Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific Tech Monitor

Vol. 33 No. 1 Jan - Mar 2016

Science, Technology and Innovation as a means to achieve 2030 sustainable development agenda

Plus

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

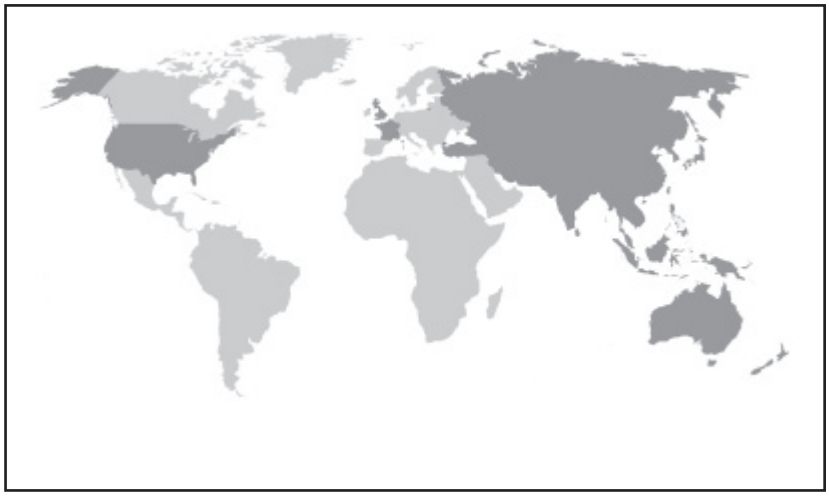
APCTT
Asian and Pacific Centre for Transfer of Technology

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

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

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

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



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

Asia-Pacific
Tech Monitor
Vol. 33 No. 1 ❖ Jan-Mar 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

ISSN: 0256-9957

CONTENTS

Introductory Note 2

Technology Market Scan 3

Technology Scan: Environmentally Sound Technologies 8

Special Feature: Science, Technology and Innovation (STI) to achieve 2030 sustainable development agenda

- **Transforming science, technology and innovation toward sustainable future** 12
  Masuo Aizawa
- **The orientation of Philippine science, technology and innovation toward social objectives** 18
  Adoracion M. Navarro
- **Sharing economy**
  Sustainable development driven by internet technology 25
  Zhu Xinyue and Guo Rong
- **Transferring technology through competitive bidding**
  A case study of ISRO's IMDPS 32
  Nirmalya Bagchi

Tech Events 39

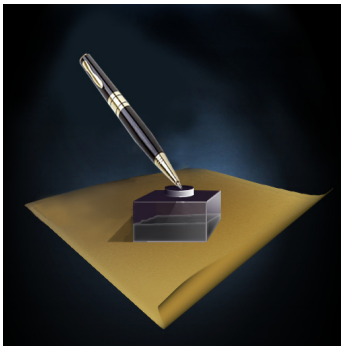
Tech Ventures & Opportunities 40

Business Coach

- **Start-up Venture Creation** 41
- **Technology Transfer** 43
- **Venture Financing** 46
- **Managing Innovation** 48
- **Green Productivity** 51

Tech Opportunities

- **Technology Offers** 53
- **Technology Requests** 56



Introductory note

In September 2015, the leaders of 193 Member States of the United Nations adopted a new transformative Agenda 2030 on Sustainable Development. The Agenda covers seventeen Sustainable Development Goals (SDGs) and 169 targets that seek to eliminate poverty and hunger and provide a life of dignity to all while addressing the effects of climate change. Subsequently in Paris in December, the Member States of the United Nations reached another landmark agreement on climate change under the UNFCCC. Science technology and innovation (STI) is recognized as the key means of implementation of both the SDGs and the climate change agreement. Without access to STI, developing countries will find it challenging to implement SDGs in several key areas such as water and sanitation, clean energy, food and nutrition, industrialization, sustainable production and consumption, climate change mitigation and sustainable agriculture among others. STI indeed touches on virtually every SDG and has a cross-cutting role in addressing the interconnected challenges of sustainable development and providing effective solutions to the emerging problems in a post-2015 world.

Since SDGs will be key indicators of progress in the coming years, it is important that national STI strategies are aligned with SDGs and that the plans for achieving SDGs take into account STI strategies. Countries could meet their SDG targets through mainstreaming STI in national policies and programmes and making adequate STI interventions aimed at creating, enhancing and adopting policies, institutions and processes that increase national capabilities not only to develop access and adapt technological innovations, but also to leapfrog in new and emerging technology areas. Some of the areas where governments can influence the development, promotion and utilization of STI to achieve their national development goals include: education, R&D spending, skill development, R&D in private sector, entrepreneurship development, collaborations and partnerships, mainstreaming open innovation in STI, intellectual property protection, and mainstreaming gender in STI. While most countries do understand the importance of STI and higher investment in STI they lack the capacity to translate the outcomes of STI investments in terms of SDGs.

In the Asia-Pacific region, STI capacity development efforts should be particularly emphasized for the least developed countries (LDCs), the land-locked developing countries (LLDCs) and the Pacific island countries (PICs). These efforts would require vital support in terms of enhancing the countries' capacity in training and skill development in a number of technology areas relevant to sustainable development. There is also a need to explore new and innovative mechanisms for financing and implementing STI partnership initiatives for sustainable development projects in LDCs, LLDCs and PICs.

Developing appropriate national STI strategies would require good analysis of existing national innovation systems (NIS) of countries. This can provide useful information for policymakers in planning changes to, and strengthening the existing STI systems and strategies relevant to the evolving national context and development objectives. Therefore, it is essential to diagnose or evaluate the quality and efficiency of a NIS by conducting evidence-based studies to understand the strengths and weaknesses of various components of NIS and evolve informed policy decisions and implementation mechanisms. Analyzing and understanding the NIS of member States would be the first step towards strengthening their STI capacities for achieving sustainable development.

This issue of *Asia-Pacific Tech Monitor* discusses the challenges, opportunities and strategies to develop and adapt appropriate STI policies, frameworks, institutional support mechanisms and programmes for achieving sustainable development in the countries of Asia-Pacific region. The issue also features relevant case studies from China, India, Japan and the Philippines.

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

INTERNATIONAL

Expanded list of duty-free technology products

New UNCTAD research shows that the expansion of the list of technology goods earmarked for duty-free treatment by participating economies of the World Trade Organization's Information Technology Agreement (ITA), agreed to in July 2015, will cover 99 per cent of the value of global information and communications technology (ICT) goods, and some 80 per cent of all product lines in this category.

The research, published in a technical note, *Trade in ICT Goods and the 2015 Expansion of the WTO Information Technology Agreement*, on 15 December 2015, also indicates that the expanded list covers many goods that were not classified as ICT products under the original agreement such as medical appliances, electric conductors and instruments. Equivalent to a market worth more than $3 trillion, goods included in the original ITA of 1996 (ITA I) and in the revised ITA list of 2015 (ITA II) represent almost one fifth (18 per cent) of world merchandise imports.

The expanded agreement currently has 54 participants, which in 2013 accounted for 87 per cent of world imports and 94 per cent of world exports of ITC goods. Once it comes into force, exports from all of the WTO's 162 members – irrespective of whether they were signatories – will enjoy duty-free treatment of the listed goods in markets covered by the ITA II. These include new-generation semi-conductors, GPS navigation systems, medical products which include magnetic resonance imaging machines, machine tools for manufacturing printed circuits, telecommunications satellites and touch screens.

The main findings of the research reveal that:

- The expansion of the product coverage of ITA II will mean that almost all ICT goods traded will receive duty-free treatment when imported into ITA II member economies. The ITA I+II product list encompasses more than 99 per cent of the value of global ICT goods imports (see chart, right-hand side) and 80 per cent of the ICT goods product lines.
- In value terms, ICT goods account for two-thirds of all imports of ITA I+II goods (see chart, right-hand side). At the same time, the expanded ITA II increases the product coverage also for other, non-ICT goods, such as medical appliances, electric conductors and instruments. Indeed, ICT goods make up just over a quarter of the individually-identified product lines covered by ITA I+II (see chart, left-hand side).
- Although the list of products covered by the new list has expanded, fewer WTO members are party to ITA II than ITA I. While far from all developing and transition member economies of the WTO had signed up to ITA I (in total 81 WTO Members are contracting parties to ITA I), even fewer have so far joined the ITA II – just one African country (Mauritius), and three in Latin America (Colombia, Costa Rica and Guatemala) and none from the Commonwealth of Independent States. Developing Asian countries are better represented, but there remain fewer parties from this category to ITA II than there were to ITA I.
- That being said, the largest exporters and importers of both ICT goods and ITA I+II goods are signatories of both ITA I and II. Mexico is the only non-ITA II member among the top 10 traders of such products. Other non-ITA II members with exports of ITA I+II goods, of above $10 billion annually, are Viet Nam and India. On the import side, non-ITA II members with the 10 highest related imports are Mexico, India, the Russian Federation, Viet Nam, Brazil, Indonesia, Saudi Arabia, South Africa, Argentina and Chile. Consumers in these economies will not benefit from the duty-free provisions of ITA II after it goes into force.

http://unctad.org

WTO members cut import tariffs on IT products

More than 50 members of the World Trade Organization signed an agreement to remove import tariffs on 201 information technology products, marking the first major global tariff-cutting deal in 19 years. The products covered account for 10 percent of global trade and should mean consumers pay less for items such as GPS navigation systems, computers and other goods, while companies see cuts in the cost of machine tools. The deal, signed by 53 countries including China, will remove tariffs on trade worth $1.3 trillion, which is expected to give a $190 billion boost to the world economy.

It is the first major agreement to come out of the World Trade Organization's ministerial conference under way this week in the Kenyan capital Nairobi, and was hailed as a victory for global commerce and for the famously slow-moving organization.

In July, the WTO finalised the list of 201 products. Tariffs on them will be lifted in several stages, taking effect for 65 percent of the products concerned immediately and full implementation within seven years. New-generation semi-conductors, medical products including magnetic resonance imaging (MRI) machines, printed circuits and satellites are all included in the deal, the WTO said.

Once in force, the agreement will update the WTO's 18-year-old Information Technology Agreement and add the new products to the list of goods covered by zero-tariff and duty-free trade.

http://www.reuters.com

Inventions in climate change mitigation technologies

A new study conducted by the European Patent Office (EPO) and the United Nations Environment Programme (UNEP) shows that inventions in climate change mitigation technologies have seen a fivefold increase worldwide between 1995 and 2011. It also finds that Europe is a leading region for low-carbon inventions.

Presented at the Sustainable Innovation Forum 2015 organised alongside the UNFCC COP 21 in Paris, the report finds that the number of inventions in climate change mitigation technologies (CCMTs) worldwide has risen steadily since the signing of the Kyoto Protocol in 1997. This suggests that the implementation of climate change policies has helped stimulate innovation in CCMTs. The

growth in low-carbon inventions has been much faster than in other technologies; today they represent nearly 6% of all of the world's inventions, up from 2% in 1995. Public policies put in place after the Kyoto Protocol signing appear to have been particularly successful in encouraging the development of CCMTs in Europe. As a result, the carbon intensity of Europe's GDP has fallen by 30% in the past decades, and has been the lowest in the developed world since 2000.

The study shows that Europe is among the leaders in technical advances towards a low-carbon economy. The region produces nearly one fifth of all low-carbon inventions in the world. Looking at "high-value" inventions (those with higher economic potential, for which patent protection is sought in more than one country), Europeans account for nearly two fifths.

Europe's contribution to global inventive efforts is very significant across all CCMT areas. Most CCMT inventions in Europe (and also worldwide) are made in the clean energy and transport sectors, followed by buildings. When comparing CCMT inventions with inventions in all areas of technology, Europe has become increasingly specialised since 1995, and is now among the most advanced regions in the world in low-carbon technologies.

Six countries account for more 80% of all European inventions in sustainable technologies; Germany leads, with almost half of Europe's CCMT inventions, followed by France, the UK, Italy, Sweden and Spain. Allowing for economic size, Germany is still ahead, followed by Sweden, France, Finland, Austria and Denmark. Meanwhile other countries, including Greece and Portugal, also show high degrees of technological specialisation in CCMTs.

https://www.epo.org

Low carbon technology transfer for Africa

The Government of Japan is expanding its contribution to the Low Carbon Low Emission Clean Energy Technology (LCET) Programme implemented by the United Nations Industrial Development Organization (UNIDO), specifically in Africa. The programme aims to promote the rapid deployment and dissemination of new low carbon technologies across the world. The second replenishment of JPY 300 million (around USD 2.5 million) will help further strengthen activities in Ethiopia and Kenya. An agreement on this was signed in Vienna by Ambassador Mitsuru Kitano, the Permanent Representative of Japan to the International Organizations in Vienna, and LI Yong, the Director General of UNIDO.

The LCET programme focuses on fostering inclusive and sustainable industrial development through enhancing productivity, creating new jobs, boosting the use of clean and affordable energy, and providing training to the local communities. It offers new opportunities for introducing innovative financing mechanisms such as the Government of Japan's Joint Crediting Mechanism (JCM), which aims to facilitate the global diffusion of low-carbon technologies and products in developing countries.

The LCET programme was designed to help accelerate global clean energy innovation with the objective of making clean energy widely affordable. It will also contribute to the implementation of the Sustainable Development Goals and the recent historic Paris climate agreement which recognizes technology transfer as an effective, long-term global response to climate change and as a contribution to promoting economic growth and sustainable development.

Under the LCET programme, the ongoing projects in Ethiopia and Kenya focus on demonstrating unique Japanese ultra-low head micro hydropower (ULH-MHP) technology systems, which are environmentally-friendly. These systems will provide access to renewable energy for productive use in rural areas. Compared to the conventional hydropower technologies, the micro hydropower system can be installed within a short period of time in standard water canals, including in irrigation systems, as well as in drinking and waste water canals.

http://www.unido.org

ASIA-PACIFIC

CHINA

Patent application list

China handled more patent applications for inventions than any other country for the fifth year running in 2015, official data showed. The country had over 1.1 million patent applications last year, up 18.7 percent year on year, according to figures from the State Intellectual Property Office (SIPO). About 359,000 invention patents were authorized, 263,000 of which were granted to domestic applicants, 100,000 more than in 2014, said Gong Yalin, an official with the SIPO, at a press conference. That brought the number of invention patents owned by every 100,000 Chinese to 6.3, Gong said.

Of all the invention patents authorized in 2015, 60.5 percent went to Chinese enterprises, an annual increase of 4.1 percentage points. China's top oil-refiner Sinopec obtained 2,844 patents, the most among all Chinese firms, followed by telecom giants ZTE and Huawei.

Authorities have rolled out favorable policies to support high-tech companies and encourage investment into research and development. In late October, the Communist Party of China made innovation one of five key concepts of development for the 2016-2020 period. The number of patent applications filed by Chinese for inventions more than doubled in the past five years, according to SIPO data.

http://news.xinhuanet.com

Innovation index rises in 2014

China Innovation Index (CII), a barometer of innovation capability, rose 3.7 percentyear on year in 2014 to 158.2 points, the statistics authority said. The index comprises four sub-indices, which measure the country's innovation environment,input, output and effects, the National Bureau of Statistics (NBS) said in a statement.

The sub-index for environment rose 3.3 percent last year, while that for innovation effectsrose 2.8 percent. The sub-indices for input and output rose by 3 percent and 5.2 percent. NBS statistician Zhang Peng said the steady increase of the index shows China's newachievement in promoting innovation, amid the government's efforts to promoteentrepreneurship and innovation.

http://www.chinadaily.com.cn

Tax cut to boost innovation

China cuts more than 300 billion yuan (46.15 billion U.S. dollars) of taxes in 2015 to boost mass entrepreneurship and innovation, according to official data. Among this, tax exemptions and breaks on small enterprises reached 100 billion yuan and tax cuts designed to encourage high technology development totaled 140 billion yuan, according to the State Administration of Taxation. In the face of economic headwinds, China is counting on mass entrepreneurship and innovation to generate new jobs and improve the skill set of its citizens, and warm up the slowing economy.

Besides, a policy to cut tax for vehicles with smaller engines resulted in nearly 15 billion of tax cuts from October to December, according to the administration. China halved the vehicle-purchase tax to 5 percent for passenger vehicles with engines that are 1.6 liters or smaller. The tax cut took effect on October 1, 2015 and will end on December 31, 2016.

http://news.xinhuanet.com

High-tech enterprise startups supported

More favorable policies will be granted to small and medium-sized high-tech enterprises by the government to encourage startups and innovation. The initiative was announced during a State Council executive meeting presided over by Premier Li Keqiang. Measures to identify high-tech and new technology enterprises will be improved to provide better policy support for small and medium-sized startups and to stimulate economic upgrading.

This includes relaxing the requirement for the percentage of workers who have received higher education from no less than 30 percent to no less than 10 percent. The new figure covers staff members performing research-related work. The measures also lower the requirement for small and medium-sized high-tech companies' entry level for research funding from 6 percent to 5 percent of a company's entire funding, and relax the accreditation requirements for high-tech enterprises. The government will also grant support to high-tech companies in a wider range of industries.

The meeting also discussed further steps to streamline lower-level administrative and delegation power, especially relaxing administrative pressure for enterprises. Efforts will be made to end the procedures required to provide technological services for industries, and to simplify administrative licensing that previously restricted startups. Sixty-one types of professional qualifications will be eliminated. The measures form part of government incentives to further strengthen economic structural reform of the supply side to increase the quality and efficiency of the supply system and provide growth impetus for sustainable economic development.

http://www.chinadaily.com.cn

INDIA

Start-up India movement launched

The Prime Minister, Shri Narendra Modi, launched the Start-up India initiative in New Delhi. The Prime Minister said successful start-ups are usually created by those who are driven by an idea, or an urge to solve a problem that people face. He said making money is not the primary objective, but is often a by-product. He said Start-up innovators are often driven by a sense of compassion for others.

The Prime Minister said he wishes to turn the youth of India from job-seekers to job-creators. He said if a Start-up can offer employment to even five people, it would be doing a great service to the nation. He mentioned some areas where youth innovators should focus, including crop wastage, and cyber security.

The Prime Minister unveiled the highlights of the Start-up Action Plan. He said a dedicated Start-up fund worth Rs. 10,000 crore will be created for funding of Start-ups. He said Start-ups will be exempted from paying income tax on their profit for the first three years. He said the Government is working on a simple exit policy for Start-ups. He also said the Government is working towards fast-tracking of Start-up patent applications.

He announced an eighty percent exemption in patent fee for Start-up businesses, and said a self-certification based compliance system for Start-ups would be introduced for 9 labour and environment laws. He said the Atal Innovation Mission will be launched to give a boost to innovation.

http://pib.nic.in

$100-billion turnover is biotech target

India has unveiled the National Biotechnology Development Strategy 2015-2020, aimed at achieving $100 billion in turnover by 2025, a more than ten-fold rise from the current $7 billion. Unveiling the strategy, Science and Technology Minister Harsh Vardhan said the target was "not imaginary" as the Centre was confident that biotech had the potential to be the next boom sector.

While forging global and public-private partnerships are the key to achieving the target, the strategy aims at establishing India as a world-class manufacturing hub and plans to launch four major missions in healthcare, food and nutrition, clean energy and education. In line with 'Make in India' and the Indian Science Congress' theme of *Science and Technology for Indigenous Development in India*, the biotech strategy focuses on R&D to make affordable products for the Indian and global markets.

Technology Development and Translation networks would be set up across India with global partners while five new clusters and 150 Technology Transfer Organisations would come up, said Renu Swarup, Senior Advisor, Department of Biotechnology, who played a key role in formulating the strategy. A Life Sciences and Biotechnology Education Council would also be established to build skilled human capital.

http://www.thehindubusinessline.com

Technology transfer MoA

National Research Development Corporation (NRDC), an Enterprise of Department of Scientific & Industrial Research, Ministry of Science & Technology, Govt. of India, New Delhi, has entered into Memorandum of Agreement (MoA) with CSIR - Indian Institute of Chemical Technology Hyderabad (CSIR-IICT) for marketing the inventions/innovations, patents, formulations, know-how/processes developed by CSIR-IICT and also

collection of Premia and Royalties arising from these activities.

CSIR-IICT during its seventy year journey has made its mark as a dynamic, innovative and result oriented R&D organization in chemical and allied sciences and technology. It has emerged as a reliable destination of chemical and biotech industries and its clientele spans all corners of the globe. The research efforts during the seventy years sojourn with science has resulted in development of several innovative processes for a variety of products necessary for human welfare such as drugs, agrochemicals, food, organic intermediates, adhesives, materials etc. In terms of research outputs, CSIR-IICT has an outstanding record in research publications, patents and technology packages. It presently occupies the top spot in the Chemical Science research in India in all such research performance metrics. The main strength of CSIR-IICT is its rich pool of scientists and PhD students numbering over 600. CSIR-IICT has active collaborations with several countries including France, Germany, UK, Switzerland, Italy, USA, Australia, Japan, Korea etc., and several students have benefitted from various exchange visit and post-doctoral opportunities.

CSIR-IICT has generated a large number of Technologies, know-how/processes which can be transferred to industries for commercial exploitation and for social benefits. Under this MOA, NRDC will work with CSIR-IICT to commercialise/transfer the technologies developed by CSIR-IICT.

http://www.business-standard.com

PHILIPPINES

TBIs to encourage 'techno startups'

The Department of Science and Technology (DOST) and the University of the Philippines (UP) have established UP Enterprise Center for Technopreneurship, which is being supported by the Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD). They are doing this through their project: Outreach with a P21-million budget from DOST. It is now ongoing and helping State Universities and Colleges (SUCs) establish their own technology business incubators (TBIs). DOST assistance covers initial operations and equipment cost for the TBIs of the partner institutions.

A statement from the Enterprise Center pointed out that Project: Outreach "aims to increase inter-university collaboration, accelerate the formation of a critical mass of innovators, and provide a bigger pool from which future ventures can form." The Enterprise Center is currently assisting three SUCs, such as Batangas State University (BSU), Mindanao State University-Iligan Institute of Technology (MSU-IIT), and Bataan Peninsula State University (BPSU). The assistance covers operations planning; program for venture development; technical and administrative support and training; participation in an established technopreneurship course, and others.

http://www.mb.com.ph

Multibillion-peso spice industry to be established

The Department of Science and Technology (DOST) is set to establish a multibillion-peso granulated spice industry in the country, which is expected to benefit food processors and farmers producing onions, garlic and peppers. Science Secretary Mario Montejo told The STAR that DOST's Industrial Technology Development Institute (ITDI) has developed a process to manufacture granulated spices using idle food processing equipment of the institute inside the DOST compound in Bicutan, Taguig City.

The initial target will be the local food processing industry. Farmers of onion, garlic and pepper are expected to benefit. The process the DOST developed to manufacture granulated spices could also be tweaked for the manufacture of other products.

http://www.philstar.com

REPUBLIC OF KOREA

Scientific and technological innovation capabilities

The Ministry of Science, ICT & Future Planning and the Korea Institute of Science & Technology Evaluation and Planning (KISTEP) announced on Dec. 20 that Republic of Korea ranked high among 30 OECD member countries in terms of innovation capabilities in the field of science and technology. The ministry and KISTEP have analyzed and compared Republic of Korea's innovation capabilities in this field each year since 2006. Specifically, the assessment is made up of 13 items in the five segments of resources, environments, networks, activities and outcomes. They use 31 detailed indices in drawing up the Composite Science & Technology Innovation Index (COSTII) and compare the result with those of the 30 OECD member countries excluding Israel, Chile, Estonia and Slovenia.

In this year's assessment, Republic of Korea moved up from ninth to sixth in resources, from 11th to 8th in networks and from 10th to 8th in outcomes. It maintained the second place when it comes to activities and climbed one notch to 22nd in environments.

Republic of Korea was found to be doing well as far as budget and manpower inputs and patent production are concerned, while lagging behind most of the other countries with regard to qualitative performances such as inter-enterprise technological cooperation, protection of intellectual property rights and technology exports with respect to R&D investments. The ministry and KISTEP pointed out that the relatively poorer qualitative indices imply that Republic of Korea's policy in this field is failing to produce practical results.

http://www.businesskorea.co.kr

SRI LANKA

Exporters get support for R&D

Exporters will get support to develop new products under a deal between the Export Development Board (EDB) and the SriLanka Institute of Nanotechnology (SLINTEC), a top research and development outfit. Under the agreement, the EDB has provided space to SLINTEC to open a satellite office at their headquarters in Nawam Mawatha. SLINTEC will also conduct a weekly 'Science Clinic' to enable exporters to discuss their main concerns and drive new innovation to their current product range, a statement said.

"The EDB encourages the exporters to utilize the facilities being offered and to seek assistance from SLINTEC where necessary," it said. The EDB said it will also consider providing financial assistance to exporters to carry out research and development on 'high impact' projects.

SLINTEC chief executive Harin de Silva Wijeyeratne said SLINTEC's presence at the EDB will provide access to key science and engineering resources in a timely manner to support the EDB's initiative to grow exports. SLINTEC is a public-private partnership between the government of Sri Lanka and major private sector firms, MAS Holdings, Brandix, Dialog, Hayleys, Loadstar and Lankem.

http://www.economynext.com

VIET NAM

Local innovation incentive

The Finland–Viet Nam Innovation Partnership Programme Phase 2 (IPP2) plans to support start-up ecosystem developers, universities and other educational organisations in Viet Nam this year to improve their innovation and entrepreneurship. The information was unveiled at the Final Demo Day in HCM City on Saturday to review the implementation of IPP2 between 2014 and 2015.

The ministry has worked to improve policies in the field while encouraging private firms to set up venture investment funds. IPP2 is an Official Development Assistance (ODA) programme financed by the Vietnamese and Finnish governments. The second phase of the programme runs from 2014 to 2018 with a budget of VND264,320 million, aiming to strengthen the Vietnamese innovation and entrepreneurship ecosystem. It also looks to promote sustainable economic development by increasing production and exports of innovative products and services.

Between 2014 and 2015, IPP2 provided financial, training, consulting and connection assistance for 22 innovation projects in Ha Noi, HCM City, Da Nang, and Thua Thien-Hue. As of 2015, the projects generated more than 480 jobs for locals and grossed over VND9,632,000,000 in domestic revenue. The projects also raked in more than VND4,816,000,000 by selling products to foreign markets such as the US, Germany and the Republic of Korea. In 2015, Viet Nam jumped 19 places to rank 52nd out of 141 nations in the global innovation index. It also ranked 56th among 140 countries in global competitiveness, up 12 places.

http://vietnamnews.vn

Climate Innovation Center launched

A new business hub supporting local clean-tech enterprises was launched today by the Government of Vietnam with the Governments of Australia and the United Kingdom and the World Bank Group. First of its kind in the country, the Vietnam Climate Innovation Center (Vietnam CIC) aims to assist 48 clean-tech businesses within its first three years of operations, expanding access to new and improved climate-smart products and services to over 1,700 households.

Vietnam is one of the five countries most vulnerable to climate change and the Government sees clean technologies as key to reducing greenhouse gas emissions by 8 to 10 percent between 2010 and 2020, and a further 1.5 to 2 percent by 2050. To achieve the country's goal of 50 percent of enterprises applying green production techniques by 2020, the World Bank Group's Climate Technology Program estimates that Vietnam's clean technology market will need up to $19 billion in investment through to 2025.

The Vietnam CIC, which is supported by the Australian Department of Foreign Affairs and Trade and the UK Department for International Development, will provide financing, mentorship, and advisory services to the growing number of local clean-tech entrepreneurs working in five key sectors—energy efficiency, information technology, renewable energy, sustainable agriculture, and water management.

Hosted by the Ministry of Science and Technology, the VCIC is part of World Bank Group's Climate Technology Program, which is currently implementing a global network of innovation centers in seven countries.

http://www.worldbank.org

$300 million R&D centre licensed

On March 30, the Hanoi People's Committee granted the investment certificate for Samsung Electronics Vietnam (SEV)'s $300 million research and development (R&D) centre to be built in Hanoi's Hoang Mai district. Accordingly, SEV will develop a 21-storey building on a three-hectare land plot and employ 2,000 labourers in 2016, which will be bolstered to 4,000 in the upcoming years. A total capital volume of $300 million will be disbursed within four years, including $50 million in the 2016-2017 period, $150 million in 2018, and the remaining $100 million in 2019. The centre will be licensed to operate for 50 years with exemption from land lease fees.

According to the chairman of the Hanoi People's Committee, Nguyen Duc Chung, once the centre comes into operation, it will contribute to attracting FDI capital, training and developing high-quality human resources, and creating links with local enterprises to develop the supporting industries in the capital.

According to Han Myoung Sup, general director of SEV, Samsung will concentrate its resources to complete the construction on schedule, professing to determination in building a long-term co-operation. The centre is expected to bring benefits for both Samsung and Viet Nam.

Samsung has been renting eight floors at PVI Tower in Hanoi since 2012 for Samsung Vietnam Mobile Research and Development Centre (SVMC), which has contributed around 10 per cent of the software used in Samsung's smart phones and tablets globally. SVMC is currently Samsung's largest R&D centre in the Southeast Asian region, taking up an eminent position among corporation's 25 R&D centres worldwide.

Debuting in Viet Nam in 1996, the Republic of Korean giant currently has three major manufacturing complexes in Vietnam, including Samsung Vina Electronics in Ho Chi Minh City and the $2.5 billion Samsung Vietnam Electronics project in the northern province of Bac Ninh, which became operational in 2009. The remaining one is the $5 billion Samsung Vietnam Electronics Thai Nguyen complex, which went on stream in March 2014.

http://www.vir.com.vn

INTERNATIONAL

Nano-photocatalysts used to clean wastewater

A new method for making the material used for cleaning wastewater makes the production process greener - and 20 times faster. In a study published in *Applied Materials Today* ("Phase-controlled microwave synthesis of pure monoclinic BiVo4 nanoparticles for photocatalytic dye degradation"), researchers show how using microwaves can reduce the temperature and pressure needed to make photocatalysts. Powered with sunlight, materials like titanium dioxide (TiO_2) and bismuth vanadate (BiVo4) are used to clean wastewater, break down dyes and even kill bacteria in transparent bandages. Despite being considered 'green', the processes traditionally used to make these materials are energy intensive.

Now, researchers at Chiang Mai University and the National Nanotechnology Center in Thailand, and the University of Wollongong in Australia, have come up with one-step method using microwaves to make BiVo4 nanoparticles that doesn't require high temperatures and pressures. This, say the researchers, makes the material truly environmentally friendly, and will cut production costs and time.

The new method uses pure direct microwaves to make BiVo4, so doesn't require high temperature and pressure, or an additional process to improve the material. The new method is a simplified, one-step process carried out at 60-90 degrees Celsius, making it industrially viable and safer. It is also much quicker - compared to the standard 6 hours, the new method takes just 16 minutes. What's more, the BiVo4 nanoparticles made using the new process are pure and uniform in shape and size. The team adjusted the pH, temperature and reaction times to control the crystal phase of production. This meant they could control the shape and size of the nanoparticles, without the need for an additional process.

The team tested how well the material can break down a dye called Rhodamine B (RhB). They found their materials to be highly photocatalytic, and works as well as BiVo4 made using traditional methods. The researchers now hope to extend the method to synthesizing other metal oxides and related composites.

http://www.nanowerk.com

ASIA-PACIFIC

CHINA

Technology turns potato effluent into fertilizer

Scientists in China have developed a way of making fertilizer from waste-water discharged by potato processing plants, solving a pollution problem which has held back China's potato ambitions. China sees potatoes as a new staple food to ensure food security, but protein-rich water discharged by starch processors, a major buyer of the spuds, has been blamed for polluting rivers and lakes. "For years, there has been no technical solution to this problem, forcing environmental authorities to close more than 10,000 small plants, which has hurt the potato market and farmers," said Liu Gang, researcher with the Chinese Academy of Sciences, Lanzhou institute of chemical physics.

Liu's team has developed technology that can halve the chemical oxygen demand (COD) of the effluent by removing starch, fiber and protein. The processed water does not need to be dumped either, because of its high nitrogen, potassium and phosphorus content make it a perfect irrigation water. A four-year test has shown the water harmless to crops, and three starch companies are now using the technology to purify their discharge.

http://www.shanghaidaily.com

INDIA

Novel technology converts carbon dioxide into bricks

In path breaking research that would put a lid on major polluters like CO_2 (carbon-dioxide), which contributes to 60% of total pollution and global warming, Anna University has successfully carried out a project that captures and coverts CO_2 into useful products like bricks, carbonate and carboxylic acids. The researchers say the technology, when made foolproof, can be adopted by major polluting industries like coal fired power plants, steel and aluminum manufacturing firms to ensure zero discharge of CO_2 into Earth's atmosphere.

In Chennai that was left devastated by floods which many blame on climate change, a group of researchers has made a breakthrough that might be a turning point towards a low-carbon future.

"It's a culmination of three years of effort. An experimental laboratory was step-up at a cost of Rs 55 lakh, which was funded by Department of Science and Technology (DST), New Delhi. Only recently, we have submitted the report and the project tasted great success, although it was only at laboratory level. The next step would be the field level experiments," said Dr K. Palanivelu, director, Centre for Climate Change and Adaptation Research, Anna University. Dr Palanivelu said there were two focus areas. One was the Carbon-dioxide Capture and Storage (CCS) or CO_2 sequestration and another is CO_2 utilisation to permanently tap the pollutant.

http://www.deccanchronicle.com

Thermal power plant without carbon dioxide emission

A coal-fired power plant that won't release carbon dioxide in the atmosphere may become a reality in future if a technology developed by Indian scientists, found its takers in the power sector. At the technology's core lies a novel gas-absorption material to efficiently suck out the carbon dioxide from a gas mixture and hold it for months for safe disposal. The researchers at Indian Institute of Science, Education and Research (IISER), Pune obtained patent on the material and is now on the lookout for an industry partner for trial.

The chemical created by the IISER scientists jointly in collaboration with a team from the University of Ottawa led by Tom K Woo, will be needed in the second strategy

of pre-combustion capture of carbon dioxide. The findings appear recently in the journal Science Advances.

Pre-combustion carbon dioxide capture is a technology envisioned for future power plants and involves fossil fuel emissions being converted into a mixture of carbon dioxide and hydrogen gas. The carbon dioxide is subsequently removed from the gas mixture, leaving hydrogen that could be burned to produce steam to run the turbine. The material, which would be available as a dry powder, is stable and don't lose its ability for six months in laboratory studies.

http://www.deccanherald.com

Using nano materials to purify water

A chemistry professor from IIT, Madras, has innovated technology for purifying water using nano materials. Nanotechnology can purify arsenic contaminants in water and has been successfully demonstrated in arsenic-contaminated areas of Murshidabad in West Bengal. Scientist P. Pradeep, who developed this technology with support of Pradeep Research Group, discussed the benefits of this technology at a session on Safe Water and Sanitation here on Tuesday. He and his team's research found that combining the capacity of diverse nano composites to scavenge toxic species can result in affordable, all-inclusive drinking water purifiers that can function without electricity.

http://www.thehindu.com

JAPAN

Cheaper MRI technology

Canon and Kyoto University have together developed technology that will lead to smaller and more affordable MRI machines, paving the way to make cancer screenings easier and more widespread. The technology will reduce the price of MRI machines to roughly a tenth that of their predecessors. Commercializing such innovations would lead to earlier detection and treatment of cancer for the 1 million patients in Japan who are newly diagnosed each year.

Canon created the technology for highly sophisticated MRI scans, with the machines employing it to cost just tens of millions of yen. An MRI machine currently runs between 500 million yen and 1 billion yen. Kyoto University has tested the effectiveness of the new equipment.

MRI machines have superconducting electromagnets which need large-scale cooling units. But with the new technology, MRI equipment will instead utilize Canon's novel sensors that employ rubidium, an element which becomes magnetized by lasers. The smaller machines can be compact enough to fit inside mobile diagnostic units, much like X-ray machines. Canon does not make MRI machines itself, so the company is expected to provide the technology to other medical equipment makers. Canon aims for commercialization within five years.

The new technology will provide a number of advantages. One is that MRI machines will spread from large hospitals to smaller institutions, giving more people access to screening. The equipment will reduce cost burdens for hospitals, especially with medical reimbursements projected to decline. Furthermore, there is no danger of being exposed to radiation, unlike with CT scans.

http://asia.nikkei.com

PHILIPPINES

Solid waste bioreactor deployed

A technology to turn biodegradable wastes into soil-enriching compost that was developed by the Department of Science and Technology (DOST) has been deployed at the University of the Philippines (UP), Diliman, Quezon City. The deployment was part of the UP-Diliman Material Recovery Facility (MRF)-Bioreactor which UP and DOST inaugurated.

DOST-National Capital Region (NCR) partnered with UP for the first academic application of the biomass reactor (bioreactor) in the project dubbed "Pioneering the Employment of Locally-Developed Technology Using the 500 kg/day ITDI-DOST Bioreactor Technology in Academic Set-up."

It can be recalled that DOST's Industrial Technology Development Institute (ITDI) developed and introduced the bioreactor technology in 2000, which it designed to transform wastes into compost that can be used to grow vegetables and flowers and to propagate seed crops. Since then DOST has been sharing its bioreactor (composting) technology to adopters from the local government units (LGUs). ITDI engineers behind the technology have been improving the bioreactor, touted as the agency's "most successful innovation."

A DOST briefer of the project at Barangay (Village) UP Campus showed the community has a population of 75,000. "Using the Quezon City estimate of 0.6 kg. per capita waste generation per day, they can be generating about 45,000 kgs. of waste daily," it said.

http://www.mb.com.ph

SINGAPORE

Technology could save millions in energy costs

A new technology from Nanyang Technological University, Singapore (NTU Singapore), could help companies and factories cut their energy bills by as much as 10 per cent. The new algorithm is able to analyse energy consumption by tapping on sensors in computer chips already found in equipment such as computers, servers, air conditioning systems and industrial machinery. Such computer chips are needed for a host of functions such as to measure temperature, log data traffic and monitor the workload of computer processors. By combining it with externally-placed sensors, such as those that monitor ambient temperature, the new technology can integrate and analyse all the operational data and recommend energy-saving solutions with almost no upfront cost.

This new algorithm which extract all such readily data and turn them into a treasure trove of information that can be studied and analysed is developed by Asst Prof Wen Yonggang from NTU's School of Computer Engineering. It has been licensed by an NTU-incubated company, Evercomm Singapore.

Evercomm, a two-year-old company, already has a few semi-conductor manufacturers as their clients, of which one is a heavy electricity user in Singapore, GlobalFoundries, the second largest foundry in

the world. The latter's management team is committed to sustainable energy consumption by providing ample opportunities to adopt local innovations, as proven by being the first in the industry to engage Evercomm's energy analytic services.

http://phys.org

EUROPE

SWEDEN

Renewable fuel from bio oil

In a first, researchers have produced renewable fuel from pyrolysis bio-oil, a synthetic fuel being considered a substitute for petroleum. Pyrolysis bio-oil is produced by rapidly heating and then cooling the forest residues in an oxygen-free environment. By co-gasification with black liquor, a renewable fuel was produced by researchers in Lulea University of Technology's Green Fuels one of the world's most advanced pilot plant for gasification of biomass to synthesis gas and green fuels, *sciencedaily* reported.

"We have made a breakthrough developing the new process and managed to get 1+1 to be equal to three," said Erik Furusjo, project manager at LUT. "Black liquor makes it possible to gasify pyrolysis oil at a lower temperature, which provides better yield than if the raw materials were gasified separately," said Furusjo.

By converting forest residues into a liquid, called bio-oil or pyrolysis oil, energy density was increased and transportation facilitated. The conversion of the pyrolysis oil to a renewable transportation fuel was made through a process called gasification. It was performed in combination with black liquor that was a by-product from pulp and paper production.

http://tech.firstpost.com

SWITZERLAND

Ultra-fine carbon to mop up micropollutants

Researchers at the Federal Institute of Technology in Lausanne (EPFL) have developed an ultra-fine carbon that rapidly filters out micropollutants. It could be used to improve treatment at wastewater plants. Chemists working at the EPFL have created an extremely fine powdered form of activated carbon, which has the potential to treat micropollutants more efficiently. New tests showed it speeds up micropollutant removal rates by a factor of five on average; in one case it was 65 times faster than normal.

Powdered activated carbon is used at wastewater treatment plants to eliminate micropollutants – traces of chemical compounds from pharmaceutical or agricultural chemicals – which can pose a threat to aquatic ecosystems. But it can be expensive and requires lots of energy to produce. Using the new form of carbon, which works faster and more effectively, could help reduce costs, the EPFL said in a statement.

http://www.swissinfo.ch

Cheap water purification technology

Swiss scientists presented a cheap water purification process that remove water impurities by up to 99 percent and could solve the Flint water crisis. For at least a year, high levels of lead havecontaminated Flint's water supply affecting over 100,000 residents, including children. The proposed technology is pretty straightforward. The new purification process uses a paper-like membrane that is packed with processed milk proteins and carbon that absorb radioactive waste, heavy metals and other industrial byproducts. The prototype was successful in lab tests at the Switzerland's Mezzenga lab in ETH Zurich. The real challenge now is to see if the prototype will stand the tests of real-life settings. Moreover, if it can be produced inexpensively in a bigger scale.

Swiss scientist Raffaele Mezzenga worked on the two-year research that was published in the *Nature Nanotechnology* journal on Jan. 25. The debut is timely as it could help solve the lead pollution disaster that struck Flint, Michigan.

Apart from lead, the Flint water crisis also left residents at risk of contaminating E. coli, Legionnaires' disease and other life-threatening chemicals. With no current solution, people are forced to rely on expensive bottled water or personally installed water filters, which are even more expensive. Mezzenga said that a kilogram of the paper-like membrane costs around $100 to produce. This amount is enough to filter more than the estimated amount of water one individual could drink his entire life.

http://www.techtimes.com

UK

Waterless toilet uses nanotechnology

A toilet that does not need water, a sewage system or external power but instead uses nanotechnology to treat human waste, produce clean water and keep smells at bay is being developed by a British university. The innovative toilet uses a rotating mechanism to move waste into a holding chamber containing nano elements. The mechanism also blocks odours and keeps waste out of sight.

"Once the waste is in the holding chamber we use membranes that take water out as vapour, which can then be condensed and available for people to use in their homes," Alison Parker, lead researcher on the project, told the Thomson Reuters Foundation. "The pathogens remain in the waste at the bottom of the holding chamber, so the water is basically pure and clean."

Cranfield University is developing the toilet as part of the global "Reinvent the toilet Challenge" launched by the Bill and Melinda Gates Foundation. Parker said that despite "significant" interest from developed countries, the toilet is being designed with those in mind who have no access to adequate toilets. Cranfield University says its toilet is designed for a household of up to 10 people and will cost just $0.05 per day per user. A replaceable bag containing solid waste coated with a biodegradable nanopolymer which blocks odour will be collected periodically by a local operator, it says.

http://news.trust.org

NORTH AMERICA

USA

Technologies could cut jet emissions by 75 percent

Airlines could cut costs and air pollution by adopting some of NASA's latest green

aviation technologies. The nation's airlines could realize more than $250 billion dollars in savings in the near future thanks to green-related technologies developed and refined by NASA's aeronautics researchers during the past six years. The new technologies fall into three categories – airframe technology, propulsion technology and vehicle systems integration. Among other things, NASA's Environmentally Responsible Aviation project includes a new process for stitching together large sections of lightweight composite materials to create damage-tolerant structures that could be used in building uniquely shaped future aircraft that weighed as much as 20 percent less than a similar all-metal aircraft.

Altogether, adoption of the technologies could cut airline fuel use in half, pollution by 75 percent and noise to nearly one-eighth of today's levels. By the time the project officially concluded its six-year run, NASA had invested more than $400 million, with another $250 million in-kind resources invested by industry partners who were involved in ERA from the start.

A brief summary of the integrated technology demonstrations completed by the ERA researchers:

- Tiny embedded nozzles blowing air over the surface of an airplane's vertical tail fin showed that future aircraft could safely be designed with smaller tails, reducing weight and drag. This technology was tested using Boeing's ecoDemonstrator 757 flying laboratory. Also flown was a test of surface coatings designed to minimize drag caused by bug residue building up on the wing's leading edge.

- NASA developed a new process for stitching together large sections of lightweight composite materials to create damage-tolerant structures that could be used in building uniquely shaped future aircraft that weighed as much as 20 percent less than a similar all-metal aircraft.

- Teaming with the Air Force Research Laboratory and FlexSys Inc. of Ann Arbor, Michigan, NASA successfully tested a radical new morphing wing technology that allows an aircraft to seamlessly extend its flaps, leaving no drag-inducing, noise-enhancing gaps for air to flow through. FlexSys and Aviation Partners of Seattle already have announced plans to commercialize this technology.

- NASA worked with General Electric to refine the design of the compressor stage of a turbine engine to improve its aerodynamic efficiency and, after testing, realized that future engines employing this technology could save 2.5 percent in fuel burn.

- The agency worked with Pratt & Whitney on the company's geared turbofan jet engine to mature an advanced fan design to improve propulsion efficiency and reduce noise. If introduced on the next-generation engine, the technology could reduce fuel burn by 15 percent and significantly reduce noise.

- NASA also worked with Pratt & Whitney on an improved design for a jet engine combustor, the chamber in which fuel is burned, in an attempt to reduce the amount of nitrogen oxides produced. While the goal was to reduce generated pollution by 75 percent, tests of the new design showed reductions closer to 80 percent.

- New design tools were developed to aid engineers in reducing noise from deployed wing flaps and landing gear during takeoffs and landings. Information from a successful wind-tunnel campaign, combined with baseline flight tests, were joined together for the first time to create computer-based simulations that could help mature future designs.

- Significant studies were performed on a hybrid wing body concept in which the wings join the fuselage in a continuous, seamless line and the jet engines are mounted on top of the airplane in the rear. Research included wind-tunnel runs to test how well the aircraft would operate at low speeds and to find the optimal engine placement, while also minimizing fuel burn and reducing noise.

http://summitcountyvoice.com

Motion-based energy producing technology

A new technology that can harness energy from natural motions and activities has been developed at the Massachusetts Institute of Technology (MIT) in the US. Researchers at MIT have designed the new system based on electrochemical principles, which can offer a small but virtually unlimited power supply from walking and other motions. It has been based on the slight bending of a sandwich of metal and polymer sheets, MIT said.

MIT Nuclear Science and Engineering and professor of materials science and engineering Battelle Energy Alliance professor Ju Li said: "When you put in an impulse to such traditional materials, they respond very well, in microseconds. But this doesn't match the timescale of most human activities. Details about the new flexible invention have been published in the journal *Nature Communications*.

The electrochemical technology used in the device is similar to that of lithium ion batteries and can be produced at minimal costs in large scale. It involves the use of two thin sheets of lithium alloys as electrodes, which are separated by a layer of porous polymer soaked with liquid electrolyte, which in turn, can efficiently transport lithium ions between the metal plates. Power produced by the system comes in the form of alternating current (AC), unlike that in batteries and solar cells. It results in conversion of mechanical energy to electrical, and thus "it is not limited by the second law of thermodynamics," Li said.

The new technology can be used to power wearable devices with daily motions. It can also be used as actuator with biomedical applications, or for embedded stress sensors in settings including roads, bridges, keyboards, or other structures, MIT said.

http://www.power-technology.com

TRANSFORMING SCIENCE, TECHNOLOGY AND INNOVATION TOWARD SUSTAINABLE FUTURE

Masuo Aizawa
Couselor to the President
Japan Science and Technology Agency
5-3, Yonbanchou, Chiyoda-ku, Tokyo 102-8666, Japan
Tel: +81. 3. 5214.8409
E-mail: masuo.aizawa@jst.go.jp

Abstract

The world is obliged to transform toward a sustainable future through enhancing global partnership. It is a time for Asia to make a tectonic shift of growth power from the west by transforming S&T and innovation beyond the multi-challenges. As a Nation of S&T and innovation, Japan has been thriving in pursuit of global excellence to attract the world, empowerment of basic research, issue-driven and disruptive S&T innovation, and enhancement of global partnership toward the sustainable future.

Introduction

In the great transformation that takes place toward the sustainable future, three movements are distinctive in relation to Science and Technology (S&T), and Innovation.

First, "Tectonic Shift of Growth Power with Rising Asia". The world has been marking an exponential growth of population and GDP in the last two hundred years. Now, more than 7 billion people live together with expanding life expectancy on the Earth. It is predicted that the world population will exceed 8 billion by 2030. The world GDP and GDP per capita also boosted exponentially during this period. Such an exponential growth could have been driven by the Industrial Revolutions in the 18th, 19th and 20th century that happened in the West and coordinated with the scientific revolutions in the 19th and 20th century. Since then, the West has kept taking a global leadership in S&T and innovation-driven growth.

In the early 21st century, Asia has been enormously rising, particularly due to an explosive growth of China. The Asian share of the world GDP reached 40% in 2013, and would exceed 50% by 2030. Interestingly, Asia could have shared 60% of the world GDP in 1820 (Maddison, 2007), and flourished as the world growth center. Because of the great transformation to the Industrialization Era, however, the West could have taken off toward the exponential growth in contrast with falling Asia. So, it is the historical moment that Asia is remarkably rising, leading to the tectonic shift of growth power from the West. But, Asia is urged to transform in S&T and innovation toward the sustainable future.

Second, "Transformation of the World toward Sustainable Development". Despite the exponential growth during the last two hundred years, the world faces the fiercer multi-challenges that threaten the growth and sustainability. They include the crucial issues of demographic and climate changes, energy and resources, food and water, and infectious diseases. Due to an accelerated growth of population and GDP, Asia, particularly China and India, has been forced to address the energy and resources challenges.

It was 40 years ago that the world was alarmed "Limits to Growth" and should have been prepared. Jorgen Randers (2012), one of coauthors of "Limits to Growth", debated in his book entitled "2052: A Global Forecast for the Next Forty Years, A report to the Club of Rome Commemorating the 40th Anniversary if the Limits to Growth" that the break point could have been relaxed, but the world should transform to make a transition to the sustainable and well-being society.

The United Nations (2015) adopted the "Sustainable Development Goals (SDG)", September, 2015, in which 17 goals to "End Poverty, Protect the Planet, and Ensure Prosperity for All" were agreed by all member nations. Seventeen Goals, to be applied universally, mark the first time nations fully accepted this new responsibility. Furthermore, the Climate Summit in Paris, December 2015, agreed to transform the world, in line with science, within a climate boundary of 1.3-2 degree C, which requires a global transformation to be a de-carbonized world by 2040-2060. The world is forced to transform and take actions toward sustainable development by global partnership.

Third, "Transformation of S&T toward the Sustainable Future". Jeremy Rifkin (2011) suggests, in "The Third Industrial Revolution: How Lateral Power is transforming Energy, the Economy, and the World", that we can arrive at Sustainable Post-carbon Era by mid-century and avert catastrophic climate change, we have the science, the technology, and the game plan to make it happen. His term of "The Third Industrial Revolution" means a sort of the coming industrial revolution. The good news is that we are in the midst of unprecedented and revolutionary advancement of S&T, specifically ICT, Big Data, and IoT, that provide opportunities to lead the next industrial revolution. In the Global Economic Forum 2016, the Fourth Industrial Revolution was discussed as the main theme. Time is now that S&T should transform itself toward the sustainable future.

With addressing the great transformation, this article aims at discussing where we are, where we go, and what we do toward the sustainable future.

Where we are and where we go

Without any doubt, Asia is growing in economy and S&T, but the growth is threatened by the multi-challenges that have been fiercer than ever. Asia is forced

to transform toward the sustainable future with global partnership. The key is to transform S&T and innovation toward the sustainable future.

To address the issue, it is worthwhile to remind of the "Declaration on Science and the Use of Scientific Knowledge" that was adopted by the World Conference on Science at Budapest (1999), proclaiming;

1) Science for Knowledge; Knowledge for Progress;
2) Science for Peace;
3) Science for Development; and
4) Science in Society and Science for Society.

In the Declaration, it is claimed that S&T is indispensable for development. All levels of government and the private sector should provide support for building up an adequate and evenly distributed scientific and technological capacity through appropriate education and research programs as indispensable foundation.

It is important to understand where we are in respect to the Asian status of S&T and innovation. First, Asia has been tremendously rising in S&T research. Much attention is paid on the comparison of research activity by country. But, the point is to grasp the total activity of Asian S&T community.

A significant change appears in the S&T paper production. From a view point of quantity, the total production of S&T papers from Asia has been significantly increasing due to a dramatic change in China. The individual country wise share of the world S&T paper production in 2014 as following:

China 14.9%, Japan 6.2%,
India 3.9%, Rep. of Korea 3.2%,
Taiwan Province of China 2.0%

The total sum of the Asian share could exceed a quarter of the world production. That is amazing, because Asia becomes comparable with North America and Europe in the S&T paper production. In addition, the co-authorship with international collaborators was markedly enhanced. It suggests that international collaboration becomes the norm in S&T research in Asia.

Even from a view point of quality, Asia is distinctively rising in S&T research. The share of top 1% papers is one of the indicators to show the quality of research. China and Japan are ranked No.2 and No.7, respectively, in the world ranking. Asian Rise in S&T might be featured by boosting Nobel Laureates in Natural Sciences in the 21st century, which could be ranked after U.S.A.

Second, Asia Innovation Power has been vividly rising with global perspective. The Global Innovation Index (GII), for instance, indicates that economically smaller countries such as Switzerland could have emerged in the early 21st Century. Of these, Singapore, Republic of Korea, and Taiwan Province of China have been rising in Asia as innovation new power, while Japan, China, and India are staging in the world ranking. This is reflected from the public and private investment in R&D. In 2011, Asia occupied 34.3% of the world R&D investment, which are comparable with Europe (24.9%) and North America (32.2%). Republic of Korea expended 4.% of GDP, Japan 3.4%, and Taiwan Province of China 3.0%.

Judging from these data, it may be concluded that Asian Power of S&T and innovation is getting apparently comparable with the Europe and North America, if Asian partnership works.

What we do in Japan

In the 1970's and 1980's, Japan has had aggressively thrived in the world to compete with Europe and America. We could have been so successful in catching up the world front and getting internationally competitive specifically in technology innovation. In 1990's, however, the world changed drastically in any aspects. Japan should have turned to transform by claiming "From Catching Up to Running Front".

It was 1995 that the S&T Basic Law was legislated with aiming at innovating Japan as a Nation of S&T. Based on this Basic Law, the S&T Government Structure has been systematically organized:

- Council for S&T Policy (CSTP), reorganized as Council for S&T and Innovation (CSTI) in 2015, is chaired by Prime Minister and acts as Headquarters, Cabinet Office.
- Relevant Ministries:
  Ministry of Education, S&T, Sports and Culture (MEXT)
  Ministry of Economics, Trade, and Industry (METI)
  Ministry of Welfare and Labor (MWL), and others.
- Funding Agencies:
  Japan Society of the Promotion of Science (JST)
  Japan Science and Technology Agency (JST)
  New Energy and industrial Technology Development (NEDO)
  National Research Institutes for Medical Research and Development (AMED)
- National Universities, National Research Institutes
- Private Universities, Public Universities
- Private Sectors

As a Nation of S&T and Innovation, the S&T Basic Plan has been formulated for every five years since 1996. The 5th Basic Plan was decided for 2016-2020 by Cabinet in January, 2016, while the 4th Basic Plan is finishing in March, 2016. There are three pillars of policies:

- S&T Innovation
- S&T Basic Research
- Human Resources Development and S&T Systems Reform

The Government Investment Target is clearly declared in each basic plan:

- 2011-2015: 1% GDP per year, 25 trillion yen for 5 years
- 2016-2020: 1% GDP per year, 26 trillion yen for 5 years

About two thirds of the total budget is granted to the National Universities and National Research Institutes, and the rest is spent for competitive funding:

- Non-competitive Funding
  1) Operational Grant for National Universities
  2) Operational Grant for National Research Institutes

- Competitive Funding
    1) Grant for Basic Research Grant-in-Aide by JSPS
    2) Grant for Strategic Basic Research ERATO, CREST, PREST by JST
    3) Grant for S&T Innovation

    SIP, ImPACT by CSTI

    COI by JST

    NEDO Grants

    AMED Grans

As a whole, Japan has been thriving with global perspectives toward the sustainable future through the transformation of S&T and innovation.

Pursuing global excellence toward a sustainable future

"Science knows no country, because knowledge belongs to humanity,and is a torch which illuminates the world."

by Louis Pasteur

A vast expectation lies in the Pursuit of Global Excellence in S&T to Attract the World. Since Nobel Prize is regarded as premier international recognition, we are proud that Nobel Laureates in Physiology or Medicine, Physics, and Chemistry are boosting from Japan particularly in the early 21st Century. Amazingly, these Nobel Laureates have made an extraordinary contribution on not only creating new knowledge for humankind, but also driving innovation for the sustainable future. Here are three cases:

- Induced Pluripotent Stem (iPS) Cells
- Innovative Therapy against Neglected Tropical Diseases (NTD)
- A New Energy-Efficient and Environment-Friendly Light Source: Light Emitting Diode (LED)

First, "Induced Pluripotent Stem (iPS) Cells". It was symbolic that Professor Shinya Yamanaka was awarded the 2012 Nobel Prize in Physiology or Medicine for his grand breaking discovery of Induced Pluripotent Stem (iPS) Cells. He was successful in creating Quantum-leap/Breakthrough Knowledge and opening up a new way to reprogram adult, differentiated cells to turn them into stem cells. His accomplishment immediately attracted the world by global excellence that was originated in Japan. His research aim is also attractive enough to gain the global attention, because he intended to create innovative therapies for saving human lives. In fact he would have collaborated with many researchers throughout the world to drive disruptive innovation in regenerative medicine and pharmaceutical development.

It is important to note how the government has supported his research. His research was initiated in the early 2000's under the support of Strategic Basic Research Grant of CREST by JST. He could have established iPS cells in mouse in 2006, and human in 2007. It took only several years until he could have an immense impact to the world. Council for S&T Policy (CSTP) launched a new program of Funding Program for World-leading Innovative R&D on S&T (FIRST) in which 100 billion yen in total was funded to top 30 core researchers for five years (2009-2013). He was selected as one of them and could have promoted his research in a well-supported institute. This must be the best practice of government funding for establishing a world-leading researcher.

Second, "Innovative Therapy against Neglected Tropical Diseases (NTD)". The 2015 Nobel Prize in Physiology or Medicine was awarded to Professor Satoshi Omura and Professor William C. Campbell for their discoveries concerning a novel therapy against infections caused by roundworm parasites, jointly with Youyou Tu for her discoveries concerning a novel therapy against Malaria. These discoveries have provided humankind with new means to combat the diseases that affect hundreds of millions people annually.

Nobel Laureate Omura discovered and developed "Ivermectin" through a unique international collaboration of public and private sectors. He isolated new strains of *Streptomyces* from soil samples in Japan and successfully cultured them in the laboratory. Ivermectin has been donated free of charge since 1987 by its manufacturer, Merck & Co. The drag donating program has been benefiting billions of the world's poorest people, which meets the Sustainable Development Goal of End Poverty and Global Health. This case is quite different in funding from Professor Yamanaka. Professor Omura could have been provided with affluent financial support from Merck & Co. It was a unique international collaboration of academia/business.

Third, "A New Energy-Efficient and Environment-Friendly Light Source: Light Emitting Diode (LED)". The 2014 Nobel Prize in Physics was awarded to Professors Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura for inventing a new energy-efficient and environment-friendly light source – the blue light-emitting diode (LED). Their invention was rewarded as greatest benefit to mankind; by using blue LEDs, white light can be created in a new way. With the advent of LED lamps we now have more long-lasting and more efficient alternatives to older light sources.

Professors Akasaki and Amano have had tackled the difficulties to grow the gallium nitride crystal. They succeeded in placing a layer of ammonium nitride on a sapphire substrate and then growing the high quality gallium nitride on top of it, and made a breakthrough in creating a p-type layer to emit a bright blue light in 1992. In contrast, Professor Nakamura found his own clever way of creating the crystal in an industrial company. Professor Akasaki should have suffered from a limited financial support during the 1970's and 1980's. When he succeeded in growing gallium nitride crystal, JST started granting for the joint research with Toyoda Gosei Co. in 1989. Blue LED was commercialized in 1995. White LED was on market in 1999.

Pursuing Global Excellence toward the sustainable future is always Japan's top priority as a nation of S&T and innovation.

Empowering basic research

"Basic research is where it all starts: new ideas, fundamental theories, unanswered questions, and investigation into something that doesn't quite make sense. The basic researcher is driven by curiosity and a desire to explore unknown territory." American Chemical Society

Though basic research is defined in a variety of manners, American Chemical Society describes it to inspire researchers to get involved in. If it may be added, however, basic research leads to new knowledge.

In the great transformation toward the sustainable future, basic research is expected to create quantum-leap/breakthrough knowledge that can lead to the new frontier. Even if researchers are driven by curiosity, society wishes that S&T can do something good.

"Science the Endless Frontier" by Vannevar Bush has long been cited as reference in the formulation of S&T and innovation policy. Accordingly, basic research has been prioritized in U.S. funding. The MIT Committee to Evaluate the Innovation Deficit (2015) issued an interesting report "The Future Postponed: Why Declining Investment in Basic Research Threatens a U.S. Innovation Deficit". The report cites many examples of the benefits from the basic research that have helped to shape and maintain U.S. economic power, as well as highlighting industry trends that have made university basic research even more critical to future national competitiveness.

With facing financial difficulty, many countries have been struggled with prioritization of basic research. It is stressed that Japan could have kept a priority policy on basic research through Grant-in-Aide by JSPS, though the Operational Grant to National Universities had been gradually decreased. In addition, the large-scale S&T Infrastructures have been provided by MEXT, which includes Spring-8, SACLA (Spring 8 Angstrom Compact Free Electron Laser), and Super Computer "KEI".

The followings are also the successful initiatives for empowering basic research, particularly, to explore the new frontier of science:

- KAMIOKANDE and Super-KAMIOKADE for Neutrino Observation
- World Top Research Center (WPI)

First, "KAMIOKANDE and Super-KAMIOKANDE for Neutrino Observation". Professor Takashi Kajita was awarded 2015 Nobel Prize in Physics, jointly with Professor Arthur B. McDonald, for their discoveries of Atmospheric Neutrino Oscillations which show that neutrinos have mass. Professor Kajita made observations at KAMIOKANDE and Super-KAMIOKANDE. KAMIOKANDE is a large scale S&T infrastructure that is equipped with a large water-tank detector containing 3,000 tons of pure water placed deep underground in the Kamiokande mine. It is designed to detect Cerenkov light from charged particles moving in the water. Professor Masatoshi Koshiba, a founding member of KAMIOKANDE, was also awarded Nobel Prize in Physics. It is quite difficult to promote this type of big science without government support.

Second, "World Top Research Center (WPI)". The successful program for basic research is the World Premier International Research Center Initiatives (WPI). The aim of WPI is to explore new science frontier by fusion research. These centers have a high degree of autonomy, allowing to shift from conventional research operation to more open research platform.

Nine WPI's are on-going in the fields of Origin of Universe/Earth/Life, Materials/Energy, and Life Science.

Five centers adopted in 2007 are:

- Tohoku University: Advance Institute for Materials Research (AIMR) Director: Motoko Kotani
- National Institute for Materials Science: International Center for Materials Nanoarchitectonics (MANA), Director: Masakazu Aono
- The University of Tokyo: Kavli Institute for the Physics and Mathematics of the Universe, The University of Tokyo Institutes for Advanced Study (Kavli IPMU), Director: Hitoshi Murakami
- Kyoto University: Institute for Integrated Cell-Material Sciences (iCeMS), Director: Susumu Kitagawa
- Osaka University: Immunology Frontier Research Center (IFReC), Director: Shizuo Akira

One center adopted in 2010:

- Kyushu University: International Institute for Carbon-Neutral Energy Research (I2CNER), Director: Petros Sofronics

Three centers adopted in 2012:

- University of Tsukuba: International Institute for Integrative Sleep Medicine (IIIS), Director: Masashi Yanagisawa
- Tokyo Institute of Technology: Earth-Life Science Institute (ELSI), Director: Kei Hirose
- Nagoya University: Institute of Transformative Bio-Molecules (ITbM), Director: Kenichiro Itami

From research performance, WPI's have been highly evaluated and ranked as the world top research institutes.

Driving strategic basic research and issue-driven innovation

"I have a great respect for incremental improvement, and I have done that of thing in my life, but I've been always attracted to the more revolutionary changes."

by Steve Jobs

Toward the sustainable future beyond the threats to growth, "Disruptive/Breakthrough Innovation" should be prioritized rather than Incremental Innovation, Furthermore, "Issue-driven Innovation" should be effective on tackling the global/local challenges by integrating a diversity of knowledge across disciplines.

As often cited, "Basic Research is the Key Driver of Innovation". There are two steps of programs for translating basic research to innovation. One is the Strategic Basic Research Initiatives that include ERATO, CREST, and PREST by JST. The other is the Innovation Initiatives of SIP and ImPACT by CSTI, COI and A-STEP by JST, the METI Initiatives by NEDO, and the AMED Initiatives.

The 4th S&T Basic Plan sets a priority on the Issue-driven S&T Innovation to address the challenges we face. The initiatives are "Recovery from the Earthquake: Addressing Natural Disasters", "Green Innovation: Addressing the Energy and Environment Issues", "Life Innovation: Addressing the Health Issues", and others. Most of these initiatives concern the Sustainable Development Goals.

For further promotion of the Issue-driven S&T Innovation, the following initiatives such as SIP and ImPACT have been formulated and managed to meet the System Reform by CSTI with help of JST.

1) Cross-Ministerial Strategic Innovation Promotion Program (SIP) (2014-2018) by CSTI
   - Highly Efficient Engine Technologies, PD: Sugiyama

- Next Generation Power Electronics, PD: Oomori
- Advanced Structural Materials, PD: Kishi
- Energy Carrier – Hydrogen Society -, PD: Muraki
- Next Generation Marine Resources Survey, PD: Nisio
- Connected and Automated Driving, PD: Watanabe
- Social infrastructure Management, PD: Fujino
- Resilient, PD: Nakajima
- Next Generation Agro Technology, PD: Nisio
- Innovative Manufacturing, PD: Sasaki

2) Impulsing Paradigm Change through Disruptive Technologies (ImPACT) (2014-2018) by CSTI

- Ultra-Thin and Flexible Tough Polymer, PM: Ito
- Turning Serendipity into Planned Happenstance, PM: Goda
- Ubiquitous Power Laser for Achieving a Safe, Secure and Longevity, PM: Sano
- Ultimate Green IT Devices, PM: Sahashi
- Innovative Cybernic System for a Zero Intensive Nursing-care, PM: Sankai
- Super High-Functional Structural Proteins, PM: Suzuki
- Tough Robotics Challenge, PM: Tadokoro
- Reduction and Resource Recycle of High Level Radioactive Wastes with Nuclear Transmutation, PM: Fujita
- Ultra-High-speed Multiplexed Sensing System, PM: Miyata
- Innovative Visualization Technology, PM: Yagi
- Brain Information Industries, PM: Yamakawa
- Quantum Artificial Brains in Quantum Network, PM: Yamamoto

Disruptive/Breakthrough Innovation has often been driven by quantum-leap/breakthrough knowledge that was created in basic research. But, in most cases, it takes more than ten years, sometimes 30 – 40 years until successful accomplishment is achieved. Furthermore, academia / business collaboration and infrastructure should be strategically strengthened. The followings are successful cases:

1) Case One: "IGZO", Professor Hideo Hosono created repeatedly quantum-leap/breakthrough knowledge in basic research and strategic basic research, and succeeded in driving disruptive innovation. He always broke up the common understanding and generally accepted knowledge.

   His first outbreaking discovery was Transparent Amorphous Oxide Semiconductor (TAOS) under the support of ERATO by JST. The quantum-leap/breakthrough knowledge had been successfully translated into disruptive innovation of IGZO, which could open a new way of energy-efficient and environment-friendly displays for smartphnes and others. Collaboration with private sector had been successful in driving disruptive innovation of IGZO for displays.

   The second was the extraordinary discovery of Iron-based High Temperature Superconductor under the support of CREST by JST and TIRST by CSTP. No one except him believed that iron-containing materials show superconductivity. His outbreaking discovery could have gave the impulsive impacts to the world. He is Thomson Reuters Citation Laureate.

   Third was a sort of serendipity discovery of New Ammonia Catalyst during exploratory research on Superconducting Materials Frontier under the support of FIRST by CSTP. He was awarded Japan Prize in 2016.

2) Case Two: "Photocatalysis", Professor Akira Fujishima created quantum-leap/breakthrough knowledge in basic research and strategic basic research under the support of Grant-in-Aide and succeded in disruptive innovation under the support of CREST by JST. His success was outbreaking discovery of Water Photolysis on a Titanium Oxide electrode and published in *Nature* in 1972. The phenomena was named "Honda-Fujishima Effect". He is Thomson Reuters Citation Laureate.

   His second breakthrough was the discovery of Super-hydrophylicity of Titanium Oxide in 1997, which could have driven disruptive innovation of Self-Cleaning, Air-cleaning, and Water-cleaning, leading an explosive application in ceramic, glass, and other industries. He was awarded Japan Prize in 2004.

Enhancing global partnership

The world is obliged to transform toward the Sustainable Development Goals. The seventeen Goals cannot be achieved without global partnership. As prioritized in S&T diplomacy, the successful initiatives have been promoted for addressing the global/local challenges with which the developing countries are struggled.

SATREPS (S&T Research Partnership for Sustainable Development) is a joint research program, specifically addressing the global issues with which the developing countries are confronted. This program is organized by JST and JICA. In the first eight years beginning in April 2008, a total of 99 projects commenced in 43 countries. Currently a total of 44 international research projects in 26 countries are in progress as SATREPS projects in environment and energy, bioresources, and disaster prevention and mitigation. SATREPS projects in the field of infectious diseases control have been transferred to AMED.

SAKURA Exchange Program (Japan-Asia Youth Exchange Program in Science) aims at fostering human resources to the future S&T and Innovation. It is a short-term exchange program to promote the interest of Asian youth towards the leading S&T in Japan. Outstanding youth from 15 Asian counties are invited to join the various activities, including science camp, communicating with S&T researchers and administrators, and attending S&T symposiums. This program is implemented with a close collaboration among industry, academia, and government.

Conclusion

The world is obliged to transform toward the sustainable future. The United Nations adopted the Sustainable Development Goals in 2015. The 2015 Climate Summit in Paris agreed to transform the world to be de-carbonized by 2040-2060. The World Conference on Science adopted the "Declaration on Science and the Use of Scientific Knowledge" at Budapest in 1999. A set of these agreements clearly directs where we go.

While Asia is dramatically rising, the growth power is tectonically shifting from the West to the Rest of the World. Asia is urged to transform toward the sustainable future by transforming S&T and innovation with enhancing global partnership.

As a Nation of S&T and Innovation, Japan has been thriving in pursuit of global excellence, empowerment of basic science, issue-drive S&T innovation, and enhancement of global partnership, toward the sustainable future. Transformation of S&T and innovation must be indispensable to tackle the global/local challenges beyond the threats to growth and sustainability.

References

- ✓ Madisson A. (2007). *Contours of the World Economy, 1-2030 AD*. (Oxford, Oxford University Press)
- ✓ MIT Committee to Evaluate the Innovation Deficit (2015). "The Future postponed: Why Declining Investment in Basic Research Threatens a U.S. Innovation Deficit".
- ✓ NISTEP, MEXT (2015). "Japanese Science and Technology Indicators 2015".
- ✓ Rafkin J. (2011). *The Third Industrial Revolution: How Lateral Power is transforming Energy, the Economy, and the World*. (New York, Palgrave Macmillan).
- ✓ Randers J. (2012). *2052: A Global Foresight for the Next Forty Years. A Report to the Club of Rome Commemorating the 40th Anniversary of the Limits to Growth*. (Vermont, Chelsea Green Publishing).
- ✓ World Conference on Science (1999). "Declaration on Science and the Use of Scientific Knowledge", Budapest, Hungary. ■

The orientation of Philippine science, technology and innovation toward social objectives

Adoracion M. Navarro
Senior Research Fellow
Philippine Institute for Development Studies
18th Floor, Eton Centris Cyberpod Tower 3, EDSA,
Quezon City, Philippines
Tel: (632) 372-1291 or (632) 372 -1292
E-mail: anavarro@mail.pids.gov.ph
Web: http://www.pids.gov.ph

Abstract

It has been observed that innovations in the Philippines are oriented toward social objectives and this has been partly explained by development indicators like income inequality. In this article, it is shown that such orientation is also supported by the fact that the country has greater capacity for knowledge absorption and modification than for creation of original knowledge. The science, technology and innovation indicators in the country show that Filipinos have advanced ability to absorb original knowledge and use such knowledge to come up with value-adding goods and services responsive to social objectives, which often do not require the sophistication that high-tech products need. The examples of products and services provided in this article also demonstrate that such ability serve the country well in meeting sustainable development goals.

Introduction

In 2013, a BBC feature story discussed the Philippines' innovation drive to make tech start-ups blossom which resulted instead in Filipinos being driven to find local solutions to social problems, and then asked: "What happened?" As explanations, the story highlighted the fact that despite the economic growth that the country is experiencing, inequality remains high, and the hypothesis that the band of "social innovators" see improving the lot of ordinary Filipinos as a higher priority than making profits (Kalan 2013).

There is a lot of truth in the observation on Philippine innovations being oriented toward social objectives and it is also because Filipino innovators who avail of government incentives or look for commercialization opportunities see the domestic market as the primary markets for their outputs given that more than 99 percent of Filipino firms are small to medium enterprises. In a 2012 inventory, the Department of Trade and Industry found that of the 944,897 business enterprises operating in the Philippines, 99.58 percent are micro, small and medium enterprises. This inward-looking stance and the smallness of the market (relative to the global market) contributed to the slow development of high-technology products in the country and instead, imports are relied upon to meet the demand for sophisticated technology. As can be gleaned from the science, technology and innovation indicators in the discussion below, the capacity of the country is concentrated less on creating original knowledge through invention patents and more on absorbing original knowledge produced elsewhere and using such knowledge to come up with value-adding goods and services.

Moreover, universities and colleges are a venue for inspiring scientists and innovators at the age when they are most receptive and easily moved. Research and development activities in universities and colleges provide both inspiration and experience, which serve the scientists and innovators well when they actually try to solve society's problems. Most Filipino innovators get their inspirations on science and technology applications from their experiences in state-supported universities and colleges which are scattered throughout the archipelago and exposed to social problems at the local level.

Selected science, technology and innovation indicators

Statistics reporting on science, technology and innovation (STI) indicators in the Philippines has widely varying timeliness and some are a bit outdated, particularly research and development indicators. Nevertheless, tenable conclusions on the current state of STI can be made from the available statistics.

Technology Balance of Payments

The indicator technology balance of payments, which measures international technology transfers based on payments for and receipts from production-ready technologies, is not being reported in the Philippines. Nevertheless, since the Bangko Sentral ng Pilipinas (or BSP, the country's central bank) is compliant with the International Monetary Fund's BPM6 reporting of balance of payments, the technology balance of payments for the Philippines can be constructed from the BSP reports on the current accounts portion of the balance of payments. To the author's best knowledge, this is the first time that such indicator is constructed for the Philippines.

Let us start with the OECD definition of technology balance of payments, which states that trade in technology has the following four main categories (OECD 2009):

1. transfer of techniques (through patents and licenses, disclosure of know-how);
2. transfer of designs, trademarks and patterns;

3. services with a technical content; and
4. industrial research and development.

Applying the OECD definition, the following categories from the "Services" portion of the Current Account of the Philippine Balance of Payments can be used to describe the country's technology-related receipts and payments (Table 1).

Let us then look at the receipts from and payments for these categories of transactions using data from 2005 to 2014, the earliest and latest available.

The balance of payments on charges for the use of intellectual property shows that the Philippines during the period was paying more than it is receiving from the rest of the world for licenses, trademarks and patents. In other words, in terms of original knowledge, the country is more of a knowledge user than a knowledge creator. Receipts from the use of Filipino intellectual property had also been relatively flat and almost insignificant while payments for foreign intellectual property had been on the rise (Figure 1).

The balance of payments on telecommunications, computer and information services shows that the Philippines' exports of these services had risen sharply and the gap between exports and imports had also widened sharply (Figure 2).

By component, the trend is influenced significantly by trade in computer services, where 2014 exports had grown to about 20 times the size in 2005. With respect to telecommunications services, exports had a good start in 2005 but recently experienced a decline. With respect to information services, imports had always been greater than exports throughout the period.

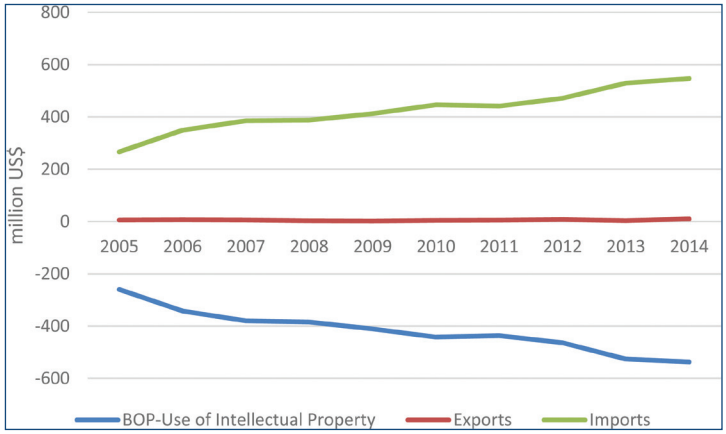
Professional and management consulting services balance of payments shows that the country had been a consistent importer throughout the period (Figure 3).

The technical, trade-related, and other business services balance of payments shows that the export receipts consistently exceeded the import payments and

Table 1: Compatibility of entries in the Philippine balance of payments with the OECD definition of technology balance of payments

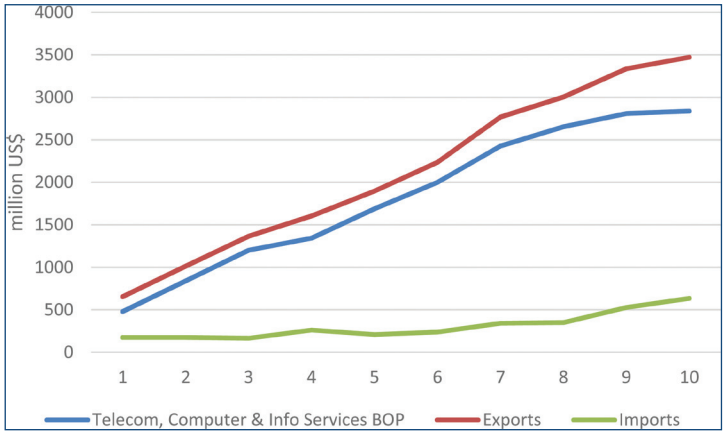
Entries in the Philippine Balance of Payments[1]	Compatibility with OECD Definition of Technology Balance of Payments
1. Charges for the use of intellectual property	Capture both transfer of techniques and transactions involving designs, trademarks and patterns
2. Telecommunications, computer, and information services	Together correspond to services with a technical content
3. Professional and management consulting services	
4. Technical, trade-related, and other business services	
5. Research and Development Services	Correspond to industrial research and development

Source: Author's interpretation.



Source: Bangko Sentral ng Pilipinas database

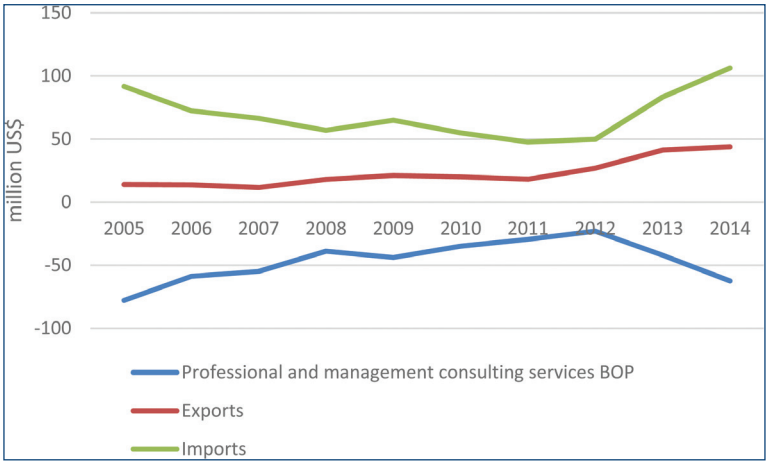
Figure 1: Balance of payments on charges for the use of intellectual property



Source: Bangko Sentral ng Pilipinas database

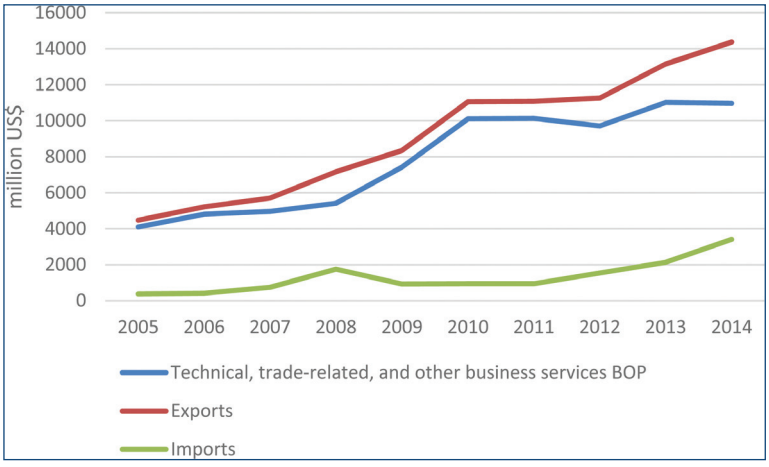
Figure 2: Telecommunications, computer and information services balance of payments

[1]The other categories in Current Account-Services of the Philippine Balance of Payments are: maintenance and repair, transport (passenger, freight, and others), travel, construction, insurance and pension, financial, personal, cultural and recreational, and government services.



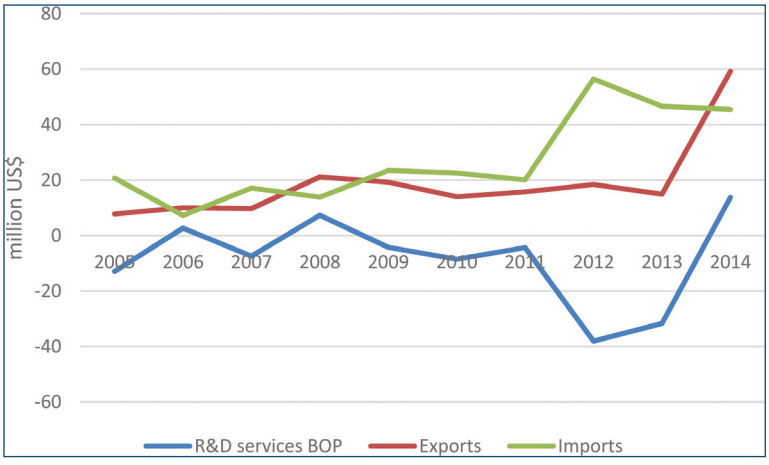
Source: Bangko Sentral ng Pilipinas database

Figure 3: Professional and management consulting services balance of payments



Source: Bangko Sentral ng Pilipinas database

Figure 4: Technical, trade-related, and other business services balance of payments



Source: Bangko Sentral ng Pilipinas database

Figure 5: Research and development services balance of payments

the gap had also widened. Although imports generally rose during the period, the imports increase was not as striking as the exports increase (Figure 4).

The research and development services balance of payments shows mixed performance — with alternating deficit and surplus between 2005 and 2008, then deficit thereafter until 2013; 2014 ended with remittances from research and development services exceeding payments (Figure 5).

Thus, of the five components of the technology balance of payments of the Philippines, only two components consistently showed a surplus — the telecommunications, computer and information services balance of payments and the technical, trade-related, and other business services balance of payments. However, the overall technology balance of payments of the Philippines shows a consistent surplus during the period (Figure 6). This is because the mentioned two components account for the two largest sources of export receipts among technology-related services exports.

In fact, exports of technical, trade-related, and other business services ranged between 78.65 percent to 86.79 percent during the period, whereas exports of telecommunications, computer and information services ranged between 16.18 percent to 20.98 percent during the same period (Table 2).

Given the trends in the services which are bringing balance of payments surpluses to the country, it is safe to say that such can be related to the growth of business process outsourcing in the country. A profiling done by the BSP in 2013 shows that the business process outsourcing industry are heavy users of these services. The Philippines led globally in voice-driven IT-business process management (BPM) services, particularly in customer relations management and in niche services such as IT help desk services and game support, and was the second most preferred destination for complex non-voice IT-BPM services (e.g., financial services, business intelligence, health care information management, IT and

engineering services, human resource management, and creative processes). The industry has also been in a high growth trajectory — with annual growth rates ranging between 11.4 percent and 50.88 percent in 2004-2013. The industry is a US$15.30 billion industry (based on revenues) as of 2013 (Bangko Sentral ng Pilipinas, 2013).

Intellectual property rights granted and registered

Let us look at original knowledge creation or the intangible assets called intellectual property rights, which, in the Philippines statistical reporting system, consist of registered patents, trademarks, utility models, industrial designs and copyrights.

Data on intellectual property rights granted to investors show that invention patents were only a small component and trademarks were the largest component of intellectual property rights granted (Figure 7). (However, no data on the value of these intangible assets were made available to the author).

Nevertheless, note that the trend on grants of intellectual property rights is generally increasing, which is a promising trend.

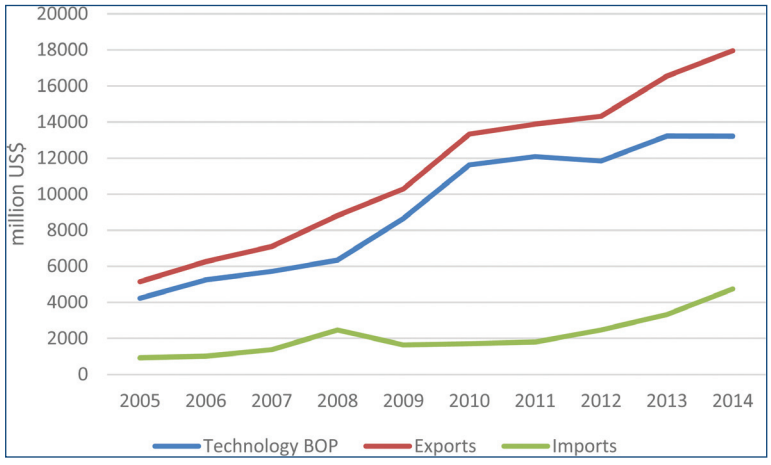
Research and development

In 2011, total national research and development expenditures were PHP12,046 million or 0.2 percent of GDP; this is an increase of 37 percent from its value in the 2009 survey. Private industry's research and development expenditures accounted for 61 percent of total national research and development expenditures. Among higher education institutions, public institutions had a greater contribution to research and development spending than private institutions (Table 3) (Department of Science and Technology, 2013). These public higher education institutions are the so-called state universities and colleges which are spread throughout the archipelago.

Compared with global averages on gross expenditure on research and development (GERD) as a percentage of GDP, the Philippines' spending at 0.2 percent of GDP is on the low side. The average GERD as a percentage of GDP in the 141 countries surveyed in the 2015 Global Innovation Index is 0.91 percent, while the average for lower middle-income countries (to which group the Philippines belong) is 0.28 percent (Cornell University, INSEAD, and WIPO 2015).

Global Innovation Index scores

The country's ranking in the Global Innovation Index (GII) progressed to rank 83 among 141 economies surveyed in 2015. The GII is a composite index using indicators of innovation inputs, including enabling environment, and innovation outputs. The country's rank is an improvement of 17 notches from its 2014 rank of 100th. It moved significantly up in the business-sophistication pillar, which



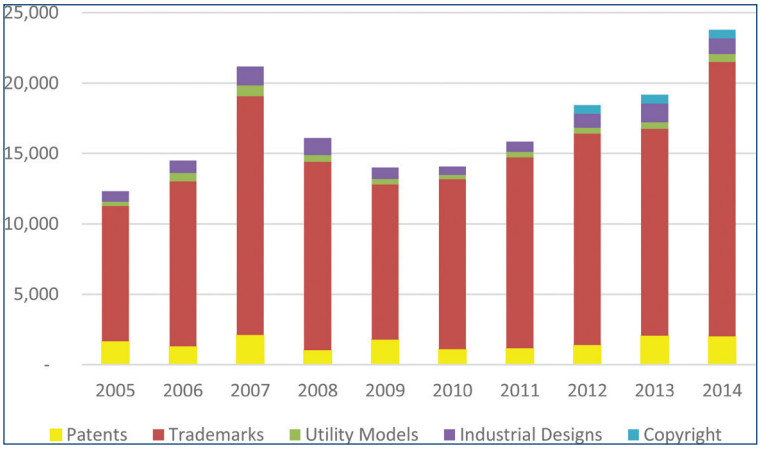
Source: Bangko Sentral ng Pilipinas database

Figure 6: Overall technology balance of payments of the Philippines

Table 2: Composition of technology-related services exports

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total Technology-related Services Exports (million US$)	5153	6261	7096	8815	10289	13327	13886	14316	16546	17955
of which:										
Intellectual Property	0.11%	0.10%	0.08%	0.03%	0.02%	0.03%	0.04%	0.05%	0.02%	0.05%
Telecom, Computer & Info Services	12.68%	16.18%	19.24%	18.20%	18.44%	16.78%	19.94%	20.98%	20.16%	19.34%
Professional and management consulting services	0.27%	0.22%	0.16%	0.20%	0.21%	0.15%	0.13%	0.19%	0.25%	0.24%
Technical, trade-related, and other business services	86.79%	83.34%	80.39%	81.33%	81.15%	82.94%	79.78%	78.65%	79.48%	80.03%
R&D services	0.15%	0.16%	0.14%	0.24%	0.19%	0.11%	0.11%	0.13%	0.09%	0.33%

Source: Bangko Sentral ng Pilipinas database



Source: Intellectual Property Office of the Philippines

Figure 7: Number of intellectual property rights granted to investors

Table 3: 2011 Research and development expenditures by performing sector

National Government	17%
Higher Education	22%
a. Public	17%
b. Private	5%
Private Non-Profit	0.40%
Private Industry	61%
Total	100%

Note: Numbers do not sum up to 100% to due to rounding.

Source: Department of Science and Technology

covers knowledge workers, innovation linkages and knowledge absorption. Among the pillars of the GII, the Philippines ranked highest in "Creative outputs" where it ranked 101st. The pillar consists of the sub-pillars intangible assets, creative goods and services, and online creativity. In the GII research methodology, intangible assets refer to trademarks, information, communication and technology (ICT) and business model creation, and ICT and organizational model creation. Creative goods and services refer to cultural and creative services exports, national feature films, global enterprises and media output, printing and publishing output, and creative goods exports. Online creativity refers to proliferations of generic top-level domains (TLDs), country-code TLDs, Wikipedia edits, and Video uploads on Youtube (Cornell University, INSEAD, and WIPO 2015).

Philippine innovations inspired by social objectives: some examples

It seems that although the Philippines lacks sophistication when it comes to intellectual property rights (e.g., patented inventions) and high-tech goods production, it more than compensates for this through its ability to innovate. As the STI indicators discussed above imply, Filipinos for the most part are users and innovators of original knowledge created elsewhere rather than conceivers of such original knowledge. This positively affects the country's terms of trade. Moreover, the innovativeness of the Filipinos are helping meet social objectives in the Philippines and has the potential to help meet global sustainable development goals (SDG) described in the 2030 Agenda for Sustainable Development agreed upon by members of the United Nations. Innovations with applications for small and medium enterprises exist in agri-business and the ICT industry.

One example of such innovation is a wound dressing using the Filipino nata de coco. It is directly relevant to SDG 12, which is "to ensure sustainable consumption and production patterns." The commercial product is called VERMAC® (short for vitro engineered restorative microcellulose absorbent covering), which takes advantage of the properties of microbial cellulose or bacterial cellulose, a cellulose produced by bacteria from the genera *Aerobacter, Acetobacter, Achromobacter, Agrobacterium, Alacaligenes, Azotobacter, Pseudomonas, Rhizobium, and Sarcina*. The Filipino nata de coco is an example and it is produced through the fermentation of coconut water using the bacteria *Acetobacter xylinum*.

The company that produces VERMAC®, Xyderm Corporation which is a pioneering Filipino company, documented the efficacy of the use of the product and claims that the product acts as a scaffold for regeneration of tissues, such as skin and blood vessels, during wound healing. on scaffolding for tissue. As early as 2006, Helenius et al. (2006) have studied bacterial cellulose for medical use as a scaffold in tissue engineering. Using experiments on rats, they were able to get good results about the biocompatibility of bacterial cellulose and concluded that the material has potential to be used as a scaffold in tissue engineering. Among the already commercial wound dressing products which use bacterial cellulose are Xcell®, Bioprocess® and Biofill® (Torres, et al. 2012).

The award-winning inventor of VERMAC is a Filipino nurse who said that he was motivated to develop the product because when he worked at the Burn Center of the Philippine General Hospital, he saw that most burn patients were poor and ordinary people and the existing treatment then was expensive. Xyderm claims that the cost of 3-day wound dressing using VERMAC is PHP648.40 whereas the standard cost of 3-day wound dressing using silver sulfadiazine ointment is PHP1,572.75 (Xyderm, n.d.).

Another example is RxBox, a multi-component program for telemedicine which can allow patients in rural areas to be diagnosed by doctors in urban areas. It is directly responsive to SDG 3, which is to "ensure healthy lives and promote well-being for all at all ages." The program components are biomedical devices, electronic medical record systems and telemedicine trainings designed to provide better access to life-saving health care services in isolated and disadvantaged communities nationwide. The telemedicine device being used is also called a RxBox. It can capture medical signals through built-in medical sensors, store data in an electronic medical record (i.e., the Community Health Information Tracking System or CHITS), and transmit health information via internet to a clinical specialist in the Philippine General Hospital for expert advice. Since it facilitates teleconsultations (e.g., through audio-video conferences), the use of RxBox also catalyzes improvement in the local referral system of the National Telehealth Center, which is based at the University of the Philippines-Manila, a state university. Given the innovations in the device and practices, the RxBox program reduces the overall cost of healthcare for patients in far-flung areas in the Philippines. The collaborators in the RxBox program are four attached agencies of the Department of Science and Technology (i.e., the DOST the Philippine Council for Health Research and Development, Philippine Council for Industry, Energy and Emerging Research and Development, Advanced Science and Technology Institute, and Information and Communications Technology Office), the Electrical and Electronics Engineering Institute of the University of the Philippines-Diliman, and the program team from the University of the Philippines-Manila (RxBox, n.d.).

An innovation that directly responds to SDG 13, that is, to "take urgent action to combat climate change and its impacts," is the Nationwide Operational Assessment of Hazards (NOAH) program, which is more popularly known locally as Project NOAH.[2] It comprehensively utilizes ICT know-how and advanced equipment for disaster prevention and risk management and integrates the assessments in an interactive website (http://noah.dost.gov.ph/#/). Although the website is still in beta version, local government units are already finding it useful in preparing for natural disasters such as typhoons or tropical cyclones. Note that the Philippines is often in the path of typhoons crossing the Asia-Pacific and the country experiences an average of 19 typhoons a year (Philippine Atmospheric, Geophysical and Astronomical Services Administration, 2009).

The ongoing NOAH program has the following components (NOAH website, n.d.):

1. Hydrometeorological Sensors Development
2. Disaster Risk Exposure Assessment for Mitigation-Light Detection and Ranging (DREAM-LIDAR) 3D Mapping project
3. Flood NET or Flood Information Network for timely and accurate flood early warning systems
4. Strategic Communication
5. Disaster Management using WebGIS
6. Enhancing Geohazard Mapping through LIDAR and High-resolution Imagery
7. Doppler System Development
8. Landslide Sensors Development
9. Storm Surge Inundation Mapping
10. Weather Information Integration for System Enhancement

ICT innovations' forward linkage through mobile apps is also demonstrated in the evolution of the NOAH program. ARKO,[3] the mobile app for NAOH, serves as a vehicle to timely deliver important information regarding floods to communities which are at risk. The app was actually one of the five winners in the e-Inclusion and Empowerment category of the World Summit Awards Mobile Content 2014. A total of 456 projects from 98 countries were submitted for the awards (Department of Science and Technology, 2014).

These examples speak well of the advanced ability of Filipinos to use science and ICT for innovations and value-adding services. There are, however, critical challenges that need to be addressed in order to accelerate further the development of innovative and socially responsive products and services in the Philippines. Foremost among the challenges is slow and expensive broadband in the Philippines. Government policy directions will be needed to level the playing field in the increasingly duopolistic telecommunications industry, expand the existing infrastructure, and bridge the digital divide in the country. More industry applications of STI are also needed as these can help SMEs to grow and create employment. In this regard, foreign direct investments (FDI) still remain an important channel for technology transfer and FDI in the country is restricted by caps on foreign equity and restrictions on professional practice by foreign nationals. FDI liberalization is a serious challenge because the restrictions are enshrined in the country's Constitution and the amendment of economic provisions in the Constitution has been a long drawn-out political battle in the Philippines.

References

- ✓ Bangko Sentral ng Pilipinas (2013). Results of the 2013 Survey of Information Technology-Business Process Outsourcing (IT-BPO) Services.
- ✓ Cornell University, INSEAD, and WIPO (2015). *The Global Innovation Index 2015: Effective Innovation Policies for Development*, Fontainebleau, Ithaca, and Geneva.
- ✓ Department of Trade and Industry (2012). SME Statistics. Retrieved January

[2]Given that most Filipinos are Christian, the name NOAH also recalls to mind the flooding story in the Christian bible and the advance planning done by the main character Noah.

[3]The word "arko" is Filipino for "ark" or the large boat in which Noah and his family were saved from the great flood.

29, 2016, from http://www.dti.gov.ph/dti/index.php/resources/sme-resources/sme-statistics.

- ✓_____ (2013). Results of the 2011 Survey of R&D Expenditures and Human Resources and Updates on R&D Indicators in the Philippines (presentation material), 12th National Convention on Statistics, Mandaluyong City, October 1-2, 2013.
- ✓Department of Science and Techology (2014). Project NOAH mobile app wins international award. Retrieved January 29, 2016, from http://dost.gov.ph/index.php/knowledge-resources/news/34-2014-news/617-project-noah-mobile-app-wins-international-award.
- ✓Helenius G., Bäckdahl H., Bodin A, Nannmark U., Gatenholm P., and Risberg B. (2006). "In vivo biocompatibility of bacterial cellulose." *J Biomed Mater Res A*, Vol. 76(2), pp. 431-8.
- ✓Intellectual Property Office of the Philippines (2016). Intellectual Property Statistics.
- ✓Kalan, J. (2013, October 8). Philippines: The innovation drive that turned social. BBC. Retrieved January 30, 2016, from http://www.bbc.com/future/story/20131007-innovation-drive-that-went-social.
- ✓Nationwide Operational Assessment of Hazards (NOAH) website (n.d.). Retrieved February 1, 2016, from http://noah.dost.gov.ph/#/.
- ✓OECD (2009). "Technology balance of payments," in OECD Science, Technology and Industry Scoreboard 2009, OECD Publishing. Retrieved January 30, 2016, from http://dx.doi.org/10.1787/sti_scoreboard-2009-49-en.
- ✓Philippine Atmospheric, Geophysical and Astronomical Services Administration (2009). Member Report to the ESCAP/WMO Typhoon Committee, 41st Session, Retrieved February 1, 2016, from http://www.typhooncommittee.org/41st/docs/TC2_MemberReport2008_PHILIPPINES1.pdf
- ✓RxBox (n.d.). RxBox: Advancing Community Healthcare. Retrieved January 30, 2016, from https://rxbox.chits.ph/.
- ✓Torres, F.G., S. Commeaux, and O.P. Troncoso (2012). "Biocompatibility of Bacterial Cellulose Based Biomaterials." *J. Funct. Biomater*, Vol. 3, pp. 864-878.
- ✓Xyderm (n.d.). VERMAC webpage. Retrieved January 30, 2016, from http://xyderm.com/vermac/. ■

OECD Science, Technology and Industry Scoreboard 2015

According to the new, OECD Science, Technology and Industry Scoreboard 2015, countries should step up their investment in long-term R&D to develop frontier technologies that will reshape industry, healthcare and communications and provide urgently needed solutions to global challenges like climate change. A breakdown of patent data in the report puts the United States, Japan and Republic of Korea far in the lead in a new generation of "disruptive" technologies in advanced materials, health, and information and communication technology that have the potential to displace existing processes. Republic of Korea, in particular, has made great strides in these fields recently. While Republic of Korea's public R&D spending has quadrupled in real terms since 2000, reaching 1.2% of GDP in 2014, public R&D spending in many advanced economies has stagnated or experienced significant fluctuations, averaging less than 0.7% of GDP in 2014 in the OECD area.

The report shows that the US, Japan and Republic of Korea accounted for over 65% of patent families in advanced materials, health and new ICT-related technologies filed in Europe and the US in 2010-12. Republic of Korea shows the strongest relative rise since 2005-07 in filing patent families in the three areas, while the BRIICS countries are also advancing, especially China. In the ICT sector, Republic of Korea is pushing ahead in Internet of Things technologies, the EU in quantum computing, and China in Big Data. Total R&D spending in OECD countries grew by 2.7% in real terms in 2013 to USD 1.1 trillion – a rise driven by business R&D. Governments increased R&D spending during the economic crisis to support businesses, but since 2010 R&D funded or performed by governments in many advanced economies has declined or flattened. Cuts to R&D spending threaten to destabilise science and research systems in many advanced economies, the OECD warns.

Given that 70% of R&D in the OECD area takes place within the business sector, and tends to focus on developing specific applications that improve on previous versions, the report underscores the need for governments to keep up their spending on the more open-ended "basic research" that can spawn brand new findings and inventions relevant to a range of potential users.

For more information, access:
www.oecd.org/science/oecd-science-technology-and-industry-scoreboard-20725345.htm

Sharing Economy

SUSTAINABLE DEVELOPMENT DRIVEN BY INTERNET TECHNOLOGY

Zhu Xinyue[a] and Guo Rong[b]

[a]Assistant Researcher, Institute of Science of Technology Investment, Chinese Academy of Science and Technology for Development (CASTED), China
E-mail: zxykjb@163.com
[b]Corresponding author. Management committee, Chinese Academy of Science and Technology for Development (CASTED), China
E-mail: grkjb@163.com

Abstract

The Sharing Economy as a brand new business model is expanding rapidly in the world because of its evident advantages in energy efficiency, effectiveness improvement and cost reduction. In particular, after the latest international financial crisis, countries in the world are actively sharing new economic fields, making full use of connected infrastructure and research innovations to improve and develop the Sharing Economy. At present, the Chinese economy is in the stage of its new normal. The research innovations, mainly represented by Sharing Economy, are developing rapidly. In particular, the "Internet+" car field in China is catching up quickly with other countries in the arena of Sharing Economy. However, China still faces some problems that cannot be neglected, e.g., friction between the old and new economic models and yet to improve regulatory system. In light of this, this thesis works to make general conclusions and offer relevant policy suggestions after studying the current development of Sharing Economy in the world.

Introduction

Sharing Economy, also known as "Collaborative Economy", is a new cooperative production and consumption mode that enables the sharing of various goods and services by virtue of the Internet; and it has such advantages as cost reduction, making the utilization of resources more effective, and narrowing the gap between the rich and the poor. Therefore, these types of economies have recently become one of the important forms of achieving sustainable development by use of scientific and technological innovations. That is, in a Sharing Economy, the Internet (mobile Internet) will be made use of to promote the combination of technology and the economy (traditional industries) and achieve the transformation from labor intensive industries to knowledge, information, and technology intensive industries by use of scientific and technical innovations so as to transform the previous pattern of economic development simply based on being driven by cost factors, dedicating large amounts of resources and environment consumption. It is predicted that the total value of output created by the global Sharing Economy will increase by 26 times from the current USD13.5 billion to USD348.9 billion by 2025.

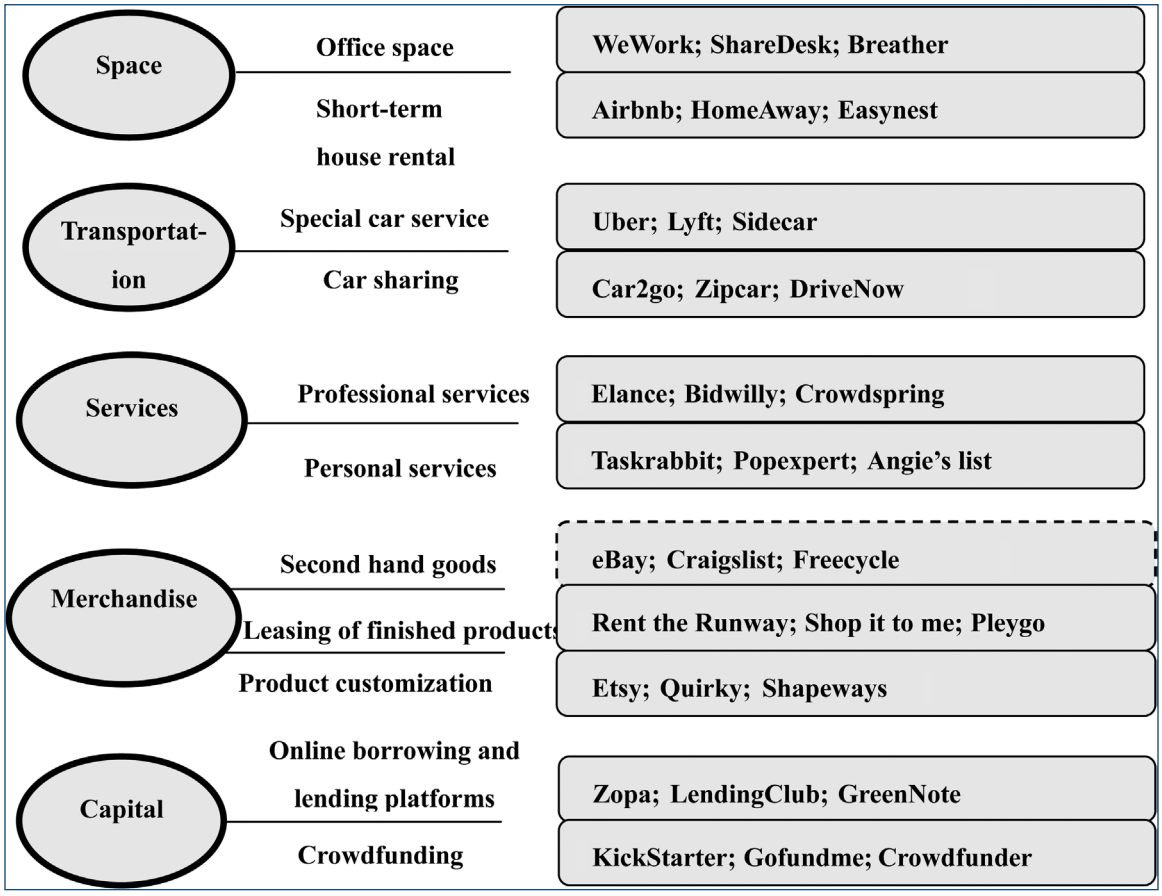
Sharing economies are surging forward

Sharing Economies can be classified into the following categories (Figure 1).

- The first category is space sharing, which includes releasing the information and prices of idle properties through various platforms on the Internet for tourists, people who are taking business trips, and other people with a need for, or those who are looking for housing, to select.
- The second category is the sharing of transportation tools of many types and in a number of forms, including "private car services", "public car rentals", and "Rideshare".
- The third category is the sharing of skills and time, which for the most part means to match services by use of intangible assets owned by community members, such as professional skills and time. Included in this category are professional service platforms, P2P labor employment, and scientific research crowdsourcing.
- The fourth category is known as merchandise sharing, which mainly includes the leasing of finished products, commodity customization, and a trading platform for second hand goods.
- The fifth one is capital sharing, which includes online P2P capital borrowing and lending platforms, as well as crowdfunding, a way to raise money through the collection of contributions of various sizes by way of the internet, events, or even mail subscriptions.
- The sixth category is the sharing of applications in other fields, including online classes with Coursea as a representative and the model of sharing food and beverages, namely "meeting friends at the dining table".

The following points should be noted and paid attention to in the development process of Sharing Economies:

- First, large multinational companies have been playing an active role in exploring the Sharing Economy after the international financial crisis. Daimler has launched the Car2go car rental project and put about 125,000 cars in 29 cities in a number of countries on the road; IKEA and Patagonia have successively provided their customers with relevant platforms on which goods can be resold; Marriott Hotel Group has cooperated with LiquidSpace, an office space leasing platform, and rented out hotel conference facilities by hour or by day in 432 hotels owned by the Group



Source: Sharing New Buying Collaborative Economy

Figure 1: Classification of Sharing Economy

throughout the world in order to meet the needs of entrepreneurs for office space.

- First, large multinational companies have been playing an active role in exploring the Sharing Economy after the international financial crisis. Daimler has launched the Car2go car rental project and put about 125,000 cars in 29 cities in a number of countries on the road; IKEA and Patagonia have successively provided their customers with relevant platforms on which goods can be resold; Marriott Hotel Group has cooperated with LiquidSpace, an office space leasing platform, and rented out hotel conference facilities by hour or by day in 432 hotels owned by the Group throughout the world in order to meet the needs of entrepreneurs for office space.
- Second, Sharing Economy has the alluring features of low economic costs and high social benefits. Multiple studies have shown that the price of a house subject to short term rental is 20% to 70% lower than that of a hotel at the same level and location; a "shared car", or a special type of car used for carpooling which works effectively can replace about 4 to 10 private cars. Compared to year 2000, the number of German people using car sharing services has increased by 375% while the number of private cars owned by every 1,000 young people with an age range between 18 to 29 years old has decreased by 34%; while in the city of Bremen, the carbon dioxide emissions have reduced in the form of 1,600 tons each year by using "shared cars". In the future, it's estimated that other cities in various countries around the world will also be able to decrease carbon dioxide emissions in a similar manner.
- Third, the governments in major countries and regions attach great importance to the promotion of Sharing Economies. As the place where the Sharing Economy originated, the United States continuously strengthens and supports fair competition and its protection over the rights and interests of consumers and sharers; the British government puts forward the creation of a global center for Sharing Economies due to the fact that London is one of the world's largest financial and trade centers. The British government also takes measures including establishing an economic technology platform (the first TravelTech Lab), carrying out pilot city programs, holding

creative contests, formulating evaluation standards, implementing special tax policies, and opening data information (such as criminal records) to encourage economic and social sectors to take part in the Sharing Economy. The German government not only supports the participation of Daimler Group, BMW, Volkswagen, Mercedes-Benz, and other automobile manufacturers in sharing, but also encourages community residents to use new energy technology to set up "electricity production cooperatives" while vigorously promoting shared "street public welfare" projects, such as street public bookcases and wardrobes.

Analysis on reasons for the rise of sharing economy

At present, the global economy is still faced with many challenges; the environment and the income gap between the rich and the poor are still the main obstacles restricting the development of all of the countries in the world. While reducing production and living costs, Sharing Economy also enhances production efficiency, weakens the ownership of assets by means of scientific and technological innovation in order to achieve the improvement of efficiency, cost reduction, and shrinkage of the gap between the rich and the poor. The rapid development of Sharing Economies is most likely attributed to the following two points:

- On the one hand, a new generation of information technology propels the development of Sharing Economies. In the less developed period of information technology, "sharing" exists only on a small scale or among acquaintances. "Collaboration" was first used in the 1950s and its usage rate began to soar after the invention of the computer and internet since the 1960s. 2014 marked the rapid development of internet around the world and the development of communication technology weakens the ownership of articles, breaks through the limitation of space on intangible assets and urges people to pay more attention to energy saving, efficiency improvement, and protection of the environment as well.

- On the other hand, the low cost accelerates the development of Sharing Economies. Compared with the traditional hotel industry, shared houses have more advantages and are priced lower. According to the survey and research of PRICEONOMICS, in most major cities in the United States, the prices of apartments on Airbnb are 21% cheaper than that of hotels on an average basis. In addition, the survey and statistics of iRESEARCH show that the prices of houses which are used for short term rentals in China are significantly lower than that of hotels at the same level and location, and the discount rate of houses used for short term rentals can often reach as high as 70%.

The sharing economy in China

The Chinese culture has long had the spirit of "sharing happiness with others is better than enjoying happiness alone". After the Sharing Economy was imported into China, its total revenue and the domains it covered in China grew rapidly to catch up with and even surpass the advanced world level. For example, the total revenue of the online short term rental industry was only RMB 7 million when it started in 2011 but reached RMB 4.05 billion in 2014, and it is expected to exceed RMB 10 billion in 2015, indicating the growth of more than ten thousand times over five years. The fields and representative enterprises (platforms) of Sharing Economy in China are shown in Table 1.

First, the willingness to share of market players has increased. Thanks to the rapid development of the Internet, the living costs of consumers have been cut down and a larger space has been provided for the development of the Sharing Economy. According to China Internet Network Development State Statistic Report (Hereinafter referred to as Statistical Report), 60% of internet users who were polled hold a positive attitude in regards to network sharing, 13% of which are extremely willing to conduct network sharing activities and 47% are willing to do so (Figure 2).

In addition, people at different age levels have shown respective levels of willingness to participate in network sharing (Figure 3). People aged from 10 to 29 have the strongest willingness to share. In the coming years, as this group gradually becomes the backbone of society, the role of the Internet in driving mutual benefit, sharing, cooperation, and innovation will be more obvious and will be shown in different ways through various manifestations.

Second, the amount of trust people have in the Internet has gone up gradually. Compared to in 2007, trust internet users in the Internet had increased significantly from 35.1% to 54.5% in 2014 (Figure 4). The increase in the proportion of trust in the Internet provides a stronger guarantee for the future development of Sharing Economy in China and has made up for the lack of the traditional social trust to some extent.

Third, keen attention and recognition have been successively received from venture capitals. Whether a company engaged in Sharing Economy as a new

Table 1: Main application fields of China's sharing economy

Short term house rental	YOUTX.COM, MAYI.COM, TUJIA.COM, XIAOZHU.COM
Short term office rental	SOHO 3Q, YOU + International Youth Apartments
Means of transportation	KUAIDI & DIDI GROUP, eHi Car Services, PPZUCHE.COM
Capital	RENRENDAI.COM, DREAMORE.COM
Goods	BUY42.COM
Time and skills	ORDER APP, SKILLBANK.CN
Education	OTONE EDUCATION

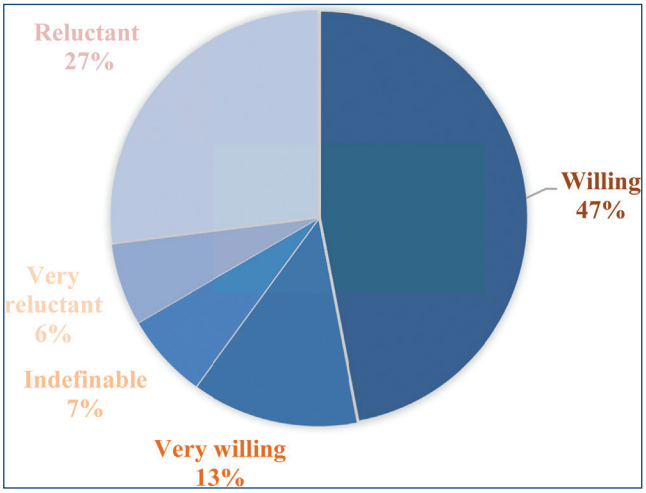


Figure 2: Survey on sharing willingness of Chinese netizens

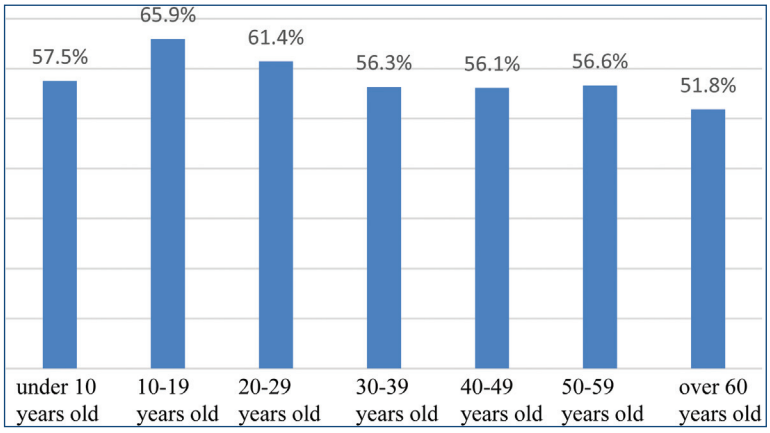


Figure 3: Proportion of netizens at different ages willing to share on the internet

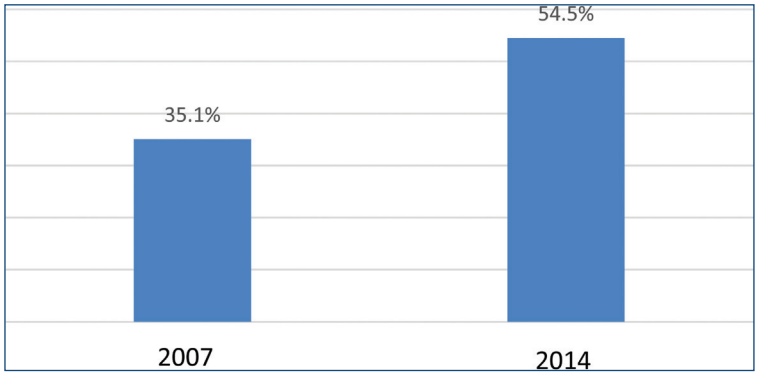


Figure 4: Proportion of trust of netizens in the internet

business form and business model can get access to financial support in time is the key for its rapid expansion and development. Chinese companies involved in the Sharing Economy have just ushered in a financing boom: on April 10, 2015, TTYONGCHE.COM completed its Round C of financing and its value has been closer to USD200 million; early in July 2015, XIAOZHU.COM finished its Round C of financing of USD60 million; in the middle of July 2015, MUNIAO.COM obtained its Round A of financing of USD 60 million; early in August 2015, TUJIA.COM achieved its Round D of financing of USD 300 million, and its valuation has exceeded USD 1 billion. In the venture capital industry, the valuation of enterprises related to short term renting industry is increasingly improved, which reflects strong market development potential of Sharing Economy in China to a certain extent.

Fourth, "Internet+" has become the major stimulus that shifts the growth pattern of the Chinese economy. At the 2015 Summer Davos, the Chinese Premier Li Keqiang pointed out that the world's Sharing Economies are developing rapidly, thus becoming a new path of stimulating economic growth. This was the first time for the Chinese leader to voice China's acceptance of the Sharing Economy. At present, China is moving from rapid economic growth to the moderately fast growth. The Chinese economic structure and development methods are facing major changes. In addition, it is imperative and urgent to abandon the previous pattern of economic growth which included the mammoth consumption of resources. As one of the major strategies adopted by the Chinese economic development at present, "Internet+" would, when the global economy is under great downward pressure, encourage people to make technological innovations, upgrade institutional innovations, management and marketing innovations, and research & innovation capacity. It is also the important carrier of mass innovation and entrepreneurship. As the supply side and structure reform are gradually getting attention from the Chinese government and national leaders of China, the Sharing Economy will definitely become the new stimulus for the future shift of economic growth patterns.

China's "Internet+" car field has been in the "Leading" state

A "shared car" refers to the car shared by many people, that is, the driver only has the right to use rather own it, and a cer-

tain company coordinates the cars and is responsible for issues concerning the cars such as insurance and parking. This mode of car sharing that rises quickly based on the development of internet technology not only lowers the cost of living, but also helps to ease traffic congestion and reduces highway wear, air pollution, dependence on and consumption of energy resources at the same time, thus ultimately achieving sustainable development. These are some of the many benefits of shared cars which are becoming more and more popular as time goes on.

According to the report, there are more than 1 billion cars running on the road around the world, but these cars are in idle state in about 96% of the time. On the other hand, more than 15% of the space in our cities is occupied by those cars which are restricted and idle. Therefore, in 2010, Uber began to launch its taxi hailing service based on its mobile terminal in San Francisco, achieving the rapid integration of resources which were not in use, and at the same time effectively reducing the travel cost of passengers, and providing drivers with the possibility of taking a part time job and getting additional, supplemental income.

Didi and Kuaidi occupy most of the market share

With the rapid expansion of Uber all over the world, China's shared car renting industry represented by Kuaidi and Didi are the leading trend. After China's first taxi hailing software came out in 2012, Didi and Kuaidi had been grabbing off market shares with strong market occupation rate and completed the final merger in February 2015. The existing data shows that as of May 2015, 70% of drivers within the national coverage area use Didi and Kuaidi platforms every day, which has become the world's largest online travel platform with about 6 million orders every day and the trade scale of which is 6 times that of the world's second travel platform. According to statistics on the market share of professional cars, from May 2015, the coverage rate of Didi and Kuaidi's active users in the special car market of China reached 86.2% (Figure 5).

The modes of operation of Didi and Kuaidi

Considering different population densities, town distribution, and development processes of first and second tier cities in China, Didi and Kuaidi Group adopted the strategy of "multiple business and line coordination", namely, operation with various forms including taxis, professional cars, and shared payment carpooling. In terms of taxi business, Didi and Kuaidi adopt the mode of project management POWERED BY DIDI, and establishes unified standards, that is, all orders will be uploaded the network, and if no taxi driver gives a response within 60 seconds, the system will automatically judge the transport capacity of near special cars, express cars and carpools, so as to provide consumers with more choices and realize real "zero empty running".

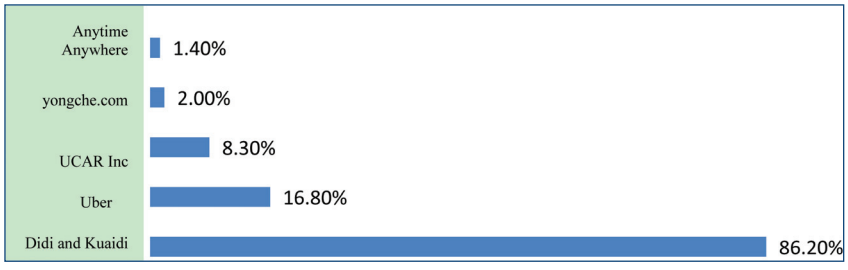
In the special car market, Didi and Kuaidi pursues a goal of "dignity", namely enabling users to travel more decently and with more dignity; therefore, Didi and Kuaidi puts forward the "ACE Certification" by reference to the standards of the motorcade for state guests, selects the best (and even the most handsome) drivers for training and arranges the most complete in-car services reaching the standard of five star; the drivers meeting the standards of "ACE Certification" will also enjoy 30% of the negotiated price.

"Internet+" car field has extended to the freight transport field

At the same time when Didi and Kuaidi develop quickly, the field of road freight transport has also undergone a wave of innovations and starting business under the mode of the Sharing Economy. At present, some companies engaged in freight transport with the mode of online APP, such as 56qq.com, are developing and beginning to take shape. As one of the earliest explorers of Sharing Economy modes in the world, Transfar Company of China began to put the freight logistics port mode into practice in 2003, helping drivers and freight forwarding companies implement highly efficient matching of logistics information in the form of offline aggregation and information exchange. As the market environment for the Mobile Internet becomes increasingly mature, Transfar Road Logistics Port gradually uses the Internet in its work to achieve rapid expansion and the network effect. In the long term, the shared logistics mode represented by Transfar Road Logistics Port is expected to surpass traditional large scale logistics giants in terms of the overall operating efficiency and lead the global industry renovation.

The field of shared cars helps boost technological innovations

According to the data set forth in the *Statistics Bulletin on the Communication Operation Industry in 2013 of China*, the penetration of mobile phone users has reached the large number of 90.8 phones per one hundred people, which marks that fact that the mobile phone market of China has entered the era focusing on updating its demands. However, the update cycle of mobile phones is usually two to three years, while the update cycle of smart phones is less than two years. In order to improve the efficiency and the possibility of grabbing many orders as fast as possible, many Didi and Kuaidi drivers who never used smart phones before have begun to use smart phones and replace their own SIM cards with 3G/4G ones. This, on the one hand, can continue to boost



Source: Enfodesk

Figure 5: Top five with the highest coverage of special car active users in China in 2015

smart phone hardware and software and speed up the innovation in a bid to meet more and more consumer demands, and on the other hand, will promote the upgrade of consumption structure in the information industry, so as to meet the demand of internet users for network speed.

Shared cars may effectively lower the empty run rate and reduce carbon emissions

Shared cars not only can drive the boost of technological innovation, but also make outstanding contributions to energy saving and efficiency improvement at the same time. According to the *Research Report on Economic and Social Impacts of Taxi Hailing (2014)* by Tsinghua University, 55% of drivers believe that the empty run rate in each month decreases by 10%, while 41.2% drivers think that the empty run rate in each month falls by 10%-30%. If it is assumed that, before the decrease of the empty run rate, the number of taxi passengers and the number of taxis are 1 respectively, on the premise that the empty run rate falls by 10%, 1+10% passengers can be satisfied under the condition of constant current transport capacity as estimated in the ideal state. However, before the empty run rate decreases, in order to meet the demands of passengers, there must be 1+10% taxies. The 10% of transport capacity saved can reduce 5.7 million tons of carbon emissions from taxis. According to the data of the United Nations Environment Program, a common tree can absorb 0.012 ton of carbon dioxide each year, so 5.7 million tons of carbon emissions are equivalent to the ecological compensation quantity of 475 million trees throughout a year.

In addition, the development of the "carpooling" business also has a great influence on the reduction of carbon emissions. If the carpooling implemented refers to two people taking one taxi, the utilization rate of taxies is 74.3%, and it is expected that carbon emissions will decrease by 14.649 million tons each year. Also found to be true according to the above data, 14.649 million tons of carbon emissions are equal to the ecological compensation quantity of 1.22 billion trees throughout a year, and are approximately equal to every single person in China, the country with the largest population in the world, planting a tree. This form of business can not only reduce the pressure put on the environment by cars, but can also help to restore and ease some of the damage that has already been done.

Main problems in the development of sharing economies

Since it is something that is relatively new in the world, Sharing Economies have strong development potentials but also face many underlying problems which can be seen in the examples below:

- First, the friction between the old and new economic models increases. The rapid development of the Sharing Economy brings a great challenge to the existing law and system of regulations and may get the interests of the original large service groups affected; there are no set rules on certification and insurance, etc. in such fields as sharing of accommodation and transportation means; practitioners of the Sharing Economy may consequently obtain higher benefits while traditional industries thus have to pay more costs. There have been incidents where the legality of professional cars was debated over from time to time in various countries in the world. In the first half of 2015, the incidents where professional cars hailed through the internet were debated under law happened in 15 cities within China; similar cases have also occurred in many countries, including the United States, Britain, France, and Germany.

- Second, the lack of supervision has resulted in the occasional occurrence of security problems. Even though the platforms engaged in the Sharing Economy strictly examine the qualifications of both the suppliers and demanders, the absence of supervision and supporting laws still occasionally leads to repeated occurrences of security problems in countries around the world. For example, drivers of professional cars are notorious for their misdeeds in the United States, India, and other countries. It is also common that the safety of life or property of owners and tenants of houses used in online short term rentals is under threat. In addition, no credit system covering most countries in the world has been formed, which also challenges the supervision over multinational sharing.

- Third, regional IT technical resources are distributed unevenly. The gap between the rich and the poor in various countries in the world continues to increase and the development level of science and technology varies from country to country. The gap in terms of Internet penetration is rather clear: the Internet penetration in Europe is generally very high while that in African countries is notably lower. According to the *Measuring the Information Society Report* (hereinafter referred to as the "Report") promulgated by the Intentional Telecommunition Union (ITU), a professional organization of the United Nations (UN), in November 2015, various regions still differ greatly in the development index of information and communication technology (hereinafter referred to as the "Index"); 29 out of 37 African countries are part of the quarter of countries with the lowest Index, highlighting the importance of solving the gap between Africa and other regions of the world. Moreover, it is also pointed out in the Report that the average growth rate in the Index of high income economies is significantly more than that of low income economies, reflecting the close connection between the development of information and communication technology and also the national income level. The higher the income level of a country is, the more advanced their communication technology will be.

Conclusion and suggestions

In short, the Sharing Economy no longer simply emphasizes the ownership of articles but achieves the "Access but not Ownership" of assets by the use of the Internet as a medium; it has attracted broad atten-

tion from venture capitalists with its strong advantages in energy saving, efficiency improvement, cost reduction, shrinkage of the gap between the rich and the poor, and other aspects, and it develops rapidly across various countries all over the world. However, it still cannot be ignored that the development of the Sharing Economy is confronted with many obstacles arising from the frictions between the old and new economic models, the lack of legal supervision system, and uneven distribution of communication technology. As such, there are some general suggestions below which may help to balance out the disadvantages found in the rise of Sharing Economies.

First, comparative advantages shall be utilized to urge various countries to explore new models of the Sharing Economy. Governments of all countries should give great emphasis on new opportunities brought by the Sharing Economy, strengthen top level design of the Sharing Economy and create supporting environment conducive to the development of the Sharing Economy. Traditional industries shall be actively encouraged to build new business models of the Sharing Economy by using the internet. To a large degree, the success of Sharing Economy relies on the ability of all countries to precisely identify their own comparative advantages. By reference to relevant experience of the United States, the United Kingdom, and Germany, and the combination with comparative advantages of different countries, it is imperative to strengthen the top level design of the Sharing Economy, set up the laboratory of the Share Economy, push forward and promote sharing modes in terms of means of transportation, public space, health and medical care, and other aspects. Organize the competitions in mass innovation and entrepreneurship and encourage the young people to get actively involved in new models of Sharing Economy. Domestic and multinational companies, research and development institutions, and scientific research institutes are actively encouraged to carry out scientific research in crowdsourcing, and use the Internet and other information and communication technologies to drive global innovation.

Second, it is necessary to accelerate the construction of a fair, inclusive, national, and highly unified subtle supervision mechanism. The Sharing Economy brings new thinking methods for reexamining traditional supervision of ideas and mechanisms and shall receive enough attention. Countries around the world shall strengthen close cooperation in sharing of accommodation and transportation, internet finance, and other fields closely related to the livelihood of their people, formulate laws and regulations which can be used in Sharing Economies, and improve the construction of the credit system under the conditions of the internet economy, gradually and orderly open credit information, and establish a network credit blacklist system. Make pilot test to establish uniform regulatory framework for livelihood related industries such as sharing of transport vehicles and Internet finance while segmenting the market positioning of traditional and emerging business models so that the different groups of old and new models can work together for the harmonious social development.

Third, the Internet coverage shall be enhanced in various countries, especially those in Africa. One of the targets set in the 2030 Agenda for Sustainable Development of the UN is "by 2030, significantly improving the ability of access to information and communication technology, and providing the least developed countries with universal and affordable internet services." Therefore, the UN shall play a leading role in Internet infrastructure construction; strengthen international investment in and construction of infrastructure, and increase the investment from the World Bank(WB), the Asian Development Bank (ADB), and the Asian Infrastructure Investment Bank (AIIB) in Africa and regions with lower internet penetration. Improving the global credit system's place in the Internet economy and strengthening the swapping and sharing mechanisms between the Internet credit information and relevant credit information in other fields in the society can achieve the goal of sustainable development.

References

- ✓ Jeremy Rifkin (2014). The Zero Marginal Cost Society (London, UK, Palgrave MacMillan Press).
- ✓ Research Department of CITIC Securities (2015). "Uber: Sharing Economy, Reconstructing Transportation and Others". internal report.
- ✓ Mu Nan (2015). "Data Published by Didi and Kuaidi Group after Merger for the First Time". unpublished. ■

TRANSFERRING TECHNOLOGY THROUGH COMPETITIVE BIDDING

A CASE STUDY OF ISRO'S IMDPS

Nirmalya Bagchi

Dean of Research and Management Studies, Professor and Area Chairperson
Technology Policy, Management and Innovation Area
Administrative Staff College of India
Bella Vista, Raj Bhavan Road
Hyderabad 500082, India
E-mail: bagchinirmalya@gmail.com, nirmalya@asci.org.in

Abstract

Technology transfer mechanisms in the R&D establishments of India are not very well matured and hence many technologies that have a societal impact or a market demand do not get transferred to industry/users. Indian Space Research Organization (ISRO) has been working on weather monitoring technologies for a long time and had developed an integrated weather monitoring and prediction system called INSAT Meteorological Data Processing System (IMDPS). However, weather monitoring and forecasting in India is the responsibility of the Indian Meteorological Department (IMD). Therefore ISRO was finding it difficult to convince its sister department IMD to adopt this technology. ISRO therefore took a bold decision to bid (global bid) competitively for the integrated system when such a bid was initiated by IMD. Such a step of aggressively biding a project from a sister department was a novel approach in Indian context. ISRO won the bid and implemented IMDPS in IMD. This system is now online and since its launch has helped India in predicting numerous extreme weather events thereby saving lives and property. This impact of the ISRO technology has therefore had an enormous effect on the development of the regions and it has helped to save from extreme weather events by timely weather forecasts.

Introduction

Scientists were huddled in the mission control room in the Space Application Centre (SAC) of the Indian Space Research Organization in Ahmedabad on 11th October 2013 waiting to check, if their predictions derived from their INSAT Meteorological Data Processing System (IMDPS) were correct about *Phailin*[1], a category 5-cyclone. The cyclone was about to make landfall in the eastern coast of India in the province of Odisha, later that day according to their prediction. This eastern coast of India is notorious for being hit by the most devastating cyclones in the country. A similar cyclone in 1999 had caused the death of more than 10,000 people and destroyed property worth several million. Cyclones and their prediction was therefore serious business in the country as several thousand lives depend on the prediction of the path of the cyclone. If the path is predicted correctly while there is still time for the government to take action then disaster can be avoided. Similarly, correct prediction of other extreme weather events like floods, droughts etc. can also save lives and property. An accurate weather monitoring and forecasting system is therefore of utmost importance in a country like India which gets affected by many such events each year. A group of SAC scientists had therefore contemplated developing a comprehensive solution for weather monitoring and forecasting by using space based technologies. The INSAT Meteorological Data Processing System (IMDPS) was the output of their efforts over several years. It is being used by the Indian Meteorological Department (IMD) for monitoring and forecasting weather in the country.

The context

Weather monitoring and forecasting is a very important objective of any government in India. Many important decisions depend on the correct prediction of the weather. Majority of the country is dependent on agriculture for sustenance (more than 50% of the population depends on farming as a livelihood); of which more than 60% depend on rain fed agriculture whose success depends largely on the monsoon and its correct prediction. Hence, one of the biggest development initiatives of the government is to have the capability to predict weather. Development[2] as we know is reflected in enhanced capability of the people. Sustained development through science, technology and innovation especially in emerging economies like BRICS countries is the final frontier to achieve the goals of well being in a society. However, harnessing science, technology and innovation needs a new template for emerging economies. Bagchi (2011) provides a comparative analysis of innovation in BRICS countries.

Extreme weather events occur in the country with regular frequency and the

[1]This system had identified a depression forming within the Gulf of Thailand in Cambodia on 4th October 2013 and was monitoring it continuously when the depression morphed into a massive cyclone and was rated as a category 5-cyclone just before land fall. Some among the team of scientists were from Odissa had witnessed the 1999 cyclone first hand and knew the power of these storms. The team knew that lives of several thousand hinged on the prediction from their system.

[2]Development means many things to many people. The South Commission in its report in 1990 titled *The Challenges to the South: The Report of the South Commission* (Oxford University Press) defines development as " a process, which enables human beings to realize their potential, build self-confidence, and lead lives of dignity and fulfillment. It is a process, which frees people from the fear of want and exploitation."

prediction of such events help in saving lives and property. Therefore, the development of the entire package of science, technology and innovation platform for an indigenous weather monitoring and forecasting system using satellite data has been a long standing dream for ISRO. However, the idea of a comprehensive end-to-end solution for weather forecasting that included hardware, software and data acquisition technology, took shape in ISRO only in 1989.

Even though ISRO[3] has all the technology and mathematical models for weather forecasting, the statutory responsibility of weather prediction and monitoring in India is vested with the Indian Meteorological Department (IMD)[4].

In its efforts to modernize the country's weather information management, ISRO had developed the INSAT series of satellites for IMD in the nineties for weather monitoring but the Image processing software that analyzed and processed the INSAT data was not developed by ISRO. Hence, IMD was procuring the software from other agencies at a huge price, that too in foreign currency.

ISRO had the capability and the experience to develop an integrated solution which would serve the needs of IMD in a better way[5]. ISRO had expertise in development of sensor systems, ground reception hardware / software systems for INSAT 2/INSAT 3 satellites, and image processing software development. Moreover the INSAT payload was also developed in house at SAC, ISRO and hence all the nuances of the technology of the satellite and its working were fully known to the ISRO team. A domestic capability that matched any other platform in the world in terms of accuracy of prediction would help the country in evidence based decision making. This was the rationale for developing an end-to-end system for IMD.

ISRO was confident that its system would be world class and would work without a hitch in its centre/laboratory but transferring the technology to another agency of the government was a challenge for even ISRO. Many extraneous factors creep into the transfer of technology process that complicates the process. ISRO therefore decided to transfer technology through a transparent and open process by bidding competitively to a global tender of the IMD.

Technology transfer in Indian scientific organizations

Science and technology has always been an area of focus for the Government of India, right from the country's independence. Many institutions have been created and over the years, the country can boast of a vibrant science and technology community[6].

Scientific organizations in India are mainly created with scientific objectives. The country has invested in science and technology since its independence with the objective of advancement of the boundaries of scientific knowledge and for societal benefit. However, many good science and technology initiatives originating in the country have not resulted in breakthrough products and services from India. In many cases the failure to take an indigenous scientific achievement from the laboratory to the market or to the society has not been due to poor scientific research or development but due to poor mechanisms to translate a scientific development to a product or service for the market or society. The reason for this is that the policy makers often fail to have a comprehensive vision when starting a scientific project. In many scientific projects, before the start of the scientific project, there is no clear roadmap of how the information or knowledge gained from the project is to be used or how a product or service if developed in the project is to be utilized. A commercialization or exploitation motive albeit for societal causes is absent. Hence many scientific discoveries in the country end up only as fantastic scientific achievements and publications[7].

[3]Indian Space Research Organization (ISRO) is the country's premier space research organization of the country. The vision of the organization is to use space technology for national development. India, aided by ISRO, has joined the elite nations of the world by successfully entering the Mars orbit, making it the first Asian nation to do so. The Space Applications Centre (SAC) is a centre under the Indian Space Research Organization. It was established in Ahmedabad in 1966. SAC designs and develops payloads for ISRO missions.

[4]India Meteorological Department (IMD) was established in 1875 and it remains the main government agency in all matters relating to meteorology, seismology and allied disciplines and provides weather and climate information services. The Director General of Meteorology heads IMD, which is has its headquarters in New Delhi. There are 5 Additional Director Generals and 20 Deputy Director Generals. It maintains 6 regional meteorological centers at Mumbai, Chennai, New Delhi, Calcutta, Nagpur and Guwahati. Different operational units like Meteorological Centers at state capitals, Forecasting Offices, Agro-meteorological Advisory Service Centers, Flood Meteorological Offices, Area Cyclone Warning Centers and Cyclone Warning Centers report to the Director General, IMD.

[5]"IMD at that time was using ISRO satellite data from imagers and sensors but the software for monitoring and forecasting was from Canada. The software used data from ISRO's INSAT satellite and made predictions about the country's weather. ISRO now wanted to develop an end to end turnkey solution for IMD so that the entire set of data capture, data analysis and predictive analytics using INSAT data could be handled by one single system. The INSAT Meteorological Data Processing System (IMDPS) was therefore conceived and a proof of concept was established in 2005."- Dr. R. Ramakrishnan (Project Director, IMDPS)

[6]According to the latest report on R&D Statistics 2011-12 by the Department of Science and Technology, Government of India, the gross expenditure on R&D (GERD) in the country has doubled from Rs.24,117.24 crores in 2004-05 to Rs. 53,041.30 crores in 2009-10 and is estimated to be Rs.72, 620.44 crores in 2011-12. Of this expenditure, Defense Research and Development Organization accounted for the maximum share of 31.6% followed by Department of Space (15.5%), Department of Atomic Energy (14.4%), Indian Council for Agricultural Research (10.8%), Council for Scientific and Industrial Research(10.0%) and Department of Science and Technology (8.3%) etc. In total India spends around 0.88% of its GDP on research and development of which more than 60% comes from the central and state governments. As on 1st April 2010, about 441,000 personnel were employed in R&D establishments in the country, which makes it a very large community of researchers.

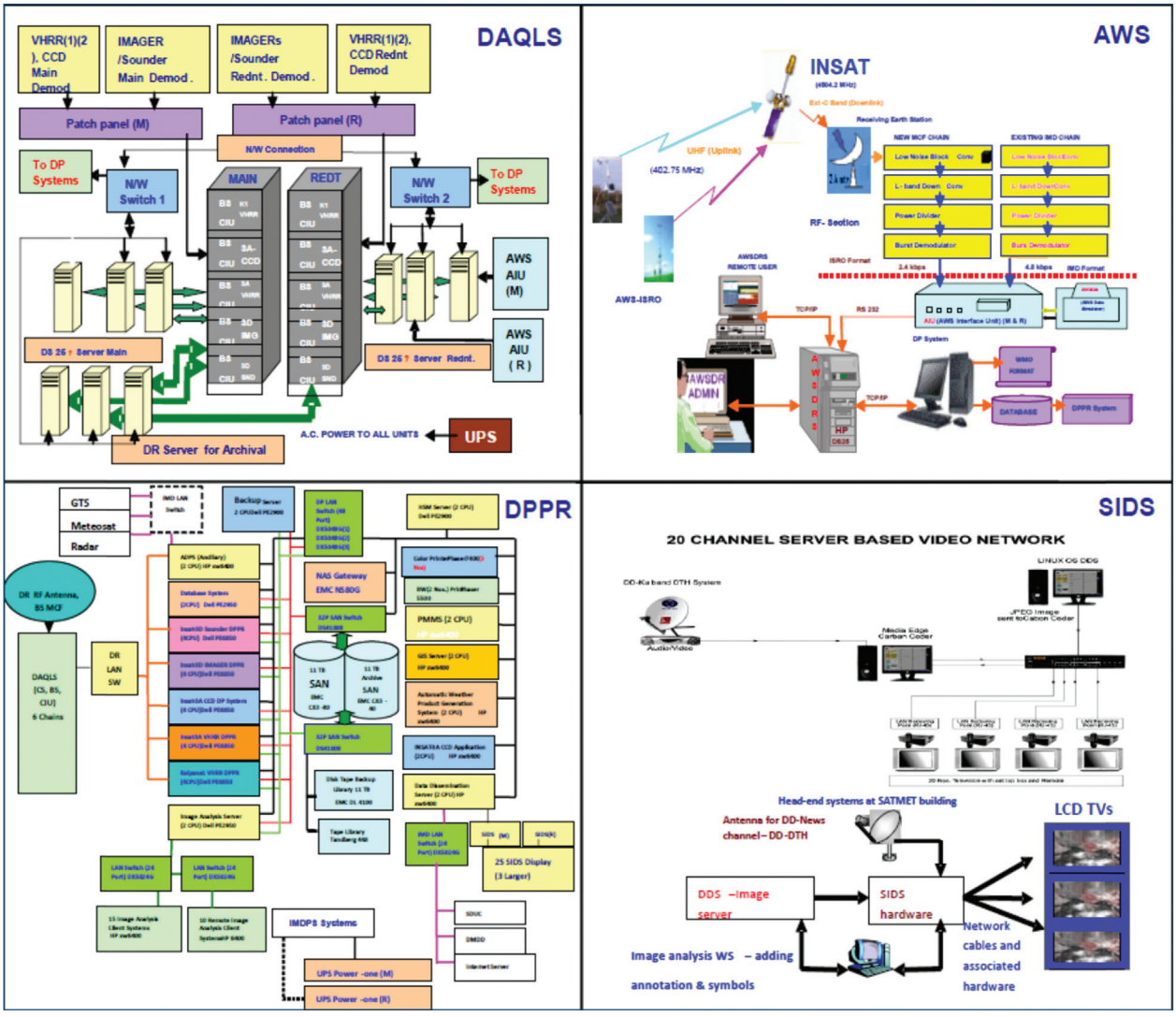
[7]A report published by Evidence, Thomson Reuters in 2012 suggests that India's share in global research publication increased from 2.2% in 2000 to 3.5% in 2010 as per the SCI database. In the year2010, India's share of global research publication was highest in Chemistry at 6.5% followed by Material Science at 6.4%, Agricultural Sciences at 6.2%, Pharmacology and Toxicology at 6.1%, Microbiology at 4.9%, Physics at 4.6% and Engineering at 4.2%. The report also states that India's volume of scientific publication remained ahead of Russia, Australia, Brazil, and Korea. The UNESCO Science Report 2010 ranks India, 9th globally in terms of scientific publication output. This indicates that the quality of the scientific work in the country is good and showing signs of improvement.

This problem afflicts ISRO too. ISRO makes great space technology and space technology applications but many a times, it gets caught up in the red tape and the true potential of the application is not realized fully by the country. However, when ISRO was developing IMDPS, it knew that it was a world class technology and the organization decided to actively engage with sister line departments to transfer the technology. However, many impediments were encountered by ISRO and as a last ditch effort ISRO decided to bid for contracts through its commercial arm so that the indigenous space technology applications already developed by the organization can reach a larger audience and benefit the millions of people for whom it has been created. Typical of any noisy democracy, India too has a large bureaucracy that is at times accused of being insular and unresponsive. Hence, in many cases applications developed by ISRO that can serve the needs of the line departments and ministries in the country in a much better way and help in evidence based decision making do not get operational due to red tape.

IMDPS is a success story of the manner in which ISRO took a huge risk, cut through the bureaucratic red tape and in effect competitively bid successfully for a prestigious project. One arm of the government bid and successfully secured a project from another arm of the government. It is to be noted that this initiative to take a good scientific development to its logical conclusion was not achieved by fighting with the government to relax rules or to create a favorable ground but by openly competing as any other competitor in the market for a government contract.

The IMDPS project

INSAT Meteorological Data Processing System (IMDPS) is a system that generates, acquires processes data from INSAT 3D satellite and is meant for monitoring



Source: Information provided by IMDPS team

Figure 1: The IMDPS system

and forecasting the country's weather (Figure 1).

INSAT 3D is a three axis stabilized geostationary satellite that is parked at 82 ° East. It has two payloads and 6 channels (VIS, SWIR, TIR1, TIR2, MIR, WV). Its Imager is an optical radiometer for Meteorological applications and has 19 channels Sounder (LWIR, MWIR, SWIR and VIS). The Sounder is used to generate temperature and humidity vertical profile of the atmosphere for weather forecasting.

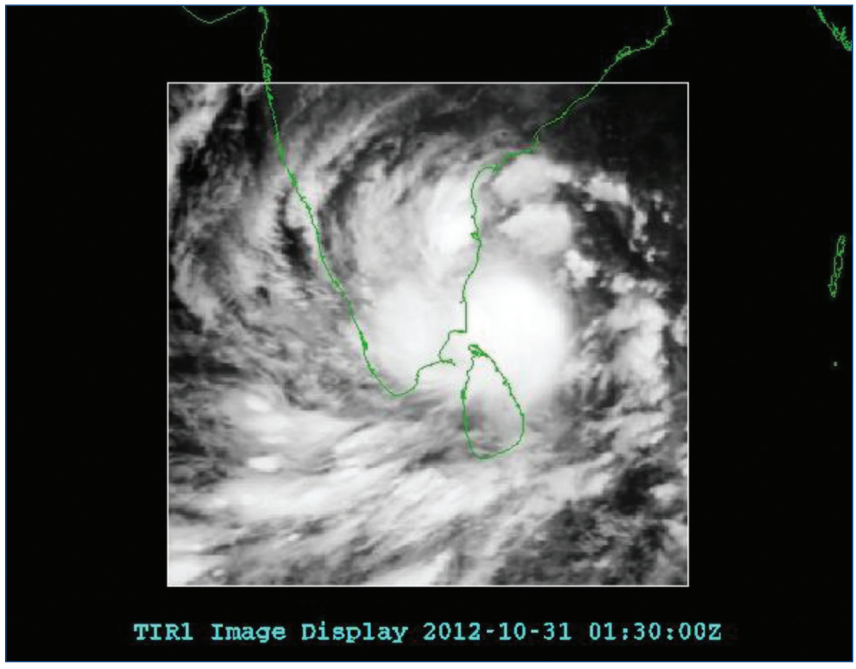
IMDPS has three major Sub-systems, which are:

- Data Acquisition Quick Look System (DR);
- Data Products Generation System (DP); and
- Geophysical Parameter Retrieval (GPR).

The entire IMDPS software has been indigenously designed and developed. It is installed and commissioned at IMD, New Delhi with Mirror Site at SAC - BES, Ahmedabad. It is operational 24X7 for INSAT-3A & Kalpana-1. Even though the idea of an end-to-end weather forecasting and monitoring system was always being pursued by ISRO, the firm decision to develop a system like IMDPS was taken in response to the Request for Proposal (RFP) submitted by India Meteorological Department (IMD), and subsequently an MOU signed between IMD and ANTRIX Corporation, the technology transfer arm of ISRO. An IMDPS project team at SAC was created for developing the system. It was a turnkey solution to IMD from ISRO through ANTRIX. The IMDPS acquires raw data from serial data streams from INSAT-3D satellite, process the data and generates various quantitative outputs including predictive analytics from the data (Figures 2 and 3).

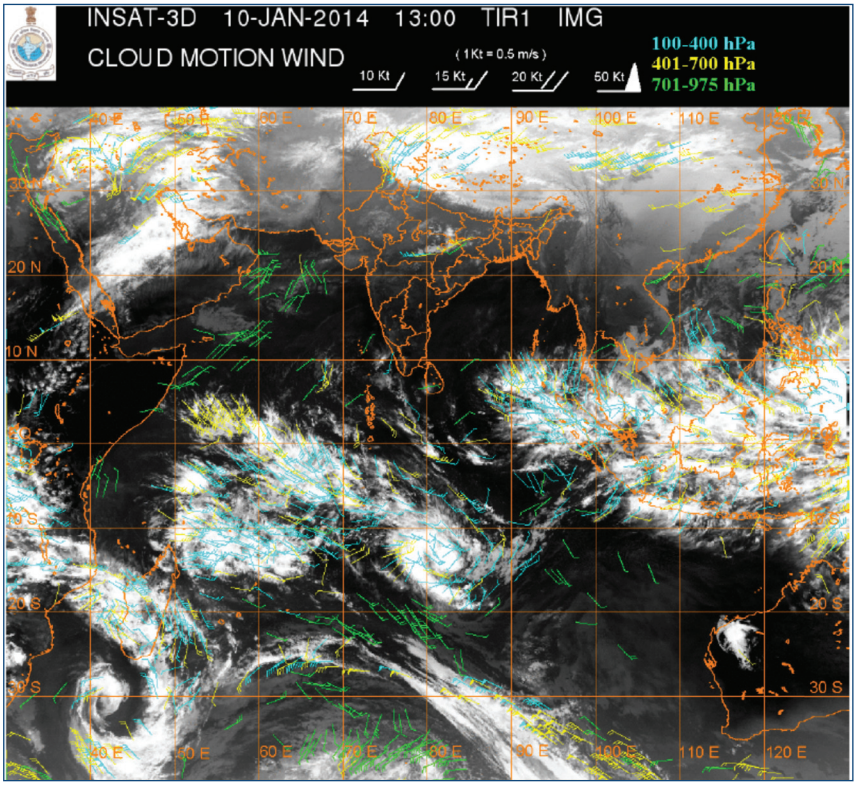
The major aspect of the system was the predictive analytics in-built in the system. The data from the INSAT 3D satellite is taken in and then passed through several mathematical models to derive meaning from it. These models make use of the geo-physical parameters and other data points from the system and generate predictions (Box 1).

The idea for such a project had taken root in ISRO in 1989-90 and the organization was working on ways and means to develop a comprehensive system for weather fore-



Source: Picture provided by IMDPS team

Figure 2: Coverage of cyclone PHAILIN by visible channels of INSAT-3D satellites on 11-Oct-0600Z



Source: Picture provided by IMDPS team

Figure 3: Cloud Motion Vector, IMDPS images from INSAT 3D

Box 1: Products generated by the Data Products System

The various types of products generated by the Data Products System are:

1. LEVEL - 1 (Full Globe, Sector)
2. LEVEL - 2 (Geo-Physical)
3. LEVEL - 3 (Binned Geo-Physical)

Geophysical (GP) parameter retrieval: Different types of Geophysical parameters are retrieved using Imager and Sounder. Geo-physical products will be generated as soon as Level-1 processing is over. All geophysical parameters take Level-1 data as input along with dynamic forecast data, climatological data, DEM and few static inputs.

Imager GP Products: Atmospheric Motion Vector Winds, Outgoing Long wave Radiation (OLR), Upper Troposphere Humidity (UTH), Sea Surface Temperature (SST), Quantitative Precipitation Estimates (QPE), Fire, Smoke, Fog, snow cover and Aerosols}.

Sounder GP Products: Algorithms and products (e.g. temperature, humidity profiles, and total ozone) are tested INSAT-3D sounder radiances and operational products are generated.

Source: IMDPS project team

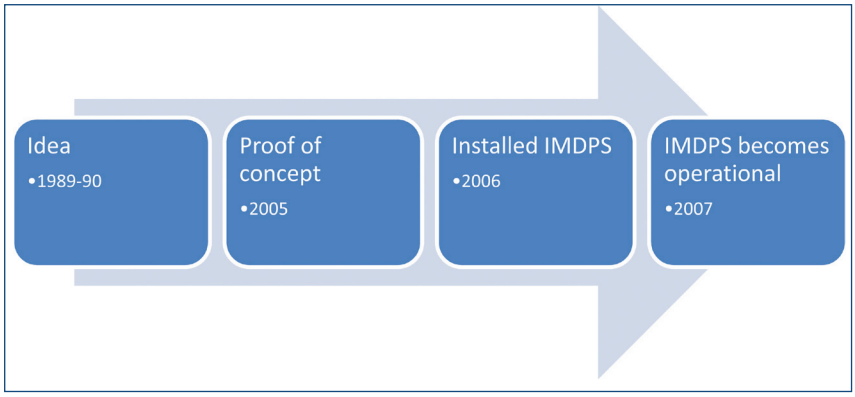


Figure 4: Timeline of IMDPS development

Table 1: IMDPS component cost

IMDPS Component	Hardware Cost In INR	Software Cost In INR	Total Cost In INR
Satellite Imagery Display system (SIDS)	6,600,000	700,000	7,300,000

casting and monitoring. A proof of concept was developed in 2005 and IMDPS was installed in 2006. Following many changes to fine tune the software to make its predictions successful, IMDPS has been declared operational in 2007 (Figure 4).

Goals and objectives were very well defined so that the team knew exactly what was expected. In order to deliver the project on time a structure for the project was created. Several bodies like Project Management Council (PMC), Project Management Board (PMB), Standing Review Committee (SRC), and Central Procurement Committee (CPC) chaired by Executive Director (ED), ANTRIX was created to monitor technical and non technical aspects of the project so that deviations from milestones can be minimized. Figure 5, shows the project structure in detail.

The cost of the project as per the Memorandum of Understanding signed between ANTRIX Corporation, the technology transfer arm of ISRO and IMD was around INR 25 Crores. Hardware and outsourced manpower cost to develop IMDPS components was INR 16 Crore approximately (Tables 1 and 2).

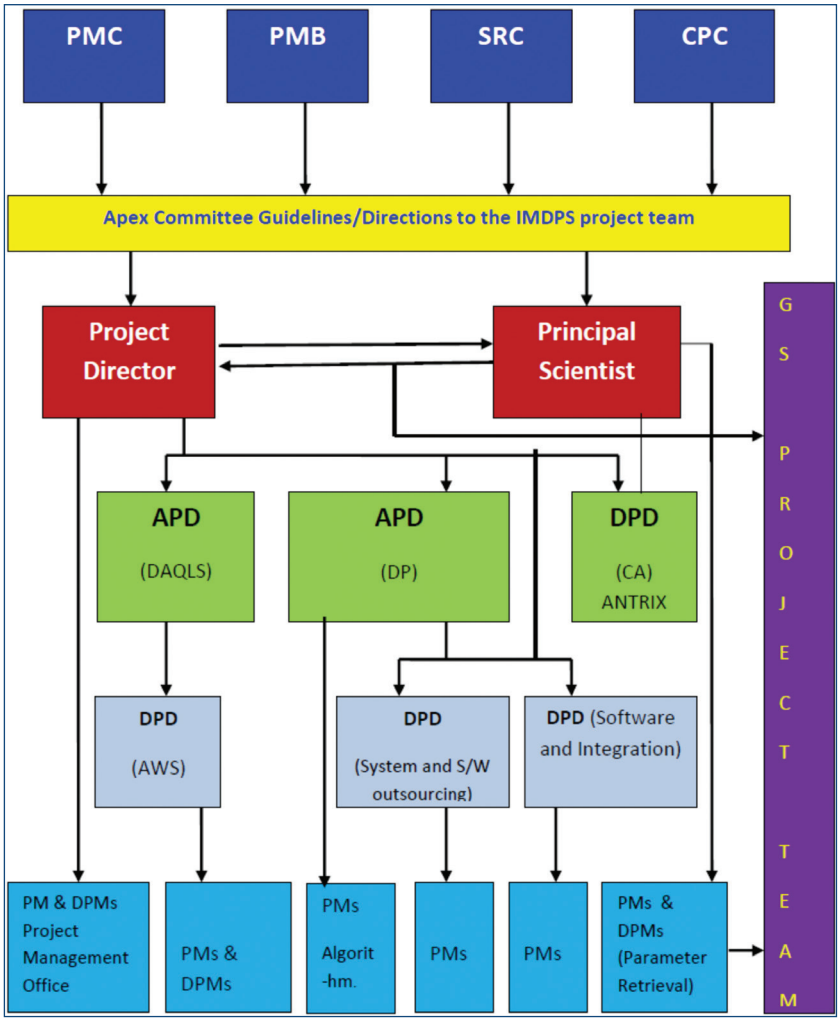
The project team had collaboration with the Space Science and Engineering Center (SSEC), University of Wisconsin-Madison, the United States. An agreement was reached between SAC and Space Science and Engineering Center (SSEC), University of Wisconsin-Madison to work together on retrieval of various Geo-physical parameters from INSAT-3D meteorological satellite data and data vitalization. Space Science and Engineering Center (SSEC), University of Wisconsin-Madison, has considerable expertise in this area and therefore a team of scientists, engineers and officers from ISRO and IMD were deputed to SSEC to work on various research areas. This exposure and training of the scientists helped them in fine tuning the system to derive greater value and insights from the INSAD-3D data. Table 3 lays out the collaboration of agencies and the time of engagement with outcomes.

However, even though the hard technology aspect of the project was easy for ISRO to manage and complete, the understanding of the data and estimation of the geo-physical parameters was a challenge as ISRO had no experience with this kind of work. Hence the entire capability in this field had to be developed so that the data can be used for forecasting of weather. Models of forecasting were also developed. These were calibrated and validated with international models and only when they matched up to the performance of international models was they incorporated in the system. This was the main challenge in developing the system and the team was fully able to cope with it (Box 2).

Conclusion

The ISRO team that was huddled in the conference room on 11th October 2013 was relieved to find that their system generated prediction about the path of the cyclone *Phailin* was correct. Unlike the cyclone of 1999 in which 10000 perished, *Phailin* only claimed less than 10 lives. Much of the credit for this goes to the correct prediction of the path of the cyclone by IMDPS and the team at ISRO which developed it. Had it remained just as a scientific discovery, it would never have made the kind of impact that it did on that single day and on many such occasions thereafter and hence in hindsight, credit must be ultimately given to the bold decision of the ISRO management to bid for the project in open competitive bidding. That risk of bidding and winning the project order from IMD paid off.

Today a new order exists in the international economic arena. The role of the market is in the limelight. The writ of the state[8] as the sole structure of authority is not the same anymore and a mood for liberalization is sweeping through most of the developing world. Indeed, this is the era of globalization when the philosophy of the market rules the roosts. We would, however submit that the role of the state in planning and delivering services to the society should be given adequate attention even when there is festivity with 'market'. This case study of the manner in



Source: Information provided by IMDPS

Figure 5: Project management structure of IMDPS

Table 2: Total Manpower cost estimate of IMDPS

Sr No	IMDPS component	No of persons (A)	Work duration in months (B)	Man months (A *B)	Average man month cost In INR (thousands)	Total cost in INR
1	Data Acquisition and Quick Look Display (DAQLS)	3	36	108	70	
2	Data Processing (DP)	7	36	252		
3	Parameter Retrieval (PR)	8	36	288		
4	Image Analysis and Display System (IAS)	1	24	24		
5	Ancillary Data Processing System (ADPS)	1	24	24		
Total Cost						4,87,20,000

[8]A nation-state, the concept of which came into being following the Treaty of Westphalia in 1648. Later it was redefined on ethnic and racial terms and after the second World War, it assumed a development agenda for its people as well.

Table 3: Collaborative research areas and its outcome

Agency, No of People Deputed	Collaborative research areas	Duration of work in months	Outcome/Remark
ISRO, 5	Navigation and Registration of IMAGER and Sounder Products	3	Exposure to navigation methods used by other Geo-stationary Meteorological satellites.
	Atmospheric Motion Vectors retrieval from Imager/Sounder Observations and application for tropical cyclone studies.	6	The accurate and widely used height assignment algorithms (i.e. Infrared-window technique, H2O intercept method and cloud base method) are implemented successfully in the ISRO wind retrieval algorithm. The statistics generated after implementation of new height shows improvement in ISRO wind retrieval
	Retrieval of Atmospheric Parameters from Sounder Observations	4	Experience gained helped IMSPS to improve Sounder Products.
	Visualization and Analysis Software for Meteorological Satellite Data	8	Developed in-house software for data visualization and analysis software for Meteorological Satellite Data.
IMD, 3	Retrieval of Atmospheric Parameters from Sounder Observations	4	Exposure to IMD Scientists helped them to use INSAT-3D products effectively.
	Navigation of Imager products	4	
	Atmospheric Motion Vectors retrieval from Imager/Sounder	4	
IITM, 1	Image analysis using Mc-IDAS Package	4	
NCMRWF,1	Now casting techniques	4	

Source: IMDPS project team

Box 2: Challenges, limitations and achievements of the project

- Under the flagship of this project, geophysical parameter retrieval from meteorological instruments on-board Indian geo-stationary satellites using fully indigenous technology was undertaken for the very first time.
- Even though ISRO had its experience in retrieving and using satellite derived parameters for a very long time, nevertheless it got a chance to show its ability for generating world class geophysical parameters from own satellites using in-house developed algorithms.
- Scientists started developing and customizing different algorithms to derive parameters such as Atmospheric Motion Vectors (AMVs), Outgoing Long-wave Radiation (OLR), Rain rate, Short Wave Radiation at surface, surface skin temperature (land and ocean), Upper Tropospheric Humidity etc. Several of these parameters were already available from other mission such as Meteosat over the same region, therefore, IMDPS had daunting task of matching with high international standards of EUMETSAT, that too with limited manpower, computer and other resources (such as lack of network of ground stations, limited international collaboration etc.).
- These challenges posed only little hurdle in generating best quality products, thus, gave a way to explore new methods that can generate the same quality geophysical products with simpler algorithms. For instance, genetic algorithm is applied for height assignment in AMV retrieval and OLR retrieval, a new and simple method is developed to compute UTH and short wave radiation.

Source: IMDPS team

which ISRO transferred technology for the common good is a template that can be followed for a multitude of functions.

The project and the manner in which it was realized, the fact that the technology was developed by ISRO and was transferred to IMD, the user, and the challenges that were overcome to make the system operational is a tale worth emulating. Many scientific organizations that have made good scientific discoveries may emulate ISRO, take the risk and plunge wholeheartedly to make their discoveries make a difference to the lives of people.

References

- ✓Bagchi, N. (2011). "A Comparative Analysis of the Factors for Fostering Innovation in BRICS Countries from 1995 to 2009", *ASCI Journal of Management*, Vol. 41(1), pp. 1–20.
- ✓BUNDP, 1990, *Human Development Report 1990*, Human Development Report Office, UNDP, New York. ■

Tech Events

2016

May 17–19, Manila, Philippines
THE SOLAR SHOW PHILIPPINES 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

May 23–25, Jeju Island, Republic of Korea
2016 5th International Conference on Environment, Energy and Biotechnology (ICEEB 2016)
Contact: Ms Lydia Liu
CBEES Senior Editor
Tel: +852-3500-0137
E-mail: iceeb@cbees.org

May 23–25, Kuala Lumpur, Malaysia
GREEN ENERGY ASIA 2016
Contact: AMB Exhibitions Sdn Bhd
1701, 17th Floor, Plaza Permata (IGB),
6, Jalan Kampar, Off Jalan Tun Razak,
50400 Kuala Lumpur
Malaysia
Tel: +603 03 4041 9889
Fax: +603 03 2770 5301

May 31–Jun 2, Kuala Lumpur, Malaysia
BIOMALAYSIA 2016
Contact: Malaysian Biotechnology Corporation Sdn. Bhd.
Level 16, Menara Atlan
161B Jalan Ampang
50450 Kuala Lumpur
Malaysia
Tel: +60 3 2116 5588
Fax: +60 3 2116 5411

Jun 1–4, Bangkok, Thailand
ENTECH POLLUTEC ASIA 2016
Contact: UBM ASIA (Thailand) Co Ltd.
503/23 K.S.L. Tower
14th Floor Sri Ayuthaya Road
Kwaeng Thanon Phayathai
Khet Rajathewee,
Bangkok 10400
Thailand
Tel: +66 0 2642 6911
Fax: +66 0 2642 6919-20

Jun 1–4, Bangkok, Thailand
RENEWABLE ENERGY THAILAND 2016
Contact: UBM ASIA (Thailand) Co Ltd.
503/23 K.S.L. Tower
14th Floor Sri Ayuthaya Road
Kwaeng Thanon Phayathai
Khet Rajathewee,
Bangkok 10400
Thailand
Tel: +66 0 2642 6911
Fax: +66 0 2642 6919-20

Jul 25–27, Gombak, Malaysia
4th International Conference on Biotechnology Engineering
Contact: ICBioE'16 Secretariat
Tel: +603 6196 4441
Fax: +603 6196 4442
E-mail: icbioe@iium.edu.my
Web: http://www.iium.edu.my/icbioe/2016

Jul 25–27, Kuala Lumpur, Malaysia
2016 International Conference on Green Energy Technology (ICGET 2016)
Contact: Ms. Eve Lee
CBEES Senior Editor
Asia-Pacific Chemical, Biological & Environmental Engineering Society
Tel: +852-3500-0137
E-mail: icget@cbees.net
Web: http://www.icget.org

Aug 1–4, Hangzhou, China
5th International Conference on Biomedical Engineering and Biotechnology (ICBEB 2016)
Contact: Linda Li
Tel: +86-27-87051286
E-mail: icbeb@academicconf.com
Web: http://www.icbeb.org

Aug 5–6, Bangkok, Thailand
3rd International conference on Innovative Engineering Technologies (ICIET'2016)
Contact: Conference Secretary-ICIET'2016
Tel: +66 849204416, +66 822120260
E-mail: info@iieng.org
Web: http://www.iieng.org/2016/08/06/79

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 1–30, Busan, Republic of Korea
ENVIRONMENT & ENERGY TECH 2016
Contact: Bexco (Busan Exhibition & Convention Center)
55 Apec-ro, Haeundae-gu
Busan, 612-704
Republic of Korea
Tel: +82 51-740-7518,7520
Fax: +82 51-740-7360

Sep 6–8, Kuala Lumpur, Malaysia
International Conference on Sustainable Development 2016
Contact: Ontario International Development Agency
364 Moffatt Pond Court
Ottawa Ontario, K2J 0C7 Canada
Tel: 24/7 Hotline: + 1 613 612 7615
E-mail: oida@ontariointernational.org
Web: http://www.ontariointernational.org/icsd-2016-malaysia.html

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
United Kingdom
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

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: Solar Promotion GmbH
Kiehnlestr 16,
Pforzheim, Baden-Württemberg75172
Germany
Tel: 49-7231-58598-0
Fax: 49-7231-58598-28
Web: www.intersolarglobal.com

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

Tech Ventures & Opportunities

Business Coach

Start-up Venture Creation 41

- Methods of conducting business in Malaysia
- Accounting and financial reporting requirements for businesses in Thailand

Technology transfer 43

- IP assignment and licensing in Viet Nam
- Voluntary licensing of patents in Philippines

Venture Financing 46

- Technology Acquisition and Development Fund of India
- Merit-based incentives for investment in Thailand

Managing Innovation 48

- Global Cleantech Innovation Programme Malaysia
- Fostering SMEs to succeed with innovative technologies in the Republic of Korea

Green Productivity 51

- Government green procurement in Malaysia
- Eco-innovation in Sri Lanka

Tech Opportunities

Technology Offers 53

- Metal reclamation technology in electroplating (Hungary)
- Wastewater management (India)
- Value-added chemicals from cashew nut shell liquid (India)
- Membrane purification of palm sap (NEERA) (India)
- Mechanical circulator or homogenizer (India)
- New green stove design (India)
- Sensor for detecting nitrogen dioxide gas (India)
- Chitin and chitosan (India)

Technology Requests 56

- Micropropagation of potato cultivation (India)
- PET polyols (India)
- Silica from rice husk ash (India)
- Medical disposables (India)
- Hydrosulphite and metabiusulphite plant (Pakistan)
- Water saving devices (United Kingdom)

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

Methods of conducting business in Malaysia

Malaysian Investment Development Authority, Malaysia
http://www.mida.gov.my

In Malaysia, a business may be conducted:

- By an individual operating as sole proprietor
- By two or more (but not more than 20) persons in partnership, or
- By a limited liability partnership (LLP), or
- By a locally incorporated company or by a foreign company registered under the provisions of the CA 1965

All sole proprietorships and partnerships in Malaysia must be registered with the Companies Commission of Malaysia (SSM) under the Registration of Businesses Act 1956. In the case of partnerships, partners are both jointly and severally liable for the debts and obligations of the partnership should its assets be insufficient. Formal partnership deeds may be drawn up governing the rights and obligations of each partner but this is not obligatory.

Company structure

The CA 1965 governs all companies in Malaysia. The Act stipulates that a a company must be registered with the SSM in order to engage in any business activity.

There are three (3) types of companies that can be incorporated under the CA 1965:

- A company limited by shares is a company formed on the principle that the members' liability is limited by the memorandum of association to the amount, if any, unpaid on the shares taken up by them
- In a company limited by guarantee the liability of the members is limited by the Memorandum and Articles of Association to the amount which the members have undertaken to contribute to the assets of the company in the event the company is wound up.
- An unlimited company is a company formed on the principle of having no limit placed on the liability of its members

Company limited by shares

The most common company structure in Malaysia is a company limited by shares. Such limited companies may be incorporated either as a Private Limited Company (identified through the words "Sendirian Berhad" or "Sdn Bhd" as part of the company's name) or a Public Limited Company (identified through the words "Berhad" or "Bhd" as part of the company's name).

A company having a share capital may be incorporated as a private company if its Memorandum and Articles of Association:

- Restricts the right to transfer its shares
- Limits the number of its members to 50, excluding employees in the employment of the company or its subsidiary and some former employees of the company or its subsidiary.
- Prohibits any invitation to the public to subscribe for its shares and debentures
- Prohibits any invitationto the public to deposit money with the company for fixed periods of payable at call, whether interest-bearing or interest-free.

A public company can be formed or, alternatively, a private company can be converted into a public company subject to Section 26 of the Companies Act 1965. Such a company can offer shares to the public provided:

- It has registered a prospectus with the Securities Commission
- It has lodged a copy of the prospectus with the SSM on or before the date of its issue.

A public company can apply to have its shares quoted on the Bursa Malaysia subject to compliance with the requirements laid down by the exchange. Any subsequent issue of securities (e.g. issue by way of rights or bonus, or issue arising from an acquisition, etc.) requires the approval of the Securities Commission.

SME Finance Initiative

The SME/Finance Initiative (SME/FI) is a knowledge-cum-business network that will put together development banks, other specialized financial institutions and development organizations in different countries to discuss and address specific issues in the financing of and other support services to SMEs.

For more information, access:
http://www.smefi.com

Accounting and financial reporting requirements for businesses in Thailand

Thailand Board of Investment, Thailand

http://www.boi.go.th

Books of accounts and statutory records

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

"In keeping accounts, the person with the duty to keep accounts must hand over the documents required for making accounting entries to the bookkeeper correctly and completely, in order that the accounts so kept may show the results of operations, financial position according to facts and accounting standards."

Accounting period

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

Reporting requirements

All juristic companies, partnerships, branches of foreign companies, and joint ventures are required to prepare financial statements for each accounting period.

For a private limited company, the director is responsible for arranging the annual meeting of shareholders to approve the company's audited financial statement within 4 months at the end of the fiscal year, and filing the audited statement and supporting documents, including a list of shareholders on the date of the meeting, to the Registrar no later than 1 month after the date of the shareholder meeting.

For a foreign company, i.e. branch office, representative office or regional office, and excluding joint ventures, the Manager of the branch office must submit a copy of the financial statement to the Registrar no later than 150 days after the end of the fiscal year. Approval of the shareholder meeting is not required.

For a public limited company, the director is responsible for arranging the annual meeting of shareholders to approve the audited financial statements of a company within 4 months at the end of the fiscal year. A copy of the audited financial statement and annual report, together with a copy of the minutes of the shareholder meeting approving the financial statement, should be certified by the director and submitted to the Registrar, along with a list of shareholders on the date of the meeting, no later than 1 month after approval at the shareholder's meeting. In addition, the company is required to publish the balance sheet for public information in a newspaper for a period of at least 1 day within 1 month of the date it was approved at the shareholder's meeting.

Accounting principles

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

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

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

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

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

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

IP assignment and licensing in Viet Nam

ASEAN IPA, Malaysia

http://www.aseanipa.org

General

Under the current rules, the license of an IP object shall be subject to certain conditions. As a pre-requisite, to license an IP object in Vietnam, such object must be already protected in Vietnam, i.e. it has been granted patents or certificates of registration. Those IP objects not yet registered in Vietnam can not be licensed.

Assignment and license agreements

Assignment or license agreements of IP objects must be made in writing, and contain minimum statutory provisions applicable to each kind. Oral agreements, letters or telegrams shall not be accepted and have no legal effect. If the assignment or license of an IP objects is included in another agreement (such as technology transfer contract, service contract, etc.), it must be made in a part separate from the other parts.

The assignment or license agreement must include the followings:

(i) The identity of the parties (assignor and assignee, or licensor and licensee)
(ii) The basis of the assignment/license (i.e. patent or certificate of registration granted and, in case of license, the exclusive license already granted to the licensor);
(iii) The IP object(s) to be assigned, or in case of license, the scope of license granted including: kind of license (exclusive or non-exclusive), the IP object(s) to be licensed, license territory, license term (within the balance of protection term granted by the respective patent or certificate of registration);
(iv) Assignment price or license royalty (it must be stated if the assignment/license is granted free of charge);
(v) The rights and obligations of the parties as stipulated;
(vi) Conditions for amendment, termination or invalidation of the agreement;
(vii) Dispute settlement;
(viii) Signatory date and place;
(ix) The signatures of the parties.

The current licensing rules mandate that the license agreement must not contain the following provisions which are considered as unreasonably restricting the rights of the licensee:

(i) Provisions directly or indirectly restricting the export of products manufactured under the license to other markets/territories except those where the licensor is the owner of the corresponding IP rights or holds the exclusive right over the importation of the corresponding IP object;
(ii) Provisions compelling the licensee to purchase the whole or part of materials, components or equipment from the licensor or from sources appointed by the licensor, without aiming to ensure the quality of the licensed products;
(iii) Provisions forbidding the licensee to improve the IP objects (except for trademarks), or compelling the licensee to transfer free of charge to the licensor the improvements made by the licensee or the right to apply for IP protection over such improvements; and
(iv) Provisions forbidding the licensee to appeal against the validity of the licensed IP object or the right to grant license of the licensor.

Registration of assignment/license agreements

The registration with the NOIP is compulsory for all assignment agreements to make them legally effective and enforceable in Vietnam. The agreements take legal effect upon their registration with the NOIP.

Regarding the registration of license agreements, Vietnamese laws currently provide quite controversial provision. Accordingly, license agreeements take effects as so agreed by the parties, however, to be effective against any third parties, such license agreements should be registered with the NOIP. Since there is no explanation from the authorities regarding the term "third parties" to date, the registration of license agreements is strongly recommended to ensure the smooth implementation and enforcement of license agreements.

For registration of the assignment/licenseagreement, the NOIP is the receiving office which in fact will consider the agreement for registration.

Regarding documents required to be to the NOIP for registration of assignment/license agreements, please see Filing Requirements in Vietnam.

The NOIP will examine the application file and issue a decision on registration of the agreement or refuse registration, within 2 months from the date of receipt.

Royalties and taxation

The royalties or price for assignment of IP objects will be agreed upon between the parties.The assignment/license of IP objects in Vietnam shall be subject to the enterprise income tax of 10 percent of the royalties paid, according to Circular No. 05/2005/TT-BTC guiding the tax regime applicable to foreign organizations without Vietnamese legal person status and foreign individuals doing business or earning incomes in Vietnam.

Voluntary licensing of patents in Philippines

Intellectual Property Office of the Philippines, Philippines
http://www.ipophil.gov.ph

REPUBLIC ACT NO. 8293

SECTION 85. Voluntary License Contract

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

SECTION 86. Jurisdiction to Settle Disputes on Royalties

The Director of the Documentation, Information and Technology Transfer Bureau shall exercise quasi-judicial jurisdiction in the settlement of disputes between parties to a technology transfer arrangement arising from technology transfer payments, including the fixing of appropriate amount or rate of royalty.

SECTION 87. Prohibited Clauses

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SECTION 88. Mandatory Provisions

The following provisions shall be included in voluntary license contracts:

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

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

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

(ICC) shall apply and the venue of arbitration shall be the Philippines or any neutral country; and

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

SECTION 89. Rights of Licensor

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

SECTION 90. Rights of Licensee

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

SECTION 91. Exceptional Cases

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

SECTION 92. Non-Registration with the Documentation, Information and Technology Transfer Bureau

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

Asia Pacific SE4All Hub

The Asia Pacific SE4All Hub is led by the Asian Development Bank (ADB), the United Nations Development Programme (UNDP) and the Economic and Social Commission for Asia and the Pacific (ESCAP), with the Hub Secretariat hosted at ADB Headquarters in Manila, Philippines. The three organizations will help catalyze major new investment opportunities to speed-up the transformation of the world's energy systems, pursue the elimination of energy poverty, and boost prosperity. The Hub will leverage on the existing structures of ADB, UNDP and ESCAP energy programs and integrate the strengths of all three development partners. It looks to grow its partnerships and consolidate efforts to promote Sustainable Energy for All in Asia and the Pacific region.

The SE4All Asia Pacific Hub aims to accelerate and facilitate the achievement of SE4All's goals to transform energy systems for a sustainable, prosperous future by harnessing its three development partners' convening power, country presence and networks to mobilize partnerships to catalyze concrete actions at the country level. The Asia Pacific Hub will facilitate and coordinate core activities in the region, with respect to the SE4All goals, in close cooperation with the SE4All's Global Facilitation Team. A better policy environment will accelerate the further development of sustainable energy, which is why the AP-SE4All Hub established a Sustainable Energy Center for Excellence, hosted by the Sustainable Energy Association of Singapore. The Singapore-based facility will become a venue for the region's policy makers to receive training on policy, technology, and project financing matters in the sustainable energy sector.

Key Activities of the Asia-Pacific Hub for the SE4All Initiative:

- Support the preparation of rapid assessments, country action plans and investment prospectuses.
- Facilitate policy dialogues among stakeholders.
- Catalyze investments in energy access, renewable energy, and energy efficiency.
- Develop market-based approaches for the delivery and consumption of energy.
- Build synergies and promote knowledge sharing among its stakeholders.
- Conduct regular monitoring and evaluation of activities and initiatives of its stakeholders.

For more information, contact:
Mr. Jiwan Acharya
Senior Climate Change Specialist (Clean Energy)
Sustainable Development and Climate Change Department
Asian Development Bank
E-mail: jacharya@adb.org
Web: http://www.se4all.org/hubs/asia-pacific-hub/

Technology Acquisition and Development Fund of India

Global Innovation & Technology Alliance, India

http://www.gita.org.in

The Technology Acquisition and Development Fund (TADF) is revolutionary scheme for enabling Technology Acquisition and Development as per the National Manufacturing Policy 2011 (NMP) through patent pool and licensing; reimbursement of direct patent acquisition cost; incentivizing production of equipment for controlling pollution, reducing energy consumption and for water conservation through interest and capital subsidies; and incentives for energy and environmental audit, waste water treatment, rain water harvesting, renewable energy and Green Buildings.

It aims to provide funding support for the acquisition and development of Clean and Green Technologies.

The Scheme is applicable to all existing and new Micro, Small and Medium Enterprises (MSMEs) including those in the National Investment and Manufacturing Zones (NIMZs) in respect of their investments made after notification of the Scheme which will remain in force upto March 31, 2017.

India needs to create an effective environment to enable its Micro, Small & Medium Enterprises (MSMEs) to partner with global businesses to evolve "Innovative Clean / Green / Energy Efficient Technologies" to catalyze the manufacturing growth which will contribute to the national focus of "Make in India".

To accelerate this process, Department of Industrial Policy & Promotion (DIPP), Ministry of Commerce & Industry, Govt of India had notified [vide DIPP's Notification reference no SO 2580 (E) dated September 21, 2015 , a unique Scheme for enabling Technology Acquisition and Development under the National Manufacturing Policy 2011 especially supporting the followings:

- Reimbursement of Direct Patent Acquisition Cost.
- Incentivizing through Capital subsidies for adoption of innovative technologies in the areas of Energy & Water Conservation, Controlling Pollution, Waste Water treatment, Rain Water harvesting, Renewable Energy and Green Buildings.

TADF scheme is a transformational mechanism for Indian MSMEs to acquire Clean, Green & Energy Efficient Technologies, in form of Technology / Customised Products / Specialised Services / Patents / Industrial Designavailable in the market with requisite level of proof from individuals, organizations located in India or anywhere else across the Globe.

TADF Scheme is applicable to All Existing & new MSMEs including those in the National Investment and Manufacturing Zones (NIMZs).

TADF scheme is Technically & Administratively managed by the Global Innovation & Technology Alliance (GITA). *Contact: Global Innovation & Technology Alliance (GITA), 4th Floor, IGSSS Building, 28, Institutional Area, Lodi Road, New Delhi - 110003, India. Tel: +91-11-4577-2030; Fax: +91-11-4577-2014; E-mail: gita@gita.org.in*

Sl.No	Schemes of TADF	Funding Support
1	Direct Technology Acquisition	Reimbursement of 50% of technology transfer fee or Rs 20 Lakhs, whichever is lower
2	In-direct Technology Acquisition	Subsidy of 50% of the mutually agreed value or Rs 20 Lakhs, whichever is lower
3	Subsidy for Manufacturing Equipment / Technology	Subsidy of upto 10% of capital expenditure incurred on new Plant & Machinery subject a maximum of Rs 50 Lakhs
4	Incentive Scheme for Green Manufacturing **	The scheme facilitates resource conservation activities in industries located in NIMZ through the introduction of incentive / subsidy schemes for energy/ environmental / water audits, construction of green buildings, implementation of waste treatment Facilities and implementation of renewable energy projects.

** Refer Gazette

ASEAN SME Service Center

The ASEAN SME Service Center serves as the portal or gateway to facilitate SMEs throughout ASEAN region and beyond to reach business services provided by SME service providers from public, private, academic institution non-profit organization, and other sectors; in a convenient, comparable, and centralized manner. Among the benefits of the ePCT is an automatic checking function during the preparation phase, ensuring the validity of the data provided, and reducing and potentially eliminating errors before filing. After filing, ePCT allows both applicants and patent Offices to manage international applications in a paperless environment, saving time and money.

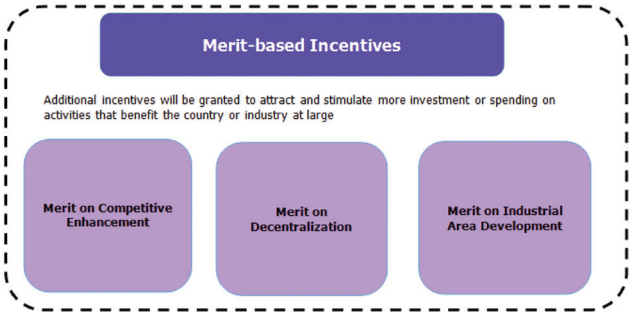
For more information, access:
http://www.aseansme.org

Merit-based incentives for investment in Thailand

Thailand Board of Investment, Thailand
http://www.boi.go.th

In order to attract and stimulate more investment or spending on activities that benefit the country or industry at large, the Board stipulates additional incentives based on the merits of the project, as follows:

Merit on competitiveness enhancement



Investment capital and expenditure will be eligible if meeting the following criteria:

Types of Eligible Investments/Expenditures	Additional Cap
1. R&D: In-house, outsourced in Thailand or joint R&D with overseas institutes	200%
2. Donations to Technology and Human Resources Development Funds, educational institutes, specialized training centers, R&D institutes or governmental agencies in the S&T field in Thailand, as approved by the Board	100%
3. IP acquisition/licensing fees for commercializing technology developed in Thailand	100%
4. Advanced technology training	100%
5. Development of local suppliers with at least 51% Thai shareholding in advanced technology training and technical assistance	100%
6. Product & packaging design: In-house or outsourced in Thailand, as approved by the Board	100%

Additional CIT incentives will be granted depending on investment/expenditure ratio (%)

Percentage of qualified Investment/ Expenditures to combined revenue of the first 3 years	Additional CIT Exemption (with additional cap)
1% or > 200 mil.baht	1 year
2% or > 400 mil.baht	In-direct Technology Acquisition
3% or > 600 mil.baht	2 years

Merit on decentralization

Projects located in 20 provinces with lowest per capita income—Kalasin, Chaiyaphum, Nakhon Phanom, Nan, Bueng Kan, Buri Ram, Phrae, Maha Sarakham, Mukdahan, Mae Hong Son, Yasothon, Roi Et, Si Sa Ket, Sakhon Nakhon, Sa Kaew, Sukhothai, Surin, Nong Bua Lamphu, Ubon Ratchatani and Amnatcharoen(excluding border provinces in Southern Thailand and Special Economic Development Zones which have separate special incentive packages)—shall receive additional incentives, as follows:

Three additional years of corporate income tax exemption shall be granted. Projects with activities in Group A1 or A2 which are already granted an 8-year corporate income tax exemption shall instead receive a 50% reduction of corporate income tax on net profit derived from promoted activity for 5 years after the corporate income tax exemption period expires.

Incentives for merit on decentralization

	A1	A2	A3	A4	B1	B2
Activity-based corporate income tax exemption	8 yrs.	8 yrs.	5yrs.	3 yrs.	×	×
Additional corporate income tax exemption	×	×	3 yrs.	3 yrs.	3 yrs.	3 yrs
Total of CIT exemption period	8 yrs.	8 yrs.	8 yrs.	6 yrs.	3 yrs.	3 yrs
Additional 50% CIT reduction for 5 years	a	a	×	×	×	×
Double deductions from the costs of transportation, electricity and water supplyfor 10 years	a	a	a	a	a	a
Additional 25% deduction of the cost of installation or construction of facilities	a	a	a	a	a	a

Merit on industrial area development

Projects located within industrial estates or promoted industrial zones shall be granted one additional year of corporate income tax exemption.

Global Cleantech Innovation Programme Malaysia

Malaysian Industry-Government Group for High Technology (MIGHT), Malaysia

http://malaysia.cleantechopen.org

The Global Cleantech Innovation Programme (GCIP) in Malaysia is a competition-based approach to identify and nurture Malaysian technopreneurs in clean technologies. Supporting the development of entrepreneur and innovators developing ingenious solutions to major challenges in energy generation, distribution and storage, air and water pollution, waste management, new forms of transport and construction techniques. Furthermore, to address the impending concern on energy security, climate change and the adverse environmental impacts associated with conventional economic activities.

GCIP is about coupling entrepreneurs with experts in the field through mentoring, training, showcasing and connection with the investors. Through the programme, mentors will be assigned to the selected entrepreneurs to help them address business and technology gaps, build the entrepreneurs' capacity within the scope of the competition, as well as the capacity of the mentors themselves.

Cleantech Open Mentor

Being a Cleantech Open Mentor can be a very rewarding experience. One can make the difference by mentoring a team in the Accelerator.

Generalist Mentors

Experienced professionals with proven records of success in leading early stage businesses. Cleantech industry experience is not required, but is helpful. These general mentors become key assets for the entrepreneurs that are accepted into the Accelerator program. In the context of the Accelerator, Generalist Mentors become an integral part of the team coaching in association with the eight modules and supporting the entrepreneurs with feedback for final deliverables such as the investor pitches, financial models and summaries. After the Accelerator concludes in November, many mentors often become trusted advisers for their teams as they scale their businesses.

- Coach teams through deliverables development
- Provide feedback on all aspects of the business
- May attend education and training events along with team (i.e. Cleantech Open Academies or workshops)
- Work with or help identify Specialist Mentors to provide specialist coaching

Required Skills

- Proven experience in high-growth (scalable) early-stage entrepreneurship
- Ability to quickly become a useful, trusted advisory to accelerator companies
- Willingness to participate, help out, debate, engage proactively with teams

If multiple Generalist Mentors are assigned to a team, one mentor should be selected as the "primary mentor." This mentor will take the lead on such roles as compiling mentor feedback, helping to drive agenda for meetings, and acting as the mentor contact to the Cleantech Open Regional Mentor Chair and staff.

Generalist Mentors are committed to at least one hour every other week of assistance and mentoring. They are welcome and encouraged to attend the Cleantech Open Academies, the Business Clinics/workshops, and also be present during Mock Judging. Depending on space and regional availability, the mentors may sit in on final judging by experts, and also are welcome to attend the Regional Innovation Summits in October and the Global Forum in November.

Specialist Mentors

Specialist Mentors are subject matter experts who act as resources for one or more teams in the Accelerator. Typical Specialist Mentors are Director or VP-level executives at companies large and small who are recognized leaders in their discipline.

- Have opportunity to facilitate training and workshop sessions during Cleantech Open Academy
- Lead Business Clinics/workshops in the regions where teams present functional aspects of their businesses for feedback
- Work with Generalist Mentors to provide functional coaching to team as needed
- Provide deep expertise in key functional areas which may include but are not limited to:
    - Finance (finance modeling, P&L development, financial performance benchmarking)
    - Marketing (positioning statement, pricing, value prop. development, marketing, product launch,
    - strategic partnering)
    - Engineering (product development, architecture, innovative designs, design for manufacturing)
    - Early stage fund-raising
    - IP
    - HR

- o Digital and online presence
- o Interaction with university and federal labs (technical validation)

Sustainability Mentors

Each team has access to a Sustainability Mentor from a pool of sustainability experts identified by the regional Sustainability Chairs. The sustainability mentor's role is to provide mentor-ship to the teams that seek advice, and support for integration and advancement of triple bottom practices for deliverables and investor pitch. Mentors receive a basic orientation to Cleantech Open process and available resources, but are expected to have knowledge of basic sustainability principals.

Business Clinic/Workshop Mentors

In the month of August, each region conducts a series of Business Clinics. During these 60-minute one-on-one consulting sessions, participating teams receive in depth assistance with core sections of the worksheets (business planning) and investor pitch from subject matter experts. Business clinic consultants are often sourced from the Mentor Program database and are matched with sessions that relate to their field of expertise. Mentors are asked to act as the Business Clinic mentors, consulting in the fields such as:

- Client development
- Early Stage Investing
- Engineering
- Finance
- Legal – Corporate and
- IP
- Marketing & Media
- Human Resources/Organization
- Sustainability

Mentoring areas

The mentoring programme will cover eight modules / support areas, as below: i. Product – Market Fit

- Estimated market potential; total addressable market
- Understanding of customer needs and responses
- Tools required to gain understanding of market requirement and customer needs

ii. Product – Technology Validation

- Proof of concept of technology and product
- Means for product validation

iii. Business Model

- Develop a sound business proposal and model
- Managing risks and challenges of fitting in the value chain

iv. Market(s) and Getting to Them

- Develop strategies to penetrate the marketplace and managing internal and external factors
- Develop promotional strategy to gain recognition and capture the targeted market

v. Finances & Financing Strategy

- Develop a strong and credible financial projection
- Develop a financing strategy such as funding required, marketing, product development and , based on market share and size
- Business pitching to targeted funders

vi. Entrepreneur

- Identify entrepreneur's skill gaps and addresses through appropriate training or skill development plan
- Identify additional resources or skill sets required to develop and sustain the business

vii. Legal – IP & Corporate

- Develop an IP strategy
- Initiate or Acquire patents to fit into value chain
- Develop organisational and corporate structure to avoid conflict
- Review of existing Agreements and Establish necessary Legal documents where necessary

viii. Sustainability

- Establish environmental, economic and social responsibility's impact
- Acquire product / process certifications such as Life Cycle Analysis (LCA), ISOs , Eco Labelling and any other product-specific, if necessary

Climate Technology Centre and Network

The CTCN promotes the accelerated transfer of environmentally sound technologies for low carbon and climate resilient development at the request of developing countries. The network provides technology solutions, capacity building and advice on policy, legal and regulatory frameworks tailored to the needs of individual countries.

For more information, access:
http://ctc-n.org

Fostering SMEs to succeed with innovative technologies in the Republic of Korea

Small and Medium Business Administration, Republic of Korea

http://www.smba.go.kr

The Small and Medium Business Administration (SMBA) of the Republic of Korea is in the vanguard of a pan-national SME era, developing and delivering a broad range of practical and productive SME policy initiatives. SMBA is endeavoring to develop and implement custom-tailored policies and services, responding to the on-site needs of SMEs.

Enhancing the capacity of SMEs for technological innovation

SMBA is carrying out a program to develop technologically innovative SMEs as part of its representative R&D program of promoting first-mover and creative investment in promising technologies to enhance the key capacity of SMEs that are playing a key role in the Korean economy. Furthermore, it is working to intensively foster SMEs in the fields of green growth as well as cutting-edge fusion and convergence technologies that are rising as the main new growth engines in addition to manufacturing-based root industries, to respond to the rapidly changing global technology environment.

In addition, SMBA is expanding the technological development base of start-ups at their initial stage and their creation of high added value through ICT convergence in tandem with the government's agenda to create a creative economy. As such, SMBA is working hard so that globally competitive small enterprises will grow through policies tailored to each stage of their growth and innovative capacity.

Discovering and fostering innovative SMEs

SMEs are the key factor of the Korean economy, enhancing the technological capacity by strengthening the national competitiveness and in flexibly responding to global technological changes within the rapidly changing global economic paradigm. As such, SMBA has established plans to discover and foster technologically innovative SMEs since 2001 to discover technologically innovative SMEs and comprehensively link diverse support projects so that they will consolidate global competitiveness.

Since 2006, SMBA has discovered and fostered SMEs with business innovation to strengthen their capacity to innovate not only their technology, but also their marketing and customer services.

Supporting technological development through industry-academia-research institute cooperation and their joint use of research equipment

SMBA is supporting the establishment of corporate research centers through industry-academia-research institute cooperation so that they are able to develop together the necessary technologies by using the cutting-edge research equipment and manpower of universities and public research institutes, mainly targeting SMEs with difficulties establishing an independent corporate research centers as well as weak technological capacity.

Furthermore, SMBA is offering free use of expensive testing and research equipment possessed by regional SMBA administrations to solve difficulties that regional SMEs had facing issues of testing equipment scarcity. In addition, the administration has supplemented the R&D equipment at its Digital Design Innovation Support Centers and Test Product Manufacturing Support Centers to enhance manufacturing capability and design development of test products and support the technological innovation of regional SMEs.

Supporting the protection of SME technologies

SMBA supports expert consulting in each field (security, laws, etc.) to protect key technologies held by SMEs and prevent their unauthorized dissemination. It manages a technology deposit system to guarantee the stable use of technologies between transacting enterprises and the safe storing of technological data.

In addition, it built and manages the SME Technology Protection Center to prevent and respond to technological infringement from external cyber-attacks and DDOS (distributed denial of service) through e-mail, among other electronic means. The administration also supports the building of technological and physical security solutions (network server security, CCTVs, and entry and exit management systems, etc.) appropriate for the security environment of each individual enterprise.

Government green procurement in Malaysia

Sustainable Consumption and Production (SCP) Secretariat, Malaysia

http://www.scpmalaysia.gov.my

Government Green Procurement (GGP) refers to the acquisition of products, services and work in the public sector that takes into consideration the environmental criteria and standards to conserve the natural environment and resources. As the Malaysian public expenditure is a big player in the nation's GDP, the Government's purchasing power can be used to spur the use of environmentally friendly products and services by participating in the market as purchasers and at the same time regulate its practices.

Based on the recommendations of the Sustainable Consumption and Production ('SCP') Malaysia team, the Ministry of Finance has adopted GGP and is going to mandate the Government's agencies through the GGP circular to procure green products and services.

Malaysia has a series of plans for the better tomorrow of its people. Right now, two of Malaysia's plans share the same vision. Both the 10th Malaysia Plan ('10MP') and GGP are instruments that will transform Malaysia into a high income, developed, inclusive and sustainable nation.

The Ministry of Finance has issued the GGP circular on 10th April 2014. The Short-Term Action Plan that is initiated to materialise Malaysia's long-term GGP strategy and is designed to embrace the nation's GGP policy in 2014 is a go.

Choosing the first green product groups

The application of environmental criteria for a specific product groups constitutes the core of every green procurement strategy. The short-term action plan on GGP in Malaysia involves selecting the first product groups and their pilot implementation of GGP.

Potential product groups

The efforts of Ministry of Energy, Green Technology and Water ('KeTTHA') and Malaysian Green Technology Corporation ('MGTC') have indicated a number of potential products. Energy efficient lighting, cleaning services, building materials etc are among the potential product groups identified. The final selection of pilot product groups will be completed after taking into account supply and demand factors.

Based on pre-existing experiences, know-how, active interest, and practical considerations (especially sufficient demand for the selected product groups), at least two pilot implementers will be selected.

Pilot implementers

The Government Green Procurement ('GGP') begins with a Short-Term Action Plan. This Short-Term Action Plan is firstly implemented by identifying at least 5 product groups and initiating pilot implementation for these product groups.

Trial run

Pilot implementation represents a trial run to gauge whether these product groups are effective towards fulfilling the strategy of GGP. By having a pilot implementation, the Government that's armed with sufficient information can pivot its course in a better direction towards greener procurement.

The Ministry of Finance has appointed 4 ministries as pilot implementers for the GGP Project based on pre-existing experiences, know-how, active interest, and practical considerations (especially sufficient demand for the selected product groups).

Opportunities to business owners

One of the hardest stages of having a successful business is finding customers. An entrepreneur or an innovator may have the most revolutionary idea but the fear of not having anyone to buy into a new idea is ever present.

The fear of a failing business is especially felt by those enterprises who wish to venture into environmental friendly products thinking that the consumers may not be so quick to adapt. But with the introduction of Government Green Procurement ('GGP'), the Malaysian companies can put their worries to rest.

Government green procurement means business

The Ministry of Finance ('MOF') will issue GGP circular which contains the Short-Term Action Plan. The plan was approved by GGP Steering Committee in July last year. In short, the Government, having recognised the impact of green products and services on transforming the nation into one that's sustainable, is now seeking to leverage its purchasing power to encourage industries to provide more green products and services.

The Government through GGP will actively acquire products and services that are environmental friendly. Therefore, business owners have the opportunities to meet such demands by producing and providing green products and services.

Eco-innovation in Sri Lanka

National Cleaner Production Centre, Sri Lanka

http://www.ncpcsrilanka.org

Rethinking the business strategy

Improving the organizational structure, products / services, processes, market approach, service delivery mechanisms etc. in a creative and innovative way is necessary to maintain the competitiveness of the businesses. Incorporating the sustainability dimension to the innovation process helps the companies to emerge as green enterprises with extraordinary performance that leads eventually to be triumphant in the global and local markets.

Eco-innovation is an approach that has been adopted by enterprises knowingly or unknowingly to harness to benefits by incorporating sustainability dimension to the innovation process; United Nations Environmental Programme (UNEP) undertook in 2009 to develop this concept into a formal approach/tool with an application methodology so that Small and Medium enterprises in the developing countries also can benefit.

Why is eco-innovation approach necessary?

In recent decades, there has been a growing recognition amongst manufacturing business leaders on sustainability challenges such as climate change, worker welfare and resource constraints which have a significant impact on businesses. Ultimately, companies that do not take action now run a higher risk of failure when these issues inevitably take effect in their industry. Sticking with the 'business as usual' approach will leave companies unable to respond to issues such as rising energy costs, disruptions to supply of the raw materials or changes in legislation. Thus, an alternative approach going beyond the boundaries of Cleaner Production or EMS and that can help to address sustainability related business drivers is needed whilst offering opportunities for growth, cost reduction and competitive advantage.

Eco-innovation is an approach that aims to fulfill these multiple requirements by identifying the key sustainability challenges and opportunities and then using these to drive changes throughout the company and its value chain, from the business strategy and business model to the operational level.

Eco-innovation is the development and application of a business model, shaped by a new business strategy that incorporates sustainability throughout all business operations based on life cycle thinking and in cooperation with partners across the value chain. It entails a coordinated set of modifications or novel solutions to products (goods / services), processes, market approach and organizational structure which leads to a company's enhanced performance and competitiveness.

Added value from eco-innovation

Access new & emerging markets

- ncrease productivity & technical capacity

Increase profitability along the value chain

- Stay ahead of standards & regulations

Attract investment

UNEP project on eco-innovation

The UNEP eco-innovation project was initiated in 2014 aiming to develop local resources and capacities for eco-innovation in developing and emerging economies. It specifically targets small and medium sized enterprises (SMEs) of Agri-food sector.

To reach the SMEs, the UNEP eco-innovation project co-operates with National governments and National Cleaner Production Centres as service providers. National Cleaner Production Centre Sri Lanka (NCPCSL) is the implementing partner for the project in Sri Lanka. NCPCSL is entrusted to initiate the 1st pilot project on Eco-innovation under Agri-food sector.

Initially, twenty (20) enterprises will be selected to conduct a feasibility study by identifying the potential to apply eco-innovation approach with desire of the industry. Finally, eight (8) enterprises will be provided technical assistance together with comprehensive training by international experts for the implementation of eco-innovation. The success stories of those companies will be publicized internationally.

The industries will be enabled to handle their sustainability issues in a holistic way and position as a sustainability thought leader.

Technology Offers

HUNGARY

Metal reclamation technology in electroplating

Description

Our client is a SME in Hungary. They offer equipment for recovering metals, applied in electroplating technique of surface treatment. 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. The equipment was designed for recovering all the metal ions from the flushing water. Along the galvanic line, 90% of the galvanic solution sticked to the metal surface aggregates in the economy rinsing vat while the rest 10% comes to the stream rinsing vat. The aim is to recover all metal ions from the solution aggregated in the economy rinsing vat (90% of the total loss). This aim can be reached by electrolysis. As metal ions remain in the solution after the process, the solution is reverted and the electrolysis is repeated. This technology can be used for chloride ion free and chlorid containing solutions, as well. Further results are the reduction of the quantity of galvanic sludge during the process and easy reuse of the metal recovered. Innovative aspects: The process of metal reclamation is known but the other technologies are uneconomical. The novelty of this process is the concentration of the solutions, such as the extremely low level of the metal loss and this technology is economical, the investment returns in 3 or 4 years.

Area of Application

- Potential users: Companies providing electroplating services; Companies active in metal processing and/or machinery industry having an in-house electroplating workshop.

Advantages

Main advantages are as follows:

- 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

Contact:

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

INDIA

Wastewater management

Description

We are a company offering a technology for wastewater management for ETP and STP. Our technology is a breakthrough in the field of ETP and STP. The equipment offered comes is least space requirement and flow rates starting from 5 KLD and above. The technology is 100% green and is absolutely user friendly. With our technology you can gain upto 98% water back for utilisation with least of sludge and waste. Helps you derive a 100% discharge free environment.

Area of Application

Any industry that seeks the waste water management. Domestic and commercial Sewage Treatment.

Advantages

Eco-friendly, Cheap, Maintenance free, No technical assistance required to operate, Least space requirements.

Environmental Aspects

Cleaner production, Waste utilization, Energy efficiency, Systems integration

Development Status

Pilot plant, Fully commercialized

Legal Protection:

Trade mark

Technical specifications

Variable depending on the Loading and Flow rates

Transfer Terms

Consultancy, Technical services, Technology licensing, Equipment supply, Turnkey

Contact:

Shah Marketing Co, 312, Nakshatra V, Sadhuwasvani Road,
Off University Road, Rajkot 360007, India. Tel: 9898077452
E-mail: mitesh@shahmarketing.com

Value-added chemicals from cashew nut shell liquid

Description

A range of difunctional monomers (dihalides, diacids, diisocyanates, diamines, diacyl hydrazides, diphenols, dialdehydes etc.) and polymer additives are produced utilizing 3- pendadecyl phenol derived from cashew nut shell liquid (CNSL) using NCL's technology. A host of high-performance polymers (polyimides, polyamides, polyesters, poly(amide-imide)s etc.) can be prepared using the difunctional monomers mentioned above.

Areas of Application

Thickeners in paints, cosmetics, oils, food and textiles

- Electrical insulating varnishes
- Enamels & adhesives
- Auto brake lining
- Substitute for linseed oil (in manufacturing foundry core oil, which is used as a binder)

- Cement hardening agent
- Used in lamination industry (for reduced brittleness and improved flexibility)
- Epoxy resins & rubber compounding resins

Advantages
- High performance polymers produced from CNSL have improved processability characteristics
- Produced from low cost raw materials that are widely available in India
- Sustainable, renewable source

Development Status
Laboratory model

Legal Protection
Patent

Transfer Terms
Technology licensing

Membrane purification of palm sap (NEERA)

Description
Palm sap is a nutritious drink, but it cannot be stored for long duration (once it is extracted from the palm tree) even under refrigeration. Polymeric membranes are used to purify/clarify palm sap (Neera). The resulting palm sap is visibly better, without turbidity, is free of bacteria and yeast (that cause fermentation). This can be achieved without loss of nutrients, and without any use of chemical additives/ biopreservatives. The purified palm sap has a shelf life of up to 6 months.

Area of Application
- The purified palm sap (Neera) can be sold as a refreshing and natural drink
- Could be packaged and sold without getting spoilt (due to removal of micro-organisms)
- Has long shelf-life
- Cheap and natural drink

Advantages
- Natural drink from a widely available source
- It has been shown conclusively that Neera is a nutritive and a body coolant
- Nutritive: contains protein, natural sugars, iron, phosphorus, calcium, ascorbic acid, riboflavin and thiamine
- Cheap, affordable drink that could be made available throughout the year, and around the country (in its purified form)
- No refrigeration needed for packaged/purified Neera

Environmental aspects
Laboratory model

Transfer Terms
Joint venture, Technology licensing.

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

Mechanical circulator or homogenizer

Description
The present technology offer is for a novel bottom-mounted mechanical circulator assembly having wide application in process industry and in particular batch & continuous pans in sugar industry. It is highly compact and energy efficient.

Area of Application
Processing equipments requiring mechanical agitation / stirring. The innovative device has been successfully applied in Batch Pans for evaporative crystallization of sugar solutions in Cane and Beet Sugar Industries.

Advantages
Increased pan capacity, Higher yield, Efficient operation, Better quality

Environmental Aspects
Energy efficiency

Development Status
Fully commercialized

Legal protection
Patent

Technical specifications
The innovation involved in the present invention lies in the novel features of construction and combination and relation of readily available, off-the-shelf components.

Transfer terms
Technology licensing

Contact:
Spray Engineering Devices Limited (SED), Spray House, C-82, Industrial Area, Phase 7, Mohali - 160055, Punjab, India. Tel: 00911723029769; Fax: 00911723029774; E-mail: rajeevnath.tiwari@sedl.in

New green stove design

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

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

Advantages
- High thermal efficiency with reduced rate of smoke emission.
- In the stove, primary air is supplied throughout the perforated circumferential wall at the lower part of combustion chamber for better mixing with wood fuel during combustion.

- In addition to typical preheating system of secondary air while passes through annular air passage surrounded the combustion chamber wall, primary air is also preheated in this stove while comes in contact with perforated lower circumferential wall of the combustion chamber.
- The primary air is entered through perforated wall located above the fuel rest plate, not through conventional grate at bottom so that, deposited ash on fuel rest plate cannot be able to block the air passage for primary air entry.
- Ash removal is very easy, just by opening of holding clip of fuel rest plate.
- Sliding cover plate of fuel feed opening prevents entry of outside cold air inside of combustion chamber.

Environmental Aspects
Cleaner production, Energy efficiency

Legal Protection
Patent will be applied soon

Technical specifications
Cross sectional area of combustion chamber = 314sq.cm. Cross sectional area of solid fuel rest plate = 346.2sq.cm. Cross sectional area of larger diameter portion of stove = 880.9sq.cm. Cross sec.

Transfer Terms
Consultancy, Joint venture, Technology licensing, Research partnerships

Contact:
Subhra Datta Mohanta Para, Lane opp. to Senior Citizens Park, P.O. Jalpaiguri 735101, West Bengal, India. Tel: 0091-9474390725 E-mail: subhradatta611@gmail.com

Sensor for detecting nitrogen dioxide gas

Description
A novel nitrogen dioxide gas detecting film has been developed. The detecting film is based on light emitting conjugated polymer Poly [2-methoxy-5-(3',7'–dimethyloctyloxy)-1,4-phenylenevinylene (MDMO-PPV). It has been demonstrated for the first time that a thin film of MDMO-PPV deposited on glass substrate or filter paper can be used to sense NO2 gas by just change in color at room temperature. It has been observed that the bright orange fluorescence of MDMO-PPV is quenched to yellow in color in the presence of NO2 gas above 150 ppm level in few seconds. The quenching time is proportional to the concentration of the NO2 gas. The quenching of the fluorescence of the detecting film after exposure to NO2 is also studied by absorption and emission spectroscopy.

Area of Application
The tecnology is useful for monitoring nitrogen dioxide in

- Factories.
- Environmental monitoring.
- Medical applications.

Advantages

- Easy detection procedure in the form of color code in few minutes above 150 ppm.
- A sensor based on conjugate polymer on various substrate such as glass, plastic or paper.
- no change in color of the sensor is observed on exposer to any other gases and chemical vapors like LPG, ammonia gas, hydrogen peroxide and alcohols.
- process is very cheap and hence can be used as disposable strips.

Environmental aspects
security purpose

Development Status
Laboratory model

Legal Protection
Patent

Technical specifications
A conjugate polymer polyp[2-methoxy-5-(3',7'-dimethyloctyloxy)-1,4-phenylene-vinylene (MDMO-PPV) based NO2 gas sensor film.

Transfer Terms
Consultancy,Technical services,Technology Licensing,Research Partnerships

Contact:
Amity University, Uttar Pradesh, Sector-125, Noida Dist. Gautam Buddha Nagar 201303, India. Tel: 91-0120-4392815; Fax: 91-0120-4-2431870; E-mail: registrar@amity.edu

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.

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

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

Environmental Apects
Waste utilization

Development Status
Pilot plant, Fully commercialized

Transfer Terms
Consultancy, Technology licensing

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

Technology Requests

INDIA

Micropropagation of potato cultivation

Description
We need technology for micropropagation potato cultivation.

Area of Application
Agriculture

Studies Available
Feasibility report

Project
Start-up

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

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

PET polyols

Description
We are trading based company planning to go for PET polyster Polyols manufacturing. We are planning for small scale project. We will procure recycled PET flakes locally.

Area of Application
Polyols

Project Type
Start-up

Assistance Sought from Potential Partner
Technical

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

Silica from rice husk ash

Description
We are interested in equipment and technology suppliers for setting up a 10 tpd silica extraction unit from rice husk ash.

Area of Application
Silica manufacturing

Transfer Terms
Consultancy, Subcontracting, Turnkey plant, Technical services, Equipment supply, Technology licensing, Research partnerships, Others

Project Type
Diversification

Assistance sought from potential partner
Need the suppliers of equipment and technology

Contact:
Rajahmundry, Andhra Pradesh, India.
Tel: 8331873337; E-mail: bikkinakarthik@gmail.com

Medical disposables

Description
We are interested in technology for 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 244501, India
Tel: 05912220061; Fax: 05912220061
E-mail: shreejeekanth@gmail.com

PAKISTAN

Hydrosulphite and metabiusulphite plant

Description
We require the hydrosulphite plant as well as Metabisulphite plant along with technologies.

Area of Application
Chemicals, Textiles

Studies Available
Feasibility Report, Environmental Impact Studies (EIA/EIS), Others

Project Type
Start-up

Contact:
Makda Enterprise, d/103 A Site, Karachi, Pakistan 75600
Tel: 00923218275587; Fax: 00922132578288
E-mail: adamjee@makdagroup.com

UNITED KINGDOM

Water saving devices

Description
Our client is keen to find innovative technical devices to reduce water consumption, and have focused on applications where consumers use and therefore potentially waste the most amount of water.

Area of Application

Water saving devices for domestic and commercial use

Project Type
New idea

Contact:
Strategic Allies Ltd., The Red & White House 113, High Street Berkhamsted, U.K HP4 2 DJ, Berkhamsted, United Kingdom, HP4 2DJ
Tel: 00441442860634
E-mail: ashima@strategicallies.co.uk

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.*