



Confederation of Indian Industry



Innovation Ecosystem in India

मनुषि भरति फत्ति धरति गत्ति अति उत्ति हस्त सक्ति किण रथकि किष्ठे ।
चलाकि किञ्च हवय धकि किच सा दाश दृव वल म फ छ कला-अर्थ-वदाम् ॥

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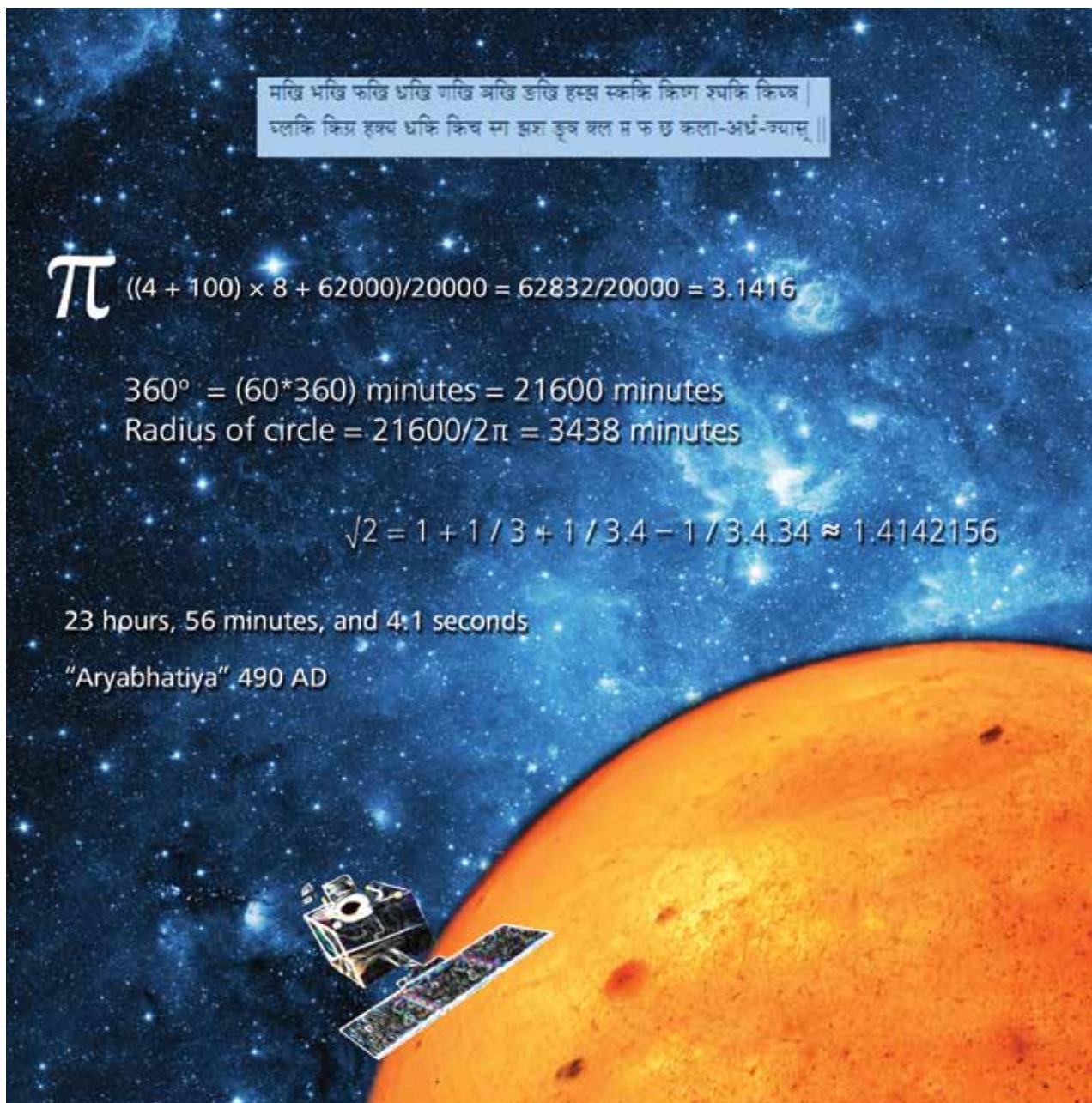
$$((4 + 100) \times 8 + 62000)/20000 = 62832/20000 = 3.1416$$

$$360^\circ = (60 * 360) \text{ minutes} = 21600 \text{ minutes}$$
$$\text{Radius of circle} = 21600 / 2\pi = 3438 \text{ minutes}$$

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23 hours, 56 minutes, and 4.1 seconds

"Aryabhatiya" 490 AD



Knowledge Partner

“Just as oxygen is the lifeblood of living organisms, I think innovation is the driving force behind a successful economy. For too long, under the license raj system, India's innovators were stifled by its protectionist bureaucracy and red tape. But as India increasingly becomes a significant player in the global village, it is the ability of Indians to deliver frugal innovations at global scale that can become the nation's true comparative advantage.

I therefore commend i4c for donning the mantle of turbocharging India's innovation ecosystem and encouraging innovators from different walks of life to commercialize their ideas. I wish them tremendous success in this noble endeavour.”

Anand Mahindra, Chairman,
Mahindra Group

Foreword



Hemant Joshi

India is and has always been at the center stage of some great innovations - be it the digit '0' by Aryabhata or the contribution towards astrology and technology. World is coming back to accept the knowledge of Ayurveda and Yoga for the betterment of individual life. The recent success of indigenously built Mars Orbiter – Mangalyaan on its first attempt is a tribute to not only frugal innovation (cost incurred ₹7 per kilometer in covering the 650 million km distance to Mars, least amount spent - \$74 million, one-tenth of the \$670 million that NASA spent on its Maven explorer) but also a demonstration of India's mastery of technology and leadership.

The Digital India program of the government is a very good platform for people to display their talent and share ideas on spectrum of topics. Participatory governance is a step towards inclusive and equitable growth of all the segments of the society with inputs from grassroots to the dominant. The digital revolution will also kick in innovations for the bottom of pyramid segment for effective and sustainable growth. More and more innovations are expected in the sectors like education, agriculture, healthcare and environment in the coming years to solve the challenges faced by the rural masses.

Technology innovation will disrupt the traditional models which have been accepted and used for ages, rendering them obsolete or redundant (example: railway ticket booking through IRCTC, e-commerce, video on demand, etc.). Technology is disrupting the long-established paradigms in several sectors from automotive, energy, healthcare to media, governance and education. India

is at the forefront in terms of IT and IT enabled services. Young, creative entrepreneurs, private entities, both for-profit and non-profit, across the country are engaged in innovative projects to develop products and services of high quality and low-cost. Pune is emerging as the preferred destination for start-ups because of proximity to industries like automotive, IT and manufacturing.¹

India has been good at service innovation in the past few years but we need to harness the power of product innovation to significantly contribute to India's glory globally. India fell to 76th position in the Global Innovation Index 2014 among the 143 economies considered, which shows that India is lagging behind in various parameters in R&D spending, IPRs, ease of doing business, etc. "Make in India" campaign of the government would positively foster the innovation ecosystem in India and could help India in achieving the world leadership.

In the knowledge economy, it is the youth population who are the knowledge assets of the country. India should leverage on the demographic dividend and bridge the innovation gap between the developing countries and the developed world.

Real, sustainable economic development and growth in India will come from indigenous innovations, technologies, products and services. We need to have entrepreneurial spirit to rise to the challenge of Clean India, Safe India, Skilled India, Digital India and Innovative India.

Message from Organizers



**Anand Deshpande,
MD & CEO, Persistent Systems Limited**

Inter-Institutional Inclusive Innovations Centre (i4c)

India is a country of wide-diversity, many opportunities and our own set of challenges. While our scientists have been successful in sending Mangalyaan to Mars, we are still struggling to provide basic sanitary needs for a large population of our country. More than half our population is under the age of 25 and they all aspire for a better future and we owe it to them.

It is well-known that we have some of the brightest and the most innovative minds and that is what makes the i3 event exciting. The i3 event promoted by AICTE, CII, and the Department of Science and Technology, Government of India encourages our brightest minds to find solutions for the problems for our masses. For our problems, just incremental solutions will not do and as it is very clear from the proposals received, we have people who can think of exciting ways to solve our problems. I consider it my privilege to be associated with i4c. Our mission at i4c is to foster innovation in the country and to help create an ecosystem that will allow us to take innovations from concept to the masses. I am delighted that Deloitte has taken the efforts to document ideas and innovations received from the idea competition conducted through i3 and made them available for investors, entrepreneurs and the government to take these to the next level.



**Chandrajit Banerjee
Director General, CII**

Confederation of Indian Industry (CII)

Innovation and Entrepreneurship are the two important pillars of economic growth which India needs to develop and nurture as it progresses towards becoming a knowledge-driven economy. Although in India people are very entrepreneurial, but the country by and large has lagged behind in creating adequate number of new enterprises that it should have achieved with its existing resource base. This issue calls for building a robust entrepreneurial support system in the country backed by the government and industry.

There is a need to act fast in this direction by the Government for creating adequate policy measures on innovation and entrepreneurship at the National, State and Student level which can then create the desired environment for students to look at entrepreneurship as a lucrative career option. Establishing such a uniform policy at the central level and properly implementing it at the state level will greatly motivate the students and create necessary momentum for the entrepreneurship revolution to move faster.

Along with the Government, the Industry should also come forward to contribute in this movement of making India a truly entrepreneurial nation. The CSR spending by industry have the potential to make a huge impact on creating new start-ups. Industry leaders should come forward to provide mentorship support to entrepreneurs to make them overcome initial hurdles and make transition of start-ups into SMEs and beyond more seamless.

I sincerely hope that this report dedicated towards helping the entrepreneurs to understand the ecosystem better and making them more aware about the opportunities available will prove to be a wonderful guide for all. I thank Deloitte to be our partner in coming out with this key report and wish to see this report making important contribution towards developing Indian entrepreneurs and the overall ecosystem.

Message from Organizers



Prof. S. S. Mantha
Chairman, AICTE

All India Council for Technical Education (AICTE)

Innovation is one of the key driving forces in today's world and is gaining further importance with each passing day. An important facet of this innovation paradigm for each nation is the development of its entrepreneurs and start-ups. Like other developed nations, India also needs to embrace entrepreneurship as a solution to its growing economic and social challenges. Entrepreneurship generates economic value, new jobs in the economy and cultures of start-ups, and by virtue of its relationship with innovation, entrepreneurship emerges as a factor in promoting economic growth.

The most important proponent for entrepreneurship in a country would undoubtedly be its students and youths who are dynamic and have the propensity to take up risk at a young age. India being the country with large number of population below the age of 35 has the inherent advantage to become the world leader in creating champion entrepreneurs of our times.

In this entrepreneurial drive, technology-driven entrepreneurship has an essential role to play to take the competition further. India's large number of technical institutions (starting from engineering colleges to polytechnics to science colleges etc.), spreading across all states and union territories, have the potential to make an impact in this space. AICTE being one of the nodal bodies to promote technology education in the country has been proactive in spreading the awareness of innovation and entrepreneurship through various schemes and initiatives in these institutions.

The current publication is an excellent effort to boost the morale of students and budding entrepreneurs to understand the nuances of this important area and to inform a large section of people about the opportunities present in the market. This would be a good value addition for all Engineering students across India and others to have it as a reference, while looking at future career options.

1. Analysis of Indian Innovation Ecosystem

a. Patenting

Innovation is one of the key driving forces in today's world and is gaining further importance with each passing day. In 2011 when Google took over Motorola Mobility, the 17000 odd patents of Motorola itself were valued about \$5.5 billion of the total deal worth \$12.5 billion. Though Google has again sold Motorola to Lenovo and Arris in parts, the patents helped the Search Engine giant to make a mark in the smartphone space with its Operating System (Android) forever. More and more companies in US are realizing the worth of patents that they hold in order to generate cash by unlocking the value held in such intellectual property, but what is happening in India?

Though there isn't any doubt that India has shown a considerable growth in its Research and Development in the past two decades, the number of patent applications filed by the Indian companies and individuals leaving aside the Pharmaceutical Industry are minuscule. The table below shows a comparison of the Intellectual Property Rights (IPRs) filed by Indians and foreigners in India in the last two years:

Table 1: Foreign companies filing majority of the patents and design applications in India

Private consultants and academics can often be a good resource for industry and innovators. But, there are

	Originator	2011	%	2012	%
Patent Applications	Total	42291	100	43955	100
	Indians	8841	20.9	9553	21.7
	Foreigners	33450	79.1	34402	78.3
Design Applications	Total	8216	100	8545	100
	Indians	5156	62.8	5100	59.7
	Foreigners	3060	37.2	3445	40.3

Source: World Intellectual Property Office Statistical Data Center

a. Challenges

A close look at India's innovation ecosystem reveals that it faces numerous challenges in virtually all aspects of the innovation ecosystem. India does not spend enough on R&D; further, it spends very little in industrial R&D. Current government-supported R&D organizations in India do not adequately serve the industry, particularly rural innovators and small entrepreneurs.

India has plenty of semi-trained, English speaking, scientific and engineering talent that is further trainable. While their youth is an advantage, their inexperience and lack of training is a major disadvantage. Young people have a strong desire to get ahead quickly and sometimes confuse activity with productivity. It is our observation that they try to make up for their lack of experience and training via shortcuts. Taking shortcuts does not portend

well for R&D and innovation. Our education system does not teach how to seek, organize, and critically analyze information. Now that information is freely and readily available to everyone, we need to provide them with skills to solve problems in a creative and efficient manner.

The industry is risk averse and has a follower mentality. Those who can spend don't have the mindset to spend in R&D; they would rather purchase proven technology to achieve growth. Industrial organizations don't see enough return in new R&D. And to compound this further, industry has very poor perception of R&D service providers – the academia and the national laboratories. Laboratories that can provide multidisciplinary input to develop technology solutions are non-existent. IP protection and enforcement are lacking.

many conflicts in Indian academia-industry relationships. Academia focuses on creation of scientific knowledge, not necessarily on solving industrial problems. The academicians generally address theoretical scientific solutions without much focus on practical need and application. In contrast, industry needs rapid, implementable but not necessarily perfect answers and needs to protect the findings for a proprietary advantage. Since academia relies on students for much of the ground work, the continuity and sustainability of R&D is affected when the student graduates and moves away for employment.

The answer lies in making available external, applied R&D services to industry in a creative, well-managed, cost-effective manner on a contract basis. Applied contract R&D, in contrast to academic R&D, uses trained R&D professionals to provide systematic, scientific and managed, practical and outcome-driven R&D service. R&D managers need freedom to operate along with responsibility to deliver results. Use of external contract R&D services avoids reinvention, reduces cost, and takes advantage of best practices and teamwork employed by R&D professionals.

Problem solving capability in Indian industry is lacking because of scarcity of trained R&D providers and managers. R&D should be managed by young, leading scientists who are more up to date with state of the art scientific training. Training mid-level R&D managers is a critical requirement in India.

Successful innovation requires strong conviction, ability to take risk, managed scientific approach, collaboration, scalability, and a suitable business model. Concepts need to be converted and exploited not only to extract value for the stakeholders but also ensuring sustaining livelihood and adequate rewards for people driving the innovation.

Currently in India, there is virtually no avenue to quickly solve industrial problems. Investment that government is making in R&D is not well-suited for industrial growth. Unfortunately, the R&D funding provided to high ranking universities and national laboratories does not address the needs of the rural innovators and SMEs. Approximately, two-thirds of all R&D funding in India is spent on academia, government and national laboratories. It is common to hear senior government officials repeatedly emphasize that industry should spend more on R&D. Generally speaking, SMEs, who are fond of

new ideas and innovation, are not rich enough to spend money on R&D. Large companies, on the other hand, that can spend on R&D, can always acquire new technologies through licensing or acquisition. Moreover, even they cannot spend large sums of money to set up comprehensive laboratories that are required to solve today's complex problems.

Challenges in patenting

Awareness and mind-set: One of the several reasons that India has lowest patent registration rates per million of population (8 patents are filed by every 1 million people as opposed to 396 in China) is lack of awareness and the cost-based mind-set. The thrust on innovation is nonexistent in our education system ab-initio and majority of the Small and Medium Enterprises (SMEs) are driven by cost-based value proposition.

While the corporate India understands the value of Intellectual assets, many companies do not allocate funds for Intellectual property creation and focus on short-term growth ideas. In October this year Nirmala Sitharaman, the Union Minister of Commerce has announced that the government will come up with its own IP policy within a span of six months. With a balanced political leadership and momentum at the centre we hope this policy will guide the way India is innovating, keeping the national interest of Indian republic. Thus, our IPR system is still in enact stage.

The continuous efforts of Indian Government gives pace to the intellectual regime but more efforts are to be taken in overcoming challenges which restrict IPR to reach the international standards.

Infrastructure: The Indian Intellectual property laws were harmonized with the Global ones during the decade 1995-2005. India being a large country also has uniquely positioned four different branches of Patent office in Kolkata (the oldest one), Mumbai, New Delhi and Chennai respectively. The government has renovated the infrastructure of these offices and ensured that the functioning of the office remains transparent. However the offices are understaffed since many Patent examiners are lured into the private jobs as their experience at the Patent office is perceived beneficial by the private enterprises.

India has less than 300 functioning examiners across four Patent offices today, as compared to 8400 in the

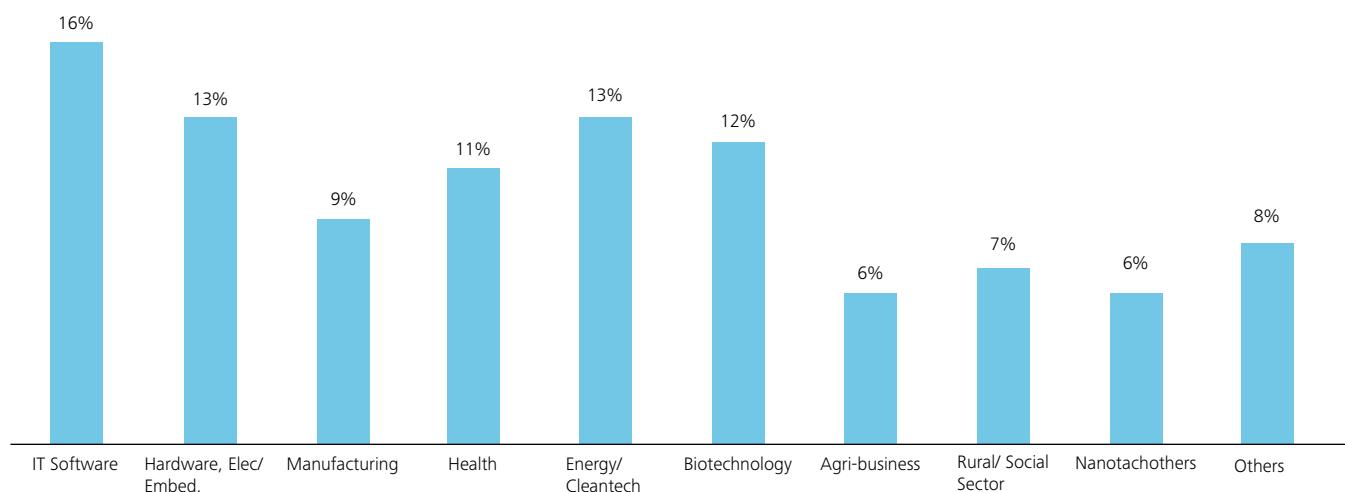
US. The average time to issue an examination report is over 55 months as compared to 20-25 months in majority of the other patent granting countries. While a National IPR Policy is being rolled out by Department of Industrial Policy & Promotion (DIPP) in India, the recruitment and the retention of Human Resource should be taken up with extreme seriousness.

b. Business Incubator Models

There are various business incubator models evolving in the country – from incubators setup at academic institutions; at early stage financial institutions; those support-

ing social enterprises and more recently some attempts by corporate houses to set up incubators as well. The Government of India through its Department of Science and Technology (DST) has provided significant support for initiation and evolution of business incubation. DST had pioneered incubation, setting up Science and Technology Entrepreneurship Parks (STEP) in the 1990s, and more recently Technology Business Incubators (TBI). These incubators can be broadly classified into two major categories – commercial (incubators/ accelerators) and not-for-profit (incubators/STEPs).

Figure 1: Thrust area of incubators²



Source: National Science and Technology Entrepreneurship Development Board

Instigating innovation in India - Creating an Innovative India

Most of those committed to innovation talk of encouraging, nurturing, fostering or initiating innovation. Given the context and the many social, psychological and economic constraints, I would urge that we look at innovation as something that needs to be instigated. As a people, we are inherently innovative; what is needed is to "instigate" people to get rid of the stifling layers of conformity and structural oppression which buries the innate innovativeness of Indians. These are imbibed through the conventional school system built on rote learning and a society that is hierarchical: an inheritance that we have to break away from.

One of the biggest facilitators of innovativeness and creativity is diversity. In a culture that is diverse, each one gets used to the fact that others around them often have a different mother-tongue, eat a different kind of cuisine, come from a different background, and sometimes espouse a different religion and ethnicity. It then becomes natural – and acceptable - that they may well think differently. This concept of "thinking differently" is the essence of innovation. India is uniquely placed in this regard: only few other countries have the scale of diversity that India does. We are, therefore, naturally blessed with one of the key ingredients necessary for evolving an innovative society. This needs to be recognized, nurtured and built upon.

Another essential ingredient which we have – unfortunately – in abundance is adversity. This pushes people to think of out-of-the-box solutions. The difficulties of day-to-day life, the shortage of critical items, the bureaucratic hurdles: all force people to find unique and creative solutions. This is undoubtedly a major driver of innovation. Obviously, adversity is not something one wants to encourage; the challenge here is of channelizing and institutionalizing the innovativeness that results from it.

Democracy, in the true sense, is a vital ingredient of innovation. In contrast, feudalism – following commands without thought or question, because they come from a "superior" authority – is the death knell for not only science, but also for the creation of an innovative society. To put it metaphorically, the "lal batti" (the red light on the cars of the powerful, entitling them to unquestioning right-of-way) is a stop sign for science. It is the free dialogue, the dissent and the many shades of views inherent in a democracy that are also the necessary hallmarks of an innovative society. The very same applies to organizations too – be they corporate entities or not-for-profit ones, including educational institutions.

The more standard necessities for innovation are well known: early-stage or angel funding; a market that facilitates exits, and mergers and acquisitions; appropriate tax and fiscal incentives to promote all these; arrangements for incubation, mentoring and networking; Also important is the recognition and show-casing of innovation, and of role models, so as to encourage innovators, especially the young. The creation of an innovative society must begin from our schools. National Innovation Scholarships for children would be a positive and long-term complement to the innovation funds – government and private – and many other initiatives. But let us not forget the importance of those vital additions to our demographics – viz., diversity and democracy.

Kiran Karnik
Former President, NASSCOM
Senior Fellow, C-PACT, Shiv Nadar University
Member of erstwhile National Innovation Council



2. Innovation Support System

a. Funding / Other Support Mechanisms

India has a well evolved system for supporting and funding science, technology and innovation (STI). The National Innovation System (NIS) has evolved over the years and positioned itself to meet the requirement of various policy changes. In the country, economic activity is gaining momentum. Innovation is thus at the center stage and so are desired collaborations and partnerships for the purpose of achieving it and deploying it for the socio economic development.

Various Government Ministries, Departments and Agencies in public domain, and several entities in private domain constitute the ecosystem of STI support and funding in India. There are various schemes in the public domain which play an enabling role and there are several venture capital and private equity funds which are providing support for innovation.

In the Ministry of Science and Technology, Department of Science and Technology (DST)³, Department of Biotechnology (DBT), Department of Scientific and Industrial Research (DSIR) and Council of Scientific and Industrial Research (CSIR) have carved out the strategic frameworks to provide the support and funding. They have several success stories – the support and funding provided has led to development of world-class technologies on one hand and techno-entrepreneurship on the other. Some of the funding mechanisms are briefly summarized here to give a feel of available framework and opportunity to obtain the desired support for innovation and deployment of the same.

1. Under the Department of Science and Technology (DST), National Science & Technology Entrepreneurship Development Board (NSTEDB) promotes knowledge driven and technology intensive enterprises.⁴ It has various support mechanisms, efforts through which have led to development of high end entrepreneurship in the country. These include: Innovation and Entrepreneurship Development Centre (IEDC); Science & Technology Entrepreneurship Development (STED) project; Science and Technology Entrepreneurship Park (STEP); Technology Business Incubator (TBI) etc. The NSTEDB runs, technology, innovation management and entrepreneurship and information services

through a web portal named TIME IS. It is a one-stop site for budding techno-entrepreneurs in terms of retrieving information and seeking guidance for setting up enterprises.

2. For supporting the development and commercialization of indigenous technology and adaptation of imported technology for wider application, Technology Development Board (TDB) is operating under the Department of Science and Technology (DST).⁵ It has been encouraging the enterprises to take up technology-oriented products and services. The TDB runs a Seed Support Scheme for technology startups in Technology Business Incubators and Science and Technology Parks as well. Enterprises can seek support in partnership with an Indian R&D institution or on a standalone basis, in case of technology commercialization. For the purpose of adapting and commercializing imported technology, board supports endeavors of effecting crucial modifications, through an R&D institution and efforts beyond proof of concept or design stage, aimed at development of commercializable technology. In doing so TDB supports diverse projects through equity participation and loan assistance modalities.
3. Srijan encourages and promotes innovation capabilities in industry and helps in bringing high-risk innovations to the market place for opening up opportunities to commercialize technology innovation. It is a joint effort of Technology Information, Forecasting and Assessment Council (TIFAC) and Small Industries Development Bank of India (SIDBI) which supports the development and commercialization of innovative technology either developed indigenously or for adapting imported technology to wider domestic applications.⁶ Commercial enterprises, start-ups / incubating companies and/or technocrat-entrepreneurs holding the intellectual property or filed for patent for the developed technology, with or without any other partners are eligible for funding under the Srijan.
4. For grassroots innovators, the National Innovation Foundation (NIF), an autonomous organization under the DST, has been providing necessary institu-





tional support.⁷ The unique framework of NIF has supported several grassroots innovators and traditional knowledge holders and handholding them for nurturing their idea to develop into a commercializable product. The NIF proactively scouts for creative indigenous ideas, innovations and traditional knowledge in process of fulfilling its mission. In doing so, it connects with various players of National Innovation System (NIS). There is an incubator of grassroots innovations and traditional knowledge, named GIAN. It provides incubation support to grassroots innovators.

5. Providing an enabling platform in the field of biotechnology for process and product development and reaching them to the market place, the Small Business Innovation Research Initiative (SBIRI) of Department of Biotechnology supports projects in Public Private Partnership (PPP) mode.⁸ It has been promoting the research and innovation in the Indian biotech sector and has facilitated risk taking by the small and medium scale enterprises. Innovators with science background have benefitted from this initiative immensely by realizing the dream of starting knowledge-based enterprises. Funding can be sought for early stage, pre proof of concept research and technology development and commercialization related to healthcare, food & nutrition, agriculture etc. Support is provided in combination of grant and loan depending upon type of project and the budgetary requirement. Further the bio-incubators supported through Biotechnology Industry Research Assistance Council (BIRAC) provide the incubation space to startup companies, along with other support services.⁹

6. Carrying out the activities relating to indigenous technology promotion, development, utilization and transfer, the Department of Scientific and Industrial Research (DSIR) through PRISM (Promoting Innovations in Individuals, Startups and MSME) scheme is providing support to individual innovators with the purpose to achieve inclusive development, in addition to providing support to other entities for developing technology aimed at MSME.¹⁰ The areas focused include green technology, clean energy, industrially utilizable smart materials, waste to wealth, affordable healthcare, water & sewage management and efforts for any other technology or knowledge intensive area. The support is provided for establishing proof of concept, developing prototypes/models,

development of knowhow/process, securing intellectual property etc. In another scheme, named PACE (Patent Acquisition and Collaborative Research and Technology Development), the attempt is to support Indian industries to acquire patented technology at an early stage, which could be from within the country or abroad, and for adding value to acquired technology either independently or in collaboration with a publicly funded institution. The support is through a soft loan to the industry and grant in aid to the publicly funded institution in project mode.

7. Aimed to enhance collaborative R&D between industry and R&D institutions/academia for developing products and packages, the Department of Electronics and Information Technology (DeitY), Ministry of Communications and IT provides support through its Multiplier Grants Scheme – "Srijan : Prithvi". For support, the idea for collaborative research, in the area of electronics and IT, should originate from industry/ industry consortium and the project needs to be submitted by R&D institutions/ academia jointly with industry/ industry consortium. The product will be commercialized by the industry. The scheme encourages development of indigenous products and is endeavoring to bridge the gap between R&D / Proof of Concept and commercialization. The government grant to the institution involved is in a multiple mode (which varies) of what industry commits to a given project. Larger support is given to those projects that attempt for the breakthrough innovation and are focused on MSME. The DeitY also operates a scheme entitled Technology Incubation and Development of Entrepreneurs (TIDE).¹¹ Covering diverse areas of electronics, ICT and Management, the scheme operates with multipronged approach. It supports Technology Incubation Centers at the institutions of higher learning and provides desired support to startup companies. TIDE also supports and helps in accelerating development of indigenous products and packages through time bound projects.

8. Development of globally benchmarked technology in public-private-partnership mode is supported by the Council of Scientific & Industrial Research (CSIR) through New Millennium Indian Technology Leadership Initiative (CSIR-NMITLI) Scheme.¹² CSIR-NMITLI looks beyond today's technology and thus seeks to build, capture and retain for India a technology leadership position by synergizing the best

competencies of publicly funded R&D institutions, academia and industry. The Government finances and plays a catalytic role. The effort is based on the premise of consciously and deliberately identifying, selecting and supporting potential winners. CSIR-NMITLI has carved out a unique niche in the innovation space. It has evolved and operationalized several largely networked projects in diverse areas viz. agriculture & plant biotechnology, general biotechnology, bioinformatics, drugs & pharmaceuticals and diagnostics, animal vaccines, chemicals, materials, information and communication technology, high-tech instrumentation, energy, biofuel, fuel cells, battery operated vehicles. These projects involve over 100 industry partners and 300 R&D groups from different institutions.

Strategy adopted for CSIR-NMITLI is to obtain an inverse risk-investment profile i.e. low investment - high-risk technology areas (with global leadership potential) with investments increasing as developments take place and the projects move up on the innovation curve with reduction in risks. Both 'push' and 'pull' type of projects are evolved under NMITLI, which are appropriately named as Nationally Evolved Projects (NEP) and Industry Originated Projects (IOP). Greater emphasis is laid on identifying the niche areas and building the projects with the help of best brains in the country. A specially constituted project-wise expert group builds the project by interacting with a large number of researchers and stakeholders with a focus on technology development. High-quality technical inputs are provided at both project development as well as at implementation stage.

CSIR-NMITLI programme provides for continuous mapping of the IP scenario for each project and in licensing of IP with a view to building of a portfolio and achieving the leadership position. An innovative feature of the programme is that it provides financial support to all players in the project. The support is in the form of grant-in-aid to the institutional partners in public domain and as a soft loan (at 3% interest) to the industrial partners.

There are several other mechanisms that support innovation(s) and innovators in the country. Seamless partnership between the constituents of National Innovation System (NIS) is pivotal in the context of knowledge-based economy and a country attempting

to position gainfully in global arena through generation and deployment of desired innovation(s). The delivery itself through such partnerships would meet the national objectives and the effort(s) should be as per the national strategic plan.

b.Information, advice, training

Innovation means delivering (not merely developing) novel solutions to the people for their problems and needs. Technology innovation is a special class of innovation, which is characterized by knowledge intensity and scientific knowledge in the understanding of the problem and/or putting together solutions. Technology innovation is often characterized by the presence of human ingenuity, creative ideas and invention. Such technology innovations result in the greatest solutions that man-kind has created including lifesaving drugs, vaccines, new energy sources, modes of transportation, the electronic gadgets and appliances that we use, the clothes we wear, the materials we use in construction etc. It is in realization of the central role technology innovation plays in influencing and transforming people's life for the better and shaping the economy that every civilized nation of the world has invested in supporting and nurturing such innovators. India too has been proactive and forward looking in its support of technology innovators despite simultaneously battling with other pressing and urgent problems faced by a developing country.

Technology innovation needs a richer, denser and diverse ecosystem than other forms of technology development or other forms of innovation. The ecosystem needs to not only provide for funding and resources at every stage of its development from conception to implementation, but also include a pool of budding and experienced entrepreneurs, resource pools of experts, mentors, service providers etc., diverse range of enabling facilities for experimentation, prototyping, trials etc., infrastructure to accommodate various activities like lab work, trial manufacturing, etc., enabling government mechanisms, and many such aspects necessary to convert ideas to products and services. While such ecosystems may come into being naturally, it is our view that Technology Business Incubators (TBI) and Innovation Centers (IC) can not only nucleate such ecosystems but also orchestrate them into something larger than the mere sum of the parts. This TBIs and ICs can do so by serving as a melting pot and nodal resource centers for all stakeholders contributing to the Technology Innovation Ecosystems.

Thanks to the initiatives of agencies (DST-NSTEDB and DBT-BIRAC) of the Ministry of Science and Technology in the last 2 decades, India today has a strong network of TBIs (under 100) across the country. The network is not as dense as in US (roughly, 1100 incubators in North America) or Europe (roughly, 900 business incubators in EU; 300 in UK alone) but is nonetheless a productive network. A database of Indian incubators is available at www.venturecenter.co.in/incubatordb/ and many of these networks with each other via the Indian STEPs and Business Incubators Association (www.isba.in). Most of the Indian incubators are associated with academic and research organizations (so as to leverage their host organizations' ecosystems). However, there is great variety in the incubation programs, facilities and expertise made available and focus areas amongst the incubators. More recently, India is seeing a growth in accelerators/acceleration programs (example: Start-up Leadership Program) or entrepreneur networks (example: TiE) which de-emphasize facilities and know-how sharing, but emphasize peer-to-peer networking aimed at growing and advancing the company. These accelerator programs work best for business in sectors that do not need a lot of specialized facilities or know-how (example: information technology, education, software services, etc.)

Like most technology innovators and entrepreneurs around the world, technology innovators and entrepreneurs in India begin with an idea for solving a problem, a conviction about the value of the idea, the willingness to persist with the idea and the missionary zeal to change the world with the idea. The challenges begin soon after! Information and more importantly, "connecting the right dots" (putting the right information in front of the right innovator) and providing referrals and connects for the innovator to make use of the information becomes crucial. This task of building and enriching information, as well as knowing to connect the right dots is an essential responsibility and skill for incubator managers or equivalent persons in an ecosystem. While there are a few formal information collections of interest to entrepreneurs available and accessible (example: VC Library at www.vcenterlibrary.com or the Funding Database at www.venturecenter.co.in/funding/), the most useful information sharing in India often happens through information sharing events, peer-to-peer networking, referrals from incubator managers (or equivalents) and consultants. Due to this, despite being in the age of the Internet, access to

high-quality information still remains a barrier to entry in businesses in India. Besides the TBIs, accelerators and networks such as TiE are breaking new ground here by their activities. That said, there is a clear need to create many more affordable mechanisms (preferably, in public-private-partnership mode) to provide high-quality information access to first generation innovators and entrepreneurs.

Merely providing information to access is not enough. Most innovators and entrepreneurs need advice, mentorship and handholding periodically and continuously in their journey. The importance of advice and mentorship cannot be under-emphasized - it is probably the most important part of a rich and productive innovation ecosystem. Advisors and mentors not only provide information and share their experience but also most importantly provide innovators and entrepreneurs with a sense of direction, control and hope. Given that most technology innovators and entrepreneurs have to "swim against the stream" until they sense their first little victories, it takes an enormous amount of courage, a good feel for risks and rewards, and experiential knowledge to keep them striving along - good mentors and advisors play a crucial role here. One of the key roles of the Incubation Managers is to help identify the right mentors and advisors for the innovators and/or create mechanisms/ forums by which innovators and entrepreneurs can "collide" with mentors and advisors. Advice and mentoring for fundraising is clearly the most sought after service followed by advice for sharpening the business model and plan. Advice and mentoring on technology and IPR strategy is also a common need. In India, the availability of mentors and advisors for innovative technology and enterprises is unfortunately spotty with a wide variability in quality, accessibility and affordability. In our experience, the best locations in India for innovators and entrepreneurs seeking mentors and advisors are Ahmedabad, Bangalore, Chennai, Delhi, Hyderabad, Mumbai and Pune.

Yet another important aspect of a technology innovation ecosystem is events including talks, networking events, workshops and training programs. This is clearly the most important determinant of the vibrancy and inclusiveness of an ecosystem. TBIs and ICs that are orchestrating an innovation ecosystem often need to plan events that serve the following purposes: information, inspiration, showcase role models, provide knowledge and skills, access to resource people,

networking, catalyze ideas, clinics that offer direct help etc. Networking events provide access and occasions for like-minded people and complementary skills to find each other. The workshops on entrepreneurship, technology commercialization, intellectual property, etc. aim to provide the necessary tool kit. The technical training programs go deeper to impart knowledge and deeper skills in selected areas. In the most vibrant innovation ecosystems in India, some key players who are contributing to enriching the innovation eco-system via events are – public academic organizations (example: IIT-Bombay, IIT-Chennai, IIT-Delhi, IISc-Bangalore, COEP-Pune, NID-Ahmedabad, UICT-Mumbai, University of Pune, Anna University in Chennai, MS University in Baroda), business schools (IIM-A, IIM-B, IIM-C), research organizations (ex: NCBS in Bangalore, NCL in Pune), TBIs (example: Venture Center in Pune, IKP in Hyderabad, TechnoPark in Trivandrum, IIT-Madras Research Park and associated incubators, CII/NDBI/Create in Ahmedabad, Deshpande Center at Hubli), accelerators and networks (example: TiE in Delhi, Pune, Bangalore and Chennai, Startup Leadership Program in Pune and other locations, i-Accelerator at Ahmedabad), Industry bodies (example: MCCIA in Pune, CII and FICCI in various locations, ABLE in Bangalore and other locations), selected private players (example: Persistent Labs in Pune, Amity University in Delhi, KIIT in Bhubaneshwar) and government agencies/ charitable organizations (example: GSBTM is Gujarat, BIRAC in various locations).

Nurturing innovation and more specifically, technology innovation is an important investment that we all need to make for the future of the Nation and the world. It is clear that we need to start by enriching and deepening the technology innovation ecosystem -- one region at a time.

c. Patenting

Intellectual Property (IP) is known to be important tool for wealth creation for both, industries and innovators and also for the industrial progress of the country. Innovation and Intellectual Property are the key attributes in the development of most developed countries. The same can be verified and analyzed by the total number of IP applications filed by developed countries. Among the seven intellectual property rights, patent is known to the most powerful one because it is directly related to technologies and Industries.

Basic concepts

Patents: Patents, the most powerful form of Intellectual property, are awarded for Technological Improvements made in Products or Processes which are not obvious to a person skilled in the particular art to which invention belongs. Under Indian Patents law even inventions that are economically significant are considered to be inventive. The invention should also be novel in order to qualify as patent; that means that the applicant should be the first person to apply for the patent and the invention should not be in the public domain before applying for patent at the Patent office.

Life of the Patent is 20 years and right awarded to the Patentee by way of a patent is that he/she can prevent third parties, who do not have his/her consent from the act of making, using, offering for sale, selling or importing for those purposes that product (in case of a product patent) or product obtained by that process (in case of a process patent) in India.

Patents have territorial jurisdiction. Patent obtained from the Indian patent office cannot be enforced outside India, thus the Patents need to be applied in every jurisdiction wherever the applicant believes the market for the technological innovation exists or where the product or process is likely to be copied. The patenting process requires great deal of both time and money.

Designs: Design registrations, another form of Intellectual Property, protect virtually any new and non-obvious ornamentation of a useful object, from the flickering icon on your computer screen to the shape of the spacecraft. The design for surface ornamentation is inseparable from the article to which it is applied and cannot exist alone. It must be a definite pattern of surface ornamentation, applied to an article of manufacture. In other words, a design patent will protect the way something looks, not the way it functions.

What all can be protected in India, under the Designs Act, 2000 includes:

- Features of shape, configuration, pattern or ornament or composition of lines or colour or combination thereof applied to any article whether two dimensional or three dimensional or in both forms, and does not include any trade mark.
- Configuration or shape of an article, to the surface ornamentation applied to an article, or to the combination of configuration and surface ornamentation.

The term of the registration of a design is 10 years in India from the date of registration and can be extended





by further period of 5 years on payment of fees. Design patents can also be an extremely useful tool in intellectual property arsenal, particularly when you are attempting to create overlapping protection, thereby developing a true intellectual property portfolio.

Patent Agents: There are about 2200 Registered Patent Agents that are Authorized by the Government of India to Prepare Patent and Design specifications for the Applicants, file Patent & Design applications, Conduct Patent searches, advise the applicants on various issues and represent them in all proceedings that are required to be done before the Patent office from time to time.

Indian Patent office has made long journey in the last two decades through Infrastructure Development, Human Resources improvement, IT-enabled environment in office and for public use, bringing transparency in information dissemination. However, a lot is still required to be done for faster patent granting process.

In India, lot of invention happens at the grass-root level by people who may not have basic education but could have great ideas as they are directly involved with process or products while working and are thus aware of the problem. The idea behind innovation creation is to solve the problem. It is observed that these people are unable to convert and protect their valuable ideas into patent due to lack of awareness, knowledge, patent documentation, language and fund issues.

For such grass-root innovators, there needs to be a mechanism at Patent office so that patent experts can help them to convert their innovative ideas into Patent Document form. With the support of government IPR policy:

- retired patent officials could help such innovators,
- expenses related to patent prosecution could be funded by government, and
- research by students at school, college and university level could be 100% subsidized.

Invention can originate at any level and does not require higher qualification or specialization for research (example: blind person visited Patent office, Mumbai to file his patent application in the form of brail script). Patents Act allows filing of patent applications in Hindi and other languages. However, efforts need to be taken by Patent office to translate and publish such documents in English so that such invention can be accessed by world community.

To understand the efforts made for innovation by person individually or collectively in Industry, it would be appropriate that an experienced person from industry, R&D institute, Laboratory, University may be appointed at middle-level entry (lateral entry) in Patent office. This will not only get the flavor of experienced person from innovation field in Patent office but also help in the creation of new environment for patent granting, patent prosecution and policy formation of Patent office.

The amended IP laws of India have built up a firm base for an innovation revolution. The factors that government and private enterprises should now consider are building up capacity and awareness to harness the benefits of innovation that India conceives.

In a nutshell, for the progress of nation, there is a need to create IPR environment in Industries and academic institutes and fill the gap to covert innovative idea into patent and granted patent into industrial product so that innovator and industry both could benefit mutually. The patent should not be treated by individual/ company for statistics or merit purpose rather as a certificate for creation of industrial product and contribution to nation by way of industrial growth. The investment in intangible asset creation will enable Indian economy to grow sustainably.

Spark - The Rise: Platform for innovation, connection and inspiration

We find ourselves living in an “innovation a day” world. In fact, more progress in science & technology has happened in the last 20-30 odd years than in any other period of human existence. The western nations, and some parts of Asia, like Japan, have led the world in driving rapid technological progress. But, what about India? Can the land which gave the world the concept of the “zero” become a technology and innovation superpower? Can we harness the potential inherent in a billion+ of us to become an innovation superpower? India has the potential to innovate in a way that can disrupt the status quo and create breakthrough solutions. We have the right ingredients – a billion strong population, a history of innovation, along with the required skills – all we need now is a fuel, a fuel to spark India. A recent study shows that 33% co-founders of the US engineering and technology start-ups since 2006 were Indians.¹³ IITs were among the top 10 higher educational institutes in the world that have produced founders of US startups that have raised venture capital funding in the past five years. Why is that Indians flourish when they go abroad but are not able to reach their potential in their own country? Why do our universities not rank in the top 50 and why do we not see disruptive technologies coming from India? India has a rich legacy of innovation and today to have world-class innovations from India, we need to have innovators and entrepreneurs from across the spectrum to come together, to create an innovation ecosystem that will identify, nurture and support tomorrow’s technologies and entrepreneurs.

It was to establish this very ecosystem of innovation that Mahindra launched Spark the Rise, a platform for tapping into a movement where people stand up to take responsibility for the future. Since the launch of Spark the Rise in 2011 Mahindra has supported >100 projects and given nearly \$1 million to up-and-coming innovators, supported them with an ecosystem of partners, and given them exposure in national media. From development agencies and investors, incubators and accelerators, to research centers and individuals who have the passion and drive to see India innovate, Mahindra provides a platform for the connections that inspire and enable the rise of disruptive innovations in India.

The one million dollar challenge, Rise Prize, is one such initiative where Mahindra is tackling two of the greatest

urban problems today – road safety and clean energy. Today almost 50% of road accidents are in urban areas and 75% are related to driver error. As the population of cars on Indian roads increases, there is a need for transformation in the way that the auto industry works. Concurrently, we’re also seeing a dramatic increase in population and growing demand for energy. It’s imperative we find sustainable and cost effective methods of using renewable energy. Therefore today in urban India we see the need for smarter, safer cars and affordable sustainable energy at and Rise Prize aims at solving these problems. Mahindra has engaged with global experts to act as mentors and jurors for the challenges. Participants will work get advised by these experts during the course of the challenge. The participants will also be given exposure by showcasing their work to the media. The Rise Prize aims to inculcate a culture of innovation by making Indians move away from the culture of “Jugaad” where we have ‘made do’ solution and focus on creating world-class solutions for problems. It also aims to create a culture of questioning where people stop accepting everything the way it is and look for their own answers. A beginning has been made with the two challenges and more challenges in cutting-edge domains will be offered in the days to come.

Innovation in India is required at all levels. With 70% of our population living in rural India, grass-root innovation is crucial for us. Along with that, we need the support of the government and corporate houses either through investment in R&D, incubation, investment or platforms like Spark the Rise. From innovations that power off-grid communities to technologies that produce nanotubes at nano-prices and breakthroughs that inch closer to finding a cure for cancer, our entrepreneurs are driving positive change and shaping the face of innovation in the 21st century. It’s time that we propagate innovation in India and become the next global innovation superpower.

We’ve all been told never to doubt that a small group of committed people can change the world - indeed, it is the only thing that ever has. All we need to do is to take the first step.

B Karthik
Vice President - Corporate Brand,
Mahindra & Mahindra

Culture of frugal innovation: Creating a century of Indian innovation

India has all the ingredients to become a global driver of innovation led by a strong market potential, an excellent talent pool, and an underlying culture of frugal innovation. Innovative countries have demonstrated the leverage of cultural advantage to capture markets. Japan leveraged its cultural emphasis on efficiency and team work to revolutionize the manufacturing and engineering industries. Korea leveraged its cultural emphasis on speed to build world-class companies such as Samsung and LG. Similarly, India can leverage her cultural bias of frugality and sustainability to capture markets not only within its shores but globally. For this to happen, our industries need to have the hunger to be on the top of the value chain, our talent pool has to get more hands-on, our customers have to be more demanding, and our policies have to be more transparent.

The Indian Industry and Government Policy should focus on the significant market needs in Energy, Water, Transport, Healthcare, and Food Security to deliver tangible human and environmental benefits:

Energy: India would need to generate 0.5 kW per person of electric power to provide reasonable level of opportunities to its population. At the current population numbers India needs to triple the generation capacity from roughly 220 GW to 660 GW. 0.5 KW per person is roughly half of the European average and a quarter of the US average and translates to approximately 6500 TW (Tera Watts) hours per year of electric energy in 2032. Transmission and Distribution (T&D) capacity should be upgraded accordingly.¹⁴

Water: India needs to double usable water from 1000 to 2000 cubic meters person per year. Less than 1700 cubic meters person per year is considered to be water-

stressed. Currently, US provides 8000 cubic meter person per year water to its citizens. Also, India would need to double the sewage treatment facilities in urban areas to even meet its current needs.¹⁵

Transportation: It is estimated that India will add 1000 passenger and freight locomotives over the next 10 years and the passenger and freight aircraft market will grow to be 100 billion+ by 2025. An additional resource to consult is the report submitted to the Prime Minister of India by National Transport Development Policy Committee in 2013-14, "India Transport Report: Moving India to 2032".¹⁶

Healthcare: India will need to grow from 4% of GDP healthcare spend to 5.5% of GDP.¹⁷ The CII report presents the vision for India's healthcare with clear goals for 2022.¹⁸

Food Security: India will have to develop innovative, accessible, diversified food plans and supply chains to enable at least around 2100 Kcal per capita per day diet for urban and 2400 Kcal per capita per day for rural population.¹⁹

With a positive demographic, political and market outlook today, India has its best opportunity in many decades to position itself for a century of innovation. India has the ability to create a unique spot in innovation history to meet its requirements using its cultural advantages of frugality and sustainability. It is our time to make it happen!

Dr. Gopichand Katragadda
Chief Technology Officer, Tata Group





3. Islands of Innovation

Innovations, particularly radical innovations and up-gradations are part of the daily business today. Radical innovations are those innovations that create new markets that are disruptive for both customers and producers.²⁰ These help redefine markets, as they tend to emerge on the fringes of well-established markets. As opposed to standard corporate innovations that focus on existing customer needs and demands - and therefore by definition create incremental innovations - radical innovations are a result of several individual innovators and scientists working independently. Such innovations, typically after a certain gestation period, suddenly explode in markets and bring about a significant change in terms of both the value propositions and product categories. These innovations therefore cannot emerge out of or be replicated in the research and development facilities of either corporations or well-established marketplaces.²¹

Hence, the incubators within higher education institutes and other private incubators or accelerators continue to be one of the best breeding grounds for both the radical innovations as well as sustainable market-linked businesses. These incubators more often have the capability to support the innovators through a multifaceted support system that comprises of technical and business advice, physical infrastructure, access to expertise, market access or mentors and even collateral free early stage risk capital. By providing these innovators with a safety net, these 'islands of innovation' ensure a higher success rate of such radical innovations thereby contributing significantly to the overall innovation in the country. Compared to the Silicon Valley or other developed markets, this support system is in its infancy in India, and yet, we have many incubators operating successfully to support the innovative startups and their innovations that are creating a significant impact in the mass market.

Amongst the several innovative startups that have been incubated by these incubators, Forus Health, Biosense Technologies, Barix Agro Sciences, EcoZen Solutions and Skymet Weather Services are a few to name. A glimpse on to their profile reflects the business innovation as well as the social impact being created by them as they progress.

Forus Health²²

Description: With the aim of detecting needless blindness at the early stage, Forus Health developed 3nethra, a device that had the prospect of bringing revolutionary changes in treating eye ailments. This single machine can detect diseases like Cataract, Glaucoma, Diabetic Retina, Refraction & Cornea problems.

Foruscare, a unique telemedicine solution using cloud, is deployed in over 30 locations for remote diagnosis. 3nethra is clinically validated and CE compliance.

Incubation support: CIEE, a technology business incubator (TBI) at IIM Ahmedabad, provided them with the initial seed funding and helped them to connect with a network of various stakeholders allowing them to pilot their solution and build a business around it.

Evolution of investment: The company started with an initial investment of ₹10 million in 2009 and raised ₹15 million from angel investors in 2010 for prototyping. The company got its series A funding of \$5 million in April 2012 from Accel Partners & IDG Ventures and raised another \$8 million series B funding with Asian Health Fund being the lead investor.

Impact: The product over time has gained immense recognition and has been employed for screening over a million individuals touching lives in 15 countries. The Company has 425 installations in India with 45+ installations outside India and plans to impact 20 million cases of preventable blindness that occur around the world in the next 3 years.



Barix²³

Description: Barix is innovating its technology on Integrated Pest Management/ Integrated Pest Control to solve pest problems while minimizing risk to people and the environment. The products are developed around

innovative scientific approaches such as semio-chemicals (pheromones, allomones and kairomones) and visual allurants (chromogenic and luminescent attractants). These products being species specific destroy only pests that damage crops hence safeguarding agriculturally important insects like honeybees, butterflies, ladybugs etc.

Evolution of investment: The sale of first product Barix Catch Fruit Fly trap initiated in two districts generating funds for further product development and marketing scale up. The company raised seed funding of ₹12 million from Omnivore and CIIE (IIM Ahmedabad) in July 2013 and invested in setting up of R&D center with full-fledged capacity. It raised series A funding of ₹65 million from Omnivore Partners in December 2013. From July 2013 to December 2013, it ramped up sales, production, hiring and marketing scale up to 32 districts across Andhra Pradesh, Karnataka and Tamil Nadu through 292 dealers with 60 employees. By October 2014 it covered 7 Indian states through 1200 retailers' network with more than 100 employees.

Impact: The company with its range of five products has impacted over 100,000 farmers, covered more than 250,000 acres of farming land and has generated employment for 83 individuals in 6 states. The product helps to increase the agricultural productivity from 20% to 80% as they prevent pre-harvest yield loss. Integrated Pest Management saves money and extra effort, improves quantity, quality and environment safety and protects farmers' health. IPM is considered a series of progressive actions to care for the earth.



ecoZen Solutions²⁴

Description: EcoZen Solutions is a clean-technology focused company developing innovative solar power technologies to create energy access in hitherto unprivileged areas and promoting the use of cleantech as an alternative power source.

Evolution of investment: The company was registered in October 2010 as an energy consulting firm. It made its entry into solar base product in August 2011. The Company also received capital funding from State Bank of Patiala in September 2013. Villgro Innovations Foundation invests in EcoZen in January 2014 in form of equity and grant. The company bootstraps and gained revenues of ₹45 million in FY 13-14.

Impact: The company has been rewarded and recognized by various awards. Over the course of its journey, it has created employment opportunities directly for 17 individuals, impacted over 5000 lives and irrigated over 200,000 sq. meters land. The pioneering product-micro Cold Storage bundles several innovation, which are necessary not only for the product to work but to ensuring precise temperature, humidity and air quality levels, achieving maximum efficiency (solar being an expensive technology), hassle free operation and user-friendliness.



Skymet²⁵

Description: Founded in 2003, Skymet Weather Services is the first private company in India with its own prediction models for weather forecasting. It works to achieve its specific goal of providing easily accessible weather information to Indian farmers to improve their livelihood possibilities.

Evolution of investment: Skymet did not start off as a capital-intensive business, so there was no real need to seek outside funding when the company launched. The

Delhi based company got its initial support from the air force personnel who had significant meteorological experience. When research became an integral part of the business, Skymet began seeking funds from other sources. Skymet has received funding from Omnivore Partners. Villgro Innovations Foundation provided the seed funding, mentoring and networking opportunities. The company has raised funds of ₹315 million and plans to set up 500 more weather stations. In the future, the company is open to engaging in a revenue-sharing model with other service providers.

Impact: Currently, Skymet's numerical prediction models are used to create forecasts for 7,000 locations in 13 states across India. Skymet provides customizable and accurate services which differentiates itself from the government. It provides accurate forecasts at the village level and helps to create a huge impact by improving the quality of information that farmer, and other agricultural stakeholders need to plan a fruitful harvest.

Biosense²⁶

Description: The company focuses on developing and commercializing accurate, low-cost point of care diagnostics using a combination of embedded system, m-Health technologies and dry chemistry. The products are in tandem with the vision of Biosense Technologies – improving access to better healthcare by extending alternate and appropriate technologies that meet the needs of the masses. All three devices developed by Biosense can be connected to send data to remote

secure cloud server where the usage, location and test results can be monitored both from an individual level to a demographic/community level. The accuracy of the devices is very high and cost less in comparison to similar products in the market.

Incubation support: Centre for Innovation, Incubation and Entrepreneurship (CIIE), a technology business incubator (TBI) at IIM Ahmedabad, provided them with the initial seed funding and network to showcase their solution to various stakeholders and build a business around it. Moreover, Villgro helped them in funding, fundraising, business plan, continued mentoring, exposure to investors, customer acquisition and pivoting.

Evolution of investment: The company has earned a revenue of ₹20 million. It has received the support from investors such as Global Super Angels, Insitor Fund and has raised over ₹25 million and institutional support such as grand Challenges Canada, ICMR, DST.

Impact: The company has screened over 100,000 patients and is creating an impact with its affordable products in the lives of several people in tier-II and tier-III cities.

A glimpse of these companies is only the introduction to the various successful businesses that have grown up with the support of incubators.

Open innovation: More than just ideas

When people ask me what open innovation is, I suggest they should view open innovation as a philosophy or a mindset that they should embrace within their organization. This mindset should enable their organization to work with external input to the innovation process just as naturally as it does with internal input. It does not really matter whether this external input is in the form of open innovation, crowdsourcing, user-driven innovation or co-creation.

This is in contrast to the old model of closed innovation, in which a company maintained complete control over all aspects of the innovation process and discoveries were kept highly secret. In closed innovation, you do not attempt to assimilate input from outside sources into the innovation process, and you avoid sharing intellectual property or profits with any outside source. Also, in a closed innovation environment, activities are often segregated within an R&D department where the best and the brightest are expected to make sure the company gets to market early with new ideas to gain the “first mover” advantage.

More than just ideas

Open innovation is very much about soliciting ideas from outside, but it goes deeper than just involving others in the idea generation phases; the contribution from outside your company must be significant. It is also more than just a partnership where you pay for specific services. Everyone involved in an open innovation process focuses on problems, needs, and issues and works them out together.

Furthermore, you can argue that closed innovation primarily focuses on products and services, whereas you are more likely to use open innovation to work with a broader range of the different types of innovation including business models, channels and processes. Too often, companies fall into the trap of considering open innovation approaches only during what is called the front end of innovation, when everyone expects more creativity and openness. Once this phase is

completed, companies go into execution mode, which is less complex and they only use the internal resources they already know very well. Companies miss out on the full potential of open innovation when they shut down to external resources later in the process.

Open innovation as a term will disappear in 5-7 years

The term “open innovation” will disappear in five to seven years and we will just view this as “innovation.” The key difference is that innovation will have a much higher external input than what we see today.

This evolution will take longer in some industries as compared to others. The length of a product/service development cycle, the level of intellectual property involved, the amount of financial investment needed, government or regulatory issues and the readiness of the industry as well as the company itself are among the factors that impact the time it takes for industries to adopt fully to open innovation models.

Ultimately everyone will get to the same place – using an open innovation model – and we will just call it innovation. Thus, there is no need to have a stand-alone open innovation unit as your end goal as you start building open innovation capabilities; it should rather become part of your company’s innovation DNA and should be incorporated into the overall innovation setup and efforts.

The idea of open innovation is still fairly new, but we are starting to see a range of companies that seem to be willing to experiment with the innovation processes themselves. This is a key requisite for innovation success in the future. Experimentation needs to go further than just products, services or technologies; you also need to innovate on how you innovate.

Stefan Lindegaard
Author, speaker and strategic advisor



Uma nova realidade é aberta
não só para os usuários, mas para todos os
que vivem nessa realidade. Devido
a mudanças, o mundo está se transformando.
Mas, ao mesmo tempo, o mundo continua

4. Innovations 2014: Selected case studies

This chapter provides a summary of some of the striking and compelling innovations that we encountered in the entries to the event. Since most of the solutions or ideas proposed by the participants were exciting and ingenious, making a choice of those to be shortlisted for showcasing in this report was challenging for the evaluators. It should be noted that unlike other events, it was not our aim in this selection to identify only the most technically brilliant or 'cool' ideas, or the ones with the most potential to be commercially successful start-up businesses. Neither is this any sort of ranking of the best ideas. Rather this should be considered a representative listing to provide the reader with a flavor of the broad range of creative solutions that are emerging in India to address the myriad challenges we face as a society and a nation. We provide below the broad guidelines we adopted and the kind of questions we used to assist us.

1. Does the solution address a clear pain point? Is there a user base that would see tangible value in the solution? that are representative of the broad range of solutions

2. While the proposed innovations are at varying stages of maturity, we have given preference to those with the technical feasibility clearly established through a working prototype, as opposed to purely conceptual or model based ideas.
3. The differentiation from existing solutions (if any) that allow it to better address the user needs.
4. Is the proposed innovation capable of being scaled or brought into production, and made available at a reasonable cost compared to alternatives for the target user, while still sustainable as a business proposition for an entrepreneur

We have also sought to maintain diversity in the types of solutions showcased here. One dimension of this diversity is the application domain, such as agro processing, healthcare, sanitation etc. The other dimension is the category of the targeted users such as individual, government and defense etc. and we have also ensured including solutions for niche users like NGOs, the differently-abled that are often underserved.

Cluster 1: Agriculture & Rural, Energy

Sunflower seeds separating machine

Primary Innovator	Vishwanathan Koushic
Location	Erode, Tamil Nadu
Contact	koushic.kayalvizhi@gmail.com
Impact	The ingenious design of the machine allows a faster separation with minimal damage to the seeds allowing the sunflower farmer to achieve a higher productivity with lower labour cost.





Automation of incense stick manufacture

Primary Innovator Abhishek Kandoi

Location Ahmedabad, Gujarat **Contact** abhishek.kandoi@tinkertank.in

Website www.tinkertank.in

The machine helps in making incense sticks (agarbattis) through a simple motorized extruder system. The bare stick is entered from one end of the extruder through a nozzle, which activates a sensor that triggers the paste extrusion mechanism and eventually a perfectly formed incense stick with a thin layer of paste is ejected. The machine allows much higher productivity and consistent product quality than the manual process, and the unique mechanism makes it simpler and cost effective compared to complex machines. It also provides flexibility of allowing multiple product types through die changes and different types of paste can be used.

Impact These products are typically manufactured by women's self-help groups, village industries etc. and the innovation provides them an affordable equipment to increase the productivity and quality and increase their incomes.

High efficiency kiln based biomass gasifier with charcoal by-product

Primary Innovator Abdul Azis Sheik Mathar Shahib

Location Dindigul, Tamil Nadu **Contact** abdul_azis@rediffmail.com

It's a novel type of gasifier that can generate fuel gas to generate power, while also leaving behind charcoal as a by-product that can be used for other fuel needs or even sold. It uses a kiln structure that can be readily constructed in any location by semi-skilled workers, followed by a scrubber for cleaning the gas that can be fed to a retrofitted genset. Partial or full replacement of the fossil fuel use is possible, and charcoal by product can be used by the villagers as a cooking fuel.

Impact The simplicity and efficiency of the kiln design makes it a very useful dual solution for generation of electricity as well as providing a cooking fuel source in remote areas with poor grid connectivity but having good biomass availability.

Energy Efficient Electricity (E3) meter

Primary Innovator Dr. Santosh Dalvi

Location Navi Mumbai, Maharashtra **Contact** santoshddalvi@gmail.com

This innovation is a specially designed electricity meter than can be used in urban households to monitor the exact points of excess energy consumption. It consists of a microcontroller based smart energy meter, that, unlike conventional meters which just show the total reading, has a monitoring feature to determine which appliances consume more electricity, as well as indicates the energy saving possibilities against the benchmark for such appliances. It also provides the monetary value of consumption continuously. A study in 415 Urban households has shown that installation of this device has led to a 12% drop in energy consumption and has also contributed to increasing awareness about energy efficiency.

Impact By driving awareness of inefficient appliances and sensitizing consumers to energy saving opportunities, it can help bridge the growing power deficit.

Cluster 2: Environment, Sanitation & Water

Zerodor : Low cost, no consumable, chemical free waterless urinal technology

Primary Innovator	Uttam Banerjee
Location	New Delhi
Contact	uttam.ekam@gmail.com
Website	
www.ekamecosolutions.com http://www.youtube.com/watch?v=LQu-gYGayDE	
<p>Zerodor consists of an active ingredient that allows urinals to function without water, yet remain odorless and hygienic. It can be retrofitted into existing urinals as also installed onto new urinals. Further it is cost effective and equally efficacious compared to competition. In addition, there are no consumable costs or replaceable components associated with this technology.</p>	
Impact	This technology is a boon to reduce water consumption in urinals without compromising cleanliness. It can potentially save between 50,000 to 150,000 liters of fresh water per urinal per year.

UV-C irradiation for disinfection and demineralization of water

Primary Innovator	Kapil Dev Sharma
Location	Jodhpur, Rajasthan
Contact	admin@greenfielddeco.com
Website	
www.tinkertank.in	
<p>This is a solution for disinfection and demineralization of groundwater, grey water, sewage, industrial effluents and technologically polluted water to clean and safe water of potable standards. The prototype includes commercial off the shelf UV-C LEDs and accessories. Germicidal disinfection (99%) and appreciable demineralization (79-92%) at 12-30 liters/minute water outflow has been achieved.</p>	
Impact	A much needed solution to tackle the increasing problem of polluted water sources that can be processed to provide potable drinking water, safe from both from pathological and chemical/mineral point of view.

Project Prajwal

Primary Innovator	Rajat Mittal
Location	Pune
Contact	rajatmittal755@gmail.com
Website	
www.enactusnpti.in	
<p>With India using more than 300 million Chloro-Fluoro (CFL) bulbs each year to meet its growing power needs, safe disposal and management of these bulbs is a big question!</p>	
<p>In the absence of any state of the art, scientific electronic recycling centre in the country, Project Prajwal aims to establish a scientific electronic recycle and repair system for faulty and spent CFLs. The system allows partners from the under-privileged sections (we call them micro electricians) to be trained in the skill of repairing faulty bulbs, locally carry out the repair, sell them into the market and build a sustainable business. The faulty CFLs, repairing equipment and knowledge resources are distributed on credit, as a form of micro finance to locals who can set up their own CFL repairing cum training business, allowing them to earn a sustainable income.</p>	
Impact	Project Prajwal aims at utilizing produced electricity efficiently along with reduction in electronic and neurotoxin waste. Also this project will result in successful entrepreneurs by teaching them the skill of CFL repair



Eco-friendly banana leaf preservation technology

Primary Innovator	Tenith Adithyaa
Location	Watrap, Tamil Nadu
Contact tenithadithyaa@yahoo.in	
Impact	The innovator has developed a technology to preserve banana leaves. It uses no chemicals and preserves the leaves for more than a year, with a sustained green color for at least a year. Further, the stored leaves cannot be infected by the fungus and are also pathogen resistant. It is non-toxic and healthy and can be used for making products as well as stored as fodder for cattle.

Eco-mappers

Primary Innovator	Dhiraj Gehlot
Location	Mumbai
Website	www.ecomappers.com
A pollution mapping kit which displays data of parameters like CO, NO ₂ , dust, noise, temperature and humidity, real-time on google maps. The kit is so well designed that it can be mounted above the street lights and traffic lights, in the society or in home for personal use. The kit collects the data from the sensors and uploads the values on our website in real time. Anyone can visualize real time readings of the kit installed in vicinity. Every area is rated on scale of 10 on the basis of data and standards defined by pollution control board. We can compare two different areas on the lines of data collected.	
Impact	The 'Eco-mapper' kit will help citizens to know the level of pollution in their vicinity and will keep a constant check on the pollution.

Entrepreneur's perspective: Think big and not niche

There is no time like now - for India, and, in India. This is the best time for professionals in India to take the plunge to set up innovative new ventures. In the last ten years, India has come a long way - in the startup arena, several innovations are being driven out of India.

Bengaluru has been rated as among Top 10 cities globally, to start business. India now has a robust ecosystem consisting of the TiE chapters, accelerators-incubators, angel networks, early-stage funds that are helping entrepreneurs take the leap of faith. From a constrained economy, we have now moved into a fast-growing, liberalized era with technology leveling the playing field. Internet technologies have helped fuel startups in mobile, cloud and in the social media space.

I believe this decade will serve to underline the innovative spirit and success in these newer areas just as the last two decades have done for services businesses from India. Demonstrated successes of first-generation entrepreneurs and exits of companies like RedBus, JustDial and TutorVista serve as great role models.

However, it is important to ensure the focus is not only on US-based startups and on copying them mindlessly. The US is a highly developed country while India, is like US in the 50s. In India, one can build huge companies by providing reliable, high quality products and services in healthcare, education, housing or any other big sector. The domestic market is humongous! Stop copying ideas from the US, stop building apps, instead start building

tomorrow's giants by solving fundamental problems that Indians face in their daily life. Think big and not niche. Take risks. In cricket parlance, go for the "boundary" or "six" and play "to win". Typically, largely due to our culture, upbringing, lack of safety net in terms of social security benefits, we are conservative and try to be defensive and don't play "to win" but we play "not to lose". This usually makes many start-ups go for "service plays", grow at a slower pace, copy proven models and do marginal improvements rather than attempt something bigger and bolder. Of course, I am generalizing but this is the largely true - with small exceptions. Success of companies like Inmobi, TutorVista, littleeye-labs are all examples of Indian companies addressing the global audience and markets.

When it comes to innovation, I firmly believe that we, Indians, are the most innovative in the world! A disproportionate number of patents in tech companies or VC funded companies in US are from Indians from India. Over the last several years a number of factors have come together that have convinced me that with enough capital and no government interference, we will rule the world!

K. Ganesh
Serial Entrepreneur, Co-founder, Chairman,
Portea Medical

His most recent success, TutorVista, was one of the biggest Indian exits seen in the ecosystem. Pearson Plc bought the eight-year-old online tutoring platform helping 10,000 students per month for over \$213 million.

Cluster 3: ICT, Education, Health Sciences

Samay-Sancharak: A digital braille enabled wrist batch and cell phone for blinds

Primary Innovator	Hitarth Patel
Location	Mumbai, Maharashtra
Contact	hnp914@gmail.com
Website	https://drive.google.com/folderview?id=0Bx5toRmnmTkaYZDMnpXSUZoX1E&usp=sharing
<p>Samay Sancharak, is a watch equipped with GPS tracking feature so that one can have an eye on blind person while out for work. The watch is wirelessly connected to blind person's cell phone so that they can get SMS and notifications on watch itself. Watch will be equipped with alarm facility. The watch is not only limited to give the time and date details but it has a small braille enabled display through which he would we able to send quick SMS and also will receive notifications.</p>	
Impact	The novel mobile cell phone and first ever digital watch working in braille by far and large will contribute in increasing the visually challenged people's effectiveness in interacting with the world at large digitally.

iGest

Primary Innovator	Pradeep T
Location	Chennai
Contact	pradeep@enability.in
Website	http://enability.in/project/igest/
<p>iGest is a wearable kinematic sensor-based system designed to capture natural gestural capability in children with cerebral palsy or motor disability. The software first receives gesture models from the child's natural movements with the assistance of a teacher. These are then associated with a dictionary of sentences or actions.</p>	
Impact	With no device similar to iGest available in the market, this technology will simplify the motor control for the children with palsy and similar motor disability and help them to eventually gain control on their movements through the feedback.

Yelo solar power bag for rural India

Primary Innovator	Alok Kumar
Location	Pune, Maharashtra
Contact	alokk@prayasinnovation.com
Website	www.prayasinnovation.com/about.html www.youtube.com/watch?v=5S9yEPH4w4A
<p>For millions of students studying in remote areas deprived of basic educational infrastructure, YELO is a revolutionary school bag that transforms into a desk that helps students meet their basic education needs. The desk offers an angle of 30- 35 degrees for students to write and read, thus ensuring they maintain an ergonomic posture while studying. 1 in 3 people across the globe lack access to reliable electricity. Yelo is built with a LED light source, capable of delivering light for more than 6-8 hours, thus empowering students for studies and rural households to carry out their evening chores.</p>	
Impact	India is a country with highest number of students out of school. The product has immediate applications in all educational facilities which are deprived of basic educational infrastructure. This product will revolutionize the education sector and can help decrease the number of school dropouts.

Electro Bricks: Electronics is fun

Primary Innovator	Aman Rajvanshi
Location	Meerut, Uttar Pradesh
Contact	sap.aman@gmail.com
Website	http://roboshack.wix.com/electro-bricks
Electro Bricks is a fun electronics block, for newbies looking to get started with Electronics. Similar to the popular construction blocks format, the bricks are pluggable into each other. In this an individual can create complex circuits using simple bricks. Easy to access, one doesn't need any programming or soldering skills to get started with electro bricks. This makes it ideal for young kids, hobbyists and artists.	
Impact	With the help of this product learning electronics can be fun and easy. It can be predominantly used as a teaching tool where kids can learn to make toys; teachers can demonstrate science concepts and engineering students can use it for their research and products.

UV-C irradiation for disinfection and demineralization of water

Primary Innovator	Kapil Dev Sharma
Location	Jodhpur, Rajasthan
Contact	admin@greenfieldeco.com
Website	www.tinkertank.in
This is a solution for disinfection and demineralization of groundwater, grey water, sewage, industrial effluents and technologically polluted water to clean and safe water of potable standards. The prototype includes commercial off the shelf UV-C LEDs and accessories. Germicidal disinfection (99 %) and appreciable demineralization (79-92%) at 12-30 liters/minute water outflow has been achieved.	
Impact	A much needed solution to tackle the increasing problem of polluted water sources that can be processed to provide potable drinking water, safe from both from pathological and chemical/mineral point of view.

Simulation games for NGO workers and similar agencies

Primary Innovator	Parag Mankekar
Location	Pune, Maharashtra
Contact	parag@neetisolutions.com
Website	www.neetisolutions.com
Computer based social gaming and simulations are currently being used by lot of organisations in training and learning across the globe. Livelihood training games will be highly useful for NGOs & Organisations dealing with poverty issues by providing real life-like situations through games and simulations. Thus providing these urban youth who mostly work with such organisations with better understanding about the issues and options to deal with them.	
Impact	Simulation and gaming can positively impact readiness of personnel in disaster management, rural development, climate change and environment. World over there is good data available that such games and simulations help train a person well for real life situations.

Smart Wheelchair

Primary Innovator	Ankit Thakker		
Location	Navi Mumbai, Maharashtra	Contact	thakker.ankit91@gmail.com
Website	https://www.youtube.com/watch?v=aki78MYZ4yE https://www.youtube.com/watch?v=fK8CkhWc6NY https://www.youtube.com/watch?v=PHIfSOEivSE		
<p>Smart Wheels is a battery operated power wheelchair, which has some unique features. While the joystick interface is a standard feature as in other wheelchairs, this innovation provides many additional commands and control interfaces such as vocal commands in most Indian languages, or even neck movement for those users who are speech impaired (in addition to being unable to operate the joystick). The inventors have also provided in-built safety features and optimized the cost through the innovative design of the driving electronics.</p>			
Impact	It is a much needed aid to extend the mobility of the physically challenged and make them independent, especially catering to the severely challenged through its multiple control mechanisms.		

Non-invasive portable vein locator

Primary Innovator	Priyanka Saxena		
Location	Bangalore, Karnataka	Contact	spriyank@yahoo.com
Website	http://vantikadixit.wordpress.com/2014/07/01/indias-first-vein-detector-veinus-promises-better-surer-cannulation/ ?preview=true http://www.youtube.com/watch?v=ypgbKyHkCGo		
<p>The device is based on an indigenously developed technology which non-invasively detects and localizes blood veins for injecting fluids/ critical medicines and drawing blood at low cost. It helps Doctors/Nurses by identifying a vein map of the patient. With access to vein map of the patient the Doctor can make an informed decision in a timely fashion.</p>			
Impact	Non Invasive Vein Locator will help in reducing inconvenience and pain to patients as well as fatalities at the time of emergency by reducing the time-consuming procedures. This will help in improving the quality of healthcare.		

TALK

Primary Innovator	Arsh Shah Dilbagi		
Location	Panipat, Haryana	Contact	dilbagi.arsh@gmail.com
Website	http://robo.im		
<p>'TALK' is an Innovative Augmentative and Alternative Communication Device (AAC) that converts breath into speech for people with Speech Impairment and helps them to communicate and feel connected to the world. TALK uses Breath as the medium of interaction between user & device. It is faster, portable, generic & inexpensive (<₹5000) as compared to current solutions.</p>			
Impact	This device can significantly improve the quality of life of people with speech impairment from multiple causes (stroke, paralysis, vocal cord cancer etc.) and take them a step closer towards a productive life.		

Cluster 4: Robotics, Transportation, Others

Intruder detector and immobilization device

Primary Innovator	Bhagat Singh
Location	Madurai, Tamil Nadu
Contact bhagat_93@yahoo.co.in	
The innovation is intended to stop infiltrators at the border with the help of a simple mechatronic robot. It consists of an infra-red trans-receiver placed on a rotating disc coupled with geared dc motor drive that scans/surveys the area for infiltrators. It also includes a firing mechanism for an immobilizing dart. In case of any intruder detection, the controller triggers a solenoid which enables the trigger for the immobilizing device and fires at the target. The bulk of the chassis can be buried in the soil behind our border or LOC thus providing visual stealth to the robot.	
Impact	This innovation has the potential to greatly aid the nation's security by scaling the surveillance capability of the border security personnel.

Autonomous underwater vehicle

Primary Innovator	Akshay Raj Dayal
Location	Chennai, Tamil Nadu
Contact	akshayarajdayal@gmail.com
Website	www.srmauv.com
The AUV is useful for subsea profiling by mounting Acoustic Doppler Current Profilers (ADCP) onto the vehicle. It can map temperature gradients in the sea. The AUV is modeled in 3D CAD software and fabricated using CNC milling techniques. It also features actuators for torpedo shooting, a grabber system & marker dropping mechanisms. The frame and the components are strategically placed to provide passive Roll and Pitch stabilization to the vehicle dynamics. The AUV's electrical system consists of custom boards (PCB's). Three imaging cameras are provided to drive the vision system of the vehicle. A depth sensor is used to measure barometric pressure and provided a depth reading to the computer. A MEMS based Inertial Measurement Unit (IMU) is used to provide vehicle angular velocities and linear acceleration that is used to compute the pose of the vehicle. Software for mission planning, computer vision and active vehicle localization has also been developed.	
Impact	This innovation can provide an excellent opportunity in sector of underwater research, where human access is not feasible. The innovations could be very helpful in water profiling in various shoreline areas across the country as well as mapping the topography of lakes in country. The vehicle has vast applications in oil and gas industry, fisheries and marine ecosystem industry.

Conversion of paper airplanes into unmanned aerial video survey drones

Primary Innovator	B Madhan Kumar
Location	Chennai, Tamil Nadu
Contact madanadan92@gmail.com	
Unmanned Aerial Vehicle (UAV) made out of paper planes which can be converted into aerial drones for surveying. It is an aerial vehicle capable of flying inside the atmospheric boundary. The control surfaces are fully active at an altitude of 20 to 70 feet. This altitude gives enough time to the paper plane to stabilize itself. So it is required that the paper plane nano UAV be dropped at least from 20 feet.	
Impact	It is easily manufactured and can be applied to various defense purpose because it is compact it does not need any engines or power plant to hover, fly and also for stability. It is cost efficient and is easily portable and assembled within 2 minutes.

SERVe: Solar Electric Road Vehicle

Primary Innovator	Anudeep Reddy & Jeet Banerjee
Location	Manipal, Karnataka
Contact	anudeep.reddy1725@gmail.com
Website	www.solarmobilmanipal.in
<p>SERVe is India's first solar powered passenger vehicle and was conceptualized keeping in mind three design philosophies – low weight, high efficiency & aerodynamic body. The idea is simple - the solar modules on the roof of the vehicle trap energy & store it in the on-board battery. This battery can alternatively be charged from the A.C. Mains. The on board battery drives the motor & other electrical & electronic components which ensures safe & smooth functioning of the car. All this is done at minimal total weight with an ergonomic interior design, aerodynamic body work & highly efficient electrical system.</p>	
Impact	With rising fuel costs, fast depleting fossil fuel resources & ever increasing toxic pollution levels, this solar car can prove to be boon for the society. Zero running costs, minimal maintenance costs and noiseless drive makes SERVe a brilliant transportation option.

Nimble: A highly accurate gesture control ring shaped device

Primary Innovator	Ayush Agrawal
Location	Bangalore, Karnataka
Contact	rishav.duttachoudhury@gmail.com
Website	www.intugine.com www.youtube.com/watch?v=pRdAuHajk1A
<p>Nimble is a gesture control device which fits comfortably on the user's fingertips. This gesture control technology turns the area within 15 feet in front of any screen into a highly interactive control area and the fingers can be used to magically control a screen, presentation or game. Sub-millimeter accuracy paired with incredibly low latency makes Nimble the ideal gesture control system.</p>	
Impact	This gaming solution is one of its kind, which is available for PC and Android games because these games require high accuracy and considerable range. The price of this device is 1/5th of all other current gesture enabled solutions.

Innovative intelligent shopping cart

Primary Innovator	Ravi Nagadi
Location	Bangalore, Karnataka
Contact	ravi.ee@ssec.ac.in
<p>This is a smart cart using RFID. While shopping, the price of the items placed in the cart is determined and displayed on the LCD which is fitted in the cart. Any addition or removal is updated and the amount adjusted. Once done, the total amount is communicated to cash counter thus making the check-out process faster and smooth.</p>	
Impact	This resourceful trolley speeds up the process of shopping and the wait time at the time of check-out at stores is reduced by up to 50%. This innovation will be first of its kind and will aid in introducing a smart shopping system in India. It is easy to use and low cost. This innovation will improve the shopping experience of buyers and has the potential to change the face of customer service in retail market.

Avalanche Prototyper: All metal 3D printer

Primary Innovator	Jayan Prajapati		
Location	Indore, Madhya Pradesh	Contact	jayannprajapati@gmail.com
Website	www.a3d.co		
The 3D printing technology has seen recent developments worldwide in cost optimization and upgrading the quality of output. Avalanche FDM Prototyper series 40x focusses on prototyping any product or design using FFF (fused filament fabrication) technology and is targeted for businesses, institutions and organizations. Avalanche FFF Prototyper series 17x (Version 1) is another product which is focusses on domestic users and hobbyists for prototyping any product or design in 2 polymers using FFF technology.			
Impact The product speed is fastest in India and has a bigger platform of A3 size prototyping. The touch interface is user friendly and has applications in Industrial, Construction, Engineering, Medical, Merchandise segments. The cost is also optimized as it is manufactured locally in Indore.			

Autonomous underwater vehicle

Primary Innovator	Akshay Raj Dayal		
Location	Chennai, Tamil Nadu	Contact	akshayarajdayal@gmail.com
Website	www.srmauv.com		
The AUV is useful for subsea profiling by mounting Acoustic Doppler Current Profilers (ADCP) onto the vehicle. It can map temperature gradients in the sea.			
The AUV is modeled in 3D CAD software and fabricated using CNC milling techniques. It also features actuators for torpedo shooting, a grabber system & marker dropping mechanisms. The frame and the components are strategically placed to provide passive Roll and Pitch stabilization to the vehicle dynamics. The AUV's electrical system consists of custom boards (PCB's). Three imaging cameras are provided to drive the vision system of the vehicle. A depth sensor is used to measure barometric pressure and provided a depth reading to the computer. A MEMS based Inertial Measurement Unit (IMU) is used to provide vehicle angular velocities and linear acceleration that is used to compute the pose of the vehicle. Software for mission planning, computer vision and active vehicle localization has also been developed.			
Impact This innovation can provide an excellent opportunity in sector of underwater research, where human access is not feasible. The innovations could be very helpful in water profiling in various shoreline areas across the country as well as mapping the topography of lakes in country. The vehicle has vast applications in oil and gas industry, fisheries and marine ecosystem industry.			

Innovator's perspective: Encourage to invest in high-risk innovations

We are faced with problems in everyday life. Recognizing these problems and finding simple, down to earth solutions using techniques which may or may not have existed before is innovation. Innovating is second nature to human species and an ecosystem that supports innovations attract people like nectar attracts bees.

India lives in villages, but the rural India has stopped innovating because of governmental funding feeding the corrupt vested interest in communication channels and supply chain. As a result, facilities in villages are unable to meet the growing aspiration of rural population. One often wonders what has happened to our villages, which once invented smart water harvesting and distribution systems, farming techniques that lead to a lifestyle that is in complete harmony with seasons and available natural resources, but can't even make proper houses any more. Villages have not kept pace with changing lifestyles and there is a definite shift towards urbanization.

It is estimated that in spite of the increase in population, rural-urban ratios will shift from 70:30 to 50:50 by 2055. Imagine the plight of Indian cities where infrastructure will crumble under burgeoning population. For India to survive, we need to reverse this trend.

What they need is an ecosystem that would support investment in rural areas creating innovative education, health, and energy delivery enterprises, which will create jobs, may not have high ROI, but high human happiness index.

Our scientific, technical and financial institutions created for supporting innovations need to reinvent themselves by starting to look at innovations outside laboratories, and investing capital in high risk innovative enterprises instead of sure shot but dead ideas promoting mediocrity instead of excellence.

The government's job is to create a policy framework that provides an enabling environment for innovations to thrive. This can be in form of not only providing technical and financial support to innovators, but also give a supportive regulatory framework. Early entrepreneurs end up spending the major chunk of their time in meeting the regulatory requirements, which could be eased if the government departments could talk to each other and create some kind of single window clearances for setting up such enterprises. These are not new ideas, but need to be re-emphasized.

What also needs to be recognized by our angel investors is that the patient capital needs to be deployed in supporting high-risk innovative ideas beyond using mobile and internet technology, which are great tools, but do not solve all the problems of the world. While mobile apps may provide logistical support to, for example, garbage management problem, innovative infrastructure to treat actual garbage will also need to be supported with equal enthusiasm if not higher, even though the return may be slower to come. Else, they'll keep recognizing business ideas for excellence in the categories of technology, business, social impact, big idea, global potential and green, but will not risk their capital as the growth is not quick enough to increase their money.

CSR, the new kid on the block, can support innovations and need to develop systems, which will take their funding support beyond corporate image building for themselves.

There is an excellent opportunity that exists in the form of government, investors and CSR, which need to be honest in taking higher risk, a necessary condition for fostering innovations.

Rajnish Jain
CEO and Founder, Avani Bio Energy

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Contacts:

Deloitte

Tel: +91 20 6624 4600

Email: inideas-tmt@deloitte.com

Confederation of Indian Industry

Anjan Das, Executive Director

Seema Gupta, Director

Jibak Dasgupta, Dy Director

Reema Garg, Consultant

Persistent Systems

Dr. Abhay Jere

Associate Vice President & Head - Persistent Labs

Tel: +91 20 6703 4562

Email: abhay_jere@persistent.co.in

Department of Science and Technology

Dr. B. P. Singh, Head, NCSTC

Dr. D. K. Pandey, Scientist, NCSTC

All India Council for Technical Education

Prof. S S Mantha, Chairman

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