

Strengthening innovation-driven inclusive and sustainable development

Asia-Pacific

# Tech Monitor

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**Technology-based entrepreneurship and innovative start-ups**



**APCTT**  
Asian and Pacific Centre  
for Transfer of Technology



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

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

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

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



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

# Asia-Pacific Tech Monitor

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

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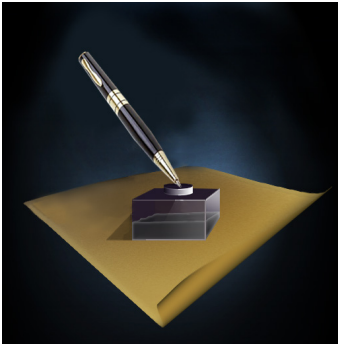


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## Introductory note

The United Nations Sustainable Development Goal (SDG) 9 calls for building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation. Increased access of Small and Medium Sized Enterprises (SMEs) and start-up companies for financial services and their inclusion into value chains and market will play an important role to achieve SDG 9.

As per Asian Development Bank study in 2014, SMEs accounted for an average of 96% of all enterprises and 62% of the national labour force in Asia and the Pacific. They also contributed an average of only 42% of the gross domestic product or manufacturing value added in the region. Therefore, it is of considerable importance that the Asian and Pacific countries provide enhanced support to accelerate the growth of their SMEs and startups.

Enabling national policies, support systems, finance and incentives are vital requirements for the growth of technology-based startups and SMEs. In addition, introduction of modern technologies could enhance their competitiveness through reducing cost of production and bringing new products to the market. You can find examples of good support, such as India's flagship programmes for promoting technology-based startups and SMEs in this volume.

Access to technology and finance are considered crucial for the development of startups and sustained growth of SMEs. In comparison to larger firms, the SMEs and startups often face challenges in accessing finance from the traditional financial institutions. Therefore, the policy makers could consider developing innovative financing instruments such as public funding programmes, tax breaks, soft loans with interest subsidies and longer repayment period, seed finance, venture capital and angel investment. Public development banks can also play a strategic role in promoting and expanding financial inclusion of SMEs through innovative programmes and products to help overcome market failures as well as create new markets. A recent example is the Korean Development Bank, which has launched a growth accelerating programme to provide venture companies and start-ups not only with funding but also with networking opportunities and mentoring support.

In addition to finance, the technology-based SMEs and startups would also require a range of support to be successful. In this context, the technology business incubators can be an important enabler and could extend mentoring support, expert guidance, access to skilled work force and market linkages. The technology business incubators, innovation clusters and networks could also provide increased access and linkages to the technology-based startups and SMEs with the research institutions.

This issue of *Asia-Pacific Tech Monitor* discusses the challenges, policies, strategies and good practices to promote technology-based startups and innovative SMEs in Asia and the Pacific.

Michiko Enomoto  
Head, APCTT-ESCAP



# Technology Market Scan

## ASIA-PACIFIC

### Asean SMEs prioritise investing in tech: Survey

Small and medium-sized enterprises (SMEs) in Singapore and across the region are prioritising tech investments over assets such as factories and machinery, according to a new survey. The poll by United Overseas Bank (UOB), professional services firm EY and consultancy Dun & Bradstreet found that three in five Asean SMEs intend to focus on technology investments in the coming year, with the majority keen on investing specifically in software.

The study polled 1,235 SMEs across the six largest Asean countries - Indonesia, Malaysia, the Philippines, Singapore, Thailand and Viet Nam - about their plans for participating in the region's growth. Among the companies surveyed, 203 were from Singapore.

Among those prioritising tech investments, 78 per cent are keen to invest specifically in software such as improving their websites and creating mobile apps, the report found. Hardware and infrastructure investments ranked second, at 65 per cent.

The poll also found that Software-as-a-Service (SaaS) and digital talent were relatively low on respondents' list of investment priorities. "SaaS has yet to gain critical mass despite being cheaper to implement versus a traditional on-premises application. This suggests respondents are more familiar with traditional licensed software than applications delivered as Web-hosted services," the report noted.

The study also found that more than a third of respondents have ambitions for overseas expansion. Overseas operations already account for up to 30 per cent of revenues for 60 per cent of the respondents, and more than 30 per cent of revenues for the remaining 40 per cent. Companies polled were also generally upbeat about the regional growth outlook, with 52 per cent anticipating revenue growth and 26 per cent projecting a double-digit expansion. Firms in the agriculture,

manufacturing and financial services sectors were most optimistic.

<http://www.straitstimes.co>

## CHINA

### Govt plans national technology transfer system

The State Council has released a plan to build a national technology transfer system. A national technology transfer system is conducive to capitalization and industrialization of sci-tech achievements and innovative development in China, the circular stated. It sets a target of building a basic national technology transfer system and a market of technologies by 2020, embedded with market-oriented technological transfer institutions, professionals and extensive international cooperation under the Belt and Road Initiative.

By 2050, a mature national system for technology transfer will be built, and the technology market will be fully developed, with various innovation entities coordinating with each other in an efficient way. Enterprises are encouraged to take a major part in R&D of technological projects that will enter the market. Also, national technology innovation centers and manufacturing innovation centers should support transfer and diffusion of key technologies. More efforts will be made to develop technologies to improve people's livelihood, including environment governance, targeted poverty alleviation, population and health, and public security.

To build a uniform and open technological market, the circular urged setting up a national technology transaction network, and stepping up development of technology market equipped with improved services, the circular stated.

The circular also encouraged universities and research institutes to set up technology transfer institutions, and private intermediaries to provide professional services, under improved government guidance and public services. Besides, the circular stressed efforts to enrich the technology transfer talent pool. Sci-tech researchers are welcome to start businesses by taking temporary post, taking part-time job, or

leaving post, in a way to transfer the sci-tech results to small and medium-sized enterprises. Also, maker spaces and open innovation platforms are encouraged to bolster the startups.

<http://english.gov.cn>

### R&D spending up 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 percent 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 percent 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 percent from 2016, while R&D spending at government institutions and colleges increased 7 percent and 5.2 percent, respectively. Some 92 billion yuan, or 5.3 percent of the total spending, was put into fundamental research in 2017, up 11.8 percent 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.ecns.cn>

### Innovation promotes patent development

China's increasing ability in technological independent innovation has promoted fast development of patent industry, according to an official from the National Bureau of Statistics. The government and society have paid great attention to technological innovation and advancement in the past decades, said Zhang Zhongliang, director of the bureau's social science, technology and cultural industry department.

Chinese leaders said “science and technology constitute a primary productive force” as early as 1988 and aimed to build an “innovative country” in 2006. In recent years, President Xi Jinping has emphasized many times “innovation is the primary engine of development” and set “innovation-driven” as a strategic plan for the country’s development.

The nation’s 1.4 billion population and improving education system provide strong human resource support for technological innovation, Zhang said. China topped the world in total investment of R&D personnel in 2013 with 3.53 million people per year and it increased to nearly 4 million people per year in 2017. The number of daily new registered enterprises surpassed 16,000 last year, up from 15,000 a year earlier.

Sustainable development of economy also provides adequate financial support for technological innovation, according to Zhang. China became world’s second-largest country in research and development investment in 2017 with 1.75 trillion yuan (\$278.5 billion), accounting for 2.12 percent of GDP and surpassing the average number of 15 European countries. Chinese companies have become the main force for technological innovation and over eighty percent of research and development investment comes from enterprises in 2017. Some companies such as Huawei have emerged as industrial leaders in research and development.

Compared to developed countries, relatively low industrial concentration forced Chinese companies to enhance technological innovation speed, Zhang said. Statistics of production capacity in steel industry indicate that the industrial concentration of top 4 large enterprises in the United States and Japan is above 70 percent; while the industrial concentration of top 10 Chinese enterprises is less than 40 percent.

Statistic shows that China had the world’s largest number of invention patent applications in 2011 and the number for last year was 1.328 million in 2017. With 49,000 international patent applications, China became the largest source of patent applications filed under the World Intellectual Property Organization’s Patent

Cooperation Treaty in 2017. The total number of China’s international technological thesis has maintained world’s second for nine consecutive years and the quoted quantity of the thesis also jumped to world’s second in 2017, surpassing Germany and Britain.

<http://www.ecns.cn>

### IP transfer to secure transparent business environment

With the aim to build a more fair and transparent regulation process for technology exports and foreign investment, China has issued a guideline tightly reviewing the transfer of intellectual property rights to overseas buyers.

“To establish and perfect the review mechanism for IP transfers overseas is not a move to upset foreign investors. The guideline has rather formulated concrete measures to secure a better business environment,” said Zhang Zhicheng, director of the Protection and Coordination Department at the State Intellectual Property Office of China (SIPO).

The proposed IP transfers will be reviewed if they involve patent rights, exclusive rights to layout designs of integrated semiconductors, software copyrights, or rights to new plant varieties. According to the guideline, Chinese companies and individuals have the right to transfer their IP to overseas enterprises, individuals or groups. IP transfers will be reviewed if they appear to affect national security or the country’s core technology in key fields.

In 2017, China’s intellectual property royalties earned abroad surpassed 4 billion U.S. dollars, according to SIPO. Regulating IP transfers involving national security complies with international rule and practices, he said, citing the WTO’s Agreement on Technical Barriers to Trade, which gives recognition to all members to protect legitimate interests according to their own regulatory autonomy.

<http://xinhuanet.com>

### Artificial intelligence development in universities

China will push forward artificial intelligence (AI) development in universities,

according to the Ministry of Education (MOE). To that end, the MOE issued a detailed action plan saying that Chinese universities should have optimized systems that fit both scientific innovation especially new-generation AI development and disciplinary growth by 2020. By 2030, they will be the core of the world’s main AI innovation centers, capable of providing China with technical support and professionals.

The plan asks for interdisciplinary links of AI with subjects like computer science, mathematics, physics, psychology, and sociology. It also calls for strengthened fundamental research, establishment of more AI centers, a high-level think tank, as well as international cooperation. According to Science and Technology Daily, 19 universities added majors in intelligent science and technology in 2017. Also, a program, organized by organizations including the MOE in hopes of training AI talent, started in April. It will help train 500 university teachers and 5,000 students over five years.

<http://www.xinhuanet.com>

## INDIA

### Innovation growth programme

Tata Trusts, Lockheed Martin and Department of Science and Technology (DST) have earmarked USD 2 million for this year’s edition of the India Innovation Growth Programme (IIGP) 2.0 which focuses on providing support to startups in the country. The partners intend to invest the amount for the seed money and to provide support to entrepreneurs to develop technology-based solutions in various fields like agriculture, healthcare, water, energy and life sciences. The programme offers an opportunity for innovators across India to bring breakthrough ideas to market.

Established by the Department of Science and Technology, Lockheed Martin Corporation and Tata Trusts, the IIGP 2.0 was launched in 2017. The first edition of the programme that began in 2007 and ran for a decade provided support to a total of around 500 startups. Last year IIGP 2.0 awarded nine University Challenge teams

and 10 individuals under Open Innovation Challenge a total support of USD 5 lakh for innovations in the areas of medicine, healthcare, water, agriculture and aeronautics, among others. Five of the winners from last year have already begun to market their products in India and overseas, while two others have conducted field trials.

Lockheed Martin started the programme in 2007 and DST joined it in 2009. IIGP 2.0 would run for three years between 2017 and 2019 which could even be expanded later. Other partners of the programme includes Massachusetts institute of technology (MIT), IIM Ahmedabad, and IIT Bombay. The IIGP has two separate tracks, a University Challenge, which is aimed at students, and an Open Innovation Challenge aimed at innovators and entrepreneurs across the country.

<https://economictimes.indiatimes.com>

## NEPAL

### Transforming agriculture with digital technology

The United Nations Capital Development Fund (UNCDF)'s Mobile Money for Poor (MM4P) programme has partnered with Sun Farmer Nepal and Prabhu Management to implement the innovative project that will enhance farmers' income by integrating digital technology in agricultural value chains. This partnership aims to facilitate the farmers to buy quality inputs to bring transformation in production of crops and vegetables and help them link with the market.

UNCDF believes that transformation in the agriculture sector and improvement in livelihoods of rural smallholder farmers is possible through the use of advanced technologies. With support from UNCDF, Sun Farmer Nepal in partnership with Prabhu Management will help farmers dramatically increase their income with modern agricultural solutions and digital finance. Farmers will get support in infrastructure (irrigation and processing), quality inputs, training on cultivation of high-value crops and improving linkages to the market, as per UNCDF country office.

Launched in 2014, Sun Farmer Nepal is a renewable energy solution company that provides solar-powered irrigation solution to help farmers increase their productivity and income. The company will sell farmers products via a co-owned company jointly set up by Sun Farmer Nepal and partner farmers. Prabhu Management is a sister company and the agent network manager for Prabhu Money Transfer and has one of the largest distribution networks with more than 3,500 agents in rural areas, mainly in saving and credit cooperatives.

UNCDF MM4P will support Sun Farmer to implement an innovative community-owned contract farming model driven on digital innovations. The solution will include pay-as-you-go solar pumps, a state-of-the-art agriculture market intelligence system for farmers and access to finance for agriculture inputs, logistics and sales. Prabhu Management, with its vast rural agent network, will provide the distribution infrastructure for financial services.

<https://thehimalayantimes.com>

## PHILIPPINES

### Online platform for MSMEs

The Department of Trade and Industry (DTI) will tie up with the Department of Science and Technology (DOST) to help micro, small and medium enterprises (MSMEs) expand their market and reach clients online with the OneStore.ph. "MSMEs are the backbone of the Philippine economy. And as part of President Rodrigo Duterte's whole-of-government approach to assist MSMEs, we are teaming up with DOST to impact the lives of more Filipino entrepreneurs," said DTI Secretary Ramon M. Lopez. The OneStore.ph is a government e-commerce platform (business-to-customer and business-to-business platform) dedicated to marketing high-quality Filipino products of MSMEs online.

Under the OneStore.ph agreement, DTI will promote the oneStore.ph to MSMEs through Negosyo Centers. At the same time, DTI will make Negosyo Centers accessible to clients of DOST and allow clients to display and dispatch their products with its payment and logistic

partners in One Town One Product (OTOP) Philippines HubStores, subject to availability of space and to DTI priorities and promote oneStore and provide signs for the spaces provided for oneStore.ph and oneStore hub in every OTOP Store identified as co-branded hub, among others. DOST, on the other hand, will develop and maintain oneStore.ph where its accredited regional hubs and MSMEs can sell products and services to its clients and engage with payment and logistics partners and provide oneStore.ph services to accredited regional hubs, MSMEs and partner agencies.

DOST will also provide priority to identified OTOP products for development initiatives including improvements in packaging and labeling, subsidy or discounts in testing fees, equipment support such as the Small Enterprise Technology Upgrading Program (SETUP), and strengthen research and development efforts.

<http://www.sunstar.com.ph>

## REPUBLIC OF KOREA

### Startups growth

As the Republic of Korean economy is rapidly changing to the digital economy, startups which are based on the mobile ecosystem with annual sales of more than 100 billion won (US\$93.55 million) are starting to spring up. In particular, online to offline (O2O) services providers show a steep growth in sales. Woowa Brothers Corp., the food-tech industry leader that runs the country's most popular food delivery mobile app "Baedal Minjok," and Republic of Korea's leading accommodation platform Yanolja Co. surpassed the sales of 100 billion won (US\$93.55 million) last year by diversifying their services and pushing into the global market. They are also expected to record the sales of some 200 billion won (US\$186.88 million) this year. The Farmers, which operates Market Kurly that converges food with information and technology (IT), is forecast to post some 100 billion won (US\$93.55 million) in sales this year for the first time in three years after the establishment.



According to industry sources on April 9, leading O2O startups, like Woowa Brothers, SoCar and Yanolja, all exceeded the sales of 100 billion won (US\$93.55 million) last year. Woowa Brothers is highly likely to surpass the 200 billion won (US\$186.88 million) mark this year considering the fact that the company saw its sales increase to 162.6 billion won (US\$151.88 million). SoCar tentatively posted some 120 billion won (US\$112.09 million) in sales last year, while Yanolja posted in some (US\$93.55 million).

In addition, all eyes are on whether Market Kurly, which provides a fast delivery service named "Morning Star Delivery" to offer the freshest and the healthiest food by 7 am at customers' front door when customers place an order before 11 pm on the previous day, will be able to see its sales exceed 100 billion won (US\$93.55 million) this year. Market Kurly posted 9 billion won (US\$8.41 million) in sales in January and 10 billion won (US\$9.34 million) in March. The company is expected to surpass the sales of 100 billion won (US\$93.55 million) this year.

SoCar saw its number of vehicles available for sharing and number of members grow to 8,000 units and 3 million, respectively, as of the end of last year. The company attracted 60 billion won (US\$56.03 million) from domestic private equity fund Private Equity on April 4, heralding a significant growth this year again. SoCar is South Korea's largest car-sharing platform that allows users to book and drop a car at their closest parking lot by using the mobile application. Recently, the IT industry considers car sharing can create a synergy with future growth engines like artificial intelligence (AI) and autonomous vehicles so it has been aggressively joining hands with car-sharing service providers.

Yanolja has declared to tap into the global market and is planning to expand its services to Japan and China by the end of this year. The company is also strengthening its O2O services at the same time by building new hotel "Heyy" offline. In regard to the appearance of startups with annual sales of more than 100 billion won (US\$93.55 million), an official from the industry said, "Leading firms by industry generally post

over 100 billion won (US\$93.55 million) in sales as they are able to gather cash cows through global investment and expand their services to new areas and global markets."

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

### R&D investment in large corporations

According to the Korea Institute for Industrial Economics & Trade (KIET) on March 25, merely 70 South Korean companies put their names on the EU Industrial R&D Investment Scoreboard in 2016 whereas the number amounts to 822 for the United States, 376 for China, 365 for Japan and 134 for Germany.

Besides, Samsung Electronics, LG Electronics, and Hyundai Motor Group accounted for no less than 62.7% of the total R&D investment of the 70 South Korean companies, which means South Korea's R&D activities were led by a small number of large corporations. The reliance in the electronics and automobile industries amounted to 92.7% and 88.6%, respectively. The KIET explained that the rest in the electronics industry is divided into 2.8% by small and medium-sized enterprises and 4.5% by venture firms. For reference, large and smaller companies account for 2.6% and 98.3% of the same industry in terms of number.

In the automobile industry, Hyundai Motor Group and major auto parts manufacturers represented 88.6% of the total R&D investment in 2015. In addition, the ratio of finished vehicles to the total R&D cost was as high as 74% whereas that was 66.2% for Germany, 68.4% for Japan and 72.7% for France.

"R&D investment by South Korean companies showed an average annual growth of more than 7% from 2010 to 2015 and, as a result, they ranked fourth in total R&D investment and second in R&D investment-to-GDP ratio among the 34 members of the OECD," the KIET explained, adding, "In contrast, they stood at 28th in technology exports-to-R&D ratio and 33rd in the number of SCI papers per researcher."

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

### IP protection

The Republic of Korean government will set aside 15.4 billion won (US\$14 million) to help protect the intellectual property of small and mid-sized exporters, the Korean Intellectual Property Office said on April 12. The patent office said it has selected 205 promising companies from a total of 845 companies that had applied for the program this year. Among them, 51 companies are developing next-generation technologies, such as artificial intelligence, virtual reality, precision medicine and the internet of things, according to KIPO.

Under the program, KIPO will provide the selected firms with support in various areas, including consultations on intellectual property, the application of patents overseas, the analysis of patent and design strategies, and brand development for products and packaging, over the next three years.

In February, KIPO announced it would create an intellectual property fund of around 100 billion won to support small and mid-sized firms, colleges and public research institutes that have outstanding patents. The 100 billion won will be allocated to a new growth business fund (17 billion won), public patent business (20 billion won), overseas IPs (30 billion won) and IP direct investment (32 billion won).

The new growth business fund will focus on key technologies for the "fourth industrial revolution," including artificial intelligence, big data and robots. KIPO said it has financed 160 billion won in the fund of funds from 2006 to 2017 and has so far collected 199 billion won.

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

### R&D focus on AI, smart factory, renewable energy

The government will spend its research and development budget mainly on strengthening artificial intelligence (AI), smart factory, renewable energy and seven other key sectors, Seoul's finance ministry said. According to the ministry, the R&D budget will be also allocated to autonomous driving and drone technology.

The ministry said it will set up task forces comprised of government officials, researchers and private companies to draw up detailed investment roadmap.

<http://english.yonhapnews.co.kr>

## SRI LANKA

### ADB provides us \$ 75m for SMEs

The Government of Sri Lanka had obtained ADB Financial assistance of USD 100 million in 2016 to finance the Small and Medium-Sized Enterprises (SME) Line of Credit Project. The objective of the project was to strengthen the SME sector by facilitating access to finance and expanding the employment opportunities in the sector. The project is being successfully implemented and given its importance, the Government of Sri Lanka decided to obtain additional financing through a loan of USD 75 million with the intention to scale up the ongoing SME Line of Credit Project.

The additional financing will be utilized to: Increase of financing to SMEs through intermediaries, Development of innovative SME financing scheme, Enhancement of capacity of SMEs in targeted clusters for accessing financial services and Strengthening of international competitiveness of information and communication technology/business process outsourcing (ICT/BPO) cluster.

The additional loan of USD 75 million is planned to be disbursed in 3 tranches of approximately USD 25 million each. The Government will relend the loan funds in local currency to participating banks through three semiannual allocations based on the banking sector's average weighted deposit rate. The proceeds of the loan will be available to the participating banks for relending to the SMEs based on the previously agreed targets between the Asian Development Bank and the Government, specially focusing on first time borrowers, women-led SMEs and SMEs located outside of Colombo etc.

The Ministry of Finance and Mass Media will be the Executing Agency of the SME Line of Credit (Additional Financing). The Department of Development Finance will

be the Implementing Agency for Outputs of Increase of financing to SMEs through intermediaries, Development of innovative SME financing scheme and the Export Development Board will be the implementing agency for outputs of Enhancement of capacity of SMEs in targeted clusters for accessing financial services and Strengthening of international competitiveness of information and communication technology/business process outsourcing (ICT/BPO) cluster. The overall project is scheduled to be completed by 31st March 2020.

<http://www.sundayobserver.lk>

## THAILAND

### R&D spending

Thailand's investment in research and development (R&D) and related areas of technological advancement is this year expected to reach 1 per cent of gross domestic product (GDP) for the first time, an agency tasked with driving innovation said. The National Science Technology and Innovation Policy Office (STI) projects investment for 2018 to swell to Bt160 billion, with 70 per cent from the private sector and the rest from the state sector. Kitipong Promwong, secretary general of the STI, said that aside from direct R&D, the expected investment would cover science and technology, human resources development and innovation technology as part of stepped-up efforts to boost the country's productivity and international competitiveness.

Kitipong said the factors driving the increased inflows include a range of incentives and privileges provided by the government. Among them, he said, are tax privileges from the Broad of Investment (BOI) that offer benefits to enterprises for between eight and 13 years and an incentive from the Revenue Department that makes some companies eligible for tax deductions of up to 300 per cent. This would apply to companies in robotics, healthcare, agriculture, biotechnology and the creative economy as part of the government's Thailand 4.0 vision.

The STI also expects that the country's spending on R&D, science and technology and other innovative technologies will

climb to 1.5 per cent of GDP in 2021. Kitipong said that last year these outlays amounted to Bt142 billion, representing around 0.95 per cent of GDP. As with this year's projection, the private sector accounted for 70 per cent of this investment.

In 2016, the investment totalled Bt113.5 billion, with private companies contributing 73 per cent of this amount. For 2017, the International Institute for Management Development (IMD) reported that Thailand ranked No 27 out of 63 countries in the IMD World Competitiveness table. Within the overall ranking of 27th, Thailand was ranked 10th for economic performance, 20th for government efficiency, 25th for business efficiency and 49th for science infrastructure.

<http://www.nationmultimedia.com/>

## VIET NAM

### Project to improve energy efficiency

The World Bank and Vietnam's Ministry of Industry and Trade today jointly launched a \$102 million project to support the efforts of industrial enterprises to adopt energy-efficiency technologies and practices. Under this project, industrial enterprises can access a new line of credit to fund their purchases of energy-efficiency and production-optimization technologies, thus reducing energy consumption and production costs and increasing their overall competitiveness in the domestic and international markets.

Funding under this project will be provided to participating financial institutions, which will then lend to industrial enterprises to invest in energy-efficient subprojects. Of the \$158 million, \$100 million comes from the World Bank's International Bank for Reconstruction and Development, the financing resource for middle-income countries, and \$1.7 million is from the International Development Association, the Bank's fund for the poorest countries. The rest of the project's funding will come from the Vietnam government participating financial institutions, and industrial enterprises.

<https://modern diplomacy.eu>

### ASIA-PACIFIC

#### CHINA

##### New drug to inhibit cancer stem cells

Chinese researchers have developed a new drug that can inhibit the growth and spread of cancer stem cells. Researchers from Wuhan and Shanghai announced that a molecular targeted synthetic drug called WYC-209 could kill or inhibit the proliferation of stem cells of melanoma and lung, ovarian, and breast cancers.

Through experiments on mice, researchers found that the drug can also prevent metastasis of lung cancer in 87.5 percent of cases. The research, led by Wang Ning, professor at Huazhong University of Science and Technology, and Yu Biao, researcher at Shanghai Institute of Organic Chemistry under the Chinese Academy of Sciences, was published in the journal *Nature Communications* on April 11.

The cancer stem cell therapy is a current strategy for cancer treatment. Inhibiting cancer stem cells can decrease the chances of new tumors. Wang and Yu started cooperating on synthesizing the new drug in 2014. According to researchers, animal experiments show that the new drug can treat malignant tumors with low toxicity.

<http://www.xinhuanet.com>

##### New medicines for lung cancer

Chinese researchers have developed two new medicines that may prolong the lives of lung cancer patients, the China Daily reported. Researchers from Shanghai Chest Hospital conducted clinical trials showing that using a small molecular, multi-targeted drug, called anlotinib hydrochloride, can inhibit the growth of tumors and the development of surrounding blood vessels.

The treatment could prolong the lives of lung cancer patients an average of 50 percent over patients receiving placebos. They survived another 3.3 months on average, said Han Baohui, who led the clinical trials involving 437 patients at 34 health centers and hospitals nationwide. "One headache for doctors around the world is that there is

no guide for how to prescribe medicines for late-stage patients who build up tolerance to various medicines after taking them for long periods," said Han, also the director of respiratory medicine at the hospital.

The new treatment "may become a standard in our country as a viable prescription for these patients," Han added. According to Han, the treatment will be available to the public this year, and the cost is estimated at around 10,000 yuan (1,600 U.S. dollars) per month. Another drug, fruquintinib, that can also inhibit vascular development around tumors will soon be used in final stage clinical trials, said Lu Shun, director of oncology at Shanghai Chest Hospital. Clinical trials showed that the three- and six-month survival rates of those who took the medicine were 90 percent and 67 percent, respectively, compared with 73 percent and 58 percent among those who received placebos.

The research was published in *Journal of Clinical Oncology* in the United States in March.

<http://www.xinhuanet.com>

##### Tomatoes with enhanced antioxidant properties

The School of Biological Sciences, Faculty of Science, the University of Hong Kong (HKU), in collaboration with the Institut de Biologie Moléculaire des Plantes (CNRS, Strasbourg, France), has identified a new strategy to simultaneously enhance health-promoting vitamin E by ~6-fold and double both provitamin A and lycopene contents in tomatoes, to significantly boost antioxidant properties.

The research group manipulated the plant isoprenoid pathway through the utilization of a variant of 3-hydroxy-3-methylglutaryl-coenzyme A synthase (HMGS). The overexpression of HMGS in tomatoes increased not only phytosterols, squalene, provitamin A and lycopene, but also vitamin E ( $\alpha$ -tocopherol) by 494%.

The HMGS DNA used in these experiments originated from a food crop, Brassica juncea (Indian mustard), that yields edible leaves, stems and seeds, the latter used in vegetable oil production. Earlier, this research group

reported that the recombinant HMGS variant S359A (in which amino acid residue "serine" at position 359 was switched to "alanine") exhibits 10-fold higher enzyme activity. The introduction of S359A in the model plant *Arabidopsis* increased phytosterol content.

Now, the research group has introduced the S359A into tomatoes, a crop plant. Although there were no differences in the appearance and size of the transformed tomato fruits, total carotenoids including provitamin A and lycopene increased drastically by 169% and 111%, respectively, as observed by a deeper colour of carotenoid extracts in S359A tomatoes over the control. Furthermore, these carotenoid extracts exhibited 89.5-96.5% higher antioxidant activity than the control. Besides carotenoids, the transformed tomatoes displayed elevations in vitamin E ( $\alpha$ -tocopherol, 494%), squalene (210%), and phytosterols (94%). These observations were attributed to the increased expression of genes in the isoprenoid pathway.

Professor Chye Mee-len who led this research said: "Increasing health-promoting components in crops is an important research area that aligns with the aspirations of Dr Wilson and Mrs Amelia Wong on the use of plant biotechnology for a sustainable future. The accumulation of the healthy components in food crops would provide added-value to fruits and vegetables in the human diet, as well as enrich feed for livestock and aquaculture." Dr Wang Mingfu added: "Extracts with enriched phytosterols, vitamin E and carotenoids can be used in the production of anti-ageing cream and sun-care lotion. These compounds show excellent anti-inflammatory and antioxidant activity."

<https://phys.org>

#### INDIA

##### Nanotech-based novel cancer drug delivery system

A path-breaking drug delivery system using nanotechnology, developed by a team of scientists at Regional Centre for Biotechnology (RCB) at Faridabad, would radically upgrade cancer therapy in the country and may dramatically boost the



number of potent therapeutic agents. The groundbreaking discovery – a new ray of hope for millions of cancer patients in India – is validated at laboratory stage and ready to be transferred to the industry for commercial application.

“It’s a vehicle for delivery of predominantly anti-cancer drugs either in encapsulated or conjugated pattern in nanoparticle forms. Unlike the drug delivery systems currently available in the market, this technology ensures a fourfold enhancement in bioavailability, which means three times higher drug concentration at tumor site. And all this is achieved with lesser toxicity owing to low drug concentration in circulation,” Dr Avinash Bajaj, Associate Professor at RCB and a prominent member of the team that developed the system, told Pharmabiz. The innovative system is highly effective in the treatment of cancers affecting stomach, breast, lungs, prostate and neck.

RCB has handed over the know-how to Biotech Consortium India Limited (BCIL), a public sector company promoted by the Department of Biotechnology, to facilitate its speedy commercialisation. According to sources, a handful of companies have already evinced interest in it and talks with BCIL for technology transfer are at an advanced stage.

The inventors have exploited the potential of nanotechnology to develop a delivery system that can substantially reduce drug toxicity in chemotherapy patients. The lipid-based nanoparticle-drug formulation is aggregated in supra-molecular form to attain different structural assemblies which is useful in target specific drug delivery. While doing so, the researchers have overcome the problem of delivery, toxic nature and insufficient retention time of hydrophobic and hydrophilic cancer drugs using a lipid-based formulation. Enhanced drug entrapment is achieved in less than an hour through a simple and single step without any special equipment for synthesis.

“We have conducted numerous animal studies to check the validity of the invention. It was checked in mice, rabbits and rhesus monkeys. In fact, this is the first time in India that a drug delivery system’s efficacy is tested in monkeys. The results were extremely impressive,” Dr Bajaj, who has

done post-doctoral work at the University of Massachusetts, pointed out. According to inventors, the nanotechnology-based system’s uses are not restricted to cancer treatment alone. It can be used for the treatment of bacterial and fungal infections, diabetes and many inflammatory ailments.

Established by the Department of Biotechnology under the auspices of UNESCO, RCB focuses on shared biotechnology growth in the Asia-Pacific region. It is part of the Biotech Science Cluster and operates in synergy with the other institutions in the Cluster.

<http://www.pharmabiz.com>

### Scientists edit gene to kill cervical cancer cells

In a recent study, scientists at the Cancer Research Program, Rajiv Gandhi Centre for Biotechnology (RGCB) in Kerala, have devised a new approach that can edit genetic sequences, in cervical cancer cells that can knock out the cancer-causing gene and thus, serve as an alternative therapeutic approach in treating cervical cancer.

Human Papilloma Virus (HPV) is one of causative agents of cervical cancer in women. While most infections caused by HPV clear up on their own, many women, with persistent HPV infections, gradually develop cervical cancer. According to a study, India accounts for one-third of the cervical cancer deaths globally. Among the two genetic sequences (genotypes) of the virus – HPV-16 and HPV-18 – that cause cancer, HPV-16 is the most prevalent gene in India. The recent study, published in Nature’s journal Scientific Reports, the researchers have used a gene editing molecule that can edit the protein producing gene E7, found in HPV, and has a role in causing cervical cancer and making it malignant.

The study showed the total silencing of E7. Even in a HeLa cell line, a type of immortal cell line used in scientific research, the researchers observed 10% editing activity and total elimination of E7 proteins produced by the gene.

But, suppressing the activity of E7 genes is not without consequences. It results in cell death. Biologically, our cells die in two ways. One is a programmed cell death, which is

a relatively ‘cleaner’ death, where all the cell contents are promptly recycled. The second, also called ‘necrotic death’, is a messier affair. Here the dead cell bursts out spewing its contents all around it. Usually, genes when edited by TALENs, result in a programmed cell death. However, in this study, the researchers report a cell death by necrosis when TALENs were used to target genes that produce E7 in cervical cancer cells. The advantage of necrotic cell death is that with the cancer cell contents now all spilled outside, the immune system can easily pick this up. Once our immune system knows the presence of these foreign bodies, it triggers pro-inflammatory cytokines – small proteins helping in cell signaling – leading to tumor-specific immunity. This could, in turn, destroy other malignant cells including those that have been resistant to natural cell death.

<https://researchmatters.in>

### Diarrhoea vaccine

The World Health Organisation (WHO) has awarded pre-qualification to the developing world’s first rotavirus diarrhoea vaccine, ROTAVAC, developed by Hyderabad-based Bharat Biotech. The recognition will allow UN agencies and Gavi, the global vaccine alliance, to purchase the vaccine from Bharat Biotech at significantly lower prices than those sourced from global pharmaceutical majors and make it available in other developing regions including Africa where diarrhoea kills thousands of children every year.

“Not only will ROTAVAC have a market in Gavi-supported countries where it will be priced much lower than similar vaccines supplied by companies such as GSK and Merck, there is also a huge market in non-Gavi countries such as South Africa where the vaccine is now available at a very high price,” Duncan Steele from The Bill & Melinda Gates Foundation told BusinessLine.

The 2015 rotavirus weighted average price for Gavi was \$ 4.80 per course, with the price for Rotarix (produced by GSK) at \$ 4.17 per course and the price for RotaTeq (produced by Merck) at \$ 10.50 per course, as per Gavi’s web-site. Bharat Biotech plans to supply ROTOVAC for Gavi countries at \$ 1 per vaccine which would add up to \$3 per course. “In a non-Gavi country such as South Africa,

one course of rotavirus can be priced up to \$ 20. If the Indian company can work out an arrangement with such countries at even a price as high as \$5 per course, there could be a big demand," Steele said.

In India, ROTAVAC, the vaccine to prevent infant deaths and hospitalisations due to rotavirus diarrhoea, was launched in March 2015 and introduced into the universal immunisation programme. At present, the programme has been introduced in nine states including Odisha, Andhra Pradesh, Haryana, Himachal Pradesh, Assam, Tripura, Tamil Nadu, Madhya Pradesh and Rajasthan. Jharkhand, too, would soon get included.

ROTAVAC was developed as a result of a multi-country and multi partner collaborative model for over two decades, Ella said. The partnership included the Department of Biotechnology, the Indian Council of Medical Research, the Indian Institute of Science, the All India Institute of Medical Science, the Christian Medical College, King Edwards Memorial Hospital, the Translational Health Sciences and Technology Institute, the Society for Applied Studies, the US National Institutes of Health, the US Centres for Disease Control and Prevention, Johns Hopkins University and PATH.

<https://www.thehindubusinessline.com>

### REPUBLIC OF KOREA

#### Anti-diabetics using microbial enzyme

The Ministry of Science and ICT announced on January 16 that a research team led by Professor Oh Deok-kun of Konkuk University developed a substance similar to lipid regulating agents in human body using microbial enzyme and confirmed the potential as a drug for diabetes.

The research team successfully compounded substances, such as hepoxilin and trioxilin which are lipid regulating agents that control glucose metabolism with a minute amount of them existing in human body. Lipid regulating agents is a substance that is involved in various biological activities in the body, including immunity, anti-inflammatory and controlling glucose and fat metabolism. Since only a small amount of substances are created in the body and they

are dissolved very quickly, it has been impossible to secure the substance until now.

In addition, the research team studied an enzyme and metabolic pathway involving in biosynthesis of lipid regulating agents from germs. They found proteinlike in microorganism, which has the same function of lipoxidase and hydroxy fatty acid enzyme that compound lipid regulating agents in the body, and use them to biologically synthesize numerous lipid regulating agents.

Professor Oh Deok-kun said, "We succeeded in mass developing and producing lipid regulating agents that only a minute amount of them can be found in human body, by making use of microorganism. We will be able to biologically synthesize various lipid regulating agents that can treat diabetes and infection in the future."

The latest findings were published in the international journal *Nature Communications*.

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

#### AI program for effective gene editing

Yonsei University Medical School professor Kim Hyung-bum and Seoul National University engineering professor Yoon Sung-ro announced on January 30 that their joint research team developed an AI program choosing the most effective gene scissors for cutting different target parts.

Gene scissors can be defined as artificial enzymes cutting certain DNA parts by coupling with animal and plant genes. Each of the enzymes is divided into a cleavage enzyme for DNA cutting and a guide RNA functioning as a cleavage enzyme carrier. One of the most important parts for effective gene editing is attachment of a selected enzyme to a target DNA sequence. These days, researchers around the world are studying which guide RNAs can be most effective for different target DNA sequences. Although there have been some computer simulation programs for predicting the effects of gene scissors, the predictions have not been accurate due to the shortage of data.

The team used deep learning as their solution to the limitation. Earlier, professor Kim

Hyung-bum came up with the gene editing effects of CRISPR-Cpf1 with 15,000 guide RNAs based on an analysis method for measuring the activities of genetic scissors. Professor Yoon Sung-ro combined the data with deep learning so that the most effective gene scissors can be presented in different conditions.

The newly developed AI program has a correlation coefficient of 0.87 whereas existing simulation programs' range from 0.5 to 0.6. Details of the research are available in the *Nature Biotechnology* journal.

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

### EUROPE

#### SWITZERLAND

#### Artificial skin implant to detect cancer

An implant which detects cancer in the body and causes a small artificial mole to appear on the skin as an early warning sign has been developed by scientists. The tiny patch lies under the skin and is made of a network of cells which constantly monitor calcium levels in the body.

Swiss scientists from the university ETH Zurich say the device can recognise the four most common types of cancer - prostate, lung, colon and breast cancer - at a very early stage of tumour development.

Cancer patients are far more likely to survive if the disease is picked up early. For example, nearly all women with stage one breast cancer survive for five years, but by stage four, survival falls to just 22 per cent. Martin Fussenegger, Professor at the Department of Biosystems Science and Engineering at ETH Zurich, said the implant could be available within a decade. "Nowadays, people generally go to the doctor only when the tumour begins to cause problems. Unfortunately, by that point it is often too late. "Early detection increases the chance of survival significantly." An implant carrier should see a doctor for further evaluation after the mole appears. The mole does not mean that the person is likely to die soon."

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

## UK

**Synthetic, bacteria-killing virus**

Researchers at University College London on Wednesday announced they have developed a laboratory-built virus that kills unwanted bacteria on contact. The breakthrough, detailed in a study published in the journal *Nature Communications*, comes from researchers at UCL, as well as Britain's National Physical Laboratory. They created a synthetic hollow shell 20 nanometers wide, or less than 0.0000008 inch, which emulates naturally occurring viruses. The artificial viruses recognize and then destroy the membranes of bacteria.

The discovery demonstrates a new approach to treating infectious and antibiotic-resistant diseases, the researchers said. "We used high-resolution and real-time imaging to see the impact of the synthetic viruses on bacterial model membranes and found that they are extremely destructive," Hasan Alkassam, a doctoral student at UCL and co-author on the study, said in a press release.

"Seconds after landing on the surface, the synthetic viruses disassemble and form rapidly expanding holes in the membrane, causing it to leak. Experiments on intact bacteria then showed that this caused the bacteria to die."

The synthetic viruses do not affect living human cells but can enter cells in the same way that natural viruses can. The researchers say the capability suggests their lab-built viruses can also be involved in gene editing and delivery, as well as in synthetic biology. "We have a potential strategy to treat infectious diseases, and we also understand how it works," said Bart Hoogenboom, a professor at the UCL London Center for Nanotechnology, UCL Physics and Astronomy, and UCL Institute of Structural and Molecular Biology.

<https://www.upi.com>

## NORTH AMERICA

## USA

**Mutant enzyme that eats plastic**

Scientists have developed an enzyme which is able to "digest" some of the planet's

most commonly polluting plastics. Undertaken by teams at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and the U.K.'s University of Portsmouth, the research could potentially lead to a "recycling solution" for plastic bottles made from polyethylene terephthalate (PET), which lingers in the environment for hundreds of years.

The researchers were initially examining the crystal structure of PETase, an enzyme that can digest PET, in order to understand how it works. But during their research, the scientists managed to engineer an enzyme that was more effective at "degrading" the plastic than the naturally occurring one, which was recently discovered in the soil of a Japanese recycling plant.

"Serendipity often plays a significant role in fundamental scientific research and our discovery here is no exception," John McGeehan, director of the Institute of Biological and Biomedical Sciences in the School of Biological Sciences at Portsmouth, said in a statement Monday.

"Although the improvement is modest, this unanticipated discovery suggests that there is room to further improve these enzymes, moving us closer to a recycling solution for the ever-growing mountain of discarded plastics," McGeehan added. The University of Portsmouth said that the "mutant" enzyme was also able to degrade polyethylene furandicarboxylate, which is a bio-based substitute for PET plastics.

<https://www.cnn.com>

**CRISPR-carrying nanoparticles edit the genome**

Nanoparticles that allow for CRISPR genome-editing in adult animals have now been developed by researchers. Using a new nanoparticle-based, nonviral delivery technique, the researchers were able to cut out a disease-causing gene in about 80 percent of liver cells, and permanently lower cholesterol in mice.

In a new study, MIT researchers have developed nanoparticles that can deliver the CRISPR genome-editing system and specifically modify genes in mice. The team

used nanoparticles to carry the CRISPR components, eliminating the need to use viruses for delivery. Using the new delivery technique, the researchers were able to cut out certain genes in about 80 percent of liver cells, the best success rate ever achieved with CRISPR in adult animals.

"What's really exciting here is that we've shown you can make a nanoparticle that can be used to permanently and specifically edit the DNA in the liver of an adult animal," says Daniel Anderson, an associate professor in MIT's Department of Chemical Engineering and a member of MIT's Koch Institute for Integrative Cancer Research and Institute for Medical Engineering and Science (IMES).

One of the genes targeted in this study, known as Pcsk9, regulates cholesterol levels. Mutations in the human version of the gene are associated with a rare disorder called dominant familial hypercholesterolemia, and the FDA recently approved two antibody drugs that inhibit Pcsk9. However, these antibodies need to be taken regularly, and for the rest of the patient's life, to provide therapy. The new nanoparticles permanently edit the gene following a single treatment, and the technique also offers promise for treating other liver disorders, according to the MIT team.

Anderson is the senior author of the study, which appears in the Nov. 13 issue of *Nature Biotechnology*. The paper's lead author is Koch Institute research scientist Hao Yin. Other authors include David H. Koch Institute Professor Robert Langer of MIT, professors Victor Kotliansky and Timofei Zatselin of the Skolkovo Institute of Science and Technology, and Professor Wen Xue of the University of Massachusetts Medical School.

In the new *Nature Biotechnology* paper, the researchers came up with a system that delivers both Cas9 and the RNA guide using nanoparticles, with no need for viruses. To deliver the guide RNAs, they first had to chemically modify the RNA to protect it from enzymes in the body that would normally break it down before it could reach its destination.

The researchers analyzed the structure of the complex formed by Cas9 and the RNA



guide, or sgRNA, to figure out which sections of the guide RNA strand could be chemically modified without interfering with the binding of the two molecules. Based on this analysis, they created and tested many possible combinations of modifications. "We used the structure of the Cas9 and sgRNA complex as a guide and did tests to figure out we can modify as much as 70 percent of the guide RNA," Yin says. "We could heavily modify it and not affect the binding of sgRNA and Cas9, and this enhanced modification really enhances activity."

The researchers packaged these modified RNA guides (which they call enhanced sgRNA) into lipid nanoparticles, which they had previously used to deliver other types of RNA to the liver, and injected them into mice along with nanoparticles containing mRNA that encodes Cas9. They experimented with knocking out a few different genes expressed by hepatocytes, but focused most of their attention on the cholesterol-regulating Pcsk9 gene. The researchers were able to eliminate this gene in more than 80 percent of liver cells, and the Pcsk9 protein was undetectable in these mice. They also found a 35 percent drop in the total cholesterol levels of the treated mice. The researchers are now working on identifying other liver diseases that might benefit from this approach, and advancing these approaches toward use in patients.

<https://www.sciencedaily.com>

### New method to improve crops

A team of University of Georgia researchers has developed a new way to breed plants with better traits. By introducing

a human protein into the model plant species *Arabidopsis thaliana*, researchers found that they could selectively activate silenced genes already present within the plant. Using this method to increase diversity among plant populations could serve to create varieties that are able to withstand drought or disease in crops or other plant populations, and the researchers have already begun testing the technique on maize, soy and rice. They published their findings in *Nature Communications*.

The research project was led by Lexiang Ji, a doctoral student in bioinformatics, and William Jordan, a doctoral student in genetics. The new method they explored, known as epimutagenesis, will make it possible to breed diverse plants in a way that isn't possible with traditional techniques. "In the past this has been done with traditional breeding. You take a plant, breed it with another plant that has another characteristic you want to create another plant," said Jordan. "The problem with that is getting an individual that has all of the characteristics you want and none of the characteristics that you don't want. It's kind of difficult. With our new technique, you can modify how the genes are turned on and off in that plant without having to introduce a whole other set of genes from another parent."

The idea for the method evolved originally from working in the lab with department of genetics professor Robert Schmitz, the corresponding author on the study. In his lab, researchers were studying DNA methylation, which controls expressed genetic

traits, and creating maps of where DNA methylation is located in many plant species, including crops. When DNA methylation is removed, researchers found that they could selectively turn on previously silenced genes in the underlying genome of the plant.

"We saw repeatedly that lots of genes are silenced by DNA methylation and thought it was kind of curious," said Schmitz. "There are lots of discussions you can have about why these exist, but the reality is that they are there. So we wondered, how can we leverage them? Let's use the plant already in the field and reawaken some of those silenced genes to generate trait variation."

To turn these dormant or silenced genes on, researchers introduced a human enzyme, known as a ten-eleven translocation enzyme, to plant seedlings using specially modified bacteria as a delivery vector. Introducing this human protein allows researchers to remove DNA methylation and thereby turn on previously silenced genes.

Figuring out the best way to introduce the protein to the plant species has been a trial and error process. With Ji's expertise in bioinformatics, researchers are able to look at large sets of data about their experiment and make decisions on how to best proceed with the project. "The data has really helped us brainstorm and coordinate what we should do next," said Ji. "That was particularly important in the beginning of this project because we just didn't know what was going to happen with this new technique."

<https://phys.org>

### Technology Bank for Least Developed Countries

The 2011 Istanbul Programme of Action called for the establishment of a technology bank and a science, technology and innovation supporting mechanism dedicated to least developed countries (the "Technology Bank"), a long-standing priority of the LDCs confirmed in the 2015 Addis Ababa Action Agenda and in Sustainable Development Goal 17. The establishment of the Technology Bank is expected to be the first target of the SDGs to be met. The new Bank is expected to improve the utilization of scientific and technological solutions in the world's poorest countries and promote the integration of least developed countries into the global knowledge-based economy. This will be achieved through improving technology-related policies and facilitating the access to appropriate technologies.

On 22 September 2017 The Technology Bank was operationalized with the signing of the Host Country Agreement and the Contribution Agreement between the Government of Turkey and the United Nations. The Technology Bank will be located in Gebze, Turkey.

For more information, access:

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

# DEVELOPING AN ECOSYSTEM FOR INNOVATIVE ENTREPRENEURSHIP AND START-UPS

## POLICY ISSUES, STRATEGIES AND GOOD PRACTICES IN INDIA

### Sunita Sanghi

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### Abstract

Entrepreneurship is an important driver for creating employment opportunities, boosting innovations and thereby fueling growth. In Indian context it assumes relevance to harness the demographic advantage and to improve the women participation in the labour market. The Flagship program of the government of India are facilitating growth of enterprises and generation of sufficient livelihood opportunities to productively absorb this economically active population to maintain the higher growth trajectory. The need of the hour is addressing the issue of information asymmetry through use of digital technology.

### Introduction

Entrepreneurship is an important driver fueling economic growth, creating employment opportunities and boosting innovations. It has special relevance in the Indian context given that India is passing through a demographic transition wherein about 35%<sup>1</sup> of the population is in the age bracket 15–29 years and 65% in the working age group. Harnessing this demographic potential necessitates generation of sufficient livelihood opportunities to productively absorb this economically active population to maintain the higher growth trajectory.

A peep into the Indian Labour Market shows that agriculture accounts for 46% of the workforce and that there is increasing informalization of the Indian Labour market with close to 93% working in the informal employment both in the organized and the unorganized sector. More than 98% of the enterprises as per Sixth Economic Census 2013–14 are employing

less than 10 workers with about 72% working as own account enterprises with no hired workers. In terms of enterprises, there are 63.4 million unincorporated non-agricultural enterprises (excluding construction) in the country employing close to 111.3 million workers<sup>2</sup> which are not necessarily decent employment both in terms of wages and access to social security.

The preponderance of own account enterprises clearly indicates that it is time to foster entrepreneurship among those entering labour market especially the marginalized and the vulnerable group viz woman, youth and minority. Entrepreneurs not only provide employment for themselves but also create employment for others and drive greater upstream and downstream value-chain activities. They also facilitate growth of both physical and social infrastructure in terms of availability of roads, educational institutions, health facilities and public utilities.

As per NASSCOM Report<sup>3</sup> India has the third largest startup ecosystem across the world, amidst intensifying competition from countries like UK and Israel. While Bengaluru, Delhi and Mumbai retained their position as the key startup hubs in India, 20% of the startups emerged from tier II and tier III cities, the report noted. There is rapid rise in startups in healthtech, fintech, e-commerce and aggregators.

The last decade has witnessed change in the nature of entrepreneurship from being driven by individuals working within the well-defined boundaries to a boundless digital sphere. These are called technology-inspired entrepreneurs who create value for both the firm and society. The technology entrepreneurs are either technology developers, those who develop a unique technology capable of diving a new business or technology users who see a new technology development and understand how it can be applied to meet a market need. In 2017, India has total of 5,200 technology startups across sectors either as technology developers or as technology user based. They comprise 43% of the total start-ups in India.

### Booming sectors for tech based startup

Technology is impacting each aspect of life. The mobiles and internet are not just the mechanism to communicate but are impacting each aspect of lives. The technology based entrepreneurs and startups have taken strong roots across sectors in India like Food Tech, Retail, Real Estate, Education, healthcare, Travel & Transport, Data Analysis, E-commerce Enablers, Sales and Marketing Tech, HR Tech impacting both consumers and the enterprises. The

<sup>1</sup>Youth in India, CSO 2017

<sup>2</sup>NSSO 73rd Unincorporated Enterprises Survey 2015-16

<sup>3</sup>Tech Start-Ups In India: A Bright Future, NASSCOM

services and facilities are a click and a call away. Companies like Amazon, Ola, Uber, Flipkart, Snapdeal, Paytm have entered the hyperlocal grocery services; home services providers like Housejoy have gone up from 40 orders a day to 4,000 in 10 months, Urbanclap received 3,000 vendors in Mumbai alone. Shopsy, a community commerce platform, digital payment provider Momoe have ventured beyond traditional business structure.

The following paragraphs provide details of some of the emerging and successful tech based entrepreneurial solution impacting every aspects of life:

The startup culture has taken great strides in the **Real Estate** space and is changing the face of real estate with their more customer-centric approach catering to every small aspect from searching of house for rent to purchase of house.<sup>4</sup> The real estate tech startups like 99 acres, no broker, Grab house have replaced the role of brokers by connecting the customer directly with the house owner. Nest Away uses technology to provide rental solutions and best design anywhere in India and offer furnished homes at affordable prices on sharing basis. The startup like SmartOwner are helping people in cashing on carefully curated investment opportunities from the fastest growing cities in India. These technological interventions have made house searching whether for rent or purchase a click away.

In the Tourism and Hospitality space entrants like Oyo & Zo Rooms, a budget hotel aggregator, Trivago – a hotel price comparison site are accelerating providing clarity on the essential requirements of today's tech-savvy budget travelers.

The **Edtech startup** space has also witnessed a boost in India with increasing interactive textbooks, rise of web-based research, access to multiple IT tools for teachers such as podcasting, virtual classroom, voice recording, use of videography for content delivery etc. The startups offer tutorials ranging from boards

to competitive exams for engineering, management and civil services. BYJU's, unicorn of India, offers learning programmes for class 6–12 and test preparation for various competitive exams JEE, AIPMT, CAT, IAS, GRE & GMAT. The platform provides personalized, adaptive learning tests and practice packages to help students ascertain and improve their rank. These platforms have transformed the pedagogy. The digital learning has now become part of the regular learning process and is done through 3D content and learning management systems (LMS) with AI interface. However, there is need to expand to tier II and tier III cities and rural areas for better outreach.

The **Health tech startups** have redefined the healthcare in India providing services ranging from preventive healthcare, to analytics, pathology, emergency services etc. The health tech startups are bridging the gap through technology adoption amongst doctors across diverse spectrum, which facilitates them to deliver quality consultation to their patients. Startup like Doc Talk and eKincare facilitates users to save all their medical records on the cloud and discuss with the doctors and get prescriptions on the go. The Platform like Grow Fit are addressing the lifestyle diseases gap with its healthtech platform expert coaching, health foods and behavioural insights. Similarly, NIRAMAI is putting forward innovative solutions for rare diseases including cancer especially breast cancer. A digital network SastaSundar.com is bringing all stakeholders viz. doctors, diagnostic services, health-care clinics, and health information services together which not only reduces cost but also brings together best medical facility and treatment, thereby reducing cost and make the availability of high-quality medicines convenient. There are applications like Practo that facilitate reach of doctors to patients.

**Fintech startups** have also brought in a revolution in financial services including Online payments, crowd funding, consumer finance, Insurance, risk management,

mobile banking etc. The technological disruption in the banking sector has played an important role in covering the unbanked population. The Government initiatives like BHIM, the interoperable payments system by the National Payments Corporation of India (NPCI), Unified Payments Interface (UPI) have made a mark in the market. The promotion of cashless technologies post demonetisation such as digital wallets, Internet banking, the mobile-driven point of sale (POS) and others – as well as the launch of Aadhaar, eKYC, UPI and BHIM have restructured the financial sector and have disrupted traditional institutions like banks. The Startups like Kissht and Faircent (P2P lending) are providing instant credit to consumers for making purchases at digital points of sale (both offline and online) even without a credit card. The data-driven, mobile-first platform like Simpl allows customers to make purchases and settle payments online thereby providing users a payment model that's faster and more convenient than wallets or cards.

BillDesk, Instamojo and mobile-based Point of Sale (POS) providers are helping to bridge the gap between the common man and the small retailers.<sup>5</sup> Similarly, Zest-Money, Capital Float, Lendingkart, CashCare, Indifi, Rubique, Faircent are providing alternative sources of funds to the micro small and medium enterprises. The FTCash is not only facilitating micro-merchants including kirana store owners to accept payments through multiple payment instruments including debit cards, credit cards, and mobile wallets but also provides short-term loans to these merchants. These platforms have empowered micro-merchants and SMEs by offering easy access to credit.

**Innoviti** which helps businesses in reducing the cost of processing digital payments by automating the manual processes used by them and supplying hassle-free working capital to small businesses has seen its flagship product UniPAY achieving 100% growth in one-year up to March 2017.

<sup>4</sup>Silicon India News

<sup>5</sup>Indian Startup Saga-Grant Throatan

<sup>6</sup>Inc42's Startup Watchlist annual series 2017



The tech-based startup in Logistics sector have broken the delivery barriers and have facilitated delivery of products at the shortest possible time from & to any part of the globe. The intracity logistics aggregator startups like trucksfirst, Moovo, the Karrier and Shippr acts as an exchange platform for cargo owners and transporters. The growth of the e-commerce is directly related to the growth of logistics. Though tier I cities are the preferred location for the logistic companies the tier II and tier III cities have the maximum potential for logistics companies expansion. Besides facilitating delivery, these logistics startups are also facilitating a modernistic and simplified way of right vehicle selection, route/delivery planning, real-time tracking, reduced transit time and reliable documentation and control, among others using data analytics and IoT.

Enterprise tech startups like e-commerce enablers, sales and marketing tech, HR tech, Big Data Apps, retail tech, enterprise resource planning, business intelligence support other startups in the ecosystem. The App based Travel, Tourism and Foodjoints startups like Yatra, Make my trips and Zomoto etc. have made life easy and a click away.

In terms of funding and investment, the tech startups raised about \$13.5 Bn in funding across 885 deals in 2017, according to the Indian Tech Startup Funding Report 2017. The amount invested in 2017 is almost three times than what it was in 2016. Enterprise tech, healthtech and fintech emerged as top sectors bagging maximum number of deals in the year 2017. The transport-tech, traveltech, deeptech, edtech and media and entertainment have also witnessed a significant growth. The technology based startups are bridging language based digital divide. For e.g., the local e-commerce startup Storeking functions with local languages and has partnered with MobiKwik a wallet service provider to bring digital disruption to Rural India. The platform like Quikr is also available in seven languages. The BillTutor, eRelgo, Indus OS, Megdap Innovation, Planet

GoGo are language technology platforms providing language tech solutions.

Though majority of startups are from metro cities, many are cropping up in different tier II cities as well. Online food service – Faaso's, Online grocery service – Grofers, are spreading rapidly to the tier II cities.

### What constrains the growth of entrepreneurship

The Hon'ble Prime Minister of India has envisioned India to be in the top 50 of the World Bank Doing Business ranking report to re-energize business and attract foreign investment. The burgeoning young large population which provides both domestic market as consumer and also availability of manpower offers great opportunities for growth of entrepreneurs. The Startup India mission launched in 2016 provides ground for promoting technology business incubators and creation of research parks and startup support hubs in national institutes of prominence. The high penetration of internet and mobiles both in rural and urban areas has given fillip to innovations of startups and have transformed the way businesses are done and consumers communicate. The access to funds have been streamlined through various sources like VC/PE, Angel investors, banks, financial institutions and incubators. The Entrepreneur groups are supporting the development of other startups. However, the growth of the entrepreneurship is slow and heterogeneous across India with few cities emerging as centers of new startups and others lagging behind.

The question is what impacts the growth of startups. A peep into the success story of some of the emerging startups highlight that the success of a startup requires availability of basic infrastructure like electricity, Internet, roads, transport; availability of a skilled workforce, network of mentors and facility for ideation and incubation and funding at different stages. However, these startups face hurdles in accessing these essentials in smaller cities or towns and rural parts of the country. The biggest problem is the lack of proper guidance and mentor-

ship to take forward the idea. A lot of young people come out with new innovative ideas with potential to take the start-ups to great heights, but due to lack of experience of industry, business and market to effectively get their products out. A good mentor can help them in capturing the markets faster, strategizing each of their steps and in networking. The scope for innovation and entrepreneurship to flourish in small towns and rural areas gets reduced if the innovators and entrepreneurs from small towns and rural settings may have to travel long distances for mentorship or other support and also for resources.

Another challenge faced by the startups is to recognize opportunity and it is difficult for them to validate and demonstrate the value of opportunity and business idea before its realization. This problem is more so for those technology based entrepreneurs in small towns, villages, as visioning for a new venture, opportunity recognition along with innovative solutions, R&D products, rapidly changing skill needs and equally changing non-techno activities remains limited due to lack of resources, knowledge and understanding of the components of entrepreneurial ecosystem and relations between them.

The technology startups face challenge of payment in terms of non-acceptability by the customers of electronic and also because of lack of proper payment gateways in different geographies.<sup>7</sup> Electronic payments are still not popular owing to absence of complete penetration to tier 2 and tier 3 cities.

Lack of effective branding strategy is yet another issue that bars startups from flourishing speedily.

It is also difficult to attract and hire the right talent and skilled workers as a startup cannot pay the compensation packages offered by larger companies. They also have challenge in raising the funds especially during the initial stage, given no credit history or track record of the company.

The delay in fund disbursement process is another challenge. According to the Task force on Innovation,<sup>8</sup> the average pendency

<sup>7</sup><https://www.businesstoday.in/moneytoday/technology/start-ups-challenge-big-online-payment-gateway-players/story/197144.html>

for a patent application to be granted in India is more than five years. To promote intellectual property, the Patent (Amendment) Rules, 2016 provide expedited patent examination on certain grounds. The newly added rule aims to reduce the application period from the prevailing 5–7 years to 18 months by March 2018 for Tatkaal applications, which is an excellent initiative. However, the patent literacy is very low, in general in India, even among educated innovators, and there is a lack of expert help available. This is a matter of major concern, particularly in case of tech-based entrepreneurs. Appropriate guidance along with faster processing and lesser cost is very crucial. Another major issue is that often Indian angels are constrained by regulations that make investment and exit cumbersome. The magnitude of deals is very low here. However, several of the venture capital funds are in the process of raising new funds.

The need for a comprehensive policy focusing on innovation and entrepreneurship was felt for creating framework for a sustainable ecosystem for the entrepreneurship.

### Policy initiatives for harnessing the entrepreneurial potential of Young India

Entrepreneurship is not new to India. In fact to quote from the Indian Industrial Commission Report (1916–1918) – “At a time when the West Europe, the birth place of modern industrial system, was inhabited by uncivilized tribes, India was famous for the wealth of her rulers and for high artistic skill of her craftsmen. And even at a much later period, when the merchant adventures from the West made their first appearance in India, the industrial development of this country was, at any rate, not inferior to that of the more advanced European nations.”<sup>9</sup> However, entrepreneurship in India has been confined to being own-account workers with one or more helpers and did not

expand in size beyond that and remained concentrated geographically depending on availability of skilled manpower as also adequate infrastructure.

A friendly ecosystem involves ease of doing business; tax incentives to entrepreneurs; Simplifying regulations for entry and exit; enabling infrastructure such as road, connectivity, utilities; mentoring and incubation of new ventures, building entrepreneurial networks, Innovation focus, access to finance, market etc. The boom in the IT sector and alumni of premier educational institutions including IITs have played a critical role in the growth of tech-based entrepreneurship. The IT revolution has seen growth of many tech-based enterprises impacting lives of all citizens pan India such as Snapdeal, Flipkart. The institutions like The National Science & Technology Entrepreneurship Development Board (NSTEDB), under the aegis of Department of Science & Technology are also promoting knowledge driven and technology intensive enterprises. Several initiatives and policy measures have been taken by Government of India to foster a culture of innovation and entrepreneurship in the country. These measures address the question of what constitute an appropriate environment for development of the entrepreneurship. What is available in India both in terms of policy and programmatic initiatives?

**1. Policy framework:** The National Policy on Skill Development and Entrepreneurship 2015 for the first time focused on creating a Vibrant entrepreneurship ecosystem of culture, finance, expertise, infrastructure, skills and business friendly regulation.<sup>10</sup> The policy lays emphasis on:

- Promoting innovation-driven entrepreneurship and making it aspirational.
- Encouraging entrepreneurship as a viable career option through advocacy.
- Enhancing support for potential entrepreneurs through mentorship, networks, financial access, technology etc.

- Integrating entrepreneurship education in the formal education system.
- Ensuring ease of doing business by reducing entry and exit barriers.
- Broadening the base of entrepreneurial supply by meeting specific needs of both socially and geographically disadvantaged sections of the society including women, SCs, STs, OBCs, minorities, differently-abled persons etc.<sup>11</sup>

The intent of the policy is supported by programmatic interventions including PM Yuva.

### 2. Programmatic interventions for creating and sustaining startups/entrepreneurships

The government of India has launched many mission mode programs directly and indirectly supporting the Startups.

(a) **Make in India** launched in September 2014 to promote the manufacturing sector by encouraging investment domestic companies including foreign investment to invest in the sector. Various measures have been taken to create favourable environment such as an online system for environment clearances, filing income tax returns and extension of validity of industrial licenses to three years; increase in the foreign Direct Investment limits for most of the sectors and Protection of the intellectual property rights of innovators and creators by upgrading infrastructure, and using state-of-the-art technology.

(b) **Startup India** was launched in 2016 to build a strong eco-system for nurturing innovation and Startups in the country. Since its launch in January 2016, the initiative has successfully given a head start to numerous aspiring entrepreneurs. The initiative with a 360° approach provides a comprehensive four-week free online learning program, set up research parks, incubators and startup centers across the country by creating a strong network of academia and industry bodies. A ‘Fund of Funds’ of INR 100 billion managed by

<sup>8</sup>Task Force on Innovation. Report on Global Innovation Index

<sup>9</sup>Entrepreneurship Development in India-the Focus on Start-ups;– Sunita Sanghi & A. Srijia Laghu Udyog Samachar 2016

<sup>10</sup>National Policy on Skill Development and Entrepreneurship 2015

<sup>11</sup>National Policy on Skill Development and Entrepreneurship 2015

SIDBI is helping startups gain access to funding. Under the program the startups can innovate and excel without any barriers. The relaxation in compliance norms has reduced the regulatory burden on Startups thereby allowing them to focus on their core business. The Startup India Online Hub launched in June, 2017 provides an online platform where all the stakeholders of the Startup ecosystem can collaborate and synergize their efforts.

(c) **Atal Innovation Mission (AIM)**, an initiative of NITI Aayog is promoting a culture of innovation and entrepreneurship by providing a platform for promotion of world-class Innovation Hubs, Grand Challenges, Start-up businesses and other self-employment activities, particularly in technology driven areas. In order to foster curiosity, creativity and imagination right at the school, AIM recently launched Atal Tinkering Labs (ATL) across India. ATLs are workspaces where students can work with tools and equipment to gain hands-on training in the concepts of STEM (Science, Technology, Engineering and Math). In the last two-and-half years, the government had opened 2,500 tinkering labs in schools under the "Atal Innovation Mission" where robots, 3D printers and internet of things are provided from class VI onwards. The aim is to support 30,000 tinkering labs in schools across India in the next three years to promote emerging technologies like Internet of Things, Artificial Intelligence, Blockchain, 3D and Robotics among school students and develop that innovative mindset from class VI onwards till class XII. Atal Incubation Centres (AICs) are another programme of AIM created to build innovative start-up businesses as scalable and sustainable enterprises. AICs provide world class incubation facilities with appropriate physical infrastructure in terms of capital equipment and operating facilities. These incubation centres, with a presence across India, provide access

to sectoral experts, business planning support, seed capital, industry partners and trainings to encourage innovative start-ups.<sup>12</sup>

(d) **SETU (Self Employment and Talent Utilization)**, a Techno-Financial, Incubation and Facilitation Program aims to support all aspects of startup businesses and other self-employment activities, particularly in technology driven areas. Experimenting in cutting edge technologies, creating value out of ideas and initiatives and converting them into scalable enterprises and businesses is at the core of government strategy for engaging youth and for inclusive and sustainable growth of the country.<sup>13</sup>

SETU has been conceived to address the five major drivers for creating a vibrant entrepreneurial eco system viz; (i) catalytic government policy and regulatory framework, (ii) easy access to equity capital and debt, (iii) businesses as entrepreneurial hubs, (iv) culture and institutions which encourage entrepreneurship over careerism and (v) adequate and effective collaboration forums.<sup>14</sup>

(e) **Digital India** has transformed India into a digitally empowered society and knowledge economy. The increased penetration of internet and mobiles has seen improvement in rural connectivity and boost to develop traditional rural arts, crafts or other innovative ideas into business models. This has offered huge business opportunity for startups and many e-Commerce companies have ventured into rural market as a part of the government's Digital India initiative. The program aims to improve citizen participation in the digital and financial space, make India's cyberspace safer and more secured improve ease of doing business. Digital India hopes to achieve equity and efficiency in a country with immense diversity by making digital resources and services available in all Indian languages.

The Electronics Development Fund (EDF) is helping in creating a vibrant ecosystem of innovation, research and develop electronic products within the country. The investment on electronic manufacturing has seen 27% increase leading to significant increase in production of mobile phones and hence direct and indirect employment. Digital transactions have also witnessed a growth of over 300% during this year.

(f) **ASPIRE** launched in 2015 is Promoting Rural Entrepreneurship through a network of technology and incubation centres and accelerating entrepreneurship in agro-industry. Sixty-two Livelihood Business Incubators (LBIs) and 8 Technology Business Incubator (TBIs) proposals have been given approval out of which 33 LBIs have been operationalized.<sup>15</sup>

(g) **Pradhan Mantri YUVA Yojana**, launched by the Ministry of Skill Development and Entrepreneurship for providing entrepreneurship education and training to over 700,000 students in 5 years (2016–17 to 2020–21) through 3,050 institutes. It also includes easy access to information and mentor network, credit, incubator and accelerator and advocacy to create a pathway for the youth. The institutes under the PM's YUVA Yojana include 2,200 Institutes of Higher Learning (colleges, universities, and premier institutes), 300 schools, 500 ITIs and 50 Entrepreneurship Development Centres, through Massive Open Online Courses (MOOCs).<sup>16</sup>

(h) **NIDHI - TBI** (National Initiative for Developing and Harnessing Innovations), launched in the financial year 2016–17 provides an enabling environment to technology-based new enterprises which are equally high-growth and high-risk ventures. Under this flagship program, more than 120 Technology Business Incubators (TBI) and Science and Technology Entrepreneurs Parks (STEP) have been

<sup>12</sup>NITI Aayog

<sup>13</sup>PIB 2015

<sup>14</sup>Entrepreneurship Development in India-the Focus on Start-ups– Sunita Sanghi & A. Srija

<sup>15</sup>Livelihood Business Incubators Projects Posted On: 01 JAN 2018 3:22PM by PIB Delhi

<sup>16</sup>Press Information Bureau Government of India Ministry of Skill Development and Entrepreneurship 09-November-2016 16:53 IST

established and several among them have matured and developed competence to become state-of-the-art Incubators.<sup>17</sup>

### 3. Easing out funds availability

To ease the credit availability requirements of start-ups and existing businesses, the Government has launched the MUDRA scheme with the objective of banking the unbanked and supporting the entrepreneurs. Since its inception, about 120 million loan accounts have been sanctioned. Out of them, during 2015–16 and 2016–17, about 22.4 million loans have been taken by new entrepreneurs, and 56.7 million loans were taken by women entrepreneurs (75%).

**Stand-Up India** launched in 2015 seeks to leverage institutional credit for the benefit of India's underprivileged. It aims to enable economic participation of, and share the benefits of India's growth, among women entrepreneurs, Scheduled Castes and Scheduled Tribes. Towards this end, at least one woman and one individual from the SC or ST communities are granted loans between INR 1 million to INR 10 million to set up greenfield enterprises in manufacturing, services or the trading sector. The Stand-Up India portal also acts as a digital platform for small entrepreneurs and provides information on financing and credit guarantee.

**India Aspiration Fund (IAF)**, an INR 20 billion has been launched by SIDBI in August 2015 to boost the startups fund-of-funds ecosystem in the country with a vision to promote and accelerate equity and equity linked investments in Start-ups and MSMEs. As on March 2018, 26 AIFs have been supported under India Aspiration Fund (IAF).<sup>18</sup>

**A SIDBI Make in India Loan for Small Enterprises (SMILE)** Scheme of INR 100 billion has also been launched

to catalyze tens of thousands of crores of equity investment in start-ups and MSMEs, creating employment for lakhs of persons, mostly educated youth over the next 4–5 years. The SMILE aims to provide soft loans in the nature of quasi-equity and term loans on relatively soft terms to MSMEs to meet the required debt-equity ratio norm. The scheme has benefitted 1,384 MSMEs by providing loans of Rs. 3586 crore till March 31, 2017.<sup>19</sup>

**Trade related Entrepreneurship Assistance and Development (TREAD)** addresses the critical issues of access to credit among India's underprivileged women. TREAD programme enables credit availability to interested women through non-governmental organizations (NGOs). As such, women can receive support of registered NGOs in both accessing loan facilities, and receiving counselling and training opportunities to kick-start proposed enterprises, in order to provide pathways for women to take up non-farm activities.

**A Credit Guarantee Trust for Micro and Small Enterprise** has been set up to strengthen credit delivery system and facilitate flow of credit to the MSE sector. The Trust crossed an important milestone in FY 2016–17 by recording cumulative guarantee approvals of over INR 2.5 million with an aggregate loan amount of over INR 1,250 billion. It has leveraged technology to achieve this scale and the entire operations is carried out online. With a view to improving the operational processes and provide better service to its Member Lending Institutions (MLIs), the Trust further upgraded its technology for enhanced efficiency and better customer service.<sup>20</sup>

**Credit Linked Capital Subsidy Scheme (CLCSS)** for Technology Upgradation aims at facilitating technology upgradation of

Micro and Small Enterprises (MSEs) by providing 15% capital subsidy (limited to maximum INR 1.5 million) for purchase of Plant & Machinery. Maximum limit of eligible loan for calculation of subsidy under the scheme is INR 10 million.<sup>21</sup>

**Prime Minister's Employment Generation Programme (PMEGP)** is the flagship programme of the government offering credit linked subsidy to establish new enterprises for generating continuous and sustainable employment opportunities in Rural and Urban areas of the country. In two years 2016–17 and 2017–18, a total of 37,785 + 72,844 projects have been sanctioned.

### 4. Ease of doing business- regulatory framework<sup>22</sup>

As a part of 'Startup India' initiative to build a strong eco-system for nurturing innovation and entrepreneurship number of measures have been taken to improve the regulatory framework so as to facilitate growth of enterprises. Some of the key initiatives includes:

- MSME unit to fill in a single one-page self-declaration online form called Udyog Aadhaar for registration.
- Self-certification with labour and environment laws and no inspection under labour laws for three years.
- Startup India hub to enable knowledge exchange and access to funding and guidance on all aspects of startup lifecycle and mentorship programs.
- To simplify startup process a mobile app and portal has been launched in April 2016. It provides up-to-date information on various notifications/circulars issued by various Government ministries/departments, towards creation of a conducive ecosystem for Startups.
- To promote awareness and adoption of Intellectual Property Rights (IPRs) Various measures have been taken to

<sup>17</sup>MSME, PIB

<sup>18</sup>MSME website

<sup>19</sup>Evening Standard July 2017

<sup>20</sup>MSME website

<sup>21</sup>MSME website

<sup>22</sup>StartUp India PIB December 2017



facilitate filing of patents, trademarks and designs by startups including fast-tracking of startup patent applications, panel of facilitators to provide general advisory on different IPRs, government bearing facilitation cost and 80% rebate on filing of application vis-à-vis other companies.

- To provide an equal platform to Startups (in the manufacturing sector) in public procurement vis-à-vis the experienced companies Relaxed Norms of Public Procurement for Startups.
- To make it easier for Startups to wind up business Faster exit for startups. Startups with simple debt structures may be wound up within a period of 90 days from making of an application for winding up on fast track basis.
- **Tax incentives**
  - To promote investments into Startups Tax Exemption on Capital Gains is provided for investment in newly formed manufacturing Micro Small and Medium Enterprise (MSMEs) by individuals to promote the growth of Startups and address working capital requirements.
  - To stimulate the development of Startups in India, profits of Startup initiatives are exempted from income-tax for a period of 3 years.
  - To encourage seed-capital investment in Startups Tax Exemption on Investments above Fair Market Value.
  - Under The Income Tax Act, where a Startup receives any consideration for issue of shares which exceeds the Fair Market Value of such shares, such excess consideration is taxable.
  - Currently, investment by venture capital funds in Startups is exempted from this provision. The exemption shall be extended to investment made by incubators in the Startups.
  - Period of claiming profit-linked tax exemption for startups has been increased to 7 years.

### Next steps

According to the World Bank Group's latest Doing Business 2018: Reforming to

Create Jobs report, India has jumped 30 positions to become the top 100th country (out of 190 countries) in terms of ease of doing business ranking. In the Global Competitiveness Index (GCI) 2017, India moved up from its earlier ranking of 71 in 2014–15 to 40 in 2017–18, out of a total of 137 countries. The score improved across most pillars of competitiveness, particularly infrastructure (66th, up by two), higher education and training (75th, up by six). In a recent study on geographical clusters generating most number of patents, three cities from India appear in the top 100 – Bengaluru at 43rd (with patent activity focused on computer technology), Mumbai at 95th, and Pune at 96th (both registering among the most patents in organic fine chemistry).

However, to empower the millions of Indians who are joining the labour market in search of livelihood opportunities there is urgent need to create platforms for information dissemination; improve education, training and quality of local physical infrastructure to improve the growth of entrepreneurship in an inclusive manner. The focus on women entrepreneurship is evident from the fact that the Global Entrepreneurship summit with women theme was hosted by India together with USA and the Women Entrepreneurship Platform and Women Transforming India Awards are some of the initiatives to promote women entrepreneurship which would improve the woman participation in the labour market and be the new driver of job growth in the future. However, together with such platform it is also necessary to ensure that the entrepreneurship is not concentrated in the big cities but also reach out to the remotest part of the country. This may necessitate converging governments various flagship programs such as Digital India to improve network & communication connectivity; Skill India to make available skilled manpower; availability of physical infrastructure as also transport to facilitate market linkages and financial inclusion to facilitate availability of credit and also channels for accepting payments. The strong linkage between education and entrepreneurship can be harnessed by improving the

availability of good education, health and infrastructure facilities in all the districts especially those enjoying demographic advantage and falls in the poor regions of the country. The Aspirational district program and Gram Swaraj Abhiyan of the Government of India are efforts to foster the linkages across programmes and focus on the growth of backward regions. These programs would not only promote growth in poorer districts, enhance equity and closing of gap in availability of infrastructure facilities and gap in knowledge.

There is no one magic formula, or one size fits all approach to make all the districts enterprising. The policymakers only facilitate availability of key infrastructure and ease of doing business to make the regions competitive in terms of good infrastructure, improved governance through capacity building of local administration and incentivizing the private sector to invest. These measures encourage investors to invest in the innovative ideas and promote entrepreneurships.

Th enhanced focus on small enterprises through the provision of MUDRA loan, Credit guarantee funds and also captive market for purchase of their products in government orders are strengthening the small enterprises where lies India's strength of entrepreneurship. The small enterprises are well integrated into the large companies as their ancillaries and through them into the global supply chain. The need really is to ensure that the benefits of various programs are reaching the targeted group through proper information dissemination. The digital platforms and the community services are the medium to overcome information asymmetry.

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### 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.

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# UNIVERSITY-INDUSTRY LINKAGE IN FURTHERING INNOVATION LANDSCAPE TOWARDS A SUSTAINABLE KNOWLEDGE ECONOMY

## ISSUES AND CHALLENGES<sup>1</sup>

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### Abstract

Innovation driven Business Enterprises (IBEs<sup>2</sup>) are critical for economy as they frame economic opportunity around societal challenges, socio-economic problems resulting in economic growth and better quality of life. But these endeavors in the uncharted water of disruptive technology landscape are fraught with landmines of failure. Building and sustaining an ecosystem to nurture these efforts to fruition, particularly in association with research and academic institutions whose views on production, management and monetization of intellectual wealth are completely at divergence with any commercial venture, is not only humungous but faced with insurmountable challenges at every turn. Given the challenges in developing countries, an institution maneuvering different dynamics of technology development, management and translation in bottom-up approach is the need of the hour.

### Introduction

The criticality of Science and Technology (S&T) development for a given economy cannot be gainsaid in a rapid globalization era. The development and growth of an economy is inherently linked with the intellectual property created, developed and harnessed to not only increase the productivity of limited resources like land, human resource and mineral wealth but create and exploit new opportunities through its intellectual wealth.

Among all the resources which drive the growth potential of any economy

the only resource whose productivity is unlimited in terms of value creation is the Intellectual Resource (IR) of an economy. IR creation to be successful and productive should focus on continuously motivating, developing and managing the Intellectual Property (IP) of the economy to its fullest extent.

Innovation driven BEs are critical for an economy as they devise economic opportunity around societal challenges, socio-economic problems resulting in economic expansion leading to a better quality of life. The pillars of this innovation

ecosystem include national laboratories, research universities, and public agencies, pools of investors, private sector enterprises, Intellectual Property protection mechanisms and government research funding.

A healthy national innovation ecosystem which promotes creation of intellectual wealth for economic and social progress consists of a complex network of very fragile linkages, critical for supporting innovation between the subsystems (pillars), featuring University<sup>3</sup> – Industry (UI) linkage, public/private pools of risk capital, programs to promote entrepreneurship among researchers to start up their own enterprises (Wessner & Wolff, 2012). The rise of global knowledge economy further accentuated, the role of long term University-Industry (UI) strategic linkage to presume criticality anchoring universities as a pivot for addressing social challenges and economic growth over the earlier discrete projects collaboration model (Edmondson, Valigra, Kenward, Hudson, & Belfield, 2012).

In emerging economies like India, with scarce private R & D (Research & Development) infrastructure, UI linkage is pivotal, as majority of public and private R & D funding and projects are directed towards or better invested through them. Fostering, Nurturing and Sustaining UI linkages plays an essential role in monetizing intellectual wealth and transforming the same into socio economic wealth. This article identifies issues and challenges associated with these linkages and solutions citing

<sup>1</sup>Some excerpts in the article are sourced and reproduced from the document co-written by B. V. Phani and R. A. Bhaskar and submitted as a supplement to the presentation made by Dr. Phani at 2016 ADB International Skills Forum: Innovative Practices in Skills Development last 19-21 September 2016 to the Asia Development Bank.

<sup>2</sup>IBEs include all types of New Business Enterprises (NBE), Existing MSMEs, services, manufacturing, tangible and intangible resource processing/value addition centers with disruptive technologies and/or innovative business models. The terms IBE, BE, NBE, Industry and startups have been used interchangeably in the document. Dependence of NBEs on knowledge ecosystem in terms of product/process improvement is critical for their survival in short and long term.

<sup>3</sup>For the purpose of this article the term 'University' has a wider connotation encompassing both standalone research organization and academic & research institutions.

theoretical models and implementation experiences over the past one decade at ‘Institutes of National Importance (INI)’ with specific focus in Indian Institute of Technology Kanpur (IITK). It is to be noted that IITK is one of the few institutes given the tag of ‘Institute of National Importance’ and is a statutory body under an act of parliament and has been one of the leading institutes of learning and research over the last 6 decades.

**UI linkage models**

Historically, universities have been associated as harbingers of Collating, Creating, and Communicating (CCC) knowledge for the development of an economy. This role and the model of contribution and their linkage to society has evolved significantly over the last few decades due to the acceleration in technological changes and diversity in the technological landscape. A wealth of literature researching these linkages, proposing and advocating various models of implementation is available. Irrespective of the model adopted, the role of the evangelism in making these initiatives a success cannot be gainsaid. Few recent models in the literature that are related to the recent technological knowledge creation and transfer are enumerated for the ready reference of the reader (Table 1).

**Other UI models**

- Industrial PhD
- Corporate universities (PDP<sup>4</sup>, IRMA<sup>5</sup>, etc.)
- Internships, and Short-term training program in interest of Industry.

More recently, the theoretical models Triple, Quadruple and Quintuple Helix Models, which are more inclusive involving more stakeholders in innovation ecosystem, have gained prominence but still their adoption is very limited in the emerging economies.

**Triple helix model**

Triple helix of UIG (University – Industry – Government) as an innovation

**Table 1: Recent models related to technological knowledge creation and transfer**

<b>Producer - Consumer Model</b>	University is producer of technology and Industry is consumer. Industry uses, whatever technology that is developed with no specific requirement / demand from its side.
<b>Joint Research Programs</b>	Both Industry and university involve in technology creation based on the market demand or societal requirement leveraging the conceptualization and generalization skills of the academicians to root it in the practical reality known by Industry.
<b>Consultancy Model</b>	Academicians work on industry defined problem, while researchers work on conceptual and generalized problem on the tomorrow’s technology, which Industries don’t need, has to be taken to market by means of new University- Industry model. There exists principal-agent relationship between institute and Industry. In fact, input of one is critical for the other

model considers the institutional arrangement and policy models to illustrate the evolution of a national system of innovation. Interactions between these institutional partners generate a layer that reorganizes these arrangements as the retention mechanism of a developing system. In this national system of innovation, ‘university research’ functions as a locus for achieving competency (Etzkowitz & Leydesdorff, 2000)

Triple Helix I (Figure 1) represents the historical setting in which state encompasses Academia and University, it was a failure because of the high control exercised by the ‘State’(Figure 1). In Triple Helix II (Figure 2), the ‘State’ plays the role of an innovation partner and there is strong boundary dividing institutional spheres.

Triple Helix III (Figure 3) is an emerging institutional framework with overlapping institutional boundaries and involvement of one actor in another (Etzkowitz & Leydesdorff, 2000) which forms hybrid organizations like technology transfer office and business and financial support institutions such as venture capital firms in the research labs and universities (Etzkowitz, 2008).

(Leydesdorff, 2001) elaborates on the reproduction of institutional arrangement by the communicative capacity of triple

helix. Paraphrasing Leydesdorff, (2001), the neo- evolutionary model of University- Industry- Government Relations (Triple helix III) focuses on reconstruction and reproduction of ‘institutional arrangement among agencies’ through continuous feedback on same by the overlay generated due to communicative capacities of carrying agents.

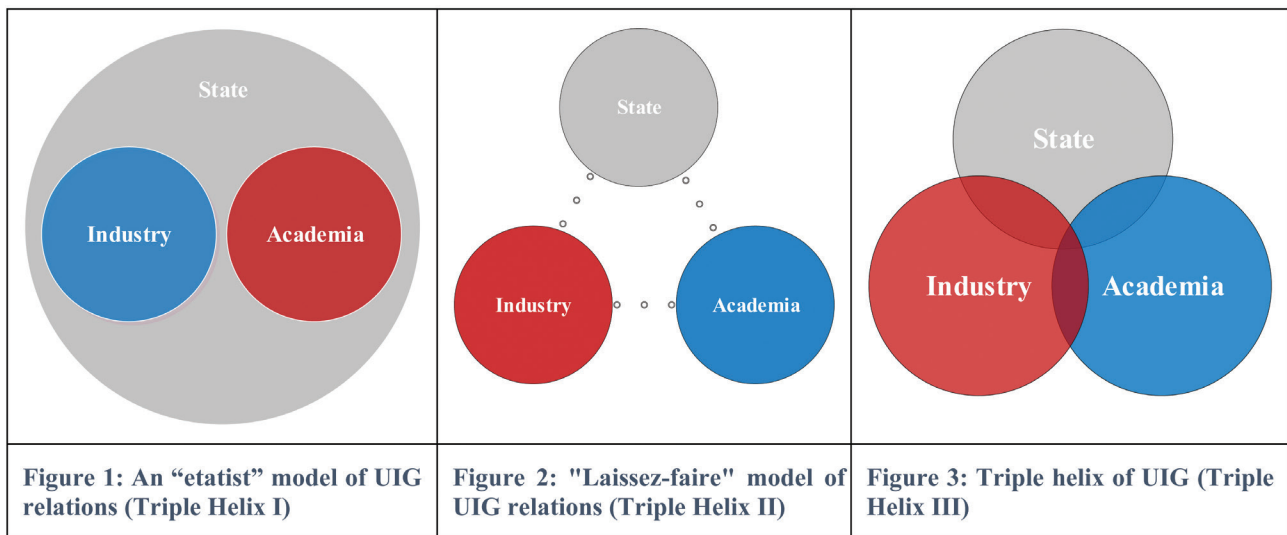
(Kimatu, 2016) further emphasized on the communicative capacities among agents by articulating that the inclusive and sustainable socio-economic development of nation depends upon the existence of a strong UIG linkage and their interaction. Continuous feedback on institutional arrangement among agents resulted in the evolution of these arrangement and their interaction itself, which has given rise to different organizations with their overlapping institutional framework one over the other like Science Parks, Technopolis, and Innopolis.

The feedback via communicative capacity among agencies not only evolve their own institutional structure but may also involve new agencies in the system. Interaction in triple helix raised the demand to include civil society in the innovation framework which lead to the evolution of Triple Helix to transform in to Quadruple Helix.

<sup>4</sup>Institute of Rural Management Anand (IRMA), an autonomous institution, located at Anand, Gujarat (India).

<sup>5</sup>Pandit Deendayal Petroleum University, a private state university in Gandhinagar, Gujarat (India).





Source: Etzkowitz & Leydesdorff, 2000

**Quadruple helix**

The advanced or more evolved triple helix which involves civil society or the end users of innovation as the fourth strand may be termed as quadruple helix model. This is more complex model as it involves the Civil Society in innovation, to leverage the benefits of localized resources and knowledge of end user for its targeted implementation. (Kolehmainen et al., 2016) reasserted the importance of this model in rural and remote locations because of the participation of social and community group and hence wider involvement of stakeholders in innovation process.

Involvement of civil society is a necessity for a country like India which is the largest democracy in the world beset with millions of challenges and a billion young innovative minds to address the same and rapidly move towards a knowledge economy.

In addition to these four stakeholders, fifth stakeholder i.e. Natural environment (Ecology) has also assumed significance to enable a sustainable socio-economic transition of this ecosystem. This inclusion is what distinguishes the Quintuple Helix Model from the Triple and Quadruple Models and makes it a holistic sustainable approach towards building this ecosystem.

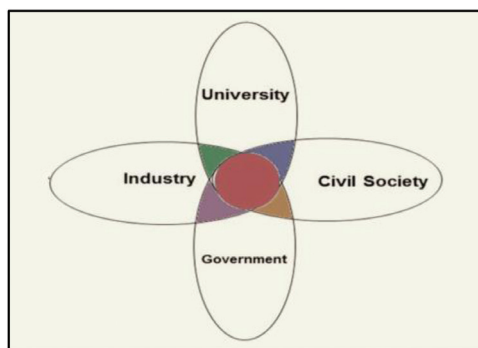
**Quintuple helix**

Comparative studies of international experiences in University Industry (UI) Linkages, brings out the critical role of the state to foster and sustain this ecosystem through adequate STIP frameworks and substantial funding for socio-economic benefit in an ecologically sensitive and sustainable manner using localized knowledge and resources. This linkage is evident in an inclusive framework designed with specific

focus on the broader development objectives of Indian State in collaboration with all the stakeholders using the Quintuple Helix (QH) model (Carayannis, Barth, & Campbell, 2012). These stakeholders include U-I-G (University-Industry-Government), Including stand-alone Research & Development (R&D) institutions, Civil Society & Natural Environments (Ecology) of society linking the 3C's of sustainable development Creation, Communication and Commercialization of knowledge. Given that the European Commission recognized the socioecological transition as a critical improvement for the future roadmap of development, this model recognizes and brings together the capital in the five subsystems (i.e., helices): (1) Education, (2) Economic, (3) Nature, (4) Social and (5) Political system to propose a sustainable developmental model. The Table 2 provides the details of the Aggregate Capital from all the five sub systems.

QH Model provides a framework as it allows us to visualize the circulation of resources (knowledge and capital) inside innovation subsystems. The Figure 5 provide a visualization of the input-output linkages between various subsystems and their impact on developing a sustainable developmental model.

On the lines of these theoretical Helix models, Academia have undertaken initiatives like crowd sourcing through competitions, interactions in seminars



Source: Kimatu, 2016

**Figure 4: Quadruple Helix Model**

Table 2: Aggregate capital

Sub System	Capital	Description
Education	Intellectual	Students, Teachers, Scientists, Researchers, Academician, Entrepreneurs, etc.
Economic	Economic	Industry/Industries, 'firms', services and banks etc.
Nature	Natural resources	Natural Resources, minerals, plants, animals, etc.
Social	Social and information	Tradition, Value systems, Information, Communication, Social networks etc.
Political	Political will	Ideas, Laws, Plans, Politicians etc.

Issues and challenges in UI linkages

Though significant steps have been taken by government of the states towards enhancing the UIG (University-Industry-Government) linkage for smooth technology translation but still there are many unresolved issues plaguing this linkage both on the supply (Academia) and demand (BE) side.

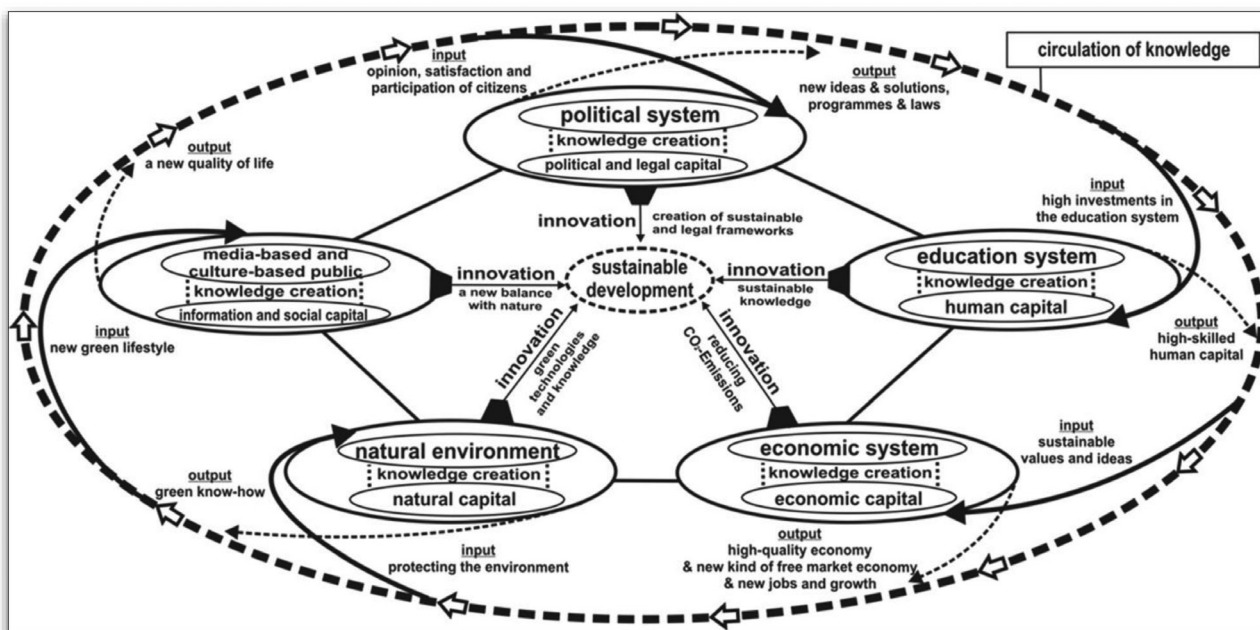
All the three key stake holders in UIG Innovation framework are under tremendous competitive pressure, academia faces this from its inherent need to continuously create knowledge to enhance students' knowledge enhancement and employability. Industries needs to be highly competitive and innovative for survival and dynamically shift from captive to open innovation models and vice versa for to be ahead of the curve. Rapid globalization and informational explosion leads to competition and sustainable socio-economic growth in line with environmental protection for state. This results in 'orientation related barriers' and 'transaction related barriers' in UIG linkage.

and workshops, open innovation models, specialists in specific domain with incredible depth. These models recommend that concerned people from both industry and university sides should come together (faculty in Industry, and Industry research in university) to start spending time with each other for development of technology and increased competitiveness at companies. This interface is all about knowledge transfer and experience/technology transfer.

Universities should also play a role in the emergence of clusters in industrial

region. Universities, recently, being very active in patenting, attracting venture funding, developing incubators to increase the commercialization of IP developed.

The above linkages and models mainly refer to fostering entrepreneurial activity in an academic setting, which receives more visibility but in the broader sense it reflects increased leveraging and harnessing of academic strengths both physical and intellectual for wealth creation and one of the significant interface should be Industry in both 'for profit' and 'not for profit' sectors.

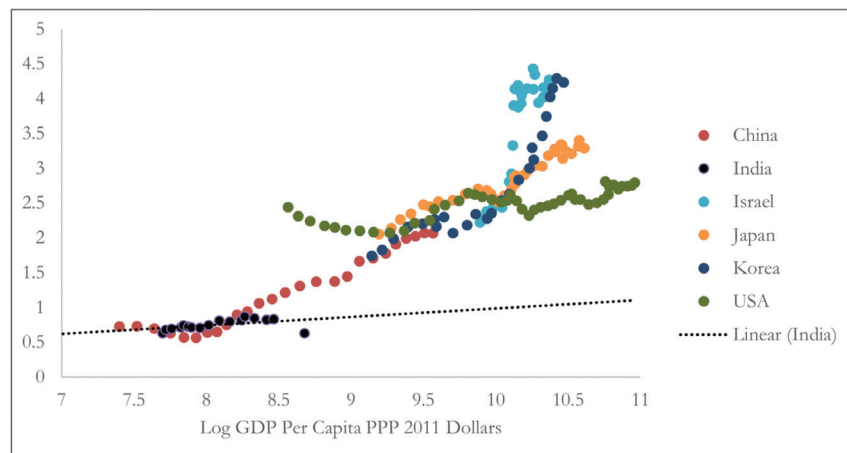


Source: Carayannis et al., 2012

Figure 5: Effects of investment in education for sustainability

**Table 3: 'I' from Mars vs 'U' from Venus**

Industry (I)	Universities (U)
<input type="checkbox"/> Return oriented	<input type="checkbox"/> Scientific curiosity
<input type="checkbox"/> Patents & products	<input type="checkbox"/> Publications
<input type="checkbox"/> Creation & protection	<input type="checkbox"/> Creation & dissemination
<input type="checkbox"/> Hierarchical model	<input type="checkbox"/> Collaborative model
<input type="checkbox"/> Performance culture & Pressure	<input type="checkbox"/> Peer culture & pressure
<input type="checkbox"/> Tangible benefit	<input type="checkbox"/> Intangible benefit



Source: UNESCO, World Economic Outlook (WEO), National Science Foundation(NSF).

**Figure 6: R&D expenditure as a percentage of GDP (Development Time) (Reproduced from Economic Survey of India 2017-18)**

Major challenges in the UI linkage are due to the different requirements of stakeholders. To paraphrase (Bruneel, D'Este, & Salter, 2010), private gain and competitive advantage are the primary motivation of firms' for knowledge creation. Private firms' attitude towards disclosure of research and timely delivery also creates conflict because researchers have different priorities as they are keener to research out of scientific curiosity and publish; for collaborative and intangible benefits; to gain peer recognition, while firms don't want to publish but use it to retain their competitive advantage, wherein appropriation of idea or patent is the priority for seeking tangible benefits.

In this respect, the differences of approach between Academia and Industry are captured in Table 3, listing the idiosyncrasies of both.

Academia and Industry may be visualized as the Left and Right Side of the human brain, unless both of these come together, implementable innovation and creativity would not be possible or optimal, therefore the need to bring them together on a common platform by upgrading from UIG-Islands with limited or no connectivity isolated entities to either virtual collaborative ecosystems or physical collaborative ecosystems or a hybrid collaborative ecosystems is highly critical to develop, accelerate and proliferate an innovative ecosystem landscape.

India, considered to be the brighter spot in South-east Asia in this regard, faces greater systemic issues in terms of stagnant and lackluster R&D funding, as does the whole region assumedly, having even more worse conditions. National R&D spend of India, given its economic conditions,

stagnating between 0.6% - 0.7% of GDP over the last two decades compared to 2-3% or more in developed economies (Figure 6).

Of the total R&D funding, only 38% comes from private sector and negligible from MSMEs as compared to more than 70% in other developing and developed economies. Only 26 Indian companies feature in the top 2500 companies list by R&D spend and Amazon alone has an R&D spend equivalent to that of India both public and private. Higher educational institutions in India also form a meagre share in R&D spending compared to the developed economies.

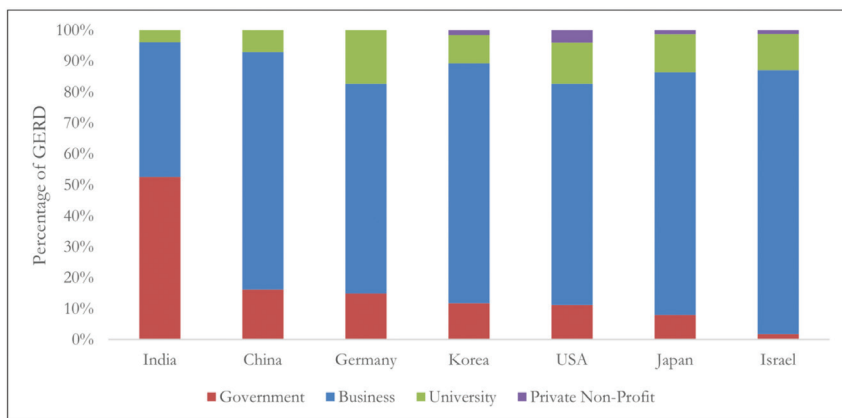
Citing the above data (Figure 7), for ameliorating the innovation ecosystem, the economic survey of India, 2017-18, advocates for doubling the R&D spend and seeks for the majority of it coming from private players specifically in STEM<sup>6</sup> areas.

**Supply side**

Given that majority of the R&D spending is state sponsored, Universities in India undertake research that does not address industry requirements and socio-economic challenges. This has resulted in significantly increasing number of research publications. As of 2015, there is an average 14% increase in the number of publications coming from the country over the last 7 years breaking the mark of 100,000 publications in a year. But of the total publication 35% get published in the journals without rigorous peer review procedure at a substantial cost.

Also 28% of the total registered patent applications take almost 6-7 years to get published or granted. There are studies which show that a large majority of these patents have been filed to enhance the resume of scientists. Patent filing and hoarding them are associated with significant cost; filing a number of patents has become a mark of success for institutions wherein very few of these patents ever see the light of the day in terms of providing any economic benefit (Gandhi, 2018). Figure 8 illustrates region wise pattern of the number of patents registered over 1959-2016.

<sup>6</sup>STEM is abbreviated for Science, Technology, Engineering, and Mathematics



Source: United Nations Educational, Scientific, and Cultural Organization (UNESCO).

Figure 7: GERD<sup>7</sup> by performer share in 2015 (Reproduced from Economic Survey 2017-18)

Given the above it would not be amiss to conclude that even though academia has significantly improved its capacity to publish it lags significantly in transformative innovation and translational capability.

Over 77% of Indian venture capitalists are of the opinion that India lacks unique business models or new technologies and a significant number of startups fail in the initial year of their lifecycle due to lack of funding availability from financial institutions and public spending is not enough for the cause (Gandhi, 2018).

A simple example regarding the fate of a hand held mobile computing device developed by Indian Institute of Science, Bangalore in 2001, known as 'Simputer' can highlight the same. This device was unique in itself as it is the first device to use accelerometer and other technologies that have been used after 2007 in Iphone's. It was tailored to the domestic conditions of India but did not achieve the commercial success it deserved as it failed to interest VCs and public funding at that juncture was also scarce (Balakrishnan, 2018). Critical junctures in the translation of technology from research to commercialization are illustrated in Figure 9.

There are innumerable examples of such technologies that have never seen the light of the day. A provision in the IPR policy allowing individuals/startups/companies to acquire these patents on deferred royalty basis or a threshold model that shares profit after a significant revenue or market size to the market would be able to address such impediments.

India has been successful in enabling the research spirit in terms of the number of publication but an ecosystem of "Patenting, Publishing, and Prospering" instead of just 'Publish or Perish' is the yet to gain supremacy.

**Demand side**

On the other hand, India has a significant number of MSMEs<sup>8</sup>, using outdated technology or no technology and conventional process, while state of the art research facilities established using public funding are isolated and underutilized due to the lack of industry problem statements.

A large number technology patents developed and owned by Universities do not get translated into commercial applications given the gap between the academia-industry interface researchers also face a dearth of industrial problem statements to work upon and any research output undertaken under such circumstances would necessarily lead to

journal publications and not industry and economic applications.

To better understand these issues, consider Uttar Pradesh (India) one of the largest states in the country, having a high concentration of SME's (11.24%). These range from traditional arts and crafts to modern manufacturing units. UP is the home of significant resources in this regard with every 4th person in U.P being a craftsman and the fact that UP contributes nearly 10% of the GDP in SME sector. Craft is also the 2nd largest sector after agriculture in terms of employment generation in the country.

Given the fact that globally MSME sector constitutes over 90% of total enterprises and credited with highest rates of employment growth, industrial production and exports (Foundation for MSME Clusters, 2013), leveraging the existing strength of UP in these sectors will accelerate UP's economic development. As per available statistics (4th Census of MSME Sector), this sector employs an estimated 59.7 million persons spread over 26.1 million enterprises.

It is estimated that in terms of value, MSME sector accounts for about 45% of the manufacturing output and around 40% of the total export of the country (Foundation for MSME Clusters, 2013). MSMEs in Uttar Pradesh have flourished due to the efforts of small time entrepreneurs, locally available resources and labor skills in the absence of any formal structure for training, up-gradation or support. They lack a global competitive edge against the highly quality products from similar enterprises in other technologically advanced countries.

In spite of having largest number of enterprises in the country, Contribution to the GDP lags behind, UP comes at fourth place after West Bengal, Kerala and Tamil Nadu with only 10% of total GDP from SMEs. This can be justified by the fact that about 50% of the organizations in the state do not have access to power but are manually operated, using either no technology or outdated technology. There is a critical

<sup>7</sup>GERD is abbreviated for Gross Expenditure on R&D

<sup>8</sup>MSME is abbreviated for Micro, Small and Medium Enterprise



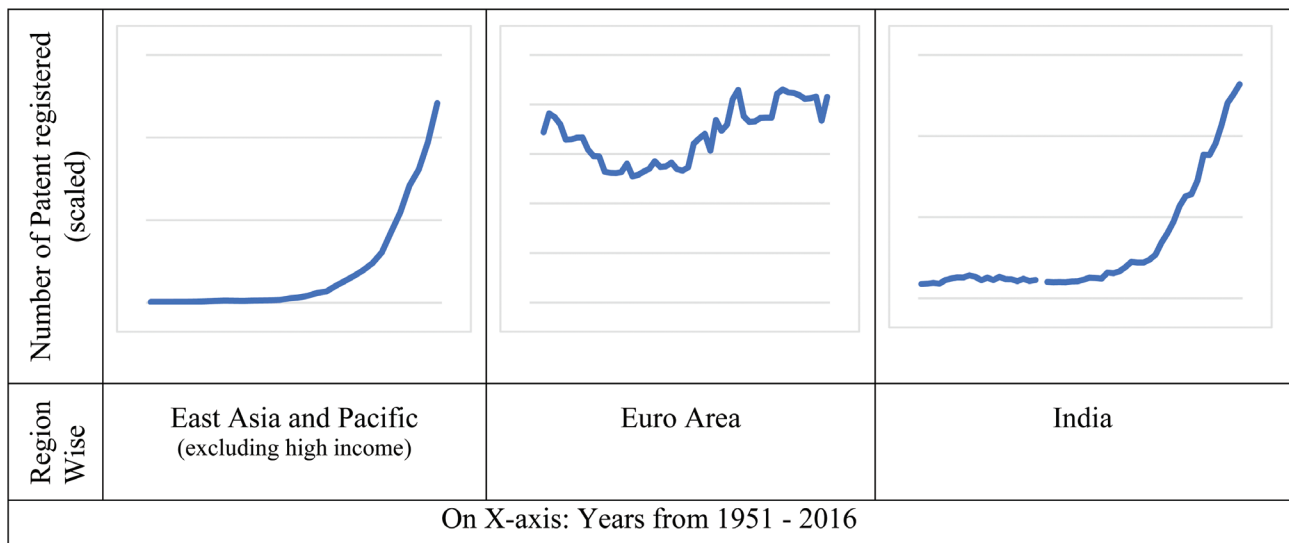


Figure 8: Region wise pattern of the number of patents registered over 1959-2016

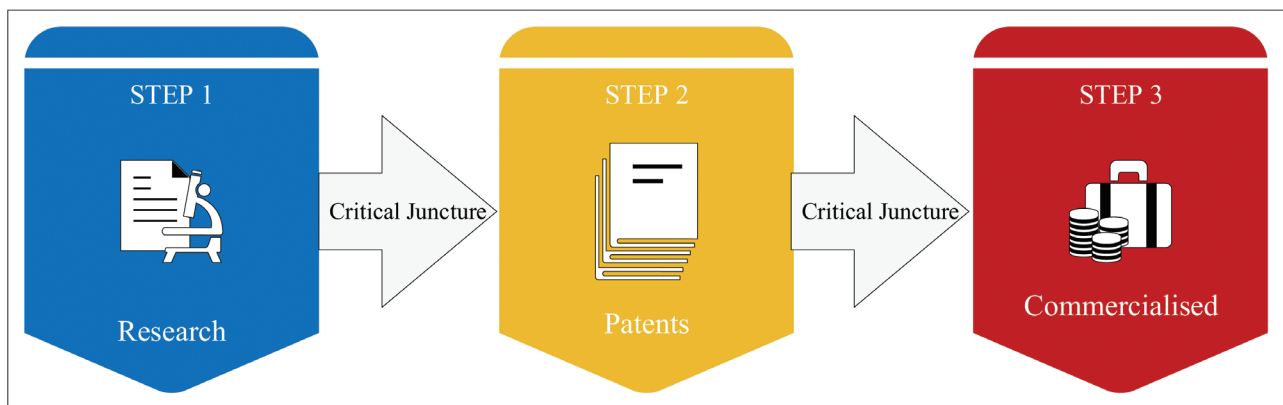


Figure 9: Critical junctures in technology translation

need of technology and financial intervention for modernization to explore the significant latent potential of this sector. MSMEs are not languishing but strategic technological interventions utilizing technology developed in academia for up-gradation of MSMEs can change the informal sector into an inclusive sector with increased productivity and high dividends with very little investment from the state.

### Proposed way forward

Bruneel et al. (2010) identified collaboration experience, breadth of interaction, and inter-organizational trust as factors diminishing barriers in UI collaboration, which can be achieved by Incubation program and Industrial research parks con-

verting research to product/service and promoting its commercialization. Bhaskar & Phani (2017) advocates for a policy design that enables a robust Business Incubation engagement that leverages the individual strengths of each stakeholders across this network in the innovation ecosystem.

The below proposed institution, BSM, is having its theoretical underpinning in the Quintuple Helix model detailed in previous sections. This inclusive model will help in overcoming the challenges and bridging the critical junctures in UI linkage.

### Business Support Mechanism (BSM)/ Maneuvering Centers

State should encourage and fund new incubators, accelerators and other start

up ecosystems in both academic and research organizations to bridge the gap between knowledge creators and users. To this end proposals to be invited on a rolling basis with specific funding models and mechanisms within a specific time frame to actualize the same. The location of these entities in academic and research organizations addresses the most critical component of access to high end prototype development, fabrication and testing facilities a start-up or an entrepreneur would need to actualize his innovative ideas into reality at little or no cost by leveraging the high-end infrastructure already available and underutilized at many of these institutions.

Industry cluster associations, marketing federation, new incubators and science parks are existing business support institutions. State shall also implement dedicated multiple Business Support Mechanism (BSM) proposed by IIT Kanpur as a part of draft startup policy to the state of UP. These institutions will enable the all five stakeholders (UIG, Civil Society and Nature) in quintuple helix model, which will essentially accelerate the technology development, management and smooth translation leading to sustainable socio-economic development and wealth generation.

A grass root level approach wherein BSM will crowd source and float projects on behalf of BEs and work in tandem with research institutes to hand hold the process through all the challenges BE's face at critical junctures in actualizing the same.

This generic Institution for BEs whose dependence on the knowledge ecosystem is critical for their survival and attaining global competitiveness both in short and long term. The design of BESM should incorporate overlapping organizational boundaries and be a highly inclusive framework bringing together eminent persons from academia, industry, civil society and relevant government departments.

BSM should assume to role of a catalyst by bringing together identified projects and relevant KPIs (Knowledge Partner Institutions) for product/process improvement. BSM should either directly or indirectly facilitate filing, protecting and managing Intellectual Property of product/services so developed. BSM should be an active intermediary facilitating and ensuring financial needs of these entities are met and assist in implementing/

commercializing the BEs product/services. A pictorial representation of BSM is provided below in Figure 10.

This state sponsored body should either be autonomous or a SPV (special purpose vehicle) and state should fund it for at least five years and targeted to be self-sustainable in the long term. BSM should hold at least a nominal percentage of equity stake in producer organizations, so that BSMs will be having inherent interest in the success of NBEs and these revenues will be allowing them to become self-sustainable in the long run.

The revenue model of these institutions will consist of rents and commissions for branding to be able to meet or subsidize the initial operational costs and the revenue flows from the equity holding NBE's will assure long term sustainability. Depending on the success of these institutions they

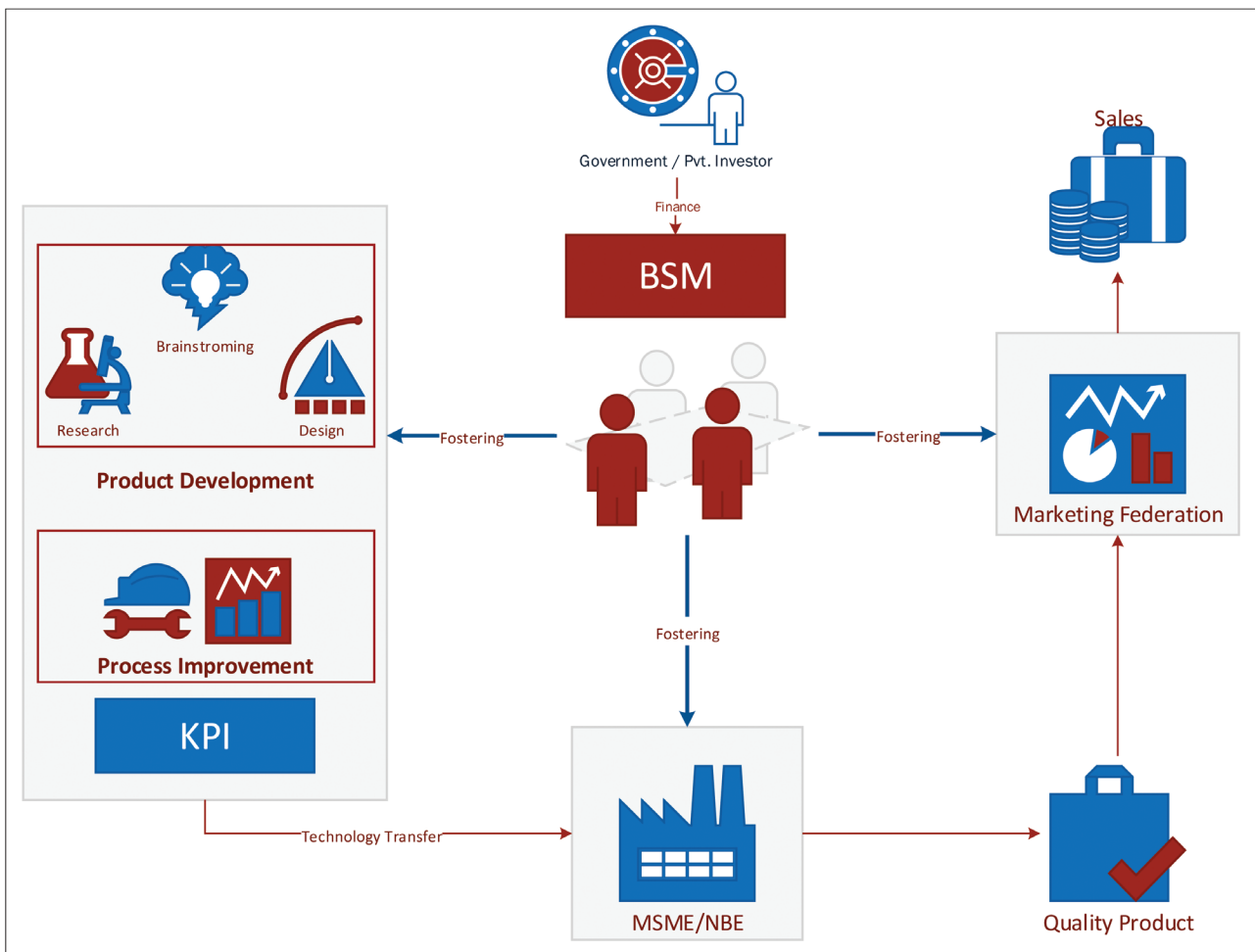


Figure 10: Business Support Mechanism (BSM)

may in the long run be converted and operated under a PPP model.

### New product development

BSM should also be instrumental in sponsoring MSME identified R&D projects in collaboration with MSME at the state and central research institutes. This will lead to bringing together the knowledge and expertise of these institutions in providing solutions and developing innovative products and improved processes at a lower cost and higher quality ensuring that MSMEs attain and remain globally competitive.

### University-Industry (UI) linkage

In addition to the above BSM should also ensure the engagement of industry with university in terms of an exchange and capacity building program wherein researchers from both sides can work together for extended periods either at the industry or the university. This dynamic exchange mechanism will go a long way in bridging the gap enumerated as the 'Mars & Venus' problem in Table 1 above.

### Certification

Certification and the cost of certification is a major impediment for the development and growth of MSME's and BSM's should be able to facilitate the same by directly funding new product quality certification or may issue itself 'innovation certification' for enhancing their competitiveness. BESM should in the initial phases of market penetration should assist in digitally branding and marketing these certified quality products.

In principle, these institutions combine the roles and skill sets of an incubator, research institute and marketing federation and will significantly reduce the failure rates of entrepreneurial ventures and motivate more and more individuals to take up the role of entrepreneurs in diverse strategic domains.

### Developing and sustaining an innovation ecosystem: A case study<sup>9</sup>

The following paragraphs elaborate the experiences of an 'Institute of National

Importance' like Indian Institute of Technology Kanpur (IITK) in developing and sustaining and Innovation Ecosystem over the last one decade. IITK currently houses 11 incubators, 5 prototype development and testing labs in all domains of science and engineering and this ecosystem currently has a 100,000 sq. ft. of foot print and is being augmented by an additional foot print of 220,000 sq. ft. to support the same. This ecosystem is supported by high profile Mentor Advisory Group (MAG), a highly efficient IP protection and management system and a highly skilled accounting and compliance management support mechanism.

It currently houses around 50 startups and has 452 patents in its portfolio out of which around 10% are either translated or commercialized. It graduated around 50 companies whose combined net worth today stands at 800-1000 Crores.

Since its inception, this Innovation and Entrepreneurship Ecosystem (IEE) has undertaken the role of a nodal agency for all Entrepreneurial, IP Management, Translation and Commercialization activities within and outside the institute. With over 20000 industrial units of innovate Leather, Saddlery, Machine tools, chemicals, fertilizers, cement, artificial limbs, Handicrafts, automobile parts, textile, plastic parts, agro, Large units, medium sized units, Navratna companies, Large defense/ordnance/arms/equipment manufacturing units are there in Kanpur, gave IEE a fertile landscape for sharing its knowledge to assist these industries and entrepreneurs in terms product development and process improvement having a high impact.

IEE also provides professional aid to the IITK faculty and students for filing patents and copyrights. Besides, this it also facilitates the use of IITK IP if desired by a start-up. The terms and conditions for such IP licensing are decided by the Institute. Since its start in 2002, the center has, so far, filed over 452 patents, out of total about 56 patents, have either been translated or successfully commercialized.

IEE also facilitates the modification and upgradation of the software/products developed by the faculty/students of IIT Kanpur to suit the industry requirements with the help of a commercial partner. The concerned faculty member acts as a mentor. The commercial partner is also responsible for marketing the product and providing customer support.

There are many other initiatives that have been taken by institute towards enabling the UIG interaction further like:

- Exposing students early to innovation and entrepreneurship paradigms
- Getting patents from undergraduate projects
- Industry connect talks and seminars
- Educating the faculty on legal and IP issues
- Industry Assisted Credit Based Courses
- Summer Undergraduate Research & Graduate Excellence Program (SURGE)
- Expert in Residence (Industry & Academia)
- Resident Scholars (Industry & Academia)
- Centers of Excellence Industry Research (PPP Models)
- Promotion of Work Experience and Research (POWER)
- Sponsored Academic Degrees from Industry Problems
- CSR & Tax Incentives
- Leveraging alumni network
- Industrial internship/sabbaticals programs
- Non-academic tinkering platforms/ Hands-on laboratories
- Openly discuss intended benefits, requirements and risks
- Consider which mode of collaboration best fits the intended objectives
- Negotiate professional contracts on IP, confidentiality and publications
- Retain full transparency on terms and conditions
- Sensitize the community/group towards confidentiality and IP rules

<sup>9</sup>For more detailed knowledge and information about the innovation ecosystem at IIT Kanpur, Readers are encouraged to read the book-section (Khandekar & Phani, 2017).



- Acknowledge and celebrating success
- Building relationship through mutual trust, respect and avoiding confrontation

IEE initiated a mutual give and take model and created a successful UI interface mechanism benefitting all stakeholders. Faculty, Students and Researchers benefited from a greater exposure to Industrial challenges, Intellectual capital Synthesis and Translational and Applied Research. This interface allowed the 300 faculty to be able to provide technical help and managerial assistance on average to 200 industry projects every year (2011-2015) and the number is ever increasing, and this assistance has been deployed at a significantly subsidized cost to the industry (Figure 11).

Given the well-developed entrepreneurship and innovation eco-system at IITK a logical extension would be the enhancement of the UI integration with increased research funding from industry and good

quality impactful implementable research and establishment of an Industrial and Translational Research Park. The establishment of the same is currently underway, with significant support from Department of Science and Technology, Ministry of Human Resources Development and industry partners and would be fully functional by the end of 2019. This park is aimed at enhancing the existing industry interaction, contributing significantly to academic value addition, acquiring large projects requiring technology intervention, handholding ancillary industry, MSME's, clusters, entrepreneurs, start-ups. It provides a State-of-the-art environment and infrastructural support to industrial research and will act as an Innovation and entrepreneurship hub in the region.

This park has been conceptualized by IEE management, the parent institute IIT Kanpur and state government as a partner. The additional IEP Park currently under proposal stage at Lucknow the state capital will also augment IEE's capability in addressing the challenges faced by MSME's and Clusters in the state of UP and surrounding regions.

Special entrepreneurial focus will be made in areas which need vital attention, looking into the socio-economic spectrum of the Gangetic belt, such as non-conventional energy sector, machine tools, ancillary units, artisans, rural technology, and bio-agro technology.

Provide all possible infrastructural and technological support to industrial partners and prospective entrepreneurs.

The institute, through its S&T Parks (in campus and out of campus), will strive to coordinate its activities with major stake holders for effective implementation of plans under the available policy framework.

The setting up of this distinctive facility would provide considerable competitive edge to the institute, in the emerging global scenario. That will catalyze a paradigm shift in R&D operations and hence its output.

**Learnings and way forward**

IITK have emerged as an Innovation Hub in an academic setting in the region. These efforts towards development of such innovation ecosystem also got acknowledgement in the form of National Award for Technology Business Incubators for the year 2011. IEE is continuously growing in both scale and scope with increased industries' engagement impact

The extant interactions with the Industry provided critical inputs for the facilities or services they are seeking from the ecosystem. This has helped in conceiving the expansion of ecosystem and in this direction, a state-of-the-art Industrial and Translational Research Complex has been envisioned. The complex is to provide easy access to R&D infrastructure, equipment, laboratories and is to provide technical knowledge base to both the Industry in terms of improving their products, process and services and to academia to create a self-sustainable and affordable industrial research ecosystem in the institute.

**Summary and outlook**

Historically, the role of universities as knowledge collation, creation and communication hubs, providing advisory services to government charting their technology road maps for protecting their existing hegemony, global competitiveness and dominance cannot be gainsaid.

This role and the model of contribution and their linkage to society has evolved significantly over the last few decades due to the acceleration in technological changes and diversity in the technological landscape. Irrespective of the model adopted, the role of the evangelism in making these initiatives a success cannot be gainsaid.

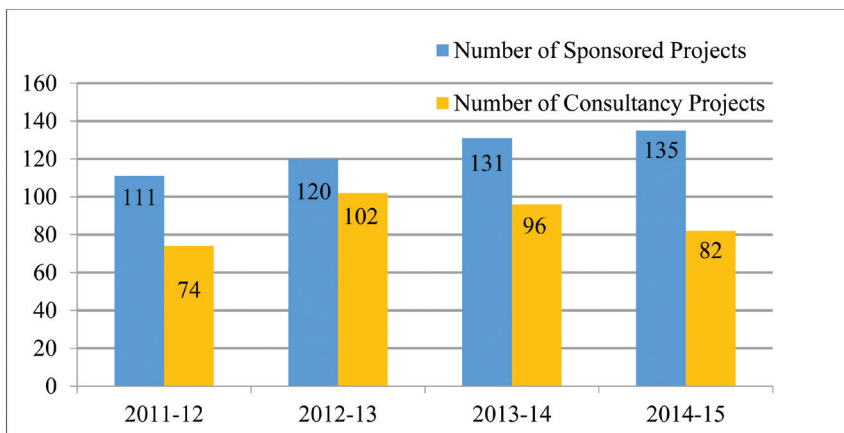
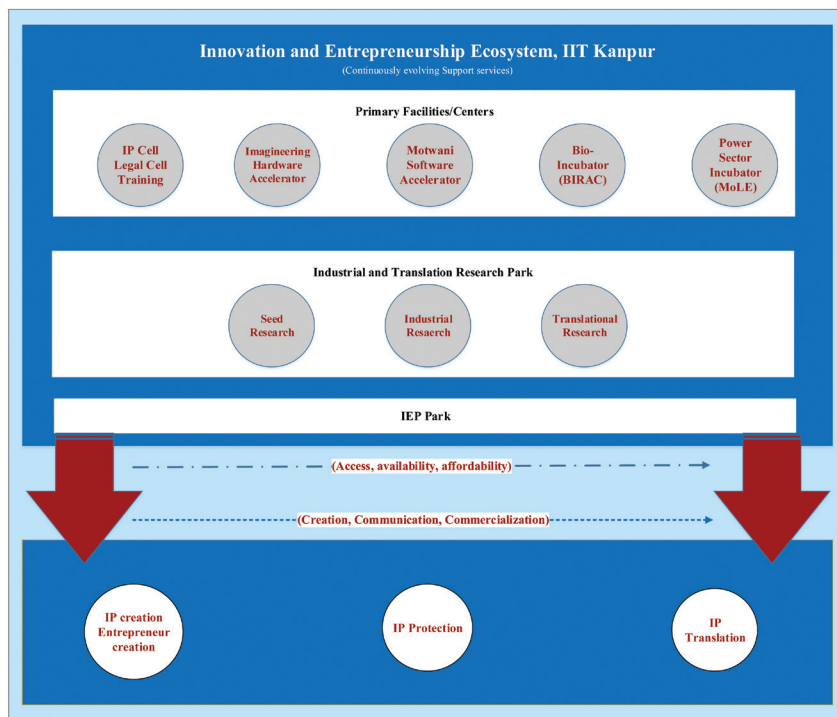


Figure 11: Present status of industrial collaboration of IIT Kanpur





**Figure 12: Innovation and entrepreneurship ecosystem, IIT Kanpur**

Universities not only need to collaborate with all stakeholders of innovation (university, Industry, government, civil society and environment) but also partner with overlapping institutional boundaries to form hybrid organizations. These individual stakeholders have a very critical role in the success and sustainability of any innovation ecosystem.

Academia's role has changed significantly over the last one decade as states focus has migrated towards knowledge economies. Knowledge hubs like, higher institutes of learning, universities and research institutions have moved towards facilitating and promoting entrepreneurial aspirations in addition to creating knowledge workers. Academic Institutions need to move away from the culture of 'Publish or Perish' to 'Patent and Progress' model. This change is also visible in many institutes of higher learning but yet to percolate to all academic institutions.

Accelerating this change needs government intervention and support in terms of both policy, institutions, incentives and funding for an economy to fully leverage its existing human, technology and resource strengths.

This would enable universities to become engines of transformation driving socio-economic growth. Industries have to learn to work with Universities in encouraging and sustaining an Industry relevant element in IP creation, prototype development and testing. They should continue to leverage their inherent strength and knowledge in production, financing and trading to translate this IP for the benefit of the economy and society, while deriving financial benefit in the process. State's role should be more of an enabler and facilitator in terms of funding, infrastructure building, and ensuring sustainability from socio-economic perspective rather than a pure academic or economic perspective.

UI linked platforms have a definitive role to play in this scenario. These platforms will intermediate and facilitate both Academia to work on real time industries' problems and Industries to have a profound knowledge partner delivering proprietary product, improved process, industry standard services, disruptive business and innovative marketing model to help them being competitive sustainably. As a consequence, such platforms will deliver highly skilled manpower, generate

employment, alleviate poverty and yield potent solutions to the socio-economic challenges resulting in improved quality of life and poverty.

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### Technology and Innovation Report 2018

#### Harnessing Frontier Technologies for Sustainable Development

The *Technology and Innovation Report 2018: Harnessing Frontier Technologies for Sustainable Development* published by UNCTAD notes that change is becoming exponential thanks to the power of digital platforms and innovative combinations of different technologies that become possible every day. This opens exciting possibilities for the democratization of frontier technologies to materialize in development solutions. The Report proposes strategies and actions, some of them based on existing experiences in STI policy for development, and some more innovative ones to make technology an effective means of implementation of our common development agenda – nationally and globally. According to the report, frontier technologies are converging through the increasing use of digital platforms to produce new combinatory technologies, accelerating the pace of change across multiple sectors.

The Report suggests that countries develop policies to help people navigate the transition period that lies ahead. This may require that stakeholders adapt the social contract to the new world that frontier technologies are forming. Education will become an even more indispensable lever for development and social justice. Since digital technologies as enablers and multipliers of other frontier technologies we should ensure that all – and specially women and girls – are given a real chance to build digital capabilities. Lifelong learning will need to be supported. For those who may struggle to keep up with the transformation, countries will have to be innovative in providing effective social protection mechanisms.

The report presents examples of how frontier technologies can improve lives in developing countries:

- Big data analysis is helping to respond to outbreaks of deadly diseases: during a typhoid outbreak in Uganda, for example, the Ministry of Health used data-mapping applications to facilitate decision-making on the allocation of medicine and mobilization of health teams; and develop insurance products for small-scale African farmers.
- 3D printers are being used in developing countries to produce prosthetic limbs that are custom-built and cheaper.
- Artificial intelligence is reading digital scans more accurately than doctors, freeing them for care in which the human touch is important.
- Internet-of-things (IoT) devices are allowing farmers to monitor soil conditions to decide when is the best time to plant.

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# RISE OF FINTECH BUSINESSES IN SOUTHEAST ASIA TO TACKLE FINANCIAL ISSUES

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## Abstract

In recent years, there has been a global trend toward the convergence of finance and Information Technology (IT) in the form of fintech, leading to the emergence of various financial services. In Southeast Asia, this has led to the rise of numerous fintech businesses, especially those that approach financial sector issues in Southeast Asia as business opportunities. These businesses, many of them led by start-ups, are using technologies and business models that originated in developed countries and China as problem-solving tools. They combine high-tech and low-tech approaches according to local conditions, by introducing cutting-edge technology while also keeping traditional methods. Governments are also looking at fintech in terms of their potential to contribute to the solution of policy issues, financial inclusion in particular.

## Introduction

A growing number of fintech-related businesses are emerging in Southeast Asia, many of them utilizing the Internet and smartphones, in conjunction with their usage spreading rapidly in this area. One of the key players of this fintech boom, along with financial institutions and telecom companies, are start-ups. Fintech start-ups have evolved both in numbers and influence. They offer a wide range of services, including e-payments, lending, cryptocurrencies, and money transfers.

## The significance of fintech for Southeast Asia

In the emerging markets of Southeast Asia, there is ample scope for the development of fintech businesses. This is because of the potential of fintech to solve the many issues affecting the financial environment in these countries.

In developed countries, the level of financial services available is already relatively high, which means that the improvements provided by fintech solutions are generally only marginal. While fintech can

enhance usability of the customers or yield cost savings for financial institutions, so far it has not triggered any dramatic changes to the financial industry. Blockchain technology has that potential, but full-scale practical implementation is still some distance in the future.

This contrasts with the situation in Southeast Asia, where fintech has the potential to have a major impact in finance. The region's financial systems are underdeveloped, and in many countries there is considerable room for improvement through the use of fintech. Various things that were previously difficult can now be achieved with fintech, and the benefits gained from these new possibilities are substantial. Similar factors explain the surge of fintech in China and India.

Another factor that affects the scope for the emergence of fintech businesses is differences in the regulatory surroundings. In developed countries, financial activity is subject to stringent regulation, which tend to create barriers when fintech start-ups try to introduce pioneering initiatives. In contrast, many Southeast Asian countries offer an environment in which fintech start-ups

can operate freely because their regulatory systems are either relatively relaxed or have not yet been established.

## Key financial issues

What specifically are the issues affecting the financial environment in Southeast Asia? Most of them are common to developing and emerging countries.

First, there is a significant population of people who have problems in terms of identity verification and credit checking, especially among the low-income. From the perspective of banks, providing services to these people is both difficult and expensive. A significant number of people have no documents that can be used to verify their identities, and even if they are available, their authenticity is questionable. For example, in Indonesia all citizens over the age of 17 possess an ID card (Resident Identity Card), but because of inadequacies in managing the system, fraud is not uncommon. Some people possess multiple ID cards, while there are occasional cases of forgery. For this reason, banks need to ask for multiple identifying documents and spend time verifying them.

In addition to the difficulty of identity verification, assessing creditworthiness is further complicated by the inadequacies of credit information systems in Southeast Asia. According to World Bank figures (2017), credit bureau coverage (the larger of either public or private, % of adults) is around 50% in Thailand, Indonesia, and Viet Nam, and only 8% in the Philippines<sup>1</sup>.

Also, the financial needs of low-income earners, whether deposits or loans, tend to involve small amounts, leading to higher operating costs for the providers of these services. As a result, banks have been reluctant to offer financial services to low-income individuals and have

<sup>1</sup> World Bank Open Data. <https://data.worldbank.org/> (accessed April 25, 2018).

concentrated their branch and ATM networks in urban areas. They have also been charging account maintenance fees, and have applied strict terms and high interest rates to loans. Another factor is low financial literacy among low-income people. For these reasons, formal financial services have not been widely available to people in these countries.

These developments have led to the following issues in Southeast Asia.

- Low bank account holdings
- Limited access to bank loans and credit cards
- Low utilization of banking services
- High rate of cash-based transactions

### What fintech can bring to finance

What specifically can fintech achieve that were not previously possible?

First, fintech has transformed mobile devices, such as smartphones, into portable ATMs, allowing users to access basic financial services without needing to go to bank branches or ATMs. In addition, it is now possible to use mobile devices to make payments, both online and face-to-face. The funds that can be used for these mobile payments is no longer limited to money tied up in bank accounts and credit cards, thanks to the emergence of electronic money, which can be used even by people who have no bank accounts or credit cards. With QR code payments<sup>2</sup>, accepting electronic payments has become possible at low costs, making this method attractive to retailers that handle small-ticket items, such as street vendors.

At the same time, fintech has made it possible for financial service providers to acquire customer information more easily and at a lower cost than in the past. Identity verification processes can be completed more quickly and no longer need to be carried out at specific locations, thanks to new methods such as image capturing of documents. The use of biometrics is also leading to faster processing and cost reduction.

In addition, financial service providers have greatly expanded the range of information that they can acquire about both individuals and businesses by tracing their digital footprints. For individuals, the content of their social media posts, the types of goods they buy through e-commerce and the sites that they access can to some extent be used to gauge their incomes and personal characters, such as whether they are responsible enough to repay loans punctiliously. Digital footprints can also be used to assess the creditworthiness of SMEs (small and mid-sized enterprises), which is usually difficult if you rely on conventional means. The financial position of an SME that has opened a store on an e-commerce site can be ascertained from various data such as sales figures, deposits to and withdrawals from payment accounts. Methods have been developed to allow rapid, low-cost credit checking by automatically collecting and analyzing vast amounts of data without human intervention.

### Characteristics of Southeast Asian fintech businesses

Some of the fintech businesses that have emerged in Southeast Asia are not much different from their counterparts in developed countries. However, there are also many businesses with characteristics that are unique to Southeast Asia and emerging countries. Overall, the following three characteristics can be observed.

First, many of these businesses have been established to solve problems. This reflects the numerous issues that the Southeast Asian financial sector faces. Founders of fintech start-ups in this area tend to begin not by thinking about what they can achieve with fintech, but by identifying problems and considering whether they can use fintech to solve them.

Second, the underlying technologies and business models utilized in fintech businesses in Southeast Asia are generally not developed in the region

but are instead imported from developed countries and China. Southeast Asian entrepreneurs identify financial issues in the region and scour the world for fintech technologies and business models with the potential to solve those issues. They then integrate them into their own business operations. From another point of view, which relates back to the first characteristic of these businesses, fintech is considered a tool for solving problems. Little importance is attached to where the technology was originally developed or whether it is simply a rehash of another technology.

Third, the fintech businesses in Southeast Asia employ models that combine both high-tech and low-tech methods. Emerging markets such as Southeast Asia are able to enjoy the “Leapfrog Effect,” that is, instead of making progress gradually by introducing technology in stages, they can shortcut intermediate stages and achieve rapid evolution by introducing the latest technology. Southeast Asian fintech businesses have thus leapfrogged and adopted cutting-edge technologies and business models. However, at the same time they also retain traditional methods that seem unsuited to the digital age from the perspective of developed countries. For example, fintech companies that provide mobile payments usually do not offer all services digitally but also through brick-and-mortar small retailers in local communities. One reason for this is the difference in the speed in which digital and non-digital businesses have evolved in Southeast Asia; that non-digital areas have not kept up with digital, resulting in gaps that usually do not exist in developed countries. A good example is that many people do not have bank accounts, a basic necessity from a developed country’s point-of-view, even though they own such high-tech gears as smartphones.

The following section will look at fintech businesses that illustrate these characteristics.

<sup>2</sup>With QR codes, payment is completed by scanning a QR code with a smartphone. Shops can store QR codes on smartphones, or simply print them on cardboards, and allow customers to scan them using smartphone apps. Alternatively, customers can install apps on their own smartphones to display QR codes identifying their payment information. The shops can then use smartphones or dedicated devices to scan the QR codes.



## Mobile payment services

### (a) Typical scheme

Mobile payment services that have emerged in Southeast Asia are basically the same as those in developed countries. However, one feature in Southeast Asia that is not common in developed countries is the availability of measures that can be used by people who do not have bank accounts. As in other emerging and developing countries, most mobile phones are prepaid types, for which call charges must be paid in advance. Users top up from bank accounts, or in cash through local retail outlets and convenience stores. Many of the mobile payments have features that you can load electronic money in the same way.

### (b) Case study: MoMo<sup>3</sup>

MoMo is a payment service in Vietnam operated by the start-up M\_Service. MoMo was born out of two trends in Vietnam that was perceived as a great business opportunity. The first was that most low-income people were unable to access financial services. The second was that smartphones were rapidly becoming common in Vietnam, including rural areas. Initially M\_Service provided payment services using SIM cards, but in 2014 it switched to its own mobile payment app called “MoMo”<sup>4</sup>. The app can be used to load electronic money and carry out various transactions relating to electronic payments, including money transfers between individuals, utility charge payments, online shopping payments, and airline ticket reservations.

In response to the current environment in Vietnam, M\_Service’s target user base includes not only people with bank accounts, but also people with bank

accounts but no local access to bank branches or ATMs, people without bank accounts, and even people who do not own smartphones. To meet the needs of this broad customer base, M\_Service has established a network of around 4,000 agents throughout Vietnam. These agents enable people who cannot go to bank branches or ATMs as well as people without bank accounts to load prepaid electronic money for their mobile payments, and to receive cash transferred to them. Those who do not own smartphones can have the agents use their mobile payment facilities to transfer funds or pay utility charges on their behalf.

Currently about one-half of MoMo customers are users of mobile payment services, while the other half use agent services. The company’s approach reflects the situation in Vietnam, where customer needs for financial services cannot be met solely through mobile devices. They even offer a feature that allows users to find the nearest agent using the GPS function on their smartphones.

In rural areas of Vietnam, post offices play an important role in providing financial services, such as remittances and payments, for people who do not have bank accounts. However, these services are not entirely customer-friendly. For example, counters normally close at 5 p.m., and remittances take 3-4 days<sup>5</sup>. MoMo agents have longer operating hours than post offices, and remittances reach recipients instantly.

In November 2017, M\_Service entered into a partnership with Vietnam Sun Corporation (Vinasun), a major local taxi operator and announced several new services<sup>7</sup>. One of them is that passengers on Vinasun taxis are able to pay with electronic money

through the MoMo app by using their smartphones to scan the QR codes provided by the drivers. Another is passengers who book taxis with the Vinasun app can choose to link with the MoMo app so that they can pay automatically.

In addition to service content, M\_Service claims that it has made security a priority with the MoMo system. It meets the PCI DSS (Payment Card Industry Data Security Standard) and has also adopted layered security measures, such as one-time password verification, and SSL (Secure Socket Layer).

## Mobile international remittance services

### (a) Typical scheme

A significant number of people work overseas in Southeast Asian countries, especially in the Philippines. These people generally remit funds each month to their families in their home countries, primarily through money transfer operators such as MoneyGram and Western Union. Many expatriate workers do not have bank accounts, and even those that do are eager to avoid the high transfer charges levied by banks<sup>8</sup>. With money transfer operators, transfers commonly involve time-consuming manual processes, and it takes time for the money to reach the recipients. This situation has recently led to the emergence of services that allow people to remit money overseas easily at low costs using mobile devices.

### (b) Case study: Toast<sup>9</sup>

Toast provides international remittance services that allow Philippine people working in other countries to send money back home using mobile devices. The service is provided by Toast, a Singapore-based startup, and is currently available in

<sup>3</sup>The main source for this part is the MoMo website. <https://momo.vn/> (accessed April 24, 2018).

<sup>4</sup>“How a fintech outgrew banks in the mobile wallet market in Vietnam”, *The Asian Banker*, May 11, 2017. <http://www.theasianbanker.com/updates-and-articles/how-a-fintech-outgrew-banks-in-the-mobile-wallet-market-in-vietnam> (accessed April 24, 2018).

<sup>5</sup>International Finance Corporation, “E- and M-Commerce and Payment Sector Development in Vietnam”, December 2014, p.14.

<sup>6</sup>Vietnam Post is currently digitizing its financial services in an effort to overcome these issues.

<sup>7</sup>“Vinasun, MoMo partner on smart payments”, *Viet Nam News*, November 17, 2017. <http://vietnamnews.vn/bizhub/417696/vinasun-momo-partner-on-smart-payments.html#k7KJEDzukU3iMyC1.97> (accessed April 24, 2018).

<sup>8</sup>According to a World Bank survey, the average money transfer costs in 1Q/2018 were 10.57% for banks, 7.44% for post offices, 6.27% for money transfer operators, and 3.06% for mobile operators. (World Bank, “Remittance Prices Worldwide”, Issue 25, March 2018)

<sup>9</sup>The main source for this part is the Toast website. <https://toastme.com/sg> (accessed April 24, 2018).

Hong Kong and Singapore, but the company aims to increase the range of countries in the future. The co-founder and CEO is Aaron Siwoku from the United Kingdom. He had the idea for the service after seeing Philippine women waiting in long lines to send money home and noticing that they all had smartphones in their hands<sup>10</sup>.

The person making the remittance loads the funds through a smartphone app and then completes the transfer process. There are multiple ways to load funds, including transferring from a bank account. Users can also make deposits in cash at affiliated stores. To use this method, the person wishing to make a remittance first scans identification documents into his or her mobile phone and then goes to the affiliated store to hand over the cash. This saves time, since confirmation of identity, which previously had to be carried out in the store, can now be completed in advance on a smartphone. Another advantage of this system is that it is based on a familiar remittance method and is therefore easy for users to accept<sup>11</sup>. A method that would allow the entire process to be completed on a mobile device would be more convenient, but there is a risk that existing customers would not use such a service because of psychological resistance to new ways of doing things.

Recipients in the Philippines can choose from three methods for receiving remittances. They can have the money sent to the Toast app or to their bank account, or obtain cash at an affiliated retail outlet. This means that the service can be used even if neither the remitter nor recipient has a bank account. The service fee is set low. In the case of remittances from Hong Kong to the Philippines, there is no fee when using the Toast App, while a charge of HKD15 (about USD2) is levied when funds are transferred to a bank account, and HKD19 (about USD2.4) for transfers to an affiliated retail outlet.

Toast plans to use the data accumulated through its remittance services to start a lending business for overseas workers. By monitoring monthly remittance amounts, the company can estimate the incomes of overseas workers to some extent as the basis for determining their creditworthiness.

### Lending services based on the use of alternative data

#### (a) Typical scheme

Credit screening schemes based on the use of digital footprints as alternative data have emerged in Southeast Asia. Credit providers have developed these schemes themselves or purchased them from outside. The fact that credit is not widely available in Southeast Asia is attributable in large part to the inadequacy of credit information systems, which makes it difficult to assess the creditworthiness of potential borrowers. By using alternative data as the basis for credit checks, lenders are able to target new borrowers who were previously overlooked due to the lack of credit histories. In addition to the benefits for borrowers, this approach is also expected to allow credit providers to expand their customer bases.

#### (b) Case study: LenddoScore<sup>12</sup>

Lenddo, based in Singapore, provides personal credit scores, "LenddoScore" and identity verification, "Lenddo Verification" services to organizations such as banks, micro-finance providers, and credit card companies.

"LenddoScore", the credit score service is based on the perception that there are a certain number of people who are credit-worthy despite having no data registered with credit information agencies, and that the repayment capacity and commitment of such people can be ascertained to some extent by analyzing their digital footprints, since they generally own smartphones.

Lenddo launched a lending business in the Philippines in 2011 and subsequently expanded into other countries, including Colombia and Mexico. However, it sold the lending business in 2015 and has since specialized in providing services to third parties. It currently offers its services in over 15 countries.

In addition to data provided by credit information agencies, Lenddo also collects and analyses alternative data with the consent of the loan applicants. Using this data, it calculates a credit score (1-1,000, where a higher score indicates a higher credit rating) using its own proprietary method, and supplies this information to banks and other organizations. The types of data gathered include smartphone usage data, social media data, and psychometric data. For example, social media data include pages accessed on Facebook, LinkedIn, and Twitter, access frequencies, the number of friends, and the content of messages. If credit information agencies have data, those are also incorporated. Based on 12,000 data items per case, Lenddo calculates a score using an AI prediction algorithm. The process takes just three minutes.

Digital footprints are also used for "Lenddo Verification", the identity verification service, which can be completed in three seconds. Lenddo boasts that the system is highly accurate. According to Lenddo, other benefits include cost cuts as lenders can reduce the amount of documentation collected from customers, and the number of credit checks that need to be carried out by human staff.

### Expectations towards financial inclusion

Southeast Asian governments have taken a keen interest in the emergence of various fintech businesses in the region. Recognizing the potential of fintech to change the face of finance, governments are eager to ensure its sound development, so that it

<sup>10</sup>Jon Russell, "Toast lands \$1.5M for cross-border payment services for migrant workers in Asia", TechCrunch, November 10, 2016. <https://techcrunch.com/2016/11/10/toast-funding-cross-border-remittance-payments/> (accessed April 24, 2018)

<sup>11</sup>Kevin McSpadden, "Toast to become fully financial service platform for migrant workers", e27, November 10, 2016. <https://e27.co/beyond-remittances-toast-wants-to-become-full-scale-financial-services-platform-for-migrant-workers-20161109/> (accessed April 24, 2018)

<sup>12</sup>The main source for this part is the Lenddo website. <https://www.lenddo.com/> (accessed April 24, 2018).

leads to the improvement and advancement of their countries' finance systems. Governments in each country are implementing a range of measures, including the formulation of policies, the establishment of specialist fintech units within financial regulatory and supervisory agencies, and the introduction of regulatory sandboxes<sup>13</sup>. The governments have in particular strong expectations toward the potential of fintech to improve financial inclusion.

Low-income and lower-middle-income countries in Southeast Asia have problems relating to financial inclusion, specifically the fact that a significant number of people do not have access to financial services. Financial inclusion is a key policy priority in these countries because of its potential to contribute to poverty eradication and economic development. A variety of initiatives have been implemented over many years. Even in Thailand, a middle-income country where a relatively high percentage of its people have bank accounts, the government is committed to financial inclusion, as bank loans and insurance are not widely available. While Singapore has largely achieved financial inclusion, its government sees this as a problem for the entire region and is thus actively engaged.

Governments in various countries are promoting fintech as a way to achieve financial inclusion. Indonesia and the Philippines have adopted national strategies for financial inclusion, while Myanmar has drawn up a financial inclusion roadmap. Indonesia's strategy highlights the use of ICT, while the Philippines is focusing on the power of technology. Myanmar's roadmap points to the potential of mobile devices (Figure 1).

While Vietnam has not formulated a national strategy, the Deputy Governor of

<b>Indonesia</b>
National Strategy for Financial Inclusion Working Group, <b>“National Strategy for Financial Inclusion Fostering Economic Growth and Accelerating Poverty Reduction”</b> (2012) —Main fintech-related references— “Technology can enable some of the most important bottlenecks to be overcome and increase the supply of financial services.” (p.8)
<b>Philippines</b>
Bangko Sentral ng Pilipinas, <b>“National Strategy for Financial Inclusion”</b> (2015) —Main fintech-related references— “Use of technology and other innovations to reach the financially excluded” (p.8)
<b>Myanmar</b>
Making Access Possible Myanmar, <b>“Financial Inclusion Roadmap 2014-2020”</b> (2013) —Main fintech-related references— “Development of electronic payments will require the installation of essential payment, clearing and settlement infrastructure. This must remain a priority for the government.” (p.19) “Mobile is likely to play an increasing role in distribution by enabling new business models, and through mobile network agent especially in rural areas.” (p.21)

Source: Compiled by JRI from government releases in each country.

**Figure 1: Financial inclusion policies in three Southeast Asian countries**

its central bank has acknowledged the role of fintech, saying that “digital technology will help banks accelerate financial inclusion”<sup>14</sup>.

In fact, many of the fintech services that have emerged in Southeast Asia can lead to greater financial inclusion. As illustrated by the previously mentioned examples, even people without credit cards or bank accounts are able to benefit from various financial services by using mobile devices. The use of mobile payments can also encourage people to set up bank accounts. This expectation has been heightened by the success of the M-Pesa mobile money transfer service in

Kenya. The spread of that system has led to a major improvement in financial inclusion in Kenya<sup>15</sup>.

Mobile overseas money transfer services offer a way to send money overseas with lower costs than traditional methods. This reduces the financial burden on people working overseas and their families. Also, the increasing use of lending based on alternative data is improving access to loans for certain segments that were previously unable to obtain finance. This means, for example, that SMEs will be able to free themselves from a hand-to-mouth existence by obtaining loans to buy the latest equipment so that they can increase their earnings.

<sup>13</sup>Regulatory sandboxes are deregulated environments in which regulations are eased within a limited scope for a fixed period, giving companies the freedom to try out new business ideas, just as children can play freely in sandboxes.

<sup>14</sup>“VN financial inclusion focuses on tech”, Viet Nam News, May 20, 2017. <http://vietnamnews.vn/economy/376742/vn-financial-inclusion-focuses-on-tech.html#FULOuwwWjkKcY30A.97> (accessed April 24, 2018)

<sup>15</sup>Launched in 2007, the M-Pesa service is provided by the mobile phone company Safaricom. Its use has expanded rapidly among low-income people who have no bank accounts. M-Pesa has also acted as a starting point for the increasing use of mobile banking, including deposits and loans. The percentage of the adult population with no access to financial services has plummeted from 41.3% in 2006 to 17.4% in 2016. (Njuguna Ndungu, “Digitalization in Kenya: Revolutionizing Tax Design and Revenue Administration”, in Sanjeev Gupta, Michael Keen, Alpa Shah, and Genevieve Verdier, eds., Digital Revolution in Public Finance, International Monetary Fund, November 2017, pp.243-260.

Awareness of these benefits is prompting governments to promote fintech while also taking steps to ensure that fintech contributes to financial inclusion. In addition to initiatives to improve the usability of services, such as encouraging service providers to achieve interoperability between different mobile payment platforms, governments are also ensuring that users can access financial services safely through supervision, regulation, and the prosecution of fraud. Other government initiatives include educational activities to enable users to make the best use of financial services.

Southeast Asian countries are looking closely at financial inclusion policies in India. The Singapore FinTech Festival hosted by the MAS in November 2017 included a session on India, and the Indian Minister of Finance was one of the speakers. Identity verification in India has become easier since the introduction of a biometric national ID system called "Aadhaar"<sup>16</sup>. India has also launched the Pradhan Mantri Jan Dhan Yojana (PMJDY), a project to ensure that every citizen has a bank account<sup>17</sup>. Under this project, banks have agreed to provide savings accounts without charging account maintenance fees. By the end

of 2017, just over three years since the launch of the project in 2014, 300 million new accounts had been created<sup>18</sup>.

### Concluding remarks

This paper examined the developments of fintech in Southeast Asia. There are many issues related to finance in Southeast Asia that are viewed by the private sector as business opportunities. This is reflected in the continuing emergence of fintech start-ups trying to tackle these issues. Governments in the region are encouraging these developments.

Of course, many obstacles remain before fintech businesses can become firmly established in Southeast Asia and contribute to the solution of the region's financial issues. The sustainability of some fintech business models has not yet been tested. For example, the effectiveness of credit screening systems based on alternative data during an economic recession can only be proven when a recession actually occurs. There will also be fintech businesses that are viable when still small but struggle to maintain their viability as the scale of activities expands. It will take time to determine whether these businesses are truly sustainable.

Moreover, whether potential users of these new financial services will become active users is hard to predict. While strong dissatisfaction with the current state of financial services will certainly motivate people to use the new services, it is not easy to change long-standing customs and practices. In finance, as in any other fields, new things tend to be viewed with unease and suspicion. There is also deep-rooted anxiety about the security of online payment systems. To overcome these barriers, service providers will need to earn the trust of the users. This will require efforts by both the private sector and governments, including (1) the creation of mechanisms that allow potential users to try out new systems and assess their usability, (2) the establishment of both voluntary rules and laws/regulations, as well as security measures, to ensure customer protection and the soundness of transactions, and (3) educational activities to enable customers to use these new services effectively. Only when confidence has been built through initiatives such as these will fintech businesses be able to earn the trust of society and contribute to the solution of financial issues in Southeast Asia. ■

<sup>16</sup>"Aadhaar" is a Hindi word meaning "foundation."

<sup>17</sup>This means "Prime Minister's People Money Scheme" in English.

<sup>18</sup>Pradhan Mantri Jan Dhan Yojana website. <https://pmjdy.gov.in/> (accessed April 24, 2018).

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# BUILDING AN ENTREPRENEURIAL ECOSYSTEM FOR TECH START-UPS

## A CASE STUDY OF THE ROLE PLAYED BY A PRIVATE UNIVERSITY

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### Abstract

The promotion of entrepreneurial ecosystems for tech start-ups through policy initiatives is a recent development in India. As of now, tech start-up hubs are predominantly confined to Tier-1 cities, particularly Bangalore, National Capital Region (NCR) Delhi, Mumbai, Hyderabad, Chennai and Pune, and the emergence of tech start-ups in Tier-2 cities is an exception than a rule. This is primarily due to the absence of a conducive entrepreneurial ecosystem for nurturing tech start-ups. However, a private technological university in a Tier-2 city (Hubli) in Karnataka has slowly but steadily taken exceptional leadership initiatives towards the building up of a nascent ecosystem for generating tech start-ups. How did this happen? What results did it yield so far? Given the current scenario, what prospects does the ecosystem have for the future? This article explores and throws light on these issues.

### Introduction

University promoted incubation to assist the growth of spin-off firms through a dedicated facility providing subsidized space, consultation and other services and support to encourage technology entrepreneurship is a noted worldwide phenomenon (Etzkowitz, 2002). This is done through, what is commonly known as, Technology Business Incubators (hereafter TBIs). In fact, universities constitute one of the Triple Helices and TBIs form one of the indispensable components of an entrepreneurial ecosystem for technology based start-ups (Bala Subrahmanya, 2017a). TBIs provide a mechanism for technology transfer and commercialization for new venture creation (Wonglimpiyarat, 2014). Over a period of time, they have become one of the most successful tools to mentor start-up ventures (Jordan, 2010).

Today, TBIs are present in many parts of the world that facilitate development of regional innovations through industry-institute interactions (Thursby and Kemp, 2002). More often than not, TBIs are

sponsored and promoted by academic institutions/universities, mostly in fairly well-developed technology/innovation clusters which has a strong base of university research (Mian et al, 2016). However, they can also be found in institutions that do not perform basic research, but which have strong links with the infrastructure of science and technology and the commercialization of technologies (Breschi and Lissoni, 2001).

But, in an emerging economy, particularly in a city, which has the presence of neither a well-developed entrepreneurial ecosystem nor a strong university research base, initiating a TBI and thereby driving the creation of an entrepreneurial ecosystem for technology based start-ups is quite a challenge. The hurdles to bring together the ecosystem components for enabling ideation, commercialization of innovations and technology transfer for creating tech start-ups will be numerous and daunting, to say the least. Given this, how did a private engineering institution (which later became a full-fledged

university) overcome the multiple challenges towards creating a nascent ecosystem for tech start-ups in a Tier 2 city through the establishment of a TBI is interesting to examine and analyze. This is done by means of an exploratory case study for KLE Technological University (which was earlier known as BVB College of Engineering) in Hubli, Karnataka.

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, and relies on multiple sources of evidence (Yin, 2014). A case study is a complete analysis of an individual subject with respect to specific phases of its totality (Krishnaswamy et al., 2006). The advantage in using case studies as a method of business research is that they offer rich and reliable results due to the combination of both quantitative and qualitative data collection and analysis methods and the triangulation of information from multiple sources (Robson, 1993).

### Role of academic institutions and TBIs in an ecosystem for tech start-ups: A review of literature

The creation, sustenance and growth of a tech start-up involve a considerable degree of uncertainty and challenge to its founders/promoters, due to three important factors, which are as follows:

- (i) These tech start-ups are unfamiliar and without precedence and therefore suffer from the liability of newness;
- (ii) They are generally created on a small scale with limited resources; and
- (iii) They often, directly or indirectly, face established competitors, powerful suppliers, sceptic customers and hesitant financiers.

Given their limited internal resources and strength, they tend to depend on the local environment for critical resources which

are essential to sustain their operations (Romanelli and Schoonhoven, 2001; Bala Subrahmanya, 2015). Start-ups which are promoted in a structured and vibrant entrepreneurial ecosystem have higher chances of success compared to the rest, because such ecosystems have a positive impact on start-up fertility, stability and growth (Arruda et al., 2013; Cukier, 2016). A strong entrepreneurial ecosystem in a region will have the ability to promote technological innovations and development of business environment for the growth of tech start-ups in that region, which in turn, would promote employment generation and national income in an economy (Krajcik and Formanek, 2015). Due to these reasons, policy makers in the world's most dynamic areas explicitly focus on promoting entrepreneurial ecosystems for start-ups (Manzella, 2015).

Though several empirical studies have defined entrepreneurial ecosystems for start-ups in different ways, there are found to be some common components which are interlinked with one another in the process of start-up creation, sustenance and growth. In a broad sense, an ecosystem for start-ups is defined as a set of interconnected entrepreneurs (both potential and existing), entrepreneurial organizations (e.g., firms, venture capitalists, angel investors, banks), institutions (such as universities, public sector organizations, and financial agencies), and entrepreneurial processes (consisting of business births, number of high growth firms, levels of 'blockbuster entrepreneurship', number of serial entrepreneurs, degree of sell-out mentality within firms and levels of entrepreneurial ambition) which formally or informally consolidate to connect, mediate and govern the performance within a local entrepreneurial environment (Mason and Brown, 2013). Thus, a start-up ecosystem comprises entrepreneurs, different kinds of financial support such as debt finance, equity investments and grants, non-financial support in the form of incubation, acceleration support, mentoring and technical experts. In addition, it includes government policies and programmes relevant to start-ups, academia and other organizations which in different ways interact with start-ups (CII, 2015).

There are two unique entrepreneurial ecosystems for tech start-ups in the global economy which are often cited as the benchmarks, namely, Silicon Valley and Israel. Both have generated more successful start-ups than other nations could create in years or decades, and they are not identical but distinct in their respective ambiances (Arruda et al., 2013). This brings out that different nations with different economic environments, can build their own entrepreneurial ecosystems to nurture successful tech start-ups. There is no exact formula for creating an ecosystem, but there are only practical, though imperfect, road maps (Isenberg, 2011). This implies that it is not possible to replicate either a Silicon Valley or an Israel, rather what is significant is to identify and promote the key benchmark elements of an ecosystem for nurturing tech start-ups.

It is equally important to note that entrepreneurial ecosystem for tech start-ups is dynamic in nature. Ecosystems change from time to time, in terms of people, organizations and environments. This could be due to differential talent pool, resource base, cultural attitude and support structure, created/emerged over a period of time. Further, the introduction of non-native people, knowledge and skills can cause substantial shifts in the ecosystem functions (Isenberg, 2011). This enables us to derive three inferences, which are as follows:

- (i) Even within a country where start-ups are subjected to the same macroeconomic policy environment, entrepreneurial ecosystems in two different regions are unlikely to be similar;
- (ii) The spontaneous or induced influx of non-native people with knowledge and skills, resulting in cross-cultural migration, would facilitate an entrepreneurial ecosystem to experience substantial improvements; and
- (iii) Where there is hardly any presence of an identifiable entrepreneurial ecosystem, internal initiative or external intervention or both can lead to a slow and steady emergence of ecosystem components thereby cultivating an

ecosystem for the benefit of tech start-ups.

The above discussion enables one to understand that entrepreneurial ecosystems are crucial for nurturing tech start-ups, and these ecosystems can be defined in terms of certain common components and their functions. Further, an ecosystem is dynamic in nature as it can be nurtured/developed in a region, over a period of time. Given this, it is appropriate to know the key elements which can drive the creation/development of an entrepreneurial ecosystem in a region.

There are nine core issues concerning an entrepreneurial ecosystem for tech start-ups, which are as follows: (i) sources of entrepreneurship, (ii) finance, (iii) market, (iv) human resources, (v) support structure (including accelerator/TBIs/proof of concept centres/prototype/product development & testing centres), (vi) business & technology mentorship, (vii) policy, (viii) culture, and (ix) media. These nine core issues are provided or promoted by one or more of the four key elements, namely, (i) large companies (domestic as well as foreign), (ii) tech start-ups (in different stages of their lifecycle), (iii) education & research institutions, and (iv) governments (regional and national) (Figure 1) (Bala Subrahmanya, 2017a). The four key elements broadly fall under (i) Government (G), (ii) Academia (A), and (iii) Industry (I), which constitute the Triple Helix model, as originally proposed by Etzkowitz (2003).

It is this Triple Helix and its interactions which form the base or support structure for an entrepreneurial ecosystem. Within the Triple Helix model, an entrepreneurial ecosystem would comprise a nucleus consisting of tech start-up and prospective tech start-up entrepreneurs, with two outer layers. The first outer layer will include indispensable (primary) components consisting of (i) sources of finance such as seed funds, angels, venture capitalists, private equities and investment banks, (ii) market, (iii) human resources, (iv) support system comprising accelerators, TBIs, co-working spaces, common facility centres, common technology platforms/laboratories, and (v) business and technology mentors. The second and outer

most layer will comprise supplementary components such as (i) supportive local culture, and (ii) supportive media. The primary components are those without which an ecosystem will not emerge or sustain or be effective, whereas secondary components are those which play only a supportive role

(Bala Subrahmanya, 2017a). A typical structure of an entrepreneurial ecosystem for tech start-ups feasible in the Indian context, as defined by Bala Subrahmanya (2017a), is given in Figure 2.

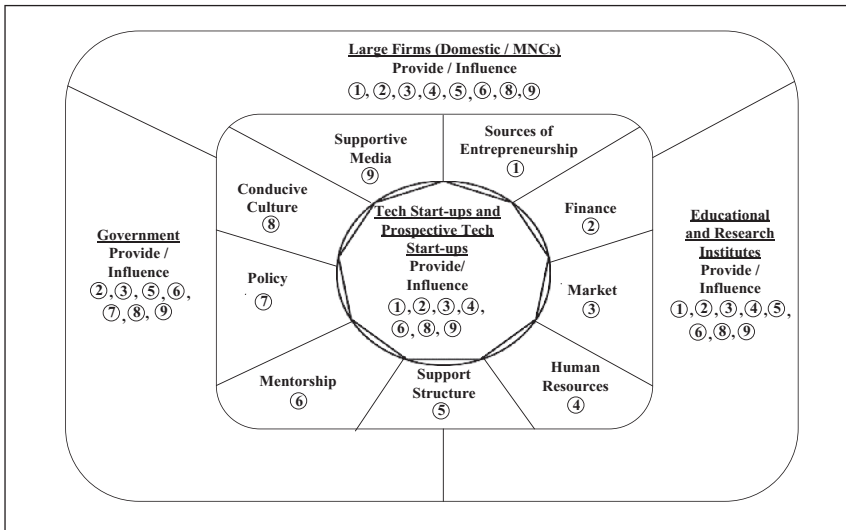
A triple helix interaction typically starts as university, industry and government

enter into a reciprocal relationship with each other in which each helps to enhance the performance of the other. Most such initiatives take place at the regional level where specific contexts of industrial clusters, academic development and presence of governing authority influence the development of the triple helix (Etzkowitz, 2007). It is the triple helix interactions which generate or influence the primary and the secondary components of an entrepreneurial ecosystem in a region (Bala Subrahmanya, 2017a).

The triple helix interactions driven by public policy initiatives leading to the emergence and growth of an entrepreneurial ecosystem for tech start-ups over a period of about six decades, is empirically illustrated by Bala Subrahmanya (2017b) in the context of Bangalore and Hyderabad. Public policy initiatives laid the foundation for the creation of academic institutions, public sector enterprises, and public R&D institutions which led to the creation of a modern industrial cluster in Bangalore by the mid-1980s. Subsequently, it was the entry and growth of MNCs in the IT and BT sectors followed by an increasing entry of MNC R&D affiliates (both in response to steady economic policy liberalizations) which created the IT/BT industries cluster by the late 1990s/mid-2000s followed by an R&D centres' cluster by mid-2000s/late 2000s. These three clusters, with the aid of Government (G), Academia (A) and Industry (I) together played a decisive role in the gradual emergence and growth of different components of an entrepreneurial ecosystem for tech start-ups in Bangalore as well as Hyderabad (Bala Subrahmanya, 2017b).

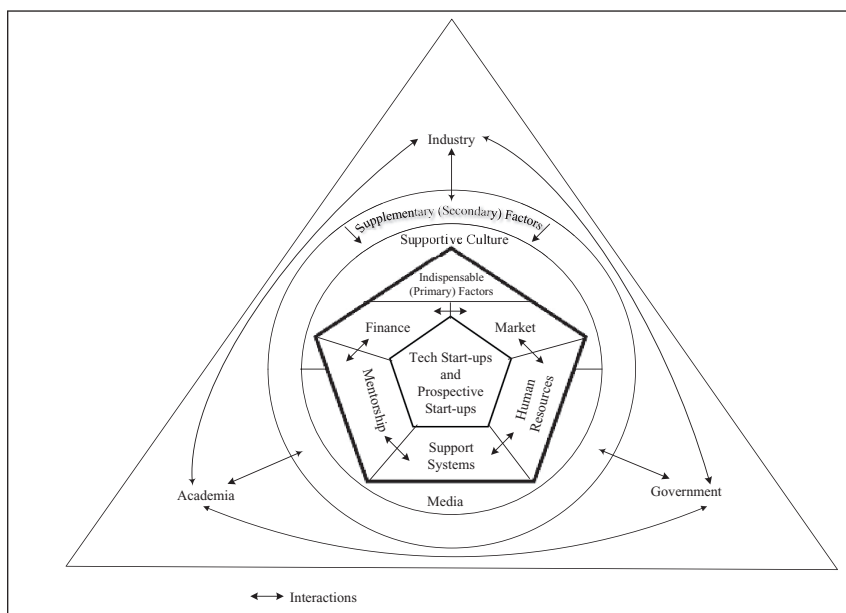
However, the challenge of developing an entrepreneurial ecosystem takes a different dimension, in a tier 2 city in an emerging economy, particularly when:

- (i) it is away from the regional government (G);
- (ii) it has no significant research base generated from the presence of research intensive public/private universities or public R&D institutions (A); and
- (iii) it has no significant presence of large scale industries, particularly MNCs (I).



Source: Bala Subrahmanya (2017a)

Figure 1: Entrepreneurial ecosystem for tech start-ups – core issues and supportive elements



Source: Bala Subrahmanya (2017a)

Figure 2: Entrepreneurial ecosystem for tech startups in India: structure and components

This is a situation where Triple Helix base is largely absent. How could an entrepreneurial ecosystem be promoted to nurture tech start-ups in such a region? Who has to take the initiative? What course of action is appropriate? How effective will be such an ecosystem, if at all, developed? Empirical literature has hardly addressed this research question, which is of relevance to all emerging economies, particularly India, in the current context. The present study is undertaken to address this research gap.

### Objectives, scope and methodology

The present study has two research objectives:

- How could a private technological university initiate the building up of an entrepreneurial ecosystem in a region, which is bereft of a Triple Helix base?
- What are the key achievements of such an initiative, and what promise does it hold for the future?

The study is primarily confined to exploring the role played by KLE Technological University in developing a tech start-up ecosystem in Hubli, officially known as Hubballi, which is the second largest city (next to Bangalore) in Karnataka state. Hubli forms continuous urban area with the city of Dharwad. Hubli-Dharwad is the largest conurbation in the state after the capital city of the state, i.e., Bangalore, in terms of geographical coverage and population. Hubli is located in Dharwad district, which is situated in the western sector of the northern half of Karnataka State. The district encompasses an area of 4260 km<sup>2</sup> lying between the latitudinal parallels of 15°02' and 15°42' North and longitudes of 73°43' and 75°33' East. The most conspicuous contour lines of very high and very low areas of the district are located 500 and 700 metres above the mean sea level, respectively. The district is bound by Belgaum in the north, Haveri in the south, Gadag in the east and in the southwest by Uttara Kannada district (Census of India, 2014) (Figure 3). The twin cities of Hubli-Dharwad are located at a distance of around 420 km north-west of

Bangalore, the capital of Karnataka state and 550 km south-east of Mumbai.

The district has a moderate concentration of manufacturing industries spread over eight industrial areas, namely, (i) Belur Industrial Area, (ii) Rayapur Industrial Area, (iii) Tarihal Industrial Area, (iv) Lakkamanahalli Industrial Area, (v) Sattur Industrial Area, (vi) Gamanagatti Industrial Area, (vii) Gokul Industrial Area, and (viii) Mummi-gatti & Narendra Industrial Area (KIADB, 2017). The district has a total of about 19,000 industrial enterprises, of which 924 are registered industrial enterprises comprising six large and six medium enterprises, the remaining being small scale and micro enterprises (MSMED, 2017). It is important to note that not even a single foreign MNC operates out of Hubli-Dharwad, as of now.

In the recent years, several initiatives have been taken to promote IT industry in the region, both in terms of infrastructure and academia. The Government of Karnataka through Karnataka Electronics Development Corporation (KEONICS) is setting up an exclusive IT Park in Hubli (KEONICS, 2017). A Software Technology Park of India (STPI), set up by the Government of India, has been operational since May 2001, which has its own incubation

centre and currently 30 companies are under incubation there (STPI, 2017). Thus, a drive to facilitate the growth of IT industries in the city has been initiated.

Hubli-Dharwad is the educational hub of northern Karnataka. The twin-cities have four universities, namely, (i) Karnataka University, Dharwad, (ii) University of Agricultural Sciences, Dharwad, (iii) Karnataka State Law University, Hubli, and (iv) KLE Technological University, Hubli, the last being the youngest and the only private technological university in the region. In addition, an Indian Institute of Information Technology (IIIT), as an autonomous institute setup by Government of India (MHRD), Government of Karnataka and Industry Partners (represented by KEONICS) as a not-for-profit Public Private Partnership (N-PPP) Society, was established in 2015. This is intended to be a world-class Information Technology Institute with the objective of developing professional expertise and to address the increasing skill challenges of Indian IT industry (IIITD, 2017).

More recently, an Indian Institute of Technology (IIT), as an autonomous premier engineering and technology university under the Ministry of Human Resource Development, Government of India, was set up in Dharwad in July 2016 (IITD, 2017). Thus, both industry and

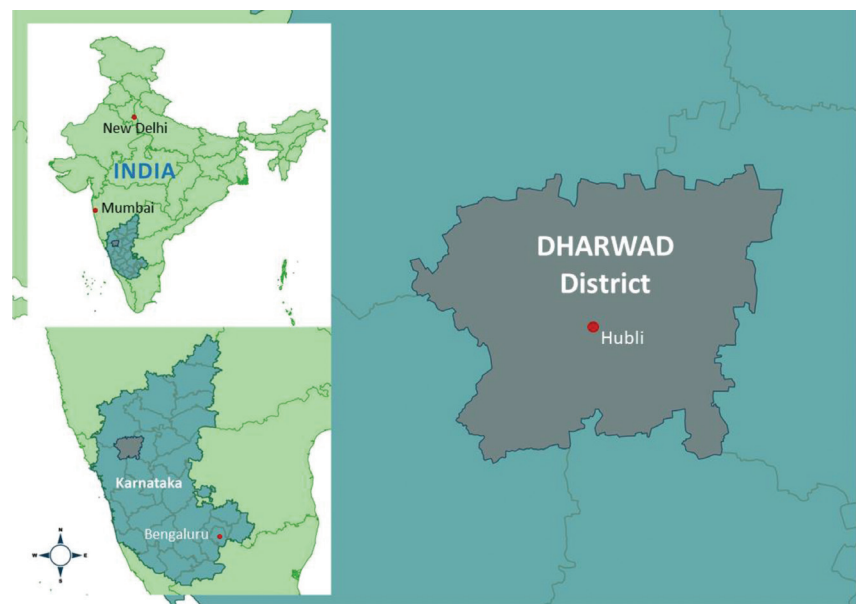


Figure 3: Dharwad district in Karnataka, India



academic institutions have yet to make a mark in the knowledge and technology intensive industries, on the map of Hubli-Dharwad twin cities, to attract any national attention.

Obviously, there was hardly any tech start-up that emerged and was operating out of Hubli about a decade back, and therefore, there was neither any venture capital fund nor any TBI or Accelerator or Co-working space based out of Hubli (as ascertained from multiple sources). The market base in terms of technology intensive industrial enterprises was absent and tech savvy consumers might have been very limited, to say the least. The engineering graduates, who emerged out of the engineering colleges in Hubli-Dharwad cities largely migrated to Bangalore and Mumbai in search of jobs. Given all this, the scope for the prevalence of business and technology mentors was practically nil. All these indicate the absence of a start-up conducive culture as well as a supportive media. This brings out that an ecosystem for tech start-ups [characterized by a Triple Helix base, with a nucleus surrounded by two outer layers consisting of five primary/ indispensable components and two secondary/supplementary components (as discussed earlier)] was non-existent in Hubli.

Given the above, a description on KLE Technological University (hereafter KLE-TU) is in order. The origin of KLE-TU can be traced back to 1947 when Karnataka Lingayat Education (KLE) Society, Belgaum established B V Bhoomaraddi College of Engineering and Technology with an aspiration of creating an institution that would lay the foundation of modern engineering education in northern region of Karnataka. Over the years, it evolved to reach and hold a unique position of pride in the technical education system of the state. According to one source, KLE TU was ranked 12th among all the engineering institutions in the State of Karnataka in 2016 (Career360, 2017). In pursuit of academic excellence, the BVB College attained academic autonomy from the University Grants Commission (UGC) in the year 2007, which enabled the institution to establish its distinctive character in the academic space through

its curriculum and student experience (KLE-TU, 2017).

In the ever-dynamic global economy, apart from delivering good quality education, the engineering institutions are expected to develop their capacity in research and innovation. They also need to undergo a fundamental transformation in terms of their role in the society, mode of operation, and economic structure and the scale at which they operate. To respond to these challenges, BVB College of Engineering and Technology undertook a strategic initiative of transforming itself into a University of national distinction. In 2014, BVB college was recognized as a state private University by the Government of Karnataka. Since then, it has embarked on several new initiatives towards nurturing entrepreneurship through promoting industry-institute interactions, on the one hand, and setting up a TBI, on the other (KLE-TU, 2017).

The case of KLE-TU in Hubli attracted our attention because recently we heard frequent references to KLE-TU in the Bangalore ecosystem for tech start-ups, due to (i) the former's noticeable performance in tech start-up generation, and (ii) migration of tech start-ups from Hubli in search of a larger market for stability and growth to Bangalore and elsewhere. Since we had previous interactions with KLE-TU through S V Patil, Professor and Head, Department of Management Studies, we approached him to obtain some preliminary information and to schedule personal interviews with the key personalities in KLE-TU and other relevant ecosystem stakeholders, on mutually convenient dates. Accordingly, based on the advice and help of S V Patil, authors scheduled a visit to Hubli on 29<sup>th</sup> and 30<sup>th</sup> May 2017.

To understand and analyze the role played by KLE-TU through the promotion of industry-institute interactions and establishment and operations of a TBI for promoting technology entrepreneurship led start-ups, we visited Hubli and carried out day-long intensive consultations and interactions on 29th and 30th May 2017, with the following:

i. Naveen Jha, CEO, Deshpande Centre for Social Entrepreneurship, KLE-TU;

- ii. C M Patil, Chief Executive, Sandbox Startups, Start-ups Incubation Centre;
- iii. Four start-ups which originated and operating out of Sandbox Startups;
- iv. Vivek Pawar, CEO, Sankalp Semi-Conductors;
- v. Nitin Kulkarni, Director, KLE Centre for Technological Innovation and Entrepreneurship (KLE-CTIE), KLE-TU;
- vi. Three tech start-ups, which originated and operating out of KLE-TU TBI; and
- vii. Ashok Shettar, Vice Chancellor and Professor, KLE-TU.

In addition, we scanned for, gathered and reviewed secondary data relating to general profiles, education institutions and industrial concentration of Hubli-Dharwad district as well as business news items published in print media on tech start-up initiatives in Hubli. This formed the basis for our case description, case analysis and discussion, inferences and conclusions.

### The driving role of KLE-TU in creating an entrepreneurial ecosystem for tech start-ups in Hubli: A case study

If entrepreneurship has to increasingly blossom in a particular location, the prerequisites are: (i) presence of an adequate industrial ecosystem, (ii) visibility of the location, with adequate industrial infrastructure, and (iii) willingness of industrial enterprises, located elsewhere, to collaborate with local institutions. However, Hubli, as a location, did not have any of these, as recently as about a decade back. As a result, leave alone attracting entrepreneurship, even the engineering graduates who emerged out of KLE-TU migrated to large cities such as Bangalore and Mumbai, in search of employment opportunities. This hardly gave scope for the emergence of local entrepreneurship and thereby deprived nurturing of local competitiveness.

Therefore, the challenge facing KLE-TU was crystal clear: apart from playing the traditional roles of (i) human resource development through knowledge transfer, and (ii) knowledge generation through R&D, it had the responsibility of driving

regional economic and social development. With no significant presence of regional government (G) and large scale industries (I), to drive the Triple Helix base, as a representative of Academia (A), KLE-TU under the leadership of its Vice Chancellor, Ashok Shettar, decided to take the lead role in the beginning of the current decade.

However, in the absence of a clear role model visible in the context of Indian higher education institutions, KLE-TU looked up at the Massachusetts Institute of Technology (MIT) and its impact on the regional economy, as brought out by one of the reports of Kauffman Foundation. To foster, enable and grow the innovation and entrepreneurial ecosystem, KLE-TU founded Centre for Technology Innovation & Entrepreneurship (KLE - CTiE), informally in February 2012. It got official recognition from the Department of Science and Technology, Government of India, New Delhi in February 2016. KLE - CTiE adopted a two-pronged strategy to build an entrepreneurial ecosystem, to (i) attract and support external entrepreneurs, and (ii) inspire, educate and enable student start-ups. Let us first examine how were the external entrepreneurs attracted and supported to emerge from Hubli.

### Developing external support for the ecosystem

#### *Deshpande Foundation India*

The roping in of Deshpande Foundation of Gururaj Deshpande and Jaishree Deshpande (who hail from Hubli but attained global reputation through their outstanding professional achievements in the IT industry in the USA) as an external supporter for entrepreneurship promotion by KLE-TU was one of the first major steps taken by KLE-TU. Gururaj, an alumnus of IIT Madras, was the Co-chair of a National Council to support US President Barack Obama's innovation and entrepreneurship strategy. He has set up Deshpande Centre for Technological Innovation at Massachusetts Institute of Technology (MIT), USA, among others. He has pursued an entrepreneurial career for the last three decades. He is involved either as the founder, a founding investor or chairman

of several companies including Cascade Communications, Sycamore Networks, Coral Networks, Tejas Networks, Cimaron, Webdialogs, Airvana, Sandstone Capital, A123 Systems and Curata (Deshpande Foundation, 2017).

Gururaj Deshpande and Jaishree Deshpande have encouraged the use of entrepreneurship and innovation as catalysts for sustainable change in the United States, India and Canada since 1996. The Deshpande Foundation India was established in 1996, as a part of the global philanthropic pursuits of Deshpande Foundation, which launched Hubballi Sandbox in 2007. "The aim of the Sandbox is to create an environment where unconventional approaches to addressing social innovation is encouraged. The value of the Sandbox lies in its ability to identify synergies and explore potential collaborations among the catalyst network" (Deshpande Foundation, 2017). Applying a 'bottom-up' approach to build scalable solutions, the Deshpande Foundation India - Hubli Sandbox works to create an effective ecosystem where resources are put to use through entrepreneurship, innovation and sustainability. The Hubli Sandbox engages with not-for-profits, academics, organizations and entrepreneurs leading to the launch of effective and scalable models of development.

It has adopted three distinct approaches for the creation of entrepreneurship and start-ups, namely:

- (i) Sandbox Action Partnerships;
- (ii) Inculcating Leadership among Communities; and
- (iii) Building Entrepreneurs through Education and Mentorship.

KLE-TU invited Deshpande Foundation and enabled the location of the Deshpande Centre for Social Entrepreneurship inside the University campus in 2012. In line with the spirit of the Deshpande Centre at MIT, USA, the Centre at KLE-TU has the mission of funding technology products for commercialization. This is achieved, in two ways:

- Prospective entrepreneurs for incubation are short-listed based on their ability to conceptualize the ideas and the identification of target markets. In addition, the background of promoters and team composition played a crucial role.
- The short-listed prospective start-up funders are invited to visit Deshpande Centre to make a presentation and for an interaction. The final selection of prospective start-ups is made based on their suitability and ability to get accommodated in the TBI ecosystem.

### *Facilitated the location of large scale Private Enterprises in-house*

KLE-TU felt the need for the location of private enterprises within the campus. Accordingly, it facilitated the in-campus birth and growth of four private enterprises, namely, (i) Sankalp Semi-conductors (hereafter SS), (ii) Navya Biologicals, (iii) Athena composites, (iv) Hi-Wi Communication (GDV), by creating the right value propositions in terms of (i) providing working space, (ii) support facilities, and (iii) start-up - student/faculty synergy. The objective was to have anchor entrepreneurs on the campus who can develop synergy with the faculty and students for mutual advantage.

Of the four, a reference to the birth and growth of SS in KLE-TU is in order. SS is an advanced technology services provider offering comprehensive solutions from concept to prototype, in the semiconductor space. It offers an integrated portfolio of services to their clients in key domains including digital, analog, high speed physical interface IP, Embedded Memory Compiler and EDA modelling (Sankalp Semiconductors, 2017). The CEO of SS, Vivek Pawar was an employee of Texas Instruments (TI) in Bangalore. He was subsequently shifted to Houston, USA. But, Vivek always felt the need to do something for his country, by generating entrepreneurship and providing employment to the local youths and prevent brain drain to metropolitan cities in a technologically less developed Tier-2 city.

Though Vivek created his enterprise (SS) in Bangalore, he got business from TI

based in Houston. As his objective was to move into a Tier-2 city, he had the option of shifting SS to one of the three cities in Karnataka state, namely, Mysore, Belgaum and Hubli. The prompt positive response that he received for his query from KLE-TU led him to Hubli and understand the efforts put in by KLE-TU for entrepreneurship promotion and ecosystem building. The offer of space, free of cost, by the Vice-Chancellor of KLE-TU to Vivek clinched the issue in favour of creating another unit of SS in Hubli, apart from Bangalore. He founded Hubli-based SS in 2005. Today, SS employs about 1000 persons (mostly rural youths) and operates out of six locations, namely, Bangalore, Kolkata and Hubli in India, apart from Canada, Germany and USA. His only intent was to create centres in Tier II cities of India, in order to enable *inclusive growth*, and SS is a small step towards that (Yourstory, 2016).

#### Partnering with NETRA

NETRA is the acronym for National ESDM Technology Research Academy, which is a consortium and think tank supported by India Electronics and Semiconductor Association (IESA) and Electronics Sector Skills Council of India (ESSCI) which includes, among others, the Vice Chancellor of KLE-TU. The vision of NETRA & ESSCI is to transform engineering campuses into ESDM Product Innovation Centers [EPIC] through Industry Partnerships. The key promoters of NETRA envisioned to integrate the right ingredients to drive the global leadership from India in a high-technology sector such as ESDM.

To achieve their vision, the key stakeholders of NETRA derived a plan to focus on research with productized solutions. This plan was arrived at after a careful review of the operating models of successful global entrepreneurial ecosystems across the world – such as Stanford University, USA, Industrial Technology Research Institute (ITRI), Taiwan Province of China, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea and International Medical Equipment Collaborative (IMEC) in Europe. Technology research where the right problems were chosen by industry trained faculty, incuba-

tion of new product ideas derived out of the technology research, capacity building of faculty and students as a result of the previous activities leading to development of an indigenous chip from India as a high-tech product formed the key tenets of the implementation roadmap of the proposed plan. Though IESA aimed at promoting six ESDM Centres of Excellence (ECOE) in six different locations of India, only KLE-TU could establish the centre. The students, faculty, resident entrepreneurs, the support system at KLE-TU served as the key ingredients required to enable success of the pilot program to build an indigenous IOT chip out of the activities pursued as part of this consortium (IESA, 2016).

As of now, the first India Chip built from the above efforts is being tested. About 90% of the students involved in this activity were successfully absorbed to lateral positions in different MNCs – indicating the success in capacity building and skill development in the sector. The flexibility provided by KLE-TU to consider Industry course as a credit course enabled the incubation, research and product development activities of this plan. In summary, by being a core partner in the NETRA program, KLE-TU is providing the foundation for further success in the high-tech entrepreneurship sector.

#### Building internal ecosystem

What was equally challenging was the creation of an internal system to nurture entrepreneurial talent within KLE-TU. To achieve the objective, CTIE planned both formal and informal interventions with the graduate student community (ranging from the first year till the final year of engineering). The interventions are aimed at (i) inspiring, and (ii) educating & enabling student start-ups.

The informal intervention has three stages of operations:

**Pupa → Ideation Camp → Butterfly**  
→ Capstone Project Track

**Pupa:** The objective of Pupa is to capture ideas from the young minds for its subsequent nurturing. Pupa is an annual programme conducted by and at KLE-TU for the engineering graduate students belonging to various engineering education institutions across the state and

beyond. Pupa was initiated in 2013. Since then, it has been attracting more and more students, year by year, where student groups exhibit their ideas for evaluation. In 2016 alone, 1250 students from 30 institutions participated in the Pupa where 404 teams exhibited their ideas.

**Ideation camp:** The ideation camp is a two-day workshop (with 72 seats) where students are trained for idea validation, and pitching. This will have multi-disciplinary teams and it is result oriented. Ideation camp was initially launched by *Intel* as a Youth Enterprise Programme, which was started by KLE-TU in 2014. As of now, Ideation Camp is primarily confined to KLE-TU students.

**Butterfly contest:** The KLE-TU students with proven ideas are encouraged to move on to the Butterfly stage involving technology business plan contest, which has an overall duration of three weeks. The business plan contest is judged by industry partners of KLE-TU. The successful ones graduate to join Capstone Project Track of CTIE in the final year of their engineering degree programme. The Butterfly contest was first launched in 2012 as a lead into the Capstone Project Track with seven projects comprising 37 students successfully joining the track (out of a total of 14 teams involving 52 students altogether).

The formal intervention is done through planned curriculum introduction as follows:

**Engineering design → Product design and realization → Principles of innovation & entrepreneurship → Capstone Project Track**

An engineering design course has been introduced across all the disciplines of engineering and it ends with a design project. This enables the students to get a grasp over project designing. This is generally done in the second semester. In the third and fourth semesters, the students are formed into multi-disciplinary teams for enabling them to understand product design and realization, with hands on projects. This is done with respect to existing technology products.

Subsequently, these students have to credit a course on principles of innovation and entrepreneurship, to get exposure to

business development. In addition, they are trained in business communication and other soft skills. They are also exposed to Massive Open Online Course (MOOC) and field work. This was initially confined to the freely available University of Maryland (USA) online course, but recently this has been replaced by "Start-Up India Programme" inputs.

Finally, they enter into Capstone Project Track with their final year projects. Capstone Project Track is held for the final year students spanning over the last two semesters of their engineering degree programmes. Here they are trained in conceptualizing and developing their innovative ideas which have a commercial potential, and after graduation, opportunities are given for such students to get into formal business incubation.

It is important to note that both informal interventions and formal interventions converge at the Capstone Project Track, which is the stepping stone for technology entrepreneurship emergence in the form of tech start-ups.

### Major achievements: Developing industry-academia linkages for start-ups

The CTiE of KLE-TU has come a long way since its inception. The key achievements are as follows:

- CTiE currently has 38 start-ups, nearly  $\frac{3}{4}$  of them are from serial entrepreneurs.
- These start-ups have engaged more than 450 students through internships and projects, indicating the growing enterprise-student synergy.
- In four of the start-ups, faculty members of KLE-TU have joined as co-promoters and/or co-innovators, implying enterprise-faculty synergy.
- These start-ups have created more than 400 engineering jobs for the local graduates and thereby prevented their out-migration from Hubli in search of employment.
- The products from start-ups such as LabinApp, Navya Biologicals, Krishagni, GDV Research are exported all over the world, which indicate their international acceptability.

- Some of the start-ups work on smart drones, block chain technology, bio-medicines and bio-materials, among others, which reflect on the technology intensity of the projects involved.
- During 2014-2016, CTiE has led to the emergence and operations of 11 student led start-ups. Thus, encouragement to student entrepreneurship has started bearing fruits.
- Eight of the 38 start-ups, which have already started their revenue generation stream, has moved into KLE-CTiE Tech park in January 2017 on commercial terms thus providing revenue for KLE-CTiE. This is a win-win situation for both start-ups and the incubator.
- Two of the enterprises which emerged as start-ups, namely, Sankalp Semiconductors and Navya Biologicals have grown to become Rs.1000 million+ turnover companies. This indicates their success and growth in terms of scaling up.
- Growing media attention towards Hubli and slow and steady building up of the culture of entrepreneurship, thanks to the diverse initiatives of KLE-TU and its outcomes.

Overall, KLE-TU through CTiE has primarily aimed at encouraging the building up of ecosystem components with the help of industry, by directly encouraging industrial enterprises/start-ups to emerge within the university campus, and enabling them to develop synergy with both faculty and students, for mutual advantage. This is achieved by providing the following to in-house enterprises:

1. Physical space;
2. Access to the facilities on campus;
3. Student and faculty partnerships;
4. Business and Technology mentoring (in case of matching skills being available on campus);
5. Business plan reviews and potential pivots; and
6. Professional business environment.

At the same time, with a clear definition of formal and informal interventions, CTiE has developed a road map for the emergence of student entrepreneurship for technology start-ups. In the whole

process, CTiE has achieved a considerable degree of success in developing a bare minimum entrepreneurial ecosystem in Hubli comprising the following:

1. A Double Helix base bringing together Academia and Industry, in the absence of explicit role of the Government;
2. A growing number of tech start-ups and prospective tech start-ups;
3. Five indispensable components consisting of (i) finance, (ii) market, (iii) human resources, (iv) support system involving business incubation and support services, and (v) business and technology mentors;
4. Two supplementary components, namely, (i) supportive culture, and (ii) supportive media.

This entrepreneurial ecosystem, though at its infancy, is able to produce results in the form of growing number of start-up emergence leading to their stability and sustenance, and even success and growth, but on a very limited scale.

### Inferences and conclusions

KLE-TU has played a commendable role towards creating an entrepreneurial ecosystem for tech start-ups in Hubli, in the absence of an explicit Triple Helix base. As an academic institution, it found the local presence of private large enterprises imperative, to prevent the exodus of engineering graduates out of the city, in the short-run, and as a means of generating different components of an entrepreneurial ecosystem, in the medium to long run, apart from generating technology entrepreneurship itself. The entry/growth of private large enterprises in the field of IT industry was a challenge because earlier attempts to rope in domestically grown IT MNC, Tata Consultancy Services (TCS), followed by Bangalore-based Quest, an engineering services IT company, into Hubli had ended up in failure, due to the inordinate delay in the decision-making process of the regional government in allotting the required land (Times of India, 2006).

Thus, in the absence of a conducive and explicit support of the regional government for the entry and/or birth and growth



of domestic large-scale IT enterprises in Hubli, apart from the absence of any MNC and any major research oriented public educational institution till recently, it was left to the only reputed engineering education institution, KLE-TU in the region “to act or to leave it”. The leadership of KLE-TU took the plunge by taking appropriate initiatives towards the building up of an entrepreneurial ecosystem for nurturing tech start-ups. It rightly focused on encouraging large scale high-tech private enterprises, in the absence of any major public-sector enterprise in the region. It has made the right judgement by promoting the birth and growth of private large-scale enterprises within the university campus, to forge links with the faculty and students, for learning as much as for generating employment and thereby prevent out-migration of young technical talent from the city. Though the achievement made thus far is only on a tiny scale, it is a heartening beginning.

The fact that Gururaj Deshpande who hails from Hubli, but more importantly well-disposed to the city to contribute to the development of IT industry and entrepreneurship, became handy for KLE-TU to seek his contribution to the ecosystem development initiatives. By arranging talks from him in the University during his annual visits to Hubli, KLE-TU is deriving benefits out of his international experience and exposure as an entrepreneur and venture capitalist, for strengthening Hubli ecosystem. The setting up of Deshpande business incubator and its entry into KLE-TU added further strength to the external environment of the university. However, KLE-TU rightly observed that mere development of external support will not carry it any far. What is equally important is to build an internal environment for the creation of entrepreneurship. It is here that the two-pronged strategy in terms of informal and formal initiatives for entrepreneurship development adopted by KLE-TU needs to be appreciated. Even here the University has made a beginning, though on a modest scale, not only by forging links with the large scale private enterprises (located within the campus as well as outside) by providing quality technical talent, but more importantly by generating technology entrepreneurship.

Thus, the KLE-TU initiatives, on the one hand, tried to make up for the absence of a strong “Triple Helix” base, and on the other, contributed to the creation of the much needed “nucleus” of tech start-ups (and prospective tech start-ups), and one of the important indispensable (primary) components, namely, human resources. The involvement of University faculty in the nurturing of tech start-ups in the proof of concept/prototype development and a Minimum Viable Product (MVP), led to a gradual emergence of “technical mentors”. In addition, the forging of successful links with private enterprises enabled the provision of “business mentors” to tech start-ups, for “market” identification, locally, regionally and even internationally. As majority of the “fledgling start-ups” were primarily looking for “finance” in the form of seed funds, they were arranged internally either by the start-up founders themselves or by the TBIs, including CTIE of KLE-TU.

The emergence of tech start-ups and their operations, thanks to the role of Deshpande Foundation, particularly Deshpande Centre for Social Entrepreneurship and CTIE of KLE-TU, the favourable “entrepreneurial culture” is slowly and steadily blossoming. This has started attracting the attention of local and regional “media”. Further, by opening up its student entrepreneurial programs to all other universities and colleges around the region, KLE-TU is building strong networks and awareness about technology entrepreneurship which will be conducive to enhance the entrepreneurial culture of the region, thereby also generating positive media coverage for its activities. Thus, slowly and steadily two supplementary (secondary) components are also emerging in Hubli.

This is how, KLE-TU ensured the bare minimum - emergence, presence and availability - of tech entrepreneurial ecosystem components: acting single handedly for a Triple Helix base, and thereby generate a nucleus and five indispensable components, followed by two supplementary components. To sum up, KLE-TU has enabled Hubli to make a beginning on the path of a suitable entrepreneurial ecosystem development for tech start-ups, but it has a long way to go to make a mark on the start-up ecosystem landscape of India. Particularly, its

task of building on the gains already made will be more challenging in the future.

Bangalore, being a globally recognized tech start-up hub with heterogeneous high-tech clusters, involving a strong Triple Helix base, a growing number of tech start-ups and prospective tech start-ups, apart from the other valuable ecosystem components, is still considered to be “evolving”, implying that it is still moderately matured (Bala Subrahmanya, 2017c). As of now, Hubli still lacks a strong base of R&D institutions and MNCs, particularly Fortune 500 companies in the IT sector, both of which are diverse sources of tech entrepreneurship, human resources, early market adopters, technology and business mentorship, sometimes even finance and support system in the form of TBIs/Accelerators. Unless and until (i) KLE-TU networks with the “recently born” IIITD and IITD, and (ii) regional government takes an initiative for attracting IT MNCs into Hubli, further growth of the ecosystem can be hardly achieved to ensure an increasing number of birth as well as growth of tech start-ups in the future. To conclude, ensuring the presence of a fairly strong Triple Helix base as early as possible is the need of the hour for KLE-TU as much as for Hubli if it has to make it big in the future.

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**FUTURE ENERGY ASIA EXHIBITION &  
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# Tech Ventures & Opportunities

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# Digital startup: key mechanism for Thailand 4.0

## Digital Economy Promotion Agency

<http://www.depa.or.th>

Thailand 4.0 is a policy vision of Thailand's economic development or a model of the government's economic development under the administration of Gen Prayut Chan-o-cha, Prime Minister and Head of the National Council for Peace and Order (NCPO).

Thailand 4.0 is a policy vision of Thailand's economic development or a model of the government's economic development under the administration of Gen Prayut Chan-o-cha, Prime Minister and Head of the National Council for Peace and Order (NCPO). The Prime Minister has managed the country with the vision of stability, prosperity and sustainability to achieve the key reform missions to adjust, organize and align directions and create the country's development guidelines to cope with new, rapidly changing opportunities and threats in the 21st century.

To ensure effective results, Thailand needs development in terms of academics, creativity, innovation, science, technology and research and development for further improvement of target technology and industry groups. Right now, Digital Startup is a hot trend because it emphasizes applying digital technology to business operations in order to create products and services that integrate innovative creation and business operation; encourages small and medium enterprises to drive the country's economic system; and creates ample digital human resources for the country's development for the future.

Digital Economy Promotion Agency (depa) realizes the importance of creating more understanding of digital businesses among the new generation and the general public and for potential support and enhancement to prepare and create competent personnel for the industry and also Digital Entrepreneurship according to the government's economic development policy. This will help encourage the growth of Thai entrepreneurs and their success in the business.

Digital has played an important role in various aspects, including agriculture, food, health, medicine, robotics, finance, education, design and tourism, but Thailand still lacks personnel and professionals for digital development. Therefore, depa, as a main agency that promotes the digital industry, has become the Digital Startup Promotion and Development Center. It has initiated Digital Startup Project to create inspiration, develop potential and stimulate creativity to develop creative, practical works and further upgrade business operations. Digital Startup is a project that emphasizes promoting innovative work creation to become Digital Entrepreneurship.

Digital Startup Project searches for competent persons who have smart, interesting ideas that can be further developed into a commercial business. It welcomes more than 500 participating teams from all regions. depa has selected 40 finalist teams for Level Up Camp which will extensively enhance their potential under the supervision of mentors and prepare for the next round of competition. The 10 finalist teams will have a chance to join an internship program at leading international companies or organizations. The activity is also aimed at stimulating creativity which has practical application.

However, depa gives a chance to the defeated teams to join the competition again because some startups have interesting ideas but lack presentation skills and profound understanding in the target industry, making their works fail to serve the industry's purpose. depa has solved these problems proactively by providing university students with instructions on each industry's operations and training programs on rapidly changing technologies for more understanding in each industry's characteristics and future development.

### Global Programme to Help Boost Access to Patent System

The programme aims to help inventors and small enterprises with limited finances to pursue the patent protection that is key to successful commercialization of a product or new solution. Qualified attorneys help by providing free legal advice to inventors who would otherwise be unable to afford the legal costs of obtaining a patent. The Program seeks to stimulate an innovative environment where all inventors are able to commercialize their products, bringing economic benefits to them, their families and communities.

For more information, access:

Media Relations Section  
World Intellectual Property Organization (WIPO)  
Web: <http://www.wipo.int/>

# Technology incubation and development of entrepreneurs

**Ministry of Electronics & Information Technology, Government of India**

<http://meity.gov.in>

The Department of Electronics and Information Technology (DeitY), Government of India is implementing a scheme titled "Technology Incubation and Development of Entrepreneurs (TIDE)". Initially launched in 2008 the scheme has been revised and extended till March 2017. As per the scheme provision, 27 centres are being supported at academic institutions across India. TIDE has a multipronged approach in diverse areas of Electronics, ICT and Management. It aims to assist institutions of higher learning to strengthen their Technology Incubation Centers and enable young entrepreneurs to initiate technology startup companies for commercial exploitation of technologies developed by them.

TIDE Incubation Centers provide a gamut of services to new enterprises and facilitate linkages congenial for their survival and growth. The centres network with Angel Investors and Venture Capitalists who provide mentoring and financial support to the startups and enable tenant companies to mature over a period of 2-3 years and ultimately graduate to a commercial place to transact actual business.

DeitY is providing financial and policy support for strengthening technology incubation activities on the premise that this would in the long run result in indigenous development of products and packages in the ICTE sector.

## Scope

Recognizing the importance of Technology Incubation, many institutions of higher learning have already taken initiatives to nurture this activity. These include policy measures, infrastructure support, entrepreneurial training, IPR facilitation, and create a framework to nurture technology incubation. The incubation centers provide a host of services to new enterprises and facilitate linkages that are congenial for their survival and growth. The centre also network with Angel Investors and Venture Capitalists who provide mentoring and financial support to the startup companies and enable the tenant companies to mature over a period of 2-3 years and graduate to a commercial place to do the actual business. The involvement of the faculty of the institute in

the technology start-up activity reinforces teaching and research, strengthens linkages between education and industry, and also better aligns education to meet market requirements.

It is proposed to support such initiatives by providing financial and policy support for strengthening technology incubation activity. This would nurture technology innovation and, in the long run, enable local development of Electronics and IT products and packages.

## The TIDE Center

The TIDE centre is generally set-up by the Host Institute (HI) as a Society or Section 25 company, or Other Legal entity with a mandate to nurture and support technology startup companies. This entity can receive funds from the Government and non-Government bodies and financial institutions including VCs and Angel Investor Groups, give loans to startup companies, hold financial instruments (such as shares) in the companies, and plough back the revenues/funds received for the objects of the center.

The TIDE centre will provide operating space to the selected companies, nurture them and mobilise technical / mentoring / managerial / financial / administrative / legal and other support as required by them.

## Benefits

The expected benefits from the proposed scheme are:

- The technology incubation will become a nurturing ground for technology startup companies. This would also enhance the relevance of Education and Training to meet the market requirements;
- This would foster innovation in academic institutions and more indigenous products would emerge;
- The industry would be encouraged to become product oriented rather than service oriented; and
- Strengthen the academia – industry interaction.

### Home-grown innovation

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

For more information, contact:

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World Health Organization  
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# 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;
    - (1) If the authorization is done outside the Kingdom of Thailand, the signatures in the authorization letter or power of attorney shall be certified by the authorized official of the Thai embassy or consulate or Director of the office of the Ministry of Commerce located in the country where the principal or power grantor resides, or the person authorized to act on behalf of the said officials or the person authorized to certify the signature according to the law in that country, or
    - (2) In case the authorization is done in the Kingdom of Thailand, the applicant shall submit a copy of passport or temporary residence certificate of the principal or power grantor, or any evidence indicating that at the time the authorization was made, the principal or power grantor was in Thailand.
  - 2.2. The Power of Attorney shall be attached with the revenue stamp of 30 Baht/patent agent 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
    - (1) The law stipulates that the fee must be refunded, or
    - (2) The applicant double-paid or overpaid the fee, by which the faulty payment resulted from the mistake of the state official, not the payer. In this regard, the Department of Intellectual Property shall consider the refund case by case.
  4. In case the applicant is required to submit many additional documentary evidences, the applicant shall submit all additional documentary evidences in the same time.
  5. In case the applicant submits the copy of the documentary evidence, the applicant shall certify the copy of the documentary evidence.
  6. In case the applicant submits the document in foreign language, the applicant shall submit the document with Thai translation and the correct translation certification of the translator.
  7. In case the applicant or the authorized patent agent/patent attorney does not submit the application by himself, and granted power to the other person to submit the application, the application submitter shall present a sub power of attorney or temporary power of attorney, so that he is eligible to submit the application and sign in the record of conditions on application reception. If it appears that the application and the documentary evidence is not correct or incomplete, and the application submitter is not authorized to sign on the said record, the official shall not receive the application.
  8. The working period does not include the time period when the applicant follows the official's instruction or corrects the application, or the period of temporary suspension of registration.

### Translation tool for patent documents

The World Intellectual Property Organization (WIPO) has developed a ground-breaking 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 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.

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# Technology transfer arrangement in the Philippines

## Intellectual Property of The Philippines

<https://www.ipophil.gov.ph>

Technology Transfer Arrangement refers to contracts or agreements, including renewals thereof, involving the transfer of systematic knowledge for the manufacture of a product, the application of a process, or rendering of a service including management contracts; and the transfer, assignment or licensing of all forms of intellectual property rights, including licensing of computer software except computer software developed for mass market.

The signing of Republic Act 8293, otherwise known as the Intellectual Property (IP) Code, on June 6, 1997 liberalizes regulations on technology transfer registration particularly the rate of fees or royalties and strengthens intellectual property rights protection in the Philippines. Voluntary Licensing has been provided by the Code. Recordal with the IP Philippines of agreements that involve transmission of rights is necessary. However, registration is no longer required where the agreement is in conformity of the requirements of the law under Sections 87 and 88.

Section 87 of the IP Code covers the prohibited clauses which are adverse to competition and trade.

### Prohibited Clauses (Section 87, IP Code)

1. Those which impose upon the licensee the obligation to acquire from a specific source capital goods, intermediate products, raw materials, and other technologies, or of permanently employing personnel indicated by the licensor;
2. Those pursuant to which the licensee reserves the right to fix the sale or resale prices of the products manufactured on the basis of the license;
3. Those that contain restrictions regarding the volume and structure of production;
4. Those that prohibit the use of competitive technologies in a non-exclusive technology transfer arrangement;
5. Those that establish full or partial purchase option in favor of the licensor;
6. Those that obligate the licensee to transfer for free to the licensor the inventions or improvements that may be obtained through the use of the licensed technology;
7. Those that require payment of royalties to the owners of patents for patents which are not used;
8. Those that prohibit the licensee to export the licensed product unless justified for the protection of the legitimate interest of the licensor such as exports to countries where exclusive licenses to manufacture and/or distribute the licensed product(s) have already been granted;
9. Those which restrict the use of the technology supplied after the expiration of the technology transfer arrangement, except in cases of early termination of the technology transfer arrangement due to reason(s) attributable to the licensee;
10. Those which require payments for patents and other industrial property rights after their expiration or termination of the technology transfer arrangement;
11. Those which require that the technology recipient shall not contest the validity of any of the patents of the technology supplier;
12. Those which restrict the research and development activities of the licensee designed to absorb and adapt the transferred technology to local conditions or to initiate research and development programs in connection with new products, processes or equipment;
13. Those which prevent the licensee from adapting the imported technology to local conditions, or introducing innovation to it, as long as it does not impair the standards prescribed by the licensor; and
14. Those which exempt the licensor from liability for non-fulfillment of his responsibilities under the technology transfer arrangement and/or liability arising from third party suits brought about by the use of the licensed product or the licensed technology.

On the other hand, Section 88 of the IP Code contains provisions which need to be included in voluntary license agreement as follows:

1. That the laws of the Philippines shall govern the interpretation of the agreement and in the event of litigation, the venue shall be the proper court in the place where the licensee has its principal office;
2. Continued access to improvements in techniques and processes related to the technology shall be made available during the period of the technology transfer arrangement;
3. In the event the technology transfer arrangement shall provide for arbitration, the Procedure of Arbitration of the Arbitration Law of the Philippines or the Arbitration Law of the United Nations Commission on International Trade Law (UNCITRAL) or the Rules of Conciliation and Arbitration of the International Chamber of Commerce shall apply and the venue of arbitration shall be the Philippines or any neutral country; and
4. The Philippine taxes on all payments relating to the technology transfer arrangement shall be borne by the licensor.

# Guidelines on equity policy and foreign investment in Malaysia

## Malaysian Investment Development Authority (MIDA), Malaysia

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

### Equity policy in the manufacturing sector

Malaysia has always welcomed investments in its manufacturing sector. Desirous of increasing local participation in this activity, the government encourages joint-ventures between Malaysian and foreign investors.

### Equity policy for new, expansion, or diversification projects

Since June 2003, foreign investors could hold 100% of the equity in all investments in new projects, as well as investments in expansion/diversification projects by existing companies, irrespective of the level of exports and without excluding any product or activity.

The equity policy also applies to:

- Companies previously exempted from obtaining a manufacturing licence but whose shareholders' funds have now reached RM2.5 million or have now engaged 75 or more full-time employees and are thus required to be licensed.
- Existing licensed companies previously exempted from complying with equity conditions, but are now required to comply due to their shareholders' funds having reached RM2.5 million.

### Equity policy applicable for existing companies

- Equity and export conditions imposed on companies prior to 17 June 2003 will be maintained. However, companies can request for these conditions to be removed and approval will be given based on the merits of each case.

### Protection of foreign investment

Malaysia's commitment in creating a safe investment environment has attracted more than 8,000 international companies from over 40 countries to make Malaysia their offshore base.

### Equity ownership

A company whose equity participation has been approved will not be required to restructure its equity at any time as long as the company continues to comply with the original conditions of approval and retain the original features of the project.

### Investment guarantee agreements

Malaysia's readiness to conclude Investment Guarantee Agreements (IGAs) is a testimony of the government's desire to increase foreign investor confidence in Malaysia. IGAs will:

- Protect against nationalisation and expropriation
- Ensure prompt and adequate compensation in the event of nationalisation or expropriation
- Provide free transfer of profits, capital and other fees
- Ensure settlement of investment disputes under the Convention on the Settlement of Investment Disputes of which Malaysia has been a member since 1966.

Malaysia has concluded IGAs with the following groupings:

- Association of South-East Asian Nations (ASEAN)
- Organisation of Islamic Countries (OIC)

### Convention on the settlement of investment disputes

In the interest of promoting and protecting foreign investment, the Malaysian government ratified the provisions of the Convention on the Settlement of Investment Disputes in 1966. The Convention, established under the auspices of the International Bank for Reconstruction and Development (IBRD), provides international conciliation or arbitration through the International Centre for Settlement of Investment Disputes located at IBRD's principal office in Washington.

### Kuala Lumpur Regional Centre of Arbitration

The Kuala Lumpur Regional Centre for Arbitration was established in 1978 under the auspices of the Asian-African Legal Consultative Organisation (AALCO) - an inter-governmental organisation cooperating with and assisted by the Malaysian government.

A non-profit organisation, the Centre serves the Asia Pacific region. It aims to provide a system to settle disputes for the benefit of parties engaged in trade, commerce and investments with and within the region.

Any dispute, controversy or claim arising out of or relating to a contract, or the breach, termination or invalidity shall be decided by arbitration in accordance with the Rules for Arbitration of the Kuala Lumpur Regional Centre for Arbitration.

# Start-up financing in India

## Small Industries Development Bank of India (SIDBI), India

India <https://www.sidbi.in>

With a strong purpose to support, develop and nurture ideas of modern entrepreneurs that are instrumental in transforming the Indian economy, the Small Industries Development Bank of India (SIDBI) has been playing an important role in developing the Venture Capital (VC) eco-system in the country. Through its holistic offerings comprising of credit and support ecosystem with tailor-made initiatives, SIDBI operates thoughtfully designed initiatives that meet the requirements of a modern entrepreneur at every stage of his journey, from idea generation to venture formation to scaling up a business. SIDBI's initiatives have been instrumental in creating a vibrant entrepreneurial support ecosystem where a strong capital flow is made available along with relevant hand-holding to ventures. To provide financial resources for Start-ups / MSMEs, SIDBI has been contributing to corpus of various Alternative Investment Funds (AIFs) / Venture Capital Funds (VCFs) for over two decades, which in turn invest at both early & growth stages in Start-ups / MSMEs.

SIDBI does not invest directly in Start-ups, but participates in the capital of Alternative Investment Funds (AIF) registered with Securities and Exchange Board of India (SEBI). SIDBI, thus, contributes to the corpus of Alternative Investment Funds (AIFs) for investing in equity and equity-linked instruments of various Start-ups at early stage, seed stage and growth stage.

SIDBI has been managing the following funds for start-ups:

### Fund of Funds for Start-ups

In line with the Start-up India Action Plan unveiled by the Hon'ble Prime Minister on the January 16, 2016, the Cabinet approved the establishment of 'Fund of Funds for Start-ups (FFS) at SIDBI for contribution to various Alternative Investment Funds (AIFs). Introduced with a focussed objective of supporting development and growth of innovation driven enterprises, the Fund of Funds

(FFS) facilitates funding needs for Start-ups through participation in capital of SEBI registered Venture Funds.

### Aspire Fund

The Aspire fund provides support to various Angel / Venture Capital Funds (VCFs) for investing in start-ups / early stage enterprises in the areas of innovation, entrepreneurship, forward backward linkage with multiple value chain of manufacturing and service delivery, accelerator support in the agro-based Industry verticals and sectors which would galvanize the rural economy.

### India Aspiration Fund

India Aspiration Fund set up SIDBI with the support of RBI pursuant to a budget announcement is an INR2000 crore fund introduced by SIDBI with a vision to promote and accelerate equity and equity linked investments in Start-ups and MSMEs. IAF contributes to the corpus of SEBI registered Alternative Investment Funds (AIFs), with sector agnostic investments specifically involving MSMEs as key strategic investment sectors.

### TIFAC-SRIJAN Scheme

TIFAC-SRIJAN Scheme aims at facilitating development, demonstration and commercialization of technology innovation projects pertaining to new product or process development to encourage and promote development of capabilities in MSMEs to innovate and to bring high-risk innovations to the market for opening up opportunities for business linked with innovations. The programme supports MSMEs towards development, up-scaling, demonstration and commercialization of innovative technology based projects by providing developmental loans at flexible terms & interest rate to encourage / promote development / innovation of new technology / process / product and its commercialization.

### Globalization of Low-Carbon Technologies: The Impact of the Paris Agreement

This book explores the opportunities and barriers within the Intended Nationally Determined Contributions (INDC) framework of the Paris Agreement for low-carbon technology diffusion. Further, it proposes appropriate and feasible mechanisms required at local, national and regional levels to achieve the INDC targets. The book employs both meta policy analysis and scenario building to examine, whether the diffusion of low-carbon energy future by 2030 is economically viable under the INDC framework and how international technology cooperation could accelerate investments on the scale required for achieving the INDC targets. Further, this book provides new perspectives on market and non-market mechanisms for the globalization of low-carbon technologies, within the framework conditions of the Paris Agreement, which will be of significant value to senior policy makers, multi-disciplinary academia, and investing communities.

For more information, contact:

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# Area-based innovation in Thailand

## National Innovation Agency, Thailand

<http://www.nia.or.th>

Area-Based Innovation strategy has been developed to accelerate innovation potential in certain residential areas and generate the co-creation of communal innovation opportunities for people via the Yothi Innovation District project, emphasizing mainly on the development of medical innovation, e-Government, and area-based innovation.

The National Innovation Agency (NIA) has determined to maximize people's innovation potential at an area-based level, leading to the Innovation Corridor, Innovation City, and Innovation District. In other words, the increase of innovation potential will focus mainly on three developmental aspects, consisting of promoting infrastructure development conforming to the advancement of an innovative ecosystem, managing vital resources to stimulate area-based innovation, and fostering community involvement.

### Innovation Corridor

The GMS Southern Economic Corridor possesses an approximate distance of 1,320 kilometers that strategically connects Thailand, Myanmar, Cambodia, and Vietnam together.

In fact, the area-based innovation has taken into account the efficiency of being exposed to geographical strengths and natural resources in certain communities, expecting to stimulate economic and social development in various living areas. Key strategies used for driving economic and social progress consist of communal industry, infrastructure, human resources, and advances in science and technology. The economic and social development plan generally focuses on the advancement of infrastructure and investment. However, the plan still faces extreme difficulty due to a lack of knowledge-based and technological support.

The NIA has recognized the importance of advancing area-based innovation based on the development of overall aspects. The NIA, in collaboration with the Geo-Informatics and Space Technology Development Agency (Public Organization) (GISTDA), the Designated Areas for Sustainable Tourism Administration (Public Organization) (DASTA), the Industrial Estate Authority of Thailand (IEAT), and Rayong Provincial Governor's Office, has launched the "Area-Based Economic Innovation to ASEAN" project, while signing a Memorandum of Understanding with the mentioned organizations to support the acquisition and completion of statistical data, climatological information, details of potential raw materials used for production, and facts on potential investments generated by the public and industrial sectors, as part of the goal to get the required data processed and analyzed complying with the government's policy on the Special Economic Development Zones. In order to make such ideas achievable, the NIA has

hence invited experienced innovation-based business providers and new startup entrepreneurs to work together to create a potential innovation cluster, emphasizing on the development of infrastructure, tools, and mechanisms required for successful business operations and a better quality of life for people in different communities. This helps encourage people to create productive ideas towards the progress of innovation, promote the co-creation of innovation through innovative concepts, and foster knowledge sharing among agencies, businesses, and people in various communities.

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

### Innovation District

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



# MSC Malaysia innovation voucher

**Malaysiaeconomy.net.**

<http://www.malaysiaeconomy.net>

MSC Malaysia Innovation Voucher is a programme designed to increase collaboration between Malaysia's public and private Institutions of Higher Learning (IHL) and Research Institutions (RI) with MSC Malaysia status companies, so as to tap into each other's capabilities and strengths. This serve to create a cultural shift in the business community's approach to innovation as companies can tap into experts/talents residing outside the company. The innovation voucher is a financial incentive worth of RM10,000 awarded to qualified MSC Malaysia status companies to support collaborative R&D projects from the approved collaborators. These collaborative R&D activities would then facilitate the transfer of know-how from the collaborators to the MSC Malaysia status companies and vice versa. In turn, this will lead to the production of innovative prototypes, quality products and potential Intellectual Property (IP) creation.

The objectives and desired outcomes of the Innovation Voucher are:

1. To increase the number of collaborations in research and innovation between MSC Malaysia companies and IHLs/ RIs/COEs.
2. To increase the number of innovative proof-of-concepts (POCs), products, services and solutions from MSC Malaysia. Potentially, it will lead to increase in technology commercialization and sales growth of the companies.
3. To increase in potential creation of IP (intellectual property).
4. To support the development and strengthening of triple helix model fundamental to National Innovation, contributing to national competitiveness.

## Eligibility

1. The Applicant must be a Local MSC Malaysia Status Company with at least 50% Malaysian shareholding.
2. Must have completed SCORE+ exercise.

## Programme details

1. The total project cost funded by one Innovation Voucher should be at least RM15,000 with the company's financial contribution of at least RM5,000.
2. Voucher is valid for 1 year only.
3. Innovation Voucher supports collaborative projects in line with the list of approved technology areas and list of eligible services.

4. The collaboration must be procured from participating Research Institutions or Institutions of Higher Learning or Centres of Excellence as approved by MDeC.

## Conditions of the usage of the MSC Malaysia Innovation Voucher

1. An eligible MSC Malaysia Status Company is only allowed to submit one application per call.
2. Each Innovation Voucher is worth Ringgit Malaysia Eight Thousand (RM8,000.00) only. If the total cost incurred in engaging services is more than Ringgit Malaysia Eight Thousand (RM8,000.00), the participating company is required to bear the difference.
3. An Innovation Voucher can only be used to offset project cost of at least Ringgit Malaysia Ten Thousand (RM10,000) with the company's financial contribution of at least Ringgit Malaysia Two Thousand (RM2,000). The Innovation Voucher can only be used to procure services as defined in the list of eligible services.
4. Innovation Voucher is valid for 1 year from the approval date i.e. the Innovation Voucher has to be redeemed within 1 year. After the expiry date, the Innovation Voucher ceases to have any effect and is no longer usable; and MDeC shall be discharged from all responsibilities thereunder.
5. Innovation Voucher is nontransferable i.e. can only be used by the approved applicant.
6. Subject to availability of the Programme and funding to MDeC, recipients of Innovation Voucher can reapply upon expiry of two (2) years from the date specified in the approval letter.
7. Innovation Voucher can only be used at MDeC's list of approved service providers.
8. Innovation Voucher is non-tradeable or exchangeable for cash.
9. All Innovation Voucher applicants are required to provide true and complete information as per the Innovation Voucher Application Template. Application must be signed by the authorised representative(s) of the company and participating service provider.
10. Innovation Voucher recipients are required to submit a final report prepared jointly with the participating service provider and signed by the authorised representative(s) of both parties upon completion of the approved project.
11. Innovation Voucher will be redeemed by the participating service provider upon verification that the project milestones are met and the company has paid its part of the cost.

# Cleaner production initiatives in Sri Lanka

## National Cleaner Production Center Sri Lanka

<http://www.ncpcsrilanka.org>

### METABUILD

Project Resource efficient supply chain for metal products in building sector in South Asia (METABUILD) is an ongoing project of NCPC. Metal sector with a huge potential in resource saving is a new segment to NCPC. Generally metal sector operations like degreasing, pickling, galvanic baths use acids and the wastewater is highly polluted. Further, waste, high energy consumption and pollution are major concerns due to lack of material stream and waste management systems which also lead to reduced profits. Also the metal sector lacks awareness about best practices in RECP; knowledge of technical solutions and financial options for RECP implementing.

As a solution, centre will provide consultancy services to 80 metal processing industries to improve their resource efficiency. The Energy and Resources Institute (TERI), the adelphi research gGmbH, Austria Recycling Vereinzur Förderung von (AREC) and STENUM Asia Sustainable Development Society (STENUM Asia) are engaged in implementing this project.

### Eco Innovation

As global trends: environmental, social, technological drivers continue to shift the foundations of current business models. Incremental innovation stand alone has become less sufficient in enabling industries to succeed. Identifying the need for adopting fundamentally different approaches to innovation, United Nations Environment Programme (UNEP) introduced "Eco Innovation". The concept aims to fully uncover its value creation potential for a company through incorporating sustainability. Project is being implemented in 6 agri-food industries (Dairy, Cinnamon, Desiccated Coconut, Fruit processing and soy manufacturing) in Sri Lanka for last one and half years mainly targeting to increase profitability through a critical analysis over life cycle of companies. Concept is being proven by UNEP publishing case studies from different countries that it brings out increased performances of businesses.

### Green Chemistry and Technologies

Chemicals have made our lives easier and today it is an indispensable resource. However, the increasing usage of chemicals in industrial processes poses a considerable threat to the Health Safety and Environment (HSE) aspects of the organizations. These effects can be observed throughout the supply chain from the point of sourcing to the point of consumption. As the country's premier provider of sustainability solutions, NCPC has come forward in partnership with UNIDO and Yale University, USA to address

these concerns in local industries with its new project on "Green Chemistry and Technologies"

### Chemical Leasing

Chemical Leasing is a new strategy introduced by UNIDO to reduce the consumption of chemicals and minimizes harmful environmental impacts caused by them. The novelty in Chemical Leasing is that it brings together the supplier and the user to form a partnership through which chemicals are used more efficiently and in an environmentally sound manner.

Chemical Leasing strives for a win-win situation and aims at increasing the efficient use of chemicals while reducing the risks of chemicals and protecting human health. It is cost effective to both the supplier and the user. It also improves the economic and environmental performance of participating companies and enhances their access to new markets. Key elements of successful Chemical Leasing business models are proper benefit sharing, high quality standards and mutual trust between participating companies.

### The traditional business model

According to the traditional system chemicals are a commodity that are sold by suppliers and bought by users. Therefore users now become the sole owners of these materials which mean that they are responsible for the storage, usage, management and disposal of chemicals. The supplier has a clear economic interest to sell more quantities of chemicals to the user and this practice can lead to high chemical wastage. If the consumer on the other hand takes measures to reduce his consumption it can have a negative business impact on the supplier.

### Chemical leasing business model

Chemical Leasing is a service-oriented business model that shifts the focus from increasing sales volume of chemicals towards a value-added approach. The supplier sells the functions performed by the chemical instead of the chemical itself and these functional units become the basis for payment. In this business models the responsibility of the supplier is extended beyond selling of chemicals to include the entire lifecycle of the chemical.

### Chemical leasing activities

Chemical Leasing is a new concept being introduced in the country to reduce environmental impacts of chemicals through the development of a synergy between user and supplier. NCPC offers awareness and training services to interested industries.

# Green Technology in Malaysia

Malaysian Investment Development Authority, Malaysia

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

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

## Renewable energy

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

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

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

## Energy efficiency

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

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

## Green technology incentive

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

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

## Asia Sustainable and Alternative Energy Program

The Asia Sustainable and Alternative Energy Program (ASTAE) is a global partnership to scale up the use of sustainable energy in the Asia-Pacific region in order to reduce energy poverty and protect the environment. Achieving this objective rests on promoting ASTAE's three pillars for sustainable development: renewable energy, energy efficiency, and access to energy. Activities that support countries in adapting to and mitigating the impacts of climate change cut across these three pillars.

ASTAE helps accelerate and intensify early-stage energy sector innovations. The program assists to conduct a study, hire a consultant, or test a promising "first of its kind" concept which in turn can inform the direction of a World Bank investment project or help alter its course in the case of rapidly evolving conditions during the implementation phase. To better support World Bank investment projects and enable private sector investment, ASTAE also shares best practices to improve institutional, policy, financial, legal, and regulatory frameworks across the region.

For more information, access:

<https://www.astae.net>

# TECHNOLOGY OFFERS

HUNGARY

## Digital dermoscopy device

Our partner, a Hungarian SME has created a novel digital dermoscopy device and analyzing software connected to it. The product was developed to examine pigmented skin lesions and to diagnose their malignancy automatically. This purpose is inspired by the fact that skin cancer tumors (like Melanoma Malignum) belong to the most rapidly increasing cancers in the world. They are interested in a license agreement.

### Area of Application

Typical application areas are:

- Dermatology
- Cosmetics
- Law enforcement: bank note checking

### Typical customers are

- Dermatologists
- Cosmeticians
- Dermatology patients

### Advantages

- Easy usage
- The image recording device can take an image series from a pigmented skin lesion with different illuminations.
- A database of patients can be easily made, which helps the users to follow the changes of their lesions. With this feature, higher accuracy recognition of many malignant diseases can be achieved.
- The automatic diagnosis feature allows the product to be used both by experts and untrained persons.

### Development Status

Laboratory model

### Legal Protection

Patent

### Transfer Terms

- Technology licensing
- Equipment supply
- Research partnerships

### Target Countries

Worldwide

## Central venous catheter system

A Hungarian medical research institute has developed a central venous catheter system for subclavian or jugular vein puncture. The kit contains the following items: insertion needle with the patented two-way valve system, syringe to check if the catheter is in place, the catheter itself, wrapped in sterile package and plastic adaptor to lock the catheter securely after the removal of

the needle. The patented "HunCath" catheter system is a novel alternative to a safer catheter which can be widely used in techniques, such as pacemaker electrodes.

### Area of Application

Medical technologies

### Advantages

Among all catheters currently used this product bears with the lowest risk for the patient and the easiest use for the physician.

### Development Status

Commercial prototype

### Legal Protection

Patent

### Technical specifications

- Requires fewer changes of grip during introduction of the catheter into the vein; therefore, accidental withdrawal of the catheter is less likely.
- The "HunCath" can be inserted into the vein

### Transfer Terms

- Subcontracting
- Technology licensing

### For the above two offers, contact:

Laser Consult Ltd  
H-6701 PO Box 1191  
Szeged  
Hungary

## Composting process using microbes and herbal extracts

Herbal extracts along with the microbes are used for the preparation of the compost which is quite effective in the controlling the soil pathogens and increasing the yield. We could offer an easy method of preparation using the agricultural waste.

### Area of Application

Agriculture

### Environmental Aspects

Waste utilization

### Development Status

Pilot plant

### Legal Protection

Patent filed

### Transfer Terms

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

INDIA



# TECHNOLOGY OFFERS

## **Target Countries**

Worldwide

## **Contact:**

Hiran Biotech

Research and Development Division

66 Turner Road Cantt.

Kanpur 208004, U.P.

India

## **Herbal termite killer formulation**

This is an herbal formulation for instant termite killing. The patent application is pending for the formulation. It holds the potential to wipe-off existing products and hold monopoly in the market. IT is equally good in fields and with furniture etc.

## **Area of Application**

Woodwork, furniture, agriculture, house, offices.

## **Advantages**

Non-toxic, cheap and highly effective

## **Environmental Aspects**

Cleaner production

## **Development Status**

Commercial prototype

## **Legal Protection**

Patent

## **Transfer Terms**

Technology licensing

## **Contact:**

Intellectual Property Lab

2/11, Vishwas Khand-2,

Gomti Nagar,

Lucknow - 226010

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

## **Virgin coconut oil**

Virgin Coconut Oil (VCO) is the oil obtained from fresh, mature endosperm (kernel-meat) of the coconut by mechanical or natural means, with or without use of heat, no chemical refining, bleaching or deodorizing and maintain the natural aroma and nutrients.

## **Area of Application**

Many potential applications in food, health and cosmetics sectors.

## **Development Status**

- Pilot plant
- Commercial prototype

## **Transfer Terms**

- Consultancy
- Technology licensing

## **Chitin and chitosan**

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

## **Area of Application**

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

## **Advantages**

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

## **Environmental Aspects**

Waste utilization

# TECHNOLOGY OFFERS

## **Development Status**

- Pilot plant
- Fully commercialized

## **Transfer Terms**

- Consultancy
- Technology licensing

## **For the above three offers, contact:**

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

## **Nanoparticle for drug delivery**

The technology suggests a sustained-release nanoparticle composition composed of a copolymer of a Nalkylacrylamide, a vinyl monomer, and a polyethylene glycol conjugate for preventing or treating a disease or a condition. The said nanoparticle composition further contains a therapeutic agent such as an antibiotic, anti-restenotic agent, anti-proliferative agent, anti-neoplastic, chemotherapeutic agent, cardiovascular agent, anti-inflammatory agent, immunosuppressive agent, or anti-tissue damage agent. Such nanoparticle compositions generally have a diameter in the range of 20 nm to 100 nm and are used locally for the prevention or treatment of diseases or conditions. The said technology also suggests a method for using a sustained-release nanoparticle composition for preventing or treating a disease or condition. The preclinical studies of this technology have been performed on animal model (rat).

## **Area of Application**

Medical industry

## **Advantages**

- The technology can be used for delivery of various pharmaceuticals agents.
- Provides efficacious treatment.
- It is an adjunct to the existing approaches.
- Nanoparticle prolongs the release of drugs and thus make it bio-available for longer duration.

## **Development Status**

Laboratory model

## **Legal Protection**

Patent

## **Transfer Terms**

Technology licensing

## **Target Countries**

India

## **Contact:**

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

## **Decortication of fibrous plants**

Technology allows for extraction of bast fibers from straw by so called decortication process without prior drying of the straw which considerably influences the price of the fiber and simplifies the process resulting in energy, labor and cost reduction. The key elements of the technology are decortication device allowing for processing of non-retted hemp and flax stems and cleaning unit. High efficiency machines produce a "green" fiber of quality suitable for pulp or composite materials production. Produced fiber is baled in 300 kg bales by hydraulic press.

## **Area of Application**

Bast fibrous plants processing industry; Farm cooperatives focused on bast fibrous plants production

## **Advantages**

- High output
- Energy savings
- Purity of end-product (fiber)
- Straw can be processed without prior drying

## **Environmental aspects**

- Cleaner production
- Waste utilization
- Energy efficiency

## **Development Status**

Fully commercialized

## **Legal Protection**

Patent

## **Technical specifications**

- Processing capacity: 1.5 t of straw/h
- Energy consumption: 110 kw/h
- End purity of produced fiber: 10-15%
- Service requirements: 3 people

## **Transfer Terms**

Technology licensing

## **Contact:**

Institute of Natural Fibres and Medicinawl.  
Wojska Polskiego 71B Poznan  
Poland  
Zip/Pin Code: 60-630

# TECHNOLOGY REQUESTS

CHINA

## Disposable syringes plant

We need complete consultancy and technical know-how to manufacture Disposable Syringes of 2 ml and 5 ml using Semi-Automatic Disposable Syringes plant.

### Area of Application

Clinics and hospitals

### Project Type

New idea

### Contact:

*Ploytex Chemical Engg. Co.*

*No.317 Wenhuidong Rd, Yangzhou city, Jiangsu*

*China 225009*

## Syringe making plant

An Indian firm is interested in setting up a Syringe making plant. They need consultancy and price quotes for this project.

### Area of Application

Pharma industry

### Project Type

Start-up

### Contact:

*Mr. M.K. Sharma Shree Cement Limited*

*Bangur Nagar Beawar - 305901*

*Tel: +91 - 01462 - 228101 to 05*

*Fax: +91 - 01462 - 228117 to 19*

*E-mail: sharmamk@shreecementltd.com*

## Quinine sulphate

We are looking for the detailed process from actual experienced persons or organisations.

### Area of Application

Malaria treatment

### Project Type

Start-up

### Contact:

*Auro Associates B-12,*

*Dhanlaxmi Complex, Nr. Samta Society, Subhanpura,*

*Baroda 390021, India*

## Shoe manufacturing system or machine

We are looking for the technology that can help us to produce shoes. We also want to know detail of the technology such as, specification, price, etc.

INDIA

THAILAND

### Area of Application

Textile industry, Manufacturing industry, Shoe manufacturing industry

### Transfer Terms

- Consultancy
- Joint venture
- Equipment supply

### Project Type

Start-up

### Target Countries

Worldwide

### Contact:

*Textile Development Co., Ltd.*

*43/43 Moo 2 Soi Prompian 6, Tambol Bansuan, Muang*

*Chonburi*

*Thailand 20000*

## Proteins and polyphenols from 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.

### Area of Application

Consumable product

### Transfer Terms

- Joint venture
- Technical services
- Technology licensing

### Project Type

New idea

### Target Countries

Worldwide

### Contact:

*Strategic Allies Ltd.*

*The Red & White House 113, High Street*

*Berkhamsted, U.K. HP4 2DJ*

*United Kingdom*

UNITED KINGDOM

## Climate Technology Centre and Network

CTCN provide technology solutions, capacity building and advice on policy, legal and regulatory frameworks tailored to the needs of individual countries by harnessing the expertise of a global network of technology companies and institutions.

For more information, access:

<https://www.ctc-n.org>

## Selected Analytical Reports and Technology Platforms & Databases of APCTT

### Analytical Reports (available online)

1. National Assessment Framework on Enabling Environment, Technology Innovation Ecosystem for Making Sustainable Energy Options Affordable and Accessible (For Indonesia and Lao People's Democratic Republic), January 2014  
[http://apctt.org/nis/sites/all/themes/nis/pdf/National-assessment-framework\\_-final\\_ESCAP.pdf](http://apctt.org/nis/sites/all/themes/nis/pdf/National-assessment-framework_-final_ESCAP.pdf)
2. Report on the National Assessment Framework of Enabling Environment and Technology Innovation Eco-system for Making Sustainable Energy Options Affordable and Accessible – Indonesia, May 2014  
[http://apctt.org/nis/sites/all/themes/nis/pdf/Indonesia\\_Report-on-National-Assessment-of-Sustainable-Energy\\_optimized.pdf](http://apctt.org/nis/sites/all/themes/nis/pdf/Indonesia_Report-on-National-Assessment-of-Sustainable-Energy_optimized.pdf)
3. Indonesia National Sustainable Energy Strategy Report on Enabling Environment and Technology Innovation Ecosystem for Affordable Sustainable Energy Options, May 2014  
[http://apctt.org/nis/sites/all/themes/nis/pdf/Indonesia-National-Strategy-Report\\_final.pdf](http://apctt.org/nis/sites/all/themes/nis/pdf/Indonesia-National-Strategy-Report_final.pdf)
4. Report on the National Assessment Framework of Enabling Environment and Technology Innovation Ecosystem for Making Sustainable Energy Options Affordable and Accessible - LAO PDR, May 2014  
[http://apctt.org/nis/sites/all/themes/nis/pdf/Lao\\_Report-on-National-Assessment-of-Sustainable-Energy.pdf](http://apctt.org/nis/sites/all/themes/nis/pdf/Lao_Report-on-National-Assessment-of-Sustainable-Energy.pdf)
5. Lao People's Democratic Republic National Sustainable Energy Strategy Report on Enabling Environment and Technology Innovation Ecosystem for Affordable Sustainable Energy Options, May 2014  
[http://apctt.org/nis/sites/all/themes/nis/pdf/Lao-National-Strategy-Report\\_final.pdf](http://apctt.org/nis/sites/all/themes/nis/pdf/Lao-National-Strategy-Report_final.pdf)
6. National Innovation System (NIS) training manual - "NIS Diagnosis and STI Strategy Development to Achieve National Sustainable Development Goals", 2016  
<http://apctt.org/nis/sites/all/themes/nis/pdf/NIS%20Training%20Manual.pdf>

### Technology Platforms and Databases

1. APCTT's Technology4SME Database  
The Technology4SME Database serves as an online platform for information exchange on the availability and sourcing of technologies for small and medium enterprises in countries in the Asia Pacific region.  
<http://apctt.org/technology-transfer>
2. Renewable Energy Technology Bank  
The primary objective of the Renewable Energy Cooperation-Network for the Asia Pacific (RECAP) established by APCTT is to facilitate technology transfer cooperation among countries in the Asia-Pacific region in the area of renewable energy. RET-Bank provides tested and proven renewable energy technologies (RETs) initially in the areas of solar, biomass, wind, mini-hydro power and geo-thermal energy.  
<http://apctt.org/recap/renewable-energy-technology-bank>
3. Global Technology Databases  
APCTT has compiled a list of global as well as country-wise technology databases that deal with the technology transfer related services for SMEs and entrepreneurs.  
<http://apctt.org/apitude/>



# Techmonitor.net

The website for YOU to

- Network with your potential technology partners
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- Know latest technological developments in

- Biotechnology
- Waste Technology
- Non-Conventional Energy
- Food Processing
- Ozone Layer Protection

- Read articles on

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- Technology Markets
- Technology Transfer

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- Start-up venture creation
- Venture financing
- Innovation management
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New Delhi, India