Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific Tech Monitor

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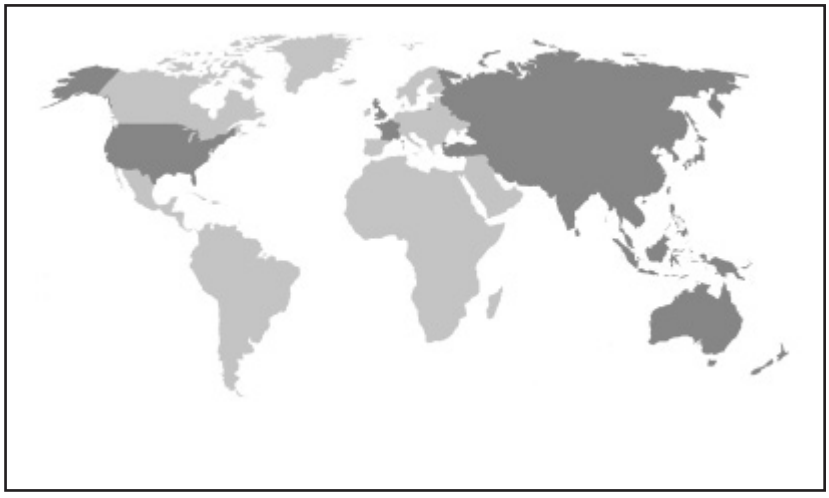
APCTT
Asian and Pacific Centre for Transfer of Technology

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

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

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

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



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

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

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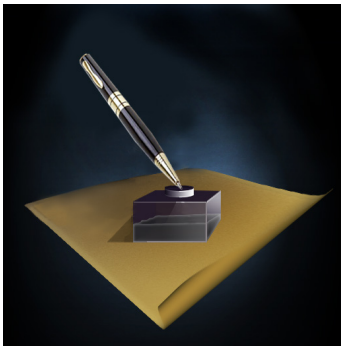

Introductory note

Ensuring inclusiveness and reducing inequality within and among countries is one of the important pillars of 2030 Sustainable Development Goals (SDGs). The SDG 10 calls for reducing inequalities in income as well as those based on age, sex, disability, race, ethnicity, origin, religion or economic or other status within a country, and among countries.

The UNESCAP study *Inequality in Asia and the Pacific in the era of the 2030 Agenda for Sustainable Development* finds that "unequal access to basic opportunities has left large groups of people behind and contributed to widening inequalities of outcomes, particularly in income and wealth. In turn, these inequalities have aggravated inequalities in access to health care, education, technology, and protection from natural disasters and environmental hazards – creating hardship for communities and families over generations."

Innovative technological applications have demonstrated potential to benefit the poor and deprived sections of society. For example, India's banking and financial sector is increasingly using blockchain and artificial intelligence to better access and serve the previously excluded or underserved population. The applications ensure faster payment, fraud detection, enhanced security and privacy in financial transactions. Grassroots innovations offer promising applications which can be scaled up to solve problems of local communities. Bamboo-based building materials, greenhouses and bio-factories to produce organic manure are some applications promoted to enhance the livelihoods of poor farmers of Nepal. In India, potential grassroots innovations are being popularized to enhance the skill and income of the rural population.

The role of technology to reduce inequality largely depends on the capabilities of the poor to access and use the technologies that respond to their needs. Therefore, empowerment of the poor and vulnerable sections of society is critical. For lower-income and vulnerable groups to benefit from modern technologies, Governments can introduce targeted technology and innovation programmes to address their specific needs and challenges. Such efforts would also require strategies to attract investment into important development sectors like sanitation, rural livelihoods, agriculture, clean energy, affordable housing, and financial inclusion.

This issue of *Asia-Pacific Tech Monitor* discusses the challenges, opportunities, strategies and best practices to harness innovative technologies for ensuring inclusiveness and reducing inequality in the Asia-Pacific countries.

Michiko Enomoto
Head, APCTT-ESCAP

ASIA-PACIFIC

BANGLADESH

Policy on nanotechnology for profitable agriculture

The cabinet approved the draft of 'The National Agriculture Policy 2018' incorporating nano-technology to control disease and determine generic nutrition. Some new issues have been incorporated in the draft of the new policy including research on agriculture development, technology transfer and agriculture extension, mechanisation, specialised agriculture, ICT, marketing of agricultural products, women empowerment and nano-technology, Cabinet Secretary Mohammad Shafiul Alam told journalists after a cabinet meeting.

About the nano-technology in the agriculture sector, the Cabinet Secretary said, primarily nano-technology will be used to identify diseases in crops, determine the demand of generic nutrition and increase the capability of collection of nutrition. Besides, sensor-technology will be used to examine the quality of land, he said. The approval was given at the weekly meeting of the Cabinet held at Bangladesh Secretariat with Prime Minister Sheikh Hasina in the chair.

The policy aims to ensure profitable agriculture and nutrition and food security in the country, he said. "The new agriculture policy has been formulated incorporating some new issues following the expiry of the Agriculture Policy 2013," he said. Shafiul Alam said, "The main goal of the policy is to ensure food security and socio-economic development through productivity of crops, boosting production and raising farmers' income, diversifying crops, producing safe foods and developing marketing system, profitable agriculture and use of natural resources."

https://www.thedailystar.net

CHINA

R&D spending

Chinese companies' innovation spending increased 34.4 percent over 2017, or nearly three times the overall growth rate among 1,000 global innovative companies listed by consulting firm PricewaterhouseCoopers (PwC), according to the latest report. The report by PwC's Strategy& showed that in 2017, total research and development (R&D) spending by the Global Innovation 1000, the 1,000 largest global public companies by R&D spending, reached 781.8 billion U.S. dollars, up by 11.4 percent.

A total of 145 Chinese companies are on the list in 2018, up by 20 year on year. The companies' R&D spending reached 60.08 billion dollars. Among "high-leverage innovators," defined by the report as companies that outperform the industry financially while spending less on R&D as a percentage of sales, Chinese companies make up 17 percent of the group. That presents a big contrast of only 3 percent in 2007, the report said.

The report also noted that China and Europe are the only regions that saw high-leverage innovators increase in recent years. One reason for China's rise as an R&D leader is simply the vibrancy of the country's economy in the 21st century, said Patrick Hui, a partner with PwC China. Companies headquartered in China lead other regions by similar margins on indicators such as their executive team's involvement in innovation strategy and company-wide cultural support for innovation programs, Hui said.

According to the National Bureau of Statistics, in 2018, China's production in high-tech industries, strategic emerging industries and the equipment manufacturing sector expanded by 11.7 percent, 8.9 percent and 8.1 percent, respectively.

http://www.xinhuanet.com

Draft foreign investment law

China came one step closer to finalizing the draft of a streamlined foreign investment law that would assure foreign companies of treatment that is fair and equal to that of domestic enterprises and promote the opening of the domestic market. One month after the first round of deliberations, the Standing Committee of the National People's Congress, China's top legislature, conducted a two-day meeting to review the draft law.

Lawmakers aim to prevent unfair policies and to provide a sound market environment for foreign companies. After comments from foreign companies and foreign chambers of commerce are collected, the revised draft will be submitted to the second session of the 13th NPC in March for final approval.

Adding such a special discussion on a draft law is unusual for the country's top legislature, especially within a short period. The move reflected China's intention to accelerate the lawmaking process and strengthen foreign investors' confidence amid the risks of global economic slowdown, analysts said.

The draft law stipulates the protection of intellectual property rights of foreign investors and companies and encourages technological cooperation "based on a voluntary basis and business rules". The conditions of technological cooperation should be settled by all the investors themselves on a fair basis. Government officials cannot use administrative methods to force technology transfers, according to the draft law.

The revised version added three clauses to improve the management of foreign investment. New regulations include stipulations that foreign investors that merge with Chinese domestic companies should agree to anti-monopoly investigations if required in accordance with the law. A new system for reporting investment information will be launched, according to the revised draft law. If foreign companies refuse to provide the required information, administrative penalties from 100,000 yuan ($14,890) to 500,000 yuan will be charged.

The draft also clarified that foreign companies should be regulated by the same laws that govern Chinese companies, except in prohibited industries. The streamlined law will replace three separate laws for foreign equity joint ventures, contractual joint ventures and foreign wholly owned ventures. The streamlined foreign investment law will use measures prescribed in the company and partnership enterprise laws to regulate foreign investment enterprises.

"The new law will be the foundation to promote, protect and manage foreign investment in China," said Wang Xiang, deputy head of the Office for Economic Law of the NPC's Legislative Affairs Commission. Some foreign companies will need to reorganize their business structure as required by China's Company Law. "They think the changes are acceptable, according to foreign companies' feedback so far," said Wang.

As for profit, investment returns and compensation that foreign companies earn in China, they can freely be transferred abroad in renminbi or foreign currency, the draft law says. The draft law further explains the principle of pre-establishment national treatment with a negative list. It means foreign investment receives treatment equal to that of Chinese companies in all phases, with the exception of special industries where market access is forbidden.

The negative list is issued by the State Council, the country's Cabinet. The current version, updated last year, sets out 48 areas where foreign investment is barred. With an expected improvement in the business environment after the new law's debut, analysts forecast that China's FDI will keep growing. The new law will also support more flexible policies for global companies operating in pilot free trade zones or free trade ports, said Ma Yu, a researcher at the Chinese Academy of International Trade and Economic Cooperation in Beijing.

http://global.chinadaily.com.cn

US patent holdings in 2018

Chinese inventors received a record number of US patents in 2018 and are on pace to overtake Germany in the No 4 position of top recipients, according to an analysis of filings with the US Patent and Trademark Office. Inventors working for Chinese companies were issued 12,589 US patents in 2018, a 12 percent jump on the year and a 10-fold increase over the 1,223 they received a decade ago. The US still dominates the field, with 46 per cent of the 308,853 US utility patents issued last year, followed by companies based in Japan, South Korea and Germany.

International Business Machines (IBM) alone received 9,100 patents, retaining its spot as the top recipient and extending IBM's streak to 26 years, according to the analysis by Fairview Research's IFI Claims Patent Services. Overall, the number of patents issued by the patent office declined 3.5 per cent for the year, with every major country except China receiving fewer patents than the year before.

The steady rise in patent filings suggests Chinese companies are developing their own technology as well. The US patent office has a process to challenge patents filed based on stolen ideas, although few such proceedings have been filed against anyone.

https://www.business-standard.com

INDIA

FDI data analysis to boost tech transfer

The Centre is analysing foreign direct investment (FDI) inflows to introduce specific provisions in the new industrial policy and the FDI Policy for ensuring such funds result in enhanced technology transfer, local value-addition and innovation. The discussion paper on a future-ready industrial policy had already recommended a review of the current FDI regime.

The analysis is being done with the help of 'Invest India' — the government's investment promotion and facilitation agency. According to the August 2017 discussion paper by the Department of Industrial Policy and Promotion, while the FDI policy had largely aimed at attracting investment, "benefits of retaining investments and accessing technology have not been harnessed to the extent possible." It said the "FDI policy requires a review to ensure that it facilitates greater technology transfer, leverages strategic linkages and innovation." As a long-term measure, the paper pitched for an FDI regime that balances short-term and long-term benefits of inward and outward investments. It said in the medium-term, what should be looked at is, "How can the FDI policy channelise investments into the potential sectors to increase domestic value addition, strengthen (global) linkages and enable brand building?"

In the current FDI policy, the explicit condition specifying that "value addition facilities are set up within India along with transfer of technology" is limited to 'mining and mineral separation of titanium bearing minerals and ores' where 100% FDI is allowed through the government-approval route.

There have been concerns regarding an overweening emphasis on the quantum of FDI and not as much focus on the quality of the funds. A recent study initiated by the Institute for Studies in Industrial Development and conducted by K.S. Chalapati Rao and Biswajit Dhar found that "it was acquisitions which provided the sustenance for the rise in (FDI) flows during 2016-17," raising doubts about capacity addition.

India received record FDI inflows of $60.1 billion during 2016-17. Referring to (the Centre's) 'Make In India' sectoral achievement reports, the study said they were "lacking close scrutiny of the reported (FDI) inflows or the nature of foreign investments" — including whether the inflows were for greenfield projects, mergers and acquisitions or for other purposes.

The study said "companies have been allowed to not disclose crucial information on foreign exchange transactions, capacities, production, etc., which limits the ability to analyse corporate performance." Instead, the potential of various filings by the corporates to different official agencies should be exploited fully, it said.

https://www.thehindu.com

NEPAL

World Bank supports renewable energy

The World Bank today approved the Strategic Climate Fund (SCF) grant amounting to $5.61 million and SCF loan in the amount of $2 million to help Nepal diversify its energy sources to renewables. The SCF grant and credit support the private sector-led Mini-Grid Energy Access Project, which aims to mobilise energy-service companies in selected regions of the country to

increase the capacity of renewable energy mini-grids, the World Bank said in a statement issued today.

"One component of the project will provide credit facility to the private sector to support renewable mini-grid sub-projects, and help this sector prosper and expand," said Subodh Adhikari, World Bank senior energy specialist and task team leader of the project. According to him, the second component will provide technical assistance to the mini-grid sector, energy-service companies and partner banks to ensure smooth and sustainable implementation.

The project is aligned to the efforts of the government of Nepal to address barriers to private sector participation in the renewable energy mini-grid sector and aims to address these barriers by successfully demonstrating new approaches that will promote public-private partnerships. Similarly, private entities and cooperatives will be mobilised to provide electricity services to rural areas as 'energy service companies (ESCOs)'. These specialised ESCOs will crowd-in the necessary technical expertise and financing capacity to develop, build, own and operate renewable mini-grid projects. They will have access to better credit terms and stronger project development support through project.

"This project will tap into the vast business opportunities and technical potential for the private sector to provide more efficient and sustainable energy services in Nepal," said Faris Hadad-Zervos, World Bank country manager for Nepal, adding that it is directly linked to the government of Nepal's effort for greater private sector management and commercial financing through public- private partnerships, and the World Bank's mission of maximising all financial opportunities for development.

Furthermore, the project aims to improve the overall energy supply situation in Nepal by promoting renewable energy solutions, including the opportunities to capture private sector efficiencies through PPPs.

While enhancing the market, the project ultimately aims to support rural residential and non-residential customers, who will gain access to new or improved energy services in rural areas through renewable energy mini-grids.

https://thehimalayantimes.com

PHILIPPINES

Innovative startups bill

The Bicameral Conference Committee tasked to reconcile the disagreeing provisions of the proposed Innovative Startup bill targeted ratification by Feb. 6. Parañaque-2nd district Rep. Gus S. Tambunting of the House contingent said the bill has "big chances" of being enacted before the 17th Congress adjourns. House Bill No. 8862, or the proposed Innovative Startup Act of the Philippines, was passed on third reading last week, with 179 affirmative and zero negative votes. Its counterpart measure, Senate Bill No. 1532, sponsored by Senator Paolo Benigno A. Aquino IV, was approved on third reading in May 2018.

The bills defines an innovative startup as a registered business entity "within the sixty months of its business operation," involved in creating an "innovative product, process, or business model." Among the provisions in the bills are the tax exemption on "income tax arising from the operation of the enterprise" and "value-added tax for the sale and lease of goods, properties or services arising in the course of trade or business of the enterprise or percentage tax," both carried in the Senate version.

If enacted, the consolidated bill will waive registration fees, expedite processing of business permits and required certifications, and provide grants in aid of research and development and expansion projects. It will also exempt startups from fees and charges levied by the national government for using equipment, facilities and other services availed of as well as subsidize visa applications, renewal and extension. A provision securing the intellectual rights of covered businesses is also present in both the House and Senate bills.

It will also establish an Innovative Startup Visa for foreign investors to be exempted from securing an Alien Employment Permit, as issued by the Department of Labor and Employment. The visa will be valid for a period of five years, but may be renewed or extended for another three years. Another provision in the Senate bill is the creation of a P10-billion Innovative Startup Venture Fund.

https://www.bworldonline.com

REPUBLIC OF KOREA

Pharmaceutical R&D spending

Major Republic of Korean drugmakers are set to expand their spending on research and development (R&D) this year, industry sources said. Top pharmaceutical firm Yuhan Corp. has decided to invest 160 billion won (US$143 million) to 170 billion won in R&D this year, about 10 percent of its sales target, according to sources. Yuhan spent an estimated 110 billion won on R&D last year.

Hanmi Pharm Co., which invested 19 percent of its sales in R&D last year, plans to spend some 15 percent to 20 percent of its revenue on research efforts, focusing on the development of new products, sources said. Other major firms in the industry, including Greencross Medical Science Corp. (GMSC) and Chong Kun Dang Pharmaceutical Corp., also aim to spend 10 to 20 percent of their annual revenue on R&D.

The proportion of investment in R&D out of total sales among South Korea's listed drug firms has been on a constant rise from an average 5 percent in 2006 to 9 percent in 2017, according to the Korea Pharmaceutical and Bio-Pharma Manufacturers Association.

https://en.yna.co.kr

SRI LANKA

Handlooms go hi-tech

Sri Lanka's textile and handlooms sector gets a major upgrade this year after many decades when a global technology platform used in complex patterns is presented to domestic craftsmen and designers this year. "I have been told that modern hi-tech can greatly increase the productivity of our high-quality handlooms" said the Minister

of Industry and Commerce Resettlement of Protracted Displaced Persons & Cooperative Development Rishad Bathiudeen addressing a progress review of many institutions under his Ministry on 17 January.

Jacquard machines are used by handloom designers to speed up their manual production looms' speed. Jacquard machines give the strength of power-looms to hand-loom machines by speeding up complex handloom designs using a punch card system.

"Our Sri Lankan handloom designers already use punch-card driven Jacquard machines handlooms for their production. However, these machines are not sufficient to meet the speed of today's handloom market. The Textiles and Handlooms Development Division of the Ministry therefore will replace these punched card machines to digital, computerised Jacquards. I have been told that this modern hi-tech can greatly increase the productivity of looms and appeal of the design" said Minister Bathiudeen.

http://www.dailynews.lk

VIET NAM

High-tech FDI for development

Viet Nam would continue encouraging foreign investments in the long term, with focus on high-tech projects and modern governance in a move to expand export markets, join global supply chains and enhance competitiveness. Deputy Minister of Planning and Investment Vũ Đại Thắng made the statement at a conference titled 'Future outlook of FDI attraction and implementation' held in the northern province of Vĩnh Phúc.

According to Thắng, after three decades, FDI has become an important part of Việt Nam's economy. As of November 2018, the country was home to some 27,000 FDI projects worth nearly US$340 billion of registered capital and $188.8 billion of disbursed capital of investors from 128 countries and territories. Up to 57 per cent of the total was invested in industry.

FDI was an important source of the country's total social development investment capital as its proportion increased from 15 per cent in 2005 to 23.7 per cent in 2017, Thắng said, adding the resource had been also the driving force of the country's economic growth in recent years. "The growth rate of FDI firms reached 12.6 per cent in 2017, the highest in all economic sectors. The force contributed 27.7 per cent to the country's economic growth in the 2010-17 period, compared with 15 per cent in the 1986-1996 period," Thắng said.

In addition, FDI has also contributed to promoting the country's economic restructuring and forming some key industries of the economy such as telecommunications, petroleum, electronics and information technology. Besides, he said, FDI has also made an important contribution to the country's export growth in recent years.

Since 2010, the export growth rate and export turnover of FDI firms have been two to three times and 1.5-2 times higher than that of Vietnamese firms, respectively. The export value of FDI accounted for 72.5 per cent of the country's total export revenue in 2017, surging sharply against 17 per cent in 1995.

https://vietnamnews.vn

Programme for student-led innovation

Students at the HCM City University of Technology and Education present their innovative ideas on generating material from eggshells for an air purifier in the final showcase of a five-month programme following the EPICS curriculum model, an internationally recognized model of service learning where students not only learn by doing, but also by creating.

Three student teams at HCM City University of Technology, HCM City University of Technology and Education, and Đà Nẵng University of Technology won prizes in this year's Engineering Projects in Community Service (EPICS) contest. Students at HCM City University of Technology developed an anti-theft alarm for improved public safety, while the team at HCM City University of Technology and Education made a smart walking cane for the elderly. Students at Đà Nẵng University of Technology also make a smart walking cane which can help the blind to walk.

EPICS is an international award-winning, design-based, service-learning programme founded at Purdue University in 1995. During EPICS, student teams partner with a community organisation to design, build and deploy systems to solve engineering-based problems. The program guides student teams through design innovation, team management, testing, and presenting in technical English. EPICS projects span the spectrum, including finding solutions to challenges in human health care, energy, sustainability, and more. More than 150 participating STEM (Science-Technology-Engineering-Maths) students from six engineering and technology universities on January 18 presented their innovative ideas in the final showcase of the five-month programme following the EPICS curriculum model.

EPICS is a model of service learning where students not only learn by doing, but also by creating. This is the third EPICS programme held in Việt Nam and the second year of collaboration with the Dow Vietnam STEM Program which provided funding for students' projects, faculty support, and industry-based mentoring to ensure the success of more than 150 students and the 27 competing student teams.

Working together, the United States Agency for International Development's (USAID) Building University-Industry Learning and Development through Innovation and Technology (BUILD-IT) Alliance, Arizona State University and the Dow Vietnam STEM Program support student-led innovation and service learning at Vietnamese universities. The USAID BUILD-IT Alliance is a five-year public-private partnership founded to support world-class engineering programs and create work-ready graduates in Việt Nam. The Alliance has over 16 industry partners and 11 Vietnamese university partners. Collaboration between the Alliance members strengthens university-industry linkages, and introduces project-based learning programs such as Engineering Projects in Community Service into Vietnamese STEM programs.

https://vietnamnews.vn

Technology Scan

Technologies for inclusiveness and sustainable development

ASIA-PACIFIC

AUSTRALIA

AI platform for agriculture analytics

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has launched a new artificial intelligence-powered platform that brings together a trove of land-use data for agribusiness to better predict performance. The Rural Intelligence Platform combines a variety of technology developed by CSIRO over the years, including the Digital Soil Map and satellite imagery analysis, to comprehensively assess and monitor rural land anywhere across the country.

To do so, RIP takes into account elements like access to water, crop types, rainfall, drought impact, yield and historical productivity. Climate information is also interpreted to show how drought, frost, and heat stress for livestock are likely to impact on farmers.

The platform combines all of these features using machines learning, and incorporates an AI-initiated Automation Valuation Model - the same technology used by real estate agencies to gain a quick, relatively accurate estimate of a residential property's value - that the CSIRO said has can instantly value rural properties with up 90 percent accuracy.

Digital Agricultural Services (DAS), a collaborator on the project that was established in partnership with the CSIRO in 2017, estimates $125 billion in agricultural economic decisions in Australia each year are based on unreliable or incomplete data. DAS has already worked with several companies to pilot the platform, with strong interest coming from the property, financial services and insurance sectors.

https://www.itnews.com.au

CHINA

Technology purifies rural wastewater

A Chinese high-speed train maker has used its toilet technology to treat rural sewage. In a demonstration project in Sanxing Township on the island of Chongming in Shanghai, a bio-active filter integrated purification tank developed by CRRC Corporation Limited, China's largest high-speed rail carriage maker, has been installed underground about 10 meters away from two rural houses.

Domestic sewage from the two families is gathered by gravity flow and treated with a microbial anaerobic-aerobic process, then goes through a deep treatment with a bio-active filter in the tank. After treatment, the sewage has been turned into clear and odorless water, which has been tested as meeting Shanghai's first-class standard of discharged water, suitable for irrigation and supplementing natural water.

The CRRC-developed purification tank wirelessly provides real time data on its operating conditions and decontamination results to a village control room, which means any technical issues or faults can be identified and remotely fixed in a timely fashion. "The secret of the purification tank is the bio-active micro flora that eat the dirty stuff in sewage," said Ni Xiaohong, 25, a sewage treatment worker in Chongming.

Yang Zhen, vice general manager of Shandong Zhongche Locomotive Co. Ltd. Shanghai Branch, said the biological purification tank is based on the vacuum-drainage and biotechnology integrated treatment devices used in toilets on high-speed trains. Pilot projects of similar decentralized rural domestic sewage treatment equipment have been launched in over 20 provinces and regions across China since 2015, he said.

A small purification tank can be installed in one day. It can deal with at least one ton of sewage a day, enough for treating daily discharge from two to three families. The treated water can be sluiced directly into streams. Yang said the tanks address the needs of household sewage treatment for people living in remote areas.

The Chongming District government has set the target to achieve full coverage of rural domestic sewage treatment by 2020. In some villages, drones are used to monitor water pollution. It plans to introduce the CRRC-developed sewage tanks for isolated households. For densely-populated villages, centralized treatment like Shanghai Electric's container-size sewage treatment station using micro-dynamic high-efficiency biofilm technology can meet the needs of sewage purification for up to 200 households.

http://www.xinhuanet.com

Big data tech to aid children, elderly

Guizhou Berkeley Big Data Innovation Research Center (GBIC) launched two public welfare campaigns using big data technology to benefit left-behind children and elderly people. The center announced the campaigns on Saturday during the 2018 China international big data industry expo in Guiyang, capital city of southwest China's Guizhou Province.

The center will use big data to perform online diagnosis of 100,000 cataract patients in Guizhou. The program, which lasts three years, aims to make up for the lack of professional ophthalmologists in remote and poor counties in the province, the center said. Another program targets 40,000 left-behind children whose parents are migrant workers. The center will develop software to test the children's psychological health and learning abilities, and offers remote education functions. The program is also designed to help 4,000 elderly people in Guizhou.

The GBIC was jointly launched by Msweeky-data, in cooperation with the University of California at Berkeley, electronics department of the Ministry of Industry and Information Technology, and the Guiyang City government. The center targets regional social problems using big data.

http://www.xinhuanet.com

INDIA

Solar lighting of villages

Solar DC Inverterless Technology, pioneered by Indian Institute of Technology Madras Researchers, is lighting up homes in remote parts of the country where the terrain is so foreboding that they are beyond the reach of Electricity Grids. Cygni Energy

Private Limited, an innovative Solar-DC solutions startup that was incubated by the Rural Technology Business Incubator (RTBI) of IIT Madras, is now installing 3,026 units in villages located high up in remote corners of Manipur and another 25,000 units Solar inverters and lights in the villages of Assam.

Speaking about the importance of this Project, Ashok Jhunjhunwala, Institute Professor, IIT Madras, who lead the research on this technology, said, "It is of great importance that we have played major a role in taking power to remote villages in Manipur, Assam, Meghalaya and J&K. Solar-DC system makes the equipment much smaller in size and cost. It has helped us in these difficult terrains where carrying anything would have been difficult. Powering homes with DC power-line reduces the power-consumption and would be increasingly deployed with solar in urban and rural India homes."

The Manipur Project, taken up at a cost of Rs.11.5 crore, was funded by Manipur Renewable Energy Development Agency. Installation has been completed in 2,800 Homes. Most Beneficiaries are situated in remote, inaccessible mountainous regions of Manipur. This project resulted in electrthe ification of 96 villages in places such as of Senapati, Ukhrul, Churachandpur, Chandel, Phrezawl, Thoubal and Tamenglong.

With Solar-DC solution, people are able to use power for 8 hours t full load and close to 12-14 hours in reserve mode [only basic appliances like bulb and mobile chargers]. IIT Madras worked closely with Cygni to develop Inverterless technology. This product was built ground up with high efficiency and affordability in mind.

The Solar-DC Inverterless technology, conceptualised and ideated by IIT Madras, uses complete DC solutions to remove AC to DC and DC to AC conversions. Removing the need of conversion helps in saving 30% to 40% of energy. This later provides more power backup with lesser size of batteries and solar panel which thus also contributes in reducing the cost of the system. The Solar DC products are designed and developed in such a way that it can be easily installed in off-grid or near off-grid homes. This solution can also be seamlessly integrated with the AC grid power supply providing 24x7 power backup.

https://www.edexlive.com

Technology for disinfecting water

Scientists at the Council of Scientific and Industrial Research's Lucknow-based Indian Institute of Toxicology Research (CSIR-IITR) have developed a technology for disinfecting water that promises to provide safe and clean drinking water at a very low cost. The technology is based on the principle of anodic oxidation. Raw water is passed through a chamber and disinfection occurs with the help of singlet oxygen species generated at the anode. The technology has been named Oneer – 'O' for singlet oxygen species and `neer' for water. The know-how has been transferred to a Delhi firm, Bluebird Water Purifiers. The technology is modular in design and can be used both at domestic and community level.

A senior CSIR official noted that a key feature of the technology is that purified water will retain all essential minerals and there will be no wastage as it happens in reverse osmosis (RO)-based purifiers. In addition, there will be no need to add any chemical and the water can be stored for around 30 hours without the risk of any recontamination.

The community model will have in-built smart sensor system that will provide real-time information of all operational steps. It also provides for auto self-cleaning of the system after fixed number of cycles depending on water quality. The system consumes only around one unit of electricity per 5,000 litres of water and can be operated with solar power as well. The domestic model can be used at homes, street food vendors and small shops, while the community model is suitable for schools, hospitals, restaurants, bus/railway stations and rural community centres.

The water purifier can eliminate disease-causing pathogens such as virus, bacteria, fungi, protozoa and cyst to provide safe drinking water as per national and international standards, CSIR officials said.

https://www.thehindubusinessline.com

Removing arsenic from drinking water

Researchers at Assam's Tezpur University have developed and patented the filter that removes arsenic and iron from drinking water. It has been making a difference to the lives of thousands of people across the state by providing them access to clean drinking water they did not have until a few years back.

High amounts of arsenic, a poisonous contaminant that can cause diseases like cancer, have been detected in Assam's 29 of the 33 districts. The World Health Organisation (WHO) recommends a maximum of 10 ppb (part per billion) of arsenic in drinking water. A Tezpur University research found 990 ppb of the carcinogenic agent in a tubewell in Mazgaon. "Concerned about the situation, we began our research in 2005 to find an easy and cheap solution that would benefit poor people in rural areas," said Tezpur University professor Robin Kumar Dutta.

Dutta and his team tried finding a new method as several existing methods of removing arsenic like reverse osmosis were found to be ineffective for use in rural areas of developing countries due to high cost, use of electricity etc. Dutta said a Japanese firm has approached them for exclusive rights to produce the filter commercially. "But as that would make the method costly and out of reach of poor people, who we want to benefit, we rejected the offer."

Dutta's team developed the filter in 2010, which involves treatment of contaminated water using small quantities of cooking soda, potassium permanganate and ferric chloride. The results were impressive. The process was able to remove arsenic content from as high as 1,000 ppb to less than 2 ppb or to the undetectable levels. "…(The filter) is very effective as, unlike other available methods, it does not use electricity and removes arsenic and other heavy metals at very lost cost," said Manoranjan Nath of Tezpur-based North Eastern Regional Institute of Water and Land Management (NERIWLM).

NERIWLM did the third party technical evaluation of Arsiron Nilogon using various samples of groundwater with high arsenic content (between 500 ppb and 250 ppb). It found the filter was able to bring it down to single digits – below the WHO's recommended levels.

https://www.hindustantimes.com

PAKISTAN

Arsenic water filter

Scientists at the University of Agriculture Faisalabad (UAF) examined many natural biowastes for arsenic removal and finally discovered that chemically modified "xanthated watermelon rind" is the best to catch arsenic usually found in abundance in groundwater across many parts of the world.

According to the research published in *Science of the Total Environment*, the filter proved to be effective to clean the water from arsenic by up to 95 per cent. The research to utilise xanthated water melon rind was performed under supervision of Dr Nabeel Khan Niazi by his PhD student, Muhammad Bilal Shakoor, at the UAF. Niazi and his team won the funding from the Grand Challenges Canada – Stars in Global Health in 2014 to develop the technology.

Dr Niazi said that high-tech arsenic filters cost around 20 to 25,000 rupees or more but the watermelon rind arsenic filter will only cost Rs5,000 to Rs6,000 and it can work for six to eight months. The developed prototype can treat 20 liters of water a day.

The watermelon rind is washed to remove dirt and heated to dry in sunlight and oven. The dried rind is then turned into powder in an electric grinder. Xanthated watermelon rind's next phase is fine example of chemistry as the powder is treated with sulfuric acid, which opens the biopolymer rings of the material and exposes many surface functional groups for reaction. The UAF team then treated it with Carbon disulfide – as sulfide has a unique quality to bind arsenic from water and the xanthated watermelon filter material is almost ready.

The team tested many water samples collected from different parts of the country and the material was found very promising to embed in the filter.

https://tribune.com.pk

EUROPE

Tools to improve farm nutrients

EU-funded researchers have developed new mapping tools and services to help farmers better manage the application of nutrients and water to their fields and promote sustainable agriculture. Sustainable agriculture means optimising the yield and income of farms with a minimum of inputs like irrigation water, nutrients, energy, pesticides and herbicides. The FATIMA project addressed these challenges by developing operational large-scale precision farming tools and creating a dedicated stakeholder community.

Researchers worked with farmers, managers and decision makers in the agribusiness sector, developing a series of maps ranging from the farm to river-basin scale. The project developed precision farming tools using Earth Observation data and wireless sensor networks tailored to local needs and deployed them on the ground.

"We created high-resolution maps for determining nutrient and water requirements, so farmers can fine-tune the amount of inputs they actually need to avoid over-fertilisation and save water," says project coordinator Prof. Alfonso Calera. In arid La Mancha, Spain, for example, partners focused on ensuring efficient water and fertiliser use, while in Marchfeld, Austria a key concern was water quality problems due to intensive agriculture. Thessaly in Greece has been declared a vulnerable region due to groundwater nitrate pollution.

The developed multisensor constellation built by the COPERNICUS satellites Sentinel 2a and 2B, complementary with Landsat 8, offers a unique tool for providing 'intelligence' for implementing operational Variable Rate Fertilization. Its main characteristics include high temporal repetitiveness, which makes it possible to follow the vegetation during the critical stage revealing the soil/water/nitrogen interactions. In addition, its high spatial resolution (10 m) is adapted to the spatialised application scale of fertilisers and it has an interesting spectral content for the characterisation of the nitrogenous status of plants.

FATIMA also explored farmers' preferences and willingness to adopt new mapping technologies in the short-term, as well new production methods over the longer term. According to Prof. Calera: "We conducted surveys and focus groups on seven pilot areas and analysed results relating to both short-term and long-term strategies." This led to the identification of specific conditions deemed essential for FATIMA services to flourish following project completion. "These include successfully demonstrating and validating tools by core users, achieving a critical mass of committed users as well as recognition and support by policy and decision makers," claims Prof. Calera.

https://phys.org

Portable solar energy system

Most people without access to electricity live in regions with very good or excellent solar conditions but must pay a disproportionate amount of their income for energy. In Europe, rural, mountainous and remote regions make a significant contribution to the economy. These regions require a low carbon, cost-effective system to support smart grids capable of reducing the development gap between them and urban areas.

The Horizon 2020 SUNINBOX project has addressed these challenges and developed a standalone, easy-to-install, photovoltaic generator where all the equipment is configured in the factory ready for use as a portable 'plug and play' system. "All the component parts necessary for generating electricity, like electronic systems, battery packs and the solar tracker can be packed into a standard 20-ft shipping container for easy transportability," says project coordinator Sergio Hernández-Bazan.

Currently, SUNINBOX possesses an inverter power capability of up to 90 Kilo-volt-amperes (kVA) to change direct current, DC, power from the lithium ferro-phosphate battery system into conventional mains alternating current, AC, for operating electric lights, electrical devices and so on. "The mixed configuration allows optimal management of the solar resource, both for direct consumption and storage," explains Hernández-Bazan.

Project partners employed a highly innovative telescopic solar tracker to orientate the solar panels towards the sun. According to Hernández-Bazan: "A geolocation system allows the tracker to position and deploy the entire photovoltaic field semi-automatically according to its location. This

takes less than 10 minutes and the system is ready for use in less than 30 minutes."

Researchers developed SUNINBOX with two types of markets in mind. The first is rural areas in southern Europe with high levels of solar radiation and large numbers of farms employing irrigation. "With regards to irrigation, energy represents around 40 percent of total water costs, so water use, and energy costs cannot be considered independently. SUNINBOX therefore represents a realistic alternative for increasing energy use efficiency for irrigation," Hernández-Bazan claims.

The second market for the device is remote smart energy grids and rural electrification projects in Africa and Latin America. Here SUNINBOX's portable system can supply power to support local development in areas where solar radiation is very high, but accessibility to the local electricity grid is difficult. To date, energy in such areas is obtained using diesel generators, but now SUNINBOX can lower the cost of energy while producing no carbon dioxide. «In Africa, the cost of energy with our system is EUR 0.3 /kWh compared to more than EUR 0.5 /kWh using diesel generators,» points out Hernández-Bazan.

The SUNINBOX system guarantees a continuous supply of electricity along with low operating and maintenance costs via a highly efficient portable PV system. The system is 35-45 percent more efficient than its competitors, thanks to the solar tracker, which reduces payback period.

Hernández-Bazan concludes: "It is the best option for NGO projects, which need cost-effective, reliable equipment for refugee camps, areas hit by natural disasters, or anyone who has difficulty accessing an electricity grid and/or wants to reduce their carbon footprint." In addition, SUNINBOX will benefit installation companies, as well as companies in general dedicated to the photovoltaic sector.

https://phys.org

NORTH AMERICA

USA

AR Tool for Remote Health Care

Purdue University researchers have developed augmented reality (AR) tools that allow experienced surgeons and physicians around the world to help less-experienced doctors in war zones, natural disasters, and rural areas perform complicated procedures. The Purdue technique involves using AR tools to connect health care professionals in remote areas with more experienced surgeons and physicians around the world. The AR headset worn by the mentee in the field is designed to replace current telestrator technology, which uses a separate video screen and freehand sketches to provide feedback.

"There is an unmet need for technology that connects health care mentees in rural areas with experienced mentors," said Edgar Rojas Muñoz, a doctoral student in industrial engineering who worked on the project. "The current use of a telestrator in these situations is inefficient because they require the mentee to focus on a separate screen, fail to show upcoming steps, and give the mentor an incomplete picture of the ongoing procedure."

The Purdue system features a transparent headset screen display that allows mentees to see the patient in front of them, along with real-time on-screen feedback from the mentor. That mentor is at a separate location using a video monitor to see the AR feed and provide instant feedback to the field surgeon. Purdue's system uses computer vision algorithms to track and align the virtual notes and marks from the mentor with the surgical region in front of the mentee. "Our technology allows trainees to remain focused on the surgical procedure and reduces the potential for errors during surgery," Muñoz said.

https://www.photonics.com

AI to guide, support cancer patients

Artificial Intelligence is helping to guide and support some 50 breast cancer patients in rural Georgia through a novel mobile application that gives them personalized recommendations on everything from side effects to insurance. The app, called MyPath, adapts to each stage in a patient's cancer journey. So the information available on the app – which runs on a tablet computer – regularly changes based on each patient's progress. Are you scheduled for surgery? MyPath will tell you what you need to know the day before.

In January MyPath was recognized by iSchools, a consortium of some 100 institutions worldwide (including Georgia Tech) dedicated to advancing the information field. The work was also honored in 2016 when it was featured in a report to President Barack Obama by the President's Cancer Panel. The report, Improving Cancer-Related Outcomes with Connected Health, aimed to "help patients manage their health information and participate in their own care," according to a Georgia Tech story at the time.

MyPath begins with a mobile library of resources compiled from the American Cancer Society and other reputable organizations. Then, it is personalized with each patient's diagnosis and treatment plan, including the dates for specific procedures. Patients also complete regular surveys that help inform the system – and caregivers – of their changing needs and symptoms.

The result is a system that provides each patient with resources and suggestions specific to their personal situation. Because MyPath knows, for example, that you have stage 2 breast cancer and will be undergoing a lumpectomy on a specific date, when you click on the category "Preparing for Surgery" it will suggest relevant articles to prepare you for what's ahead. Have you reported nausea in the system's survey? MyPath will bring your attention to resources that can help combat the side effect. The system also provides quick access to contact information for specific caregivers.

MyPath is the second generation of the app. Patient feedback from its predecessor, My Journey Compass, led to changes including the personalization. Development continues. For example, Mynatt's team is hoping to expand the app for use by cancer survivors, who often face additional challenges like hormone replacement therapy. The team is also working on a version that individual patients could download, which would make the app available to many more users.

http://www.rh.gatech.edu

Use of Blockchain and Aritificial Intelligence to promote financial inclusion in India

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Abstract

The financial sector covers five broad functions. These are to (i) make and receive payments, including across borders; (ii) save to be able to consume or invest later; (iii) borrow to be able to consume or invest now; (iv) manage risks to income, savings, and transactions; and (v) receive advice on all above. Fintech may spur efficiency gains in the financial sector, offer better and more targeted products and services, and deepen financial inclusion in the developing world. However, it may also pose risks if its application undermines competition, trust, monetary policy transmission, and financial stability. This article examines the potential of Distributed Ledger Technologies (DLTs) and Artificial Intelligence (AI) in financial inclusion. DLT coupled with AI can be beneficial in the domains of control, security and privacy in financial transactions and financial inclusion.

Fintech

The term financial technologies or 'Fintech' is used to describe a variety of innovative business models and emerging technologies that have the potential to transform the financial services industry (OICO-IOSCO, 2017). Innovative Fintech business models offer one or more specific financial products or services in an automated fashion through the use of the internet. Emerging technologies such as cognitive computing, machine learning, artificial intelligence, and distributed ledger technologies can be used to supplement both Fintech new entrants and traditional incumbents.

Alternative finance grew rapidly in the Asia Pacific region in 2016-17 with China an undisputed leader, followed by Australia, Japan, Republic of Korea, Singapore and India in the region. The Asian region is expected to fuel the growth in this sector as financial inclusion and quality access is an unfinished agenda, and mobile and internet penetration is increasing rapidly. In 2016-17, of the USD4.3 billion investment in the region, 45 percent of that amount is attributed to developments in China and 38 percent to India, with the rest for other countries.[1] Globally, two sectors that received most cumulative funding are payments (US$24.3 billion) and lending (US$ 13 billion). The Chinese fintech sector has shown phenomenal growth with relatively short maturity curve. A ranking of the world's most innovative fintech firms gave Chinese companies four of the top five slots in 2017. The most notable growth in mobile payments, online lending and investment. Extraordinary growth in Chinese fintech sector was due to a tech-savvy population, and an underdeveloped banking industry.

Singapore is fast turning into a major destination for investors and foreign industry players owing to extensive government support and expertise of corporate mentors. Indonesia is another country with fast growing fintech industry. It is the fourth largest mobile market in the world with 339.9 million connections and about 43% owns a smart phone and mobile is the preferred medium for internet access but very low levels of financial inclusion so far. The Republic of Korea boasts of a very vibrant fintech business and most notable growth is happening in payment related services and new banking platforms. In July 2017, the Republic of Korea created a separate ministry, Ministry of start-up to strengthen competitiveness and support innovation within the SMEs and start-up space in the Republic of Korea. Digital financial services is yet to make inroads in Thailand. Digital banking penetration in Thailand is close to 19 per cent — far from Taiwan's province of China 92 per cent and Singapore's 94 per cent. Credit card usage in Thailand stands at 3.7 per cent, compared with 51 per cent for Taiwan province of China and 31 per cent for Singapore.

The Indian Fintech industry, and especially payments vertical greatly benefited from digitization policy of government. AADHAR, envisaged to provide residents of India with a unique identity and a digital platform to authenticate anytime, anywhere has been the biggest enabler. It was widely adopted by all the players for customer on boarding and digital Know Your Customer (KYC) verification.[2] Unified Payments Interface (UPI), promoted by the National Payments Corporation of India (NPCI), is fully interoperable across all payments system players. It powers multiple bank accounts

1 2nd Asia Pacific Region Alternative Finance Industry Report (2017)

2 Due to the Supreme Court ruling, Aadhar can be used for E-KYC verification only by banks. See also: https://economictimes.indiatimes.com/wealth/p2p/how-will-the-sc-verdict-on-aadhaar-impact-online-lending-companies/articleshow/66144423.cms

into a single mobile application (of any participating bank), merging several banking features, seamless fund routing and merchant payments into one hood. The Digital India campaign and demonetization also substantially contributed to the growth of digital transactions. Sustained growth in smartphone penetration and internet connectivity also helped.

In recent times, payments, transfers and lending are receiving maximum attention in this space. Innovations in this category are targeted at improving the speed and efficiency of payments, clearing, and settlement, reducing cost and changing the ways people access financial services and conduct financial transactions. Technology can (i) reduce the need for financial intermediaries (specialized financial firms, banks and non-banks alike, that facilitate transactions between two or more parties); (ii) push intermediaries to change their internal structures (possibly leading to partnerships and acquisitions); (iii) induce the entry of new intermediaries while displacing older one. Technology can alter the market imperfections across the financial system, which underpin the need for trusted intermediaries. It can reduce asymmetric information (limited knowledge of one's counterparties to a transaction), facilitate the matching of parties to a transaction, and reduce transaction costs. Technology can also affect the incentives for intermediaries to be horizontally or vertically integrated (offer multiple services to end-users, as does a universal bank, or acquire upstream suppliers). Finally, technology can alter barriers to entry for new intermediaries to compete against incumbents.

In this context we look at two technologies: artificial intelligence and blockchain or distributed ledger technology and their impact on financial inclusion in India.

Artificial Intelligence

Artificial intelligence (AI) has been defined as the theory and development of computer systems able to perform tasks requiring human intelligence. The origin of AI goes back to the 1950s when Alan Turing published a paper on possibility of machines with true intelligence. AI has been defined as, "the scientific understanding of the mechanisms underlying thought and intelligent behaviour and their embodiment in machines" (Association for the Advancement of Artificial Intelligence, (AAAI).[3]

The array of technologies in AI includes audio processing, knowledge representation, speech-to-text, deep learning, expert systems, natural language processing, machine-learning (ML), robotics, and symbolic logic. It is a general purpose technology. Many of these have the potential to be applied in the fintech sector and promotion of financial inclusion. Their popularity picked up after 2011 when IBM, Microsoft, Google and Facebook started investing in AI and machine learning for commercial applications. The commonest use is via machine learning which is essentially understood as computers learn from data and can predict patterns in the data. It enables human-like intelligence and learning capacities to overcome the current limitations of capital and labour (Accenture, 2017).

Use of artificial intelligence in finance

Fintech companies are using AI applications to advance consumer protection and user experience, manage risk, detect fraud, etc. in the country. Other prominent areas of use include credit scoring, chat bots, capital optimization, market impact analysis, trade signaling, and 'reg tech' applications.

Customer support and helpdesk: Chat bots are increasingly being adopted by Indian financial organizations to increase efficiency and reduce cost of customer support – e.g. HDFC Bank's EVA (Electronic Virtual Assistant), City Union Bank's Lakshmi chatbot etc.

Fraud detection: Anomaly detection to prevent frauds and improve monitoring - e.g. National Stock Exchange intends to use machine learning to identify market patterns to improving monitoring and prevent manipulation of its high-frequency trading (HFT) markets.

Risk Management: More personalized products to clients based on historical data, risk analysis, minimizing human errors.

Security: AI-enabled cyber security systems to guard against and prevent possible security breaches.

Wealth management: Robo advisors that provide automated financial planning services like tax planning advice, insurance advice, health, investment advice etc.

HDFC uses AI for its Mobile Banking App, and OnChat, which uses Natural Language Processing where users can interact, confirm and pay for services within chat. It is also planning to develop AI solutions for Customer Support, Process Automation, HR, Security and Fraud Detection.

With respect to AI, the biggest hurdle to innovation and large-scale application is financial investment. Access to funding is a concern for many developers and those seeking to use applications. As pointed out by Accenture (2017), combinations of technologies, multi-variant data and interdisciplinary skills are quite often not in the possession of any single player. This could limit the market to few large players who could successfully navigate the landscape and could cause an oligopolistic market (Accenture, 2017). Hence there is a need to strengthen research and development in AI to ensure ease of entry and sharing of technological breakthroughs.

The Financial Stability Board (FSB, 2017) points out that the black box aspect of AI might also be problematic. There is lack of clarity with respect to ethical considerations, responsibility, governance and regulation in such applications. The rapid pace of adoption of AI in the industry calls for regulatory oversight and policy intervention. The possibility of an open source platform that shares AI frameworks and tools needs to be explored (Accenture, 2017). Integration of AI may also render

[3] https://aitopics.org/tag/artificial%20intelligence

many jobs obsolete but open up new ones. This warrants skilling of a future workforce and retraining of existing workforce. Most importantly, regulatory practices have to be stepped up to ensure that developments and innovations follow fair market practices. A range of legal issues related to privacy and data protection, consumer protection, anti-discrimination and liability issues, and cross-border issues may arise with further development in the industry.

Fintech companies are increasingly relying on Artificial Intelligence-based technologies to expand the unsecured loan business and tap clients who were previously unserviceable; however, it is too early in the day to assess how this is working.

Blockchain

Blockchain, "is a particular type of data structure used in some distributed ledgers which stores and transmits data in packages called 'blocks' that are connected to each other in a digital 'chain'. Blockchains employ cryptographic and algorithmic methods to record and synchronize data across a network in an immutable manner" (World Bank, 2017). Distributed Ledger Technology (DLT) also known as blockchain technology refers to a protocol that allows peer-to-peer transfer of assets over the internet. DLT is a novel way of sharing data across multiple data stores (or ledgers) (World Bank, 2017). The shared database allows peer-to-peer transaction without requiring a central authority.

This technology creates an immutable ledger of all activity across peer-to-peer transactions.[4] Transactions through the DLT are cryptographically logged in 'blocks' of data, which when verified by members of the distributed network, creates a permanent record of the transactions. The network is both a medium of transactions and a means of recording it, since the blockchain file belongs to all members of it (Botton, 2018). The peer-to-peer system means that information can only be modified by a majority of members, thus making it secure.

The technology is characterized by decentralized networks, absolute digitization, and real-time transfer. There are no intermediaries, and trustless exchange, maintenance of high quality data with reliability, longevity and immutability; process integrity and transparency; fast transactions enabling reduced costs required for settlement. The promise of tamperproof record-keeping and data security makes it possible for banks to transition from an independent ledger to a universal and encrypted distributed ledger system and also improve upon their product offerings. Distributed ledger technology can be used to execute transactions in real time by making irreversible/undeletable transaction entries into DLT copy which would be available to all participating entities.

There are five key components of a Blockchain: Cryptography,[5] Peer-to-peer network[6], Consensus Mechanism,[7] Distributed Ledger[8] and Validity rules.[9] Network participants can independently verify the state and integrity of a blockchain.

There are permissioned blockchain and permissionless blockchain: in the former, only authorized members are part of the network; here, it is possible to customize access control structures and consensus algorithms, that is, who can view what and who verifies what can be controlled. Permissioned blockchain has greater potential for adoption in the near future than permissionless chains.

Specific areas with the potential for application include: maintenance of KYC records, application of the DLT, Blockchain Cryptography and Smart Contracts.[10] The technology can successfully be applied in payment processes.[11]

Smart contracts: Smart contracts (computer programs) would be one of the most immediate applications in financial services. They would emulate regular contractual constructs and could be made partially or fully self-executing, self-enforcing, or both. Such smart contracts could replace standing instructions, electronic clearing service (ECS), etc.

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4 https://digitalchamber.org/assets/blockchain-and-financial-inclusion.pdfhttps://digitalchamber.org/assets/blockchain-and-financial-inclusion.pdf

5 A variety of cryptographic techniques including one-way hash functions ensures near full proof security. This is achieved by using public-private key combinations to generate the hash value so that information is visible to and can be processed only by the person for whom it is intended.

6 Equally privileged and capable participants in the blockchain.

7 An algorithm that determines the ordering of transactions in an environment that ensures the parties follow the protocol and prevent unethical practices. This helps maintain the single state of the transactions.

8 A list of transactions of assets grouped together in cryptographically linked "blocks"

9 A smart contract can be conceptualized as, "a computerized transaction protocol that executes the terms of a contract. The general objectives are to satisfy common contractual conditions (such as payment terms, liens, confidentiality, and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries" (Cong and He, 2018). Smart contracts are one of the most anticipated applications of blockchain technology. Smart contracts often emulate the logic of regular contractual constructs, and therefore, many kinds of contractual clauses can be made partially or fully self-executing, self-enforcing, or both. Payments Smart contracts can replace standing instructions, electronic clearing services and bill payments.

10 A common set of rules of the network (for example, what transactions are considered valid, how the ledger gets updated).

11 Ripple and Tangle are two other important DLTs. Ripple uses a consensus ledger to confirm transactions and is being used among banks as a worldwide payment system. Tangle was created for B2B models while Ripple simplifies settlement. Tangle's verification method removes transacting costs. Both are non-mineable. See https://stockhax.com/blog/distributed-ledger/

Authentication: Blockchain could also be used to authenticate identities and documents through a digital blockchain recorded version. This would have applications in KYC authentication, due diligence, etc. A central KYC is a related use case in which Blockchain can have a potential use.

Blockchain cannot be implemented in all use cases for digitization or to all transaction related problems. It is most useful when multiple parties share data and need a view of common information. Blockchain can be employed as an effective solution if at least three out of following prerequisites are met (PwC, 2018):

Multiple parties share data – Multiple parties need a common view of the information at hand.

Multiple parties update data - When actions undertaken by multiple parties need to be recorded and the data coming from multiple parties needs to be updated.

Requirement for verification - When it is necessary to build trust amongst parties and make them understand that their actions that are being recorded are valid.

Intermediaries add complexity - When a transaction is dependent on multiple intermediaries and their presence increases the cost and complexity of the transaction.

Interactions are time sensitive - When it is beneficial for the business to reduce delay and expedite a transaction.

Transactions interact - When transactions created by multiple participants interact and depend on each other.

The most important features of Blockchain with respect to payment processes would be reduced turnaround time (no more intermediary/ faster authentication), increased transparency, reduced costs and faster reconciliation. It also leads to reduced risks, data auditability and resilience. Transfer of value via blockchain takes approximately 10 minutes which might not work for retail payment in developed economies, but in developing countries, might increase the speed of transactions significantly. Reduction or elimination of operational and financial inefficiencies and other frictions including improved end-to-end settlement speed.

Use of blockchain/ DLT in finance

DLT and blockchain technologies are of immense importance to the financial services industry, because of which there is much interest in its use among stakeholders in the Indian Banking, Financial Service and Insurance (BFSI) industry. Currently, it is tested largely in applications to do with information sharing. Popular use cases which have gained traction with the Indian industry are intra-bank applications, authentication and document management, trade finance and invoice discounting, applications without a native currency.[12] Some of the use cases of blockchain in India include (Iyer and Kumar, 2018):

- MonetaGo (in trade)
- ICICI, Yes and Axis Bank (in Proofs of Concept)
- NSE collaboration with banks such as ICICI, IDFC, on KYC POC
- Unocoin and Coinsecure (Bitcoin exchanges and wallet)
- EzyRemit (remittance solutions)
- SignZy (document storage, signing, and validation)

The **IndiaChain** initiative of the NITI Aayog is a much anticipated development. The NITI (2017) has reported that, "NITI is parallely working on a platform called 'IndiaChain which will be a shared, India-specific blockchain infrastructure, utilising the power of the Jan-Dhan Yojana, Aadhaar, and Mobile trinity and enable blockchain developers to build social applications." This platform, which is expected to be linked with India Stack, could provide the much-needed boost to adoption of blockchain technology in India.

Having realized the potential of these innovative technologies, banks, finance companies and microfinance institutions are scaling up their expertise and integrating them into operational models. The sector's evolution and growth is very rapid and is expected to bring in new business models, products and services, change consumer preferences and market structure. The regulators' attention has been drawn towards reviewing and reorienting the relevant regulatory framework. Establishment of the inter-regulatory Working Group on Fin Tech and Digital Banking and publishing of white papers and initiatives by the Institute for Development and Research in Banking Technology (IDRBT) are steps in this direction.

Many companies already use many of these technologies to better access and serve previously excluded or underserved customers in the financial sector. It is also argued that an optimal mix of the human touch element along with the adoption of digital solutions promotes access to and usage of financial services. For instance, banking agents and employees can facilitate in bridging the gap between awareness and usage of digital financial services. Agents can help their customers understand different financial processes and products, and ensure that no one is left out in the digital financial revolution.[13] It can be used to provide specific solutions to problems faced by the unbanked to help them through tailored solutions.[14] These products are useful to current consumers and can also bring in the unbanked and under-banked to financial area.

Financial inclusion

Financial inclusion refers to the number of adults having access to banking or financial services. The Global Findex Survey

[12] Digital currencies, and crypto assets such as Bitcoin, Etherium, central bank-issued digital currencies, etc., are applications with native currency.

[13] For details, see Accenture (2015), 'Branching out: The case for the human touch in banking', by Frederic Brunier and Stefano Trombetta' https://www.accenture.com/t00010101T000000__w__/gb-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_12/Accenture-Human-Touch-Banking.pdf

[14] *ibid*

(Demirgüç-Kunt, et al., 2018) reported that in the 15+ age group, 79.9% of the population had accounts with financial institutions in year 2017. This meant a strong growth compared to 53.1% reported in the previous edition of the survey in 2014, and 35.2% in 2011. Nearly half of the world's adult population (or 3.5 billion people) are unbanked and under banked (with limited or non-transactional access to finance). Of these 1.7 billion adults in the world without an account, China, India, Pakistan and Indonesia account for the largest unbanked persons.

The first step towards financial inclusion is having an account. Increasingly, digital payments are being used for financial transactions. Ethiopia and India stand out for low use of digital payments: only about a third of account owners in these two countries reported making or receiving at least one digital payment in the past 12 months. In other developing economies, 19 percent of adults (30 percent of account owners) reported making at least one financial transaction in the past year using a mobile money account, a mobile phone, or the internet. However, this figure masks large differences between countries. In economies where a large share of adults have a mobile money account, such as Kenya and Tanzania, the use of a mobile phone to make transactions through an account is close to universal among account owners: in Kenya 88 percent of account owners (72 percent of adults) reported using a mobile phone or the internet to make a transaction through their account in the past year. By contrast, in India less than 10 percent of account owners reported doing so. In China, 49 percent of account owners (40 percent of adults) reported using a mobile phone to make a financial transaction.

Debit card ownership and use vary considerably across developing economies. 100 million adults with an inactive account have a debit card, while nearly 2.5 times as many, while 240 million have an inactive account plus a mobile phone. Brazil, China, Malaysia, Russia, and Turkey follow the general pattern among developing economies of relatively high debit card ownership and use, with about half of those with a debit card using it to make a direct purchase in the past year. In India and Kenya, by contrast, less than half of account owners have a debit card, and among those who do, only about a third used it to make a direct purchase.

Making or receiving digital payments is one important use of an account. Saving is another. Few people, however, reported using their account for saving but not also for making or receiving digital payments in the past year. In India the share was 7 percent. Most relied on money from working or family and friends as the main source of emergency funds in many developing economies. Money from working was most commonly cited as the main source of funds in China, Indonesia, and Tanzania while family or friends were given as the main source in Brazil, Egypt, and India (Demirgüç-Kunt, et al., 2018).

About 56% of all unbanked persons in the world were women in 2017. In India three years ago, men were 20 percentage points more likely than women to have an account. Today, India's gender gap has shrunk to 6 percentage points. This has been due to a strong government push to increase account ownership through biometric identification cards (Demirgüç-Kunt et al., 2018). Technology has been helpful in achieving gender parity and reduced the gap between richer and poorer adults. The Jan Dhan Yojana (JDY) scheme, developed by the government to increase account ownership. Launched in August 2014, the program had brought an additional 310 million Indians into the formal banking system by March 2018, many of whom might not yet have had an opportunity to use their new account. The financial inclusion programmes in India include policies undertaken by the government (like PMJDY, launch of Bharat Interface for Money (BHIM) and UPI), measures taken by the Reserve Bank of India (like the banking correspondent model and launch of financial literacy programme).

How can AI help in financial inclusion?[15]

AI to build credit history: Artificial intelligence can be used to collect information on various indicators which can then be used to create credit history of customers. The information collected could be on crop turnover, Aadhar linked data, GPS data, handset details, insurance etc. to build credit scores for customers. The system can recommend a smaller value loan and then to top up further based on the renewed credit worthiness re-estimated by the AI machine.

AI as a relationship manager: Artificial intelligence can be used as a relationship manager. HDFC has already introduced a chatbot for this purpose. Most of the bank staff have urban orientation and do not have inclination and patience to talk to the rural customer. Natural Regional Language processing based AI trained robot- to train and talk to the rural customers in regional language: explain them about banking products, can also discuss about the amount of the debt that they have and suggest how much do they need to save. AI trained Robots can become their financial advisors.

AI assisted lifestyle based banking: Another way in which AI can be used is to assist in the financial literacy endeavours. There are a number of government schemes like Gram Sadak Yojna, Swachh Bharat Abhiyan, Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) etc. where the incentives go through the Pradhan Mantri Jan Dhan accounts. Banks can use feeds of all such incentive payments data from the Unique Identification Authority of India (UIDAI) database into the AI engine and come up with the best possible products the customer can be offered.

How can blockchain help in financial inclusion?

Opening an account – Individuals can open an account or deposit cash through their phones.

Usability of an account – Transfer of funds using blockchain takes 10 minutes which is faster compared to such transfers through conventional means in developing countries

Costs to the financial institutions – Payments via blockchain do not need to

[15] https://www.edgeverve.com/blog/artificial-intelligence-financial-inclusion/

go through the national payments system and hence there is no need of physical branches. The cost of transfer of funds is a percentage of the value of the transferred and makes payments more feasible.

Currency risk - Individuals and SMEs have the option of adding funds in the fiat currency. This shift the volatility risk to the financial intermediary (FI). FIs are using bitcoin as vehicle currency – the dollar is the dominant vehicle currency and used in 88% of trades. Using boitcoin as vehicle currency and blockchain's platforms means that the recipient and the sender are not exposed to the volatility of the virtual currency.

Conclusion

In this article, we examine how AI and blockchain technologies can contribute to financial inclusion. While the potential of blockchain technology, in general and smart contracts, in particular, to make financial services more efficient, cost effective and inclusive is not disputed, there is concern with respect to scalability, interoperability, cost impact and regulation. Lack of understanding and expertise also create cultural barriers making movement away from legacy system more difficult. Blockchain technology can be a game changer if it is widely adopted and there is agreement on the technology architecture that needs to be put in place for its adoption. As far as AI is concerned, it is a nascent technology and there are challenges such as transaction speed, verification process, and data limits. Its regulatory status is uncertain and there are integration concerns (within an organization, on account of the existing ecosystem), scarcity of talent, and costs involved. The potential of both these technologies in achieving greater financial inclusion is undoubtedly clear. Whether that will happen will depend on many factors including those highlighted above as well as how quickly these technologies are adopted by most fintech players.

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Bamboo based Green Economy - Where local is global

A case study of Nepal

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Bamboo is part of livelihood of close to 3.2 million people in Nepal - more than 10 percent of the population. Majority of the people who are engaged in this sector are considered poor, disadvantaged and women and they lie at the bottom of the economic pyramid. These people appropriate bamboo in myriad of sophisticated ways from building their houses to using them as foods, baskets, agricultural implements to bridges or in other words in all facets of life.

There are local customs where bamboo is instrumental in birth, marriage and death related rituals. Although, indigenous and local knowledge can be considered irreplaceable intangible heritage, they now face strong onslaught of globalization and consumer choice. Their intricate weaving skills cannot compete with mass produced industrial plastic products - hence many skills are dying and the artisans are vanishing. Very few young men and women are motivated in continuing this age-old craftsmanship as they make more money working as unskilled construction labor.

While the potential of bamboo to transform the economic landscape of the country without hurting the ecology is immense and very well documented, the sector suffers from complete apathy from government, private or semi/ non-government bodies due to variety of reasons, especially due to poor perception and taboos.

At a global scale, however, in the last 20 years, a slow but a powerful renaissance has occurred. The poetics of bamboo is finding many followers, as in its natural state it is lightweight but very strong. It has properties similar to state-of –the-art industrial materials like carbon fiber. Bamboo elasticity enables it to diffuse strong impacts like earthquake or flood. It grows very fast - some species can grow as fast as one meter a day. It is classified as grass and needs to be regularly harvested or else it will wither. A study conducted by International Centre for Bamboo and Rattan (INBAR) shows that properly managed bamboo forest as sequester as much carbon as Douglas fir forest.

For these reasons, the market for bamboo products is increasing worldwide. Many countries like Germany, Portugal, China and India used bamboo to build their pavilions in the last World Expo. This is a testimony to the fact that these countries are seeing potential of bamboo as the future building material. It is worth mentioning here that in the same Expo, about a hundred years ago these industrialized nations used steel to build their pavilion - as steel was being considered as the material of the future.

A private initiative undertaken by the authors in Nepal through our organization Adobe and Bamboo Research Institute (ABARI), has been promoting the potentials of bamboo as environmentally sound alternative to steel. Our noteworthy achievement has been construction of earthquake resistant schools and libraries aftermath the 2015 devastating earthquake in Nepal. Our bamboo based rehabilitation work has transformed a flooded riverbank into a vibrant bamboo forest in Chitwan district. It has not only benefitted hundreds of farmers by providing additional income but also protected their land from soil erosion. It was observed that bamboo while firmly holding onto soil with its extensive root system is flexible enough to bend almost parallel to the soil thus letting river pass without rupturing or causing any damage to the plants. Our plantation began in 2011, after a major flood of 2010. Our idea was vindicated in 2017 when another major flood caused lot of devastation in the area while our corridor survived the flood. It was seen

Figure 1: Ariel view before bamboo plantation

Figure 2: Ariel view after bamboo plantation

that gabion walls suffered damages because they were rigid while bamboo was effective because of its elasticity.

The bamboo forest is now bestowed with differed varieties of birds and a very vibrant ecosystem and happier community. These events have caused a lot of faith in bamboo as

Figure 3: Bamboo and earth schools built post-earthquake

a strong medium to control soil erosion. Currently with the support of South Asian Association for Regional Cooperation (SAARC) Development Fund (SDF), we are developing large scale bamboo nurseries owned by local farming communities to supply bamboo and other non-timber plants for both commercial and ecological plantations. Developing bamboo-based greenhouses and creating bio-factories to produce organic manure is expected to enhance bamboo's contribution to agriculture sector.

We also aim to create bamboo-based community-owned enterprises wherein bamboo contributes significantly to their livelihood. We are working with farmers and artisans to enhance their skills so that they can make products that cater to modern sensibility from high-end products to everyday usable products such as construction or agricultural materials.

We have created lots of trust among local community and government sectors as the buildings we had built using bamboo and earth had survived the devastating earthquake right at the epicenter. Ever since there has been major leap of faith as we have built a modern library in the heart of the capital city and built more than a dozen classrooms in rural areas of Nepal. And while doing so we are using bamboo planted by the farmers.

Ours is a pursuit to show that profit does not have to be extractive to the planet but can benefit both humans and the planet. ■

Global Assessment of Bamboo and Rattan for Green Development

The Global Assessment of Bamboo and Rattan for green development (GABAR) is the first comprehensive assessment of its kind. It aims to maximize bamboo and rattan's contribution to national economic development and environmental protection. These actions will help to better inform policies, development strategies and opportunities for investment in International Bamboo and Rattan Organization (INBAR) Member States using bamboo and rattan. Guided by its 2015-2030 Strategy, INBAR's priority is to work with countries to focus the use of bamboo and rattan as strategic resources that support sustainable development and their green economy action plans. INBAR's priorities, defined under the 2015-2030 Strategy, are to promote the promise of bamboo and rattan as practical and sustainable solutions to the producers and users of these plants.

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Venture Capital, Technology and Innovative Startups in India[1]

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Abstract

Venture capital provides an effective vehicle as a financial intermediary to share risk and mentor the innovators into successful entrepreneurs as evidenced in the USA. Efforts to transfer this institution to developing countries like India have been fructifying in recent years with both demand creation through rise of risk-taking startups and supply-side factors like policy support and emergence of venture capital (VC) funds. The number of VC deals and quantum of funds have been growing at a high rate. VCs played crucial supportive role in nurturing several firms in telecom, IT, pharmaceutical and the recent start-ups like Flipkart, Paytm, Ola, Oyo and others. Regression analyses reveal that the firms located in Bangalore, Mumbai and National Capital Region (NCR) and those engaged in providing online services, Business Process Outsourcing (BPO) and infrastructure development attract significantly higher venture capital and private equity (VCPE) investments; and that these investments positively impact firm revenue. The paper then discusses some policy issues for inclusive growth.

Introduction

Development economists are unanimous in attributing the surge in innovation and growth dynamism in the USA towards the last decades of the twentieth century to the rise of venture capital (VC) as an institution of financial intermediation for risk taking innovators (Kortum and Lerner, 2000; Dossani and Kenney, 2002; Nanda and Rhodes-Kropf, 2013). Studies have shown that VC investments positively impact firm starts beyond the firm it invests and thereby employment and aggregate income (Samila and Sorenson, 2011). VC support at early stages played crucial role in the emergence and growth of several iconic information technology behemoths of the current generation like Microsoft, Intel, Google, Apple; retail giants like Amazon, eBay, Starbucks; biotechnology firms like Argen, Celgene, Genentech; and others including Costco, Fedex, Paypal, and Cisco. Also, sectors with higher capital requirement like banking, real estate, petroleum or mining are supported by VC.

Another strand of development that elevates significance of VC development is the shifting focus from large firms to entrepreneurial small firms with innovation and risk taking for creation of bulk of new employment (Osnabrugge, 2000). These high tech firms cannot be financed by banks in view of the inherent risks in the new technology and new services offered and venture capital provides the answer to these problems effectively (Audretsch and Lehmann, 2004; Da Rin, 2016). Therefore, development discourse has focused on transferring the US model of venture capital to other countries.

Venture capital goes beyond financing innovative firms that face information asymmetry, intangible assets and unproven ideas. They advise these firms to close the gap on nontechnical shortcomings (Gompers and Lerner, 1998) and gives chance to the mindset of experimentation and shows willingness to fail. They take equity for the capital invested, take preferential shares and mentor the entrepreneurs on various issues relating to production, marketing and connects them to related players in the ecosystem including other sources of funding. Each VC firm creates several funds to be invested by other individuals for a maximum period of ten years. This makes it mandatory for the VC firm to show returns on each investment by generating huge gains through innovation and duly covering the risk involved in the process.

This paper examines the links between venture capital, technology and innovation through literature; brings out evolution of VC industry in India; and analyses Indian VC industry from 1999-00 to 2018-19 using VentureIntelligence PEVC Database. VentureIntelligence data is widely used by academic researchers, consulting firms and players in venture capital industry. It provides disaggregated data on individual venture capital and private equity transactions. We have divided the data into four time periods, 1999-00 to 2002-03, 2003-04 to 2007-08, 2008-09 to 2012-13 and 2013-14 to 2018-19. During this period the economy witnessed major macroeconomic events viz., the DotCom bubble (2002-03), financial crisis (2007-08), and lowest GDP growth rate (5.5%) in 2012-13. Due to prevalence of inaccurate data on revenue of firm, we combined PEVC database with VentureIntelligence's CFS database to form a comprehensive database. CFS database provides information on balance sheet of companies from 2007-08 to 2018-19. Kaplan and Lerner (2016) have argued that databases on venture capital and private equity in-

[1] This paper is based on a larger study being undertaken by the first author and financed by the Indian Council of Social Science Research (ICSSR), New Delhi, India.

vestment suffer from large inconsistencies and general problem of incompleteness. This also seems to be the case with VentureIntelligence database. However due to unavailability of data on private VC/PE investments, we relied on secondary data of commercial data providers. The monetary values were deflated using deflators to convert to constant 2011-12 prices. A simple linear regression model is employed to determine the relationship between investment amount, company's performance, sector of operation, geographical location etc. Rest of the paper is as presented as follows. Section 2 reviews links between VC, technology and innovation, while the evolution of Indian VC is briefly traced in the third Section. Section 4 presents analysis of Indian VC industry and the last Section concludes with policy suggestions.

Venture capital for new technology and innovation

Venture capital contributes to growth of innovative entrepreneurial firms by both selectivity effects and also value added effects (Da Rin, 2016). They are likely to finance innovators than imitators (Hellman and Puri 2002). Several studies controlled for these selectivity effects and concluded that VC financed firms perform well in terms of innovation, growth and employment by virtue of monitoring and guidance by VC firms. A study of manufacturing firms over three decade period between 1965 and 1992 in the USA found that venture capital funded firms are associated with significantly higher patent possession and innovativeness (Kortum and Lerner, 2000). Similar finding was reported in Italy (Bertoni et al., 2010), though contrary evidence comes from Germany. However, for Germany, VC is associated with a faster time to market for innovators (Engel and Keilbach, 2007). Venture financing improves firms total factor productivity on the strength of greater monitoring ability (Chemmanur et al., 2011). VC-backed startups receiving their initial investment in hot markets, conditional on going public, are valued higher, have more patents and higher citations (Nanda and Rhodes-Kropf, 2013).

Venture funding leads to quicker growth of firms in terms of human resources and employment (Davila et al., 2003; Engel and Keilbach, 2007; Belke et al., 2004). Puri and Zarutskie (2012) analysed whole census on US companies and concluded that 0.1% of start-ups that are VC funded account for about 5% of total employment over the quarter-century upto 2005. Similar positive employment effects are not observed in Belgian firms and British firms. Promoting entrepreneurship and innovative activity are more useful to spur VC than capital gains tax (Gompers and Lerner, 1998). Higher GDP growth and R&D spending, lower capital gains tax spur VC funding (Gompers and Lerner, 1998). It is futile for the government to intervene as venture capitalist as it is not a substitute for private initiative (Da Rin, 2016).

Imperfections in VC market: Market for venture capital is subject to significant market imperfections that substantially lower the total social gain (Lerner, 2002; Sonne, 2012). VC benefits only few industries and a handful of companies (Aldrich, 2008; Lerner, 2002). Further, the founding of VC firms and their financing is highly cyclical and their impact on innovation during boom times is attenuated (Lerner,2002; Nanda and Rhodes-Kropf, 2013). Close involvement of venture capitalists can sometimes be disadvantageous to the entrepreneur as it takes away significant share of his time and attention, and can result in loss of control and even a trust deficit as reported among Indian firms by Joshi (2018).

Evolution of Indian VC industry

The formation of Technology Development and Information Company of India (TDICI) as a subsidiary of the Industrial Credit and Investment Corporation of India (ICICI) in partnership with the state-owned Unit Trust of India paved the way for the slow evolution of venture capital industry in India (Pandey, 1998). The initial funds invested from the government of India with support from the World Bank gradually attracted domestic private sector investors and then foreign VC since the middle of the nineties. It was the development of software industry since the late eighties that created the critical mass for investing to the VCs (GoI, 2006).

It was hypothesised that transference of VC institution from the USA into other countries can either succeed without any change to the institution or the environment; or fail; or VC may be modified to country environment and country environment can also change to the requirements of VC (Dossani and Kenney, 2002). India is a fascinating example of the last possible trajectory. Initially, the VC firms operated in the public domain as a creditor due to regulatory restrictions as in the first option and then the environment has changed dramatically over the last two decades for a successful function of venture capital. Several reforms introduced over the last two decades have been galvanising venture capital funds in the country. To cite a few, formation of Securities and Exchange Board of India (SEBI) in the early nineties, easing of norms for listing in stock exchange and bringing new guidelines in 1996 and in 2000 and subsequently after Nitin Desai Committee in 2006. Other major milestones are enactment to allow limited liability partnership in 2008, allowing insurance firms to invest in VCs in 2013, pension funds' investments into VCs in 2016, and the enactment of Insolvency and Bankruptcy Code, 2016. All these measures can be termed as changing environment of the host country to enable transfer of the desired institution viz., venture capital.

Sustained economic growth and massive infrastructure investments especially in ICTs, coupled with availability of skilled manpower have been ushering in new forms of organisation of enterprises in the country. Apart from demand side factors like consistent growth in disposal incomes at around 6%, the rising confidence of Indians equipped with the forces of globalisation, ICT revolution, Diaspora and government initiatives like startup India propelled emergence of start-ups with innovations in various sectors of the economy (Subrahmanya, 2015; Rao et al., 2017). These proliferating startups generate the demand for VCs.

Though venture capital entered India in the mid-eighties, the take-off was in the latter part of the last decade (Sabarinathan

et al., 2017). Concomitantly, the continued growth in the emerging economies of China and India in the face of financial meltdown in the US and Europe attracted VC into these countries. Higher interest rates in the banking system and depressed stock market encouraged this in India (Joshi, 2018). India (6%) and China (18%) garnered a quarter of the global venture capital in 2017 and their shares are on the rise. An estimate shows that VCPE investments in India are 26 billion and exits of 31.8 billion in 2018.

Trends in venture capital flow into India, determinants and impact

The flow of venture capital and private equity into India during 1998-99 to 2018-19 was 140 billion dollars in constant prices with an aggregate of 7702 deals (Table 1). The large proportion of this investment viz., 46% materialised in the last few years indicating the growing nature of this market. The total investment as well as the number of deals goes up till year 2007-08. The financial crisis in 2008 seems to have dented the number as well as the amount. It took five years to reach the same level of investment as in 2007-08. The highest number of deals is recorded for this period in the 2015-16 and thereafter the number showed decline, though investment amount moved up. The VCs, on average, financed companies for 23% equity stakes.

The average revenue of companies at constant prices is 5-6 billion INR (Figure 1). The average funding per company has been on increase since 2014 and is roughly equal to 2.3 billion INR (constant prices) in year 2017-18. As can be seen from the Figure 1, the investment amount per deal became bigger since 2016-17, while the number of deals has gone down. This might be a pointer towards the maturity of VCPE market in India.

The geographical distribution of VCPE investments in India is increasingly concentrated in Mumbai, Bangalore, National Capital Region (Delhi, Gurugram and Noida), while all other cities accounted for just 26% in the Triennium Ending 2018-19 (Figure 2). Among these three cities, Mumbai continued to be the centre of these investments till the onset of startup revolution in 2014-15. Top 10 cities enjoy on average 90% of total VC investment amount. After 2014-15, tech

Table 1: Trends in venture capital and private equity flow into India

Year	No of Deals	Funding current prices (Billion INR)	% funding constant prices	Average funding current prices (Million INR)	Average% stakes	Revenue current prices (Million INR)
1998-99	20	4	0.1	195	19	949
1999-00	68	28	0.6	415	26	4648
2000-01	106	22	0.4	203	20	1460
2001-02	60	37	0.7	619	24	2367
2002-03	60	29	0.5	477	32	5447
2003-04	69	58	1.0	837	24	20436
2004-05	126	90	1.5	711	19	6531
2005-06	241	141	2.3	586	21	2606
2006-07	369	323	4.9	876	24	3152
2007-08	521	595	8.4	1142	23	5082
2008-09	371	301	3.9	811	24	4092
2009-10	299	213	2.6	713	25	2912
2010-11	440	431	4.9	979	23	5410
2011-12	530	465	4.9	878	21	7708
2012-13	506	489	4.7	967	24	6740
2013-14	522	587	5.3	1125	21	10594
2014-15	625	826	7.3	1322	23	6519
2015-16	849	1237	10.6	1457	23	4811
2016-17	746	1462	12.2	1959	21	4643
2017-18	6 95	1605	12.9	2310	21	7342
2018-19	476	1327	10.2	2788	24	4334
Total	7702	10275	100	1334	23	5793

Note: Data for 2018-2019 are upto February 20, 2019

Source: Calculated from Venture Intelligence database

firms and startups in Bangalore obtained large share of this finance, though Mumbai is not far behind.

Stage-wise funding of VCPE in India: The share of investment dedicated to early stage during the late nineties is relatively better and has declined in subsequent periods (Table 2). However, early stage ventures have large share in total number of investment deals. The proportion of deals in early stage also went down thereafter before rebounding to 49% in the latest period. This wedge between share in investment amount and number of deals is hardly surprising because early stage firms are smaller in size and require less capital for operations. The information asymmetry, lack collateral and low cash flow make it difficult for early stage firms to access debt type of financing. The share of late stage deals in investments is 30-35% which is the highest in the last ten years and its share is the second highest in total number of investments. Thus significant private investment through VCs and PEs is going to established firms despite the increased investment opportunities due to significant increase in new start-up ventures. This poses problems for budding firms, as early stage funding can have signalling value as shown in Davila et al., (2003a). This VC focus on late stage investment is witnessed after the bursting of dotcom bubble in the early 2000s and is in contrast to China (GoI, 2006; Annamalai and Deshmukh, 2011).

Approximately 100 % and 50% growth in growth-PE stage funding hints at investments in recently established firms is rising. PIPE (Private Investment in Public Equity) stage has significant share in total investment and points to possible investment gap in public equity market which is filled by PIPE investments (Sabarinathan, 2017). Share of buyout-large staged investments (>100 mn USD) witnessed 181% increase in 2013-19 compared to 2009-13 and accounts for only 1.3% of total no of deals. Buyout staged deals (<$100M) are fairly constant with a share of 4% in total investments. Chokshi (2007) has noted the relative slow evolution buyout market. Pre IPO has seen the lowest share in both total investments and number of deals in last ten years.

Technology and Innovation through VCs: The VCPE investments in India, as elsewhere, mainly funded telecommunications and information technology firms during the study period from 1997-98 to

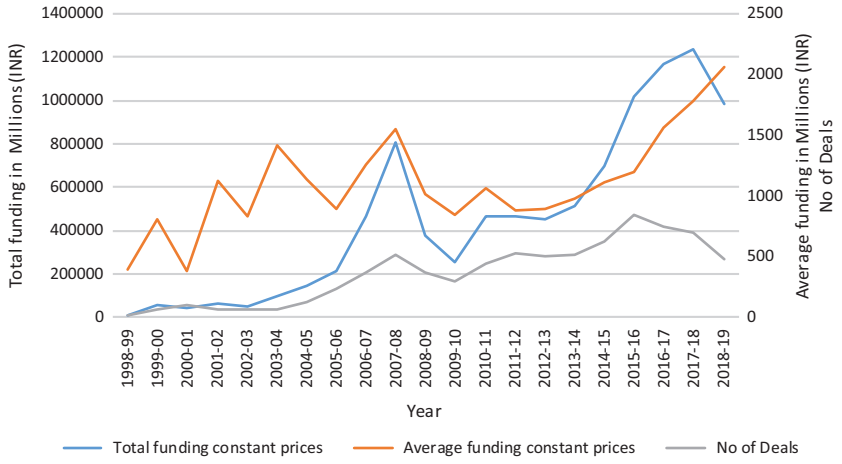

Figure 1: Total funding, number of deals and average funding per VCPE deal in constant 2011-12 prices

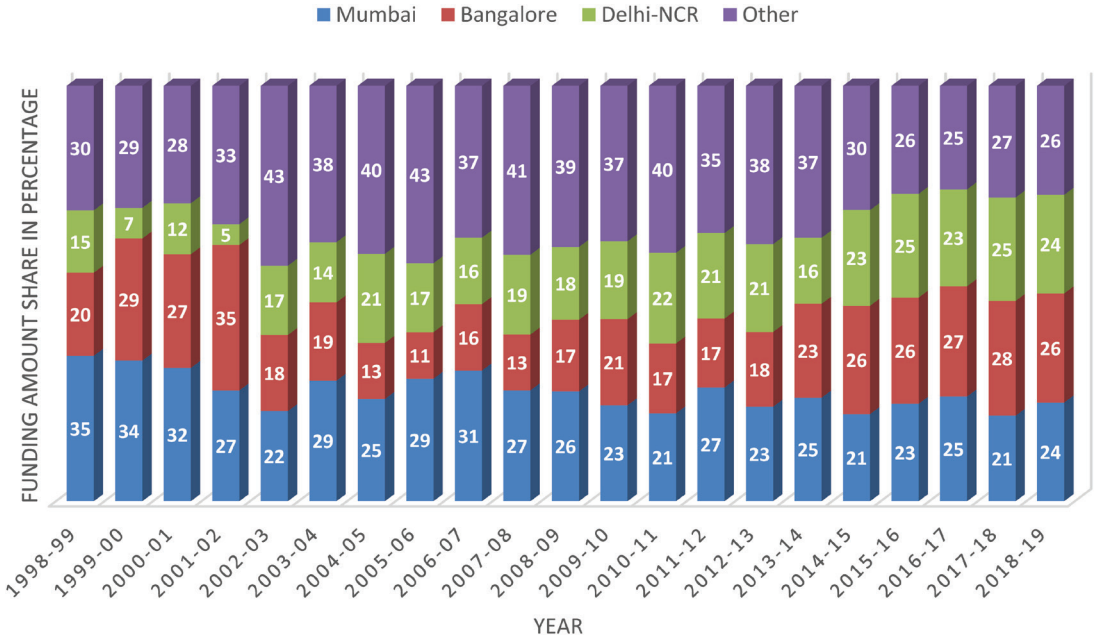

Figure 2: Geographical distribution of VCPE investments during 1998-99 to 2018-19

Table 2: Stage-wise VCPE funding in India during 1997-98 to 2018-19

Stage	1997-98 to 2002-03		2003-04 to 2007-08		2008-09 to 2012-13		2013-14 to 2018-19	
	Funds %	Deals %	Funds %	Deals %	Funds %	Deals %	Funds %	Deals %
PIPE	22.0	9.1	29.4	22.4	18.9	18.7	12.6	8.5
Early	21.4	58.7	3.0	16.5	4.7	27.6	4.5	43.9
Pre-IPO	17.8	0.9	4.1	4.1	1.4	1.4	0.5	0.3
Growth-PE	11.3	2.8	7.8	4.5	16.8	6.2	22.8	10.2
Late	10.0	11.4	34	31.5	37.6	26.0	32.2	15.3
Other	6.9	2.2	8.5	3.2	7.1	2.7	7.2	4.1
Growth	6.6	13.9	3.9	12.9	5.0	13.4	2.9	13.1
Buyout	4.0	0.9	4.2	4.3	3.7	3.6	3.7	3.3
Buyout large	-	-	5.1	0.5	4.8	0.3	13.5	1.3
Grand Total	100	100	100	100	100	100	100	100

Source: Calculated from VI database

Table 3: Temporal changes in extent of VCPE funding to companies during 1997-98 to 2018-19

Period	Companies	Funding received in descending order
1997-98 to 2002-3	Top 10 funded companies in descending order	Bharti Airtel (20.7%), Ambuja Cements (5.0%), Patni Computer Systems (4.4%), Gujarat Ambuja Cements (3.0%), Satyam Computers (2.8%), HDFC (2.6%), Moser Baer (2.6%), DSQ Software (2.4%), Orchid Chemicals & Pharmaceuticals (2.3%), Brigade Corporation (2.0%)
2003-04 to 2007-08	-do-	Bharti Infratel (4.2%), ICICI Bank (3.1%), GENPACT (2.1%), HDFC (2.1%), Idea Cellular (2.0%), National Stock Exchange (1.9%), Caritor (1.5%), Tata Teleservices (1.4%), Reliance Infratel (1.1%), MCX (1.1%)
2008-09 to 2012-13	-do-	Vodafone India (2.83%), M*Modal** (2.80%), GENPACT (2.55%), Aditya Birla Telecom (1.31%), Asian Genco (1.27%), iGate** (1.23%), National Stock Exchange (1.23%), Viom Networks (1.14%), Max Financial Services (0.81%), Greenko Group** (0.81%)
2013-14 to 2018-19	-do-	Flipkart* (5.19%), One97 Communications* (2.79%), Ola (2.56%), Snapdeal* (1.69%), Reliance Infratel (1.57%), Oyo Rooms* (1.36%), NHAI TOT Bundle I (1.33%), Senvion (1.21%), HDFC (1.11%), GlobalLogic (1.10%), ReNew Wind Power* (0.90%)
	Other companies	Byjus Classes* (0.75%), Paytm E-Commerce* (0.57%), BigBasket* (0.5%), FirstCry* (0.5%), Swiggy* (0.4%), Zomato Media* (0.4%), PolicyBazaar* (0.4%), Greenko Group** (0.4%),

*Note: * indicates Indian startups; ** indicates foreign startups*

Source: Venture Intelligence database

2002-13 (Table 3). The last years of this period witnessed investments into foreign startups like M*Modal, iGate and Greenko. After 2013-14, the major focus of these funds shifted to financing startups like FlipKart, PayTm, Ola, snapdeal, Oyo and so on. It is no exaggeration to say that the software and telecommunications would not have developed the way they did in the absence of venture capital support in India. This is equally true if not more in case of several of the new generation startups bringing innovations in several frontiers leading the country to the Fourth Industrial Revolution. Similarly, Bowonder and Mani (2002) surveyed 26 VC invested firms and found that they ventured into new products development and contract research for global firms. Kiran Majumdar Shaw of pharmaceutical giant Biocon vividly recounted how the first VC in India viz., TDICI helped bring life to her innovative ideas (Mazumdar-Shaw, 2017).

These impressive investments during the latest period after 2014-15 showed in the quick graduation of several startups to the higher level of valuation and output (Table 4). Twenty of them working in diverse sectors such as technology, financial inclusion, transport, hospitality, logistics, renewable energy and agriculture have valuation of more than one billion USD in 2018-19. Another twenty soon to be unicorns are given in the same table. All these startups received nearly INR 1000 billion of VCPE investments over the last few years that catapulted them to the development phase. Ecommerce startups got a boost from these investments. FlipKart was mentored by the VC firms so much so that Tiger Global changed the CEO to bring in more professionalization and cut losses and the later turn of events including its acquisition by Wal-Mart proved that these measures were successful. Literature

shows that venture investors play this larger role as analysed in Hellman and Puri (2002). Similar instances can be found in the growth trajectories of several of these and other startups in India.

Determinants of VCFE investments and impact on revenue: Regression analysis reveal that the firms engaged in providing online services, business process outsourcing (BPO) and infrastructure development attracts significantly higher VCPE investments (Table 5, columns 3 and 4). Internet users in India have increased from 5% of population in 2009 to 30% of population in 2019, thus opening untapped market for internet services. This possibly explains the higher investment in firms that provide online service. BPO sector is attracting high investments as India is a supplier of cheap skilled labour producing annually roughly 25% of engineering and science graduates in the world.

The investment in firm increases when firms operate from Mumbai, Bangalore and NCR region which reflects the advantage of mega cities in bringing investment demand and supply together, as the concentration of firms and investors are high in these cities, thereby increasing networking opportunities; which makes it easier for VC firms to monitor and mentor the firm. Few earlier empirical studies underlined the importance of geographical proximity for knowledge spillover (Audretsch and Tamvada, 2008). *Ceteris paribus*, investment amount will be significantly higher if the source of investment is foreign because of the large size of foreign VC firms with high potential investors. Seed and first round of financing attract low investment as indicated by the negative coefficient because the early stages of funding is more risky than the later stages. Moreover, VC investments moved away from early stages to later stages worldwide after bursting of the dotcom bubble.

Regression estimates show that increase in VCPE investments significantly improve revenue of firm (Columns 4 and 5 of Table 5). Further, firms which received foreign investments show higher revenues. Similarly if a firm is in banking sector or received investment is through PIPE, the revenues are significantly higher. A large

Table 4: Number of VCPE deals and funding amount raised by large startups in India until 2018-2019

Unicorns	No of Deals	funding constant prices (Mn. INR)	Soonicorns	No of Deals	funding constant prices (Mn. INR)
One97 Comm (PayTM)	13	158281	BigBasket	9	26363
Ola	12	143986	FirstCry	7	26311
Snapdeal	13	97500	Bookmyshow	5	11911
Oyo Rooms	7	76385	MakeMytrip	6	11571
ReNew Wind Power	7	63394	Rivigo	6	10231
Byjus Classes	10	42719	Druva Software	6	9849
Paytm E-Commerce	2	32303	Cardekho	7	9806
Swiggy	9	23756	Practo	6	9659
Zomato Media	6	22575	Grofers	3	9549
PolicyBazaar	8	20702	BlackBuck	7	7914
Quikr	7	16617	Dailyhunt	11	6939
Udaan	3	14679	Lendingkart	6	6394
BillDesk	5	14287	Gaana	1	5705
Delhivery	6	13807	Mobikwik	6	5299
Freshdesk (Freshwork)	7	12892	PharmEasy	6	4966
ShopClues	7	12691	Capillary Tech	5	4458
InMobi	4	10531	CureFit	5	2437
Mu Sigma	3	6854	RazorPay	3	1605
Pine Labs	2	4382	LivSpace	4	1163
Hike	1	3391	Cleartax	2	753
UST Global					
Total	132	791732	Total	111	172883

Source: Venture Intelligence

Table 5: Determinants of venture capital and private equity flow and its impact on venture 008-09 to 2018-19

Variable	Venture capital quantum		Revenue of companies	
	Coefficient	Std. Err.	Coefficient	Std. Err.
VCPE investment in million INR			1.66***	0.10
Revenue of company in Million INR	0.05***	0.00		
Mumbai dummy	294.9*	157.9	2616.9***	887.7
Bangalore dummy	450.6***	167.5	343.8	943.5
NCR dummy	246.5*	164.6	-17.8	926.1
Foreign Investment dummy	743.7***	186.9	2221.6**	1053.2
Indian Investment dummy	-470.6***	170.1	516.4	958.2
Early stage dummy	-846.2***	171.5	162.6	968.4
Late stage dummy	622.4***	168.0	222.3	947.4
PIPE stage dummy	-1062.3***	205.7	21265.0***	1098.7
Online services dummy	494.4***	157.0	-580.4	884.6
NBFC dummy	-123.9	319.0	1632.7	1794.3
Banking dummy	-1094.6*	617.8	17521.8***	3463.1
Agricultural business dummy	-271.7	513.4	-3072.4	2887.6
IT service dummy	56.7	354.6	-1482.6	1994.7
Telecom dummy	-877.3	1603.8	3974.7	9022.5
BPO dummy	3574.8***	658.1	-4321.4	3718.6
Renewable energy dummy	703.2	436.4	-2579.9	2455.4
Infrastructure dummy	1827.6***	574.3	-941.3	3235.9
Seed round dummy	-359.2*	226.0	491.3	1272.1
1st Round dummy	-423.1***	155.2	376.2	874.1
Constant	1013.1***	196.3	-1731.9*	1108.8
Number of observations	3170		3170	
Adjusted R-squared	0.17		0.24	

Source: Analysed by the authors from VI database

volume of transaction takes place through banks in India thus banking firms should hold higher reported revenue. Firms established in Mumbai exhibit higher revenues compared to other cities. The coefficient of PIPE stage dummy reflect that the investment will be lower, if it is a PIPE stage investment and the revenue of firm will be higher if the investment type is PIPE.

Conclusions and ways forward

Nurturing innovations to bring new products and services is inherently risky with high chances of failure. Traditional debt financing institutions like the banks cannot support them in the face of information asymmetries, lack of tangible assets and unproven ideas. Venture capital provides an effective vehicle as a financial intermediary to share risk and mentor the innovators into successful entrepreneurs as evidenced in the USA, Israel, Taiwan province of China, the UK and few other countries. Research studies show that they foster growth of firms, create employment and innovations even after controlling for selectivity effects. Efforts to transfer this institution in developing countries like India have been fructifying in recent years with both demand creation through rise of risk-taking startups and supply-side factors like policy support and emergence of VC funds. Analysis of VC industry in the paper demonstrates that the number of deals and quantum of funds have been growing at a high rate. It played crucial supportive role in nurturing early stage growth of several firms in telecom, information technology, pharmaceutical and the recent start-ups like Flipkart, Paytm, Ola, Oyo and several others. Regression analyse reveals that the firms located in certain megacities like Bangalore, Mumbai and National Capital Region and those engaged in providing online services, BPO and infrastructure development attracts significantly higher VCPE investments; and that these investments positively impact firm revenue. There can however be significant investment gaps as VCs finance few firms in selected areas. Efforts are needed to cover these gaps as well as attracting investments into sanitation, rural livelihoods, agriculture, clean energy, affordable housing, and financial inclusion. Israeli model of fund-of-funds (Yozma) and mass incubators to support early stages of entrepreneurial firms will go a long way in levelling the playing field.

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Dissemination and Social Diffusion of Innovations

An Indian experience

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Abstract

"iAUs.B'iDeas" was a team innovation designed as the best practice to disseminate and diffuse innovations socially in the University campus. The event has been focused on exhibits of engineering and agriculture with newness in out-of-the-box thinking way. Students and researchers were invited to register more than 100 innovations during the event. An open innovation, online crowd sourcing platform has been created, performed and maintained. The best innovative twelve ideas were honoured with citation and awards by the University for processing into prototype development. Thrust has been given to drinking water, economy housing and agriculture (high yielding varieties). The exhibition included University Innovators (UI), School Innovators (SI) Grassroots Innovators (GI) on registered patents and geographical indications of National Innovation Foundation (NIF), Annamalai University, Technical institutes and other schools from Tamil Nadu, India. Marketing efforts continue on innovation management to transfer technologies in the form of dissemination with uniqueness. The author has consistently designed his thinking to diffuse socially while updating competent skills on internal marketing, blue ocean leadership, and employee communications to overcome shortfalls. NLC India Limited case of innovation is included to bring out the need for dissemination and social diffusion.

Introduction

The experiences of an Indian academician in business management with a thirst for innovation has been presented in the form a case study as to how Annamalai Innovations (Figure 1), NIF grassroots innovations (Figure 2) and Open innovation can be popularized to ensure inclusiveness and equality. The journey of the author from 1998 till date has been narrated with his drive for innovation management over two decades. There were five major innovative events expedited with a focus on transfer of technologies as innovation management both in the form of products and services. The events were, walk-the-talk (Figure 3), ni3M-need for innovation in men, machine & management, physical marketing simulation game (https://www.youtube.com/watch?v=YwuATm0_JVA; 1631 views), Colour Fish show-Students' shoppee (marketing venture initiative for promoting destination brands-*surat sarees*-salem mango), and 'e-students' shoppee' (https://www.bestprice.in) with Walmart venture initiatives in India (https://www.youtube.com/watch?v=IDaaxC2B4J0). The efforts to disseminate innovations, patents (Table 1), high-yielding varieties (Figure 4), ideation of refrigeration (Figure 5), etc. have been all along diffused socially in the University campus and also in the public place locally. The experiences of an Indian academician devoting his time in establishing a network for innovation management shines beyond both his physical and financial constraints. The cases described his lessons learned in innovation management and his journey continues with designing of strategies with a niche executive MBA programme on corporate campus in NLC India Limited, a Public Sector Undertaking (PSU) by overcoming challenges in equality and inclusiveness. The future scope of innovations in designing business management academic programmes and continuing the ideation process are mentioned in the end with directions in the form of assignment questions. A PSU case of diffusing innovation for sustainable development have been brought by the Director Human Resource, NLC India Limited, which is under the Ministry of Power, Government of India.

Walk-The-Talk

This was a marketing campaign to focus on the objectives of dissemination and social diffusion of innovation as team of iAUs.B'iDeas (Business ideas Annamalai University sharing). Ten different faculties of studies from Annamalai University have been involved even though the original proposal was aimed at the Faculty of Agriculture (FA) and the Faculty of Engineering & Technology (FEAT). Due to the diffusion of the information about the campaign through FA & FEAT in the campus, all the ten faculties pooled to participate naturally. Collectively to integrate the participation from all the departments of studies, 62 co-ordinators have been involved to disseminate and diffuse the scope of transfer of technology. The objective of the innovation-marketing campaign was to facilitate the transfer of technology among the university level stakeholders such as the district administrators, university authorities, grassroots innovators, researchers, professors, school teachers, students from school level to the university levels. The slogan for the campaign was designed as '*Hoisting a significant positive change*' to emphasise the meaning 'let this world bequeath with *the pearls of my wisdom*'. The logo of the event was designed to convey the meaning of 'out-of-the-box' thinking by placing a star with a dot realigned to the first arm of the five stars. The star was

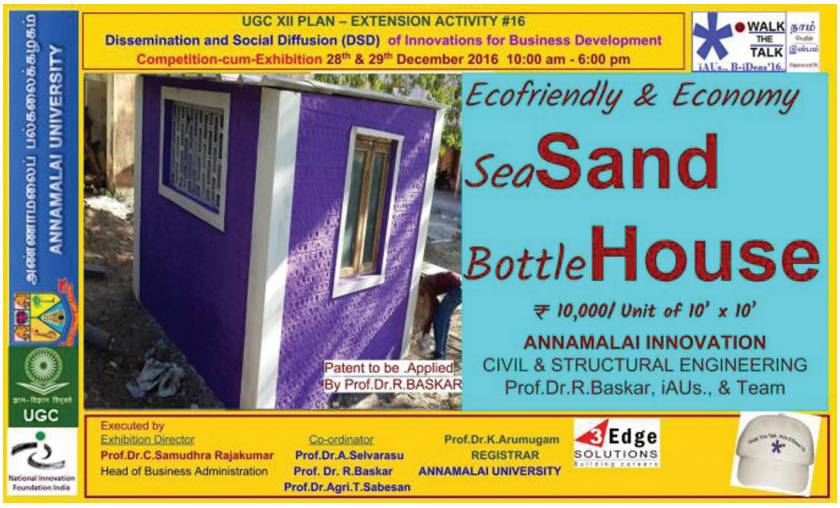
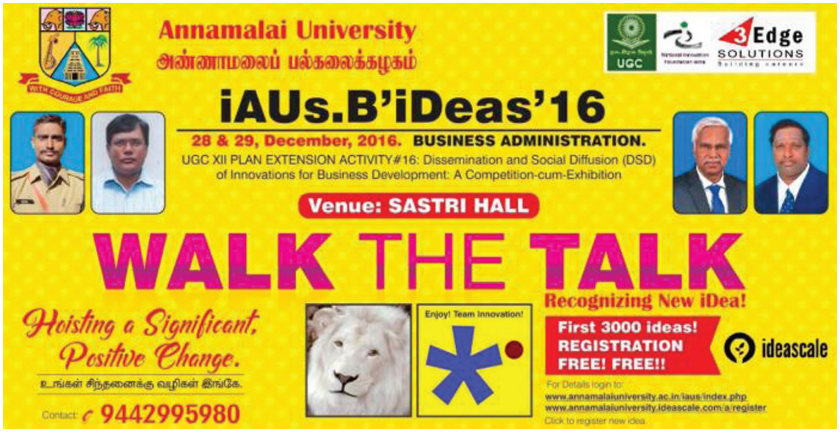


Figure 1: Bottle House Green Building (UI)

Source: Market positioning messages created and designed by the Author for promotion

Figure 2: Washing machine – bicycle powered (NIF)



Source: Designed

Figure 3: Dissemination and social diffusion event display by the author and sponsored by Caino Bakery Foods, Chidambaram

drawn using the Bodoni MT Condensed font and the dot was drawn using Cooper Black font. The marketing promotion materials for the exhibitions were prepared in the form of Polo Shirt, Cap, Bag, etc.

The dissemination and social diffusion (DSD) campaign

The campaign has two pronged approach as one was to rope in with National Innovation Foundation (NIF) (http://nif.org.in/) for transfer of technology and the other was to create a platform towards registering innovative ideas for crowd sourcing to establish open innovation as a culture powered by ideascale, USA (https://ideascale.com/). NIF is an autonomous body founded by Prof. Dr. Anil K Gupta, who is the Professor of Entrepreneurship at Indian Institute of Management Ahmadabad (IIMA), as an executive vice president under the Department of Science and Technology (DST), Government of India. NIF is focusing more on the innovations at the Grassroots level who have educational qualification up to higher secondary level. During 2006, an association with NIF was established as 'Valued Volunteer' through the process of conducting innovation marketing campaign (ni3M: need for innovation in Men, Machine and Management) for 800 students of technical Institutes with innovation competition-cum-demonstration. In continuation, the department of business administration has documented around fifteen grassroots innovations and submitted to NIF for further processing. A decade after, during 2016, the version 2.0 of innovation marketing campaign was expedited for business development. NIF has extended its information support with patented technology of 43 innovations and 11 high yielding varieties.

It was intended to invite the innovators with their prototype or product to be displayed in the form of exhibits for two to three days during December 2016. Due to lack of financial resources at the minimum level, it was designed to invite innovations in the district, in addition to a poster presentation of above NIF innovations by the students of business administration. About 54 students of Business administration have been allotted with an innovation

Table 1: NIF innovations exhibited in the DSD Walk-The-Talk

S. No	Innovation	Innovator	Unit price	Comments
1	Multi tree climber	D N Venkat	13,000	
2	Tender coconut breaker and instant cooler	Vinod Mahadevia	50,000	
3	Mitticool refrigerator	Mansukhbhai prajapati	5,500	
4	Modified Walker with Adjustable Legs	shalini kumari	3,000	
5	Sugarcane Bud Chipper	roshanlal vishwakarma	2,200	
6	Cotton Wick making machine	dipakbhai vyas	15,500	
7	Laxmi Asu Making Machine	C Mallesham	20,000	
8	Paddy Thresher	Fazlul Haque	55,000	
9	Turmeric/Ginger Planter	indrajit khas	75,000	
10	Nutmeg Desheller	Sachidanandan VR	28,000	
11	Power operated passive Weeder	K Mahipalchary	30,000	
12	Pepper Thresher	P.K. Ravi	30,000	
13	Fish dryer	Deben singh	800	
14	Garlic Peeling machine	M Nagrajan	3,00,000	2 variants of machine are available
15	Bamboo splint making machine	Paresh panchal	37,500	
16	Bamboo splint making machine	Usman shekhani	5,900	
17	Bamboo splint making machine	Ralte and Sailo	5,000	
18	Sanitary napkin making machine	afzal Sheikh	2,10,000	
19	Paddy husk stove	Ashok Thakur	1,000	
20	Manually operated water lifting device	N Shakthimainthan	1,200	
21	Multipurpose cooking vessel	Abdul Razzak	1,200	
22	Natural water cooler	Arvindbhai	55,000	
23	Poultry raking machine	Sureshbhai Narotambhai	25,000	
24	Egg incubator	Milan jyoti das	55,000	Model 1: capacity of 300 eggs
			70,000	Model2: capacity of 500 eggs
25	Pole Pro	Mustaq Ahmad Dar	10,000	
26	Manually operated cow dung pot making machine	Gopalbhai surtia	20,000	
27	Interlocking brick making machine	Umesh Chandra sharma	1,50,000	variant 1: 300 bricks per day
			2,00,000	variant 2: 500 bricks per day
			3,00,000	variant 3: 1000 bricks per day
			3,40,000	Variant 4: 1200 bricks per day
28	Cow dung log making machine	Masukhbhai prajapati	25,000	
29	Knapsack sprayer	Mohna mukta lamb	1,500	
30	Bicycle mounted sprayer	Mansukhbhai jagani	4,500	
31	Bicycle weeder	Gopal M Bhise	2,000	
32	Turmeric harvester	P Ramaraju	40,000	
33	Coconut tree climber	Late MJ joseph	2,500	
34	Multipurpose processing machine	Dharmveer Kamboj	1,10,000	V-60 (Model 1)
			1,80,000	V-120 (Model 2)
35	Milk master	Raghava Gowda	31,500	
36	Walnut cracker	Mustaq Ahmad Dar	40,000	
37	Portable energy efficient wood stove	V Jayaprakashan		Capacity (in Kg)
		Mild steel	2,500	1
		Stainless steel	3,000	
		Mild steel	3,500	2
		Stainless steel	6,000	
		Mild steel	12,000	5
		Stainless steel	15,000	
		Mild steel	15,000	10
		Stainless steel	20,000	
		Mild steel	20,000	20
		Stainless steel	25,000	
38	Emoinu stove	Emoinu stove	1,200	
39	Stencil cutting device	Nazim Sheikh	300	
40	Clay cooker	Mansukhbhai prajapati	1,000	
41	Shock absorbing cruthches	Archana konwar	1,500	
42	Wrapper picker	Mukul and Diptanshu malviya	Price on order	
43	Coffee cooker	Mohammad rozadeen	2,000	

Source: Submitted by the NIF-Nodal officer of Tamil Nadu, via email on 04-08 2016.

each and they are all provided with 2' x 3' posters with fliers carrying descriptions of innovations. Mr. Ramaraju, an innovator of turmeric harvester from Erode has been invited to give the feel and representation of NIF during the event. It was supported by the Sustainable Agriculture and Environment Action SEVA (www.sevango.in/), a Non-Government Organization functioning from Madurai, Tamil Nadu, India, with ten innovators covering Kurinjipadi, Panruti, Villupuram and Erode. Mr. P Vivekanandan, the founder and Executive Director of the NGO has participated. The participation of innovations from schools, colleges, and various departments of Annamalai University was highly appreciated by the district collector. All the prizes were distributed to the winners (Table 2) along with the team innovation (Figure 6) on 29th December, 2016.

The online open innovation platform

http://annamalaiuniversity.ideascale.com/

It is an innovation management tool, which is cloud-based, SAAS. It uses crowd sourcing to help and develop the next big thing. It is a platform that allows community participants to generate, aggregate, and prioritize ideas in a manageable online setting. Innovation community Walk-The–Talk (public) has been created in it, to invite users, submit idea, get idea submitted by users, vote, collect vote on ideas, comment and collect comments on ideas (Figure 7). Then the administrators and moderators within that community route, evaluate, and implement those ideas based on company needs. Administrators and moderators who join this system are a key part of the crowd that moves the great ideas from a member base into reality. The ideas have been exported data in the form or excel file; also we get a chance to check the same via Dashboard report and it can be promoted via social website from within IdeaScale.

Crowd sourcing

It is the act of taking tasks traditionally performed by an employee or contractor and outsourcing them to a generally large group of people or community in the form of an open call. Amateurs or volunteers working in their spare time may participate in crowd sourcing, as many experts or businesses that had been unknown to the contractor initiating the call for crowd sourcing. The word unites "crowd" and "outsourcing." Users (the crowd) are formed into online communities, and the communities submit solutions. The crowd also sorts through the solutions, finding the best ones. Best solutions are then owned by the entity that broadcast the call in the first place, the crowd sourcer, and winning individuals in the crowd were rewarded or acknowledged. In some cases, this labour is well compensated, either monetarily, with prizes, or with recognition. In other cases, the rewards were in the form of intellectual satisfaction or thanks for a job well done.

Strategies to make Walk-The-Talk

The source of inspiration for any academicians of business management is experiencing their dreams come true. The writer is recognized as "Innovative Teacher-2005" by a NGO initially for making the classroom sessions live and practice oriented. The recognition has given a drive for him to become 'Valued Volunteer 2006' by National Innovation Foundation for creating

Source: Submitted by the NIF-Nodal officer of Tamil Nadu, via email on 04-08 2016.

Figure 4: HMT high yielding paddy variety

Source: Submitted by the NIF-Nodal officer of Tamil Nadu, via email on 04-08 2016.

Figure 5: MittiCool Refrigerator (NIF)

awareness on the scouting and documentation of more than 15 ideas at the grassroots level. The author was invited to serve as Professor of Marketing in the institute of National importance under the Ministry of Textiles at Coimbatore, India. He could facilitate the transfer of technology of PADMAN- Innovator Padhma Shri Arunachalam Muruganantham (For his innovation and supply of Napkin Making Machine for Self Help Groups both in India and also internationally), a NIF Innovator with innovation fund from the Institute as Volunteer of NIF while serving in Sardar Vallabhbhai Patel School of International Textile & Management (2007-2009). Keeping the drive moving forward; a physical marketing simulation game was conducted after five years on his return to parent University subsequently during 2012. Also, the strategic approach to experience a real time research, 'Students' Shoppee' with a theme of Colour Fish Show for about 20 days gave lessons to business management. The experiences gained as a snowball gave rise to rope in with 'e-Students'shoppee' with the Best Price, Modern wholesale Stores at Hyderabad (https://www.bestprice.in) of Walmart India.

Walk-The-Talk is a strategy of innovation management by snowballing from one level of ideation to another level with team spirits. All the innovations provided by the NIF and other innovations identified within our University have been designed with a advertisement danglers carrying positioning message of each innovation. All the danglers were displayed as a marketing campaign for two days. The business management students have learned experienced and started registering ideas and took part in the ideation process both physical and online formats.

The competition to exhibit innovations by combinations of stakeholders in the event brought in good number of public participation as innovation-awareness-diffusion-adoption during the innovation management campaign. The decisions to rank the innovations by the experts have made the event more successful both from the academic community and corporate practitioners.

Source: Photo recorded on 29th December. 2016.

Figure 6: Team Innovation with Prize Winners

Table 2: List of Innovators as prize winners

LIST OF PRIZE WINNERS
iAUs.B'iDeas'16. Walk The Talk. Hoisting a significant positive change.
Team Innovation Competition-cum-Exhibition

Judgment by Corporate: Winners under the CATEGORY-A

1.	**A.K. YUSUF KALAM:**	First Prize	POWER GENERATION USING MAGNET AND COIL
2.	**Dr. S. THIRUGNANA SAMBANDAM** Faculty of Engineering & Technology, Annamalai University	Second Prize	CEMENTLESS BRICKS AND HOLLOW BLOCKS
3.	**S. BALAJI,** B.E., Mechanical Engg.	Third Prize	A NEW APPROACH TO REDUCE EMISSION FROM POWER PLANTS

Judgment by Corporate: Winners under the CATEGORY-B

1.	**K. BALAJI** & S. KUMANAN	First Prize	POLLUTION LESS WITH AVOID ACCIDENT BY VEHICLES
2.	**K.M. BAHEERATHAN**, M. NIKILAN & P. HARIHARAN	Second Prize	HIGHWAY TOWER CAR AND SOLAR POWER BANK WITH POLLUTION FILTER FACTORY
3.	**C. KAVIN,**	Third Prize	CONVERSION OF C3 RICE PLANT INTO C4

Judgment by Academics: Winners under the CATEGORY-A

1.	**V. NAVEEN**, B.Sc.Agri	First Prize	USING OF RECYCLED PLASTIC AS A BEDDING MATERIAL IN RICE FIELD
2.	**E. SENTHAMIL**, B.Sc.Agri	Second Prize	COMPOSTING OF PROSOPIS JULIFLORA
3.	**M. JUHI JESSILA**, M. KALAIARASI & R. JEYAVARSHINI Faculty of Dentistry	Third Prize	SMART STOP – A REVOLUTION IN SMOKING CESSATION

Judgment by Academics: Winners under the CATEGORY-B

1.	**Dr.R.BASKAR,** Associate Professor, Faculty of Engineering & Technology, Annamalai University	First Prize	BOTTLE HOUSE
2.	**M. JANANI &** K. GOPINATH, B.Sc.Agri.,	Second Prize	**SODIUM SALT TREATMENT IN WATER HYACINTH FIBER**
3.	**N. INDIRA &** P. JANANI, Faculty of Dentistry	Third Prize	**DENTIFROBOTS – A MINUTE MARVEL**

Judgment by Points Scored in the open innovation category http://annamalaiuniversity.ideascale.com

1.	**RAMKUMAR I MBA.,**	**First Prize**	**791 Points**
2.	**YAZZAR ARAFAT I MBA.,**	**Second Prize**	**724 Points**
3.	**GANESH SARAVANAN, B.Sc.Agri.,**	**Third Prize**	**686 Points**

SPECIAL PRIZE:

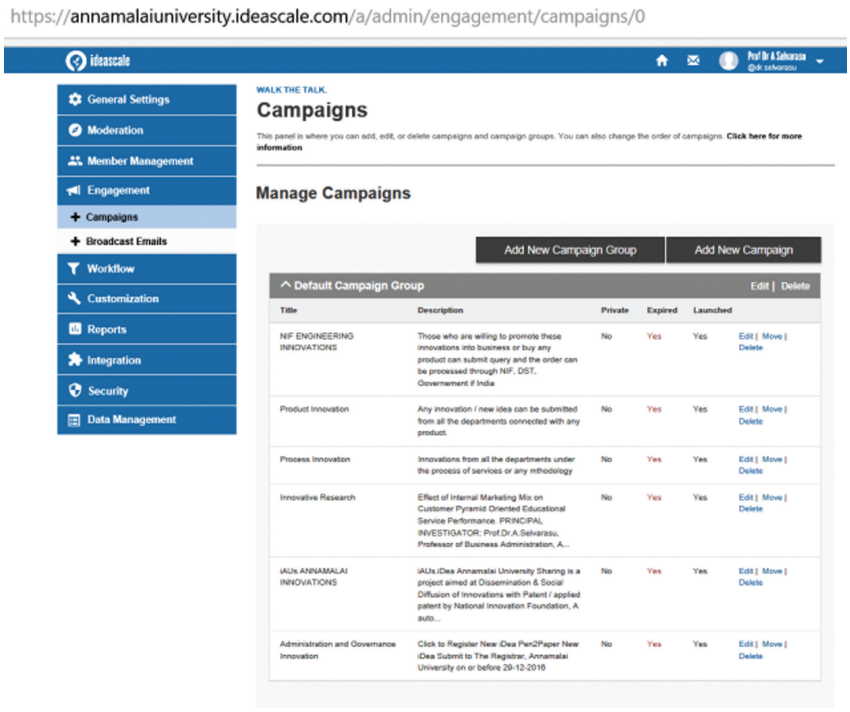
Mr.DHAKSHNAMOORTHY, CHIDAMBARAM FOR DESIGN OF KICK STARTER

Source: Results declared for Exhibition-cum-Competition held on 28&29th December, 2016.

In essence, to practice innovation management, the best strategy is to identify the innovator and facilitate him both physically and financially from the district administration to the educational institution across India with very little constraints.

Challenges in continuing Walk-The-Talk

The critical aspects of planning such an innovation management campaign are uniqueness in the design of the event and support services in various forms of administration and management. The most important challenge is the approach of networking various stakeholders across the nations and the world at large. The stakeholders those who are participating



Source:http://annamalaiuniversity.ideascale.com/ - visited on 02-02 2019.

Figure 7: Walk The Talk innovation community in ideascale

in the event are having different objectives and focus in meeting the demand for innovations. The efforts of the event organizer are to connect everyone on the common point of transfer of technology. The innovators have manifold objectives of conducting modification in their innovation, creating new solution for the existing problems, scaling up their innovation, etc. The age of different organization in the field of innovation management is another critical thing while bringing all of them at one common point. However, the relentless effort of the event organizer has given five innovation events and the drive for various new innovative management programmes.

Individually, it is very difficult to focus on innovation without compromising and sacrificing the personal and family goals. The journey continues as an innovator in the form of products and services. A 'Sip Sip & Lessens, Brands of new beverages (1998), zipped collar short for worn-out shirts (2007), OTTAM (Oceanic tri-aquarium) patent application registration (2012), and Executive MBA programme on PSU's corporate campus (2017) are successful innovations in addition to the accolade of 'Best Research Paper award in Indian Institute of Management Bangalore on internal marketing mix (2013) by Association of Indian Management Scholars (AIMS) International, Texas, USA.

In effect, the critical aspect of innovation management is mobilising funds for continuing the innovation management as a continuum. The registered ideas of more than 200 under the ideation process were remaining idle for the last three years. The funding agencies and venture capitalists can look into the requirements of this kind of marketing campaign for innovation management and come forward to support in all means and ways to promote the niche marketing opportunities.

Conclusion

Innovation management as a practice inculcates the habit of ideation to disseminate socially as diffusion-adoption process. The case study of an academ-

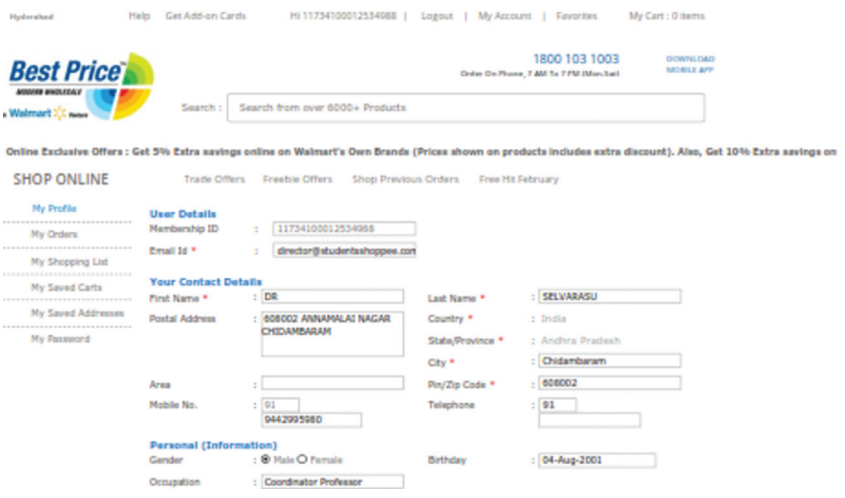
Diffusion of Innovation at NLC India Limited for Sustainable Development – A PSU Case

Vikraman Raman, Director, Human Resource of NLC India Limited, India

A Navaratna Public Enterprise (Public Sector Undertaking - PSU) which has incorporated innovation as a culture among employees in all its process of mining through thermal power generation. NLCIL have a scheme in place for diffusion of innovation with an objective of living with our Value "INNOVATION" and encourage the creativity of employees and their participation by way of contributing new ideas for improving company's efficiency, reduction of waste and enhancing productivity for sustainable development. Technological innovations have been used as a driver of new production alternatives to reduce the harmful impacts of industrial development on society and nature. Some of innovations at NLCIL are created high impact for organisation and society as a whole, Treated waste water from the mines benefits the nearby agriculture community and pumping out of ground water for agricultural purposes in the nearby villages is prevented. The fly ash generated in the power station is utilised for constructive use like cement manufacture, fly ash bricks blocks etc. NLCIL is reclaiming the mined out area and overburden dumps. Integrated Farming system (IFS), a novel method has been developed in collaboration with Tamilnadu Agricultural University for reclamation of backfilled areas. NLCIL has put up pilot plant to sequent CO_2 from one of the boilers by erecting photo-bioreactor of 1000 litre capacity and algae is produced. Algae are processed to produce biodiesel. NLCIL has successfully carried out this pilot project for the first time in India as algae grows faster and absorbs more CO_2 than a tree. This project is first of its kind as a CO_2 sequestration is carried out in an operating Thermal Power Station expansion to address climate change issue.

Source: https://www.bestprice.in webpage visited on 02-02 2019.

Figure 8: Innovator Padma Shri A. Muruganantham and star actor Akshay Kumar as hero of Padman movie



Source: https://www.bestprice.in webpage visited on 02-02 2019.

Figure 9: Students shoppee account in Best Price Wholesale

ician of business management in the Indian context gave the feel of possibility with inclusiveness and equality. All the five innovation management events of marketing gave a fair understanding of the need for networking different stakeholders involved in scouting and documentation of grassroots innovation (NIF) to open innovation on online (ideascale.com). There are innovators like the Padman at the grassroots level and he was known not only for his innovation but also winning the real business game by keeping the corporate world away from acquiring his patent. There were stories traced with innovators like Mr.Krishnamurthy, an auto mechanic from Chidambaram, Tamil Nadu, India who have been exploited for his bike kicker design by the corporate automobile manufacturer by not keeping their promise to protect his idea as patent. The story continues in innovation management beyond the commercial power to receive benefits by the society in some form or other as imitations at some point. Let's hoist a positive change in innovation management at academic institutions.

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Tech Events

2019

Apr 03–05
Daegu,
Republic of Korea

GREEN ENERGY EXPO 2019
Contact: Energy EXPO Secretariat
(702-712) 90, Yutongdanji-ro(St.)
Buk-gu, Daegu, Republic of Korea
Tel: +82 53 601-5371, Fax: +82 53 601-5372
E-mail: energy@excodaegu.co.kr

May 21–24
Chengdu,
China

2019 INNOVATIVE SMART GRID TECHNOLOGIES ASIA (ISGT ASIA)
Contact: Professor Qi Huang
E-mail: hwong@uestc.edu.cn
Web: http://sites.ieee.org/isgt-asia-2019/

May 22–25
Busan,
Republic of Korea

Busan International Machinery Technology Fair
Contact: Kotra (Korea Trade Investment Promotion Agency), Heolleungno
Seochu-Gu, Seoil 137-749, Republic of Korea
Tel: +82 (0)2 3460-7114, Fax: +82 (0)2 3460-7777
E-mail: digitalkotra@kotra.or.kr

Jun 5–8
Bangkok,
Thailand

INTERNATIONAL ENVIRONMENTAL PROTECTION AND POLLUTION CONTROL TECHNOLOGY
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
E-mail: info@cmpthailand.com

Jun 5–8
Bangkok,
Thailand

ASEAN SUSTAINABLE ENERGY WEEK (ASE)
Contact: Ms. Jidakarn Jarhatchaithitikhun
UBM Asia (Thailand) Co., Ltd.
Ari Hill 18th Floor, 428 Phahonyothin Road.
Samsen Nai, Phayathai Bangkok 10400,
Thailand , Tel: +66 2 036 0500
Fax: +66 2 036 0588 , Mobile: +66 91 874 6776
E-mail: Jidakarn.j@ubm.com
Web: http://www.asew-expo.com

Jun 17–21
Manila,
Philippines

ASIA CLEAN ENERGY FORUM (ACEF) 2019
Contact: Asia Clean Energy Forum
E-mail: acef@adb.org
Web: http://www.asiacleanenergyforum.org

Jun 19–21
Seoul,
Republic of Korea

EXPO SOLAR 2019
Contact: Infothe Co. Ltd.
13th floor Shinhan DM building
33-1 Mapo-dong, Mapo-gu
Seoul, 121-708, Republic of Korea
Tel: +82 2-719-6931, Fax: +82 2-715-8245
E-mail: interexpo@infothe.com

Jul 7–9
Bangkok,
Thailand

7TH ANNUAL SUSTAINABLE DEVELOPMENT CONFERENCE 2019
Contact: Tomorrow People Organization
Address: Dusana Vukasovica 73,
11000 Belgrade, Serbia
Tel/Fax: + 381 62 680 683
Web: http://www.sdconference.org

Jul 21–24
Macau,
China

4TH INTERNATIONAL CONFERENCE ON NEW ENERGY AND FUTURE ENERGY SYSTEMS (NEFES 2019)
Contact: NEFES 2019
Tel: +86-18071410263
E-mail: nefes@intergridconf.org
Web: http://www.intergridconf.org

Aug 16–18
Guangzhou,
China

GUANGZHOU INTERNATIONAL SOLAR PHOTOVOLTAIC EXHIBITION 2019
Contact: Guangzhou Grandeur Exhibition Services Co., Ltd
Room 2303-2305, The 4th Tower
Dong Jun Plaza, No.836 of
Dong Feng Dong Road,
Yuexiu District
Guangzhou, 510080, China
Tel: +86 2022074185,
Fax: +86 20-82579220
E-mail: grand.ad@grahw.com

Sep 3–5
Kuala Lumpur,
Malaysia

RENEWABLE ENERGY WORLD ASIA 2019
Contact: PennWell Conferences & Exhibitions, 1421 S. Sheridan Road
Tulsa, Oklahoma 74112, USA
Tel: +1 (918) 835-3161,
Fax: +1 (918) 831-9497
E-mail: Headquarters@PennWell.com

Sep 6-8
Gandhinagar,
India

AGRI ASIA 2019
Contact: RADEECAL Communications
402, 4th Floor, "Optionz" Complex,
Opp. IDFC BANK,
Between Girish Coldrink and Xaviers Corner,
Off C.G Road, Navrangpura,
Ahmedabad - 380009,
Gujarat, India
Tel:+91 079-26401101/ 02/ 03
E-mail :agriasia@agriasia.in
Web: http://www.agriasia.in

Sep 10–12
Singapore

IOT WORLD ASIA 2018
Contact: Secretariat
Tel: +44 (0) 20 755 19200
E-mail: danny.danzieri@knect365.com/
Web: https://tmt.knect365.com/iot-world-asia/

Sep 25–27
Bangkok,
Thailand

BIO INVESTMENT ASIA 2019
Contact: Project Manager /
Head of Science & Technology Unit
Tel: +662 670 0900 ext. 202
E-mail: anucha@vnuexhibitionsap.com
Web: http://www.bioinvestmentasia.com

Oct 30–Nov 1
Singapore

ASIA CLEAN ENERGY SUMMIT (ACES)
Contact: Faith Tan (Ms),
ACES Secretariat
Tel: +65 6831 1392
Web: https://www.asiacleanenergysummit.com

Oct 31–Nov 2
Hong Kong,
China

IWA-ASPIRE 2019
Contact: IWA-ASPIRE 2019
Conference Secretariat
C/o International Conference Consultants Ltd.
Unit C-D, 17/F, Max Share Centre,
373 King's Road,
North Point, Hong Kong, China
Tel: (852) 2559 9973,
Fax: (852) 2547 9528
E-mail: info@iwaaspire2019.org
Web: http://www.iwaaspire2019.org

Nov 27–29
Bangalore,
India

INTERSOLAR INDIA
Contact:, Brijesh Nair
Project Director, India
Tel: +91 22 4255-4707
Fax: +91 22 4255-4719
Web: https://www.intersolar.in

Tech Ventures & Opportunities

Business Coach

Tech Opportunities

Investment climate in Bangladesh

Bangladesh Investment Development Authority, Bangladesh
http://bida.gov.bd

Ease of doing business

Doing Business, a World Bank Group flagship publication, is a series of annual reports which measures the regulations that enhance a country's business activities and those that constrain it. Doing Business presents quantitative indicators on business regulations and the protection of property rights that can be compared across 190 economies. A high Ease of Doing Business ranking indicates a more favorable regulatory environment for starting and operating business in that particular country. Doing Business captures several important dimensions of the regulatory environment as it applies to business enterprises, providing quantitative indicators on regulation for the following: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, resolving insolvency.

To promote a more sustainable and inclusive investment environment, Bangladesh Investment Development Authority (BIDA) has undertaken steps for massive reforms to ensure:

- Creation of a true one-stop service for the investors.
- Facilitate the development of entrepreneurs.
- Aid the creation of necessary skills to match the needs of higher value production chains.
- Efforts to improve the ratings of Bangladesh in various indicators such 'Doing Business report of World Bank', 'Global Competitive Index' of the World Economic Forum and others.

Entrepreneurship development

The Government has taken many steps for investment promotion that include building infrastructure, undertaking mega projects, making available energy and power, enhancing access to finance, reforming policies, re-designing various programs, improving tax and regulatory regime, arranging better services, improving incentive structure, creating ancillary facilities and developing institutions like BIDA.

To realize the full potential of the Bangladesh economy double digit growth is required from the current 7% per annum. The tools to attaining this is to bridge missing links one of which is 'entrepreneurship development' to sustain and to create entrepreneurs in a number of leading sectors like RMG, Power, transportation, pharmaceuticals etc and also in new frontiers including those in 'sun-rise1 industries like IT, biotech, health care, financial services etc in other news sectors. The rear the new entrepreneurs mentoring and financial support is of utmost important. Financing through Venture Capital or other mechanism can be endeavored.

An exhaustive entrepreneurship development program (with sector specific variation as needed) aiming at developing 300,000 entrepreneurs over a period of three years with 100,000 every year on average.

Guiding the new investors at every stage in their progression from beginning to closure of a business/ project is absolutely necessary. This mentoring/ guidance may be provided by a successful/ established businessperson with real life experience of navigating through the difficult terrain of developing a business.

Economic corridor development

The concept of Economic Corridor in Bangladesh is a recent phenomenon. Economic Corridor is an infrastructure that helps to facilitated economic activities along a defined geography by linking economic nodes or hubs usually centered on urban landscapes, in which large amount of economic resources concentrated. The Seventh Five-Year Plan of Bangladesh envisages an integrated development strategy for the southwest region. Given its strategic locational advantage, Bangladesh's southwest region is a strong claimant to becoming domestic and regional industrial, trade, and investment hub.

Privatization

Privatization in Bangladesh started in mid-seventies. Later on it got an institutional shape by creation of the Privatization Board in the year1993. Privatization Board was transformed in to the Privatization Commission under the provision of the Privatization Act, 2000. In the backdrop of sickness and continual decaying condition of State Own Enterprises (SOEs), government was committed to quickly privatize such SOEs and commercial enterprises to strengthen the role of private Sector and to stabilize it as an instrument of development. Since the establishment of Privatization Board and thereafter Privatization Commission a total of 74 SOEs have been privatized of which 54 were privatized through outright sale and 20 through offloading of government shares. There were 12 methods of privatization of SOEs, but Privatization Commission generally followed the method of sale through tender.

Finance and banking

The financial sector in Bangladesh is continuously evolving towards a more modern and efficient system of finance which is supportive of greater investment and inclusive economic growth. The financial system of Bangladesh consists of The Bangladesh Bank, scheduled banks, non-bank financial institutions, micro finance institutions, insurance companies, co-operative banks, credit rating agencies and stock exchange.

Investment promotion criteria in Thailand

The Board of Investment of Thailand

https://www.boi.go.th

The Board of Investment stipulates the following criteria for project approval:

Development of competitiveness in the agricultural, industrial and services sectors

- The value added of the project must not be less than 20% of revenues, except for projects in agriculture and agricultural products, electronic products and parts, and coil centers, all of which must have value added of at least 10% of revenues.
- Modern production processes must be used.
- New machinery must be used. In case of imported used machinery, criteria are as follows:

  a) In case of used machinery not over 5 years old, counting from the manufacturing year to the importing year, the machinery shall be allowed to be used in the project and counted as investment capital for the calculation of the cap on corporate income tax exemptions; however, they shall not be granted import duty exemption. A machinery performance certificate issued by a trusted institute identifying efficiency, environmental impact and energy usage for the machine, as well as its fair value, must be obtained.

  b) In case of used machinery over 5 years old but not exceeding 10 years old, counting from the manufacturing year to the importing year, only press machines shall be allowed to be used in the project and counted as investment capital for the calculation of the cap on corporate income tax exemptions; however, they shall not be granted import duty exemption. A machinery performance certificate issued by a trusted institute identifying efficiency, environmental impact and energy usage for the machine, as well as its fair value, must be obtained.

  c) For sea and air transport activities and molds and dies, used machinery over 10 years old, counting from the manufacturing year to the importing year, may be allowed to be used in the project as deemed appropriate, counted as investment capital for the calculation of the cap on corporate income tax exemptions and granted machinery import duty exemption.Criteria shall be as specified by the Office of the Board of Investment.

Environmental protection

- Adequate and efficient guidelines and measures to protect environmental quality and to reduce environmental impact must be installed. The Board will give special consideration to the location and pollution treatment of a project with potential environmental impact.
- Projects or activities with type and size that are required to submit environmental impact assessment reports must comply with the related environmental laws and regulations or Cabinet resolutions
- Projects located in Rayong must comply with the Office of the Board of Investment Announcement No. Por 1/2554 dated May 2, 2011 on Industrial Promotion Policy in Rayong Area.

Minimum capital investment and project feasibility

- The minimum capital investment requirement of each project is 1 million baht (excluding cost of land and working capital) unless specified otherwise on the list of activities eligible for investment promotion that is attached to this announcement.

  As for knowledge-based services, the minimum capital investment requirement is based on the minimum annual salaries expense specified in the list of activities eligible for investment promotion that is attached to this announcement.
- For newly established projects, the debt-to-equity ratio must not exceed 3 to 1. Expansion projects shall be considered on a case-by-case basis.
- For projects with investment value of over 750 million baht, (excluding cost of land and working capital), the feasibility study for projects applying for investment promotion must be submitted with details as specified by the Board.

Registration of transfer of patent and petty patent in Thailand

Department of Intellectual Property, Thailand
http://www.ipthailand.go.th

Consideration criteria

The patent transferring contract is a contract with which the assignor grants the right to the assignee right (assignment of patent/petty patent). In this regard, the right transferring shall not exceed the protection period as follows;

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

Conditions of application submission

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

Proceeding according to the official's instruction

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

Notes:

1. The working process starts after the inspection of the documents is completed, as specified in the manual of the public service.
2. In case the application or documentary evidence is not correct or incomplete, the official shall record the defect of the document or indicate the required additional documentary evidence (Record of conditions on application reception). The applicant shall correct the document and/or submit the additional document within 90 days of the application filing date. If the applicant fails to submit all additional documents within the specific period of time, the applicant shall be deemed to have abandoned the application. The official shall return the

application to the applicant and inform the reason of the return and his appeal right.

3. Any person fee paid to the Department of Intellectual Property shall not be refunded in all cases, except
   (1) The law stipulates that the fee must be refunded, or
   (2) The applicant double-paid or overpaid the fee, by which the faulty payment resulted from the mistake of the state official, not the payer. In this regard, the Department of Intellectual Property shall consider the refund case by case.
4. In case the applicant is required to submit many additional documentary evidences, the applicant shall submit all additional documentary evidences in the same time.
5. In case the applicant submits the copy of the documentary evidence, the applicant shall certify the copy of the documentary evidence.
6. In case the applicant submits the document in foreign language, the applicant shall submit the document with Thai translation and the correct translation certification of the translator.
7. In case the applicant or the authorized patent agent/patent attorney does not submit the application by himself, and granted power to the other person to submit the application, the application submitter shall present a sub power of attorney or temporary power of attorney, so that he is eligible to submit the application and sign in the record of conditions on application reception. If it appears that the application and the documentary evidence is not correct or incomplete, and the application submitter is not authorized to sign on the said record, the official shall not receive the application.
8. The working period does not include the time period when the applicant follows the official's instruction or corrects the application, or the period of temporary suspension of registration.

Relevant laws

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

Artificial Intelligence-Based Image Search Tool for Brands

The World Intellectual Property Organization (WIPO) has launched a new artificial intelligence (AI)-powered image search technology that makes it faster and easier to establish the distinctiveness of a trademark in a target market. Earlier-generation image search tools primarily determine trademark image similarity by identifying shapes and colors in marks. WIPO's new AI-based technology improves on this technology by using deep machine learning to identify combinations of concepts – such as an apple, an eagle, a tree, a crown, a car, a star – within an image to find similar marks that have previously been registered.

The new technology results in a narrower and more precise group of potentially similar marks, facilitating greater certainty in strategic planning for brand expansion into new markets. With fewer results to scrutinize, this also translates into labor-cost savings for trademark examiners, attorneys and paralegals, industry practitioners and researchers.

WIPO's new AI search technology leverages deep neural networks and figurative elements classification data from the Madrid System for the International Registration of Marks and from large trademark offices. All users can access the AI search technology for free through WIPO's Global Brand Database, where it has been fully integrated into the database search engine.

The new search functionality covers the national collections of 45 trademark offices already participating in the project - even if they have not been using a classification system for figurative elements. This represents a total number of almost 38 million trademarks to date. WIPO periodically adds new collections from around the world to the database.

For further information, contact:

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

Voluntary licensing of patents in the Philippines

The Intellectual Property Office, Philippines
http://ipophil.gov.ph

REPUBLIC ACT NO. 8293

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Technology Trends" Study Probes Artificial Intelligence

A new WIPO flagship study has documented a massive recent surge in artificial intelligence-based inventions, with U.S.-based companies IBM and Microsoft leading the pack as AI has moved from the theoretical realm toward the global marketplace in recent years. The first publication in the "*WIPO Technology Trends*" series defines and measures innovations in artificial intelligence (AI), uncovering more than 340,000 AI-related patent applications and 1.6 million scientific papers published since AI first emerged in the 1950s, with the majority of all AI-related patent filings published since 2013.

This inaugural Technology Trends report provides a common information base on AI for policy and decision makers in government and business, as well as concerned citizens across the globe, who are grappling with the ramifications of a new technology that promises to upend many areas of economic, social and cultural activity.

This report is the first in a new series from WIPO tracking the development of technologies through the analysis of data on innovation activities. It reveals trends in patenting of artificial intelligence (AI) innovations, the top players in AI from industry and academia, and the geographical distribution of AI-related patent protection and scientific publications. Its findings are accompanied throughout by commentary and industry perspectives from more than 20 of the world's leading experts in AI, making it of particular interest to business leaders, researchers and policymakers.

This report identifies the key players in AI from both the corporate and public sectors across different research areas and industries. Furthermore, the analysis of the data and the inputs from AI experts address many of the policy issues raised by AI, such as the regulation and control of data, the incentivization of further research, the role of intellectual property (IP) protection and the development of human-centered and ethical AI to benefit all.

For more information, access:

https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf

Financing for small and medium enterprises in Malaysia

Bank Negara Malaysia
http://www.bnm.gov.my

SMEs are a critical component of the Malaysian economy, contributing more than a third of gross domestic product (GDP) and providing job opportunities to more than four million workers in Malaysia. Banking institutions is the main source of financing for SMEs, providing more than 90% of total financing. Provision of SME financing is also complemented by the Development Financial Institutions, Bank Negara Malaysia's Funds for SMEs and Government Funds.

Bank Negara Malaysia's Funds for SMEs

Bank Negara Malaysia has recently consolidated the existing BNM's Special Funds into an omnibus fund and is now renamed as BNM's Fund for SMEs or *Tabung BNM untuk PKS*. The funds are channelled through participating financial institutions (PFIs) comprising all licensed banks, prescribed development financial institutions and the Corporate Guarantee Corporation Berhad (CGC). Application must be submitted through any PFIs and approval will be subjected to the normal credit assessment of the PFI.

- **BNM's Fund for SMEs:** Enhance access to financing at reasonable cost for SMEs in all economic sectors
- **Bumiputera Entrepreneur Project Fund-i (BEPF-i):** Provide financing to Bumiputera entrepreneurs who have been awarded contracts/projects by the Government, Government-related agencies, statutory bodies and reputable private/public companies.

Credit Guarantee Corporation Schemes

CGC products and services are as follows:

- Guarantee schemes (Conventional)
- Guarantee schemes (Islamic)
- Government funded schemes
- Direct financing

Development financial institutions

The DFIs that prescribed under Development Financial Institutions Act 2002 provide financing to the SMEs, including micro enterprises of various strategic economic sectors. Apart from financing, these institutions provide a broad range of advisory services to supplement the financial services, including financial management, business diagnosis and marketing support.

Non-financial institution lenders

Non-financial institution lenders play a complementary role in the financing ecosystem. They facilitate business growth by providing financing and ancillary services, including:

- Specialised funds which include equity financing to support businesses at different stages of the business life cycle, thus helping to address funding gaps unmet by financial institutions;
- Advisory services including facilitation from the conceptualisation of a business to its commercialisation, legal and marketing advice;
- Promoting strategic partnerships by linking businesses to public and private partners;
- Capacity building programmes including training and coaching;
- Promoting angel investments and creating awareness of investment opportunities;
- Assistance in securing the protection of intellectual property e.g. registration of patents, trademarks and copyright, industrial design; and
- Technology scouting programmes to connect entrepreneurs with the desired technology to improve their productivity.

Among the non-financial institutions in Malaysia are:

Cradle: An agency under the Ministry of Finance that manages Cradle Investment Programme, a development and commercialization grant to fund technology startups. For further information, visit www.cradle.com.my, www.cgp.com.my or www.csv.com.my.

Malaysia Debt Ventures Berhad: A Government-owned company that was established in mid 2002 to provide project financing facilities to ICT companies to finance procurement of the necessary project inputs, capital expenditure and working capital. Through its Partner Banks, MDV provides trade and guarantee facilities as required by the project or contract. For further information, visit www.mdv.com.my.

Agensi Inovasi Malaysia: Agensi Inovasi Malaysia (AIM) was created to jump start wealth creation through knowledge, technology and innovation to stimulate and develop the innovation eco-system in Malaysia. AIM lays down the foundation of innovation that inspire and produce a new generation of innovative entrepreneurs. AIM facilitates collaborations between government, academia and industry in advancing the consolidation and execution of new ideas in innovation. For further information, visit innovation.my.

PlaTCOM Ventures Sdn Bhd, a wholly-owned subsidiary of AIM, provides end-to-end facilitation for commercialisation of innovations from ideas to products and services, including financing support. For further information, visit www.platcomventures.com.

Modes of financing for startups

Small Industries Development Bank of India (SIDBI), India
https://smallb.sidbi.in

Finance is required by a business enterprise at almost every stage of the business life cycle. MSMEs often find it difficult to arrange adequate finance for their operations as well as for expansion and growth. These enterprises can raise finance by various methods. Below are some of the ways to raise long term and short-term capital.

Sources of long term capital

Reinvestment of profits

Profitable companies do not generally distribute the whole amount of profits as dividend but, transfer certain proportion to reserves. This may be regarded as reinvestment of profits or ploughing back of profits. As these retained profits actually belong to the shareholders of the company, these are treated as a part of ownership capital. Retention of profits is a sort of self-financing of business. The reserves built up over the years by ploughing back of profits may be utilized by the company for the following purposes:

- Expansion of the undertaking
- Replacement of obsolete assets and modernization
- Meeting permanent or special working capital requirement
- Redemption of old debts

The benefits of this source of finance to the company are:

- It reduces the dependence on external sources of finance
- It increases the credit worthiness of the company
- It enables the company to withstand difficult situations
- It enables the company to adopt a stable dividend policy
- It increases the debt raising capacity of the company

Loans from commercial banks / financial institutions

Medium and long-term loans required for setting up projects can be obtained from banks and \or financial institutions for all viable projects. Similarly, funds required for modernization and renovation schemes can be borrowed from them. Such loans are generally secured by mortgage of the Company's properties, pledge of shares, personal guarantees etc.

Public deposits

Companies often raise funds by inviting their shareholders, employees and the general public to deposit their savings with the company. The Companies Act permits such deposits to be received for a period up to 3 years at a time. Public deposits can be raised by companies to meet their medium-term as well as short-term financial needs. The increasing popularity of public deposits is due to:

- The rate of interest the companies have to pay on them is attractive.
- These are easier methods of mobilizing funds than banks, especially during periods of credit squeeze
- They are unsecured

Risk capital

Risk capital denotes the provision of capital where the provider reduces the risk burden of the entrepreneur, and in turn bears some part of the overall risk involved in a productive activity. As per a definition widely used in India – The term 'risk capital' includes equity as well as mezzanine/ quasi equity financial products that have features of both debt and equity. Risk Capital is an important instrument for not only start-ups and innovative / fast growing companies but is also critical to those companies looking at growth. Risk capital substitutes promoter's contribution, thereby reducing the capital to be brought by the entrepreneurs. Under such cases, Risk capital is one of the most viable options for raising capital for MSMEs. Some of the major risk capital options available for MSMEs include Venture Capital, Angel Investment and Public Listing.

Issue of shares

It is the most important method. The liability of shareholders is limited to the face value of shares, and they are also easily transferable. A private company cannot invite the general public to subscribe for its share capital and its shares are also not freely transferable. But for public limited companies there are no such restrictions. There are two types of shares:

- Equity shares: the rate of dividend on these shares depends on the profits available and the discretion of directors. Hence, there is no fixed burden on the company. Each share carries one vote.
- Preference shares: dividend is payable on these shares at a fixed rate and is payable only if there are profits. Hence, there is no compulsory burden on the company's finances. Such shares do not give voting rights.

Issue of debentures

Companies generally have powers to borrow and raise loans by issuing debentures. The rate of interest payable on debentures is fixed at the time of issue and the debentures have a charge on the property or assets of the company, which provide the

necessary security. The company is liable to pay interest even if there are no profits. Debentures are mostly issued to finance the long-term requirements of business and do not carry any voting rights.

Sources of short term capital

Trade credit

Companies buy raw materials, components, stores and spare parts on credit from different suppliers. Generally, suppliers grant credit for a period of 3 to 6 months, and thus provide short-term finance to the company. Availability of this type of finance is connected with the volume of business. When the production and sale of goods increase, there is automatic increase in the volume of purchases, and more of trade credit is available.

Factoring

The amounts due to a company from customers, on account of credit sale generally remain outstanding during the period of credit allowed i.e. till the dues are collected from the debtors. The book debts may be assigned to a bank and cash realized in advance from the bank. Thus, the responsibility of collecting the debtors' balance is taken over by the bank on payment of specified charges by the company. book debts may be assigned by the seller to a FACTOR, who will provide about 80 - 85 % or more of the value of the book debt, as advance to the seller. The FACTOR will also undertake the task of collecting the amount representing the debt (credit sales) from the debtors. Factoring is an important avenue of raising short funds against the receivables for the MSME units. The charges payable to the FACTOR is treated as cost of raising the funds

Discounting bills of exchange

This method is widely used by companies for raising short-term finance. When the goods are sold on credit, bills of exchange are generally drawn for acceptance by the buyers of goods. Instead of holding the bills till the date of maturity, companies can discount them with commercial banks on payment of a charge known as bank discount. The rate of discount to be charged by banks is prescribed by the Reserve Bank of India from time to time. The amount of discount is deducted from the value of bills at the time of discounting. The cost of raising finance by this method is the discount charged by the bank.

Technology Bank for Least Developed Countries

The Technology Bank, a new body dedicated to the least developed countries (LDCs) has been operationalized with the signing of the Host Country Agreement and the Contribution Agreement between the Government of Turkey and the United Nations. This is an important milestone in global efforts to strengthen the science, technology and innovation capacity in the world's 47 least developed countries.

The 2011 Istanbul Programme of Action called for the establishment of a technology bank and a science, technology and innovation supporting mechanism dedicated to least developed countries (the "Technology Bank"), a long-standing priority of the LDCs confirmed in the 2015 Addis Ababa Action Agenda and in Sustainable Development Goal 17. The establishment of the Technology Bank is expected to be the first target of the SDGs to be met.

The new Bank is expected to improve the utilization of scientific and technological solutions in the world's poorest countries and promote the integration of least developed countries into the global knowledge-based economy. This will be achieved through improving technology-related policies and facilitating the access to appropriate technologies. The establishment of the Technology Bank marks the first Sustainable Development Goal (SDG) target to be achieved, SDG 17.8. Its achievement is highly symbolic, as it responds directly to the 2030 Agenda's principle of leaving no one behind.

For more information, access:
http://unohrlls.org/technologybank/

Area-based innovation in Thailand

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

Area-Based Innovation strategy has been developed to accelerate innovation potential in certain residential areas and generate the co-creation of communal innovation opportunities for people via the Yothi Innovation District project, emphasizing mainly on the development of medical innovation, e-Government, and area-based innovation. The National Innovation Agency (NIA) has determined to maximize people's innovation potential at an area-based level, leading to the Innovation Corridor, Innovation City, and Innovation District.

Innovation Corridor

The GMS Southern Economic Corridor possesses an approximate distance of 1,320 kilometers that strategically connects Thailand, Myanmar, Cambodia, and Vietnam together. In fact, the area-based innovation has taken into account the efficiency of being exposed to geographical strengths and natural resources in certain communities, expecting to stimulate economic and social development in various living areas. Key strategies used for driving economic and social progress consist of communal industry, infrastructure, human resources, and advances in science and technology.

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

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

Innovation District

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

Innovation City

The NIA has secured municipal and provincial collaboration with four major Thai cities, including Pattaya Municipality and Saensuk Municipality of Chonburi province as well as Phuket City Municipality and Patong Municipality of Phuket province. Strategically, the NIA aims to develop Pattaya Municipality and Saensuk Municipality based on the "Smart Tourism and MICE City" and "Smart Living City" concepts, respectively. The two metropolitan cities will mutually focus on the advancement of "Healthcare and Elderly Care" practices. Meanwhile, another two municipalities of Phuket are anticipated to become the "Smart Tourism and Mobility" cities.

Innovation promotion in India

National Institution for Transforming India, Government of India
http://niti.gov.in

Atal Innovation Mission (AIM) including Self-Employment and Talent Utilization (SETU) is Government of India's endeavour to promote a culture of innovation and entrepreneurship. Its objective is to serve as a platform for promotion of world-class Innovation Hubs, Grand Challenges, Start-up businesses and other self-employment activities, particularly in technology driven areas.

The Atal Innovation Mission shall have two core functions:

- Entrepreneurship promotion through Self-Employment and Talent Utilization, wherein innovators would be supported and mentored to become successful entrepreneurs
- Innovation promotion: to provide a platform where innovative ideas are generated

Atal grand challenge awards

The factors holding back rural and semi-urban India are lack of 24/7 electricity, roads that are usable round the year, clean water, suitable housing, access to basic healthcare, quality education, lack of farm mechanisation and employable skills. While state-of-the-art technology can address a number of these challenges, the existing solutions have been out of reach due to their excessive high costs.

Atal Grand Challenge (AGC) Awards, under the Atal Innovation Mission, has the objective of developing novel disruptive technologies that are ultra-low cost, low maintenance, durable and customised to the local conditions of India. AGC will award grand prizes to anyone who delivers in a timely manner the desired solution as per the challenge specific criteria. NITI Aayog has called on the national and the international community to join the initiative and in finding solutions to the most intractable problems.

Wide spread adoption and deployment of these disruptive solutions will result in economic transformation of the bottom 70% and beyond of the population and elimination of poverty. An additional objective is to further energize the local scientific and engineering community/academic institutions and engage them in innovative research and development towards finding novel solutions. Yet another objective is to make India a source of innovation and novel products to address similar problems faced by bottom 5 billion people of the world and in the process also accelerate our own economy.

Atal Tinkering Labs

With a vision to 'Cultivate one Million children in India as Neoteric Innovators', Atal Innovation Mission is establishing Atal Tinkering Laboratories (ATLs) in schools across India. The objective of this scheme is to foster curiosity, creativity and imagination in young minds; and inculcate skills such as design mindset, computational thinking, adaptive learning, physical computing etc.

ATL is a work space where young minds can give shape to their ideas through hands on do-it-yourself mode; and learn innovation skills. Young children will get a chance to work with tools and equipment to understand the concepts of STEM (Science, Technology, Engineering and Math). ATL would contain educational and learning 'do it yourself' kits and equipment on – science, electronics, robotics, open source microcontroller boards, sensors and 3D printers and computers. Other desirable facilities include meeting rooms and video conferencing facility.

In order to foster inventiveness among students, ATL can conduct different activities ranging from regional and national level competitions, exhibitions, workshops on problem solving, designing and fabrication of products, lecture series etc. at periodic intervals.

Atal Incubation Centers

AIM intends to establish 'new' incubation centres (Atal Incubation Centres) across India by providing them with financial support. AICs would further support and encourage start-ups to become successful enterprises. They would provide necessary and adequate infrastructure along with high quality assistance or services to start-ups in their early stages of growth.

AICs would be established in subject specific areas such as manufacturing, transport, energy, health, education, agriculture, water and sanitation etc. Each AIC would be required to choose at least one area for specialisation.

AICs can be established either in public/private/public-private partnership mode. These can be established in:

- Academia - This includes higher educational institutes and R&D Institutions.
- Non-academic - This includes Companies/ Corporates/ Technology parks / Industrial Parks/ any individual/ group of individuals.

Scale-up support to established Incubators

The scheme envisages to augment capacity of the Established Incubation Centres in the country. It will provide financial scale-up support to enable Established Incubation Centres. The scheme would radically transform the start-up ecosystem in the country by upgrading the Established Incubation Centres to world-class standards.

- Legal entity registered in India as public, private or public-private partnership.
- Legal entity must be in operation for a minimum of three years.

Green Economic Development Project of The Philippines

Bureau of Small and Medium Enterprise Development (BSMED), The Philippines
https://www.dti.gov.ph

The impact of micro, small and medium enterprises (MSMEs) in the economy cannot be overemphasized. Together, MSMEs account for 99.5% of established businesses, employ 62.8% of the total workforce, and account for about a third of the country?s Gross Domestic Product. MSMEs play a key role in increasing competitiveness and promoting rural and global value chain development, thereby achieving inclusive growth and poverty reduction. although MSMEs contribute to economic growth, it however, put pressure on the environment and the climate through high water and energy usage, malfunctional waste and wastewater management as well as a high emittance of carbon. Unfortunately, they are also among the most vulnerable to fluctuations in the prices of production inputs such as power, fuel, water, raw materials, and others. The good news is that there are "green business" strategies that MSMEs can adopt to minimize the impacts climate change and enhance the long term competitiveness of the enterprise.

Why should MSMEs go Green?

- Reduces cost of production (materials, power, fuel, and water) which results in increased efficiency - Makes MSMEs competitive
- Promotes access to new and higher value markets
- Facilitates innovation (new products, processes)
- Makes MSMEs resilient to climate change and disaster impact
- Improves employee morale, health and productivity
- Provides employment to local community
- Better control of product safety and quality

Green Economic Development

Green Economic Development (GED) is a driver for competitiveness, innovation, tapping new markets, generating new jobs, and thus achieving inclusive growth and poverty reduction. It is founded on the five pillars of mitigation, adaptation, competitiveness, generating green jobs, and the preservation and even enhancement of nature's capital, without which any form of economic activity would not be possible.

The GED program builds upon the four-year long cooperation between DTI-ROG and the GIZ ProGED Project. The program aims to enhance the competitiveness of MSMEs by helping them adopt climate-smart, environmental-friendly, and inclusive strategies and measures by aligning with the green value chain approach to identify hotspots for greening.

Objectives and outcome

The overall goal of the program is to enhance MSME competitiveness thru the adoption of climate-smart, environmental-friendly, and strategic measures that will help them in preparing for the impacts of climate change. Specifically, the program aims to:

- Increase MSME awareness on GED, climate change, and promote the adoption of greening strategies and measures
- Increase the number of MSMEs greening their operations at the regional and provincial level
- Facilitate the linkages and matchmaking activities between MSMEs and BDS providers and financing institutions
- Further develop and establish green policy framework at the DTI national, regional, and provincial level

Target beneficiaries

Existing and potential MSMEs are the direct beneficiaries of the program and may also include cooperatives, trade associations, LGUs, and other stakeholders.

GED strategic framework

Implementation of the program will be guided by a strategic results framework which is influenced by the ProGED project. Similarly, the program has three strategic focus areas to facilitate implementation.

A. Green information and awareness – This strategy centers on increasing the awareness of MSMEs and other stakeholders about climate change and its negative impact on their business and how the adoption of greening measures and strategies can further minimize its effect while enhancing resilience and competitiveness.

B. Green linkages and matchmaking – This strategy focuses on facilitating linkage between MSMEs and green business development service providers, green technology suppliers, and green financing institutions that can help MSMEs advance their greening initiatives.

C. Green policy framework – The focal point of this strategy is to further develop and establish the policy framework in mainstreaming the GED initiative in the programs, projects and activities within DTI regional and provincial level.

Green technology promotion in Malaysia

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

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

Renewable energy

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

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

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

Energy efficiency

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

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

Green technology incentive

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

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

Technologies and practices for small agricultural producers (TECA)

TECA is an FAO initiative that aims at improving access to information and knowledge sharing about proven technologies in order to enhance their adoption in agriculture, livestock, fisheries and forestry thus addressing food security, climate change, poverty alleviation and sustainable development. With TECA, users have easy access to a vast knowledge database to improve their production systems, product marketing and farm management. They can also benefit from online communities of experts (Exchange Groups) where they can share experiences and find solutions for small-scale systems.

For more information, access:

http://teca.fao.org

Technology Offers

CHINA

Small steam turbine

The small steam turbine works by pressure and temperature differences between the passing-in and passing-out steams. When equipped with an electric generator and a steam boiler with an over-heater, it becomes an electric generator set. The steam turbine is also an ideal motive power for water pumps, blast fans, etc. The matched steam boiler, generator and their manufacturing technologies can also be provided.

Area of Application

- Energy: thermoelectric power stations using waste heat, chemical industry, petroleum industry
- Textile industry: dyeing and printing
- Pharmaceutical industry
- Pulp and paper industry
- Sugar refineries, wine industry

Advantages

High efficiency; Energy saving; Run-reliability; Simple operation; Quick start; Convenient installation and maintenance; Low noise; Compact structure.

Environmental Aspects

Energy efficiency

Development Status

Fully commercialized

Transfer Terms

- Consultancy
- Joint venture
- Technology licensing
- Equipment supply
- Turnkey
- Others

Target Countries

Worldwide

Contact

Mr. Li Juntian
Economist
699 Lianmeng Road, Shijiazhuang 050 061, Hebei, China.
Tel: (86-311) 777 5046; Fax: (86-311) 777 5048

GERMANY

Laser waste destruction and co-generation of power

A German consulting firm offers to arrange the technology of laser waste destruction and co-generation of power from its United States (US) based client company. The US-based technology supplier company is a multi-faceted high-temperature materials processing, energy production and recycling company. It specializes in system design, manufacturing, management and operation of the company's proprietary Laser Waste Destruction System (LWD) which are used in processing both liquid and solid waste streams. The company's "Thermal Energy Production Systems" (TEP) incorporate the use of co-generation technology for generating economic electric power on an environmentally friendly basis. Both systems have application designs which will accommodate the energy production and waste stream disposition needs of a small factory or a large municipal user.

Area of Application

Waste treatment, waste utilization: processing of solid wastes and liquid wastes from medium and large factories; hospital wastes, waste from markets/supermarkets; municipal wastes; sludge processing.

Advantages

The system has considerable environmental advantages compared with incinerators: zero NOx & zero dioxine emissions; complete destruction of waste; zero bottom ash; metals are turned into useful by-products; energy from wastes: the electricity produced is used to power the processing plant and excess energy is sold to local power companies at fair market rates. co-generation reduces operating costs and makes the system a profit-centre; heat is recovered to power co-generation plant 5-50 mw; flexible size and configuration; both stationary installation and mobile units are available; automatic control and continuous monitoring; easy maintenance; low manpower required; prefabricated and easily installed everywhere; low capital investment; low operating costs; and turn-key financing/installation/operation.

Environmental Aspects

Waste utilization

Development Status

Fully commercialized

Transfer Terms

- Joint venture
- Technology licensing
- Equipment supply

Contact

Mr. Peter Seroka
PGS Peter G Seroka & Partners, Sandweg 53, D-60316 Frankfurt, Germany. Tel: (49-69) 495 151; Fax: (49-69) 497 0942
E-mail: PGS.AsiaConsulting@t-online.de

Wastewater treatment in electroplating

HUNGARY

A Hungarian SME offers wastewater treating equipment family for treating and decontaminating wastewater deriving from surface-treating workshops. The wastewater treating equipment removes and eliminates the contaminants from various types of wastewater produced in the surface-treating workshop, in order to keep their concentration under the limits. The wastewater treating equipment is designed according to the quantity and the type of wastewater (e.g. acidic, alkaline etc.) and with the concentration of contaminant (thin solution or concentrated solution).

Area of Application
Electroplating, Metal Processing: companies providing electroplating services and companies active in metal processing and/or machinery industry having an in-house electroplating workshop.

Advantages

- All regulations relating to contaminants can be complied with
- Water demand of the surface-treating workshops can be decreased radically
- The quantity of sludge deriving from surface treatment and costs of deposition can be significantly dropped
- Due to the individual manufacturing, special problems can be solved
- The equipment operates automatically and does not need expensive manpower

Environmental Aspects
Wastewater treatment

Development Status
Commercial prototype

Legal Protection
know-how

Transfer Terms

- Technology licensing
- Others

Bio-compatible plug for orthopedic hip prosthesis

A Hungarian SME developed the prototype of bio-compatible bone plug which suitable for use as a cement restrictor for hip prosthesis. Advantages of bio-compatible bone plugs over actually used cement stop are lower costs and shorter convalescence. This bio-asorvable bone plug can be used for the primerely implantation and revision of cement restricted hip prosthesis. Plugs actually used are made from femoral head of the patients, plastic and gelatin.

Area of Application
Surgery, Physiotherapy, Orthopaedic technology

Advantages
The plugs can be manufactured at least six different sizes designed due to the different bone cavity sizes. These sizes are designed, tested (both in animals and in humans) compressing, corrugated, and manufactured. The plugs will be manufactured by pressure compressing, and then sterilized by radio-irradiation.

Advantages of bio-compatible bone plug:

- It shortens the time of the hip revisions operations by 25%, which means this technology makes the time of procedure shorter by one hour. The patient spends one hour less in sleep, and the doctors and the assistants save 25% of their capacity. Further advantage is that the patient needs 25% less of the blood used through the operation. These cause cost-efficiency.
- It simplifies the procedure needed to be done in case of a prosthesis revision, lower the risk, which is caused by the removal of permanent plugs.
- Bio-absorvable bone plug of hip prosthesis causes no injury and/or health problem for the patient.
- It does not need specific know-how to be use.
- After short preparations of surgeons, they will be able to use bio-compatible plugs.

Development Status
Commercial prototype

Legal Protection
Know-how

Transfer Terms

- Joint venture
- Technology licensing

Metal reclamation technology in electroplating

A Hungarian SME offers an 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 stick 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 chloride 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.

Area of Application
Electroplating, Metal Processing: The potential users are companies providing electroplating services and companies active in metal processing and/or machinery industry having an in-house electroplating workshop.

Advantages

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

Technology Offers

Environmental Aspects

- Waste utilization
- reduction of the quantity of galvanic sludge

Development Status
Commercial prototype

Legal Protection
Know-how

Transfer Terms

- Technology licensing
- Others

For the above three offers contact:
Laser Consult Ltd (Hungary)
H-6701 PO. Box 1191.
Szeged, Hungary

INDIA

Waste plastics into industrial fuel

We offer plants for converting non-recyclable waste plastics into industrial fuel. Fuel quality far superior to the conventional industrial fuels such as furnace oil or light diesel oil. ALL types of plastics can be processed. We can also supply technology. Serious customers can get their waste plastics tested on our Demo Plant. Plants as small as 1 TPD of plastics up to 30 TPD can be supplied. Plants custom made to specific requirements. Municipal bodies, industries involved in generation of non-recyclable plastic scrap, plastic scrap dealers who have access of non-recyclable cheap plastic scrap, entreprenuers most welcome.

Area of Application
Converting waste plastics (non-recyclable cheap plastic scrap) into industrial fuel.

Advantages
Disposal of non-recyclable waste plastics keeps environment clean, gets excellent monetary returns, for the industries that have their own plastic scrap generation can generate fuel at a very low price.

Environmental Aspects

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

Development Status

- Pilot plant
- Commercial prototype

Legal Protection

- Trade mark
- Patent

Technical Specifications
Plants having capacity as low as 1 TPD of plastics offered. No upper limit on higher capacities

Transfer Terms

- Consultancy
- Joint venture

Technology licensing
Turnkey

Contact

Atharva ProcTek
Pune 411052,
India

Nanoparticle-polymer complex for oral care products

National Chemical Laboratory (NCL) scientists have developed a process for constructing nanoparticle-polymer complex for sustained release of active agents for oral care (for applications in toothpastes and oral rinses). Polymer multilayers are built up layer by layer on nanoparticles of 5-50 nm, consisting of a water repelling (hydrophobic) shell around a core of multiply (polyanion and polycation) charged material (the core can be of inorganics as silica, titania and/or clay) and encompassing outer layer with an affinity to the tooth enamel.

Area of Application
Oral hygiene application- sustained release of antimicrobial/ flavour compounds

Advantages

- Precisely controlled polymer multilayers can be built on nanoparticles without the requirement of the cumbersome separation step after each coating of the polymer layers
- Active compounds localised as per the requirement by fine tuning the outer layer of the complexes- retained in the complex despite extensive rinsing with water
- Enables designing systems that can anchor and retain on the surface enamel of the teeth for extended periods by adjusting the ionic strengths

Development Status

- Laboratory model
- Commercial prototype

Legal Protection
Patent

Transfer Terms
Technology licensing

Nanoparticle applications in drug delivery

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

Technology Offers

Area of Application

- Drug delivery- Inorganic/organic delivery scaffolds for Nitric Oxide- an importantbioregulatory agent
- Tissue engineering- Cell seeding scaffolds
- Cell growth substrate
- Materials for solar cells
- Electrical/thermal insulators
- Catalysis- Catalyst support for small sizes available for diffusion of reactant molecules
- Metamaterials - Electromagnetic devices ideally gold nano particles
- Electronic devices
- Chromatography

Advantages

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

Development Status
Laboratory model

Legal Protection
Patent

Transfer Terms
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

Multi-purpose and fast working food processor

This machine can be used for food processing operations like mixing, mincing, juicing, squeezing, pulping, doughing, peeling, husking, agitating, crumbling, wet grinding, semi-wet grinding, dry grinding, scraping, heating, drying, seed and skin separation, beating, chopping, centrifuging, skimming etc.

The machine can be used to produce products like fruit pulp, fruit juice, orange and grape juice without breaking a single seed (stone), pulp (free from skin and seeds) for tomato ketchup, dough for making chappathi, minced meat – fish and vegetables for making cutlets, polished wheat, beaten egg for omelet, pulverized spices, rice flour, tamarind pulp, mango pulp, gooseberry pulp, dry fish powder and chips, fried fish powder and chips, puttu mix, fine mixed food items, vada mix, wet ground mix for idley, banana powder, rough and fine chopped vegetables for pickles and curries etc.

Area of Application
Very useful in processing industries where various processing applications are required.

Advantages
The multi-purpose machine can do most of the basic mechanical operations at a high speed and efficiency.

Environmental Aspects
Energy efficiency

Development Status
Pilot plant

Legal Protection
Patent application will be filed soon

Technical Specifications
The multi-purpose and fast working food processor is a custom-made machine. It can be fabricated according to the capacity requirement. The smallest one weighs 165 kgs.

Transfer Terms
Technology licensing

Target Countries
India

Contact
Innova Reserach Centre Pvt Ltd
Ochanthuruth, Kochi 682508, India

THAILAND

Dehydrated fruits by freeze drying technique

A Thai government organisation offers technology for fruit dehydration by freeze drying technique. Freeze drying is a process in which water in the sample is frozen at very low temperature (between -20°C and -40°C) and then sublimed under vacuum and low temperature (below -50°C). This technique was applied to produce various kinds of dehydrated fruits, namely jack fruit, rambutan, lychee, longan and durian.

Area of Application
Dehydration of various types of fruits.

Advantages

- Good physical appearance
- Chemical stability
- Biological activity
- Product recovery and reproducibility

Development Status
Commercial prototype

Transfer Terms

- Consultancy
- Others

Contact
Biological Science Division
Department of Science Service, Rama VI Road, Ratchathewi District, Bangkok 10400
Tel: +(622) 2458993; Fax: +(622) 2458993
E-mail: infobio@dss.moste.go.th

CHINA

Disposable syringes plant

We need complete consultancy and technical know-how to manufacture Disposable Syringes of 2 ml and 5 ml using semi-automatic disposable syringes plant. Consultants from India may contact us.

Area of Application
Clinics and hospitals

Project Type
New idea

Contact
Ploytex Chemical Engg. Co.
No.317 Wenhuidong Rd, Yangzhou city, Jiangsu
China 225009

INDIA

Fuel cell technology and products

We are interested in getting hydrogen fuel cell based technologies for automobile, telecom, power back-up, power generation sectors.

Area of Application
Fuel cell products are applicable for automobile, telecom, power back-up ,power generation sector.

Transfer Terms

- Consultancy
- Subcontracting
- Turnkey plant
- Joint venture
- Technical services
- Equipment supply
- Technology licensing
- Research partnerships
- Others

Project Type
New idea

Target Countries
Worldwide

Contact
C.G.Motors
Plot -no-PAPR-73, Rabale MIDC, Rabale
Navi Mumbai 400701
Maharshtra, India

Activated carbon from coconut shells

We are planning to set up a manufacturing facility for activated carbon from coconet shell. We request you to kindly inform us whether you can set up the plant on turnkey basis and please inform the cost of the plant for enabling us to go further in the matter

Area of Application
Food processing, Pharmaceuticals

Project Type
Start-up

Target Countries
India

Contact
IICHE, Chamber of commerce
A-29, Mettupalyam Industrial Estate,
Pondicherry 605009
India

Sodium silicate from rice husk ash

A complete Plant for manufacturing sodium silicate solution from rice husk ash.

Area of Application
Complete technology and supply of plant and machinery for manufacturing sodium silicate from rice husk ash.

Transfer Terms

- Subcontracting
- Turnkey plant
- Joint venture
- Technical services
- Equipment supply

Project Type
Diversification

Target Countries
India

Contact
IFB Agro Industries Limited
Plot No. IND-5, Sector-1 East Kolkata Township,
Kolkata-700107
India

UK

Proteins and polyphenols from dried plant materials

We are looking to identify new processes or technologies which are able to effectively remove / extract proteins and/or polyphenols from dried plant materials.

Area of Application
Consumable product

Transfer Terms

- Joint venture
- Technical services
- Technology licensing

Project Type
New Idea

Target Countries
Worldwide

Contact
Strategic Allies Ltd.

The Red & White House 113, High Street Berkhamsted,
U.K HP4 2DJ

Selected Analytical Reports and Technology Platforms & Databases of APCTT

Analytical Reports (available online)

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

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

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

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

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

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

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

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

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

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

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

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

Technology Platforms and Databases

1. APCTT's Technology4SME Database

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

   http://apctt.org/technology-transfer

2. Renewable Energy Technology Bank

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

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

3. Global Technology Databases

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

   http://apctt.org/aptitude/