

Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific

Tech Monitor

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Enhancing technology access to reduce inequality
Strategies and best practices from Asia and the Pacific



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Asian and Pacific Centre
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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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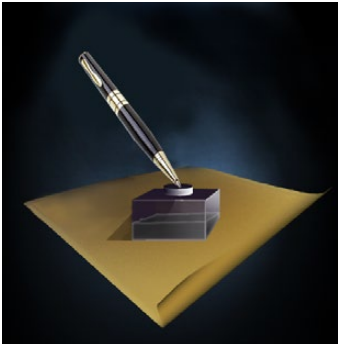
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Introductory note

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 role of technology to reduce inequality largely depends on the capabilities of the poor to access and use the technologies and solutions that respond to their needs. Therefore, empowerment of the poor is critical for improving their ability to access and use technologies and solutions. For lower-income (and other vulnerable) groups to benefit from technology-driven opportunities, ESCAP research suggests that at least four conditions are necessary: (1) the availability of technology infrastructure; (2) skills to identify and use technologies; (3) availability of technologies that address the needs of low-income groups; and (4) opportunities to access such technologies. With mission-driven approach, Governments can introduce targeted technology and innovation programmes to address the specific needs of their vulnerable population.

Technological inequality among countries in the Asia-Pacific region is widely prevalent. The least developed countries (LDCs) and countries with special needs invariably possess low technological capabilities which prevents them from achieving accelerated economic growth. Technological inequalities between countries can be addressed through increasing investment in technology development, strengthening national capacity to innovate and improving ICT infrastructure that would enable them to leapfrog. As countries grow their technological strength, they will need to focus on building stronger capabilities such as innovation and technological skills, while ensuring that the technological progress does not increase inequality.

Regional cooperation could play a key role in reducing technological inequalities among countries through exchange of knowledge and good practices. Member countries could evolve policy recommendations and strategies to harness innovative technological applications for reducing inequality. For instance, increased access to information and communication technology (ICT), renewable energy and climate smart agriculture technologies are improving access of the disadvantaged population to basic services such as food, education, healthcare and finance. Some examples are: Solar Home Systems in remote rural areas of Bangladesh; e-commerce platforms for small producers in China; and ICT-based financial inclusion for the poor in India.

This issue of *Asia-Pacific Tech Monitor* discusses the challenges, opportunities, strategies and best practices to enhance technology access for reducing inequality in the Asia-Pacific countries with concrete examples of innovative technologies and their applications.

Michiko Enomoto
Head, APCTT-ESCAP

Technology Market Scan

ASIA-PACIFIC CHINA

Innovation patents 2017

China's innovation patent filings surged both in number and quality in 2017, a spokesman said. New patent filings numbered 1.38 million last year, up 14.2%. About 420,000 have been accepted, said Hu Wenhui, spokesperson for the State Intellectual Property Office. "As of the end of 2017, the number of patents in China hit 1.35 million. That is nearly 1 patent per 1,000 people," Hu said.

China has a number of domestically developed core technologies in telecommunications, aviation and space, high-speed railways, nuclear energy. Over the years, the quality of the patents filed in these fields has notably improved, Hu said.

<http://www.xinhuanet.com>

R&D spending up 11.6% in 2017

China's spending on research and development (R&D) grew faster in 2017 as the country continued to push for innovation-driven development. Preliminary calculations showed that R&D spending rose 11.6% year-on-year to 1.75 trillion yuan (about 280 billion U.S. dollars) in 2017, 1 percentage point higher than in 2016, the National Bureau of Statistics (NBS) said. The spending accounted for 2.12% of China's gross domestic product, 0.01 percentage points higher than the previous year.

Chinese enterprises spent more than 1.37 trillion yuan on R&D last year, up 13.1% from 2016, while R&D spending at government institutions and colleges increased 7% and 5.2%, respectively. Some 92 billion yuan, or 5.3% of the total spending, was put into fundamental research in 2017, up 11.8% from a year earlier, the NBS said.

According to the 13th five-year plan for national science and technology talent development (2016–2020), China will increase its annual per capita spending on R&D to 500,000 yuan by 2020, up from 370,000 yuan in 2014.

China had 5.35 million people working in R&D at the end of 2015, the world's largest pool of R&D personnel.

<http://www.xinhuanet.com>

INDIA

R&D expenditure up

A national survey on the status of research and development in the country has shown that the gross expenditure on R&D (GERD) has more than tripled from Rs. 24,117 crore to Rs. 85,326 crore in the decade from 2004–05 to 2014–15. It is estimated that it could have further gone up to Rs. 94,516 crore in 2015–16 and crossed the Rs. 1 lakh crore mark in 2016–17 reaching up to Rs. 1,04,864 crore.

The Survey conducted by the National Science and Technology Management Information System (NSTMIS) under the Department of Science and Technology (DST) has also shown that the per capita R&D expenditure has increased to Rs. 659 (US dollars 10.8) in 2014–15 from Rs. 217 (US dollars 4.8) in 2004–05 and that GERD was mainly driven by the government sector with central government accounting for 45.1%, state governments 7.4%, public sector industries 5.5% and institutions of higher education 3.9%. The private industry accounted for the balance 38.1%.

Significantly, the share of business enterprises, from both public and private sector, has been showing an increasing trend. Their share of 43.6% in 2014–15 was found to be fairly higher than the situation in just five years earlier: in 2009–10 their share was just 34.2%. The study has revealed that public sector R&D was led by defense related industries and fuel industry, while the private sector R&D was dominated by drug and pharmaceuticals and transportation.

However, the composition of R&D expenditure in India contrasted sharply when compared with select developed and emerging economies. The survey compared the levels of participation of the government, business enterprises, and institutions of higher education in R&D in India with those in 13 other countries – USA, UK, Spain, Russia, Republic of Korea, Mexico, Japan,

Italy, Germany, France, China, Canada and Australia.

It found that India topped the list with regard to the government's participation in R&D but hit the bottom in terms of participation of institutions of higher education. Government's participation in R&D in the other countries ranged from 7% in U.K. to 38% in Mexico, as against India's 55%. In contrast, the share of institutions of higher education in R&D in the other countries varied from 7% in China to 40% in Canada, as compared to India's a mere 4%.

Another significant finding of the survey is that as much as 81.3% of R&D expenditures incurred by central government sources came from just eight major scientific agencies: Defence Research and Development Organisation led the table with a share of 37.8%, followed by Department of Space (16.6%), Department of Atomic Energy (11.6%), Indian Council of Agricultural Research (11.4%), Council of Scientific and Industrial Research (9.5%), Department of Science and Technology (7.7%), Department of Biotechnology (2.9%) and Indian Council of Medical Research (2.4%) during 2014–15.

Further, it has shown that women's participation in extra mural R&D projects has increased significantly from a mere 13% in 2000–01 to 29% in 2014–15. In absolute numbers, 1,301 women Principal Investigators had availed extramural R&D support during 2014–15 as against just 232 in 2000–01. In terms of personnel directly engaged in R&D activities, there were 39,388 women (13.9%) as on April 1, 2015, out of the total 2.82 lakh personnel. It has also revealed that out of the total of 27,327 doctorates awarded in the country, 15,246 or 56.4% were from the S&T disciplines during 2014–15. India occupied the third rank in terms of PhDs awarded in S&T after China (30,017) and USA (26,520).

On patents, the survey has noted that a total of 46,904 patents were filed during 2015–16 and of them, 28% or 13,066 were filed by Indian residents. As per WIPO report 2016, India is ranked 10th in terms of resident patent filing activity.

<https://www.thehindubusinessline.com>

Mechanism for tech transfer

Heeding to advice of the Laghu Udyog Bharati, an affiliate associated with small industries, the government has set up a mechanism in the Council of Scientific and Industrial Research (CSIR) – a public sector research institution – for regular interface with small-scale industry for transfer of technologies from its laboratories to industries. “They had certain issues about connecting with CSIR for technology transfer. (I) impromptu announced setting up of a regular mechanism for interface between SSI (small-scale industries) and CSIR and appointed a nodal officer in CSIR”, tweeted Union science and technology minister Harsh Vardhan on Monday while referring to his interaction with representatives of the Laghu Udyog Bharati.

The nodal officer in CSIR will coordinate with the small-scale industry and the CSIR labs for appropriate technology required by them. The Laghu Udyog Bharati leaders met the minister on Sunday and told him that there was a “disconnect between CSIR and the small-scale industries and it should be addressed”. The Laghu Udyog Bharati has 450 branches and 25,000-member units across the country.

Noting that the CSIR laboratories have patented over 1,000 processes and technologies, which are available for commercial exploitation, the science ministry said, “Some of these technologies have been commercialised. The CSIR labs are willing to work with user industries to develop applications and products to meet the needs of the market.” It said, “The SSI sector is the largest employment provider in the country, next to agriculture. It contributes almost 40% of the gross industrial value added in the Indian economy.”

With a pan-India presence, the CSIR has a network of 38 national laboratories, 39 outreach centres, and three Innovation complexes. These labs cover a wide spectrum of science and technology – from radio and space physics, oceanography, chemicals, biotechnology and nanotechnology to mining, aeronautics, instrumentation,

environmental engineering and information technology.

<https://timesofindia.indiatimes.com>

MALAYSIA

SME loan/financing referral platform

Credit Guarantee Corporation Malaysia Berhad (CGC) has launched Malaysia’s first SME Loan/Financing referral platform for the benefit of the country’s vibrant micro, small and medium enterprises (MSME), commonly known as SMEs. The “imSME” platform would serve as an online one-stop-center for SME loan/financing by providing an array of financing products and services offered by the participating banks and agencies. CGC targets over 2000 SMEs to benefit from the newly launched imSME by end of this year.

The imSME, represents “I am mSME” which covers micro, small and medium-sized entrepreneurs. It is the first online SME loan/financing referral platform in the country, mooted by Bank Negara Malaysia (BNM) and powered by CGC.

The imSME is targeted at all SMEs, currently facing difficulties in securing financing from the financial institutions (FIs), for various factors. It is a unique online platform that enable SMEs to search and find loan/financing product that best fits their needs, faster and at their convenience. The effort is to further strengthen the SMEs’ self-service capabilities while enhancing their total online experience in line with the central bank’s call for the SME sector to embrace financial technology (FinTech) to remain competitive.

Currently, there are 14 financial institutions (FIs) and development financial institutions (DFIs) participating in the imSME, namely, Affin Bank Berhad (Affin Bank), AmBank (M) Berhad (AmBank), Bank Pertanian Malaysia Berhad (AgroBank), Bank Simpanan Nasional (BSN), Bank Kerjasama Rakyat Malaysia Berhad (Bank Rakyat), CIMB Bank Berhad (CIMB), Hong Leong Bank, Malayan Banking Berhad (Maybank), Oversea-Chinese Banking Corporation Limited (OCBC), OCBC Al-Amin Bank Berhad, Public Bank Berhad, Public Islamic

Bank Berhad, RHB Bank Berhad (RHB), and SME Bank.

In total, these 14 FIs and DFIs have a network of over 2,400 branches throughout Malaysia and over 60 financial products for SMEs hence making it easy for SMEs to discuss with their preferred financier once the match is selected.

CGC has also set up an imSME Financial Advisory Team to assist SMEs who are unable to find their financing product match in imSME or whose applications through imSME were not approved by the FIs. The imSME Financial Advisory Team will diagnose the cases and make recommendations for capacity building programs or alternate financing accordingly.

Since the soft launch in November 2017, 321 SMEs have submitted their applications of which 64 matched with the available products at imSME, and five were approved, valued over RM500,000.

<http://www.adfiap.org>

PHILIPPINES

Program to accelerate technology transfer

To rev up agriculture, aquatic, and natural resources (AANR) technology transfer for the benefit of the people, the Department of Science and Technology – Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (DOST-PCAARRD) spearheads the “Enhancing Technology Transfer and Commercialization of Agri-Aqua Technologies” Program. The DOST-PCAARRD initiated the program which intends to accelerate the impact of over 600 technologies that were product of research and development in the field of agriculture, aquatic, and natural resources.

This PCAARRD-funded program comprises of five components namely (1) technology and business services, (2) e-research and knowledge management, (3) science and technology (S&T) promotion, (4) capacity building, and (5) technology roll out/deployment and strategic partnerships. Moreover, the program provides assistance to research and development institutions,

and promotes sharing of S&T best practices in view of the Council's mandate on technology transfer. PCAARRD has formulated certain systems in transferring technologies. It has classified programs and projects into technologies suitable for deployment, extension, and commercialization.

According to DOST-PCAARRD Technology Transfer and Promotion Division Director Melvin B. Carlos in a briefing in March, a program shall resort to deployment and extension when effective technology utilization and adoption are influenced by non-market considerations. On the other hand, commercialization is employed for technologies that can reach users and adopters more efficiently through the market system.

The crafted extension or deployment modalities of the Council are implemented in various regions in the country in partnership with AANR stakeholders in the public, academic, and private sectors. These include S&T-Based Farm (STBF), S&T Community-Based Farm (STCBF), Technomart, S&T Model Farm, and S&T Action Frontline for Emergencies and Hazards (SAFE).

In the effort to heighten its recourse, the DOST-PCAARRD Innovation and Technology Center (DPITC) was established "to serve as a one-stop hub for technology owners and generators, investors, end-users and other stakeholders to facilitate the commercialization of technologies generated in the AANR sector."

<http://pia.gov.ph>

REPUBLIC OF KOREA

Government to invest in service R&D

The government will invest 5 trillion won in R&D for the service sector. Service businesses will get more tax benefits for their R&D investments. These are part of the measures to upgrade the country's service industry that is far behind manufacturing. At an economy-related ministers' meeting Wednesday, the government noted the country's service industry lacks a competitive edge despite each administration's pledge to nurture the sector. Its labor productivity falls far short of that of the manufacturing sector.

"While developed economies are nurturing new services such as the sharing economy, telemedicine and digital healthcare as new growth engines, the Republic of Korea has been lagging behind in launching or developing innovative services," the government noted in a media release. As a result, most of the service jobs in the country are low-paying, though the service industry is about twice as effective in job creation compared with the manufacturing industry. The service industry here is mostly represented by small businesses such as restaurants and lodgings run by the self-employed, and they suffer from excessive competition.

Behind the poor performance of the service sector is a lack of R&D investment. The ratio of service R&D to total R&D stood at only 8.7% in Republic of Korea's private sector, compared to 29.9% in the United States and 46.4% in France. The ratio of service in total government R&D also stood below 4%.

According to the government plan, regulations will be eased on R&D investment by service businesses, so they can easily set up R&D institutes and get tax benefits. Newly introduced services such as the sharing economy will also enjoy tax benefits for R&D investments.

The government will also invest around 5 trillion won for the next five years in service R&D. The areas of focus this year include smart media, smart homes, and technologies to overcome dementia as well as development of services for public safety. Businesses that succeed in developing new services will get loans by state-run financiers.

The government also unveiled plans to innovate Centers for Creative Economy and Innovation. There are 17 of these centers around the country aimed at nurturing startups. These centers have their roots in the previous Park Geun-hye administration, but there has been criticism since it simply matched each center with a conglomerate, pressuring conglomerates to make contributions.

The centers will also be launching a Korean version of "TED Talks," providing diverse

lectures or organizing forums for future entrepreneurs. They will search for promising startups, funding their R&D efforts.

<http://www.koreatimes.co.kr>

Innovation index

According to the Ministry of Strategy & Finance on January 23, Republic of Korea topped the Bloomberg Innovation Index for the fifth consecutive year. The Bloomberg Innovation Index is divided into seven assessment categories: R&D intensity showing R&D expenditure as percent of GDP; Manufacturing added-value; Productivity showing GDP and GNI per employed person; High-tech density showing the number of domestic high-tech companies; Tertiary efficiency showing the total enrollment in tertiary education; Researcher concentration showing the number of professionals engaged in R&D per million population; and Patent activity showing resident patent filings, total patent grants and patents in force per million population. This year's assessment covered a total of 50 countries.

Republic of Korea was followed by Sweden, which recorded 84.7 points. Singapore jumped from sixth to third with 83.05 points. Japan ranked sixth with 81.91 points, the United States came in 11th with 80.42, and China took the 19th place with 73.36.

Republic of Korea ranked first in the Patent activity category and second in R&D intensity and Manufacturing added-value. However, it ranked 21st in Productivity, the category in which it came in 32nd last year. "The Republic of Korean government will keep trying so that the productivity of the local service industry, which is relatively lower than that of the manufacturing sector, can be improved with time," the ministry explained.

<http://www.businesskorea.co.kr>

SRI LANKA

Funds to support SME development

The Asian Development Bank's (ADB) Board of Directors has approved \$75 million in additional financing to continue support toward the development of small

and medium-sized enterprises (SMEs), considered vital for economic growth and job creation in Sri Lanka. "SMEs have the potential to reduce regional inequalities in Sri Lanka given that SMEs are more widespread throughout the country than larger enterprises, which are mainly based in the capital Colombo," said Don Lambert, an ADB Principal Finance Specialist. "The additional support will ensure that more SMEs have wider access to credit."

SMEs contribute about 45% of Sri Lanka's gross domestic product and provide about half of the country's jobs. However, access to finance remains a significant challenge for the SMEs. About 30% of local enterprises cite this issue as a major deterrent to their growth and development—one of the highest percentages among ADB developing member countries after Afghanistan, Mongolia, and Nepal.

Many of these SMEs have no previous experience dealing with formal financial institutions like banks, are led by women, or based in rural areas, according to ADB. The additional financing for the SME Line of Credit Project will increase the available loans for participating banks to \$175 million by 2020, from the original loan figure of \$100 million approved in February 2016. This additional support will further encourage local partner banks to grow their SME portfolios—particularly to enterprises outside Colombo or are women-led—and eventually help Sri Lanka address some of its major development challenges through economic diversification, job creation, women empowerment, and inclusive growth.

Apart from providing wider access to finance to SMEs, the project is also developing innovative SME financing schemes, while building capacity of SMEs particularly in information and communications technology, business process outsourcing, fruits and vegetables, as well as processed food and beverage.

<https://www.finchannel.com>

THAILAND

Innovation loan

The Science and Technology Ministry plans to ask for cabinet approval to bor-

row US\$300 million (9.67 billion baht) from the Asian Development Bank (ADB) to promote science, technology and innovation, to borrow US\$300 million (9.67 billion baht) from the Asian Development Bank (ADB) to promote science, technology and innovation, to support the government's much-touted Thailand 4.0 scheme.

Science and Technology Minister Suwit Maesincee said the ministry is consulting the National Economic and Social Development Board for the loan plan. He said the Finance Ministry has suggested ADB provide experts to help design projects, give advice, evaluate projects and recommend foreign experts to facilitate the activities. The ministry would use the loan mainly for projects to strengthen national competitiveness, said Mr Suwit.

They include improving the nation's science and technology infrastructure, such as the national biodata system, the Thailand Earth Observation System II, big data analytics, a synchrotron particle accelerator, fission and fusion technology, science and technology parks, precision agriculture, medical devices and automation.

The ministry also plans to team up with large listed companies on the SET 100 and SET 50 to drive innovation development among 5,000 small and medium-sized enterprises. Mr Suwit said thanks to the government's promotion of R&D over the past three years, spending on R&D has reached 0.75% of the country's GDP last year, up from 0.62% in 2015. R&D spending in 2017 was 102.5 billion baht.

The ministry expects Thailand's overall spending on R&D and innovation will reach 1% of GDP over the next 1–2 years. For two decades, expenditure on R&D and innovation never exceeded 0.25% of GDP, until spending began to gradually increase over the past five years, the DE Ministry said. The incumbent government is committed under the 20-year strategic plan to raising R&D expenditure to 2% of the country's GDP in 2036.

R&D spending in 2015 accounted for only 0.62% of GDP. The plan calls for the private sector to provide 80% of R&D spending by 2036. It accounts for 70% now. The gov-

ernment has allocated 17 billion baht to that end for fiscal 2018, up 15% from 2017. <https://www.bangkokpost.com>

VIET NAM

Hi-tech agricultural cooperatives

Viet Nam has planned to have 500 high-tech agricultural cooperatives and to increase the high-tech farming production value by five times by 2020. This was revealed by the Ministry of Agriculture and Rural Development, which said that 60% of the cooperatives would be located in the country's major agricultural production hubs such as Cuu Long (Mekong) River Delta, Hong (Red) River Delta, the northern mountainous region and Tay Nguyen (Central Highlands) region.

Of note, the production value of hi-tech agricultural products was expected to be five times higher. The average income from hi-tech farming products was expected to be three times higher than products which did not apply technologies during cultivation, from the current 1.5 times. In addition, the percentage of cooperatives using automation technology models and biotechnology would be increased from the current 17% to 30–40%.

The ministry said it was important to develop a production value chain of high-added value farming products and to promote the linkage of cooperatives with enterprises, as well as to encourage technology transfer and provide preferential loans to agricultural cooperatives.

At the same time, training would be provided to cooperatives' members. The agriculture ministry targeted that this year, 100 people would be sent to Japan, Taiwan province of China, Republic of Korea and Israel to learn hi-tech farming experiences, and by 2020, the number would reach 500. According to the ministry's statistics, there are now 193 hi-tech agricultural cooperatives in Viet Nam, more than 85% of which are operating in plantation and forestry, 9% in animal husbandry and the rest in aquaculture. They are mainly in Lam Dong Province, which has 36 cooperatives, while Long An has 14, Ha Noi 13 and HCM City 11 cooperatives.

<http://english.vietnamnet.vn>

Technology Scan

Focus: Technologies for Rural Applications

INTERNATIONAL

IoT development

The global Internet of Things (IoT) devices market is forecast to surge almost three-fold between 2017 and 2023, exceeding US \$45.4 billion in revenue by 2023. Much of this explosive growth will be enabled by LPWAN (Low Power Wide Area Network) technology that possesses unique characteristics – making it particularly attractive for a growing number of deployments across sectors such as utilities, logistics and transportation, agriculture, and smart cities. LPWAN is a wireless communication technology specialised for interconnecting devices together, focusing on power efficiency and long range.

Frost & Sullivan recently collaborated with Murata Manufacturing to develop a White Paper, “Growing Industry Applications of LPWAN Technologies,” to further demonstrate the functions and various adoptions of LPWAN technology. A unique 4C (Capacity, Consumption, Cost, Coverage) model was developed to highlight the key characteristics of the technology itself along with real life case studies from around the world.

As part of its research, Frost & Sullivan compared the 4Cs across eight industries and 24 sub-industries to establish a LPWAN Application Suitability Index. Some of the key findings from the index include agriculture as an emerging industry for LPWAN usage, indicating high potential for precision farming while manufacturing and smart city applications being still at nascent stages, mostly using cellular or hybrid technologies. With the diverse range of IoT devices and requirements, there is no one-size-fits-all approach, meaning both licensed and non-licensed LPWAN technologies could carve out their own niche without cannibalising the market share of each other.

“Convergence of LPWAN technologies and LTE (Long-Term Evolution, a 4G mobile communications standard) would be the logical route to address the wide range of IoT use cases. Availability of LPWAN at competitive pricing could outweigh concerns about proprietary technology;”

noted Tim Chuah, Associate Director, Automation & Electronics team at Frost & Sullivan Asia Pacific. “Partnerships and revenue-sharing business models also need to be explored more extensively in the coming years,” Chuah added.

Frost & Sullivan’s white paper is intended to serve as a reference point for business leaders and decision makers around the world to guide them towards adopting the latest LPWAN technologies applicable for their relevant industries while lowering costs at the same time. As a key vendor of LPWAN technologies, Murata remains committed to fostering innovation to consistently address the 4Cs (Coverage, Capacity, Cost, Consumption) of LPWAN application suitability for its wide-reaching end-users.

<https://www.ruralmarketing.in>

Sustainable method to filter salt, metal from water

Scientists have developed a new method to filter out salt and metal ions from water with a technology that could be used in a number of industries. A research team from Monash University, CSIRO, Australia and the University of Texas at Austin, the United States, have discovered that the membranes of metal-organic framework (MOF)—a next generation material—can mimic the filtering function or ion selectivity of organic cell membranes. “Produced water from shale gas fields in Texas is rich in lithium. Advanced separation materials concepts, such as this, could potentially turn this waste stream into a resource recovery opportunity,” Benny Freeman, a professor from the University of Texas, said in a statement.

MOFs have the largest internal surface area of any known substance, with sponge like crystals that can be used to capture, store and release chemical compounds. The membranes have the potential to perform the dual functions of removing salts from seawater and separating metal ions in a highly efficient and ultimately cost effective manner.

“We can use our findings to address the challenges of water desalination. Instead of relying on the current costly and energy

intensive processes, this research opens up the potential for removing salt ions from water in a far more energy efficient and environmentally sustainable way,” Huanting Wang, a professor from Monash University, said in a statement. “Also, this is just the start of the potential for this phenomenon. We’ll continue researching how the lithium ion selectivity of these membranes can be further applied.”

Wang explained some of the other applications for the new technology. “Lithium ions are abundant in seawater, so this has implications for the mining industry who current use inefficient chemical treatments to extract lithium from rocks and brines,” Wang said. “Global demand for lithium required for electronics and batteries is very high. These membranes offer the potential for a very effective way to extract lithium ions from seawater, a plentiful and easily accessible resource.”

Reverse osmosis membranes are currently responsible for more than half of the world’s desalination capacity and the last stage of most water treatment processes. However, these membranes can be improved by a factor of two to three in energy consumption and do not operate on the principles of dehydration of ions or selective ion transport in biological channels.

<https://www.rdmag.com>

ASIA-PACIFIC

AUSTRALIA

Graphene filter makes water drinkable

Last week, we reported on a breakthrough from researchers in Australia and the US that could make it possible to desalinate sea water inexpensively. The process involves a new class of materials called metal-organic frameworks that may also be able to extract minerals like lithium and gold from the oceans that surround us. One of the parties to that international research is the Commonwealth Scientific and Industrial Research Organization, Australia’s premier research organization. CSIRO has also announced a new form of graphene it says can filter polluted water and make it drinkable in one step.

According to a report by *Engadget*, CSIRO calls its new product Graphair. It is a combination of graphene film and nanometer-size channels that allow water to pass but block pollutants. "All that's needed is heat, our graphene, a membrane filter and a small water pump. We're hoping to commence field trials in a developing world community next year," says Dr. Dong Han Seo, who heads the research. His team is now looking for commercial partners to help scale up the technology. It is also working on other applications for Graphair, such as desalinating seawater and removing industrial effluents from waste water.

Part of the exciting news about Graphair is that it is manufactured from renewable soybean oil, which makes it quick and easy to produce in a process that is environmentally friendly. Most water filters are degraded by oil byproducts, which have to be removed before filtration can begin, but Graphair can remove those pollutants without clogging up and can do it faster than any other method.

<https://cleantechnica.com>

CHINA

Technology revolutionizes agriculture

Zhang Pan used to think of agriculture as farmers wearing straw hats, carrying reaping hooks while laboring on the land despite strong winds or scorching heat. However, when he was accepted into a graduate program two years ago he realized that the natural environment can be controlled to prevent plants from harmful weather and improve productivity.

In the lab at Northwest Agriculture and Forestry University, where Zhang studies, a piece of equipment emits a purple light onto several lettuce plants sitting in water. The temperature, humidity and light intensity are monitored by a control terminal. Zhang and three other students from the university jointly developed the technology. "The equipment can control the root temperature of the crops and supplement sunlight at any time based on their needs," he said. "It is one of the techniques of protected cultivation."

Protected cultivation involves a series of techniques modifying the natural environment of plants to improve their quality and yield. Tests showed that the yield, levels of Vitamin C and amino acids in eggplants grown with help of Zhang's equipment saw an increase of 30%, 20% and 30% respectively, compared with those grown in open fields.

<http://www.chinadaily.com.cn>

INDIA

Solar study lamps for rural students

The Indian Institute of Technology-Bombay (IIT B) have initiated 'Solar Urja Lamp' (SoUL) that aims to provide solar study lamps to the rural students through skill transfer to local communities. Through this project, the institute is lighting up homes with renewable energy and providing rural women with the chance to become entrepreneurs.

According to an IIT-B professor Chetan Singh Solanki (who is part of the project), there are two types of solar lamps – module one and module two. Module one consists of a lamp that provides LED light and a solar panel that is placed outside under the sun. Module two solar lamp also consists of a mobile charging pin. The battery life of these lamps is 10 to 12 hours when on low mode and 5 to 6 hours when on high mode. Under this intervention, one million children in Maharashtra, Madhya Pradesh, Odisha and Rajasthan have been given the solar lamps. Last year, the ministry of new and renewable energy sanctioned the project after which around 70 lakh solar study lamps will be provided in Assam, Bihar, Jharkhand, Odisha and Uttar Pradesh.

Solanki who is from the Department of Energy Science and Engineering of IIT B and initiated the project in the year 2013 said it was done keeping in mind the eradication of kerosene lamps in villages especially among school children.

"We fail to realise but kerosene lamps emit carbon dioxide fumes which are inhaled by the children causing damage to their

body. Also, as these lamps are inflammable there are high chances of mishaps like fire causing burn injuries or even death. Hence, the idea of using renewable energy (solar) is safe and this will build a solar eco system," said Harshad Supal, member of the technical team of SoUL project. Through this project, they want to promote education among the students but in an environmental friendly manner.

Faculty and students of IIT-B, along with the supply of these lamps will be training the women of villages to let them understand the solar technology. Apart from the lamps, IIT-B aims to introduce other solar products like home lighting, water pumps, solar cooking to build a solar eco system.

<http://www.asianage.com>

Solar technology for rural applications

Indian Institute of Technology Madras (IIT Madras) and Verizon Data Services India in collaboration with Southern Power Distribution Company of Telangana Limited (TSSPDCL) and Rural Electrification Corporation will now provide power using solar technology to 300 households across four hamlets in rural Telangana. IIT Madras developed this Solar Technology, which was technology transferred to and commercialized by Cygni Energy Private limited, an IIT Madras-incubated firm, which also carried out the installations. Verizon provided financial assistance of Rs. 75 lakh under Corporate Social Responsibility (CSR) for this project.

Ramunigundla Thanda, Kesya Thanda, Jogi Thanda and Mantriya Thanda are four rural hamlets of Devarakonda Mandal in Nalgonda district, Telangana. Predominantly dependent upon paddy and cotton farming for livelihoods, the hamlets are about 100kms from Hyderabad, located on Nagarjunsagar Road near Mallepalli.

The Inverterless System, comprising a 125Wp Solar Panel, a 1kWh battery, an Inverterless controller unit and DC loads operating on a 48V DC internal distribution line, were installed in all houses. It powers a DC fan, a DC tube light, two DC bulbs, a DC mobile charger, a DC power socket and a remote controller to operate

the fan and tube light. Installations were completed by June, 2017 and everything has been working flawlessly. The performance and health of all the installed systems are being monitored remotely, with data being collected via mobile phones and synchronized to a central server.

The project was implemented under Prof. Ashok Jhunjhunwala, Principal Advisor, Ministries of Power and New and Renewable Energy, Government of India, and Professor (On Sabbatical), IIT Madras. He said, "Today, millions of homes in India either do not have grid connectivity, or suffer from power outages for large fraction of the day. This is a very serious challenge as majority of these homes fall under low-income category and cannot afford power even with some subsidy. Solar DC Inverterless technology deployed in the 300 homes of Devarakonda, Telangana tackles this problem and shows how, with a small 125W solar panel on the home rooftops, the dynamics of electricity in India could be transformed."

<https://tech.economictimes.indiatimes.com>

Garden waste into fuel pellets

A new study by researchers from Indian Institute of Technology Bombay, Mumbai has, for the first time, demonstrated an efficient way to convert garden waste into fuel pellets that could be used for cooking. Many urban households, and a few rural ones, sport a garden in the backyard, often populated with flowering and vegetable plants and some trees. The gardens also are a hotspot for a host of biodiversity, like butterflies, birds, reptiles and rodents, often attracted to the greenery that grows there. Garden owners are also fond of keeping their gardens clean, often trimming the overgrowth and cleaning off fallen leaves, twigs and other biomass. The garden waste that is generated after cleaning is usually burnt or disposed off. What if all that waste needn't be wasted but can instead be put to good use, by converting it into fuel for cooking?

Scientists from IITB have been exploring ways to do exactly this. In their new study, the scientists have developed a method to convert the garden waste biomass into

fuel pellets that could be burnt for usable energy. The fuel pellets that are formed could be used in stoves as an efficient substitute to firewood and other fuels.

Various parameters, like moisture content, milling size and die size, of the pellets that were formed were further probed for optimal performance using regression models- a statistical tool. Their study showed that an increase in the moisture content of the biomass affected the durability of the final product. It also revealed a biomass moisture content of around 6% and a die size of 15mm were ideal for the pellets formed to perform efficiently. The pellets were also probed under a Scanning Electron Microscope to study the effect of moisture on the final product, which showed the pellet particles sticking closely together when the moisture content in the biomass was considerably low.

If commercialized, the technology could be used as a suitable substitute for cooking gas and other fuels in low income households. "We deduced from the combustion test that garden waste pellets may be conveniently used in a residential cookstove" claim the researchers about their new technology

<https://researchmatters.in>

Eco-friendly cement

A research collaboration between India and Switzerland on a new cement material that can reduce carbon dioxide emissions in the manufacturing process is set to take off into implementation. The construction sector is a major contributor to global carbon dioxide emissions. Though this is known, it appears difficult to reduce the scale of construction, especially as it is a route to establishing more equitable conditions in developing countries like India. One way of mitigating the emissions factor is the use of Limestone Calcined Clay Cement or the LC3 technology.

Traditional processes that manufacture cement from clinker-limestone or clinker-calcined clay combinations are well known. LC3 effects a synergy between these processes. The combination of the new method and the material properties

effectively reduces carbon dioxide emissions by 30% as compared to the traditional way of manufacturing cement. Research on this evolved over ten years in Karen Scrivener's lab at the Swiss Federal Institute of Technology (EPFL) at Lausanne, in Switzerland. Partners in this research are IIT Delhi, IIT Madras and TARA (Technology and Action for Rural Development).

In manufacturing portland cement, limestone and materials like clay are heated together in huge kilns to high temperatures (approximately 1,450 degrees C), so that they fuse without melting to give clinker. "This is the most CO₂-intensive part of the whole process. The carbon dioxide comes both from the burning of the fuel needed to create that temperature and due to the breakdown of limestone into calcium oxide and carbon dioxide. The latter part accounts for 60% of the CO₂ emissions in manufacture of cement," says Prof. Scrivener. The best thing to do would be to substitute CO₂-intensive clinker with a different material.

In India, fly ash – a waste produced in the burning of coal for producing energy – is used in the manufacture of blended cement. However this is used in a lower proportions and only where available; therefore, for effectively reducing emissions, more clinker is to be substituted with calcined clay and limestone. This reduces emissions by 30% with respect to portland cement.

To take this product from the lab to commercial use requires that the cement be certified by reputed research and testing centres, and for this purpose, Prof. Scrivener's team has collaborated with Indian and Cuban agencies. The results of the Indian tests were published in *The Indian Concrete Journal*, special issue on cements. Nearly ten tonnes each of four blends of LC3 (50% clinker, 30% calcined clay, 15% crushed limestone and 5% gypsum) were produced in India. To obtain a variation, clays and limestones of two different qualities were used. The LC3 obtained was used to manufacture solid and hollow concrete blocks, door and window frames, low duty paving blocks and roofing tiles, and to make roads.

“Good results were obtained from the blends despite the sub-optimal conditions of production of the cement, demonstrating the viability and robustness of the technology,” Shashank Bishnoi of IIT Delhi and other authors write in the paper. The authors compared the strength of the various LC3 samples with Ordinary Portland Cement (OPC, a popular type of cement) and Portland Pozzolanic Cement (PPC, a variation of OPC in which locally available fly ash was added). They found that the strength of the LC3 made with low quality clay was comparable to the OPC and the samples of LC3 containing superior quality clay was higher than the OPC.

<http://www.thehindu.com>

EUROPE

UK

Solar water purification

Researchers at the University of Edinburgh have designed a water purification system that harnesses the sun’s energy to decontaminate polluted water. According to “India-Situation-and-Prospect” of UNICEF, millions of people in India die every year from diseases like diarrhea and pneumonia related to contaminated water, including 600,000 children.

Sewage often pollutes the water supply in India’s countryside, where 70% of the population resides. The Indian government has focused primarily on treating the water in rivers and streams, but Neil Robertson, professor of chemistry, and his team at the University of Edinburgh took a different approach. “The use of solar photocatalysis to destroy pollutants has been worked on before,” Robertson told Seeker. “In our work however, we have made improvements to the material most-typically used by improving the amount of visible light absorbed and improving the efficiency of the photocatalytic process.”

Robertson’s solar-powered system takes high-energy particles from the sun and induces them within a photolytic material, creating a chemical reaction. Oxygen molecules are activated to break down bacteria and other organic matter in the

water. The materials don’t need a power source, so the technology is easy to set up off the grid. It only needs to be hooked up to containers of contaminated water and pointed toward the sun.

“Our aim is for a very simple technology with very low cost, applicable to the domestic environment,” Robertson said. “It could be rolled out across the same rural domestic context across India.” Although this technology is an innovative advancement in the field, it’s not yet a catch-all solution to India’s overall water contamination problem. “While interesting and promising, I’m not convinced that this approach deals with the full chain of water quality issues that are relevant for large swaths of rural India,” Pavani Ram, associate professor of epidemiology and environmental health at SUNY Buffalo, told Seeker. “This approach might lead to water disinfection but doesn’t seem like it would prevent recontamination of the water,” Ram continued. “[This] can happen if water is stored in wide-mouthed containers or otherwise comes into contact with unwashed hands or other sources of contamination.”

Ram points out that water in some parts of India, particularly the northeast, can also be contaminated with particles other than microbes, for example: “arsenic, [dangerous levels of] fluoride, and other chemical contaminants, which can be very damaging to human health,” she said. “We can no longer afford to look only at the microbial quality of water.” Robertson and his team recently partnered with the Indian Institute of Science Education and Research. They’re working towards scaling up this technology and hope it will be useful in some of the many other countries where accessing clean water is still a daily struggle.

<https://www.seeker.com>

Algae-powered solar cell for rural communities

Cambridge team separates charge generation and power delivery in algae solar cells, enabling energy storage function. While most research into photovoltaic technology focuses on mineral-based mechanisms, from crystalline silicon to the promising

perovskite materials, there are other possibilities. One of these exploits the most successful type of solar energy generation, photosynthesis, which has been powering the planet’s plants for aeons.

Biological solar cells generally use single-celled plants — algae — to harvest solar energy. The Cambridge team, comprising chemists, biochemists and physicists, now claims to have overcome one of the biggest obstacles to developing this technology: the conflicting demands of generating electrons and converting them into useful electric current.

Previous biophotovoltaics (BPVs) have co-located these two functions in the same chamber; algae absorb sunlight, generate electrons, some of which are secreted outside the algae’s cell walls, and immediately inject these electrons into an electrical circuit. But this is not an efficient method, explained Kadi Liis Saar, of the Department of Chemistry. “The charging unit needs to be exposed to sunlight to allow efficient charging, whereas the power delivery part does not require exposure to light but should be effective at converting the electrons to current with minimal losses.”

The team designed a system where the two functions are separated into distinct chambers, using microfluidic technology in the power delivery chamber. “Separating out charging and power delivery meant we were able to enhance the performance of the power delivery unit through miniaturisation,” explained Professor Tuomas Knowles from the Department of Chemistry, also affiliated to the university’s Cavendish Laboratory. “At miniature scales, fluids behave very differently, enabling us to design cells that are more efficient, with lower internal resistance and decreased electrical losses.”

In a paper in *Nature Energy*, the researchers explain how the power conversion chamber uses laminar flow to separate fluid streams containing positive and negative charges, allowing it to work without membranes. Moreover, the algae used were genetically modified to minimise the amount of charge generated that could not be converted to current. Together, these in-

novations allowed the cells to generate power density of 0.5W/m², five times that of previous designs.

This is still well below power densities of inorganic photovoltaics, the researchers admit. "While conventional silicon-based solar cells are more efficient than algae-powered cells in the fraction of the sun's energy they turn to electrical energy, there are attractive possibilities with other types of materials," said Professor Christopher Howe from the Department of Biochemistry. "In particular, because algae grow and divide naturally, systems based on them may require less energy investment and can be produced in a decentralised fashion." This might be particularly useful in rural Africa and South Asia, where established grids may not exist and cells could be made in local communities without the need for the high-tech factories required by inorganic PV technology.

<https://www.theengineer.co.uk>

NORTH AMERICA

CANADA

Chemical-free water purification for rural communities

The University of British Columbia (UBC) engineers have found a way to help remote communities gain access to drinking water by creating an affordable water-purification system that doesn't use chemicals. The system uses membrane tubes to filter non-potable water into drinkable water, a technique West Vancouver, Abbotsford, and several other B.C. communities already use. But those conventional membrane filters for water use chemicals to keep the membranes from getting clogged up, and UBC professor Pierre Berube has found a way to use gravity to rinse the membranes periodically, erasing the need for chemical cleaners. It also drops the operational cost of turning grey water into drinking water "to essentially nothing."

"Often in smaller communities, there is capital available to build the water system but it's difficult to get operating capital," said Berube, a civil engineer. Berube's water-purification system is essentially self-

cleaning, with the only mechanism being a valve that opens and closes, mimicking the effects of turning the system on its head every once in a while to let gravity do its work. Water and air bubbles rush up over the membranes when the valve switches, much like when a pop bottle is turned upside down, he explained. That movement is enough to dislodge most of clogged debris.

The lack of chemicals also has the added benefit of allowing microbiology communities to grow on the membranes, surviving on the contaminants stuck on the outside of the tubes. "Those micro organisms will slowly eat away at those retained contaminants. They munch away on [them]," said Berube. His team is currently using a test system installed in West Vancouver to put the finishing touches on the design. The water, although 100% safe to drink, is not going to residents, Berube said.

<http://www.metronews.ca>

USA

Mapping technique for fighting poverty

An Indian-origin scientist in the United States has developed a novel technique that combines cellphone records with satellite data to create timely and incredibly detailed poverty maps, which may be useful in areas of war and conflict, as well as remote regions. For years, policymakers have relied upon surveys and census data to track and respond to extreme poverty.

While effective, assembling this information is costly and time-consuming, and it often lacks detail that aid organisations and governments need in order to best deploy their resources.

"Despite much progress in recent decades, there are still more than one billion people worldwide lacking food, shelter and other basic human necessities," said Neeti Pokhriyal, the study's co-lead author, and a PhD candidate at the University at Buffalo in the US. "This study details a newer mapping technique for poverty using different data sources than traditionally used," Pokhriyal told PTI. She jointly led the study along with Damien Jacques, from Université Catholique de Louvain, Belgium.

Some organisations define extreme poverty as a severe lack of food, health care, education and other basic needs. Others relate it to income; for example, the World Bank says people living on less than US\$ 1.25 per day (2005 prices) are extremely impoverished, researchers said.

The latest study published in the journal *PNAS* focused on Senegal, a sub-Saharan country with a high poverty rate. The first data set were 11 billion calls and texts from more than nine million Senegalese mobile phone users. All information was anonymous and it captured how, when, where and with whom people communicate with. The second data set came from satellite imagery, geographic information systems and weather stations. It offers insight into food security, economic activity and accessibility to services and other indicators of poverty, researchers said. This can be gleaned from the presence of electricity, paved roads, agriculture and other signs of development.

The two datasets were combined using a machine learning-based framework. Using the framework, the researchers created maps detailing the poverty levels of 552 communities in Senegal.

Pokhriyal, who began work on the project in 2015, said the goal is not to replace census and surveys but to supplement these sources of information in between cycles. "The study does not try to replace census. Instead, provides a way to produce inter-censal or interim statistics on poverty, that can be generated in between cycles of census," she said. The approach could also prove useful in areas of war and conflict, as well as remote regions. The framework also can help predict certain dimensions of poverty such as deprivations in education, standard of living and health, said Pokhriyal. Unlike surveys or censuses, which can take years and cost millions of dollars, these maps can be generated quickly and cost-efficiently. And they can be updated as often as the data sources are updated. Their diagnostic nature can help assist policymakers in designing better interventions to fight poverty.

<http://www.tribuneindia.com>

BRIDGING INEQUALITY IN AGRICULTURE THROUGH ICTs

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Abstract

The Sustainable Development Goals (SDGs) have put forward ambitious targets for the world to reduce inequality and usher equal opportunities and development across regions. Agricultural development is a common thread that goes across the 17 SDGs and development (or lack of it) in the sector has the potential to affect all others. Global development agencies and research bodies have emphasized on the transformative power of Information and Communication Technologies (ICTs) in making the highly ambitious SDGs achievable by 2030. And this makes combining ICTs with agricultural development a necessity. ICTs can influence the agriculture sector by increased rate of diffusion of technologies and through development in the ICTs themselves. While ICTs are most important tools for development, their strategic implementation will only ensure success in bringing about the desired change.

Global development and ICTs

The Sustainable Development Goals (SDGs) of the United Nations (UN) followed the Millennium Development Goals (MDGs) which proved to be great success in improving lives of people by reducing extreme poverty, mortality rates from infectious diseases like HIV/AIDS and child mortality in the developing nations. SDGs are expected to further the progress aiming to end poverty, extreme hunger, provide quality education and healthcare, and overall improve the social and economic status of people worldwide. The ambitious SDGs call for bold breakthroughs to meet their goals by 2030 with efforts that go above and beyond the comfort zone of the present rate of progress and as per the Overseas Development Institute (ODI) report, not a single goal will be achieved by 2030 if the current rate of progress is continued. But then again, the idea behind the SDGs was to continue the efforts of the MDGs with higher vigor to provide better quality of life to the estimated 9 billion population by 2030. Currently, 70.1% of the global adults

hold only 3% of the global wealth, while only 8.6% of the global population own 85.6% of the global wealth. While those in the middle income bracket (earning \$10–20/day) have doubled in 2011 compared to 2001 globally, still 79% of the world's population belong to poor (\$2/day) and low income group (\$2–10/day). These are also the part of the global population that belongs mostly to low and middle income economies of Africa, Latin America, and South East Asia (Inequality.org, 2018). Because of their disadvantaged position, access to important resources like education, healthcare, food and nutrition, proper livelihood becomes limited, which leads to a cycle of poverty and further increasing inequality. And to break this ongoing circle of inequality and poverty, Information and Communication Technologies can prove to be a useful tool (Close-the-gap.org, 2018; Sustainable Development Knowledge Platform, 2018).

Using ICTs for achieving the SDGs can be critical as they can accelerate innovation and change, share good practices

and exemplary cases, improve 'capabilities to gather, analyze, manage, and exchange information' (Wahlen, 2017). For achieving the goals, no one should be left behind in the process of connecting online and that requires special attention to make sure the poor and marginalized have access to ICT enabled services in a coordinated environment of multi-stakeholder partnership (ITU, 2017). The highly ambitious nature of SDGs makes it crucial to innovatively use ICTs to increase access to financial resources as well as helping the development agencies to track and extrapolate necessary data and information to understand better how ICTs can reduce poverty and hunger; promote gender equality; make quality healthcare, education, affordable clean energy accessible; ensure sustainable development and economic growth across regions; developing and disseminating climate smart technologies; and ensuring stronger partnership for better development (ITU, 2017). Developments in ICTs industry have shown highly productive growth in the recent years and with increased affordability of the technology access has increased worldwide. Dramatic increase in mobile subscriptions in Africa and Asian countries has revolutionized health, education and financial service delivery and has also positively impacted agriculture, trade and commerce, and transportation. With further advancement in mobile broadband, Internet-of-Things (IoT), robotics, and Artificial Intelligence (AI), development can leapfrog in priority sectors. Major ways in which ICTs can contribute are accelerated service delivery in sectors like health, education, financial services, agriculture, and low carbon energy systems; reduced service delivery costs; enhanced awareness and public engagement; increased innovation, connectivity, productivity, and efficiency among sectors; and faster upgrading of service quality (Sachs et al., 2017a,b). The Huawei ICT SDGs Benchmark study suggests that countries that have performed well on ICTs have better

chance of reaching the SDGs by 2030, especially for SDG 9 (Infrastructure, Industrialisation and Innovation), SDG 4 (Quality Education), and SDG 3 (Good Health and Well-being). The study further suggested that it is the implementation and use of resources rather than their availability that influences the performance of the SDGs and ICTs can become the key influencing factor there (Huawei, 2017a).

Agriculture and its implications on global development

Agriculture is the only sector that probably connects almost all the 17 SDGs and so, developments in the sector can directly and indirectly play immense role in reaching the SDGs by 2030. While it can directly address hunger and poverty, water and energy use, climate change and climate smart technologies, and unsustainable production and consumption, the indirect effect is mostly on all of them. Rural people form the largest part of world's extreme poor and are directly or indirectly dependent on agriculture, development of which will result directly in their poverty alleviation (SDG 1). Agricultural extension services increase access to skills, tools, knowledge, and inputs, ultimately impacting education (SDG 4). Women farmers are as important part of the sector as their male counterparts in terms of both number and contribution, and investing in gender equality in the sector can go a long way in reducing global hunger as well (Goal 5). Agriculture sector is one of the major consumer of water resources and smart technologies to save and harvest water consumption can make efficient water use a reality by 2030 (Goal 6). While agriculture is a major consumer of energy as well, proper technology and investment in bio fuels can make the sector producer of clean energy (Goal 7). Agriculture can be a major source of employment generation in rural areas accelerated through pro-poor economic growth (SDG 8). Promoting urban and peri-urban agriculture can help develop a sustainable ecosystem and reduce pollution in the cities most effected by pollution like Beijing, Delhi, and so on (SDG 11). Channelizing and utilization of the production to reduce waste of agricultural produce

can contribute to responsible consumption without increasing pressure on production systems (Goal 12). Climate smart agricultural technologies can not only help farmers cope with changing climatic conditions, but reduce carbon emission and increase productivity at the same time (SDG 13). Reducing deforestation, promoting biodiversity through indigenous crop varieties, and increasing efficiency of farmland can help improve life on land (SDG 15). But specifically SDG 2 which calls for ending hunger, achieving food security and improved nutrition, and promote sustainable agriculture required major initiatives in policy, planning and implementation fronts to 'provide access to food to all; address nutritional needs of the vulnerable sections of population; increase productivity and income through secure and equal access to land, other productive resources, inputs and knowledge, financial services, markets, and opportunities for value addition and non-farm employment'; ensure sustainability and resilience in face of natural and man-made disasters; and promote biodiversity through sound management of plant genetic resources. This will require investments in infrastructure, agricultural research and extension services, technology development, enhancing productive capacity, corrections in world agricultural trade policies, and proper regulation of food commodity markets to prevent price volatility and ensure increased access (FarmingFirst, 2018).

Agriculture sector is complex with involvement of multi-stakeholders – institutions, organizations, and national governments, who are required to align their interests and goals with the SDGs or mainstream the SDGs based on their mandates. With an estimated 50% higher food requirement by 2030, sustainable food production will require sincere investments in multi-faceted approach addressing scientific, economic, cultural, and logistical aspects of food security and agriculture challenges. As the agriculture sector will effect access to food, food waste management, efficient production and consumption, without well strategized implementation of programmes and policies, the effect can be across sectors (Mancini and Korosis, 2015).

ICTs in agriculture – disruptive technologies for grassroots

Changes in technological innovation has been affecting the agriculture sector for a long time now, and with increasing advances in the technology industry combined with higher demand for information and technology in the agriculture sector, ICTs in the future have an increasing importance. Efficiency in the agriculture sector is currently low in terms of sustainability, climate smart technologies, stagnant productivity, and waste management. And as identified and reiterated by the ICT and SDGs report (Sachs et al, 2017b), ICTs will impact the SDGs and agricultural development in two ways – increasingly transforming society and its elements through accelerated and augmented communication, and through swift breakthroughs in increased capabilities of the technology itself. For agriculture, it means increased use of advanced robotics technologies like Drones for soil and field analysis, monitoring of farm activities, crop health assessment helping in better decision making; sensors to easily analyze air, water, and soil and better data accumulation, analysis, and subsequent decision making from crops to livestock sector; Artificial Intelligence (AI) making decision making easier through image based automatic inspection and data processing for easier decision making; Augmented Reality (AR) for agricultural planning and research; and Blockchain technology to gather, interpret and share information (Connolly, 2016). Digital agriculture has the potential to make farming highly optimized, individualized, real time, hyper-connected and data-driven management (Es and Woodard, 2017). While the possibilities of ICTs in agriculture are immense and encouraging, digital divide is just as real a truth in the developed as well as developing economies.

Use of ICTs in the developing economies is mostly limited to TV, radio mobile phones, and web portals. While use of big data analytics, AI, robotics technologies, and IoT are yet to pick up and become affordable for the economies, these tools are taking care of ICT requirements of the agricultural stakeholders. Major

functions carried out by the tools are offering localized and customized information; knowledge management; enabling collaboration, sharing, and partnership for innovations among extension stakeholders, giving farmers and other stakeholders at the grassroots to voice their opinions, and facilitating capacity development. The functions are generally performed to various capacities by the ICT tools described in Table 1.

Digital divide plagues both developed and developing nations, though their nature and scale are largely different. Digitalization is a pre-requisite for smart farming and rural broadband infrastructures, access to e-skill development, and strong policy roll out is of urgent need for European farmers in rural areas (Michalopoulos, 2017). Digital divide, with increased accessibility of ICTs have shifted from inequality of physical access to inequalities of skill and usage, commonly referred as second level divide (Hargittai, 2002; Dijk, 2012). The deepening digital divide caused by unequal skills, motivations, and preferences often limited to certain age, gender, education level, and occupation. In the agriculture sector, it translates to

exclusion of women and older age group farmers, who practically require the information more. Also, income inequality makes access to certain ICTs difficult. In India, many rural women are found to own a cellphone but do not know how to operate, dial numbers, or read or write messages because of illiteracy; many do not know their mobile numbers and depend on their husbands (Aneja and Mishra, 2017). This digital illiteracy constraints its use both on and off farm, marginalizing a significant part of the population, and thus rendering the digital divide wider. While inclusion of ICTs in farming communities is important, strategic implementation is crucial as well depending on the need of the community. As discussed in case 1 below, integrating digital extension services with offline interactions with extension professionals increase efficiency, reduce cost, and contribute to better income in the long run.

Case 1: eArik – Agricultural extension for tribal farmers through ICTs

The e-Arik (Arik meaning Agriculture in the local Adi tribal dialect of Arunachal Pradesh) project, implemented in 2007

in Arunachal Pradesh state in North East India, was a unique one given its location in one of the remotest part of India where electricity itself was a rarity. The project covered 12 tribal villages and 500 registered farm families and aimed at single window extension service delivery through computer, Internet, phone, radio and television. Extensive personal contact with extension professionals under the project was also initiated to increase awareness about the project as well as consultation on agriculture production, protection and marketing aspects through ICTs. A two tier information delivery system was followed, where the extension professionals under the project visited the farms of the villagers and based on the identification of pest and diseases or other problems, suggested the remedies. In case they were unable to give a solution, the problem was recorded using digital photographs and communicated to experts in the eArik Village Knowledge Centre or the experts at Central Agricultural University, the implementing institution and the recommendations were communicated back to the respective farmers. The project portal provided further information on crop cultiva-

Table 1: Appropriateness of use of different ICTs for various functions

Functions	Information and Communication Technologies (ICTs)													
	TV		Radio		Mobile phones (basic/feature)		Computer/laptop/smart phones							
	TV broadcasting	Video with DVD	Radio broadcasting	Community radio	Text	Voice	Without internet			With internet				
							Expert systems/ decision support systems/interactive multimedia CDs	Digital video	Animation	Website/web portal/ knowledge banks/ online repositories	Telere/ video conference	Mobile apps	e-Learning platforms	Social media
Offering localised and customised information, advisory, and other services	***	***	*****	*****	*****	*****	*****	***	*	***	***	*****	*	*****
Helping to create, document, store, retrieve, share, and manage the information	***	*****	***	*****	*****	*****	*****	*****	***	*****	*	*****	***	*****
Enabling collaboration, sharing, and partnerships for innovation among extension actors	*	*	*	***	***	***	*	*	*	*****	***	*	***	*****
Enabling farmers and others to gain a voice	*	*	*	*****	***	***	*	*****	*	***	***	***	*	*****
Facilitating capacity development of farmers, extension professionals, and other AIS actors	***	*****	***	*****	*	*	*****	*****	*	*****	***	*****	*****	*****

Source: Saravanan et al., 2015a

Global Forum for Rural Advisory Services (GFRAS) www.peterextension.org

tion, general agricultural practices, various schemes and programmes of agriculture and rural development department, market information, weather information, etc. A library at the village knowledge centre also made available a collection of publications, multimedia CDs on agriculture, and daily newspapers for the villagers. Computer training was also given to the young school students in the village for increased awareness (Saravanan, 2008, 2010).

The cost of extension service delivery to the farmers reduced by USD 53 per farmer, expenditure compared to conventional extension service delivery system was reduced by 3.6 times. Time taken by the farmers to avail extension services was reduced by 16 times, whereas, the time required for delivering the services was reduced by 3 times. The project also highlighted the need of appropriate methods of extension service delivery that balance offline and online methods depending on the context and need of the people to increase efficiency, rather than depending on solely ICTs, which might not have given the same outputs without the human contact. ICTs are also required to facilitate a multi-stakeholder partnership to carry forward the development initiated (Saravanan, 2012).

The project introduced computers to the farming community of the villages undertaken. With development, accessibility and availability of technological developments in the concerned villages, the project also introduced the concept of e-Village, a model ICT village for better access to information. With introduction of broadband connectivity in the areas, e-Agrikiosk was introduced or supporting the farmers with better decision making regarding agricultural activities and receive important information. As mobile phones became popular, the project m4AgriNEI (Development and Deployment of Mobile Based Agro-Advisory System in North-East India) was initiated in 2013 for mobile based information delivery to farmers. In the first phase of the project, push/pull information was delivered along with integrated IVRS calls in local languages. Database of registered farmers were maintained for better reference

and accurate advisory. In second phase of the project starting from January 1, 2018, it is undertaken by Government of Meghalaya and maintained by iTEAMS (Integrated Technology Enabled Agricultural Management System). Market extension advisory services are also provided through toll free number 1917 in addition to earlier online and offline information delivery services and capacity development programme. Mobile phones have revolutionized use of ICTs in the agriculture sector and have opened the gateway for inclusion of revolutionizing technologies of social media platforms. As of January 2018, there are 5.13 billion unique mobile users and 8.48 billion mobile connections, which is 112% of the total population. Active mobile social media users are 2.98 billion with a penetration of 39%. (WeAreSocial, 2018). Convergence and linkages have moved from linear research-extension-farmer mode to multi-stakeholder networks in complex settings. Interactive homogenous and heterogeneous groups follow different pathways and have varying nature, and social media platforms have opened up both for the pluralistic global networks in agricultural sector. Social media involves and engages the agricultural stakeholders; helps disseminating broad based information; the interactiveness gives it a flexibility as well as fluidity with changing times; archived information can be accessed anywhere, anytime; and enhances the facilitative role of extension organizations through gatekeeping of information, providing necessary linkages and supports, and forming a community online. A global survey on social media use by extension professionals worldwide emphasizes the increasing importance of its use in agricultural communities (case 2) (Saravanan and Suchiradipta, 2013; Saravanan et al., 2015b).

Case 2: Social Media and Agricultural Extension: A global perspective

Social media has given voice to the common people in every aspect, in every sector in the past decade and agriculture has not been away from it either. Facebook, Twitter, WhatsApp, YouTube and blogs are

the major social media platforms used by farmers as well as agricultural extension service providers to reach peers, clients, and experts alike. While the intensity of use varies between developing and developed countries, it is getting a wider reach and acceptability nonetheless. GFRAS Global survey on use of social media in agricultural extension and rural advisory services conducted online survey across 62 countries and 229 respondents to understand how and why social media is used by extension professionals worldwide. Facebook was the most preferred medium and searching for news and events and sharing information were the major drivers for social media use. Authenticity of information shared online was perceived as a barrier by the respondents. Social construction of information (development and publication of information socially by the users) was considered as the most important feature of social media (95.1%). Optimism about the importance of social media in agricultural information dissemination was high among the respondents (95%). While popularity was high, many of the extension professionals (71%) expressed the need for further training on how to best use social media across platform, content creation for social media, etc. At organizational level too, while increase in social media use was increasing, there was a rising awareness and need for social media guidelines in the organizations to better guide and monitor the employees in their social media use. Overall, the respondents viewed social media as not just a tool to connect with larger audience, but to build relationships as well. Lack of skill and competency among extension professionals, absence of proper organizational guidelines, lack of infrastructure, identification of training needs, knowledge management through dedicated social media managers, an overall attitude towards social media, and inclusion of rural communities on the platform were identified as major challenges in increasing inclusivity of social media in agriculture sector, which needed multipronged approach at individual, institutional, infrastructural, and policy levels to overcome (Suchiradipta and Saravanan, 2016).

Strategies for ICT implementation in developing countries

Strong e-agriculture policy: Implementation of ICTs needs a push from policy front to legitimize the inclusion efforts. Planning at national level will not just help integrate ICTs at the grassroots, it will also help in budgetary allocation for carrying out the activities.

Readiness and skill development: For making ICTs part of grassroots level activities, a positive attitude and understanding of the long term effects of ICTs is necessary. Skill and capacity development programmes to enhance user capacity can also bring about a positive attitude towards their use.

Backend support with infrastructure: Policy support and skill development can only do so much without proper infrastructure to translate the information into action. And for that, better broadband facilities, market and transport access, access to inputs, etc. also needs to be in place.

Convergence through e-platforms: Convergence of multi-stakeholder engagement have been a major constraint in agriculture sector in spite of their co-existence. To make the value chain efficient, high importance is required for promoting convergence and online platforms are a good place to start. Extension organizations can play crucial role in facilitating the convergence.

Promoting ICT champions: At community level, documenting and promoting ICT champions can not only be good indicator of its benefits, it also creates a pool of information for long term understanding of how ICTs impact communities. As good practices and success stories, they motivate ICT adoption too.

Implications of ICTs in bridging inequality in Agriculture sector

A round up of data from Indian Human Development Survey from 2005 to 2012 showed households without mobile phones have more access to private healthcare compared to those without mobile phones (Irwin, 2018). While developed economies rely on ICTs to en-

able social and economic development through transforming markets, creating new industries, and drive efficiency gains; least developed countries continue to be at a disadvantaged position due to lack of broadband infrastructure and poor internet connectivity. And considering most of the rural population of the developing and least developed economies engage in agriculture and allied sector, the gap keeps widening (UN, 2015). The Huawei Global Connectivity Index (GCI) 2017 (Huawei, 2017b) analyzed 50 countries of which, mostly developed countries emerged as front-runners in digital inclusion while middle and low income economies belonged to the adopters and starters group. ICTs were also found to be an engine of economic growth. But it was also observed that inequality among the nations have also increased making the 'digital divide a digital chasm'. This required attention from global community, policy makers and development agencies for increasing the need of ICT infrastructure development in the developing economies to give them a head start in the race to development. ICTs can specifically help the marginalized as has been observed in Pakistan, where food ordering platforms link home based women in informal food industry to wider pool of customers; in Rwanda where women farmers are connected through mobile technology to information, market, and finance; empowering women by employing them in information centres for delivering priority information to women clients in Bangladesh; identifying women innovators through grassroot innovation networks and helping them through financial assistance in India; and so on (Tottho apa, 2018; Mlambo-Ngcuka, 2018). There are more than enough evidence across the globe about how lack of ICT infrastructure can pull behind development and agriculture being a key driver in global development and reaching the SDGs, special efforts are required to bridge the inequalities at international, national, regional, and individual level.

Conclusion

In a world where knowledge and information is power and ICTs are transforming economies, it is not about if but how ICTs should be integrated to national and international development plans. While developed economies are way ahead in this aspect, developing and least developed economies need a boost. Majority of the poverty stricken people from these regions are engaged in agriculture and so, strategically implemented ICT initiatives in agriculture sector can prove to be a boon for development. But then again, ICTs need to be supported by proper planning, infrastructure development, capacity building, and appropriate implementation to reap their full benefit, or they may end up increasing the inequality that exists. ICTs in agriculture sector can prove to be transformative to meet the ambitious SDGs, only if employed with understanding of their nuances.

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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.

The interactive TECA – technologies and practices for small agricultural producers – is an online platform developed by FAO’s Research and Extension Branch to facilitate access to information that can benefit small producers around the world. This information can be accessed both through:

- a database of applied technologies and practices on various rural activities and supplied by partner organizations and initiatives; and
- online forums – or Exchange Groups – where members can enquire a community of practitioners about a specific agricultural technology or practice, and at the same time share their own experiences with other members looking for support.

The TECA platform:

- gathers and facilitates access to practical information (technologies and practices) that can help small producers in the field;
- enhances the participation of rural stakeholders in the development and improvement of technologies and practices for small producers; and
- contributes to food security and to the sustainability of farming systems managed by small producers

TECA targets practitioners from: producers’ associations, advisory services (extension agencies), national research and development organizations, NGOs, universities, the private sector, and any group or initiative working for and with small producers

Technologies

Technologies consist of practices or techniques, tools, equipment, know-how and skills, or combinations of the aforementioned elements. To be included in TECA, technologies have to be:

- Applied by small agricultural producers. They have been successfully tested or used by small producers under actual field conditions
- A public good. These technologies are expected to benefit society in general and its application shall incur no copyright fees

TECA provides technologies and practices in: Agricultural mechanization, Capacity development, Climate change and disaster risk reduction, Crop production, Fishery and aquaculture, Forestry, Livestock production, Natural resources management, Nutrition, and Post-harvest and marketing

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.

TECA partners inside and outside FAO are responsible for providing the information on agricultural technologies and practices. These partners usually consist of national, regional and international research organizations, advisory services, universities, NGOs, development agencies, farmers’ association and FAO technical divisions.

Exchange groups

Exchange Groups are online forums where people share their experiences and knowledge about different farming systems for small producers. They can be organized around a specific topic (for example, the Beekeeping Group or the Farmer Innovation Exchange Group), around a project (for example, the SALSA Project Group) or around a region or a country (for example, the Uganda Group).

For more information, access:

<http://teca.fao.org>

A CLIMATE ADAPTIVE TECHNOLOGY

CROPPING AT TEMPORARY RAISED RIVERBED

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Abstract

Bangladesh is a riverine country with severe scarcity of land. Every year, during the dry seasons the rivers dry up and some temporary raised riverbed emerge. These riverbeds are not generally used for any agricultural or other productive activities. Each year, Bangladesh loses more than 0.7% cultivable land due to unplanned urbanisation, infrastructure development, and population growth. In order to cater to the needs of the ever-growing population, it is important to adopt innovative alternative technologies for cultivation. Utilising these barren riverbeds for cultivation has enormous potential for contributing to food security and nutrition in the country. This paper outlines the key features of the sandbar cropping technology, Practical Action's experience in implementing and promoting this technique, and the overall impact of it on the participating beneficiaries.

Introduction

Bangladesh is a riverine country with severe scarcity of land. Hundreds of rivers, both large and small, flow through the country. These rivers are absolutely vital for the greater well-being of Bangladesh's population. At the same time, however, they cause immense misery during the annual monsoon and seasonal floods to a large segment of population, especially those living in the vicinity of the river. The North West region of Bangladesh is nationally recognised as an economically disadvantaged and highly food insecure area. The area is located in the foothills of the Himalayas. Five districts of Rangpur division lie close to the confluence of the two major rivers, Teesta and Brahmaputra, of the country. This area is ravaged by floods and erosion almost every year, with large areas of land getting washed away and disrupting lives and livelihoods of its inhabitants.

Nearly 20% of the total land area of country, most of which lies along the coast, has an elevation of less than 1–3 m above mean sea level. Due to a virtually flat terrain, the rivers flowing within Bangladesh

have a lower gradient which conveys huge deposit of coarse river borne sediments on the riverbeds, causing sandbars. Sandbars emerge either as islands in river channel or (less often) as attached land to the river bank. This happens mostly from October–November onwards every year and tends to disappear with onset of the next monsoon and floods sometime in June. These riverbeds are large temporary, barren land, made of sand with very limited silt. In 2016–17-time span, average permanent riverbed has been found about 1,496 sq. km. or 1,496,000 Hectares and average transitional riverbed has been found about 1,213 sq. km. or 1,213,000 Hectares.

The population of Bangladesh has increased to more than double in 2017, to 165 million from just 71 million back in 1971. Ensuring food security for this ever-growing population is one of the major concerns for this country. Innovative alternative technologies are an answer for such a challenge. Utilisation of these riverbeds for agricultural production could help mitigate the food security issue to some extent. This paper outlines the key features of the sandbar cropping technology, Prac-

tical Action's experience in implementing and promoting this technique, and the overall impact of it on the participating beneficiaries.

Sandbar cropping at raised riverbed

Sandbar cropping is a simple and innovating technology that uses pit cultivation approach to produce crops (Figure 1). Pits are dug in sandbars which are filled with manure and compost. Multiple pits, each measuring around 1 m in diameter and depth, are dug 2 m apart from one another. About 10–15 kg of compost or cow dung is mixed with pit soil, which is left for about 2 weeks. Then these pits are filled with 4–6 seeds and soaked with water. Two to three healthy seedlings are usually retained in these pits upon germination. The remaining ones are uprooted and disposed as green manure. The pits are generally covered with paddy straw to preserve the residual moisture.

In the initial stages of this process the pits are irrigated twice every week. For the first 2 months of planting seeds, 1 kg of compost is applied to each pit within a month interval. The irrigation requirements of the plants go up to three times a week, after 2 months. Irrigation is done by manually carrying water in buckets and putting to the pits. In the initial months, water is normally available in the river channels flowing nearby. As the river channels make a rapid retreat in the following months, ground water is eventually used through bore holes made with the help of diesel operated pumps. Underground water from the riverbed is generally tapped at a depth of 15–40 feet. Water is often pumped from the hole into a makeshift small sized water reservoir that are created with low cost polythene sheets through polythene pipes. These reservoirs lie in the proximity of the pits and water is manually passed to the pits using buckets. Each reservoir caters to the needs of two beneficiaries.



Figure 1: Pit preparation and irrigation process during sandbar cropping



Figure 2: The variety of crops produced using the sandbar cropping technology

Quantity and frequency of irrigation for the plants essentially depend upon the type of sand and sandy soil as well as the amount of rain during the periods of plant growth.

The technology is useful for producing vegetables such as pumpkin, squash, water melon etc (Figure 2). It can also be used for producing flowers and grasses for cattle feed.

Practical Action’s approach to reach the poor and vulnerable

Practical Action started to promote the sandbar cropping technology to the poor and vulnerable households of the North West Bangladesh since 2005. For selecting beneficiaries, an objective and transparent

process was followed. Special preference was given to landless poor people and the female headed households.

The participating beneficiaries were provided with the technical knowledge on how to cultivate crops in the barren sandbars. Usually the sandbars are located near the community population, they can widely access it by foot and more often travelling for short distances by boats. The organization ensured communities, access to sandbars land through a process of negotiations involving local administrators, local government functionaries, local leaders and communities themselves. Fortunately, the overall attitude and approach from the local government to this initiative was largely supportive,

which helped the extreme poor to come out of the poverty cycle.

In order to support the cultivators with the irrigation process, Practical Action selected and trained volunteers from the community to be an operator of irrigation motor and pump at each site. Under current arrangements, the pump operator owns and maintains the pump and provides his/her services for a small fee.

Change in lives

The project helped the beneficiaries by ensuring market linkage to sell the cultivated crops and generating income. Organisation of pumpkin producers into groups and linking them with local markets and exporters through village-based marketing system in the North West region of the country has ensured that the poor are in a position to tap not only domestic market but also the international markets. The poor and vulnerable communities got to store storable crops (e.g. pumpkin) within the proximity of their homes, all year long. This helped them to get better prices during the off-season since the market rates are favourable due to higher demand and lower supply. Thus, a year-round income is assured out of what is essentially seasonal cultivation. The vegetables produced through this initiative have been marketed in over twenty districts of Bangladesh and also have been exported to Malaysia, Kuwait and Saudi Arabia (Figure 3).

It is seen that the beneficiaries of the project have earned almost a three times rise in income, as compared to the base level. The cost-benefit ratio for pumpkin cultivation is between 1:3 to 1:5 depending upon the ability and capacity of beneficiaries to bring in additional investments. Respondents reported a 3 to 4 times hike in income due to cultivation of pumpkin and watermelon. At least 3 to 4 subsequent cycles of sandbar cropping could uplift the extreme poor by stabilising their income from \$1.25 to \$2.5 per capita per day.

In 2017, the participating beneficiaries collectively donated around 500 pumpkins for the victims of the nearby flood affected community. It was a truly unique addition to the relief efforts by Practical Action.



Figure 3: Squash and pumpkin harvest at the sandbars

Case study 1

My husband did not work and passed his time loitering. Sometimes, he used to go to Dhaka to find some work. But, he used to come back after a while. It was hard to maintain my family. With the assistance from your organisation, I cultivated pumpkins in the sandbars this year. With the earning, I managed to provide my husband with banana business.



Mst. Amena Begum
Char Suvarkuti
Kurigram Sadar, Kurigram

Remarks

Cultivation method in the sandbars, promoted by Practical Action over the years, has contributed to reducing poverty in the North Western Bangladesh.

The project seems to have brought down the participating beneficiaries dependence on external help and reduced frequent migration to urban areas.

In order to improve the sandbar cropping technology, several initiatives are being taken. Currently experimental least-cost drip irrigation by recycling used soft drink plastic bottles is being tested. This is being tried on pilot plots, which are adjacent to sandbars where vegetables and flowers are being cultivated in pits. This will reduce the amount of hard work that goes into the manual irrigation process.

About 51% of the total participating beneficiaries are women. It shows that women are capable of being involved in the process of agricultural production. It is important to think about ways to ensure women's access to mainstream agriculture. It is also worth noting that women are usually the most adversely affected group by the climate change. While men have the option to migrate in case of a natural disaster, women do not. Women end up being overburdened by having to take care of both their families and the economic activities. Thus, it is important to ensure their involvement in the mainstream agriculture.

Practical Action noted that after the project completion at different places, significant amount of beneficiaries has sustained in the sandbar cropping related activities. They have managed to continue the sandbar cultivation through their own investment. However, the remaining percentage who could not sustain were also revisited for identifying why they could not continue on. It was seen that at least one more family members of the dropped out beneficiaries were suffering from some kind of illness or are with some kind of disabilities. Therefore, it is important to give them a customised intervention so that they can also continue to engage in the activity.

Conclusion

Given the limited amount of land and growing demand for food due to increasing population, various innovative agricultural interventions are required to ensure food security. Every year, during the dry season, the water level at the rivers go down and temporary riverbeds rise up.

Case study 2

I am a blind person. Everyone was saying that, there were plenty of pumpkins in my plants. My wife took me to the sandbars. I felt the pumpkins with my hands. While my wife worked for making the storage, I helped as much as I could. We bought 2 goats and paddy by selling pumpkins. I don't need to buy any rice anymore this year. Next year, I will buy another goat and a cow. I am dreaming this now.



Md. Abu Asad
Thanahat, Chilmari
Kurigram

In general, these riverbeds are not used for cultivation or any other productive use. However, this large amount of land, emerging for nearly half a year, has enormous

potential for contributing to the food security if utilised properly. Sandbar cropping at these riverbeds tend to be a practical solution in utilising these lands

for productive use. Cultivation method in the sandbars, promoted by Practical Action over the years, has contributed on reducing poverty in the North Western Bangladesh. The project seems to have brought down the participating beneficiaries dependence on external help and reduced frequent migration to urban areas. At least 3 to 4 subsequent cycles of sandbar cropping could uplift the extreme poor by stabilising their income from \$1.25 to \$2.5 per capita per day. It can truly turn out to be a remarkable addition to the economy if utilised properly.

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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 Technology Bank will be located in Gebze, Turkey. 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.

For more information, access:

<http://unohrls.org/technologybank/>

TECHNOLOGY FOR INCLUSIVE SERVICE DELIVERY

CASE STUDIES FROM INDIA

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Abstract

India has a population of over 1.2 billion with more than two-thirds in the rural sector and with 92% of the workforce in the informal sector. Coupled with challenging development indicators like a global disease burden of 20% versus just 8% of global doctors and a gross enrolment ratio in secondary schools of only 23% versus 87% in the United States, there is an urgent need for a technology led development paradigm that can fast track and leapfrog the country's development. In India, the government plays a leading role in building up digital infrastructure in terms of laying down networking cables, building data centers, and facilitating access to mobile phones and connectivity. Initiatives like common service centers, digital content and applications to deliver citizen services like e-district, passport sewa, birth and death registrations, and programs of digital literacy, not only pave the path to digital economy, but more importantly to a digital society and leveraging technology thereby leading to self-driven pathways to development.

The choice of cases in this article has been made keeping in view the key demographics of the country with a focus on showcasing initiatives with a pre-dominant agenda for serving best of services with ease of access and affordability to the bottom of the pyramid (BOP) and significantly the un-served rural communities. Cases chosen also demonstrate scalability and sustainability across different operating models – Government led for government services, government facilitated but village level entrepreneur led, and private sector led telemedicine model.

Introduction

India's demographic dividend is a great window of opportunity in the context of skill development and employability. It can lead to making a huge productive working population who are able to chart their own destinies and improve their economic status in a fast paced globally linked economy. However, this transformation is both impacted by and impacting upon the digital transformation agenda, which has the potential to address societal problems in completely new ways. The challenge is to leverage technology to provide basic human entitlements of health, education, jobs, a productive life, and a society with reduced inequalities for all.

The cases discussed below provide such models, implementation approaches, challenges, and mitigation strategies that

have provided a workaround. The cases have been chosen based on personal experience of the author as a public policy and service delivery expert for rural India.

Karma Healthcare: Access to reliable, affordable health to rural India through telemedicine

Karma Healthcare is a first-of-its kind venture, providing affordable, accessible and quality primary healthcare in rural/semi-urban India using a judicious mix of technology and on-ground interventions to improve health outcomes. The organization operates 'e-Doctor' clinics in rural/semi-urban India providing nurse-assisted online medical consultations by qualified doctors, diagnostic services and referral services to secondary/tertiary care through a financially sustainable model.

Karma's overarching vision is to establish a pan India network of healthcare centers and transform the industry to make healthcare more inclusive, integrated and evidence-based. The organization aims to create an omni-channel healthcare delivery platform having multiple touch-points including physical clinics, mobile based solutions and referral linkages to improve transparency and efficiency and reduce information asymmetry in the healthcare system.

- Since starting operations in 2014, Karma Healthcare has established 16 e-Doctor clinics covering a population more than 300,000 and completed 60,000+ online consultations with operations in two states – Haryana and Rajasthan in India.
- 55% of the patients are either repeat/referred by existing patients.
- In the three years its operation, Karma has received a revenue of INR 77 lakh from patients.
- Additionally, Karma provides services to some clients (individuals or organizations) via TAAS (Telemedicine as a service) and SAAS (Software as a service).
- Karma's strategic collaborations with some of the leading organizations such as The Office of the President of India, Sir Ratan Tata Trust, WISH Foundation, Government of Rajasthan, UBS Optimus Foundation and a few other national and International noteworthy bodies.
- Plans to expand to 100 clinics and 13 advanced e-clinics as Super Spokes in semi urban locations across 13 states with me-health app focussed on health counselling and preventive health.

The disruptive force of the model is not just in taking an essential service to unserved communities in but in also courageously implementing a completely market-based model of business. While this has put the management team through a wringer with several skeptics challenging the sustainability of models including

The primary problem that Karma is trying to solve in the rural and semi urban areas is of lack of access to quality and affordable healthcare, lack of awareness to seek timely and appropriate healthcare, and shortage of qualified doctors and trained manpower. With 0.65 physicians/1000 patients, India ranks 117th in the world. 70% of patients seek healthcare from untrained and unqualified providers. 75% of India's health infrastructure – including doctors and specialists and other health resources – is concentrated in urban areas where only 27% of the population lives. Given the scale of the problem, technological innovation, reduction in data costs, increasing Internet penetration, and in-built financial sustainability of the model, Karma believes that it is the most-appropriate time for a digital technology intervention to turn around the existing healthcare scenario.

Computers and Skype brought together with best quality doctors across the country for tele-consultation. Doctor speaks and sees the patient through video calling, diagnoses and prescribes medicines, tests if need be and advises patients and nurses on next steps.

Combines technology with assistive health care. A trained nurse supports patients, consultations, taking of health vitals like fever, BP, sugar, giving injections, supporting patient doubts and queries, taking photos of health issues and real time sending images to doctors and other diagnostic support.

Integrated health services: combining primary, referral, point of presence diagnostics and quality medicines with point of care diagnostic services for blood pathology, vision related and others based on device availability.

Centralized pharma and decentralized delivery with local pharma for quality drug delivery – a key problem in rural areas.

Support to access tertiary hospitals if need be by Karma including tie up with such hospitals to provide empathetic care.

Patients pay for above services at very affordable rates.



well-wishers, funders and other experts, the ability of Karma to persevere with the model making a business case for its client group is commendable. Apart from the fundamental vision, grit and commitment of Karmas leadership, what sets apart Karma is its business model as noted above and the commitment to quality and processes that ensure the same. There is no compromise or incremental thinking to the quality vision which generally plagues a BOP model and this reflects in the recruitment, the training of nurses, in feedback sought from patients, and in the data anal-

yses of doctors' diagnoses and prescription which holds doctors accountable to achieve quality and affordable health care. I personally saw Karma's ability to walk the talk when he was offered a partnership by a large government led institution which wanted to dilute to his quality focus but Karma held out even in excruciating financial and regulatory pressure context.

While Karma articulates internet connectivity, availability of female and male nurses in rural areas as one of its key problems, challenges also include the influence

and disinformation of local practitioners who are the mainstay of medical services as well as the lack of proactive health seeking behavior of our population especially for girls and women and the elderly as well as the ability of funders to have deferred gratification in a service that would need to be pegged on an ability to pay rather than the cost or value of the service.

Common Service Centers (CSC) – Gateway to digital access, literacy, services, and empowerment

The CSC scheme is one of the three key critical pillars of Indian Governments' National E-Governance Plan (NEGP) and is the bedrock of citizen experience of a digital society with "Anytime Anywhere Services". CSCs are physical spaces designed to be established in every Gram Panchayat of the country, serving as a front end physical entity, delivering a range of government and other private services to rural communities, enabled by technology.

CSCs are independent autonomous entities established by village level entrepreneurs (VLEs) in partnership with an entity called CSC e-Governance Services Limited (CSC-SPV). CSC-SPV is a special purpose vehicle set up under MeITY (Ministry of Electronics and Information Technology) where the government only holds a nominal share but serves as a strategic catalyst and facilitator of VLEs and their services.

True to its mandate, the CSCs offer a range of services on what is called the *Digital Seva Portal* that encompass the spectrum of:

- G2C – Government to Citizen;
- B2C – Business to Citizen;
- G2G (Government to government); and
- B2B (Business to Business) services.

These services catalyze rural jobs or access to people's report cards through rural BPOs, digitization and data entry or surveys and samples collection amongst others. Some of the key services being delivered are shown in the chart, with an ever-growing list of new services

plementation. However, another brilliant technological application has been the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), the largest public works program in the world. It set trailblazing benchmarks for an Enterprise Resource Planning (ERP) system that covers implementation of a complex process led program spanning 250,000 Gram Panchayats, 6,465 Blocks, 619 Districts and 34 States and Union Territories (UTs) and continues to innovate with ICT, setting new standards for use of technology in delivering large public development programs through the implementation of:

- a. Integrated financial management that links line functions with budgets and funds availability and just in time cash management. This ensures that funds are not parked unutilized across over 200,000 panchayats, blocking access where needed.
- b. Pioneering the use of banking business correspondents and Self-Help Groups as Banking Business Agents to deliver Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) wages through Point-of-Sale (POS) machines or mobiles and biometrics. This was the forerunner to Aadhar based Direct Benefits Transfer.
- c. The mobile application m-nregasoft captures real time measurement of works and speed up wage payment.
- d. Geographic Information System (GIS) based systems to track asset creation and quality of assets.

MGNREGS is a demand-driven scheme which derives its existence through landmark legislation. A demand driven scheme requires that a demand should be fulfilled and if not fulfilled, such non-fulfillment be compensated. MGNREGS guarantees a minimum of 100 days of wage employment to the rural adults at a minimum assured wage, with equal wages for women and men. It is also the only wage guarantee program in the world that provides a legal guarantee for wage employment.

The key objective of the scheme was to provide employment and therefore

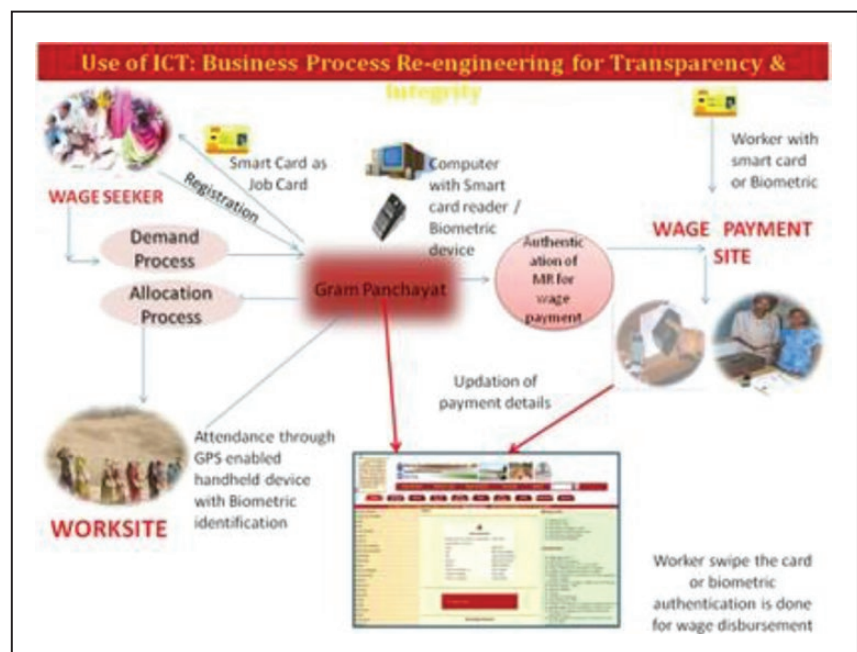
income security to rural families, especially during times of lack of agricultural work while also preventing distress migration. The Act and the scheme also envision enabling revival and creation of rural assets and infrastructure – both public and individual, which would enrich the rural and individual economic status.

Implementation of works under MGN-REGA include works that create rural infrastructure, sanitation, water conservation works, agri and forestry, fisheries, livestock related etc. The nature of a demand led program and satisfaction of demand require a series of processes that register and provide visibility to demand, preparedness in terms of works, budgets and approvals to meet the demand in time, and pay timely wages especially in an environment while a labor contractor pays sub-optimal but on need based wages, ensure quality control and mapping of works to avoid duplication and leakages, unique identification of wage seeker for demand assurance and wage payment without leakages, accounting and audit reporting as well as support to monitoring by state, national authorities as well as social auditors.

Since its inception, MGNREGS has generated work for person days of 8,001,395 workers on 957,280 worksites (as per e-Muster Roll) as on 11/03/2018.

The scale and complexity of processes led to a pioneering and highly courageous decision to implement MGNREGS only through a transaction based ERP system in Andhra Pradesh in 2006 which paved the way for NREGASOFT which now serves as the implementation and monitoring tool in the country. The principles that underpinned the design and implementation of NREGASOFT were:

- Complete transparency where transactions are recorded at source. In other words every process, every transaction, and every decision gets recorded and implemented through the software application proving complete transparency and accountability;
- That reports and records and data are available to the world at large as open data to enforce transparency while also available for research and inputs;
- All critical data Job Cards, people registered, demand met, muster rolls, wage slips, works expected and muster information – the source for manipulation are made available in public domain;
- Wage slips can be generated and provided to workers for verification and validation; and



Lakshmi, an MGNREGS worker

"I am Lakshmi. I belong to Periyakankankuppam village at Cuddalore Block in Cuddalore District. I am very poor and illiterate. I did not have any bank account before entering into MGNREGS work. I am ignorant of banking procedures and moreover my paltry earning is insufficient to make both ends meet. After joining the MGNREGS Scheme, I have been motivated and now I have opened a bank account with ATM card. It is very useful for the poor illiterates like me to draw money easily for my needs. It helps me to save money after spending for my needs."

KartikMuralidharan of University of California, US on biometric based smart card wage payment systems in MGNREGS in the state of Andhra Pradesh in India

"... beneficiaries in carded mandals experienced a faster, more reliable, and less corrupt payment experience. The smart card system reduced the lag between working on an MGNREGS project and collecting payment by 29%, and reduced the unpredictability in the lag by 39%. Further, it reduced by 19% the time workers spent collecting MGNREGS' payments"

- Reports and dashboards designed to show the responsibilities of functionaries and escalate non-performance.

MGNREGS process architecture

The software is a centrally designed but deployed across the country right down to Gram Panchayat and Block levels. The software has demystified estimates for works and digitized them, provided a rich source of data to test the efficiency and efficacy of the program, sets an unprecedented benchmark for transparency, demonstrates how a critical software can be designed and deployed for such a large number of stakeholders spread across villages of a country as large as India, stands as sterling example of bringing about large scale capacity building and change management on the supply side. It also led to the creation of bank accounts, the experience of ATM cards and the spurring of postal financial inclusion era in the country.

As activists and critics note, if we were to see if the software has ensured the guarantees enshrined in the Act - of providing demand led works or timely wages or compensation for delays or unemployment allowance or whether it has led to providing voice for citizens, one has to say that these are still unaddressed challenges and a ground for valid criticism against the governance of the program and cannot be

attributed to technology. There are similar and valid criticisms of delays in payments or denial of demand because of lack of Aadhar or delays in opening bank or post office accounts. Again, these would be administrative inefficiencies coupled with the large demand for services hitherto unknown and therefore inevitable system lags that are only natural but cannot be treated as failure of technology or a case for reversal of technology.

There is however great scope to leverage on a brilliant initiative and go to the next level of making the software, the apps, and technology citizen friendly. This requires a re-review of the design of the software from a user perspective, moving away from an administrative perspective. It also needs the creation of alternate channels of demand registration through say Community Service Centres or Civil Society organizations to serve as a counter check to non-registration of demand by the very functionaries who need to fulfill it. There is also much scope for using mobile and through text messages for better worker and citizen engagement and through auto enablement of payment of compensations or unemployment allowance and stronger efforts for citizens and civil society to understand the features of NREGASOFT for strengthening outcomes from the program. The next step should make NREGASOFT from

an implementation and monitoring solution and enhance its core to be a Jan Sewa System. However the caveat as is applicable of all ICT initiatives is that no technology solution can address governance or management gaps and therefore blaming technology would be a case of blaming the messenger instead of the message or its source

Conclusion

With millions of Indians looking to basic human services for individual and societal growth, there is a tremendous role that technology can play in providing access and creating opportunities for shared prosperity and wellbeing for 1.25 billion citizens of the country. The models and case studies discussed above are evidence to such empowerment and potential paradigm shifts when technologies come together with a commitment for doing well with doing good, converged with process led governance.

In order to realize the full potential for transformational impact on the lives of people, we need to address the challenges of infrastructure, digital literacy, and design technology for the client, keeping the person generally served last, at the centre of such design, with the understanding that no amount of technology can substitute for effective governance. ■

REDUCTION OF INEQUALITY USING EMERGING TECHNOLOGIES

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Abstract

A number of inequalities such as gender inequality or difference between rich and poor exist in a number of Asian countries. There are institutions such as NGOs/INGOs exist in order to deal with these inequalities and reduce it. Most of the victims of inequalities don't have access to technologies. For this problem, an application (app) can be made where any person can report prevailing inequality seen in his/her village. In case of gender inequality, skills must be transferred to women for empowerment. It can also be done by use of free apps from where women can learn skills and share their knowledge and stories. Also data in NGOs/INGOs can be used to make a predictive system which shall ultimately predict the next inequality to take place at respective locations such that preventive measures can be taken. These kinds of app/software can be used by NGOs/INGOs to increase their efficiency.

Introduction

In Asian countries we have a number of inequalities existing. A number of activities aiming to reduce inequality have been carried throughout the world.

According to the Commitment to Reduce Inequality (CRI) index, six out of eight South Asian countries rank in the bottom 20 in terms of addressing inequalities. India is listed as a country which has bad performance in inequality reduction. Except Nepal and Maldives, remaining South Asian countries have scored even worse than India in this index as shown in Figure 1.

Inequalities such as differences between rich and poor, male and female

in a very severe form still exist in these Asian countries.

Case study of Chhaupadi pratha in Nepal

Chhaupadi pratha is a tradition of untouchable practiced in western part of Nepal. Natural menstruation cycle of females is considered as a taboo in this region. As part of the Chhaupadi custom, women during her menstruation and post-natal state are forced to live in cowsheds, away from the home, exposing them to abuse as well as life-threatening risks (Figure 2). In this vulnerable time of month they are



Figure 2: A woman in Chhaupadi hut during her period

deprived to eat any kinds of dairy products which makes them prone to many health related attacks. In these areas 70–80% of women have uterus problem. Women also die of snake bites or suffocation in their Chhaupadi huts while on their periods. This Chhaupadi pratha had been outlawed by the Supreme Court in 2005 and had been criminalized in 2017. But still this tradition is practiced in mid and western areas of Nepal. *e-Kantipur* reported, on July 2017, a teenage girl died after she was bitten by a snake when she was sleeping in a cattle shed where she was forced to stay to practice Chhaupadi.

Overview of inequalities in Sri Lanka

In Sri Lanka two major ethnic groups are present: Tamil and Sinhalese. There existed inequalities among them which eventually caused civil war which lasted from 1983 AD to 2009 AD. This civil war took a huge number of lives of innocent Sri Lankan citizens, Tamil rebels and Sri Lankan government armies. Two decades of armed conflict in the Northern and Eastern Provinces have caused not only loss of lives but also extensive displacement; and for survivors, lack of access to basic services, livelihoods and security. This civil war has effected Sri Lanka's economy, citizen's living, employment, education and many other sectors. There are a number of conflict affected families. There are children who are poor, disabled, civil war victims, child labourers, street children, displaced, migrant and refugee children. These children are unable to get education and other basic facilities for living.

Role of NGOs and INGOs

Some inequalities prevailing in Nepal and Sri Lanka have been discussed above. Similarly number of inequalities are present in South Asian countries.

A number of NGOs/INGOs have been selflessly working to remove these inequalities and benefit the society.

Country	Rank
Nepal	81
Maldives	91
India	132
Sri Lanka	138
Pakistan	139
Bangladesh	141
Bhutan	143
Afghanistan	146

Figure 1: CRI index of South Asian countries

New laws for abolishment of immoral practices have been made. Amendments to constitution regarding existing inequalities have been done in favour of justice and equality.

Maiti Nepal, CWIN, Saathi, LACC Legal Aid and Consultancy Center, LOOM are some NGOs/INGOs in Nepal which are very actively working to remove inequalities and help victimized people to lead their life. Similarly there are a number of NGOs/INGOs in South Asian countries which have successfully helped and rescued a number of victims and locals. But still a number of local people who are victims of inequalities are unreachable. There are locals who are unaware of legal information and thus victimized. Locals just need to know that there are a number of helping hands available to help them and they just need to find them. As the locals are not able to reach the helping hands, these helping hands need to find out a solution to reach to these hidden victims.

A visit to NGO: LOOM Nepal

LOOM Nepal is an NGO which works at local and national levels. Its main goal is

to reduce gender-based inequality and fight for rights of women. It follows intersectionality approach, where the ultimate goal is reached by dividing task into multiple sections. One of the main sections of LOOM Nepal deals with is Internet and Sexuality. It is a very critical issue and deals with online harassment. There is no law for online harassment and the major challenge is to track the criminal activities and gather evidence.

One of the important tasks carried out by LOOM Nepal is that it has collected and documented stories of women's activism in a number of districts. A picture of one of the women who recorded her own story by her own words is shown in Figure 2.

In Nepal, women don't have much access to technology due to social, cultural and economic barriers. Women who have access to technology also have barriers such as fear of harassment.

A women activist, Ranju Danuwar's, word: *"We have very limited access to technology in my community but when I made that video by myself I felt powerful and confident."*

that video by myself I felt powerful and confident".

Easy access technology to find out the victims

National Women Commission in Nepal has launched a Toll-free Helpline, where any victim of gender-based violence can call and get information regarding the existing laws and advocacy.

We can find an app named "Mero Lagi" in app store which is targeted for all adolescent girls who have any queries regarding their monthly periods or any sexual queries regarding their health. This kind of app is very helpful to spread awareness among people.

Similarly we can make an app to find out the victims who need helping hands. An app where male/female can enter their details like gender, education, economic condition, family condition, condition of their village, whether has been victimized of any sort of inequality and so on. By use of this app a wide range of data can be collected. When an individual from a village gets access to this app, we can get information of their entire village. This information will help the NGOs/INGOs to track victim and reach them. A team can be sent to all the districts or parts of the country in a short period of time, the team can travel and teach the members of district regarding the use of app. The app should be in a language understandable by locals and user-friendly. As a single individual can give information about their village, anyone who sees inequality being practiced can report about it.

The legal information, updated laws regarding existing inequalities, can be placed in the app. Also name and contact details of advocates who deal with inequalities can be placed in the app. This information will help the locals and give them strength to fight back for justice and against inequality. Also few members in the district/village should be provided with some motivating factors (such as being paid) for giving the information of any kind of inequality existing in their area such that people will feel more responsible to report such activities.

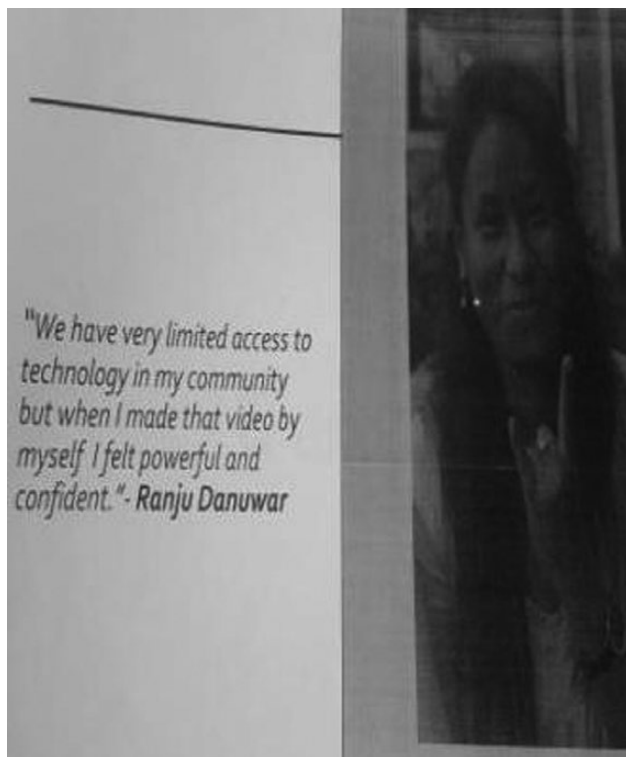


Figure 2: A women expressing her feelings after recording her story digitally on her own

Big Data usage by NGOs/INGOs

Big data refers to extremely large set of data which can be analyzed using statistical tools and techniques to identify the patterns of data, visualize data to understand the sequence or flow of data and so on.

Data science deals with Big Data. It uses statistical tools to make data analysis, data visualization effective.

Artificial intelligence is demonstrated by machines to act like humans by use of algorithms. Artificial intelligence can be used to make predictions based on the data available. In this case the past records of criminal/inequality activities can be used to predict next inequality activity along with the location. The system can also suggest prevention measures to be carried out.

There are big number of NGOs/INGOs working to bring out equality in nations. These organizations have plenty of data. There are several different kinds of organizations which deal with different kinds of inequalities. If all these data are fetched and given to the system, the system can use advanced technologies like data science and artificial intelligence to do proper analysis of data. These raw data can be processed to get useful information regarding inequality. Now, our system can actually predict the next criminal activity to be performed with the location at which it is prone to be performed.

The NGOs/INGOs can be much benefited by this modern-technology trend. If this kind of system will be used by NGOs/INGOs, then it will get predictions based on past record of criminal/inequality activities carried out. This will allow the enterprise to carry prevention activities like conduct awareness camps, survey camps, give training to the locals, give them proper information about existing laws and so on. As a result of prediction by the system, criminal activities can be prevented and public can be made aware of their rights and existing laws.

Gender inequality in society and corporate world

We can find gender inequality in South Asian countries like Nepal, India, Bangladesh, Afghanistan and so on. In these countries gender inequality is a severe

issue. Once married, women, adolescents, girls are treated as property of husband's family. Their education stops there. Women are prone to be victims of rape, domestic violence, acid violence and so on. These kinds of violence lead women to live lifeless tortured life.

We just discussed about gender inequalities in developing countries. But it is a shocking fact how females are treated differently in developed countries as well. In any small, medium, large enterprise, whenever there is a female leader, employees don't take orders from their female boss. Their decisions are not respected and obeyed with good discipline. But the same orders when given by male boss or leaders is accepted happily by the employees. Male leaders are obeyed more than female leaders by the employees. Also we can see female staff being paid less than male staff for the same job. Despite the truth that women are equally capable to handle the corporate world and take business decisions, their decisions are not trusted and respected by the employees. This is a matter of shame for the entire society having such patriarchal thinking.

From women to women (technology transfer)

For any women or girl being raised in a patriarchal society, it is difficult to go against the rules of the society and fight back for herself. As she has grown up seeing her father's worse treatment towards her mother, her strength, bravery are all killed. A girl in such society grows up with a feeling of curse for being born as a girl.

These girls should be given courage to fight for themselves. They lack self-defense training, confidence and knowledge.

A software can be made which can provide a platform for women to share their knowledge and skills. Empowered women can share their experience, skills, knowledge, stories which can play an important role in rising confidence of other women. Women should be given some training of skills such that they will be empowered which will give them confidence and independence. This training can be given through this application itself. Free videos and tutorials can be uploaded for women to learn easy skills. Ideas can be shared with women which will help them utilize

and boost their skills. It will help them earn money using the skills they already have like cooking, sewing, knitting and so on.

This kind of technology transfer app will help local women to increase their confidence and make them independent to lead their own living. Also when local women get to hear stories from other powerful, successful women, it will provide them strength to raise voice and fight against their problems. This will also let poor people learn skills to earn for their living.

Conclusion and ways forward

A number of NGOs/INGOs are working to reduce inequality. In order to help them do their work we can propose user friendly applications. Android application can be built from which information regarding prevailing inequality can be made. But for this application to work efficiently, it should be made in a language understandable by local people. Also few members from each district should be paid for reporting inequality activity being conducted in the village. Only then information of people who don't have access to technology can be received.

Data of NGOs/INGOs can be used wisely to predict inequalities to take place in future and suggest predictive measures. Also knowledge can be transferred from women to women using android applications. These kinds of software can be used by NGOs/INGOs to increase their work efficiency. For success of these applications, it should be made sure that victims somehow get access to these technologies and understand the terms used in these applications.

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Tech Events

2018

Apr 27–29
Shanghai,
China

2018 8TH INTERNATIONAL CONFERENCE ON ENVIRONMENT AND INDUSTRIAL INNOVATION (ICEII 2018)

Contact: Ms. Zero Jiang
Conference Secretary
Tel: +852-3500-0137; +86-28-86528465
E-mail: iceii@cbees.org
Web: <http://www.iceii.org>

May 3–5
Jakarta,
Indonesia

SOLARTECH INDONESIA–JAKARTA 2018

Contact: PT. Global Expo Management (GEM Indonesia)
Perkantoran Mutiara Taman Palem, Block C5 /28-29
Jl. Kamal Raya Outer Ring Road
Jakarta Barat, 11730, Indonesia
Tel: +62-21-5435 8118; Fax: +62-21-5435 8119
E-mail: info@gem-indonesia.com

May 27–30
Shanghai,
China

SNEC–PV POWER EXPO 2018

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

May 29–June 1
Kuala Lumpur
Malaysia

2018 INTERNATIONAL CONFERENCE ON SMART GRID AND CLEAN ENERGY TECHNOLOGIES

Contact: Conference Secretariat
E-mail: secretariat@icsgce.com
Web: <http://www.icsgce.com>

Jun 6–9
Bangkok,
Thailand

ASEAN SUSTAINABLE ENERGY WEEK 2018

Contact: UBM ASIA (Thailand) Co Ltd.
503/23 K.S.L. Tower
14th Floor Sri Ayuthaya Road
Kwaeng Thanon Phayathai
Khet Rajathewe, Bangkok 10400, Thailand
Tel: +66 0 2642 6911; Fax: +66 0 2642 6919-20
E-mail: info@cmpthailand.com

Jun 8–10
Kobe,
Japan

ASIAN CONFERENCE ON SUSTAINABILITY, ENERGY & THE ENVIRONMENT 2018

Contact: The International Academic Forum (IAFOR)
Sakae 1-16-26 – 201
Naka Ward, Nagoya, Aichi, Japan 460-0008
Web: <https://acsee.iafor.org>

Jul 8–12
Singapore

CLEANENVIRO SUMMIT SINGAPORE (CESS) 2018

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

Jun 4–8
Manila,
Philippines

ASIA CLEAN ENERGY FORUM 2018

Contact: Asia Clean Energy Forum
ADB Headquarters
6 ADB Avenue
Mandaluyong City, Metro Manila 1550, Philippines
Tel: +63 2 632 4444; Fax: +63 2 636 2444
E-mail: cleanenergy@adb.org
Web: <http://www.asiacleanenergyforum.org>

Jun 6–9
Bangkok,
Thailand

ENTECH POLLUTEC ASIA 2018

Contact: UBM ASIA (Thailand) Co Ltd.
503/23 K.S.L. Tower
14th Floor Sri Ayuthaya Road
Kwaeng Thanon Phayathai
Khet Rajathewe, Bangkok 10400, Thailand
Tel: +66 0 2642 6911; Fax: +66 0 2642 6919-20
E-mail: info@cmpthailand.com

Jul 17–19
Kuala Lumpur,
Malaysia

GREEN ENERGY EXPO & FORUM 2018

Contact: United Business Media (M)
Sdn Bhd A-8-1, Level 8, Hampshire Place Office 157
Hampshire,
1 Jalan Mayang Sari 50450 Kuala Lumpur, Malaysia.
Tel: +(603) 2176 8788, Fax: +(603) 2164 8786
E-mail: ridzuan.husin@ubm.com

Aug 2–4
Colombo,
Sri Lanka

SOLAR SRI LANKA 2018

Contact: CEMS Bangladesh
House # 119, Unit-A3
Road-1, Banani Block-F
Dhaka-1213, Bangladesh
Tel: +880 2-55040848; Fax: +880 2-55040031
E-mail: cems@cemsbangladesh.com

Aug 30–Sep 1
Noida,
India

FOOD TECHNOLOGY PROCESSING AND PACKAGING INDIA 2018

Contact: UBM India Pvt. Ltd.
Times Square Unit No.1 & 2
B Wing 5th Floor Andheri–Kurla Road
MarolAndheri (E), Mumbai 400059, India
Tel: +91 22 66122600; +91 22 66122626
E-mail: deepalim@ubmindia.in

Sep 6–8
Bangkok,
Thailand

ASIA RENEWABLE ENERGY EXPO 2018

Contact: Fireworks Media (Thailand) Co., Ltd.
Promphan 2 Office & Residence, 8th Floor (Office
Zone, Room 807) 1 Soi Lat Phrao 3, Lat Phrao Road,
Jompol, Chatuchak, Bangkok 10900, Thailand
Tel: (+66) 2513-1418; Fax: (+66) 2513-1419
E-mail: thai@asiafireworks.com
Web: <http://www.renewasia-expo.com> 2018

Sep 18–20
Noida,
India

RENERGY – RENEWABLE ENERGY INDIA EXPO 2018

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

Oct 25–28
Hong Kong,
China

ECO EXPO ASIA 2018

Contact: HKTDC (Hong Kong Trade Development
Council)
38/F, Office Tower
Convention Plaza
1 Harbour Road, Wanchai, Hong Kong
Tel: +852 1830 668; Fax: +852 2824 0249
E-mail: hktdc@hktdc.org

Oct 31–Nov 2
Singapore

ASIA CLEAN ENERGY SUMMIT 2018

Contact: Charissa Tay (Ms)
ACES Secretariat
Tel: +65 6880 8665
Web: <https://www.asiacleanenergysummit.com>

Nov 1–3
Mumbai,
India

ENVIROTECH ASIA

Contact: RADEECAL COMMUNICATIONS
19-A, Marol, CHS LTD,
Near Airport Road Metro Station,
Opp to Hotel Leela,
Andheri East, Mumbai – 400 059, Maharashtra, India.
Tel: +91 22 29252051
E-mail: sales@envirotechasia.com
Web: <http://www.envirotechasia.com>

Dec 12–14
Bangkok,
Thailand

FUTURE ENERGY ASIA EXHIBITION & CONFERENCE (FEA) 2018

Contact: Future Energy Asia
19 Cecil Street
#03-01 The Quadrant, 049704 Singapore
Tel: +65 6422 1475
E-mail: info@futureenergyasia.com
Web: <http://www.futureenergyasia.com>

Tech Ventures & Opportunities

Business Coach

Start-up Venture Creation

- Startup India benefits
- Philippine roadmap for digital startups

Technology transfer

- Registration of licensing agreement in Thailand
- Patent protection system in Viet Nam

Venture Financing

- Credit management, financial forecast and obtaining finance
- Arranging finance for MSMEs in India

Managing Innovation

- Global Cleantech Innovation Programme
- Grassroots innovation in Malaysia

Green Productivity

- Cleaner production and energy management in Sri Lanka
- Cleaner production

33 Tech Opportunities

Technology Offers

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- Device for eliminating smoke
- Brightness of LEDs
- Retort pouch technology
- Sugarcane juice powder technology
- Herbal pesticide
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- Sugarcane juice powder (dried)
- Biofungicidal formulation
- Kitozan biofertilizer

Technology Requests

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- Polyphenols from dried plant materials
- Magnetized Fertilizer from Fly Ash
- Ethanol Production Plant
- Chocolate manufacturing
- Food-grade stabilizing agent

Startup India benefits

Department of Industrial Policy & Promotion, Government of India

<https://www.startupindia.gov.in>

IPR benefits

To promote awareness and adoption of Intellectual Property Rights (IPRs) by Startups and facilitate them in protecting and commercializing the IPRs, Startup India provides access to high quality Intellectual Property services and resources, including:

- Fast-tracking of Startup patent applications: The patent application of Startups is fast-tracked for examination and disposal
- Panel of facilitators to assist in filing of IP applications: A panel of Facilitators is responsible for providing general advisory on different IPRs as also information on protecting and promoting IPRs in other countries.
- Government to bear facilitation cost: Central Government bears the entire fees of the facilitators for any number of patents, trademarks or designs that a Startup may file, & Startups only bear the cost of the statutory fees payable.
- Rebate on filing of application: Startups are provided an 80% rebate in filing of patents vis-à-vis other companies. This helps them pare costs in the crucial formative years. 50% rebate is also provided in filing of Trademarks vis-à-vis other companies.

Relaxation in public procurement norms

To provide an equal platform to Startups vis-à-vis the experienced companies in public procurement, Startup India has provisioned the following for Startups in public procurement tenders of Government of India/Central Public Sector Units:

- Relaxed norms of "prior experience and turnover"
- Exemption from submission of Earnest Money Deposit (EMD) in Government tenders

Self-Certification under Labour and Environment Laws

To reduce the regulatory burden on Startups thereby allowing them to focus on their core business and keep compliance cost low, Startups are allowed to self-certify their compliance under 6 Labour and 3 Environment laws for a period of 5 years from the date of incorporation.

In respect of 3 Environment laws, units operating under 36 white category industries (as published on website of Central Pollution Control Board) do not require Environment clearance under 3 Environment related Acts for 3 years.

Fund of Funds for startups

To provide equity funding support for development and growth of innovation driven enterprises, the government has set aside a corpus fund of 10,000 crores managed by the Small Industries Development Bank of India (SIDBI). The Fund is in the nature of Fund of Funds, which means that the Government participates in the capital of SEBI registered Venture Funds, who further invest in Startups.

Faster exit for startups

The Government has notified Startups as 'fast track firms' enabling them to wind up operations within 90 days vis-a-vis 180 days for other companies. An insolvency professional shall be appointed for the Startup, who shall be in charge of the company for liquidating its assets and paying its creditors within six months of filing an application in this regard.

Tax exemption for 3 years

The profits of recognized Startups that are granted an Inter-Ministerial Board Certificate are exempted from income-tax for a period of 3 years (out of a block of 7 years). This fiscal exemption is aimed at facilitating growth of business and meeting the working capital requirements during the initial years of operations

Tax exemption on investment above fair market value

If a Startup, having certificate from the Inter-Ministerial Board Certificate, receives any consideration for issue of shares that exceeds the face value of such shares, then the aggregate consideration received for such shares as exceeds the fair market value of the shares is exempted from tax.

Intellectual Property Rights and Foreign Technology Licensing in Developing Countries: An Empirical Investigation

Using cross-sectional analysis of a representative sample of firms operating in 42 developing economies, the report investigates whether expanded and strengthened protection of intellectual property (IP) fosters technology transfer to developing countries. The study finds that going from no IP protection to maximum IP protection is associated with a 65% increase in the predicted probability of licensing foreign technology for affiliated firms, but not for unaffiliated firms. It was also evident that the positive impact is limited to upper-middle-income countries, whereas there is at best no significant correlation for firms operating in lower-middle-income and low-income countries

For more information, contact:

Asian Development Bank
6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines
Tel: +63 2 6324444; Fax: +63 2 6362444
Web: <https://www.adb.org>

Philippine roadmap for digital startups

The Department Information and Communication (DICT), The Philippines

<http://www.dict.gov.ph>

The Philippine Roadmap for Digital Startups is a short and long-term strategic plan for the Philippine startup community and The Department Information and Communication Technology (DICT) towards developing digital innovation in the country. The goal of this initiative is to generate innovative startups that will spur economic growth and to find solutions to society's most pressing and pervasive issues. This roadmap is a framework that clearly defines our overall direction to push for digital innovation – one that can leverage the country's resources to its highest potential.

The Roadmap is divided into three parts:

- **Internet-related (digital) startup ecosystem:** Provides a clear definition of terms, goals and benchmarks. A summary of current internet-related technology ecosystems, as well as one for the current Philippine startup ecosystem, is included.
- **Patterns of technology startup ecosystem:** Provides insights from various startup ecosystems around the world, highlighting key features of each ecosystem. It also explores the Philippines' current progress in those defined key areas as well as a SWOT analysis of the local ecosystem.
- **Action plan:** Enumerates the short and long-term recommendations for all stakeholders to improve the Philippine digital startup ecosystem as well as the localized programs based on existing programs from international ecosystems.

The information and findings in this roadmap are gathered from leading local technology startup founders, as well as from existing literature of various projects, government reports, and affiliates including leading universities and startups.

The Philippine Roadmap for Digital Startups: 2015 and Beyond provides a framework for the government and the private sector to take a coordinated and systematic approach towards devel-

oping internet-related innovation against ambitious targets as a means for inclusive growth. The focus is to produce innovative businesses that find solutions to our country's most inherent challenges.

The roadmap is a collective effort for the community by the community, which includes the government, tech startup participants, and the academe, to come up with appropriate programs for the Philippines, focusing on the country's unique factors/features. The purpose is to provide support on all stages of development for tech startups and entrepreneurs of different backgrounds to flourish.

The roadmap contains studies of other tech startup ecosystems, which includes South America, China, Silicon Valley, Singapore and Israel. These ecosystems have attracted talent that fostered local innovation because they have the right mechanism in place for them to grow and reach their highest potential. Their environment (Intellectual Property, facilities such as Science Parks, Research and Development, Multinationals that have served as an exchange platform of knowhow, and Funding) allowed individuals to create and work collaboratively and strategically.

The Philippines, by all means, should strive to develop itself not by aiming to be a replica of Silicon Valley, but by aligning its unique resources and core strengths with strategic planning. The country has an attractive demographic (a growing young population, growing middle class, etc.), rich in natural resources, a pleasant culture (e.g. polite, English speaking). These are areas that should be highlighted on top of appropriate measures to development. The technology startup participants today alongside the government should aim to implement the best practices in promoting Internet-technology innovation through a step-by-step process and analysis on the roadmap.

ASEAN Standards Harmonization Initiative for Energy Efficiency

Funded under the EU SWITCH-Asia affiliated program, ASEAN SHINE aims at increasing the market share of higher efficient air-conditioners in ASEAN through harmonization of test methods and energy efficiency standards, adoption of common Minimum Energy Performance Standards, and changing consumer purchasing attitudes in favour of energy efficient air-conditioners.

For more information, contact:

ASEAN Centre for Energy
Jakarta-12950, Indonesia

Tel: (62-21) 527 9332; Fax: (62-21) 527 9350

E-mail: secretariat@aseanenergy.org; Web: <http://www.aseanenergy.org>

Registration of licensing agreement in Thailand

Department of Intellectual Property, Thailand

<http://www.ipthailand.go.th>

Consideration criteria

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

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

Conditions of application submission

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

Proceeding according to the official's instruction

1. In case that the official finds a correctable defect in the application, the official shall notify the applicant or his patent agent/patent attorney for the correction. The applicant shall

finish the correction within 90 days of the notification reception date. After such period, without the correction, the applicant shall be deemed to have abandoned the application, except the Director-General extends the period for correction as deemed appropriate due to any necessity.

2. After the applicant corrected the application, the applicant shall submit the correction application and the fee to the Department of Intellectual Property or the provincial office of the Ministry of Commerce. The corrected application shall enter the consideration and initial inspection processes respectively, similarly to the re-submission of the application.
3. In case of application submission via the website of the Department of Intellectual Property, the inspecting official shall check the completeness of information and details in the patent/petty patent application, request or other applications based on information and details appearing in the e-patent filing system. In this regard, the applicant shall present the application and supporting documents to the Department of Intellectual Property within 15 days of application number reception date and patent/petty patent application filing date via internet. The inspection of application submitted via internet shall be in accordance with the Notification of the Department of Intellectual Property Re: Principles and conditions for submission of patent/petty patent application, requests or other applications via internet.

Notes:

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

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

Relevant laws

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

Translation tool for patent documents

The World Intellectual Property Organization (WIPO) has developed a new "artificial intelligence"-based translation tool for patent documents, handing innovators around the world the highest-quality service yet available for accessing information on new technologies. WIPO Translate now incorporates cutting-edge neural machine translation technology to render highly technical patent documents into a second language in a style and syntax that more closely mirrors common usage, out-performing other translation tools built on previous technologies.

WIPO has initially "trained" the new technology to translate Chinese, Japanese and Korean patent documents into English. Patent applications in those languages accounted for some 55% of worldwide filings in 2014. Users can already try out the Chinese-English translation facility on the public beta test platform. The high level of accuracy of the Chinese-English translation is the result of the training of the neural machine translation tool, which compared 60 million sentences from Chinese patent documents provided to WIPO's PATENTSCOPE database by the State Intellectual Property Office of the People's Republic of China with their translations as filed at the United States Patent and Trademark Office.

WIPO plans to extend the neural machine translation service to French-language patent applications, with other languages to follow. The PATENTSCOPE database integrates with other translation engines freely available on the internet and continues to use existing statistical-based translation technology for languages where it performs well. WIPO has shared its translation software with other international organizations, including the United Nations conference management service, Food and Agriculture Organization, International Telecommunication Union, International Maritime Organization, World Trade Organization, and The Global Fund to Fight AIDS, Tuberculosis and Malaria.

Neural machine translation is an emerging technology. It is based on huge neural network models that "learn" from previously translated sentences. The specificity of neural machine translation (compared to previous "phrase based" statistical methods) is that it produces more natural word order, with particular improvements seen in so-called distant language pairs, like Japanese-English or Chinese-English. In a recent test, WIPO Translate's neural-based machine translation service substantially out-performed both the previous statistical-based model on distant language pairs, as well as other non-WIPO translation services. Since this WIPO tool is trained and focused uniquely on patent documents, instead of a more-disparate array of texts, it gives higher-quality renderings.

For further information, contact:

*Media Relations Section
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Tel: (+41 22) - 338 81 61 / 338 72 24
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Web: <http://www.wipo.int>*

Patent protection system in Viet Nam

National Office of Intellectual Property, Vietnam

<http://www.noip.gov.vn>

Statistics have shown that recent numbers of invention applications in the world in general and in Vietnam in particular gradually increased. This means patents and IP protection titles become more significant while the international market is turning into a knowledge-based market in which creativity rights of human beings play a significant role and are indicators of quality and characteristics of a product of an enterprise and a country to distinguish from those of other enterprises and countries, indicating that enterprises, research institutes and inventors to be aware of IP protection in the process of economic modernization and international integration. IPR is significantly important to small and medium-sized enterprises, research institutes, universities because those stakeholders have great potential and motivation of creativity.

Invention protection is relatively complicate and relates to different aspects such as research activities, civil law and the industry. The introduction of invention protection system will enable invention holders to use more effectively.

Industrial property protection system for invention will facilitate applicants to practice their rights effectively as a part of contributions to innovation and economic development. Under our national economy conditions, NOIP has taken part in all phases from receiving applications to handling disputes related to such inventions. Therefore, NOIP is not only a State management agency on invention but also an office establishing invention databases and providing such services as provision of patent information in technology fields as requested, provision of consultancy before filing applications and support for applicants during examination at NOIP and apply those inventions into industry. At present, NOIP has more than 60 officials working directly in patent.

NOIP is making its best in improving efficiency and productivity to meet demand of applicants through promoting examiners in both quantity and quality, putting works at NOIP into automation and expanding international relations to take use of foreign aids in experiences and knowledge in this field. NOIP is also taking into consideration the possibility of getting supports from experts outside who have knowledge, professional skills in technology fields to deal with a shortage of human resources and technical knowledge.

Patent protection in Vietnam was first in force as defined in the Decree 31/CP dated 23 January 1981 and Regulations on technical innovation, rationalization of production and patent. Accordingly, in Vietnam technical solutions shall be granted with Certificate for Inventors or Patent Certificate if they meet such

protection conditions as novelty, inventive step and susceptibility of industrial application. This Decree came into effect until 11 February 1989 (as the birthdate of Ordinance of industrial property protection). In this period, Vietnam only granted Certificate of Patent Author.

On 28 December 1988, the Decree 200-HDBT on protection of utility solutions was signed, therefore, technical solutions shall be granted with Utility Solution Certificate if they meet such protection conditions as novelty (in national phase), susceptibility of industrial application.

The Ordinance of industrial property protection revoked Certificate of Inventors for patent protection. Since then, patents and other industrial property subject matters are considered a property and an object of property right. This is reaffirmed in Civil Code 1995 and IP Law 2005. According to IP Law 2005, legal provisions on patent protection in Vietnam are almost in conformity with international standards provided in TRIPS Agreement.

Meaning of patent protection

Patent protection has a significant importance to nation, enterprises and inventors.

For the nation, patent protection under international standards shall contribute to attract foreign investment and encourage foreign technology transfer into Vietnam. In addition, the patent protection system also establishes a healthy business environment for all business sectors irrespective of State or private enterprises. Effective patent protection will encourage people to create more invention.

For enterprises (or investors in creating inventions), exclusive rights to invention within time limit, normally 20 years since the filing date allow them to prevent competitors from copying their inventions. The enterprises shall do business with more advantages than their competitors and solely exploit their inventions to make up for costs which have been invested in creation, continuously investing in other inventions and promoting technology potentials. Enterprises also benefit from granting licenses for others to utilize their patents through licensing contracts. Basically, the more value of the product basing on inventions, the more meaningful the protection for enterprises is. In order to create such inventions, it will take much time, efforts and money for research and development. Therefore, patent protection is an effective solution for enterprises to protect their investment achievements.

Credit management, financial forecast and obtaining finance

SME Corporation Malaysia

<http://www.smecorp.gov.my>

Credit management

Credit management is a term used to identify accounting functions usually conducted under the umbrella of Accounts Receivables. Essentially, this collection of processes involves qualifying the extension of credit to a customer, monitors the reception and logging of payments on outstanding invoices, the initiation of collection procedures, and the resolution of disputes or queries regarding charges on a customer invoice. When functioning efficiently, credit management serves as an excellent way for the business to remain financially stable.

The process of credit management begins with accurately assessing the credit-worthiness of the customer base. This is particularly important if the company chooses to extend some type of credit line or revolving credit to certain customers. Proper credit management calls for setting specific criteria that a customer must meet before receiving this type of credit arrangement. As part of the evaluation process, credit management also calls for determining the total credit line that will be extended to a given customer.

Several factors are used as part of the credit management process to evaluate and qualify a customer for the receipt of some form of commercial credit. This includes gathering data on the potential customer's current financial condition, including the current credit score. The current ratio between income and outstanding financial obligations will also be taken into consideration. Competent credit management seeks to not only protect the vendor from possible losses, but also protect the customer from creating more debt obligations that cannot be settled in a timely manner.

After establishing the credit limit for a customer, credit management focuses on providing the client with accurate and timely statements or invoices. The invoices must be delivered to the customer in a reasonable amount of time before the due date, thus providing the customer with a reasonable period to comply with the purchase terms. The period between delivery of the invoice and the due date should also allow enough time for the customer to review the invoice and contact the vendor if there are any questions or concerns about a line item on the invoice. This allows all parties concerned time to review the question and come to some type of resolution.

Financial forecast

A financial forecast is normally an estimate of future financial outcomes for a company or country (for futures and currency markets). Using historical internal accounting and sales data, in

addition to external market and economic indicators, a financial forecast is an economist's best guess of what will happen to a company in financial terms over a given time period which is usually one year. See financial modeling.

Arguably, the most difficult aspect of preparing a financial forecast is predicting revenue. Future costs can be estimated by using historical accounting data; variable costs are also a function of sales.

Unlike a financial plan or a budget a financial forecast doesn't have to be used as a planning document. Outside analysts can use a financial forecast to estimate a company's success in the coming year.

Reference class forecasting was developed to reduce error and increase accuracy in financial forecasts

Obtaining finance

You've got a great business idea, heaps of enthusiasm and experience, or perhaps you want to purchase an existing small business to fulfil a dream of being your own boss.

In either case, you've done a feasibility study and your research and financial forecasts indicate that your idea is viable. There's only one problem, you don't have enough money to start.

All businesses require some form of financing. The best way to access funds is to have some form of collateral. Equity in property is considered one of the best resources. However, if that's not possible there are several options you may consider financing your business.

Equity funding is personal money invested into a business. Many people use their savings, an inheritance, or sell an asset to fund their business start-up.

Starting a business can place a strain on your personal finances. It may be several months or more before your new business is profitable and can provide an income for you and your family. You must have the resources to maintain your household expenses while you establish your business, otherwise the financial success of your business will be at risk.

Well before starting a business it is advisable to get your personal finances in order. Develop a household budget that accounts for your income and your personal expenses. Once your personal finances are in order, you can assess the excess funds you have available to invest in your business.

Arranging finance for MSMEs in India

Office of DC MSME and Ministry of Micro, Small and Medium Enterprises (MSME), Government of India

<http://www.dcmsme.gov.in/howto/setup/finance.htm>

No Micro, Small and Medium Enterprises (MSME) unit can take off without monetary support. This need for finance can be classified into following types:

- Long and medium-term loans
- Short term or working capital requirements
- Risk Capital
- Seed Capital/Marginal Money
- Bridge loans

Financial assistance in India for MSME units is available from a variety of institutions. The important ones are:

- (i) Commercial/Regional Rural/Co-operative Banks
- (ii) SIDBI - Small Industries Development Bank of India (refinance and direct lending)
- (iii) State Financial Corporations (SFCs)/ State industrial development corporations (SIDCs)

Long and medium-term loans are provided by SFCs, SIDBI and SIDCs. Banks also finance term loans. This type of financing is needed to fund purchase of land, construction of factory building/shed and for purchase of machinery and equipment. The short-term loans are required for working capital requirements, which fund the purchase of raw materials and consumables, payment of wages and other immediate manufacturing and administrative expenses. Such loans are generally available from commercial banks. The commercial banks also sanction composite

loan comprising of working capital and term loan up to a loan limit of Rs.1 crore.

For loans from financial institutions and commercial banks a formal application needs to be made. The details of documentation that need to be provided with the loan application are indicated below:

- Documentation for Loan Application
- Balance Sheet and Profit Loss Statement for last three consecutive years of firms owned by promoters
- Income Tax Assessment Certificates of Partners/Directors
- Proof of Possession of Land/Building
- Architect's estimate for construction cost
- Partnership deed/Memorandum and Articles of Associations of Company
- Project Report
- Budgetary Quotations of Plant and Machinery

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

Subsequently, loan is disbursed according to the phased implementation of the project. In today's environment, there are other choices apart from commercial banks and Government owned financial institutions. These options include venture capital funds and non-government finance companies.

Asia Pacific SEforALL Hub

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

The Asia Pacific Hub will facilitate and coordinate core activities in the region, with respect to the SEforALL goals, in close cooperation with the SEforALL's Global Facilitation Team. A better policy environment will accelerate the further development of sustainable energy, which is why the AP-SEforALL Hub established a Sustainable Energy Center for Excellence, hosted by the Sustainable Energy Association of Singapore. The Singapore-based facility will become a venue for the region's policy makers to receive training on policy, technology, and project financing matters in the sustainable energy sector.

Key activities of the Asia-Pacific Hub for the SEforALL Initiative:

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

For more information, access:

http://www.se4all.org/hubs_asia-pacific-hub

Global Cleantech Innovation Programme

The United Nations Industrial Development Organization (UNIDO)

<https://www.unido.org/>

The Sustainable Development Goals and the Paris Agreement are the world's commitment to safeguarding the global commons. The United Nations Industrial Development Organization (UNIDO), with its unique mandate to support inclusive and sustainable industrial development, has partnered with the Global Environment Facility (GEF) to address the most pressing global environmental challenges of our time. Through fostering innovation and entrepreneurship ecosystems, UNIDO and GEF seek to promote affordable and scalable solutions enabling our partner countries to leapfrog to cleaner, more resilient economies.

Innovation ecosystem

The GCIP promotes an innovation and entrepreneur ecosystem by identifying and nurturing cleantech innovators and entrepreneurs; by building capacity within national institutions and partner organizations for the sustainable implementation of the cleantech ecosystem and accelerator approach; and by supporting and working with national policy makers to strengthen the supportive policy framework for SMEs and entrepreneurs.

Through this cleantech ecosystem and accelerator approach, the GCIP catalyzes investment to support and accelerate startup entrepreneurs towards the development and commercialization of their innovative ideas.

Partnerships and close collaboration with all national stakeholders are critical to maximize synergies and share knowledge and best practices that can help in enhancing the contribution of cleantech startups towards climate change mitigation, while increasing productivity and generating growth and wealth.

The GCIP accelerator

A key component of the GCIP is the annual competition-based accelerator, which identifies the most promising innovators and entrepreneurs across a country. A selected number of startups in a GCIP country participate in a rigorous, competitive national acceleration programme that trains, mentors, promotes, and connects them to potential investors, customers and partners. As the best cleantech companies progress, they are continuously developed and assessed.

The accelerator consists of an Official Launch, Investor Connect, National Academy, Business Clinic, and Mock Judging. In addition, the selected startups are continuously mentored and trained and

access to capital and showcasing opportunities are facilitated on a regular basis in order to enhance their business skills and to connect them to potential business partners, financiers and investors.

A tailored mentoring programme is provided through an elite group of general and specialist mentors and trainers drawn from industries, universities, and professional institutions, as well as business leaders from within the country and abroad.

Technology solutions

The GCIP started with four technology categories namely Energy Efficiency, Renewable Energy, Waste Beneficiation, and Water Efficiency; in 2016, the Green Building category was added to expand the scope of environmental challenges addressed. The 2017 accelerator has expanded to include two new categories, Transportation as well as Advanced Materials and Chemicals.

GCIP is planning a transition to an impact-focused accelerator in order to leverage innovation and entrepreneurship to provide solutions to protect our global commons. Existing technology categories will evolve in to impact categories to accelerate transformative clean technology solutions and integrated approaches for energy systems, sustainable cities, healthy oceans and sustainable fisheries, food systems, and landscape restoration.

GCIP also supports identification and development of demand-driven solutions that can address the most pressing environmental challenges at the national levels. Through National Innovation Challenges, innovators are invited to propose technology innovations that can address a particular problem with high-impact potential. This approach allows direct market access for the technologies, ensuring efficiency and effectiveness in impact scaling.

Innovation and entrepreneurship policy frameworks

An integral part of GCIP is the development of an enabling environment for cleantech innovation and entrepreneurship, and GCIP employs a cross-sectoral and multi-tiered approach with a view to building a sustainable "ecosystem" for innovative entrepreneurship in small businesses. This entails supporting national partners to strengthen the institutional capacities of government agencies focused on small and medium-sized enterprises (SMEs) development, clean technology and innovation.

Grassroots innovation in Malaysia

Malaysian Foundation for Innovation, Malaysia

<https://www.yim.my>

The Malaysian Foundation for Innovation (YIM) organises a wide range of activities in both Peninsular and East Malaysia all year round that provide avenues of awareness and ideas to develop grassroots innovations which are then used to improve the lives of communities at the bottom of the pyramid. These innovations should be designed to suit the local context of the targeted communities, and create value for them.

These focused activities or grassroots innovation movements bring together various stakeholders such as Government ministries, their relevant agencies, funders, universities, industry specialists and practitioners to meet with the inclusive audience of each event or activity to interact, connect and develop the innovations together. The feedback from the inclusive communities further provide base data to the Government for developing science, technology and innovation policies that relate back to the target audience. Collaboration between these stakeholders may also contribute to the sustainability of the solutions.

Over the years, YIM has organised various events for different inclusive communities. These include:

- The nationwide Innovation Walk (Jejak Inovasi)
- World Innovation Forum
- School Club Innovation Toolkit
- YIM Ideation programme.

The projects have attracted keen interest amongst students and innovation enthusiasts. Overall, the efforts have proven to be successful in enhancing appreciation and nurturing creative skills in science, technology and innovation subject matters at academia, industry and society levels.

For example, the YIM Innovation Walk helps to identify innovators from all strata of Malaysian society. Grassroots Innovation Workshops are organised to develop knowledge and skillsets necessary for continuous innovation growth and facilitate communication between potential funders and investors. They further help to promote awareness and pave the way forward for the market diffusion of grassroots innovations.

Mainstreaming grassroots innovations

YIM's Mainstreaming Grassroots Innovation (MaGRIs) programme is a project that focuses on upscaling and accelerating the development and diffusion of potential grassroots innovations in Malaysia via collaboration with various parties from government, industry, grassroots community and youth.

The MaGRIs programme provides an environment to develop grassroots innovators with potential innovations and groom them to become community role models. New methods to stimulate grassroots commercial activities into mainstream commercial activities are often uncovered while grassroots innovators leverage through opportunities to mainstream their innovations into mainstream commercial activities. Often, academic and industry collaborators are roped in to support the MaGRIs programme activities.

From innovation development to commercialisation with market diffusion to inclusive communities, the programme even has its own MaGRIs Ambassador originating from the same communities, sharing community success stories and creating engagement with this targeted community. Since MaGRIs was inceptioned in 2016, more than 13,000 people have engaged with the programme.

Publications on SMEs competitiveness

Exchanging Value - Negotiating Technology Licensing Agreements: A Training Manual

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

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

Globalization and Performance of Small and Large Firms

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

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

Cleaner production and energy management in Sri Lanka

National Cleaner Production Center Sri Lanka

<http://www.ncpcsrilanka.org>

Resource efficient cleaner production assessment

There is greater recognition that the inefficient and at times wasteful use of natural resources, including energy, water and materials, lies at the heart of the key environmental challenges, including climate change. Resource Efficient and Cleaner Production (RECP) assessments is a tested and proven tool adopted globally in past two decades to identify and quantify such resource productivity issues at firm level and to develop technically, financially and environmentally feasible solutions to the organizations.

RECP assessments analyses and quantifies input, output and waste generation at each step of a production process to increase efficiency and reduce risks to humans and the environment.

RECP addresses the three sustainability dimensions individually and synergistically:

- **Production Efficiency:** optimization of the productive use of natural resources (materials, energy and water);
- **Environmental management:** optimization of the productive use of natural resources (materials, energy and water);
- **Human Development:** minimization of risks to people and communities and support for their development.

RECP is a tool developed and promoted globally by United Nations Environmental Programme (UNEP) and United Nations Industrial Development Organization (UNIDO) since 1994 and it has caused incomparable savings in resources at firm level across the various industrial sectors during last two decades. National Cleaner Production Centre (NCPC) as the apex body in Cleaner Production has conducted Cleaner Production Assessments in hundreds of industrial organizations in past one and half decades and paved the way for the savings of millions of rupees via efficient use of resources for the companies while enabling them to meet stringent compliance obligations.

There are three types of audits focuses on improving resource efficiency:

Comprehensive cleaner production assessment: A Comprehensive Cleaner Production Assessment is an in-depth assessment carried out in an organization focusing at resource flows (energy, water and materials) within the total process in order to identify waste generation sources and causes. It also involves carrying out measurements in order to develop an accurate understanding of what, where and how waste is being generated. At the end of the assessment a detailed audit report is presented to the company listing out prioritized Cleaner Production solutions with the feasibility evaluation for waste minimization.

Short CP assessment: Short CP assessments are conducted with limited detailing in resource flow analysis. However Cleaner Production solutions are provided with feasibility evaluation in the shorter duration of assessment.

Walk through assessment/Quick scan assessment: A Walk-through Audit (Quick scan) assessment is a tool to identify resource inefficiency hotspots in an organization and make recommendations with analysis of available data. It is usually conducted during a span of 2–3 hours to familiarize oneself with the processes and activities being carried out.

Energy Consultancy/Auditing

Being an Energy Services Company (ESCO) registered under Sri Lanka Sustainable Energy Authority (SLSEA) since the inception of ESCO system in Sri Lanka, NCPC has been expertized to offer customized energy auditing services to any industry sector.

Energy Audit attempts to balance the total energy inputs with its use and serves to identify all the energy streams in the systems and quantifies energy usage. Energy Audit helps in energy cost optimization, pollution control, safety aspects and suggests the methods to improve the operating & maintenance practices of the system. With a strong dedication to providing commissioning, an energy consulting and sustainability service, NCPC has successfully consulted on over 100s of detailed energy audits and assessments.

The energy audits provide with a clear understanding of energy consumption in your buildings and facilities. Quantitative findings can provide substantial practical guidelines for:

- Continuous improvement in production efficiency
- Identifying cost saving opportunities in energy efficiency
- Identify fast-payback energy retrofit opportunities
- Make well-informed decisions on capital investments in your industry
- Identify low-cost/no-cost O&M measures that have an immediate impact
- Develop integrated capital improvement programs that coordinate energy

Starting with the development of an energy consumption inventory detailed auditing activities will be conducted to identify buildings and facilities with particular focus on rationalizing their energy profiles. Field measurements will be also taken to quantify critical operating parameters. Following the establishment of an energy consumption profile, the potential energy saving

opportunities can be identified. NCPC-SL equipped with latest energy measuring instruments including power analyzers, flue gas analyzers, Infrared thermometers and etc.

The type of industrial energy audit conducted depends on the function, size, and type of the industry, the depth to which the audit is needed, and the potential and magnitude of energy savings and cost reduction desired. Based on these criteria, an industrial energy audit can be classified into following types:

Preliminary Energy Audits: Primary energy assessments conducted in short time period based on history data and key instant measurements to identify general energy saving potentials.

Detailed Energy Audits: More comprehensive results and accurate picture of industry energy consumption is given by detailed energy audit since it based on continuous recorded measurements and more history data.

Customized Energy Services: Apart from standard energy audits, following specific energy services are offered by NCPC

- Demand analysis for tariff changes
- Power factor analysis for corrections
- Equipment efficiency analyze
- Illuminance level analysis for light replacements/daylight utilization
- Heat load calculations for chiller installations, replacements
- Building management systems and energy management systems
- Fuel switching consultancy

Measuring and verification

NCPC offers customized third party measuring and verification services for specially energy saving implementations to understand the actual energy and monetary savings of particular installation respected to baseline data.

NCPC Sri Lanka, is closely partnered with other RECP members of the RECPnet, who are rich in wealth of experience in respective countries. Hence, we maintains easy access to additional capacity and resources whenever necessary to provide a specific service beyond the capacity of us and the country. NCPC energy audit services provide a range of additional benefits. The findings of an energy audit can be a good reference for your management in supporting commercial decisions. You can acquire a sustainable reputation with your customers. As the law or policy for energy efficiency will be enacted sooner or later; earlier preparation can enhance your competitiveness. A diverse range of industries have already experienced improved energy and production efficiency following our energy audit services.

Study on Value of "Intangible Capital" in Manufactured Goods

The "World Intellectual Property Report 2017: Intangible Capital in Global Value Chains" (WIPR 2017) looks at how much income accrues to labor, tangible capital and intangible capital in global value chain production across all manufacturing activities, representing one quarter of total global economic output, with case studies focusing on coffee, solar panels and smartphones. It examined national accounts and international trade statistics from around the world and company data to provide these economic insights.

The figures reveal that nearly one third of the value of manufactured products sold around the world comes from "intangible capital," such as branding, design and technology, according to a World Intellectual Property Organization (WIPO) study of the global value chains companies use to produce their goods. This amount, some USD 5.9 trillion in 2014, shows that intangible capital contributes twice as much as buildings, machinery and other forms of tangible capital to the total value of manufactured goods. This underscores the growing role of intellectual property, which is frequently used to protect intangible and related assets in the worldwide economy.

Some WIPR 2017 findings

- Intangible capital accounted, on average, for 30.4 percent of the total value of manufactured goods sold throughout 2000-2014.
- The intangible capital share rose from 27.8 percent in 2000 to 31.9 percent in 2007, but has remained stable since then.
- Overall, income from intangibles increased by 75 percent from 2000 to 2014 in real terms, amounting to USD 5.9 trillion in 2014.
- Three product groups – food products, motor vehicles and textiles – account for close to 50 percent of the total income generated by intangible capital in the manufacturing global value chains.

For more information, contact:

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

Cleaner production

International Institute for Sustainable Development, Canada

<https://www.iisd.org>

Used in conjunction with other elements of environmental management, cleaner production is a practical method for protecting human and environmental health, and for supporting the goal of sustainable development.

Production with no regard for environmental impacts creates water and air pollution, soil degradation, and large-scale global impacts such as acid rain, global warming and ozone depletion. To create more sustainable methods of production, there needs to be a shift in attitudes away from control towards pollution prevention and management.

The United Nations Environment Program (UNEP) introduced the concept of cleaner production in 1989, and defined it as 'the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase eco-efficiency and reduce risks to humans and the environment'.

Cleaner production activities include measures such as pollution prevention, source reduction, waste minimization and eco-efficiency. They involve better management and housekeeping, substitution of toxic and hazardous materials, process modifications, and reuse of waste products. At its heart, the concept is about the prevention, rather than the control, of pollution.

The concept of cleaner production questions the need for a particular product, and looks at other ways to satisfy the demand. It is a slowing down of the rate at which we use resources, and a gradual shift from linear to more circular processes, similar to those found in nature. The eventual goal of clean production is to achieve a 'closed loop' operation in which all excess materials are recycled back into the process.

The four elements of cleaner production are:

1. The precautionary approach: potential polluters must prove that a substance or activity will do no harm;
2. The preventive approach: preventing pollution at the source rather than after it has been created;
3. Democratic control: workers, consumers, and communities all have access to information and are involved in decision-making;
4. Integrated and holistic approach: addressing all material, energy and water flows using life-cycle analyses.

The benefits of cleaner production include decreased waste, the recovery of valuable by-products, improved environmental performance, increased resource productivity, increased efficiency, lower energy consumption, and an overall reduction in costs.

Implementing cleaner production can be as straightforward as adopting better housekeeping practices, or it may involve more complex measures associated with processes and products. The more sophisticated options may include switching to renewable energy sources, increasing material efficiency, and re-using and recycling by-products. The product itself can be designed to reduce consumption of resources, to prolong its useful life, and to allow disassembly and recycling of its component parts.

Cleaner production requires a new way of thinking about processes and products, and about how they can be made less harmful to humans and the environment. For successful implementation, the concept must be effectively communicated within the organization. Employees at all levels, including senior management, should be actively involved.

The following guidelines can be used to implement a cleaner production approach:

1. Identify the hazardous substance to be phased out, on the basis of the precautionary principle;
2. Undertake a chemical/material flow analysis;
3. Establish a time schedule for the phase-out of the hazardous substance in the production process, as well as its accompanying waste management technology;
4. Implement and further develop cleaner production processes and products;
5. Provide training and technical and financial support;
6. Actively disseminate information to the public and ensure their participation in decision-making;
7. Facilitate substance phase-out with regulatory and economic incentives;
8. Facilitate the transition to cleaner production with social planning, involving workers and communities affected.

The cost of complying with environmental legislation can be significantly reduced by companies that adopt cleaner production techniques. The latter are often more cost-effective than control technologies. The costs of dealing with wastes are reduced, and there is potential for new markets to be discovered through innovations or the sale of by-products.

Cleaner production can reduce environmental risks and liabilities and lead to greater competitiveness. By demonstrating a commitment to cleaner production, companies can also improve their public image and gain the confidence of consumers.

Cleaner chromium tanning

A Chinese firm is offering technology of cleaner chromium tanning method, closed pickle tan loop system. The technology involves continuous recycling of spent liquors from a suitably standardized less-chrome, high exhaustion chrome tanning in pickling such that there is no discharge of exhaust liquors containing chrome tanning processes, preventing pollution due to these substances on the one hand and avoiding material loss on the other. Compared to conventional chrome tanning process, this new pickle-tan closed loop system ensures near zero discharge of potential pollutants such as chrome and neutral salts viz. sodium chloride and sodium sulphate. Since sulphate bearing streams viz. pickling and chrome tanning spent liquors are continuously recycled and not being allowed to mix with other sectional waste liquors, the anaerobic treatment of end of pipe treatment is improved. Sludge produced would be almost free chrome and hence, disposal becomes easier.

Area of Application

Chemical industry, Tanning industry, Leather industry

Advantages

Cleaner production: near zero discharge of chrome and neutral salts in pickle and chrome tanning processes thus preventing pollution due to these substances Avoids material loss Water consumption in pickle-tan stage is considerably minimized.

Technical specifications

- Cleaner chromium tanning method
- Closed pickle tan loop system

Contact

Polytex Chemical Engg Co.
No.317 Wenhuidong Rd, Yangzhou City, Jiangsu, China
Yangzhou
China
Zip/Pin Code:225009

Device for eliminating smoke

Our partner has developed a new efficient device for eliminating smoke. This invention uses high-frequency circuits and fly-back transformers to generate high voltage electric field arc. This arc plasma impinges upon a smoke particle, and zaps it away. The client is interested in finding license partners.

Smoke caused by burning is one of the most deadly elements in a fire. Smoke is composed by solid, liquid and gas particles which come from burning or thermal decomposition in the air. Smoke interferes people who want to exit the fire buildings and who want to extinguish the fire. Smoke is also terrific when it blocks the light and view, or rises the temperature in the fire.

Area of Application

- Part of a fire alarm system that eliminates presence of smoke to allow time for escape for civilians, or as a portable system

to enhance the firefighters' visibility when on the firefighting task;

- Self-contained household device for same purpose;
- May be portable or permanently installed for office building or public area.

Advantages

- Usability: User-friendly interface. Once switched on, the smoke zapper will start eliminating smoke instantly.
- Mobility: Smoke zapper is a portable device as big as a volleyball. Light and easy to carry. Also, it could be thrown into fire by rolling.
- Sustainability: Smoke zapper is not only fire-proof but also crash-proof. It is able to keep operating over 2 hours in fire.
- Pollution-free: Smoke releases no pollutant while functioning. Moreover, it is made of eco-friendly materials.
- Flexibility: Smoke zapper could be manufactured in different dimensions, and integrated into other fire-fighting equipment.

Development Status

Laboratory model

Legal Protection

Patent

Technical specifications

The invention uses high-frequency circuits and fly-back transformers to generate high voltage electric field, and eventually electric arc within air.

Transfer Terms

Technology licensing

Target Countries

Worldwide

Contact

Laser Consult Ltd (Hungary)
H-6701 PO Box 1191.
Szeged
Hungary

Brightness of LEDs

A device for compensating the effect of temperature variation on the brightness of LEDs has been developed. We invite interested parties to contact us for exploring the possibilities of licensing this technology.

Area of Application

- Camera calibration
- Color printer application
- Automobile applications e.g. traffic light, signal light etc.
- LED displays in different instruments

TECHNOLOGY OFFERS

Advantages

- The LED driver circuit will provide bias to the LEDs to provide temperature compensated brightness without using any temperature sensors.
- No temperature sensor is required, since properties of the diodes themselves are used to achieve the temperature compensation performance.
- The temperature controlled bias voltage/current generated according to the junction temperature of the LEDs themselves, thus any temperature gradient will not affect the temperature compensation.
- Temperature changes induced by power dissipated within the diodes are also compensated.
- No trial and error method is involved to optimize the circuit performance.

Development Status

Fully commercialized

Legal Protection

Patent

Transfer Terms

Technology licensing

Target Countries

India

Contact

Space Applications Centre (ISRO)

33 22 / TTID / PPG, Space Applications Centre (ISRO), Jodhpur Tekra
Ahmedabad 380 015, India

Retort pouch technology

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

Area of Application

Food, meat, fish processing

Advantages

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

Environmental aspects

Energy efficiency

Development Status

- Pilot plant
- Fully commercialized

Transfer Terms

- Consultancy
- Technical services
- Technology licensing

Sugarcane juice powder technology

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

Area of Application

Food processing/preservation, Sugarcane juice drying

Advantages

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

Environmental aspects

Cleaner production

Development Status

- Pilot plant
- Commercial prototype
- Fully commercialized

Transfer Terms

- Consultancy
- Technical services
- Technology licensing

For the above two offers, contact:

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

Herbal pesticide

The technology provides a sprayable biopesticidal composition comprising *Photobacterium luminescens* for controlling and eradicating various agricultural pests. It is for the first time that the insecticidal activity of *P. luminescens* is used without its symbiotic carrier nematode. In the present technology, the actively growing cells of *P. luminescens* are encapsulated in sodium alginate beads and examined for their ability to infect insect hosts. Several laboratory and field testing programme were carried out to evaluate and assess the product. Elaborative and extensive field trials were conducted to study the efficacy of the product on the serious pest of sugarcane. The results obtained from these experiments have given a clear indication that the product is very effective and is novel based on the bacterium *Photobacterium luminescens* and the plant, bacterial and insect chitinase purified to greatest extent and stabilized for longer shelf life.

TECHNOLOGY OFFERS

Area of Application

Agriculture

Advantages

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

Development Status

Laboratory model

Legal Protection

Patent applied for

Transfer Terms

Technology licensing

Contact

SkyQuest Technology Consulting Pvt. Ltd.
501, Krishna Complex,
Opp. Devashish School,
Bodakdev
Ahmedabad 380054, India

Micronutrient for vegetable crop

Commercial vegetable production is becoming less profitable day by day to stagnant yield, poor quality and pest and diseases. Cost of production is also increasing due to use of large quantity of fertilizers like DAP complexes and pesticides, chemicals. Control of pest and diseases is becoming costly due to decreasing resistance of plants. Balanced nutrition is very important for high yield; quality and resistance to diseases and very limited farmers only use micro nutrient fertilizers.

Area of Application

Agriculture

Advantages

- Compatibility with pesticides and can be mixed with any pesticide in spray schedules
- Higher nutrient uptake efficiency
- Nontoxic if used at recommended dose

Environmental aspects

Sustainable agriculture

Development Status

Pilot plant

Transfer Terms

Technology licensing

Sugarcane juice powder (dried)

We can offer technology for making sugarcane juice powder using spray drying technique. It is a natural, healthy, safe and nutritious product from Sugarcane.

Area of Application

Food & Beverages sector

Advantages

Natural, healthy safe and nutritious product from sugarcane

Environmental Aspects

Cleaner production

Development Status

Pilot plant

Legal Protection

Patent

Transfer Terms

- Consultancy
- Technology licensing

For the above two offers, contact

National Research Development Corporation
(A Government of India Enterprise)
Regional Office,
107, 8th Main, 19th cross
Malleswaram,
Bangalore 560055, India

Biofungicidal formulation

We have developed an innovative biofungicidal formulation. The formulation is neem oil based which contain some natural components. We are interested in transferring the technology to interested clients.

Area of Application

Agriculture

Advantages

- It controls the arial as well as soil borne bacterial and fungal pathogens of the crops and fruits
- Increases the growth and yield of crops and fruit plants
- Reduces the pest and insect attack in next crop sown in field
- Easy method of preparation of the formulation at very low input cost

Environmental Aspects

Ecofriendly

Development Status

Fully commercialized

Legal Protection

Patent

TECHNOLOGY OFFERS

Technical specifications

- The formulation is neem oil based which contain some natural components.
- Controls the arial as well as soil borne bacterial and fungal pathogens of the crops and fruits.

Transfer Terms

- Joint venture
- Technical services
- Technology licensing
- Research partnerships

Contact

Hiran Biotech, Research and Development Division, 66 Turner Road Cantt., Kanpur 208004, U.P., India
Kanpur 208004, India

Kitozan biofertilizer

We have five years' experience to produce Kitozan which we helped people to save environment and produce organic fruits and vegetable to feed people. which Low cost and fast result. We had more than 3 million user in Thailand.

Area of Application

Biotechnology

Advantages

- It can use with any chemical and fertilizer.
- It can mix with water and feed for animal.

Environmental aspects

- Cleaner Production
- Waste utilization
- Energy efficiency
- Systems integration
- Not Applicable

Development Status

Fully commercialized

Legal Protection

- Trade Mark
- Copy right

Transfer Terms

- Turnkey
- Others

Target Countries

Worldwide

Contact

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

Creative Productivity Index: Analysing Creativity and Innovation in Asia

This report presents the results and analysis of the Creative Productivity Index (CPI) for a select number of Asian economies. The CPI was built by The Economist Intelligence Unit. The Asian Development Bank (ADB) commissioned the work on developing the CPI as part of an overall study on Asia's knowledge economies. The report provides a benchmarking of a number of economies in Asia on creative productivity, an important attribute for strengthening knowledge-based economic development. This index gives policy makers a unique tool to assess how to foster creativity and innovation in Asia. Innovation-led growth is crucial for developing Asia to maintain and accelerate the pace of growth of its economies.

Following are the key findings of the CPI:

- Japan leads the CPI, followed by Finland and the Republic of Korea;
- Cambodia and Pakistan, with much room for improvement, are ranked lowest in the CPI;
- Singapore leads the CPI for innovation inputs;
- Finland and Hong Kong, China are best in the CPI for innovation outputs;
- Low- and middle-income economies will benefit most from policies to increase creative inputs; and
- There are many different dimensions of creativity that are captured in this report.

For more information, contact:

Asian Development Bank
6 ADB Avenue, Mandaluyong City 1550
Metro Manila, Philippines
Tel: + 63 2 632 4444; Fax: +63 2 632 4442
Web: <http://www.adb.org>

TECHNOLOGY REQUESTS

HUNGARY

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, with the aim of using the remaining material in a consumable product. The currently used extraction process is technically difficult to scale up for commercial supply and uses large quantities of water making it unsustainable for long term use.

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 2 DJ Berkhamsted HP4 2DJ, United Kingdom

Magnetized Fertilizer from Fly Ash

An Indian firm is interested in the technology for production of magnetized fertilizer from fly ash. The company wants the technical know-how for this technology and wish to receive technical and price quotes for the same.

Area of Application

Agriculture industry

Project Type

Start-up

Contact

Biocare India Pvt Ltd.

Biocare House, M. A. 23, Laxminagar Nagpur - 22

Tel:- +91-712 - 2224344, Telefax :- +91-712 - 5611766

E-mail: info@biocareindia.biz

Ethanol Production Plant

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

Area of Application

Ethanol from sweet shorgum/sugarcane

Studies

- Techno feasibility report

Project Type

New idea

Target Countries

India

Assistance from Partner

Complete Plant on turnkey basis and equity partner

Contact

Yugal Green Urja Solution private Limited

F-103, IRWO Classics, Rail Vihar, Sector 57

Gurgaon 122004

India

Chocolate manufacturing

We are looking for manufacturing know-how and process, raw materials, raw material suppliers, machinery, equipment and packing materials for chocolate manufacturing.

Area of Application

Food manufacturing industries

Transfer Terms

- Consultancy
- Technical services
- Equipment supply
- Marketing services

Studies

Feasibility report

Project Type

Start-up

Contact

Self-employment Promotion Industrial Development Board of Ceylon (IDB)

780, Maradana Road, Colombo 001100, Sri Lanka

Food-grade stabilizing agent

We are searching for an alternative light weight, inexpensive material, to act as a stabilizing agent for humectants. The solution may be a novel ingredient within the previously reviewed technologies or a new material altogether.

Area of Application

Consumable

Project Type

New idea

Target Countries

Worldwide

Contact

Strategic Allies Ltd.

The Red & White House 113, High Street Berkhamsted, UK HP4 2 DJ

Berkhamsted HP4 2DJ

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