign firms have been a very important technology transfer channel for electronics firms, especially for consumer electronics and electronic components.

From his study in the automotive and machine industries, Harianto (1996) found that SMEs which are able to form subcontracting ties with foreign firms do have technical and management benefits from that. However, he concludes that in general subcontracting arrangements between SMEs and foreign firms in Indonesia is still weak, mainly because local SMEs cannot meet the required standard of quality due to their lack of technology and skills.

In 2000 onward there are three important studies, i.e. Sato (2000), Hayashi (2002) and Tambunan (2006,2009). Sato (2000) investigated subcontracting linkages in the metal working and machinery component industries in East Jakarta and Ceper (Central Java). In East Jakarta, she examined the performance of SMEs which have subcontracting linkages with Japanese companies in automobile and motorcycles manufacturing industries. It shows that the structure of backward linkages is hierarchical with assemblers at the apex and with two or three tiers of subcontractors below. Some of the first-tier subcontractors are Japanese joint-ventures or locally owned large-scale component manufacturers and the rest, especially the second-and third-tier subcontractors, are local SMEs. Subcontracting linkages of the urban modern machinery industry in Jakarta and Surabaya have reached the top-tier firms in Ceper. Many SMEs in Ceper have also formed linkages with wholesalers located in smaller cities outside the area who functions as putters-out and who intermediate orders, transmit market information, and other trade credits to the SMEs. However, overall, the author found that subcontracting networks between SMEs in these two locations and Japanese companies in the automotive and machinery assembling industries have not yet developed well, and so the benefit for local SMEs could not be said optimal. She states that market growth is a prerequisite for the expansion of effective subcontracting networks, as one key condition. Another key condition to realize the possible further development and enhancement of subcontracting networks between SMEs and LEs is that assemblers and prime component manufacturers are necessary to move their in-house manufacturing of components and spare parts toward domestic outsourcing.

For his PhD thesis, Hayashi (2002a) investigated subcontracting linkages between Japanese affiliated firms and local SMEs in the machinery industry. His research, which was primarily based on firm-level data and information obtained from an interview and questionnaire survey, shows that the subcontracting practices in the industry generally enabled SMEs to alleviate some constraints stem-

ming from their limited internal resources, and to improve their capabilities and production efficiency. Provision of technological and marketing support mechanisms and improvement of production efficiency were the major gains that SMEs obtained from subcontracting arrangements with LEs. Subcontracting systems in the Indonesian machinery industry have developed as a vertical production mode and can be beneficial to the development of SMEs. Based on findings from some previous studies in Indonesia in the 1980s and 1990s, he summarized several types of support for SMEs as the local suppliers provided by large parent Japanese affiliated in the machinery industry, as given in Table 1.

Based on evidence from his study on subcontracting between SMEs and several Japanese affiliated companies in Tegal metalworking industry, Tambunan (2006) concludes that a key to increased productivity among manufacturing SMEs is to build their capacities through improved knowledge or technological know-how, and this technology development can take place through many channels, and the most important one for the diffusion of knowledge/technology among domestic manufacturing SMEs is through subcontracting arrangements with FDI. However, the importance of FDI as a source of technology/knowledge varies across the differing subcategories of SMEs: MEs have more capability to become FDI's local suppliers than SEs, as the former have more required sources such as knowledge on basic technology and capital than the latter.

However, based on personal opinion of surveyed/interviewed owners/managers/directors of 85 companies (from all size categories and in various sectors) in Indonesia, the *Global Competitiveness Report 2015-2016* from the World Economic Forum (WEF) may suggest that most of the respondent did see in Indonesia-located foreign firms as an important source of technology transfer. From a total of 140 countries included in the report, Indonesia ranks 54th. In other words, this report fails to provide strong evidence to support the general view that there is a significant degree of technology transfer and spillover effect from foreign companies to Indonesian firms. For one the respondents agreed is that, whether technology transfer will have a positive effect on the recipient firms in Indonesia will depend

Table 1: Support from parent firms to SMEs as their local suppliers through subcontracting linkages in Indonesia's machinery industry

	RE project developers	Electricity generators/ suppliers	End-users	Non-fiscal incentive
Technical support	• provision of QC support & technical specification	• provision of tech. support in production processes & inspection via dispatch of experts • selection of proper production equipment	• provision of technical & QC support through dispatch of experts • dispatch of suppliers to foreign markets as study tour • involvement of suppliers in design phase	• preparation for training programs in QC and production technologies (e.g. dies making) • frequent evaluation on supplier's performance (e.g. QCD)
Financial support & price setting	• provision of loans & credit guarantees for suppliers • lending of machinery • price negotiation between parent & supplier firms	• setting of favourable payment conditions • provision of loan guarantees for suppliers • supply of used equipment at low cost	• setting of favourable payment conditions (limited) • price negotiation, adopting cost plus fee method	• provision of loan guarantee for suppliers
Supply of material	• provision of raw materials	• supply of materials	• supply of materials (very limited)	• supply of materials
Management support	• provision of managerial training	• provision of managerial support through dispatch of experts	• provision of managerial support	• preparation for training programs in managerial fields (e.g. accounting)
Other support		• assistance in establishing supplier firm	• assistance in establishing supplier firms • assistance in finding other customers	• assistance in establishing supplier firms • supports by higher tier suppliers to lower tier suppliers

Source: Taken from Table 12 in Hayashi (2002a).

largely on the absorptive capacity of the firms; that is, on their ability to understand, assimilate and make effective use of the transferred knowledge or technology.

This relatively low ranking does not come as a surprise. Because the fact is that probably (as data are constraint) only few domestic companies do subcontracting activities with FDIs, and from a total of around 57 million SMEs in the country, most likely only a very small fraction does have subcontracting linkages within Indonesia located foreign firms.

Case studies

Based on limited evidence, this section discusses briefly some cases of subcontracting linkages between SMEs and LEs in a number of industries, including machinery, automotive and electronics manufacturers. The cases are based on studies conducted some years ago, as no recent studies on subcontracting have been done since then.

Tegal Metalworking Industry (Tambunan, 2006,2009)

Tegal metalworking industry in the province of Central Java is among few areas in Indonesia with a long history of a metalworking industry. It is located at the northern shore near the border of the West Java province. It has been a metalworking centre since the mid-1800s, when it was the site of several sugar processing factories and related enterprises, including locomotive repair shops and metal processing factories. The industry thrived under the New Order's massive infrastructure and development agenda. At the beginning of the 1980s, the first subcontracting activity started in the district, sparking government activity to develop the metalworking industry further. In general, the technical capability of the Tegal metal industry has been derived from a long history of family experience in metalworking or similar industries.

Although metalworking involves a range of processes, the sector is dominated by the plate-forming business. The comparative advantage here has been in meeting small orders for simple metal products or components, mainly for household appliances and handicrafts, but also for furniture, and to a lesser extent, for parts and components for the general machinery and automotive industries. The small size of workshops gives them greater flexibility, and Tegal's abundant cheap labour can outweigh the advantages of more capital-intensive production. There is often intense price competition between workshops.

According to the size of production and the level of production sophistication, there are two types of workshop in the Tegal metal-working industry: MEs and LEs, known as *inti*; and SEs, known as *plasma*. *Inti* workshops receive orders for metal components from firms outside the district. In particular, large *inti* workshops employing up to 100 men derive the majority of their income from subcontracting work. During the 1990s there were several companies (mostly LEs) that subcontracted work to Tegal metal workshops, some foreign affiliated firms such as PT Komatsu Indonesia Tbk, PT Daihatsu, and some divisions of the Astra Group such as PT Sanwa, PT Kubota and PT Katshusiro. These companies often source metal components from several parts of the country, mainly in West Java. Among these companies, the most prominent was PT Komatsu Indonesia Tbk (say from now on, KI), which is a subsidiary of a Japanese company, and has had established subcontracting production linkages with Tegal metal workshops since 1998. This company produces equipment for construction and mining activities under the global trademark of Komatsu. This includes hydraulic excavators, bulldozers, motor-graders, frames and related components, steel cast products, as well as off-highway dump tracks. Two most successful local *inti* subcontractors to KI are PT. Prima Karya and PT. Karya Paduyasa.

Plasma workshops usually hire cheap, unskilled labour or use family members (mainly men) as unpaid workers, and the owner passes basic metalworking skills on to his employees, leaving the technical capacity of the workshop highly dependent on the technical capacity of the owner. *Inti* workshops often re-subcontract part of their production to *plasma* workshops. Thus the most important difference between *inti* and *plasma* is that *inti* workshops have direct subcontracting relationships with big companies, while plasma workshops have subcontracting arrangements with *inti* workshops (or those having indirect production linkages with the big companies).

LEs, especially FDI-based companies (such as KI) are very important for the Tegal metal working industry as its main source of technology is through subcontracting. To access technology from KI, however, local workshops must first become its subcontractors. It was found, however, that not all local workshops can easily establish subcontracting relations with LEs. To become a subcontractor, local firms must have attained a certain level of technical and managerial capacity; they must show that they have the capacity to produce high-quality components and meet stringent delivery times. An audit determines whether they have the required machinery, manpower[1], facilities[2], legal standing and use of ISO standards[3]. After that, they are requested to produce a sample component from technical drawings provided to them. According to the KI *inti* workshop owners interviewed, before an agreement is signed, KI often asks for a trial run of the mass production process, subjecting the output to quality control tests. If they can produce a certain product on a regular schedule and of consistent quality, they are granted a license to manufacture different items, thereby expanding their product lines. In the last two years, many suppliers have been tested through initial batch orders. But only four local enterprises were able to meet KI's standards;

[1]They need sufficient manpower to have two shifts for higher productivity.
[2]KI, like many other LEs, requires its subcontractors to be PTs (limited liability companies), not CVs (limited partnerships).
[3]KI, like many other LEs, requires the use of ISO standards, even if the workshop is not officially certified.

two were included in the sample.

Within the SE category, there are many tiny enterprises (only with one to three hired workers, usually called microenterprises (MIEs), and they are less able than larger enterprises within the SE category to adopt new technologies in their bid to become subcontracting *inti* for KI. By building upon existing technical and managerial capacity, they are able to enter a virtuous circle in which quality output leads to subcontracts, which lead to private training provided by KI. During the survey, it was found only a very few MIEs carried out indirect subcontracting with LEs through plasma relationships with *inti* subcontractors.

While for KI, quality is the first priority, retailers generally emphasize low cost over quality. For many local workshops (mainly in the MIE category) which had been rejected by KI as their *inti* subcontractors, the wholesalers/retail markets are their only opportunity to secure their market. They sell to this market a limited range of simple final products, such as pulleys and ships' windows. While these retailers may demand a sample product, there is much less emphasis on precision. Many wholesalers and retailers purchase goods from Tegal metal workshops for resale in stores in the cities around the country. Alternatively, they sell their products directly to local consumers, or, if they are lucky, they can become plasma for KI's existing *inti* subcontractors.

After winning a contract, an *inti* subcontractor has access to a significant level of technical training. According to a subcontractor of KI, training directly addresses the technical needs of the workshop in meeting the production requirements of KI. Indonesian experts from the Jakarta KI office leading the training used a teaching style that clearly delivered the necessary knowledge and emphasized practical applications, with 90% of the time spent on hands-on experience. Trainers also help the workshop in identifying the problems.

For workshops rejected by KI (or other LEs) as *inti* subcontractors, the only sources of technology or knowledge are the retail suppliers. Some domestic retail market suppliers also act as knowledge providers by informing metal workshops about consumer preferences, demand and new innovations. One workshop owner interviewed stated that retailers created new products and commissioned them from the local small workshops. Learning takes place through quality control, as *inti* workshops often build a procedure for troubleshooting into their subcontracting relationships. *Inti* workshops engage in coaching plasma on quality control standards and, in some cases, support former employees already familiar with these standards in starting up *plasma*.[4]

In overall, this case confirms that foreign companies are indeed important for local SMEs development, as their presence gives more opportunities not only for market but also sources such as technology and other knowledge for capacity building through subcontracting to local SMEs. However, this case shows that only a few local firms are able to succeed as local subcontractors, since foreign companies are more likely to subcontract parts of their production to local firms which already have a certain level of technology capability, and these are mostly of medium-sizes. In other words, the presence of foreign companies in a condition of local firms like this will only generate a dualism development within SMEs.

PT Astra International (Astra International, 2013; Tambunan, 2006, 2007)

Astra was established in Jakarta in 1957 as a general trading company under the name of PT Astra International Inc. In 1990, the company changed its name to PT Astra International Tbk (just say ASTRA), and listed shares on the Indonesia Stock Exchange. At the end of 2013, Astra had 179 subsidiaries, associated companies, and jointly-controlled entities spanning six business segments, with automotive as its core business. ASTRA has become Indonesia's largest integrated automotive company. In this business, ASTRA collaborates with Japanese car manufacturers, namely Toyota, Daihatsu, and Isuzu, and Honda. It also collaborates with two giant European car companies, i.e. Peugeot and BMW. Components for these cars and motorcycles are produced by PT Astra Otoparts Tbk (AOP), which is 80% share ownership by ASTRA. At the end of 2013, AOP managed 279 shop and drive stores as a modern retail distribution network that specifically caters to the needs of various automotive component products, including batteries (Astra International, 2013).

ASTRA has a number of foundations for its different business segments, including Dharma Bhakti Astra Foundation (YDBA) for its automotive business. YDBA has the vision to become the best institution engaged in fostering and developing SMEs in the country, by focusing on SMEs as subcontractors, vendors and workshops associated with ASTRA's value chain. YDBA provides SME development programs to build technical, management, marketing, financing, and information technology skills. In 1997, the number of SMEs trained/assisted by YDBA amounted to 1,717 units; in 2000 to 1,870 units with a target of approx. 100 additional units per annum. In 2013, YDBA assisted approximately 8,106 SMEs, 512 training for mechanics, 71 self-sufficient SMEs, and 231 ASTRA subcon SMEs (Astra International, 2013).

It can be said that Japanese automotive car manufacturers transfer their basic technologies and management knowledge to local SMEs in Indonesia through YDBA, and for SMEs accepted as suppliers, vendors or workshops for ASTRA, they continue build up their technology know-how through day-to-day subcontracting activities with ASTRA cars and motorcycle assembling factories. Because of its aggressive activities and long experience in supporting SMEs, YDBA, therefore, is regarded in Indonesia as among the best private sector initiatives providing support to SMEs under a partnership program.

[4]They need sufficient manpower to have two shifts for higher productivity.

In 2006, Tambunan conducted a small survey on 20 SMEs, producing a variety of automotive components for ASTRA. The main aim was to find out not only their problems in starting and conducting or maintaining their subcontracting relationships, but also their main motivations and the origin of initial initiative to do that, and benefits they may get from subcontracting activities. The sampled firms were selected from various locations, i.e. Jakarta, Bogor and Bandung in West Java province, and Bekasi and Tangerang both in Banten province. Many of them have been in the business since the 1980s, and the others started in the 1990s and some after 2000. All of them before starting their own businesses worked in several automotive assembling LEs related to ASTRA.

The survey reveals some most interesting findings. First, their motivation to do subcontracting is mainly to secure their market, especially if currently they see no other market opportunities. Only some of them said that to increase their production is their main driving force behind their subcontracting activities. Second, the idea was mostly their own. As they explained, they must aggressively look by themselves for potential partners. Only a very few of them said that the idea to establish a subcontracting came from the parent company. Third, the benefits they got varies, ranging from their business performance improved, production volume or income increased, easier to get capital or easy access to finance, and their knowledge or skills increased. Fourth, the respondents have different experiences regarding the main problems in starting or conducting a subcontracting (Table 2). Fifth, the majority of them have a plan to keep doing subcontracting for some years to come. Only one respondent said that want to seek other better opportunities in the near future. Finally, the respondents were asked to explain what steps they have taken which made them be selected by Astra as its subcontractors. Their explanations are given in Table 3.

PT Nusantara Aircraft Industry (Soekarno, et al., 2009)

Soekarno, *et al*. (2009) reported the process of technology transfer they have directly observed related to turbine maintenance and overhaul activities in PT Nusantara Aircraft Industry, a state owned company, located in Bandung (West Java prvince). In 1984, General Electric (GE) won the tender competition of aircraft turbine election (GE CT7) for new CN 235 aircraft designed jointly by the PT Nusantara Aircraft Industry and CASA from Spain. As part of the agreement, GE has established facilities turbine overhaul of aircraft in Indonesia, and also has carried out the process of technology transfer so that the facility is fully functional, according to the standards set by the factory and run by local personnel.

An overhaul facility turbine aircraft must obtain authorization from the manufacturer (OEM authorization) and the airworthiness authority. To obtain authorization, a turbine overhaul facility must have the tool, skills/competencies that both of the employees, adequate shop operation procedures, and spare part supplies. After solving various problems and challenges, the process of building the turbine aircraft overhaul facilities and transfer of technology/skills to local workers had successfully done.

The lead writer was recruited as one of the trainees to be employed in the medium-sized overhaul shop. He had the opportunity to observe the whole process of the development of the overhaul shop and was involved in the technology transfer processes to develop the local talent capabilities. According to key resource persons interviewed, who were engaged directly in the process, the technology transfer was not always easy and they had to overcome several challenges. As summarized in the report, the first challenge was the lack of basic skills on the part of overhaul shop workers. Education in Indonesia does not emphasize vocational/practical training, which is a critical requirement in the industry. The industry needs certain specific skills such as: disassembly/assembly, chemical cleaning and plating, inspection (visual, dimensional, non destructive inspection),

Table 2: Main constraints in starting and conducting subcontracting

• Hard to get trust or confidence • Lack of skilled human resource • Many costs during the tryout • Lack of information • Must have minimum technical capability • Heavy competition from other potential subcontractors • Difficulties in reaching an agreement that secure "win-win Solution	• Company must be a legal entity • Organization must be well developed with clear structure within the company • Location of potential partner is far away • Requirements (e.g. ISO 9001) are hard to be met • Difficulties in administrative procedures

Source: Tambunan (2007)

Table 3: Necessary steps to become a subcontractor

- Your company must be known through e.g. aggressive promotion of your products
- You must be able to show your business capability
- First, you must be able to produce efficiently or with cost competitiveness
- You must have minimum required facilities in place, including production space with necessary production tools.
- You must first improve first your human resource, business organization and management and technology capability

Source: Tambunan (2007)

machining (conventional and unconventional), welding and plasma spraying, and special processes (heat treatment, coating, painting, and shot peening). Often the industry must create its own vocational to meet their needs for these specific skills.

The second challenge was cultural in nature. As a technology based industry, the company requires certain attributes such as planning ahead, the timeliness/punctuality, accuracy and compliance. Unfortunately, these attributes are not widely practiced in the society. It required a special effort for emphasizing these attributes to all workers. During early year of operation, many repeated inaccuracies and incompliance by its workers occurred.

The third challenge was the low level of English proficiency of its workforce. Most sources of technology come from Western countries, and the utilization of resources such as shop operation manual, engineering/technical documentation, and communications with technology licensors require a basic mastery of the English language.

The fourth challenge is the lack of supporting industries. Ideally the overhaul shop should concentrate only on the basic overhaul processes such as: receiving inspection, disassembly, cleaning, inspection, accumulation, assembly and performance test, while the repair process of the repairable parts should be contracted out to the supporting industries nearby.

Conclusion

This study demonstrates at least two important facts regarding the role of FDIs in transfer of technology to local SMEs in developing countries with some cases in Indonesia. First, despite some limitations, many foreign companies are indeed important as a source of technology transfer to local SMEs. However, many SMEs, especially SEs are largely excluded from the direct transfer of technology as foreign companies are more likely to subcontract parts of their production to local firms that already enjoy a certain level of technological capability, and these are mostly MEs. This supports the general view in the literature that the more absorptive capacity the local firms have, the more benefit the local firms will gain from a transfer of technology.

Second, subcontracting itself is not the guarantee of successful transfer of technology from FDIs to SMEs. The SMEs themselves must have a minimum absorption capacity, i.e. they must have a basic knowledge on the particular technology. In this respect, SMEs owned by persons or use workers who were employees before in LEs or have engineer diploma are more likely to be successful as subcontractors than those owned by those who have only primary or secondary school diplomas. But this is only the 'hardware' side, i.e. skilled workers. In addition to that, there is also the 'software' side that local SMEs must also have, namely culture of doing businesses, like attributes such as planning ahead, the timeliness/punctuality, accuracy, and compliance. Unfortunately, these attributes are not widely practiced in many SMEs, especially in SEs which are mainly not well organized and managed.

Therefore, the role of government in this respect is very important, not only in creating conducive business environment to attract FDIs, to make regulations on technology transfers and to facilitate the process, but also, and probably more important, to support local SMEs in their capacity building to make them ready to become local suppliers. But, government intervention must not be too much as happened during the New Order era, because, at the end, subcontracting and other forms of partnership between local SMEs and LEs or FDI must be business-oriented, not policy-oriented.

References

✓ ASTRA International (2013). "Creating New Growth Momentum", 2013 Annual Report, Jakarta.

✓ Harianto, Farid. (1996). "Study on Subcontracting in Indonesian Domestic Firms," in M. Pangestu (ed.), *Small-scale Business Development and Competition Policy*, Jakarta: Centre for Strategic and International Studies.

✓ Hayashi, Mitsuhiro (2002a). "SME Development and Subcontracting in Indonesia: A Comparison with Japan's Historical Experience", unpublished PhD dissertation, Canberra: the Australian National University.

✓ Hayashi, Mitsuhiro (2002b). "The Role of Subcontracting in SME Development in Indonesia: Micro-Level Evidence from the Metalworking and Machinery Industry", *Journal of Asian Economics*, Vol. 13, No. 1, pp. 1–26.

✓ Sato, Yuri (2000). "Linkage Formation by Small Firms: The Case of a Rural Cluster in Indonesia," Bulletin of Indonesian Economic Studies, Vol. 36, No. 1, pp. 137–66.

✓ Soekarno, Subiakto, Sylviana Maya Damayanti, and Putri Maharani Samsu Wibowo (2009). "Technology Transfer Challenges in Indonesia: An Experience from Industry Turbine Overhaul", *The Asian Journal of Technology Management*, Vol. 2, No. 1, pp. 34–38.

✓ TAF (2000). "Strategic Alliances and Development of Small and Medium-Scale Enterprises in Indonesia", Final Report, May, The Asia Foundation, Jakarta.

✓ Tambunan, Tulus (2006). "Transfer of Technology to and Technology Diffusion among Non-farm Small and Medium Enterprises in Indonesia", *Copenhagen Journal of Asian Studies*, Vol. 24, pp. 105–136.

✓ Tambunan, Tulus (2007). *Pembangunan Industri Nasional sejak Era Orde Baru Hingga Pasca Krisis* (Development of Industry since the New Order era up to Post crisis), Jakarta: Penerbit Universitas Trisakti.

✓ Tambunan, Tulus (2009). "Promoting Innovation in SMEs through transfer of technology. Lessons from a metalworking industry cluster in Indonesia", *Asia-Pacific Tech Monitor*, Special Feature: Innovation in SME clusters, Jul-Aug 2009, pp. 30–36.

✓Thee Kian Wie (1990). "Prospects for Co-operation in Technology", in Kim Seung Jin and Suh Jang Won (eds.), *Cooperation in Small and Medium-Scale Industries in ASEAN*, Kuala Lumpur: Asian and Pacific Development Centre.

✓Thee Kian Wie (1997). "The Development of the Motor Cycle Industry in Indonesia", in Mari E. Pangestu and Yuri Sato (eds.), *Waves of Change in Indonesia's Manufacturing Industry*, Institute of Developing Economies (IDE), Tokyo, pp. 93–111.

✓Thee Kian Wie and Mari Pangestu (1994) 'Technological Capabilities and Indonesia's Manufactured Exports.' Revised report for UNCTAD/SAREC Project on Technological Dynamism and the Export of Manufactures from Developing Countries, January.

✓UNCTAD (2011), " Foreign direct investment, the transfer and diffusion of technology, and sustainable development", Trade and Development Board Investment, Enterprise and Development CommissionExpert Meeting on the Contribution of Foreign Direct Investment to the Transfer and Diffusion of Technology and Know-how for Sustainable Development in Developing Countries, Especially Least Developed Countries, 16-18 February, Geneva. ■

Publications on SMEs competitiveness

Innovation and SME Financing in Selected Asian Economies

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

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

Exchanging Value - Negotiating Technology Licensing Agreements: A Training Manual

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

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

Globalization and Performance of Small and Large Firms

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

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

SME Competitiveness Outlook 2015

The book combines unique analysis, thought leader insights and case stories about developing country SMEs in international markets, along with 25 country profiles.

Contact: International Trade Centre (ITC), Palais des Nations, 1211 Geneva 10, Switzerland. Tel: (41-22) 730 01 11, Fax: (41-22) 733 44 39, Web: http://www.intracen.org

Knowledge and technology transfer of outward FDI by Thai multinational enterprises to Cambodia, Laos, Myanmar and Viet Nam

Chawalit Jeenanunta, Nattharika Rittippant, Pornpimol Chongpisal and Ryoju Hamada

Sirindhorn International Institute of Technology, Thammasat University
131 M. 5 Tiwanont Rd. Bangkadi Muang Pathumthani, Thailand 12000
Tel: 66 (2) 501 3505 - 20 ext 6000 / 6013; Fax 66 (2) 501 3505 - 20 ext 6014
E-mails: chawalit@siit.tu.ac.th, natthari@siit.tu.ac.th, pornpimol@siit.tu.ac.th, hamada@siit.tu.ac.th
Web: http://chawalit.siit.tu.ac.th

Abstract

The article presents an in-depth case study on top two Thai companies who successfully invest in Cambodia, Laos, Myanmar, and Viet Nam (CLMV) and emphasize on their systematic knowledge and technology transfer that lead to their success in establishing the business in these countries. These companies are from the natural resource-based industries, including Charoen Pokphand Foods (CPF), the leading agro-industrial and food conglomerate; and MitrPhol Sugar Group, Thailand's and Asia's biggest sugar and bioenergy producer. The motivation to transfer the knowledge and technology is to increase the recipient's technological capability, especially for improving its production quality and efficiency. The policy recommendation for investing country could be on the aid of infrastructure building and industrial zone construction in CLMV. For the recipient countries, the capacity building is recommended to attract more investment. The ease of process for visa for professional personal exchange is also recommended in both sides. The ease of the immigration process along the border could improve the personal exchange.

Introduction

Foreign direct investment (FDI) has been considered as a growth enhancing tool for many countries. Thailand was one of the developing countries that was used to be the major recipient of FDI inflows from developed countries from the past decades to 2011, as shown in Figure 1 (UNCTAD, 2012). Since 2011, Thailand started investing overseas more than the inflows. Outward FDI from Thailand can be grouped into four stages (Wee, 2007). During the first stage (1978–1985), Thai investment abroad was limited and undertaken by financial institutions. During the second stage, i.e., take-off stage (1986–1996), outward FDI raised sharply to Cambodia, Lao PDR, Myanmar, and Viet Nam (CLMV). During the financial crisis, i.e., impact stage (1997–2002), FDI outflows from Thailand dramatically declined due to the effects of the Tom Yum Kung Crisis in 1997. The fourth stage, i.e., recovering stage (2003–present) started a new wave of outward FDI. The increasing number of Thai enterprises investing abroad was driven by strong support from national government, corporation strategies, and regional integration factors. According to Chantapong (2012), Thai outward activities exceeded 1.5% in 2011 compared to the average between 2006 and 2010; the majority investment of Thai companies went to ASEAN (35%) and CLMV (28.8%). Figure 2 illustrates Thailand FDI in the CLMV countries during 2011–2013 where it increases steadily. Moreover, it shows that Viet Nam is a major recipient country of Thailand outward FDI.

The Boston Consulting Group (BCG) has identified 50 fast-growing companies of Southeast Asia challengers including 11 Thai companies (Vincent *et al.*, 2012). We selected, from this list, two companies that invest in CLMV. The first company, Charoen Pokphand Foods (CPF), is the leading agro-industrial and food conglomerate in the Asia Pacific region. The second company, MitrPhol, is Thailand's and Asia's biggest sugar and bioenergy producer. The objective of this article is to investigate on their technology transfer and knowledge transfer and its outcome. We interviewed the top executives of these two leading firms during October to December 2014 with the focus on knowledge and technology transfer to their branches in CLMV. We present the analysis in the following sections for each case with emphasize on the technology transfer and their mode of knowledge transfer.

Case study 1: Charoen Pokphand Foods (CPF)

Background information

CPF, which was established in 1978, is the leading agro-industrial and food conglomerate that operates a vertically integrated business model. There are four core businesses comprising feed, farm, food, retail, and food outlets both locally and internationally. The company's operations are divided into two main areas: domestic operation (in Thailand) and international operation. For domestic operation, the company vertically integrated agro-industrial and food business for both domestic sales and exports to more than 40 countries globally across five continents. For international operation, it operates and invests overseas in 13 countries by subsidiaries such as China, Viet Nam, Turkey, Laos as well as associated company in Cambodia and jointly controlled entities. In 2013, the total revenue from sales

was 11.85 billion USD, which was generated from Thailand operations constituting 5 billion USD or 42% of the consolidated sales and 6.84 billion USD or 58% for international operations. There are 17,125 employees in the company (CPF, 2013).

The vertically integrated business is categorized into four main businesses. First, feed business involves the manufacturing and sales of animal feed. Second, farm business involves animal breeding, animal farming and basic meat processing. Third, food business involves partially cooked production and fully cooked meat and food products under company's brand. Fourth, retail and food outlet business involves the operation of food retail outlets, restaurants, and food courts. It focuses on swine, broilers, layers, ducks, shrimps and fish. In CLMV investment expansion, CPF is still focusing on creating the value chain of its core business, starting from upstream to downstream activities.

Countries of investment

CPF mainly expands in the form of a wholly owned (100% owned) company in the CLMV countries because the company aims to retain complete control and ownership of its operation.

Viet Nam

CPF has invested in full-scale business activities in Viet Nam since 1993. It operated both a fully-integrated livestock and a fully-integrated aquatic business. This approach produced value chain from the manufacturing and distribution of animal feed, to the breeding and livestock and aquatic animals, and to the processing and production of meat and packed food.

The reason for CPF's decision to choose Viet Nam as its first investment destination in CLMV is because Viet Nam has a good potential as a new market. In addition, the government's vision has been clearly emphasizing the movement from an agricultural country toward an industrial country.

Cambodia

CPF was established in Cambodia on April 24, 1996. The company has invested in feed production in the form of concentrate, powder and pellets for broilers, layers, swine and ducks and livestock. In addition, farming such as corn, soybean meal and rice, and food processing such as sausage making and slaughterhouses, are also a part of CPF's business in Cambodia. In order to strengthen the company's integrated agricultural–industrial business as per the Cambodian economic growth, the company planned to invest 700 million THB or 21 million USD in 2014 to build a new feed meal plant and expand the capacity of its chicken and pork farms. Sales are expected to reach 10 billion baht or 307 million USD. At present, CPF has factories and farms constituting 70–80% of provinces in Cambodia. In addition, Cambodian government has fully supported CPF business because the company brings benefits and opportunities to the country and its citizens. Moreover, Cambodia enables foreigners to buy and own the land.

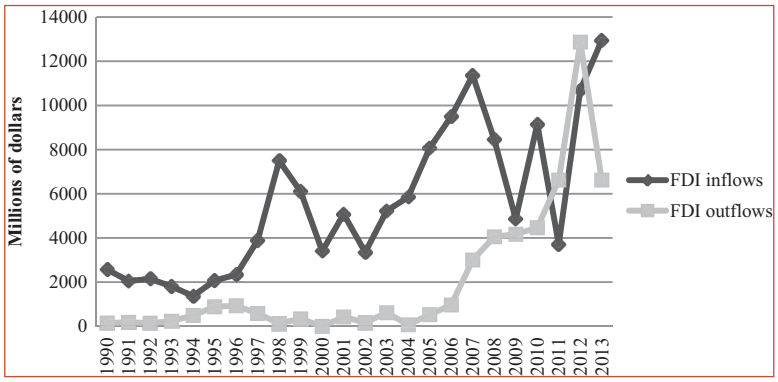


Figure 1: FDI inflows and outflows in Thailand, 1990 – 2013

Source: UNCTAD database

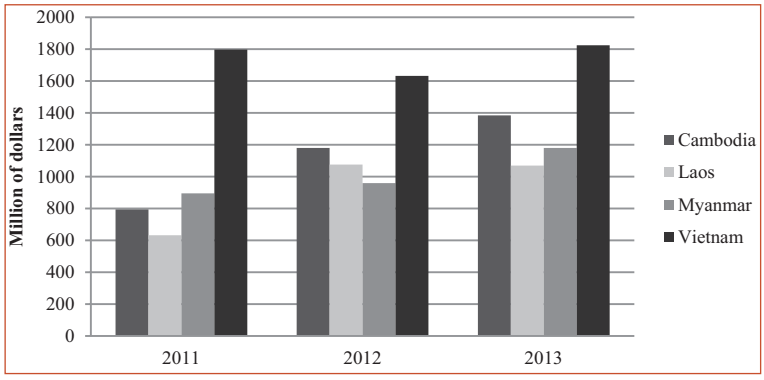


Figure 2: Net flow of Thailand direct investment to CLMV 2011-2013

Source: Bank of Thailand statistic

Myanmar

CPF has been investing in Myanmar since 1996. The reason for the key success for CPF's investment in Myanmar is its strategy to gradually grow from small business with low profile to countrywide expansion.

Lao PDR

In 2006, CPF invested in Lao PDR with a registered capital of 3 million USD. The company received a trust from Lao PDR to lease its land and animal farm for 20 years for business operation. Initially, the company operated a production facility, swine farms, fully integrated layer, broiler chicken farms and fish processing facilities.

Technology transfer

Firm-to-firm knowledge transfer

Since CPF used the same finance & accounting and human resource systems worldwide, the training and knowledge transfer became a crucial factor contributing to the company's consistent system and achieve-

ment. There are two types of knowledge transfer in CPF: knowledge transfer to in-house staff (peer-to-peer) and knowledge transfer to business partners.

For knowledge transfer to business partners, the company tries to develop agriculture with new technology. They use proactive approach by meeting farmers who are the important key in this type of business and thereafter transfer knowledge to them. The company deals with two types of farming: non-contract farming (outsourcing) and contract farming. Under non-contract farming, the farmers have their own land or plantation but the company provides farming lessons and technology to the farmers and cultivators, and thereafter the company observes the production and provides advice. The company need not buy the product directly from farmers, but they can get the product from middlemen. Under contract farming, the company recruits the contracted cultivators and farmers and supplies inputs, such as breeds, to them. Farmers need to build facilities according to the company plan. When the products reach the requirement, the company will come and collect the products. The company pays the farmers according to the performance and market price. In addition, the company transfers knowledge to the farmers with a clear succession guideline to ensure that all processes meet both the company's and the government's standard.

The company outsources its logistics to local suppliers. However, the company manages the entire logistics system by using Global Positioning System (GPS) tracking technology to monitor the truck's status and to ensure timely transportation. In addition, the company required the specific design and layout of each truck to ensure animal welfare and to meet the company's standard.

Collaboration with Governments, Universities, and Institutes

CPF and its subsidiaries in Thailand and overseas always emphasized the interests of the country, the people, and the company. Thus, the company closely examines and collaborates with the governments to generate the benefits to home and host countries. The company signed a Memorandum of Understanding (MOU) with the National Science and Technology Development Agency (NSTDA) on R&D in food and agriculture. One of the most significant collaboration between the company and government is researching on animal-disease outbreaks such as bird flu in poultry and EMS epidemic that hit the Thai and Viet Nam shrimp industry in 2012. The company and government needed to find the way to effectively protect against the disease, and they collaborated to provide the correct and relevant information to the general public. Furthermore, CPF also has collaborated with the universities both researching for new knowledge and technology and training the students. In addition, the company provided the scholarship for the CLMV students to study and train at universities in Thailand such as Assumption University.

Knowledge transfer models

Personnel exchange

Before undertaking a new international investment, CPF will perform feasibility studies and set a very clear investment policy for each country. At the initial point, the company will appoint representatives at the important positions to closely monitor operations in each country. This includes positions such as top operation manager with various skills to manage and control, finance executive or accounting manager, and support teams. The support teams are divided into three groups that include factory management specialists, poultry specialists and swine specialists. These support teams will be sent to other countries to set up the system and facilities. Once these tasks have been completed, the teams will be sent back to Thailand. In the case of problems in facility abroad, support teams will be sent there to solve the problem. Furthermore, the overseas subsidiaries must recruit local people to fill up all the needed positions. However, top management positions will be sent from the headquarter in Thailand.

Training

With the belief that employees are the most valuable resource and truly are the company's key success factor, CPF has continuously improved its training process. The company has their own "Learning Center" to train employees regarding job knowledge and particular skills that have been specified for each staffing level.

For CLMV training methods, CPF believes that local people can teach their colleagues better than Thai people. Thus, they use the "train the trainer" technique whereby the foreign subsidiary will send its employees to train in Thailand, which in turn will train others in their countries.

Although the main training and learning center is still in Thailand, associated company in Cambodia has planned to open its own learning center to train and develop employees for future growth opportunities. In addition, Myanmar government and CPF have an agreement on building "Poultry Training School" to teach farmers and people in agricultural sector by teaching 15 farmers per month without tuition fee.

Results of knowledge and technology transfer

Product innovation

The company has a specialized R&D team to analyze customer behavior in each country to meet consumer demand. In the CLMV countries, CPF tries to customize and innovate food products by placing the importance on nutrition, safety, and consumers' taste and preferences. For instance, in Viet Nam, young men prefer to consume small eggs for erectile enhancement. Consequently, the company produces small eggs for its market in Viet Nam. In Cambodia, people prefer pork, native chickens and white pork sausages. Therefore, the company produces special meal to specifically serve its Cambodian market.

CPF has learnt the techniques for egg incubation in bad environment from Cambodia. Moreover, the company conducts R&D to improve its egg incubation technique. Furthermore, Cambodian customers prefer to eat their local chicken, "Kao-Soon-Kwang" breed more than Thai chicken breed. Consequently, the company has conducted R&D to improve the Kao-Soon-Kwang breed to serve the market demand in Cambodia.

Technological process innovation

In order to maintain sustainability, the company focuses not only on increasing its productivity and profit but also on environmental impacts to customers and society. By doing so, the company encourages technology development, innovation, and alternative energy. For instance, the company in Cambodia produces biogas from biodegradable material and waste from swine. Subsequently, broiler and layer farms developed it as fuel for electricity generation for use in company's facility and transferred this technology to farmers.

Significantly improved skilled workers

The most significant improvement in CLMV for CPF is in relation to farming. The local farmers learn the methods to operate the modern farming system. Employing the best practice, knowledge and technology from company such as the closed system, farmers can prevent possible disease outbreaks and maintain suitable growing condition. Consequently, the farmers can increase efficient productivity and provide quality products.

Case study 2: MitrPhol Sugar Group

Background information

MitrPhol Sugar Group was established in 1946 at Rajburi Province where it was a small household industry producing syrup and was sold to nearby sugar mill. A decade later, in 1956, the household syrup producing industry turned into a sugar factory and registered the company as MitrPhol Co., Ltd. The company comprises five main business groups: plantation business, sugar business, wood substitute material business, renewable energy business, and investment business. The company has production plants and cane plantation areas in several regions of Thailand such as Supanburi, Singburi, Chaiyaphum, KhonKaen, Kalasin, and Loey. Its overseas branches include China, Laos, Cambodia, and Australia. The company has been ranked as Thailand's No. 1 sugar producer and exporter. In 2014, the company was ranked as the world's fourth largest sugar producer and the largest sugar producer in Asia. The company has been certified by many institutes. Moreover, it is Thailand's first sugar mill that was awarded ISO 9001:2008 for its quality management system. The other international recognitions are ISO 14001:2004, ISO 22000:2005, OHSAS 18001:2007, FSSC 22000, and TLS 800 (Group, 2013).

With years of experience, especially in sugar production, the company decided to expand its business to China by engaging in a joint venture with Guangxi Nanning East Asia Sugar Co., Ltd in Guangxi Province, China in 1993. In addition to sugar business, MitrPhol Group has brought the value-added notion to China's cane and sugar industry by expanding its business capacity. The company invested in biomass cogeneration power plant using biogas leftover from sugar production process as raw materials to produce steam and electricity.

In 2006, MitrPhol Group has expanded to Lao PDR under the name MitrPhol Lao Sugar Company. The company group was granted by the Lao PDR government a concession for cane growing area of 10,000 hectors for 40 years with the extension of another 20 years and land for sugar factory. Recently, MitrPhol Group bought 100% share of MSF Sugar, Australia's third largest sugar producer, in 2012. Therefore, MitrPhol Group has four sugar mills in Queensland, Maryborough Mill, South Johnstone Mill, Mulgrave Mill, and Tableland Mill. The markets are both in Australia and Asia–Pacific countries.

Cane plantation development, sugar factory establishment, and bioenergy business development in China, Lao PDR, and Australia are MitrPhol group's success in enhancing competitiveness in international market. The company facilitates transfer of cane and sugar expertise to the neighboring countries, which help generate and distribute income to local communities and benefit the economy as a whole.

Countries of investment

Lao PDR

With the support of the Thai government and a warm welcome from Lao PDR, MitrPhol expanded in business to Lao PDR in 2005 and received a 100 hectare concession from the government for experimentation. In 2006, the companies received more land concession to cultivate sugarcane over 10,000 hectares for 40 years, with extension by another 20 years in the Suvannakhet Province. Consequently, the company began to cultivate sugarcane and constructed a sugar factory. The company's initial investment was approximately 70 million USD in the form of a wholly owned company. The company built sugar mill in 2007 and first operated cane crushing on November 27, 2008. In addition, the company invested in biomass cogeneration power plant in Lao PDR.

Technology transfer

Firm-to-firm knowledge transfer

MitrPhol conducts contract farming with local cultivators in Lao PDR. The local farmers provide land and labor while the company provides inputs, marketing and technology. With this type of investment contract, the company can transfer its expertise in the form of knowledge and technology in sugarcane plantation and production to local people. MitrPhol educated the local farmers regarding cane preparation, soil preparation, cultivation, and ordinary practices to advance process and techniques in sugar manufacturing through training. Further, the company also supported the farmers to build connection with other members so they can work together to get better performance and they can help each other to solve problems in the future.

Collaboration with Governments, Universities, and Institutes

MitrPhol has a very good relationship with the Lao PDR government. They work together not only for promoting sugarcane plantation but also for improving the living conditions of the people in the country. In 2005, MitrPhol signed an MOU with the government for a 100 hectare concession experiment area in the Suvannakhet Province; the company contributed to the government through paying taxes and concession fees. Moreover, the company has integrated social responsibility concept to its work. Thus, it conducted various projects with government agencies that led to community development. The company constructed many common infrastructures in Lao PDR, such as hospitals, schools, roads and reservoirs.

Furthermore, MitrPhol has an agreement with the Lao PDR government called "2+3 contract farming" policy. The contract

divided benefits between villagers and investors: two factors contributed by villagers or farm households are land and labor, while three factors contributed by MitrPhol are financial support, knowledge and technology, and willingness to buy products from farmers at a price higher than the market price.

The company has joint development projects with several universities and institutes to develop new technology and work for training program, such as an MOU with the Savannaket University for student internship. In addition, it provides educational support to young people. The main reason for the projects were to improve the sugarcane strain for a higher yield and for new innovation. It has a joint project with many universities in Thailand such as Kasetsart University, King Mongkut's University of Technology Thonburi, Khonkhean University, and Mahidol University, and other government and public sectors.

Knowledge transfer models

Personnel exchange

There were two-directional processes of knowledge transfer between the firm and its subsidiaries. The case of knowledge transfer from MitrPhol to its subsidiaries includes its FDI in Lao PDR. Thai top managers were sent to Lao PDR to manage and control all the management system and improve the production process. In addition, cane promoting officers were sent to promote sugarcane cultivation in Lao PDR. As Savannakhet shared broader with Thailand, the transportation between two countries is convenient. The distance from the nearest mill of MitrPhol sugar factories in Thailand to the border of Lao PDR is 150 km. If there is any problem at the factory in Lao PDR, Thai engineers from nearest mill will be sent for as short as a one-day trip to fix the problem. Moreover, Thai employees were sent to China and Australia to learn and transfer back the knowledge for the development of sugar production.

Training

MitrPhol established a "MitrPhol Center" at Lao PDR, which focuses on training employees. Because Lao PDR is new to sugarcane plantation, they have relatively little knowledge on the ways to plant sugarcane. At MitrPhol Center, there are cane-promoting officers to introduce the career of sugarcane cultivation to people, teach farmers regarding the new technology, and organize the workshop for practical lesson for cultivating cane. Laotian staffs were sent to Thailand for training at MitrPhol's farm such as Chaiyapum, Khonkaen, Kalasin, and so on. In addition, the knowledge related to accounting is low because Lao PDR has no faculty of accounting. Thus, MitrPhol sent accounting experts to teach and train Laotian employees. On the other hand, the company sends Laotian employees to train and work in the sugar factory in Thailand hoping that when they return to their country they will transfer the knowledge they receive to everyone else. MitrPhol encourages its people, including overseas staffs, to continue their study and development. Therefore, it works with Khonkaen University's professors to train the employees in Lao PDR.

Results of knowledge and technology transfer

Product innovation

One of the successful development projects is "White Leaf Disease Testing Kit," which was a project with BIOTEC. With this kit, cultivators can check the disease before planting cane buds; thus, it is a good way to prevent the spread of the disease.

Technological process innovation

For process innovation, as the consequence of knowledge transferred from operation abroad, MitrPhol obtained the new innovation in machinery, technology and automation. One of the new innovations from Lao PDR is a cane peeling machine. Instead of using more than 30 workers to perform this task, they developed the new machine to help them to quickly peel the cane. Another new technique is tying sugarcane together into a bundle before planting to make it strong and for it to not fall, especially in a hilly area. In addition, the local farmers proposed a small process for cleaning sugarcane by shaking and sorting it with a machine.

New knowledge

First, MitrPhol faced the problem of cane cultivation in a different area. Thus, the company analyzed the real problem with local cultivators and related people. Once the problem has been identified, they can find appropriate solution such as ways to harvest sugarcane in a hilly area. Through its sugarcane plantation in Lao PDR, MitrPhol Group faced the problem of "White Leaf Disease" because of many insects living around the plantation areas. It solved the problem by letting the R&D center research for new breeds of sugarcane that are immune to the disease.

Significantly improved skilled workers

One of the most significantly improved skills is providing primary education regarding sugarcane farming, teaching from nothing until the local people have adequate knowledge to cultivate sugarcane and have the technical skills for using equipment in factories. Lao PDR workers are more disciplined and anticipatory. They have an open mind to learn new things and are also willing to participate in training or activities provided by the company, such as morning talk sessions. Lao people are courageous to express their opinion during these sessions. Through training by MitrPhol, the employees can also improve accounting skill, without having the real curriculum in the university.

Conclusion and policy recommendation

We present top two companies from the natural resource-based industries that invest in CLMV based on the list of 50 Southeast Asia challengers and Thailand's FDI statistics to investigate their knowledge and technology transfer of FDI outflow. The first company is the leading agro-industrial and food conglomerate in the Asia Pacific region. The second company is Thailand's and Asia's biggest sugar and bioenergy producer. The summary of these cases are shown in Table 1.

For the firm-to-firm level knowledge transfer, all of these cases experience systematic knowledge transfer. The motivation to transfer the technology and knowledge is to increase the recipient's technological capability, especially for improving the quality and efficiency. The recipients have strong motivation to

Table 1: The summary output of cross-case comparison

Topic	CPF	MitrPhol
Countries of investment	• 100 % own company in Cambodia Lao PDR, Myanmar, Viet Nam	• 100 % own company in Lao PDR
Technology Transfer		
Firm-to-firm level knowledge transfer	• Same Finance & Accounting and HR system. • 2 types of knowledge transfer; in-house staff and business partner • 2 types of farming with business partner; non-contract farming and contract farming • Outsource its logistics to local suppliers	• Transfer knowledge and technology in sugarcane plantation and production which the company's expertise to local farmers
Collaboration with government, universities or institutes	• **Thailand** o MOU with NSDTA on R&D in food agriculture • Internship training program with many universities	• **Thailand** o Joint project with many universities in Thailand o Co-project with BIOTEC
	• **CLMV** o Collaborate with government about animal-disease outbreaks such as Bird flu in poultry and EMS epidemic in shrimp	• **CLMV** o MOU with government for cultivate sugarcane o Do agreement called "2+3 contract farming" policy with government o MOU with Savannaket University for student internship.
Knowledge Transfer Models		
Personnel exchange	• Thailand → CLMV o Top Operation Manager and Account Managers o Support Team o Factory Staff Team • Poultry Training School in Myanmar teaching by Thai staff	• Thailand → Lao PDR o Top managers were sent to manage and control the management system and the production process o PR team promoting cane plantation
Training	• CLMV → Thailand • Train the trainer techniques • New learning center in Cambodia • Training in Thai universities sponsored by the company (MBA)	• Lao PDR → Thailand o "MitrPhol center" Lao people were sent to train and workshop for practicing in real farm of company • On-the-job training
Results of Knowledge and Technology Transfer		
Product innovation	• Customize and innovate food product for local consumers' taste and preferences o Small eggs product in Vietnam o Native chickens ('Kao-Soon-Kwang' specie) and white pork sausages in Cambodia	• High yield sugar cane breed White Leaf Disease Resistant sugar cane breed
Technological process innovation	• Biogas from biodegradable material	• Sugar cane peeling machine • Sugar cane planting technique by bundling sugar cane to prevent the damage from the typhoon • Sugar cane cleaning machine White Leaf Disease checking kit

Table 1: (Continued)

Topic	CPF	MitrPhol
New Knowledge	—	• Harvest sugar cane in hilly area New breed of sugar cane that is immune to the disease such as White Leaf Disease
Significant improvement skill	• Modern farming for local farmers	• Primary education about sugar cane farming • Technical skills for using equipment in factory Accounting skill

Source: author

receive the knowledge and technology because they would like to join the global production network, which provide them higher and stable income. Moreover, they would like to improve their skills. The obstacles to match between providers and recipients are that there are no existing firms in the business that the providers are looking for in those countries.

The mode of knowledge transfer includes both personnel exchange and formal training. These companies send the Thai management team to set up the back office and supplier training. They also provide formal training in Thailand as a part of human resource development. These help closing the gap on knowledge and technology between the firms.

The policy recommendation for Thailand could be creating a positive relationship along the bordering countries by providing the aid on infrastructure building and industrial zone construction. The process for visa for professional personal exchange should be quick and easy. For CLMV, the vocational training school is needed to increase the skill matched with the demand market. The government needs to improve the utility, healthcare system, and welfare to maintain the labor in the countries and attract FDI.

Acknowledgement

This paper was supported by Economic Research Institute for ASEAN and East Asia (ERIA). We would like to express special thanks of gratitude to the top executives from CPF (Thailand and Cambodia), and MitrPhol who provided us their valuable time for in-depth discussion.

References

✓Chantapong, S. a. S. T. (2012). *Thai Direct Investment in the Neighboring Countries: An Important Step to AEC, Focused and Quick (FAQ) Issue 71*. Bank of Thailand.

✓Group, M. P. (2013). Sustainability Report 2013.

✓UNCTAD. (2012). "Towards A New Generation of Investment Policies", World Investment Report. Geneva.

✓Vincent Chin, A. K., Michael Meyer, Evelyn Tan, and Bernd Waltermann (2012). The Companies Piloting a Soaring Region: 2012 BCG Southeast Asia Challengers: The Boston Consulting Group.

✓Wee, K. H. (2007). Outward foreign direct investment by enterprises from Thailand. *UNCTAD Transnational Corporation,* Vol. 16, No. 1, pp. 89–133.

Tech Events

2016

Aug 21–23
New Delhi, India

7th World Renewable Energy Technology Congress & Expo-2016
Contact: WRETC Secretariat
F1-F2, Pankaj Grand Plaza Mayur Vihar-I
New Delhi - 110091, India
Tel: +91-11-22758149
Fax: +91-11-43019379
E-mail: dranilgarg2011@gmail.com
Web: http://wretc.in

Sep 6–8
Kuala Lumpur, Malaysia

International Conference on Sustainable Development 2016
Contact: Convenors/Coordinators
Ontario International Development Agency 364 Moffatt Pond Court
Ottawa Ontario, K2J 0C7, Canada
Tel: + 1 613 612 7615
E-mail: oida@ontariointernational.org
Web: http://www.ontariointernational.org/ICSD_2016_Malaysia.html

Sep 7–9
Greater Noida, India

Renewable Energy India Expo
Contact: Rajneesh Khattar Group Director, UBM India
Mob: +91 9871 726762
E-mail: Rajneesh.khattar@ubm.com
Web: http://www.renewableenergyindiaexpo.com

Sep 14–16
Bangkok, Thailand

3W EXPO 2016
Contact: TechnoBiz Communications Co., Ltd.
2521/27, Lardprao Road
Khlongchaokhunsingha
Wangthonglang
Bangkok 10310
Thailand
Tel: +66 2-933 0077
Fax: +66 2-955 9971

Sep 17–19
Yangon, Myanmar

Renewable Energy and Energy Efficiency Myanmar 2016
Contact: United Business Media (M) Sdn Bhd
A-8-1, level 8, Hampshire Place Office
157 Hampshire 1, Jalan Mayang Sari
50450 Kuala Lumpur, Malaysia
Tel: +603 2176 8788
Fax: +603 2164 8786
E-mail: vicky.tan@ubm.com
Web: http://www.renewableenergymyanmar.com

Sep 19–21
New Delhi, India

11th World Congress on Biotechnology
Contact: OMICS International
Fax: +1-650-618-1414
Tel: +1-650-268-9744
E-mail: biotechnology@omicsgroup.com
Web: http://www.biotechnologycongress.com

Sep 19–24
Jakarta, Indonesia

WORLD RENEWABLE ENERGY CONGRESS & EXHIBITION 2016
Contact: WREN (World Renewable Energy Network)
147 Hilmanton
Lower Earley
Reading, RH6 4HN
UK
Tel: +44 118 961 1364
Fax: +44 118 961 13765

Sep 20–22
Seoul, Republic of Korea

RENEWABLE ENERGY WORLD ASIA 2016
Contact: PennWell Conferences & Exhibitions
1421 S. Sheridan Road Tulsa, Oklahoma 74112
USA
Tel: +1 (918) 835-3161
Fax: +1 (918) 831-9497

Sep 20–22
Guangzhou, China

GUANGZHOU INTERNATIONAL SOLAR PHOTOVOLTAIC EXHIBITION 2016
Contact: Guangzhou Grandeur Exhibition Services Co., Ltd
Room 2303-2305, The 4th Tower
Dong Jun Plaza, No.836 of Dong Feng Dong Road
Yuexiu District
Guangzhou, 510080, China
Tel: +86 2022074185
Fax: +86 20-82579220

Sep 24–25
Kuala Lumpur, Malaysia

1st International Conference on Disruptive Innovation (ICDI2016)
Contact: ICDI 2016 Secretariat
Malaysia University of Science & Technology (MUST),
47301 Petaling Jaya, Malaysia
Tel: +603 8928 0577, Fax: +603 8920 9344
E-mails: icdi2016@must.edu.my, amirfateh@must.edu.my
Web: http://must.edu.my/icdi2016/

Sep 26–29
Kuala Lumpur, Malaysia

PHARMA + BIO ASIA 2016
Contact: Protemp Group 38-3 , (2nd Floor)
Jalan PJU 5/9, Dataran Sunway
Kota Damansara
47810, Petaling Jaya Selangor Darul Ehsan
Malaysia
Tel: +603 6140 6666, Fax: +603 6140 8833

Oct 19–21
Beijing, China

China Wind Power 2016
Contact: Beijing Exhibition Co., Ltd. CCID
Tel: 010-68450820 68451467
Fax: 010-68455499
E-mail: info@chinawind.org.cn
Web: http://www.chinawind.org.cn/cwp2016/

Oct 19–21
Mumbai, India

INTERSOLAR INDIA 2016
Contact: Bombay Exhibition Centre - NSE Exhibition Complex
Highway, Goregaon (East) Mumbai - 400 063, India
Tel: +91 22-6645 0123
Fax: +91 22-6645 0101

Oct 21–23
Shanghai, China

IEEE 2016 International Conference on Power and Renewable Energy
Chen Li
E-mail: contact@icpre.org
'Web: http://www.icpre.org

Oct 26–29
Hong Kong, China

Eco Expo Asia
Contact: Exhibitions Department
Hong Kong Trade Development Council
Unit 13, Expo Galleria
Hong Kong Convention & Exhibition Centre
1 Expo Drive, Wanchai, Hong Kong, China
Tel: (852) 2584 4333
E-mail: exhibitions@hktdc.org
Web: http://www.hktdc.com/fair/ecoexpoasia-en/

Nov 15–16
Mumbai, India

BIOPHARMA INDIA 2016
Contact: Terrapinn Holdings Ltd
4th Floor, Welken House,
10-11 Charterhouse Square
London EC1M 6EH
UK
Tel: +44 (0)20 7608 7030
Fax: +44 (0)20 7608 7040

Nov 18–20
Fukuoka, Japan

7th Asia-Pacific Innovation Conference Fukuoka, Japan
Contact: Mitchell AdamsCentre for Transformative InnovationSwinburne University,
Australia
E-mail: apic@swin.edu.au
Web: http://ap-ic.org/apic-2016/

Nov 24–26
Bangkok, Thailand

SOLARTECH ASIA 2016
Contact: N.C.C. Exhibition Organizer Co., Ltd. - NEO
Queen Sirikit National Convention Center
60 New Rachadapisek Road, Klongtoey,
Bangkok 10110
Thailand
Tel: +66 2203 4260-2
Fax: +66 2203 4250-1

Nov 28–30
Bangkok, Thailand

1st Technology Innovation Management and Engineering Science international conference (TIMES-iCON2016)
Contact: Dr. Sotarat Thammaboosadee
Conference Secretary
E-mail: secretary@times-icon.org
Tel: +668-1402-3627
Web: http://times-icon.org

Dec 29–30
Bangkok, Thailand

9th International Conference on Envirotech, Cleantech and Greentech (ECG)
Contact: Conference Secretariat
Fax: +91-9001087697
E-mail: info@wasrti.org
Web: http://wasrti.org

Tech Ventures & Opportunities

Business Coach

Tech Opportunities

Technology Resources and Networks of APC T T

Technology Opportunities
www.technology4.sme.net

Business Information
www.businesss-asia.net

Innovation Systems
www.nis.apctt.org

Biotechnology Network
www.binasia.net

Traditional Medicine Network
www.apctt-tm.net

Latest Innovations & News
www.techmonitor.net

Managing your business
Records management

SME Corporation Malaysia

http://www.smecorp.gov.my

Records management, or RM, is the practice of maintaining the records of an organization from the time they are created up to their eventual disposal. This may include classifying, storing, securing, and destruction (or in some cases, archival preservation) of records.

A record can be either a tangible object or digital information: for example, birth certificates, medical x-rays, office documents, databases, applicationdata, and e-mail. Records management is primarily concerned with the evidence of an organization's activities, and is usually applied according to the value of the records rather than their physical format.

Definitions of records management

In the past, 'records management' was sometimes used to refer only to the management of records which were no longer in everyday use but still needed to be kept 'semi-current' or 'inactive' records, often stored in basements or offsite. More modern usage tends to refer to the entire 'lifecycle' of records from the point of creation right through until their eventual disposal. The ISO 15489: 2001 standard defines records management as "The field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records, including the processes for capturing and maintaining evidence of and information about business activities and transactions in the form of records". The ISO defines records as "information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in the transaction of business". The International Council on Archives (ICA) Committee on Electronic Records defines a record as "a recorded information produced or received in the initiation, conduct or completion of an institutional or individual activity and that comprises content, context and structure sufficient to provide evidence of the activity." The key word in these definitions is evidence. Put simply, a record can be defined as "evidence of an event".

Practicing records management

A Records Manager is someone who is responsible for records management in an organisation. The practice of records management may involve:

- Planning the information needs of an organization;
- Identifying information requiring capture;
- Creating, approving, and enforcing policies and practices regarding records, including their organization and disposal;
- Developing a records storage plan, which includes the short and long-term housing of physical records and digital information;
- Identifying, classifying, and storing records;
- Coordinating access to records internally and outside of the organization, balancing the requirements of business confidentiality, data privacy, and public access; and
- Executing a retention policy on the disposal of records which are no longer required for operational reasons; according to organizational policies, statutory requirements, and other regulations this may involve either their destruction or permanent preservation in an archive.

Records management principles and automated records management systems aid in the capture, classification, and ongoing management of records throughout their lifecycle. Such a system may be paper based (such as index cards as used in a library), or may be a computer system, such as an electronic records management application.

ISO 15489:2001 states that records management includes:

- setting policies and standards;
- assigning responsibilities and authorities;
- establishing and promulgating procedures and guidelines;
- providing a range of services relating to the management and use of records;
- designing, implementing and administering specialized systems for managing records; and
- integrating records management into business systems and processes.

Managing physical records

Managing physical records involves different disciplines and may draw on a variety of forms of expertise. Records must be identified and authenticated. This is usually a matter of filing and retrieval; in some circumstances, more careful handling is required.

Identifying records

If an item is presented as a legal record, it needs to be authenticated. Forensic experts may need to examine a document or artifact to determine that it is not a forgery, and that any damage, alteration, or missing content is documented. In extreme cases, items may be subjected to a microscope, x-ray, radiocarbon dating or chemical analysis. This level of authentication is rare, but requires that special care be taken in the creation and retention of the records of an organization.

Storing records

Records must be stored in such a way that they are accessible and safeguarded against environmental damage. A typical paper document may be stored in a filing cabinet in an office. However, some organisations employ file rooms with specialized environmental controls including temperature and humidity. Vital records may need to be stored in a disaster-resistant safe or vault to protect against fire, flood, earthquakes and conflict. In extreme cases, the item may require both disaster-proofing and public access. Civil engineers may need to be consulted to determine that the file room can effectively withstand the weight of shelves and file cabinets filled with paper; historically, some military vessels were designed to take into account the weight of their operating procedures on paper as part of their ballastequation(modern record-keeping technologies have transferred much of that information to electronic storage). In addition to on-site storage of records, many organizations operate their own off-site records centers or contract with commercial records centers.

Circulating records

Tracking the record while it is away from the normal storage area is referred to as circulation. Often this is handled by simple written recording procedures. However, many modern records environments use a computerized system involving bar code scanners, or radio-frequency identification technology (RFID) to track movement of the records. These can also be used for periodic auditing to identify unauthorized movement of the record.

Disposal of records

Disposal of records does not always mean destruction. It can also include transfer to a historical archive, museum, or private individual. Destruction of records ought to be authorized by law, statute, regulation, or operating procedure, and the records should be disposed of with care to avoid inadvertent disclosure of information. The process needs to be well-documented, starting with a records retention schedule and policies and procedures that have been approved at the highest level. An inventory of the records disposed of should be maintained, including certification that they have been destroyed. Records should never simply be discarded as refuse. Most organizations use processes including pulverization, paper shredding or incineration.

Commercially available products can manage records through all processes active, inactive, archival, retention scheduling and disposal. Some also utilizes RFID technology for the tracking of the physical file.

Managing electronic records

The general principles of records management apply to records in any format. Digital records (almost always referred to as electronic records) raise specific issues. It is more difficult to ensure that the content, context and structure of records is preserved and protected when the records do not have a physical existence.

Particular concerns exist about the ability to access and read electronic records over time, since the rapid pace of change in technology can make the software used to create the records obsolete, leaving the records unreadable. A considerable amount of research is being undertaken to address this, under the heading of digital preservation. The Public Record Office Victoria (PROV) located in Melbourne, Australia published the Victorian Electronic Records Strategy (VERS) which includes a standard for the preservation, long-term storage and access to permanent electronic records. The VERS standard has been adopted by all Victorian Government departments. A digital archive has been established by PROV to enable the general public to access permanent records.

Electronic tax records

Electronic Tax Records are computer-based/non-paper versions of records required by tax agencies like the Internal Revenue Service. There is substantial confusion about what constitutes acceptable digital records for the IRS, as the concept is relatively new. The subject is discussed in Publication 583 and Bulletin 1997-13, but not in specific detail.

Businesses and individuals wishing to convert their paper records into scanned copies may be at risk if they do so. For example, it is unclear if an IRS auditor would accept a .jpg, .png, or .pdf format scanned copy of a purchase receipt for a deducted expense item.

Global Brand Database

The Global Brand Database makes it easier to search around 11,820,000 records relating to internationally protected trademarks, appellations of origin and armorial bearings, flags and other state emblems as well as the names, abbreviations and emblems of intergovernmental organizations. The Global Brand database allows free of charge, simultaneous, brand-related searches across multiple collections. The Database page lets you easily search multiple brand-related data sources and receive instant feedback, letting you explore the brand landscape in a new and powerful way.

For more information contact:
World Intellectual Property Organization
34, chemin des Colombettes
CH-1211 Geneva 20, Switzerland
Web: http://www.wipo.int/branddb/en/

Doing business in India

Invest India

http://www.investindia.gov.in

To do business in India, following options are available to foreign companies:

Setting up a non-corporate entity

Liaison office: A liaison or a representative office can be opened in India subject to approval by Reserve Bank of India. Such an office can undertake liaison activities on its company's behalf. A liaison office can also undertake:

- Representing parent/group companies in India
- Promoting import/export in India
- Promoting technical/financial collaborations on parent company/group's behalf
- Coordinating communications between parent/group companies and Indian companies

Branch Office: Foreign companies can conduct their business in India through its branch office which can be opened after obtaining a specific approval from Reserve Bank of India. A branch office can undertake following activities:

- Import & export of goods
- Rendering professional or consultancy services
- Carrying out research work in area which its parent company is engaged
- Promoting technical/financial collaborations on behalf of parent company/ overseas group company
- Representing parent/group companies in India and acting as buying/selling agent in India
- Providing IT services and developing software in India
- Providing technical support for products supplied by parent company/group

Project office: If a foreign company is engaged by an Indian company to execute a project in India, it may set up a project office without obtaining approval from Reserve Bank of India subject to prescribed reporting compliances. As applicable in case of a branch office, a project office is treated as an extension of foreign company and is taxed at the rate applicable to foreign companies.

Setting up a corporate entity

Wholly owned subsidiary: Foreign companies can set up wholly owned subsidiary companies in India in form of private companies subject to FDI guidelines. A wholly owned or a subsidiary company has the maximum flexibility to conduct business in India when compared with a liaison or branch office and has following salient features:

- Funding can be done via equity, debt (foreign as well as local) and internal accruals
- Indian transfer pricing regulations apply
- Repatriation of dividends is allowed without approvals

Joint Venture with Indian partner: Foreign companies can also set up joint venture with Indian or foreign companies in India. There are no separate laws for joint ventures in India and laws governing domestics companies apply equally to joint ventures.

Foreign Institutional Investors: FII's can invest in India in financial markets such as pension funds, mutual funds, investment trusts and asset management companies or their power of attorney holders. FII's can invest in all securities in primary and secondary markets including the equity and other instruments of companies which are listed or are to be listed on stock exchanges of India.

Entry and investment routes

- Foreigners can directly invest in India either on their own or as a joint venture, with a few exceptions with regard to investment limits and sectors.
- No government approval is required for FDI in virtually all sectors except a small negative list formulated by government. Sector specific guidelines are formulated by government giving sectoral investment caps if any.
- If an investment does not qualify for automatic approval, FIPB considers the proposal.
- Use of foreign brands names/trademarks is permitted for sales in India.
- Indian capital markets are open to FII's and Indian companies are allowed to raise funds from international capital markets
- Foreign technology collaborations are allowed with agreements on
- Technical knowhow fees
- Payment for designs and drawings
- Payment for engineering services
- Other royalty payments

Licensing of IP rights

World Intellectual Property Organization (WIPO), Switzerland

http://www.wipo.int

Licensing of intellectual property rights - a vital component of the business strategy of your SME

You may be interested in starting a new business, expanding an existing business (extending your territory or the nature of business) or improving the quality of the goods or services of your SME and thereby its market position. In many situations, licensing of intellectual property rights is an effective tool for achieving these business goals.

A licensing agreement is a partnership between an intellectual property rights owner (licensor) and another who is authorized to use such rights (licensee) in exchange for an agreed payment (fee or royalty). A variety of such licensing agreements are available, which may be broadly categorized as follows:

- Technology License Agreement
- Trademark Licensing and Franchising Agreement
- Copyright License Agreement

In practice, all or some of these agreements often form part of one single contract since in transfers of this nature many rights are involved and not simply one type of intellectual property right. You may also come across licensing agreements in other circumstances, such as, during a merger or acquisition, or in the course of negotiating a joint venture.

All of these mechanisms either on their own or in combination will provide your SME, as a licensor or licensee, a wide variety of possibilities in conducting business in your own country or elsewhere. As an intellectual property owner and a licensor, your SME can expand its business to the frontiers of your partners' business and ensure a steady stream of additional income. As a licensee, your SME can manufacture, sell, import, export, distribute and market various goods or services which it may be prevented from doing otherwise.

In the international context, a formal licensing agreement is possible only if the intellectual property right you wish to license is also protected in the other country or countries of interest to you. If your intellectual property is not protected in such other country or countries then you would not only not be able to license it, but also you would have no legal right to put any restriction on its use by anyone else.

Technology licensing and joint ventures

If your SME is interested in:

- improving the quality of your product or manufacturing a new product by using the rights owned by others in the form of a patent, utility model, or know-how protected by a trade secret, then acquiring such rights through a technology licensing agreement may be the right solution, or
- entering a market or extending your existing market for a product for which your SME owns the rights to a patent, utility model or know-how protected by a trade secret, then authorizing another to use your process or product through a technology licensing agreement may be the right solution.

By a technology licensing agreement the licensor authorizes the licensee to use the technology under certain agreed terms and conditions. It is, therefore, a contract freely entered into between two parties and contains terms and conditions so agreed.

A joint venture may consist of any variety of business relationships that involve two or more enterprises pooling their resources with the objective of implementing a common business purpose. Often, in such agreements, one party will contribute technology or know-how of which he is the proprietor and the other party may contribute financial and expertise of his own to the project. The joint venture will, therefore, often include a license agreement concluded by the parties concerned to regulate the use of the proprietary information and compensation for its use.

WIPO GREEN Database

WIPO GREEN consists of an online database and network that brings together a wide range of players in the green technology innovation value chain, and connects owners of new technologies with individuals or companies looking to commercialize, license or otherwise access or distribute a green technology. These technologies are available for license, collaboration, joint ventures and sale.

For more information, access:
https://webaccess.wipo.int/green/

IP assignment and licensing in Thailand

ASEAN Intellectual Property Association
http://www.aseanipa.org

The assignment, or license agreements, of 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 in order to make them valid and enforceable in Thailand. The important rules and regulations in relation to the three main IP objects, i.e. 1) trademark, and 2) patent are as follows:

Trademark

Trademark Assignment – the assignment must be made in writing and registered with the Trademark Office, in order 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. The assignment cannot be registered only for some associated trademarks, and partial assignment is not allowed. In addition, the cancellation of filed/registered license agreements relating to assigned trademarks is always a prerequisite, before the assignment is granted in Thailand.

Trademark Licensing – the license agreement and any sub-license agreement must be made in writing and registered with the Trademark Office, in order 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 in order to maintain its validity.

A registrable license agreement, according to Section 68 of the Trademark Act, shall at least provide the following: 1) 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 2) 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.

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, in order 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, in order to make it valid and enforceable.

In granting a license, according to Section 39 of the Patent Act: 1) the patentee shall not impose upon the licensee any condition or restrictions, or any royalty term which unfairly limits competition. Conditions, restrictions or terms which 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 for example: a) 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; b) 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; c) prescribing that the licensee sells, or distributes more than half of the product produced, to the holder of the patent; d) prescribing that the licensee limits the quantity of production, sale or distribution; e) 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; f) prescribing that the licensee exercise 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.

Starting a business

Source of funds

SME Corporation Malaysia

http://www.smecorp.gov.my

How much money do you need?

It depends on your type of business and how quickly you plan to expand. You should sit down and write out how much your expected expenses will be for at least the next 24 months and how much you project to bring in as far as income on a monthly basis. There are several companies that can help you get started with funding your business.

You can refer back to your business plan or start asking yourself what type of expenses do you need the money for? Generally, for a start up business, there will be a few costs involve:

- **Cost of sales:** Product inventory, raw materials, manufacturing equipment, shipping, packaging, shipping insurance, warehousing
- **Professional fees:** Setting up a legal structure for your business, trademarks, copyrights, patents, drafting partnership and non-disclosure agreements, attorney fees for ongoing consultation, retaining an accountant
- **Technology costs:** Computer hardware, computer software, printers, cell phones, PDAs, website development and maintenance, high-speed internet access, servers, security measures, IT consulting
- **Administrative costs:** Various types of business insurance, office supplies, licenses and permits, express shipping and postage, product packaging, parking, rent, utilities, phones, copier, fax machine, desks, chairs, filing cabinets – anything else you need to have on a daily basis to operate a business
- **Sales and marketing costs:** Printing of stationery, marketing materials, advertising, public relations, event or trade show attendance or sponsorship, trade association or chamber of commerce membership fees, travel and entertainment for client meetings, mailing or lead lists
- **Wages and benefits:** Employee salaries, payroll taxes, benefits, workers compensation

No matter what your business type, take into account everything you will spend, from the moment you dig in to the startup process, through the time you're ready to sell a product or service.

Financing with debt

Financing a business with debt involves securing a loan. This can be in the form of either unsecured or secured debt. Unsecured debt refers to a loan taken without having to put up any specific form of security or collateral. This involves mainly borrowing from family or friends, a credit card, line of credit and other similar means.

Secured debt, on the other hand, refers to loans where you are required to put up some form of collateral in exchange for the loan, for example, mortgage on the house or refinancing your car, among others. For secured debts, you need to be able to assure the lender about your ability to meet your payments either through your business or other means. To secure such debt is some cases you will need to present a solid business plan, evidence of your experience and of your ability to repay.

Family and friends: Raising finance from family and friends can be rewarding for both parties: you get the finance to start or expand your business, while your family and friends have the satisfaction of helping you while earning interest on their spare cash. Family and friends may accept more flexible terms and conditions that are better suited to your business than those offered by commercial banks.

Often arrangements with family and friends are informal and based purely on trust and verbal assurances. However, a formal written agreement is strongly advised in order to minimise disputes in the future. Preserving your relationships with friends and family is as important as pursuing your business opportunity.

Personal loan: Financing a business with personal loans means that you borrow the money personally to invest it in your business. This is typically used at start-up or early stages where the business has not established enough history or performance to be able to secure a loan on its own merit.

Mortgage loan: Another source for financing a business is a home mortgage loan. Some banks allow you to mortgage or refinance your house. This may be a risky move as if you are unable to make the scheduled payments, you risk losing your home. It is therefore crucial that you are confident on your continued ability to make all payments scheduled.

Insurance loan: Another source of loan could be from your insurance policy. If you have been paying for a life insurance policy that builds up a cash value you are entitled to take up a loan on the cash value amount. Many insurance companies will loan you money with the cash value as security. This is a rather expensive method of financing a business and also means reduced benefits if you are unable to clear the loan and interests accrued.

Credit cards: Credit cards can also be a source for financing a business when you are first getting started. However, this is

another expensive method as the rates charged can be high and it could also affect your credit rating, required for other sources of financing.

Government small business loans

There are a variety of government small business loans and programs that can be used in financing a business, including those specifically for Bumiputeras and micro entrepreneurs. Most of these loans are administered by the Financial Institutions like the Development Financial Institutions (DFIs) and the commercial banks. While some are directly administered by the department/agency involved. Funding from these sources may be relatively easier to secure as the government department/agency guarantees your loan, if you are approved.

Grants: There are often a variety of government grant programs for specific types of startup businesses. For more information, search online on government websites. Unless they're reputable, don't pay money to sites that tell you they'll give you a big list of where you can get grant money. The risk is that - While grants are rarely required to be paid back, accountability is higher, and you might have to work within a difficult deadline, to show your progress. If you do not achieve the progress you indicated in your proposal, there may be some sort of penalty.

Bank loans

Banks lend money to existing businesses but for a start-up, it may be very difficult to get a bank loan as they do not have a track record. Banks require a sound business plan and must be convinced of the viability of your business before they agree to lend you money. Banks also normally need collateral as security. If you have a solid business plan and the lender agrees, this can often be the cheapest (interest rate-wise) loan sources available. The risk is that besides the fact that it's often hard for a startup to qualify - since there's little evidence you'll be profitable - if you do get a loan, it can be like a ticking time bomb if your business isn't doing well.

Equity financing

Equity Financing is borrowing where the investor/financier becomes a part-owner of the business in the process. This could be through venture capital or issuing shares.

Venture capital

Venture capitalists do not want to remain in your business forever. Generally, they want to see an exit strategy that will see them out in about 5 years, with a high return on their investment as their reward.

In terms of areas of interest, venture capitalists are interested in both high technology and various other industries. Normally they fund businesses which have already been launched and have probably reached profitability.

The angel investor, on the other hand, is a special type of venture capitalist. Usually an individual with substantial funds, the 'angel' provides capital to start-up companies and takes a personal stake in the venture. Depending on the individual 'angel', their requests for any form of control or a quick return on investment will differ. However, similar to regular venture capitalists, they seek high returns on their investment for the risks they take on.

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 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 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.

For more information, contact:
MVF Unit
Malaysian Technology Development Corporation
Level 8-9, Menara Yayasan Tun Razak
Jalan Bukit Bintang
55100 Kuala Lumpur, Malaysia
Tel: 603 – 2172 6000 / 6117
Web: http:www.mtdc.com.my

Venture capital for MSMEs

Small Industries Development Bank of India (SIDBI)

http://smallb.sidbi.in

Venture Capital is emerging as an important source of finance for small and medium-sized firms, especially for starting the business and business expansion. An entrepreneur usually starts the business with his own funds, and those borrowed from banks. It is during expansion that they find it difficult to raise funds. SMEs have traditionally been dependent on Bank finance for expansion and working capital requirements. However, in the recent past, bankers have curtailed lending to SMEs due to the greater risk of non-performing assets (NPAs) in a downturn. Thus, even though many SMEs have profitable projects and expansion plans, they find it difficult to get finance for their projects, as bankers may not be willing to fund high risk projects.

In order to provide financial support to such entrepreneurial talent and business skills, the concept of venture capital emerged. Venture capital is a means of equity financing for rapidly-growing private companies. Finance may be required for the start-up, expansion or purchase of a company. Venture capitalists comprise of professionals in various fields. They provide funds (known as Venture Capital Fund) to these firms after carefully scrutinizing the projects. Their main aim is to earn higher returns on their investments, but their methods are different from the traditional moneylenders. They take active part in the management of the company as well as provide the expertise and qualities of a good bankers, technologists, planners and managers.

Venture capital for MSMEs in India

Traditionally, Venture Capitalists in India have shied from the MSME sector. The non-corporate structure and small size of majority of MSMEs in India makes the Venture Capitalists and Private Equity Players reluctant to investing in them due to higher transaction costs and difficulties in exits out of such investments. However, the VC scenario in India is rapidly changing. Alternative funding like VC is picking up in the India, including in the MSME sector. Moreover, the VCs are expanding their reach into areas besides the traditional VC sectors like Information Technology (IT); nowadays interest in sectors like clean energy, healthcare, pharmaceuticals, retail, media, etc. is also growing.

In recent years, the government controlled financial institutions have initiated positive and progressive measures to provide MSMEs access to funds at a reasonable and affordable costs and without any usual hurdles. Venture capital funding institutions have been floated to induct fund at low cost, share the risk and to provide management and technology upgradation support to these enterprises. Government-funded schemes exist at both the national and the state levels. They tend to be relatively small — they typically do not exceed US$ 5 million.

The Small Industries Development Bank of India (SIDBI) is the main public financial institution involved in VC funding operations. SIDBI operates through wholly owned subsidiary, SIDBI Venture Capital Limited (SVCL). It co-finances state-level funds, and sometimes co-invests with private sector VCs on a case-by-case basis.

Since 2006, some new VCs are also operating at the SME level, such as Helion Venture Partners, Erasmic Venture Fund(Accel India Venture Fund), SeedFund, and Upstream Ventures. While technology remains the most sought after investment fields, interest has been shifting from internet companies to other types of operations—especially ICT enabled services and bio-technology.

A few VCs also operate at the early-stage, including Erasmic Venture Fund, Seed Fund, Infinity Venture, IFI sponsored facilities such as Swiss Tech VCF, and the government schemes such as SIDBI VC and Gujarat VF. Early stage VCs seek smaller deals, typically in the US$ 1 - 3 million range. However, they rarely go below the half million dollar mark, where there is a strong appetite for financing, but very few opportunities. Possible sources of smaller investments are represented by local public-sector facilities, business angels, business incubators funds, and isolated cases of seed VCFs, such as the microventure schemes like Aavishkaar India Micro Venture Capital Fund (AIMVCF).

Benefits of VC over other funding methods

Venture capital has a number of advantages over other forms of finance:

- It injects long term equity finance which provides a solid capital base for future growth.
- The venture capitalist is a business partner, sharing both the risks and rewards. Venture capitalists are rewarded by business success and the capital gain.
- The venture capitalist is able to provide practical advice and assistance to the company based on past experience with other companies which were in similar situations.
- The venture capitalist also has a network of contacts in many areas that can add value to the company, such as in recruiting key personnel, providing contacts in international markets, introductions to strategic partners, and if needed co-investments with other venture capital firms when additional rounds of financing are required.

Sector-based innovation in Thailand

National Innovation Agency, Thailand
http://www.nia.or.th

Bio-business

With the objective of enhancing local competency and competitiveness in bio-business, our main focus is on promoting the development of innovative technologies and commercialization of high value-added products in various areas, such as functional food, nutraceutical, cosmeceutical, medical food, rice products, and biomedical products and treatments. The National Innovation Agency focusses on strategic fields of development which include several herbal- and bio-products, wherein innovation could be applied to improve food quality and integrated health benefits.

Eco-solutions

NIA has put emphasis on the development of alternative energy sources, diversification and renewable sources. Escalating environmental problems in the last decade also call for innovation in environmentally friendly technologies and products, including waste-to-energy technology, energy saving processes, and bio-based materials. Furthermore, we promote and support the development of local renewable energy and related industry sectors.

Our strategic areas of development focus in this fileds.

- **Waste management** facilitates development and improvement of products, processes, services and consumption patterns to allow eco-friendly and efficient use of natural resources, including effective waste management systems.
- **Eco-products** focuses on commercial development of new products, processes or services based on material sciences, recycling technology and eco-designs.

Design and solutions

"Design and Solutions" combines different areas of knowledge to develop an innovation into a viable commercial product. Design involves the combination of technology, culture, and management to create higher-value products.

Innovation coupon

For many years, Thai SMEs were still not fully competitive on their development innovative business. They lacked marketing capabilities and product and services development. They had low-quality labour and used not up-to-date technologies, as well as, they have focusing only on the "Differentiation of original product".

NIA has cooperated with Federation of Thai Industries (FTI), to create the innovation coupon project for build up the capability of Thai SMEs innovative business. The project will stimulate the development of innovative projects and build up the awareness for development of innovation culture within SMEs firms.

The "Innovation Coupon" is the new mechanism of financial support for SMEs, which can support both on the productivity and the consultancy services. The 100,000 bath coupon (90% of total expense) allows SMEs to pay for the services of feasibility study project and the 400,000 bath coupon (90% of total expense) to support SMEs for implementation project stage. SMEs can apply maximum 2 coupons in one period of time. It means they can apply for both feasibility and implementation project in the same time.

Scope of Innovation coupon will covers one of the following:

- Assessment of new technology
- Early stage R&D and prototyping
- Adoption and development of new products/ processing technology/ applications/ practices/ operations
- Upgrading of existing products/ processing technology/ applications/ practices/ operations

Criteria

All local SMEs can apply for innovation coupon if they meet the following criteria:

- Physically present and registered in Thailand
- Have at least 30% local shareholding
- Have fixed assets not more than 200 million bath or group employment size not exceeding 200 employees

Project Goals

The innovation coupon will facilitate SMEs to create their innovative business. It can supports wide range of capability upgrading initiatives that enable SMEs to successfully compete and grow their businesses locally and globally. Innovation coupon will lead to drive the new mechanism of collaboration between "Innovation Service Provider (ISP)" and SMEs to develop the process of innovation development in Thailand.

Outputs of this project:

- Generate the innovative project more than 200 projects a year
- Generate more than 500 ISP
- Generate 12,400 million baht for economic value added

Technology and innovation promotion in Malaysia

SME Corporation Malaysia

http://www.smecorp.gov.my

1-InnoCERT certification programme

1-InnoCERT certification programme is initiated by SME Corp. Malaysia to promote and develop innovative companies in Malaysia as endorsed by the Jawatankuasa Tindakan Penyelarasan Inovasi Negaraand the National Innovation Council, chaired by the Prime Minister on 29th October 2009. It is aimed at fostering innovative enterprise through harnessing and intensifying home-grown innovations and R&D.

The main objective of the certification is to encourage entrepreneurs to venture into high technology and innovation-driven industries. With more SMEs participating in such activities, it will eventually lead to them being more competitive and would help in Malaysia achieving its objective in becoming a high income nation by the year 2020.

The certification awarded under the Programme identifies and verifies innovative companies through an internationally-recognised innovation standard (OECD Oslo Manual V3) and the certification process is developed from similar process practised in Korea's Innobiz (Innovation SME) Certification Programme. Certified companies under the programme will be given a fast-track access when applying for incentives to fund and market their products and services as offered by the government.

Application criteria for SMEs

1. SMEs incorporated under the Companies Act 1965 / Registration of Business Act (1956) and fulfil the new definition of SMEs (Guideline on New SME Definition (click));
2. Must undergo SCORE Certification by SME Corp. Malaysia and achieved a 3-Star Rating and above;
3. At least 60% of the equity held by Malaysians;
4. Valid business; acquire business license from the Local Authority and operating in a valid business premise;
5. At least two (2) years in business (able to provide 2 years Audited Financial Statement); and
6. Product and services must be commercialised for at least two (2) years.

1-InnoCERT certification process

The 1-InnoCERT certification process involves a two-stage assessment. Potential innovative companies are required to conduct an On-line Self-Assessment (www.1-innocert.my) to gauge on their readiness to be certified as a 1-InnoCERT company. Upon completing the self-assessment, the on-line system will generate a Technology Innovation System Evaluation Index, ranging a score from 0 to 1,000. A scoring of higher than 700 is an indication that the company's internal innovation system and processes is ready to comply with the requirement.

Companies with difficulties in scoring higher than 700 can attend regular sessions of pre-certification training to understand the 1-InnoCERT criteria, and on how to become more innovative. Upon reaching a score of more than 700, the company can apply for an on-site innovation audit to be conducted at their premise. On-site innovation audit is compulsory to ensure that companies applying for the 1-InnoCERT certifications are indeed innovative and complies with the requirement of the 1-InnoCERT criteria.

Upon a successful passing of the on-site audit, the company can then officially apply to be certified as a 1-InnoCERT certified company. However, the approval is subject to acceptance by the 1-InnoCERT Approval Committee, which oversees the overall certification Program. Please take note that minimal fees are chargeable for the 1-InnoCERT certification (RM5,000.00 for first time certification and RM3,000.00 for renewal of certification).

Enabling ePayment for SMEs and micro enterprises

Enabling ePayment for SMEs and Microenterprises is a Project under the Digital Malaysia initiative aimed to increase the adoption of ePayment among SMEs. Due to the cost constraint and intricate process of ePayment, SMEs and Micro Enterprises are facing difficulties in acquiring ePayment capability. With this initiative, SMEs and Microenterprises are being enabled to accept ePayment via means of simplifying the acquisition process and lowering its cost. It will also accelerate the adoption of ePayment with the distribution of affordable Point-of-Sale (POS) terminals.

By 2020, the Project is expected to generate 1,125,000 million ePayment merchant outlets points enabled by Electronic Funds Transfer Point-of- Sale (EFTPOS) terminal, whilst, the project's target for 2012 is 25,000.

The ePayment merchant outlets points targeted are the operators of `pasar tani', small restaurant, night market, flea market and cottage industries, amongst others.

SMEs and Microenterprises must fulfill the following criteria to participate in this programme:

- Registered under Business Act 1956 or Company Act 1965;
- Fulfilled the definition of SMEs and Microenterprises;
- At least 60% Malaysian equity;
- Valid business license from Local Authority; and
- Subscribe to only 1 of approved Third Party Acquirer (TPA)

Green industry initiative

United Nations Industrial Development Organization (UNIDO), Austria

http://www.unido.org

In the last few years, keeping with its mandate, the United Nations Industrial Development Organization (UNIDO) coined the concept Green Industry to place sustainable industrial development in the context of new global sustainable development challenges. Green Industry means economies striving for a more sustainable pathway of growth, by undertaking green public investments and implementing public policy initiatives that encourage environmentally responsible private investments.

Resource Efficient and Cleaner Production (RECP)

Taking care of materials, energy, water, waste and emissions makes good business sense. RECP is the way to achieve this. RECP covers the application of preventive management strategies that increase the productive use of natural resources, minimize generation of waste and emissions, and foster safe and responsible production.

Cleaner Production (CP)

RECP uses CP to accelerate the application of preventive environmental strategies to processes, products and services, to increase efficiency and reduce risks to humans and the environment. It addresses, a) Production Efficiency: optimization of the productive use of natural resources (materials, energy and water); b) Environmental management: minimization of impacts on environment and nature through reduction of wastes and emissions; and, c) Human Development: minimization of risks to people and communities and support for their development.

The Stockholm Convention and Persistent Organic Pollutants (POPs)

The Stockholm Convention is a global treaty to protect human health and the environment from chemicals, Persistent Organic Pollutants (POPs), that remain intact in the environment for long periods of time, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have adverse effects to human health or to the environment

The Montreal Protocol (MP)

The Montreal Protocol is an international environment treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. Since 1989, a time table establishes the different phase-outs; for example, it has been agreed to initially phase-out hydro-chlorofluorocarbon (HCFC) – a chemical compound containing hydrogen – by 2015, with a final phase-out by 2030. In its daily work, UNIDO focuses on cost-effective ways to reduce ozone-depleting substances (ODS), such as freons, halons and chlorofluorocarbons (CFC), in the areas of refrigeration, plastic foams, halons, solvents, fumigants and aerosol.

Chemicals Management

UNIDO works with projects, policies and regulations, institutions and sectoral capacity-building, development of preventative approaches and new business models such as Chemical Leasing, to assist enterprises reducing risks and impacts associated to the use of chemicals.

Chemical Leasing (ChL)

Chemical Leasing (ChL) is a strategy which creates a business environment to tackle the challenges of the changing global context and offers solutions for sound management of chemicals and reduction of emissions to the environment. UNIDO plays a leading and coordinating role for the implementation and further development of ChL.

Corporate Social Responsibility (CSR)

Nowadays, requirements for the integration of environmental concerns, human rights issues, fair labour conditions and good governance in industrial development are significantly affecting the business sectors in developing and transition countries. This is referred to as Corporate Social Responsibility (CSR). In this context, UNIDO works on a framework for small- and medium-sized firms (SMEs) that helps translate CSR principles into a relevant SME perspective, thereby enhancing their competitiveness and market access.

Water Management

UNIDO's Water Management programme provides services to transfer the best available environmentally sound technologies and environmental practices to improve water productivity in industry, as well as prevent discharge of industrial effluents into international waters (rivers, lakes, wetlands and coastal areas). Protecting water resources for future generations is amongst the top priorities.

Energy

Energy access is linked a global challenge needing to be addressed; it has links in social development and poverty alleviation, environmental degradation and climate change, and food security. It is a defining issue of our time. UNIDO aims to provide access to modern energy services for the poor, with emphasis on renewable energy projects. The Organization further helps to increase productivity and competitiveness by improving industrial energy efficiency projects, and works on reducing GHG emissions through capacity-building projects for climate change in general, and Kyoto Protocol mechanisms in particular.

'Green Factory' - SME exit strategy in green growth era

APEC SME Innovation Center (SMEIC), 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 polices. The green paradigm transition era requires 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 greenizing process, green-izng workplace and green-izing product.

First, green-ization 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 3-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 afteruse waste materials.

SMEs, viewed from a green growth perspective, despite being small in scale, are equipped with a centralized power-type organizational structure. So, manager influence is greater and employee participation in low-carbon, green growth is stronger 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.), cooperaton and strategic alliances between enterprises become easier.

Also from an environmental perspective, if their small corporate scale and comparatively simple production facilities are taken into account and the wastes minimization programs practiced in the United States, U.K. and 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. Due 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.

Home-grown innovation

The Network for Drugs, Diagnostics, Vaccines and Traditional Medicines Innovation (ASEAN-NDI) brings together researchers from 10 ASEAN countries to create products that combat diseases like tuberculosis (TB), malaria, dengue, and parasitic infections.

For more information, contact:
Bernadette Ramirez
World Health Organization
E-mail: ramirezb@who.int

INDIA

Chitin and chitosan

Description

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

Advantages

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

Environmental Aspects

Waste utilization

Development Status

Pilot plant, Fully commercialized

Transfer Terms

Consultancy, Technology licensing

Retort pouch technology

Description

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

Advantages

The technology provides a method for preparing the ready-to-serve fish curry in retortable pouch with excellent storage stability and quality:

- The ready-to-serve fish curry is thermal processed and do not require any further processing before consumption.
- The thermal processing conditions have been standardized for this product in order to make it safe for consumers

Environmental Aspects

Energy efficiency

Development Status

Pilot plant, Fully commercialized

Transfer Terms

Consultancy, Technical services, Technology licensing

Sugarcane juice powder technology

Description

A process for preparation of spray dried sugarcane juice powder/granule formulation. It is a general food product. The spray dried sugarcane juice possesses consumer acceptable qualities and commercial value.

Advantages

Sugarcane juice powder is a novel substitute to replace the commercially available soft drinks that contain only sugar, artificial chemicals, colours and flavouring agents and devoid of nutrients.

Environmental Aspects

Cleaner production

Development Status

Pilot plant, Commercial prototype, Fully commercialized

Transfer Terms

Consultancy, Technical services, Technology licensing

For the above three offers, contact:

Central Institute of Fisheries Technology, CIFT Junction,
Matsyapuri, Willingdon Island
Cochin 682029, India
Tel: 00914842666845
E-mail: nitin.bpd@gmail.com

Herbal pesticide

Description

The technology provides a sprayable biopesticidal composition comprising Photorhabdus luminescens for controlling and eradicating various agricultural pests. It is for the first time that the insecticidal activity of *P. luminescens* is used without its symbiotic carrier nematode. In the present technology the actively growing cells of *P. luminescens* are encapsulated in sodium alginate beads and examined for their ability to infect insect hosts. Several laboratory and field testing programme were carried out to evaluate and assess the product.

Advantages

- Better alternatives to the conventional chemical compositions.
- Extremely effective in controlling the spread of *Ceratovacuna langiera*.
- Effective for both soil and aerial applications.
- Useful for crops such as cabbage, cotton, pulses, peas, sugarcane, bamboo, grapes, citrus, mango and guava.
- Capable of being applied with commonly used agricultural equipment like sprayers and dusters.
- Results are comparable to chemical insecticides.
- Environment friendly.

Development status

Laboratory model

Legal Protection

Patent applied for

Transfer Terms

Technology licensing

Contact:

Skyquest Ventures
501, Krishna Complex,
Opp. Devashish School,
Bodakdev, Ahmedabad 380054, India

Technology Offers

Tel: +91 79 40054111
E-mail: kathak.mehta@skyquestventures.com

Gel-o-fuel

Description
NCL scientists have developed a polymer based gel that can absorb organic solvents like methanol, ethanol etc. and can act as a portable fuel source. The gel can be polymerized *in situ* from the selected monomers and does not require any external gelling agent.

Advantages
- Effective, flexible, compact source of fuel.
- No soot, pleasant blue flame.
- Higher burning efficiency.
- Existing gels use a commercial polymer (expensive) while Gel-o-fuel uses cheaper, easily available raw-materials.
- Liquids that is trapped in the 3D matrix of the gel is turned in to soft solids-easy and safe to transport.

Development Status
Laboratory model

Legal Protection
Patent

Transfer Terms
Technology licensing

Titanium dioxide nano needles

Description
NCL's technology involves a one-step electrochemical process for the synthesis of pure rutile Titanium dioxide (TiO_2) nanoneedles, with high aspect ratio, at room temperature. Nanoneedles with aspect ratio of =10 can be produced with very good control over the morphology of the resulting TiO_2.

Advantages
- Less energy intensive (process carried out at room temperature)
- Ability to synthesize phase-pure rutile TiO_2
- Reduced time for synthesis (as this process avoids any formation of intermediate amorphous powder or anatase phase and hence doesn't need heat treatment to from rutile TiO_2)
- Easier, cheaper, quicker process (when compared to previous methods of synthesis)

Development status
Laboratory model

Legal Protection
Patent

Transfer Terms
Technology licensing

For the above two offers, contact:
National Chemical Laboratory (NCL), A208, PAML Building, Dr Homi Bhabha Road, Pune 411007, India
Tel: 91-20-25902982
E-mail: dt.patel@ncl.res.in

L(-) Malic acid production technology

Description
The new technology of the Hungarian leading biotechnology centre produces only the biologically active L(-) form. This new biosynthesis process of L(-) malic acid has proved to be more efficient and cost effective than the presently used ones.

Advantages
This technology has some significant advantages in comparison with the traditional fermentation and chemical production. Firstly, downstream operations become cheaper by the high conversion rate and lack of bypass products. Secondly, the very intensive technology decreases the investment expenditures. Thirdly, it is an environment friendly production, which does not have any effect on human health.

Environmental Aspects
Cleaner production

Development status
Laboratory model

Transfer Terms
Technology licensing, Research partnerships

Metal reclamation technology in electroplating

Description
Our client is a SME in Hungary. It can be used to recover the metal waste, which arises during the silver-, copper-, tin-, nickel-, eventually zinc plating process and it can be recycled into the electroplating process. The investment returns in 3 or 4 years.

Advantages
- an economical method, the investment returns in 3 or 4 years in a medium-sized enterprise,
- an environmental friendly method, dangerous emission (quantity of galvanic sludge) can be radically reduced,
- the metal loss of the electroplating can be reduced to 1-2 %,
- costs of deposition of the dangerous waste (galvanic sludge) can be reduced,
- the equipment works automatically, expensive labour force is not necessary.

Environmental Aspects
Waste utilization

Development status
Fully commercialized

Legal Protection
Know-how

Transfer Terms
Technology licensing

For the above two offers, contact:
H-6701 PO Box 1191. Szeged, Hungary
Tel: +36-62/562-782
E-mail: laserconsult@t-online.hu

HUNGARY

Technology Requests

BANGLADESH

Proper utilization of CO_2 from gas fields

Description
We need investment to utilize properly a silent derivative from the oil and gas field (4% derivative), assumed a remarkable printing ink will be possible to produce from this wastage and also indirectly help to make a green environment.

Area of Application
Environment

Studies Available
Environmental Impact Studies (EIA/EIS)

Project Type
Start-up

Contact:
Seek Investor Mirpur, Dhaka, Bangladesh 1216
Tel: 008801710962792
E-mail: seekinvestor2007@yahoo.com

INDIA

Full cereal and health bar extrusion line

Description
We are a company that is looking at setting up an entire cereal flakes extrusion line. At the next stage we will be setting up the same for health bars.

Area of Application
Food processing equipment

Project Type
Start-up

Contact:
Kottaram Agro Foods
No.9 &10, 3'rd Cross, Muneshwara Block, Harlugatte village, Kudlu Gate, Bangalore, India 560068
Tel: 00919686202763
E-mail: support@kottaram.co.in

Micropropagation of potato cultivation

Description
We need technology for micropropagation potato cultivation.

Area of Application
Agriculture

Studies Available
Feasibility report

Project Type
Start-up

Assistance sought from potential partner
Yes

Contact:
ROC
CD 149 Salt Lake, Kolkata- 700064, West Bengal, India, 700064
Tel: 918334006710
E-mail: pradipgamma@hotmail.com

Copper sulphate from copper scrap and waste

Description
We need consultancy for Copper Sulphate manufactured from Copper Scrap / waste / Ash.

Area of Application
Many sectors including Chemical industries

Project Type
Start-up

Assistance sought from potential partner
Turnkey supply of plant and machine

Contact:
Mr. J J Patel, 211, Akshat Tower, Nr Pakwan S G Highway, Bodakdev Ahmedabad, India, 380054
Tel: 09904809004
E-mail: ca.jjpatel@gmail.com

Medical disposables

Description
Medical disposables (surgical dressing)

Area of Application
Health and medical

Project Type
Expansion/Modernization

Contact:
Drug Authority
Near Mandi Samitte, Moradabad Road, Mannagar, Kanth, Moradabad, India 244501
Tel: 05912220061
Fax: 05912220061
E-mail: shreejeekanth@gmail.com

Technologies and products to produce healthier, well styled hair

Description
We are working with a leading manufacturer of personal care devices that is searching for truly innovative technologies and products to produce healthier, well styled hair.

Area of Application
Hair care

Transfer Terms
Joint venture, Technology licensing

Contact:
Strategic Allies
113 High Street, Berkhamsted, United Kingdom, HP4 2DJ
Tel: 004401442860634
E-mail: suzanne@strategicallies.co.uk

UNITED KINGDOM

PUBLICATIONS from APCTT

PERIODICALS

(Free access at www.techmonitor.net)

- ❑ Asia Pacific Tech Monitor (4 issues/year) (e-version)
- ❑ VATIS Update (4 issues/year)
  - Biotechnology (e-version)
  - New and Renewable Energy (e-version)
  - Food Processing (e-version)
  - Ozone Layer Protection # (e-version)
  - Waste Management (e-version)

BOOKS

	Indian Rupees* (India, Bhutan and Nepal)	US Dollars*
❑ Managing Innovation for the New Economy: Training Manual, 2002 Volume 1: How to Guide & Quick reference materials Volume 2: Articles & Lectures	1,000.00	50.00
❑ Regional Capacity-building for the Adoption of ISO-14000 and Transfer of Environmentally Sound Technology: Training Manual, 2000	600.00	30.00
❑ Small Rural Industries in the Asia Pacific Region: Enhancement of Competitiveness of Small Rural Industries in a Liberalized Economic Environment and the Impact of Poverty Alleviation, 2000	600.00	30.00
❑ Technology Transfer and Technological Capacity-building in Asia and the Pacific		
❍ Volume 1: Big Countries and Developed Economies, 1999	600.00	30.00
❍ Volume 2: ASEAN, NIEs, SAARC and the Islamic Republic of Iran, 1999	600.00	30.00
❍ Volume 3: Least Developed and Pacific Island Countries and Economies in Transition, 1999	600.00	30.00
❍ Volume 4: Emerging Issues in Regional Technological Capability-building and Technology Transfer, 1999	600.00	30.00
❑ Rural Industrialization as a Means of Poverty Alleviation: Report of the Regional Seminar on the Enhancement of Partnerships among Governmental, Non-governmental and Private Sector Entities for the Promotion of Rural Industrialization for Poverty Alleviation, 1999	600.00	30.00
❑ Institutional Development for Investment Promotion and Technology Transfer, 1999	500.00	25.00
❑ Ozone Depletion Substances Phase-out Technologies: Problems & Issues on Technology Transfer, Absorption and Generation, 1998	300.00	15.00
❑ Development and Utilization of S&T Indicators: Emerging Issues in Developing Countries of the ESCAP Region, 1998	300.00	15.00
❑ ODS Phase-out: A Guide for Industry, 1998	500.00	25.00
❑ Proceedings of the Consultative Meeting on Technology Management Education and Training for Developing Countries, 1997	800.00	40.00

Notes: *Amount less than Rs 500 should be sent through a demand draft only. Otherwise, payment should be made by cheque/demand draft/ UNESCO coupon in favour of the Asian & Pacific Centre for Transfer of Technology, payable at New Delhi.*

 # Six issues per year. A print version for distribution to a select target group is supported by the Ozone Cell, Ministry of Environment & Forests, Government of India.

** Amount to be sent to APCTT with the order for covering costs and handling charges.*