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PERSISTENT

Inclusive Indian Innovations

Perspectives & Case Studies

Knowledge Partner

Deloitte.

“ India is the cradle of the human race, the birthplace of human speech, the mother of history, the grandmother of legend, and the great grand mother of tradition. Our most valuable and most constructive materials in the history of man are treasured up in India only”.

- Mark Twain

Contents

Foreword

India made a significant contribution in the journey from roman numerals to the digital age when Aryabhatta gave the digit “0” to the world, for which he became immortal. This invention of the digit “0” is fundamental to all the digital communication we see around us today. This brought into play a paradigm shift in the fields of mathematics and astronomy, and spread to other fields in the years to come. Ancient India was leading the world in mathematics, ayurveda, surgery, yoga, music, language, astrology to name a few.

“We owe a lot to the Indians, who taught us how to count, without which no worthwhile scientific discovery could have been made”. - Albert Einstein[1]

It would be modest to say that innovative thinking is part of our DNA. But lately India seems to have moved from leader to follower position. We have not been able to benefit from demographic advantage that India has to excel on the world map. There is immense talent in the country not only in the urban areas, but also in rural areas. The report will showcase some of the inclusive innovations which are by no means the only or the exhaustive list of innovations which have happened in the last few years.

They say necessity is the mother of invention. Given the huge challenges India faces in various sectors such as healthcare, banking, education, manufacturing, there is no other choice for companies and Government but to innovate. Not only products but also innovative processes, and services could help to scale up the productivity and efficiency required to overcome vast challenges in developing countries. We need to make innovation as a part of social process and a participatory action-research methodology to enhance innovative performance. The spirit to make things possible through passion, hard work and risk appetite is the need of the day.

As a concluding thought, consider that in the last century very few countries have devised innovation models that have truly impacted international innovation policy - Silicon Valley’s cluster model, Japan’s lean manufacturing model and Finland’s model of technology investment are some of the most important examples of this in recent memory. With its frugal innovation model, India now joins this esteemed list. Tata Nano and GE's portable ECG machine are some of the world renowned examples of this constraint-based innovation to survive in tough economic environment. If India finds a way to streamline its innovation ecosystem with its development goals while retaining its characteristic *jugaad* culture, it could very well become an international source for the most sensible and responsible form of innovation yet. To this end, let’s recognize that while there may still be a long way to go as far as development is concerned; the country has strengths that can’t be ignored and must be harnessed. The future could be frugal. The future could be Indian. What we do in India can create a 3 billion people market to serve[2].

Hemant Joshi

Message from Dr. Raghunath Mashelkar

I am so happy to note that Deloitte and Persistent together are partnering on a major initiative, namely creating a report on ‘inclusive innovation’. I wish to offer my personal congratulations to both, not just because the subject is close to my heart, but because I see 'inclusive innovation’ as a transformative way by which we could see a more equitable and sustainable world emerge.

There are new phrases that dominate the innovation dictionary today. These include, besides inclusive innovation, phrases like frugal innovation, Gandhian innovation, nanovation, reverse innovation… These phrases did not exist five years ago. What is the real reason for this phenomenon?

It is because of the realization that the economic growth needs to be balanced with social cohesion. This means the growth has to be ‘inclusive’, so that all sections of the society reap the benefits of growth – not just a privileged few. In order to achieve ‘accelerated inclusive growth’, we need to take recourse to ‘inclusive innovation’. Then only will we be able to bring into the mainstream of the economic system the resource poor people as customers, employees, distributors, and intermediaries.

For achieving such objectives of ‘true’ inclusive innovation, we need to make some paradigm shifts. For instance, getting more (performance) by using less (resources) for more (profit) is a well-known strategy of industrial enterprises. However, it is only when we achieve more (performance) by using less (resources) for more (people) then alone can we create ‘inclusive growth’. The corporate world, the government, NGOs, the international development agencies, etc. must be aligned to this goal of *‘more from less for many’* (MLM), which spells out the path forward for inclusive innovation.

There is still an ongoing debate on what is a good definition of inclusive innovation. According to me, inclusive innovation is any innovation that leads to affordable access of quality goods and services creating livelihood opportunities for the excluded population, primarily at the base of the pyramid, and on a long term sustainable basis with a significant outreach.

A truly inclusive innovation should not just be aimed at producing low performance, cheap knock-off versions of rich country technologies so that they can be marketed to poor people. That is getting *‘less for less’*. That is Jugaad. We must get *‘more from less’*. This will mean that we will have to harness sophisticated science, technology and innovation know-how to invent, design, produce and distribute high performance technologies at prices that can be afforded by the majority of the people. In other words, we should be aiming for the apparently elusive ‘affordable excellence’!

Normally we think that what is affordable cannot be excellent. What is excellent cannot be affordable. India continues to make this impossible looking objective, possible. Take the well-known challenge of ‘affordable excellence’ in health care. Can we make a recombinant DNA hepatitis-B vaccine available at a price that is 40 times lower with such a high quality that it captures 40% of the UNICEF market? Can we make cataract surgery available at a price that is 100 times lower with a quality that is better than what Royal College of Ophthalmic surgeons are able to achieve? Can we do a heart surgery that is 20 times cheaper than in the USA, but is able to achieve post-surgery results that are as good as in New York hospitals? India has done it all and demonstrated that ‘affordable excellence’ is not a myth, it can be a reality.

It must be emphasized that inclusive innovation forces us to measure opportunity by the *ends* of innovation – what people actually get to enjoy – as opposed to just an *increase in their means*. In important ways, this rationale invokes a return to the traditional case for innovation – its ability to produce breakthrough improvements in the quality of life – alongside the usual objective of competitiveness.

R. A. Mashelkar, FRS
National Research Professor, National Chemical Laboratory
Chairman, National Innovation Foundation; Chairman, Reliance Innovation Council; Chairman, Marico Innovation Foundation; President Global Research Alliance

Message from Organisers

Persistent Systems

Innovation is a key pillar of progress of any society. India has certainly made great strides in development, yet it is clear that much more is needed to solve a multitude of challenges we face. There are several grassroot practitioners, budding entrepreneurs and growing enterprises who have taken these challenges head-on by creating unique solutions. We are indeed delighted to co-host this progressive convention that aims to showcase these wonderful solutions and create a continuing eco-system to facilitate their scaling and growth. I congratulate Deloitte for bringing out an excellent and insightful report that very well complements and supports the convention's aim.

In our own journey of over 23 years, differentiation based on technology and innovation has always been a central theme at Persistent, and we are continually seeking to enhance our ability to innovate and make it a part of our DNA. It was therefore very natural for us to participate in this effort to foster the culture of innovation at the grassroots. I trust that "Inclusive Innovations" will be a small yet significant step in fostering innovations that will meaningfully contribute to sustainable and equitable economic and social growth for our nation and wish the participants all success.

Dr. Anand Deshpande,
Chairman & Managing Director

Maharashtra University of Health Sciences (MUHS)

Western world is prophesying that India will be a global economic power by 2030. To make this a reality, all of us need to be motivated by three basic principles; knowledge, research and innovations. Knowledge converts into economy, research redesigns knowledge and innovations translate research into products which improve quality of life of a common man.

Although, India is a software giant and has excelled in various fields, still the prevalent notion is that Indians do not innovate. But ironically, we are creating low cost innovations that capable of improving life of the masses. These low cost, high technology innovations are directed towards increasing affordability and accessibility to the excluded population especially at the bottom of the pyramid.

Affordable excellence is extremely critical, especially in the field of medicine and diagnostics considering the socio-economic scenario in India. Hence, MUHS, Nashik has actively collaborated with Persistent Systems Ltd., Pune and Sakal group for scouting innovations, especially in the field of Healthcare and diagnostics and plans to support them through the university setup. Moreover, MUHS plans to work with other universities and private organizations to create a unique 'Inter-institutional Inclusive Innovation Center (I4C)' to ensure that Indian innovations are also commercially sustainable and accessible to masses.

Prof. Dr. Arun Jamkar,
Vice Chancellor

Sakal Media Group

We at Sakal have always believed in nurturing Novelty. Not novelty for the sake of 'being different' but for the sake of 'making a difference'. What the Society needs are more and more creations specifically aimed at resolving its critical issues. There are many ingenious minds amongst us that come up with viable solutions to these problems. Yet most of these innovations rarely see the light of day as they lack the resources required to shape the idea into reality. Bharatovation, therefore is an attempt to showcase these creations. It was the outcome of the coming together of three like-minded pillars of Society, namely Industry, Academia and Media. Through this event we hope to celebrate the spirit of Innovation. We hope to encourage the 'curious mind' to challenge its resources to come up with the answers that Society seeks. As a media house, we are indeed excited at the positive impact the event is making and look forward to extend our support to such fruitful endeavours in the future too. We salute the Spirit of Innovation.

Pratap Pawar,
Chairman

1. Introduction

"Innovation Eco-system requires a conducive environment for collaboration among diverse set of people- researchers, developers, entrepreneurs, end beneficiary etc. such that a worthwhile idea regardless from where it emerges can be carried forward all the way up to the intended destination. Inclusive innovation should thus involve and benefit people at the bottom of the pyramid."

Anil Kakodkar
Chairman, Research Advisory Council,
JNNSM at Department of Atomic Energy

Innate Innovation

Apple and Google, two of the world's top 10 most valuable companies as ranked by *Forbes*[3] and *The Boston Consulting Group*[4], are also ubiquitously recognized as being two of the most innovative companies of our time. Consumer-goods heavyweights such as Procter & Gamble and Starbucks were ranked not too far below the tech-giants in 2013, with shares of both companies commanding "innovation premiums" of around 35% - testament to the markets' view that innovation goes hand-in-hand with long-term value. Closer to home, Hindustan Unilever and Bharat Heavy Electricals both featured in this esteemed list as well, re-emphasizing the global appeal of innovative products. It is clear that in the knowledge economy we all live in, innovation may be the only globalized currency, but it is by no means a new one.

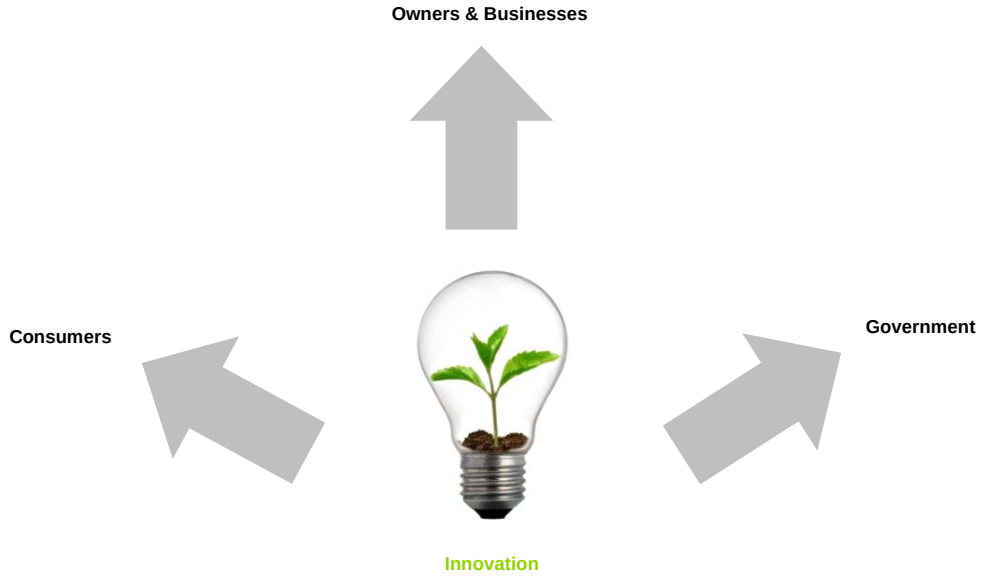
For as far back as life has existed on earth, innovation has been present. It is the invisible hand that has always dictated natural selection, forcing some species to adapt (read: innovate) in order to gain an evolutionary advantage over another, or be rendered extinct. In the case of humans, evidence of us modifying our environment to suit our needs dates back over 100,000 years[5]. Even plant-life, locked in perpetual competition for water and sunlight, has devised innovative strategies to compete for scarce resources. These innovations may seem trivial or vague, but had they not occurred, the advancement of all life would have been restricted to the rate of natural evolution. With this in mind, innovation can be defined as an innate value-adding mechanism through which all species seek to circumvent natural selection and gain advantages over their competition and the environments in which they exist.[I]

How different is today's corporate world from the primordial soup that spawned all life? The companies, corporations and countries of the world are little more than the prokaryotes of the artificial world, and as such are as bound to the concept of survival of the fittest as the rest of us organic beings.

[I] According to the OECD (1997) definition, "Innovation can be defined as all the scientific, technological, organizational, financial, and commercial activities necessary to create, implement, and market new or improved products or processes."

Inclusive Innovation

Before exploring the intricacies of inclusive innovation, it might prove useful to examine the *process* of innovation itself from a very practical perspective; how and why it occurs, but more importantly who causes it to occur. Broadly speaking, the needs of three economic groups give rise to all innovation:



Consumers initiate the entire innovation process either for economic reasons, such as their desire to consume goods and services that enhance their standards of living, or for social and personal reasons, such as the need for recognition from their families, communities and the wider society.

Entrepreneurs & Businesses translate a consumer's desires into products and services through invention or innovation in pursuit of returns on investment and to gain competitive advantages over their competitors.

Governments, in pursuit of their mandates to represent and fulfill citizens' needs and continually develop and grow their economies, facilitate innovations through the establishment of a favourable *innovation ecosystem* of policies, laws and infrastructure in their respective countries.

Segregated in this way, it can be seen that inclusiveness is already baked into the concept of innovation. It is driven by all the principal economic groups in a country, and therefore must include all of them for effective inclusive growth to be achieved. With this in mind, inclusive innovation can be interpreted as any innovation that leads to affordable access of quality goods and services creating livelihood opportunities for the excluded population, primarily at the base of the pyramid, and on a long-term, sustainable basis with a significant outreach.[6]

But why make innovation inclusive? Does inclusive innovation necessarily bring about significantly greater developmental benefits than innovation that occurs only at the fringes of society? A study performed on Innovation and Inclusive Development[7] by the OECD argues that this is in fact true due to the effects non-inclusive innovation has on a country's inequality levels. The study asserts that since innovation directly affects production, it also directly favours the highly skilled members of the workforce and the risk takers, causing an uneven income distribution. With lower average disposable incomes necessarily causing lower average consumption levels, it is plausible to assume that non-inclusive innovation is likely to give rise to lower economic growth rates and grimmer development outlook.

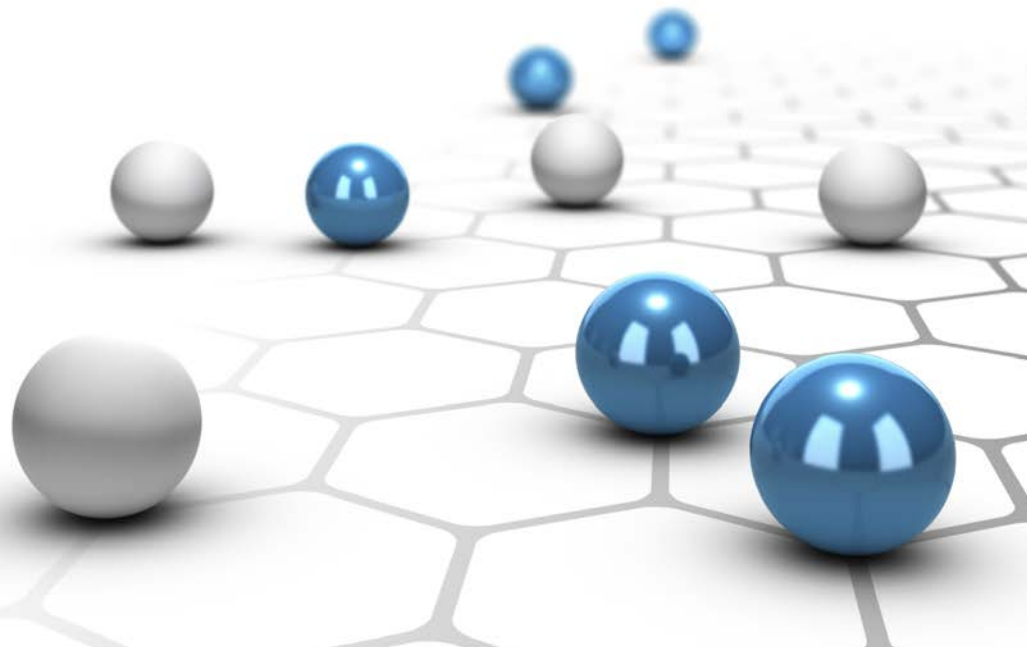
Inclusive innovation, on the other hand, will serve to lessen income inequalities, provide solutions for improving the welfare of lower- and middle-income groups (*frugal innovation*), and enable innovations by lower-income groups themselves (*grassroots activities*)[8]. A great example of this Gandhian innovation was seen at Aravind Eye Care Hospital which currently treats about 2.4 million outpatients and performs 286,000 surgeries a year. This makes it the largest ophthalmological institute in the world. Only 30% of their patients pay for treatment and rest go free of charge and yet the hospital makes 35% operating profit[9].

Fortunately, innovation is not restricted to the technology domain, and for developing countries such as India whose Services sector accounts for a larger portion of GDP than its Manufacturing sector (57% versus 26%[10]), non-technological innovation (marketing, process or organizational innovation) has a more dramatic effect than technological innovation on growth and development[11]. This is where government policy can bring about considerable change. To exemplify the value and potential of a non-technical innovation, consider the phenomenon of Mumbai's dabbawala system[12]. While conceptually simple, this system of food delivery prevalent in Mumbai is a breakthrough innovation by any measure, and it works thus: by using only the most economical modes of transport, approximately 5,000 dabbawalas collect and deliver over 200,000 lunch boxes every day, and if this isn't astounding enough, the process is handled with a 99.999% accuracy rate even though 50% of the dabbawalas are illiterate! The system's supply chain is so precisely planned and managed that collection, sorting and delivery even allows customers to request deliveries in real time. Needless to say, nothing like this exists in the advanced economies of the world – and certainly not at this scale. In fact, this business model has made such an impact on international innovation that it has been adopted by developed countries, popularizing the term reverse innovation, where the developed world adopts innovation techniques from the developing world.

Policy needs to be directed in three distinct paths:

1. On the demand side by helping the "excluded population" to find affordable, quality services and products;
2. On the supply side by providing mechanisms and platforms (including upgrading the skills of the workforce) to scale-up grassroots innovations to generate sustainable livelihood and employment[13];
3. Because smaller firms are further away from the technological frontier, technological innovations do still generate greater gains in productivity in these firms relative to larger firms, and so policies that facilitate small firms' access to new technologies could lessen productivity (and income) gaps in the economy.

Innovation in India necessarily needs to be inclusive. With the second highest population in the world, a large resource base, a rapidly growing middle class that has a strong desire to consume and a large skilled workforce that has a proven, value-adding frugal mindset[14], India's potential for growth given the right policy environment and incentives is, to put it conservatively, staggering.

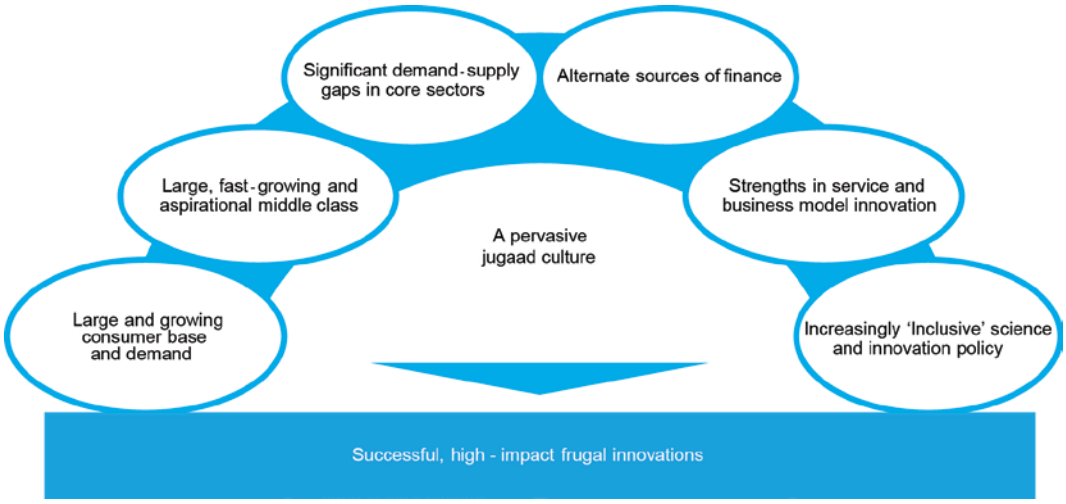


Indian Innovation

India's innovation potential is immense. The country's workforce consists of numerous pockets of young, capable and entrepreneurial talent in almost every sector, but still the country hasn't yet established itself as an innovation hub. In a democracy as large and diverse as India, it is an understandably tall order to create policies, institutions and industries that cohesively support and accelerate innovation, and so this section has a simple, two-fold aim: to explore and establish the status quo of the Indian innovation ecosystem through comparisons with other more "innovation friendly" nations, and to suggest possible strategies to reform and promote the domestic ecosystem.

India's strength has been argued to lie in frugal innovation[15]. This type of innovation, often observed in lower- and middle- income segments of the population, accommodates scarcity of resources – financial, material or institutional – to create affordable and essential products and services. Through the redesign of production and development processes or through the remodeling of a product or service, successful frugal innovations not only cost less, but also outperform the alternatives. Examples of such Indian innovations include Dr. Devi Shetty's breakthrough model of delivering affordable heart surgery[16], government labs driven crowdsource drug discovery[17] and telecom operator Bharti Airtel's cost-cutting schemes. But what gives rise to and supports a frugal innovation environment? And, more importantly, is it efficient enough to sustain India's long-term growth plans? The picture below aims to summarize India's current innovation ecosystem.

Figure 1: India's current innovation ecosystem



Source: NESTA, Deloitte Analysis

According to the Global Innovation Index 2013[18], India ranks 66th amongst 142 countries surveyed. While this is above the median rank, it is inconsistent with India's economic strengths and its current government policy, which claims to focus a great deal on Science, Technology and Innovation (STI). Furthermore, this ranking is below any of India's BRICS peers, which either suggests that the models of innovation currently utilized in India are not translating into measurable gains in development, or that these gains are not significant.

India is not seen as an innovation hub, globally. This is the case despite India's pervasive jugaad culture and the country being recognized as being highly creative. This suggests that perhaps the development gains produced by these innovations are not as significant, on average, compared to those of other countries. When factors such as political stability, workforce skill, infrastructure and ease of business creation are considered, it is clear that these are the anchors within the Indian innovation ecosystem, and could be restraining innovative thinking and action on a national scale. Each of these areas needs focused attention and dramatic reform if India is to reach the levels of the more innovation-friendly countries, including other BRICS members such as China. Even the country's education sector, in which India's top institutes feature prominently, is not a strength of the country as a whole, suggesting significant inconsistencies in education quality amongst different institutes and a lack of inclusiveness within the education sector as a whole. Measures to lessen the effects of this gap must be taken to improve the country's stock of human capital. The corporate sector can also contribute by ensuring the skill development of their employees. Reforms such as these can be suggested at almost any level in almost any field, and this is what is needed in India – a drive by all factions of the ecosystem to promote skills and innovative thinking, while building up and nurturing the necessary accompanying infrastructure to support it.

However, all is not lost, and by no means is India in an irreversible position. India is an economy in transition, and with ever more focus on inclusive innovation, all constituents of its ecosystem have the ability to influence reform. After all, we live in a time of resources and environmental constraints, and during such a time, which model of innovation could be better suited to cope with an austere future than one that exists purely *because* of resource constraints? Creating and sustaining an innovation ecosystem depends on building and strengthening interdependent links amongst ecosystem players.

2. Agricultural Innovations

Indian total factor productivity growth remains below 2% per annum; in contrast, China's total factor productivity growth is about 6% per annum, even though China also has smallholding farmers. The National Commission on Farmers indicates that there is a large knowledge gap between the yields in research stations and actual yields in farmers" fields. The yield gaps given by the Planning Commission range from 5% to 300% depending on the crop and State.[19]

Agriculture in India has been associated with resource-poor farmers, land degradation, soil and water losses, and increasing pest problems. Over a period of time, agricultural productivity has increased and production methods have changed significantly due to modernization. The challenge is to ensure that modernization will assist farmers to become economically competitive and to apply environmentally-sustainable techniques. Even in the modernization process, farmers' knowledge is indispensable[20].

Agriculture innovation provides innovative technologies and approaches to increasing agriculture production and yields, decreasing post-harvest losses, adapting to climate change and developing the agribusiness value chain from producer to consumer.

There are three broad conditions that are necessary for an individual farmer to adopt a farming-system innovation: awareness of the innovation, perception that it is feasible and worthwhile to try, and perception that the innovation promotes the farmer's objectives[21].

Solar Conduction Dryer	
Primary Innovator	Vaibhav Tidke
Location	Mumbai
Contact	vaibhavtidke@gmail.com
Website	scienceforsociety.co.in/solar-dryer/

Dehydrating fruits and vegetables can increase their shelf life to almost a year but most conventional methods use non-renewable energy.

This innovation's intellectual property involves a complex process through which heat due to solar energy is transferred and dehydrates the produce.

Impact	A much needed innovation to prevent losses in agriculture due to spoiling of produce.

Simple Soil Nutrient Analysis using AAT	
Innovators	K. Perumal, Deepak Khemani, J Arunkumar
Location	Chennai
Contact	arunkumarJ@mcrc.murugappa.org
Website	www.amm-mcrc.org/pdf/AAT_manual_english.pdf

Alternative Analytical Technology (AAT) is a simple, cost effective and reliable technology to determine soil nutrients rapidly. AAT is based on subjecting a small sample of soil to simple chromatography and using image processing for obtaining comprehensive quantitative soil nutrient analysis. The test result provides alerts on excesses or deficiency of nutrients. The resultant soil analysis is converted by software to recommend 5 suitable crops for the particular soil as well as fertilizers, secondary and micronutrients requirements for the chosen crop.

Impact	A great tool for farmers to effectively understand the soil conditions in their farms and the needed remedies.

Solar Powered Crop Harvester	
Primary Innovator	T.J. David
Location	Hyderabad
Contact	tjdevid@gmail.com
Website	tjdenergysolutions.com/innovations/agricultural-farming-sector/

The solar powered harvester can reap paddy and wheat among other crops and can collect food grains without damaging the same.

The innovators unique design is the use of direct drives with individual electric motors for the cutter, feeders, conveyer belt, trashing unit and the hydraulic lift which significantly improves efficiency over the conventional machines.

Impact	An invaluable aid to farmers to reduce the labour needed in harvesting while cutting down the usage of fossil fuels in conventional harvesters.

Automated Solar Irrigation System	
Primary Innovator	Atul Kulkarni
Location	Bangalore
Contact	atulkulkarni123@gmail.com
Website	www.sparktherise.com/projectdetails.php?pId=5844

An automated irrigation system that works without electricity thus solving the problem of other systems that fail to work when electricity is absent and endanger the health of crops.

The unique design has a very efficient solar energy converter module to run the motor and a micro controller based automatic pumping circuitry that prevents water wastage.

Impact	A decisive solution for irrigation that tackles the electricity supply issues and is also labour and water saving.

Remote Controlled Power Tiller	
Primary Innovator	Prajwal Kumar
Location	Mangalore
Contact	prajwalvk@robautonics.com
Website	www.robautonics.com/

This device allows farmers to operate their tillers from a distance. There is no need to walk along the machine as it moves in the field. The design IP includes a radio frequency based wireless electronic technology combined with a pneumatic system as a power source to operate the direction control clutches and brake lever on the tiller. A further advantage is that it can be retrofitted into the farmer's existing power tiller thus protecting his earlier investments.

Impact	A vital solution for farmers to improve their productivity several-fold and reduce labour costs.

Remotely Piloted Aircraft for Investigation of Biological Samples from Farms	
Innovators	Bhushan Gosavi, Sudip Das, Farhan Eqbal
Location	Thane
Contact	bhushangosavi12@gmail.com
Website	www.youtube.com/watch?v=TaAMynIiYEo

In case of any disease or contamination on the crop, the air above the crop area will also carry some traces of pathogen or contamination. This innovation uses an unmanned air vehicle fitted with a bio sampler to collect air samples, which are then investigated for the presence of pathogens and contamination that is harmful to the crops so that remedial action can be taken.

This unique solution solves the problems with the alternative methods for sampling: use of hot air balloons which are very difficult to control, or ground vehicles which may destroy some of the crop.

Impact	An aid to crop disease control and prevention by the timely and accurate tracking of samples.

Sugarcane Bud Chipper	
Primary Innovator	Roshanlal Vishwakarma
Location	Narsimhapur
Contact	+91 9300724167 / +91 9424997894
Website	www.nif.org.in/bd/product-detail/sugarcane-bud-chipper

The chipper is used to remove buds from sugarcane for re-plantation purpose, an operation that is typically time consuming and prone to damaging the bud.

The inventor has come up with a unique design: on the press of a handle, an implement on the unit removes the bud from the node of the sugarcane, which is then used for planting. This design is differentiated from existing methods by its low cost and higher chipping efficiency.

Impact	A simple and cost effective device that can solve a major need for sugarcane growers.

Reaper Windrower to Reduce Grain Loss while Harvesting	
Primary Innovator	Bhagwan Singh Dangi
Location	Vidisha
Contact	+91 9617729447
Website	7award.nif.org.in/awardprofile-details.php?profile_id=7&page=7&st_id=-1

This is a front mounted attachment for tractors that can be used to harvest wheat, paddy and pulses etc. It is more efficient and has lower harvesting losses compared to conventional reaper units.

Bhagwan's unconventional design IP consists of a reel unit for pushing the standing crop, a cutting unit, and gathering unit to windrow the crop at the centre making it easy to handle. This design offers the advantage of reduced breakage of grains, and the unit is capable of working in small fields, taking sharp turns and not damaging the standing crops.

Impact	A wonderful innovation that reduces manpower and the drudgery involved in the harvesting process, while preventing the grain losses while harvesting.

Automatic Watering System for Potted Plants and Saplings	
Primary Innovator	Abdul Kaleem
Location	Deoria
Contact	kaleem.nif@gmail.com
Website	nif.org.in/awards/awardprofile-details_radio.php?page=1&search=Makarand%20Kale&radiobutton=or

This is a grass-root innovation that ensures optimum watering of potted plants thus saving water and ensuring their proper growth. The design is based on a soil moisture content sensor which controls a water pump. When the soil gets sufficiently watered, i.e. moisture goes above the preset value; the sensor switches off the motor. A simple LED indication shows the status.

The simple yet elegant design allows the material cost to be extremely low compared to other automated watering systems.

Impact	A suitable innovation for horticulture and floriculture nurseries by reducing the water and manpower requirement, while ensuring the health of the saplings.

Wi Agri: An Automated Irrigation Device	
Primary Innovator	Ravindra
Location	Bangalore
Contact	ravindra@agenttech.org
Website	www.agenttech.org/Agenttech_Presentation_PowerWaterGroundwater_SavingProduct.pdf

This innovation helps the farmers to carry out irrigation in an automated and accurate way with precise monitoring of the conditions.

The device consists of smart and efficient wireless moisture, photosynthesis sensor with automatic water valve and pump controls with analyzer.

Impact	Automating irrigation through such a device helps reduce both water consumption and labour, while ensuring proper crop health.

ENOVISION: Electronic Nose and Vision System for Tea Process Quality Monitoring	
Primary Innovator	Nabarun Bhattacharya
Location	Kolkata
Contact	nabarun.bhattacharya@cdac.in
Website	nif.org.in/awards/awardprofile-details_radio.php?page=1&search=Makarand%20Kale&radiobutton=or

Normally the assessment of aroma and appearance of Indian black tea while it is being processed requires highly trained human assessors who are very hard to find. The innovation is an integrated Electronic Nose and Vision system developed for replicating the human assessor in a quantifiable and reproducible way. An online display of fermentation progress and completion and reporting helps in tracking.

The intellectual property of the solution involves proprietary algorithms that allow accurate detection of fermentation milestones, and reliable prediction of tea-taster-like quality scores of finished tea. All this is accomplished in a non-invasive manner with zero sample preparation.

Impact	Solves the problem of non-availability of skilled testers and helps in improving the quality and productivity of tea processing.

3. Health Care Innovations

India has approximately 860 beds per million people. According to the World Health Organisation, this is only one-fifth of the world average, which is 3,960. It is estimated that 450,000 additional hospital beds will be required by 2014.[22] The government is expected to contribute only 15-20%, providing an enormous opportunity for private players to fill the gap.

Health care in India is still a very fragmented industry. The highly empowered consumers of today feel absolutely frustrated as a user of the health care system.

When it comes to innovating business models for health care delivery and packaging, it appears that we have failed to keep pace with clinical advances, and surprisingly with most other industries. We are trying to move from treating diseases to preventing them. The players in the healthcare domain are now offering complete health care management to individuals rather than disease treatment. Innovative business models that bring together various players in the value chain of health care could greatly reduce cost, improve care and save precious time during the need.

Technology innovations can help reduce the cost and greatly improve quality of health care and treatment by connecting various health care systems. IT innovations can shrink the infrastructure challenges of hospitals, medical devices, and doctors in a vast and developing country like India. Gestation period of IT innovations being much shorter compared to the new drug invention, these innovations are attracting higher venture capitalists interested in investing in health care industry.

Collaborative improvement efforts need to be made to increase value and efficiency of the health care system for leaving better a world for future generations.

Vesag Watch: A Wearable and Portable Vital Parameter Tracker	
Primary Innovator	Rajendra Sadhu
Location	Hyderabad
Contact	raj@vyzin.com
Website	www.vesag.in

The Vesag watch is a personal emergency response system (PERS) providing round the clock tracking and communication of health index parameters of patients, e.g. pulse, ECG, body weight, blood sugar and blood pressure monitors. All accumulated data is wirelessly transmitted to the web portal and a medical call center for monitoring. The analysis helps determine in a timely manner if any preventive care or emergency medical response is needed.

The unique differentiator of this innovation is that unlike bulky equipment, which restricts the patient to be in a specific area, this device is wearable and highly portable due to the use of GPS and GSM technologies.

Impact	A lifesaving solution especially for geriatrics and known high risk patients who stay alone.

ToucHB and Uchek: Mobile Assisted Biochemical Screening	
Primary Innovator	Myshkin Ingawale
Location	Mumbai
Contact	Myshkin.ing@gmail.com
Website	www.biosense.in

ToucHb is a hand-held needle-free battery operated device that enables screening for anemia and simplifies monitoring of treatment on a regular basis. The uChek uses the smartphone camera to read test strips, to accurately analyze results of urine or pin prick blood tests.

The unique intellectual property of ToucHB is that it does not need a blood sample thus reducing chances of infection. uChek uses the smart-phone camera and processing to determine the results much more accurately than manual interpretation and without the need for much costlier automated readers.

Impact	A solution that can be used across government agencies, NGOs and end users to identify and treat medical conditions in a timely manner and prevent serious health events.

Breathing Sensor Apparatus	
Primary Innovator	Susant Pattnaik
Location	Odisha
Contact	sp@susantpattnaik.com
Website	www.susantpattnaik.com

This device is a User Interface that converts breath intensity into commands. With training, it can allow a completely blind, deaf and dumb disabled person to control various machines like wheelchairs and do a lot of work through them as a normal human being.

The concept and implementation of breath intensity to commands is an unparalleled innovation.

Impact	A great boon to provide mobility and control to people who are blind, dumb as well as deaf and were earlier totally dependent on attendants.

3Nethra: Ophthalmology Pre-screener	
Primary Innovator	Shyam Vasudev
Location	Bangalore
Contact	shyam@forushealth.com
Website	www.forushealth.com

3nethra, an Intelligent Pre-screening Ophthalmology Device for automated identification of eye problems such as cataract, diabetic retinopathy, glaucoma and cornea problems, and refractive errors. An automated pre-screening report, combined with telemedicine helps scale the reach of the hospitals and doctors to far-flung rural areas. This equipment is highly portable and at a much lower cost that alternative equipment.

This product uses a unique IP to avoid dilatation prior to screening. Therefore 3Nethra can be operated after training by semi-skilled operators or volunteers, and the time for testing and recovery, and inconvenience to the patient is significantly reduced.

Impact	A vital equipment in India's war against needless blindness, by scaling the hospitals and NGOs ability to identify and treat eye problems in time.

CareMother: Maternal and Child Health Device	
Primary Innovator	Shantanu Pathak
Location	Mumbai
Contact	Shantanu.ict@gmail.com
Website	scienceforsociety.co.in/wireless-health-care/

CareMother is an integrated mobile software application and set of digital sensors for pregnancy care and high risk pregnancy prediction. It is a portable kit that helps identify potentially serious conditions (e.g. Preeclampsia, Anemia, PPH etc.).

The intellectual property of this solution is the combination of innovative sensors and mobile processing that allows key screening tests and is an alternative to replace multiple expensive analyzers.

Impact	A life-saving solution that can help reduce pregnancy related complications and prevent mother and child mortalities especially in the far flung areas.

Orthosis for Treatment of Infant Club-foot	
Primary Innovator	Kanwaljeet Khas
Location	Delhi
Contact	kjitkhas@gmail.com
Website	www.techpedia.in/award/upload/award_profile/clubfoot-orthisis-2013.pdf

Orthosis is a novel solution to treat Club-foot which is a complex congenital foot deformity where the infant's feet are twisted. The product is simple to use and can be attached by the parents themselves. The orthosis is reusable multiple times by the same or different patients to reduce the cost.

The unique intellectual property is the innovative design of the orthosis which replaces the conventional plaster based treatment and also the inconvenience of multiple hospital visits.

Impact	A solution to drastically reduce the treatment cost and inconvenience for infants with club foot.

BxOne - Biopsy System	
Innovators	Siraj Bagwan, Jonathan Pillai, Jagdish Chaturvedi, Siddhartha Joshi
Location	Delhi
Contact	jon@indiolabs.com
Website	indiolabs.com/technologies.html

Liver Biopsy is the gold standard for obtaining a definitive diagnosis for liver diseases such as viral hepatitis, cancer and cirrhosis. However, due to the safety risk of internal hemorrhaging, handling of infected tissue, degree of physician skill and high cost associated with this procedure, this limits its use in the clinics and contributes to a "Silent Epidemic" (as per WHO) of undiagnosed infections in India. The device is currently undergoing pre-clinical development at IndioLabs, an Omya Healthcare company based in Bangalore.

Impact	The BioScoopTM and BXSealTM technologies, integrated into novel biopsy platform, are designed to provide safe, simple and affordable access to liver and other soft organs biopsy, and to empower the healthcare providers for definitive diagnosis and treatment.

OcuDA: Ocular Digital Adaptor for Anterior Eye Pre-screening	
Primary Innovator	Ramesh Ve
Location	Manipal
Contact	ramesh.sve@manipal.edu
Website	www.sparktherise.com/projectdetails.php?pId=1688

Ocular Digital Adaptor (OcuDA) is a simple and compact external attachment, made to affix to any affordable common cameras (hotshot, smart phones and web camera) and get a good picture of the front portion (Anterior Segment) of the eye and image processing software to evaluate for abnormal conditions. Diseases in the anterior segment account for nearly 70% of blindness cases in India.

The intellectual property of this solution is the concept and design of the external attachment combined with processing on a computer or smart phone as an alternative to conventional diagnostic equipment of slit lamp and microscope**.**

Impact	An innovation to prevent needless blindness by scaling the preliminary screening of eye diseases in a cost effective manner.

NanoSniff: Point of Care System for Cardiac Diagnostics	
Primary Innovator	NanoSniff Technologies
Location	Mumbai
Contact	nehul@nanosniff.com
Website	www.nanosniff.com

The solution is a low-cost, diagnostic aid for detecting biochemical markers that occur in cardiac dysfunctions. It is based on piezo-resistive polymeric cantilever-based technology with embedded electrical readout schemes. It is highly sensitive to trace presence of the markers as well.

The unique intellectual property developed is the cantilever-based and affinity biosensor-based arrays that can detect a suite of molecular markers with electrical sensitivity in the range of a few parts per million per nanometer of deflection.

Impact	An innovation to drastically reduce fatalities by timely detection of cardiac attacks, especially incipient ones that go undetected before a fatal attack occurs.

Laptop / PC based in 12 Led ECG Plug-in	
Primary Innovator	Ravi Mehrotra
Location	Delhi
Contact	ravi@mail.nplindia.org
Website	nplindia.org

This is a low cost alternative to ECG equipment, using any laptop/PC and standard ECG electrodes and leads. It features a real time display of the ECG signals on the screen, and the ability to print on a standard A4 printer and an archival database for later retrieval.

The unique intellectual property of the solution is the innovative noise-filtering algorithms for high quality ECG recordings, and the analysis routines to extract important ECG parameters.

Impact	A cost effective and portable aid to screen patients in remote areas and detect cardiac abnormalities in time.

Sanjeevani: Disaster Kit	
Primary Innovator	Rajendra Ladkat
Location	Pune
Contact	contact@rajendraladkat.com
Website	www.rajendraladkat.com

This kit consists of aids to effectively tackle emergency and accident conditions as diverse as drowning, snake bite, fractures, toxicity and more.

The differentiating feature is the unique combination of effective aids in a compact and cost effective kit to tackle the majority of emergency conditions and provide primary care to victims before reaching a hospital.

Impact	This compact and cost effective kit can save lives in multiple types of accident and disaster conditions, providing timely rescue or needed primary care.

AxioStat: Bleeding Arrestor	
Innovators	Leo S. Mavely, Ashish Pandya
Location	Ahmedabad
Contact	leo.mavely@axiobio.com
Website	www.axiobio.com/product.html

AXIOSTAT is a sterile, single use, non-absorbable wound dressing to stop traumatic external bleeding. It is easy to apply, controls heavy bleeding within a few minutes of application, and can be easily removed using saline water.

The unique IP developed by the innovators makes use of agents with a positive charge that naturally adhere to the bleeding wound and combine with the blood components to create an external clot and block the further flow of blood.

Impact	An essential aid in casualty units and emergency response kits to prevent complications and fatalities due to traumatic bleeding.

Digital Braille	
Innovators	Rakshith, Likhtih S, Sankiran S, Yashdeep U
Location	Bangalore
Contact	rakshith.nrr@gmail.com
Website	in.specials.yahoo.com/news/digital-braille-085350047.html

Digital Braille has two components. The first aims at helping the visually impaired people to better receive the information in the classroom, by capturing images of the handwritten information on the black board and converting it to words using template matching technique. Later these words are converted into Braille format. The other part of the Digital Braille project involves converting any available online documents into Braille script.

The unique intellectual property of this project is the Braille pad which can be read by the visually impaired people, and also used to interact with the computer by entering a Braille code using the touch sensors on the braille pad.

Impact	'Digital Braille' opens the door for the visually impaired to better access knowledge in the classroom, and communicate in an unrestricted way using the tools of the internet-connected world.

ViSparsh: Obstacle Detecting Waist Belt	
Innovators	Jatin Sharma, Tushar Chugh, Rolly Seth
Location	Hyderabad
Contact	jatin.sharma@yifp.in
Website	visparsh.blogspot.in/

The innovation is a tactile feedback based waist belt that can be used by users with vision challenges. ViSparsh uses Microsoft Kinect as a depth sensor and processes its data to identify direction, distance and movement of potential obstacles coming into the user's path. The inner side of the belt contains a vibration panel that produces stereo vibration around the waist. With training the user can determine distance, relative position as well as motion of the obstacles.

The integration of a standard Kinect sensor and the intelligent use of stereo vibrator and frequency to provide accurate information on distance, relative position, and motion is the unique feature of the product.

Impact	The product can greatly aid mobility and safety of vision challenged users.

Kavach: T-shirt that Measures Physiological Parameters	
Primary Innovator	Harsh Lal
Location	Hyderabad
Contact	harsh.einstein@gmail.com

Kavach is a T-shirt that measures bodily functions such as body temperature, pulse rate, acceleration and GPS location. It then stores this data to cloud where it can be processed and artificial intelligence algorithms can be applied to identify potential diseases in advance.

The differentiator of this innovation is the combination of sensors in a simple to use T-shirt form and processing algorithms.

Impact	It provides users, especially high risk patients, to be monitored around the clock and provide preventive medical aid.

Smart Pill Box	
Primary Innovator	Manasvi Sihag
Location	Faridabad
Contact	manasvisihag25@gmail.com
Website	www.dellchallenge.org/projects/swasthya-sanjivani

The electronic pill box device is a smart, portable, wirelessly programmed medicine storage box designed in order to help patients to take right dose at the right time. It connects to a pc/laptop by USB and installed software allows the operator to easily load the schedule into the pillbox device for their specific medication regimens and dosing times. A Pill Box Application for the Smartphones over a Bluetooth connection is also available. The controller in the Pill box will initiate an audio visual light reminder to remind the patients about different medicines that they have to take. It can also remind the patient about their next appointment with the doctor.

The compact and innovative design of the box with multiple medicine compartments and flexible programmability of the alerts is a unique feature.

Impact	Patients who have to take multiple medications, especially elderly and illiterate will find this very useful to comply to the dosage schedule and aid the effectiveness of the medication.

Smart Cane	
Innovators	M. Balakrishnan and students
Location	Delhi
Contact	mbala@cse.iitd.ernet.in
Website	www.cse.iitd.ernet.in/~assistech/

The smart cane has a detector which gauges the distance to obstacles and operates a vibrator for warning the user of nearby obstacles. It detects outdoor obstacles up to 3 meters away, and a separate indoor mode for detection of obstacles up to 1.8 meters away. Its built-in battery lasts for 10 hours.

A unique feature is that besides warning about the obstacle the obstacle distance is indicated through varying patterns of vibration.

Impact	A useful aid to improve mobility and safety of the visually challenged, especially those also suffering from hearing loss who cannot benefit from audible alerts.

Sanket: Pocket ECG Recorder	
Innovators	Neha Rastogi, Rahul Rastogi
Location	Gurgaon
Contact	rahul.rastogi@agatsa.com
Website	www.agatsa.com/sanket.php

'Sanket' is a portable ECG recording device which can also be adapted to log readings from sensors for other vital parameters. It features Cloud based ECG storage and analytics for monitoring & automated early warning alerts.

The unique intellectual property from this innovation is the replacement of conventional ECG electrodes, which are difficult for the lay user to self-apply, with a revolutionary design of easily strap type or card type electrodes that can be easily fastened by the user and can be used during normal daily activities.

Impact	By warning users well in time about emerging heart conditions, including incipient attacks, It's a potentially life-saving tool.

Smartphone for Visually Impaired	
Primary Innovator	Sumit Dagar
Location	Delhi
Contact	dagarsd@gmail.com
Website	www.rolexawards.com/profiles/young_laureates/sumit_dagar/project
The Braille phone uses a simple framework: the screen technology consists of variable height pixels. The high-resolution screen will therefore be capable of conveying simple Braille text, as well as various shapes, figures and maps. Users will be able to “view” a face using the sense of touch, or follow a map to find their way home. Like existing smartphones, the screen will be touch-responsive, so users can input information and make phone calls easily.	
Impact	Visually impaired people get a completely new user interface for their phones that allow them much greater levels of access to content and applications.

Smart Skull: An Accident and Trauma Alerting Helmet	
Primary Innovator	Mohit Bahl
Location	Faridabad
Contact	mohitbahl169199@gmail.com
Website	in.news.yahoo.com/a-helmet-that-saves-lives-103903313.html
Smart Skull consists of a modified two-wheeler helmet consisting of an impact measuring capability couple with the rider’s cell phone which has an analysis algorithms and cloud integrated application. In case of an accident or similar impact it analyses the data and automatically informs the relatives, nearest hospital, police and emergency centers about the intensity and location of the trauma. The unique intellectual property of the innovation is the combination of the sensor in the helmet of the rider that measures the impact on the head, and its wireless communication with, and processing on the user’s smart-phone.	
Impact	Smart Skull can significantly reduce the complications and fatalities in two wheeler accidents by providing the right emergency care immediately.

Multifunction Laparoscopy Instruments	
Primary Innovator	Chinmay Deodhar
Location	Pune
Contact	chinmaydeodhar@ gmail.com
Website	biodesign.stanford.edu/bdn/people/chinmaydeodhar.jsp
The innovations are about combining more than one function in a single laparoscopic surgical device. This reduces constant changing of the instrument and reduces time and possible fatigue for the surgeon and enables him to provide better for the patient.	
Impact	These are great productivity improvement devices for surgeons that enable them to improve speed and accuracy and eventually benefit patients.

Sting Ring: A Self-protection Aid for Women	
Primary Innovator	Imran Khan
Location	Chitradurga
Contact	imran11282@gmail.com
Website	articles.timesofindia.indiatimes.com/2013-09-16/science/42113381_1_imran-khan-ring-device

This is a self-defense device in the form of a Jewelry Ring, but consisting of a micro needle, micro pump, and a micro-tank containing Capsaicin. Capsaicin is a very potent chemical that stimulates chemoreceptor nerve endings in the skin, creating a strong burning sensation.

In any untoward incident such as molestation or assault, the user has to activate the device and use the needle to provide a painful injection of Capsaicin to the assaulter. A smart RFID tag is included to ensure that only the designated user can operate the device. This is helpful in preventing misuse of the device.

As against the conventional pepper sprays which are difficult to carry around at all times, the unique intellectual property of this device is the design of the extremely compact yet effective deterrent chemical and its wearable form factor. Although the capsaicin is only 0.2 ml it can provide a very painful and disabling jab to up to 5 times.

Impact	With rising incidents of crimes against women, this is a much needed innovation to enable a woman to protect herself.

Fall Detection for Geriatric Monitoring	
Primary Innovator	Vinay Chaddha
Location	Noida
Contact	vinay@joy-n-freedom.com
Website	www.sparktherise.com/projectdetails.php?pId=4701

This innovation continuously monitors position of the person being tracked, and can be continuously displayed on a remote client display. In case of a slip or collapse, it triggers an alert on the display and also warning calls to designated individuals are made.

The unique feature of this product, compared to other monitoring products, is that it does not use a camera to monitor the user but only provides positional alerts, so the privacy of the monitored person is maintained.

Impact	A great aid for geriatrics so that they can receive timely assistance in the case of falls, unconsciousness, and similar events.

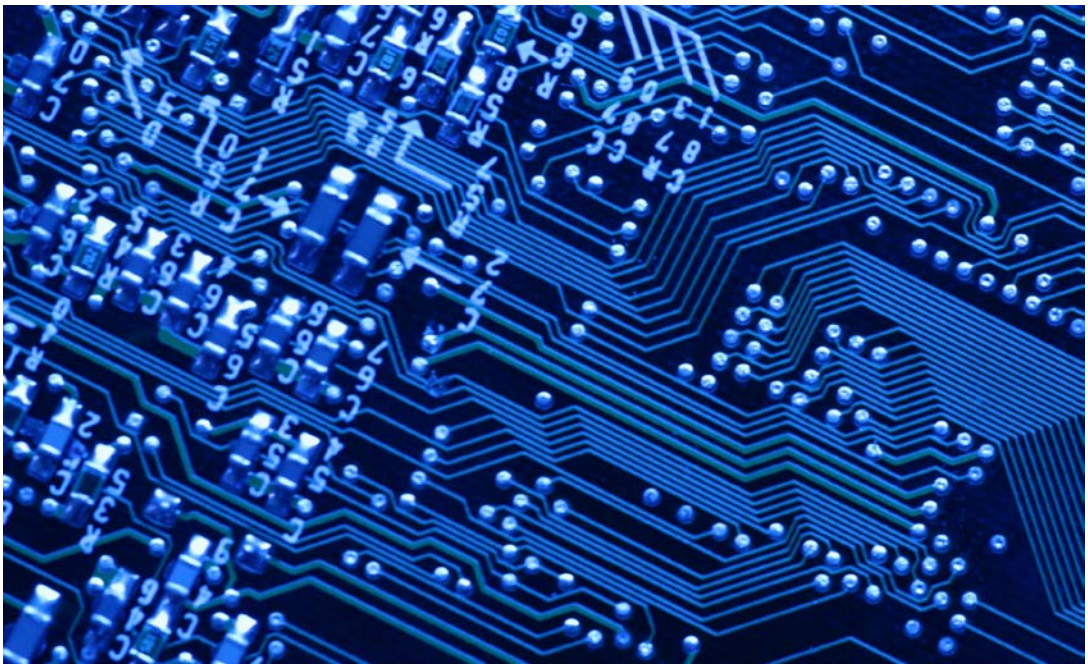
Nila: Remote Emergency Monitoring Device	
Primary Innovator	Bhairav Shankar
Location	Hyderabad
Contact	bhairav@avantari.co.in
Website	www.avantari.co.in

It is a simple, non-invasive healthcare information monitoring system, which can monitor vital parameters and transmit user-specific data using Bluetooth/Wi-Fi technology, storing it on a remote server and allows access from all types of mobile devices as well. The unique IP is the ingenious design for the sensor that discreetly measures heart rate from behind the ear.

Impact	The innovation can add significantly to the quality of life of the high risk and elderly patients by advance notice of health conditions and prove to be lifesaving as well.

Cardea ECG: Mobile ECG	
Primary Innovator	Abhinav
Location	Delhi
Contact	abhinav@cardeabiomedical.com
Website	www.cardea-labs.com
Cardea's mobile ECG product is an external device which links up with a phone via Bluetooth to show a real-time electrocardiogram of the user. The device is connected with normal ECG electrodes to the user's body like a typical ECG machine, but the differentiation is that it is a two electrode system for quick diagnosis, and it can work with ordinary feature phones with an average display and the user does not need to own a smart phone.	
Impact	This is a potentially life-saving solution for patients with known cardiac risk to self-monitor themselves and seek emergency attention in criticalities.

4. Engineering Innovations



Thomas Edison, Graham Bell, Henry Ford - Engineers are the source of a large number of innovations that has changed and is changing the life of humankind every day. Whether it is to achieve more comfort, effectiveness or making consumables more affordable, engineers are at the forefront of innovation.

Whereas research scientists describe the fundamental concepts of nature, engineers apply, combine and often stretch the same to solve a wide range of problems. These problems or challenges are often part of the engineering that is required by many industries such as manufacturing, construction or telecommunication. Engineers are therefore the key drivers of economic growth and prosperity across the globe.

In the 20th century, engineering heavily focused on manufacturing and construction. Today engineers innovate more and more in the fields that at least partially intangible such as computers, software and the Internet. Augmented reality devices such as Google Glass are examples of innovation that bridge intangible technologies with the real-world, thus opening up nearly unlimited possibilities for engineers to innovate. This intellectual property rather than physical one is moving into the focus of inventors and visionaries of the 21st century.

Auto Kit to Improve Efficiency	
Primary Innovator	Harinarayan Prajapati
Location	Jaipur
Contact	hnp2111@gmail.com
Website	www.nif.org.in/bd/product-detail/petrol-performance-enhancer

It is a grass-root invention by an innovative garage mechanic. This kit for 4 stroke engines, can be easily fitted in the inlet manifold line, and increases the mileage without compromising on power. The estimated savings in fuel consumption are about 10% or more.

The inventor's IP achieves the mileage benefits by an ingenious approach to rectify the air-fuel mixture: it sucks in and stores an extra air fuel mixture that can be released back to the engine when required.

Impact	This widely applicable innovation can go a long way in curbing the rising fuel consumption.

Mobile Controlled Starter for Motors	
Primary Innovator	Vijay Mehta
Location	Pune
Contact	khyatee.india@gmail.com
Website	www.khyatee.in/india-innovates-awards.html

A device to remotely control and monitor motors / pumps and similar equipment using a GSM mobile phone.

It is especially suitable for operating water pumps in farm irrigation remotely by using his mobile phone.

Unique features include a voice based interactive response system for very easy operations even for illiterate users; real time status of the remote equipment by SMS; preventing motor winding burning due to electrical faults.

Impact	It saves the farmer time, energy, money, petrol / electricity and can increase farm produce as well by watering in time.

Mitticool: Electricity-less Refrigerator	
Primary Innovator	Mansukhbhai Prajapati
Location	Rajkot
Contact	info@mitticool.com
Website	www.mitticool.in/

This is a grass-root innovation of an alternative method of cooling that does not require electricity.

The inventor has used the principle of evaporative cooling commonly used in 'matka's to design a clay refrigerator with two chambers, one for storing and cooling water, which also serves to cool the lower chamber where shelves are used to store vegetables, fruits and milk etc. The achieved temperature reduction is good enough to extend the life and freshness of the stored products.

Impact	For solving the problem of food and milk spoilage, it's a very good alternative to conventional refrigerators for areas with unreliable electricity supply and for people who initial running and maintenance cost.

AutoCAST-X: Fast and Accurate Method for Solidification Simulation of Metal Casting	
Primary Innovator	B. Ravi
Location	Mumbai
Contact	b.ravi@iitb.ac.in
Website	efoundry.iitb.ac.in

AutoCAST-X is software to predict the hot spots pattern of hot spots in objects produced by metal casting before an actual pour. This allows potential defects in the part's design to be addressed. It's a web based application that can link to CAD software to load the models of objects to cast.

The innovator' IP is the algorithms using a Gradient Vector Method (GVM) to simulate the heat signatures of the solidifying part.

Impact	A very useful application for foundries to improve yield quality and reliability of cast products.

RVCR: Hybrid Fuel Engine Technology	
Primary Innovator	Ajee Kamat
Location	Pune
Contact	ajeekamath@gyatk.com
Website	www.gyatk.com/index.htm

This innovation can be applied to internal combustion engines into multi-fuel hybrids which can run on petrol, diesel, or bio gas or hydrogen.

The designer's IP is the RVCR technology which offers features like multi fuel capability, energy efficiency and lower carbon footprint.

Impact	The fuel flexibility offered by this technology find wide applications in vehicle engines, generators and special purpose equipment for personal and industrial users and help consumers adopt cost effective and renewable fuels.

FlakerBot / RefilBot: Recycling Waste Plastic as a Raw Material for 3D Printing			
Innovators	Sidhant Pai, Jayant Pai, Suchismita Pai		
Location	Pune	**Contact**	jayantspai@gmail.com
Website	www.protoprint.in		

This innovation enables the creation of the plastic filament required for 3D printing from waste plastic bottles and cups.

The innovator's IP lies in the intelligent design of the two machines: FlakerBot which effectively shreds either PET or HDPE bottles & cups and RefilBot which melts the flakes and extrudes filament for use in 3D printers.

Besides the technology development, they are also actively creating a sustainable business model for rag pickers, which will enable them to substantially increase their income. They envisage FlakerBot being installed in decentralized waste processing sheds where rag-pickers can convert their pickings into flakes to be sold on at much higher values than the original waste.

Impact	A laudable approach of blending cutting edge technology with a social cause. Given the rising interest in 3D it can significantly reduce the plastic pollution issue.

Ride 2.0: Foldable Bicycle	
Primary Innovator	Pankaj Kamatkar
Location	Indore
Contact	pankajkamatkar@gmail.com
Website	www.vgyan.com/index.php?option=com_content&view=article&id=346:travel-anywhere-in-folding-bicycle-pankaj-kamatkar24&catid=26:innovative-student&Itemid=26

It's a foldable bicycle which also has an adjustable size. By taking it on buses and trains, it allows the commuter to travel conveniently and cheaply to his final destination after disembarking.

The innovator's ingenious design allows the bicycle to be folded in 45 seconds flat with no instruments into a form that fits into a convenient carrying bag.

Impact	A much needed innovation that improves the convenience and extends the reach of public transport.

Scooter Based Mill	
Primary Innovator	Sheikh Jahangir Sheikh
Location	Jalgaon
Contact	+91 9422282938
Website	nif.org.in/nifnews/How%20Jahangir%20turned%20scooters%20into%20super%20machines%20Rediff.com%20Business.htm

This grass-root innovation was featured in the final scenes of the movie '3 Idiots' as an innovation created at Rancho's school. It is scooter mounted mill that allows the creation of flour from a variety of grain without electricity.

The innovator has designed a transmission to efficiently extract power from the scooter engine.

Impact	A very useful equipment to counter the issue of unreliable electricity in rural areas and let consumers process their own grain.

Solar Mosquito Trap and Destroyer	
Primary Innovator	Matthew K Matthew
Location	Kerala
Contact	infokinetr@gmail.com
Website	www.nif.org.in/bd/product-detail/solar-mosquito-destroyer

It is a solar mosquito trapper cum destroyer that can be used in areas with a septic tank, which are common in many areas that do not have drainage pipelines.

The device makes the use of the smell from the septic tank to attract the mosquitoes and trap them inside and kill them through the heat created by solar exposure. The unique feature of this design is that attracts mosquitoes over a large area and has the capacity to kill a significant number.

Impact	Being a chemical, and electricity free zero running cost solution, it can be widely adopted by communities and government agencies to rid people of the mosquito menace and prevent the disease epidemics caused by these pests.

MPP - Multi Purpose Processing Machine	
Primary Innovator	Dharamveer Singh
Location	Haryana
Contact	+91 9896054925
Website	7award.nif.org.in/awardprofile-details.php?profile_id=6&page=6&st_id=-1

This multi-purpose machine can be used to extract juice/pulp and essential oils from various edible and non-edible fruits, herbs, flowers etc. to produce products that are raw materials for the food and pharma Industry.

The innovator's intellectual property rests in cleverly combining the essential function of multiple processing machines like pulverizer, mixer, steamer, juice/oil/gel extractor into a single portable machine.

Impact	A very useful equipment to provide additional income generating opportunities to horticulturists and Self-Help Groups (SHGs) by creating value added products.

Enable Talk Gloves	
Primary Innovator	Vinoth Gurusamy
Location	Chennai
Contact	vin28@outlook.com
Website	www.knowtheworld.in/talking-gloves/

Talking gloves are invented with an intention to convert hand gestures into speech.

The inventor's IP is the development of a device that recognizes the user's hand gestures and outputs an electronically generated voice. These gloves have the capability to convert more than 1000 words.

Impact	A wonderful aid for the speech impaired to communicate and interact with the world.

Comprehensive Protection from Electrocution	
Innovators	Ramdas M U, Ashfaq Muhammed T, Shahin T A, Sonu Unnikrishnan K, Sreelakshmi Suresh, Sruty A
Location	Thrissur
Contact	ramdasunnikrishnan@gmail.com
Website	www.techpedia.in/award/upload/award_profile/comprehensive-protection-from-electrocum-2013.pdf

It is a device to protect technicians on distribution power lines where there is a high risk of accidents.

Realizing that the most common cause of the accidents is the crossing of the minimum safe distance from the high voltage lines, the developers have created an instrument that alerts the technician with an alarm when this distance is reached. It is based on the principle of detecting the increased electromagnetic field that occurs through a sensor.

The device is small enough to be installed on the technician's security helmets.

Impact	A life-saving aid for front-line employees in the electricity sector.

Reveteq©: Cold Storage Transportation Testing Device	
Primary Innovator	Mansij Chaudhuri
Location	Gurgaon
Contact	mansij@takshati.com
Website	takshati.com/index.html

Reveteq© (Refrigerated Vehicle Tracking Equipment) has been designed keeping in mind the need to track the storage conditions and location of refrigerated vehicles.

The Reveteq IP is an electronics design that has a multi-sensor temperature monitoring capability along with vehicle tracking, which has been integrated for the first time in India.

Impact	An essential equipment for the processed food and pharma industry to prevent product spoilage during transportation and ensure product quality.

Mobile Shoe Charger	
Primary Innovator	Mandar Tulankar
Location	Nagpur
Contact	mandar@letmeknow.in
Website	techaloo.com/shoe-charger-innovator-mr-mandar-tulankar/

This device can be inserted into shoes to charge mobile phones while walking or moving around.

The key IP behind this solution is a design that maximizes the efficiency of conversion of the kinetic and pressure energy of the user's motion into electrical energy sufficient to charge mobile phones. In addition the surface design of the mobile shoes charger provides a natural acupressure to the feet.

Impact	A useful solution for farmers, villagers, NGO workers, forest staff and travelers who walk long distances to ensure cell phone charging even without access to electricity.

CanSat: Upper Air Monitoring Device	
Innovators	Udit Kumar, Abhishek, Aman, Divye, Kalyan, Pankhuri, Rakshit
Location	Chennai
Contact	udit.kumar.sahoo@gmail.com

The project is a small electro mechanical device, called as CanSat, which can be launched by sounding rockets or weather balloons typically used in telemetry and have various instruments attached to it for data acquisition within the Earth's atmosphere.

The innovation is differentiated from other similar devices in that this design is fully autonomous; the device combines a technique of using parachutes, mid-air separation and final stage aero-braking for smooth landing and a buzzer to aid recovery. The device continuously sends data wirelessly to the ground station. The simple user interface means that it needs negligible training to operate.

Impact	The innovation can prove immensely valuable to research institutes involved in atmosphere and weather research.

Melt-It: World's Smallest Desktop Foundry	
Primary Innovator	Dipankar
Location	Mumbai
Contact	dipankar@treelabs.org
Website	www.treelabs.org

Melt-IT is a 'coffee-maker' sized machine that can safely melt diverse metals like Aluminium, Silver, Zinc, etc.

Treelabs ingenious design includes a high efficiency induction heater, in-built cooling and multi-function display and controls.

Impact	An innovation that dramatically improve the capabilities of small artisans, SMEs and educational institutes who deal with metallurgy.

Car SOS: A Vehicle Safety and Accident Detection System	
Primary Innovator	Harshit Bora
Location	Mumbai
Contact	bora.harshit@gmail.com

This electronic device is meant to improve the safety of vehicular users.

The developer has combined several related features in the innovative design such as: start disablement if the driver is under the influence of alcohol; automatic accident detection and alerts to family and friends; alerts to near-by medical centers with detailed information containing severity, precise location, and number of passengers; an 'Emergency Switch' allowing the occupants to raise a manual alert for any other unforeseen circumstances.

Impact	Considering the rising incidents of vehicular accidents, this innovation can go a long way in improving citizen's safety.

SaUsR: Smart Autonomous Underwater Service Robot	
Primary Innovator	Pulkit Gaur
Location	Ahmedabad
Contact	contact@gridbots.com
Website	www.gridbots.com/index.html

This is a robot that can travel and remain under water be controlled remotely to perform operations inside water.

The salient features of the design that differentiate it are its light weight and reliable material and ruggedness that allow it to remain underwater for long periods of time and its agility under water.

Impact	An innovation with multiple applications in research, industrial and marine organizations for underwater data collection or maintenance.

Sar Fuel Saver	
Primary Innovator	Ramesh Rathi
Location	Pune
Contact	ashishcw@gmail.com
Website	sarfuelsaver.blogspot.in/
It is a kit to maximize fuel efficiency that has to be installed near Air Filter/Air Inlet. It uses an ingenious design of reusing the backstroked fuel and ensuring more complete combustion and thus averting the most harmful component of emissions.	
Impact	It offers vehicle users a dual advantage of fuel saving and causing less environmental damage.

5. Environmental Innovations

A report by the World Bank finds that environmental degradation costs India $80 billion per year or 5.7% of its economy.[23] According to WHO survey, across the G-20 economies, 13 of the 20 most polluted cities are in India.

Growing world population, rapid industrialization of devloping countries and continued high consumption by developed nations is increasing global demand of natural resources and in turn having related impact on the environment. Consumption of (renewable and non-renewable) materials, water, land and the released greenhouse gas emissions is already at peak and is negatively impacting the renewable resources and the ecology at large.

Through progressive thinking and actions towards more sustainable supply chains, businesses can make the largest positive environmental impact at reasonable costs, sometimes even having a positive effect on corporate results. To become more sustainable and energy efficient, the possibilities for adopting renewable energy and environmental quality oriented innovations need to be explored.

By blending economic, environmental, and quality of life factors, innovations that can save money while reducing environmental impacts today and for the future will be valuable. Such innovations are good for business, good for the environment, and good for the citizens that live and work in communities across the country.

Payjal: Hand Pump Integrated with Water Purification System	
Primary Innovator	Kirti Ranjan
Location	Bangalore
Contact	kirtiranjan2006@gmail.com
Website	payjalsolutions.com/JeevanDhara

In India, almost all of the rural population is dependent on hand pumps for their water, which, sadly is contaminated with various pollutants and is harmful to health. This innovative hand pump has been designed so that while the groundwater is being pumped by either muscular or solar energy, the water is also purified in the process. This can purify water to very clean levels (reverse osmosis levels) and provide enough water for a community of 20 families.

The innovator has a unique intellectual property combining the high quality purification filter and pumping.

Impact	A much needed innovation to provide safe drinking water to underprivileged populations and prevent water-borne diseases.

Multi-Utility Heat Pumps	
Primary Innovator	M.V. Rane
Location	Mumbai
Contact	ranemv@iitb.ac.in
Website	www.me.iitb.ac.in/~ranemv/

This innovative machine combines several appliances typically used in the household or commercial establishments: a refrigerator, air-conditioner, electric water heater and dryer. All this at a carbon footprint of just one of them! It features an integrated interface, provides on-demand supply of hot and cold water without water storage, cools drinking water to 18°C and heats tap water to 45°C. It has low operating costs and lower initial cost compared to purchases of conventional equipment.

The intellectual property developed by the innovator leading to high heat transfer coefficients through novel tubular exchangers leads to a highly integrated and efficient design, while keeping the carbon footprint low.

Impact	A valuable product for reducing both the carbon footprint and capital cost that is useful in either the domestic, commercial and industrial segments.

Recycling Plastic Packaging	
Primary Innovator	Hetal Vaishnav
Location	Rajkot
Contact	vaishnav.hetal@gmail.com
Website	www.nif.org.in/ignite/awardprofile-details.php?profile_id=16&page=15&st_id=-1

It is a technique for recycling the plastics which are used in food packaging. Currently they are simply burnt or put into land-fills and disposing them leads to air pollution and other contaminations.

The uniqueness of this innovation is the ability to handle the multi-layered laminates which are currently very tough to recycle, and create a useful composite material which can be used in some applications to replace plywood and similar material.

Impact	Considering the growing problem of handling non-biodegradable packaging, this solution can go a long way in averting their associated environmental hazards.

E-Waste Recycling Technology	
Primary Innovator	Rahul Nagpaul
Location	Pune
Contact	rahulnagpaul@rescuwearth.com
Website	rescuwearth.com

E-Waste is an emerging crisis faced by the world. This innovation is used to recycle all kinds of e-Waste to create materials that can replace natural resources like wood, stone etc. and also fossil fuel created plastics. It is used to create useful articles that can be applied in construction, packing and manufacturing.

The innovator's intellectual property allows the extraction of complete residual value from E-Waste, which otherwise cannot be recycled due to its potential toxicity, and converting it into useful products.

Impact	A much needed solution to avert the growing challenge of e-waste while also reducing the exploitation of natural resources for construction.

Jal Doot: Water Purification	
Primary Innovator	Subhash Devi
Location	Pune
Contact	subhashdevi@membranefilters.in
Website	articles.timesofindia.indiatimes.com/2012-09-12/pune/33788364_1_filtration-water-source-pure-water

This is a water purification system which involves taking water from a source such as a pond or lake with the help of a suction pipe and passing them through Ultra-microfilters providing clean water.

This is a cheap method as it does not use electricity and can be used to provide water at your doorstep. The uniqueness of this product is that it does not use electricity.

Impact	This will help provide pure water while saving energy.

Prakhar: Rechargeable Solar Lamp	
Innovators	Ashish Gawade and Aniruddha Atre
Location	Pune
Contact	gawade.ashish@gmail.com
Website	www.bopeei.in/Products

This is a very efficient lamp with a solar charger. Once fully charged, it can provide light for 40 Hours.

The unique features of this product are its high efficiency and extremely reliable operation and long life of 10 years. It has the possibility of being charged by either solar energy or standard Nokia chargers, and it also can charge a mobile. The innovators have also invented a pedal based generator that can charge these light and other devices.

Impact	A great innovation to provide cost effective lighting in areas that are off-grid or with unreliable electricity supply.

Clean Energy Generation Using Plasma Process	
Primary Innovator	Rajeev Prasad Gupta
Location	Patna
Contact	greensys303@gmail.com
Website	www.eai.in/360/videos/lists/60

This invention allows the production of energy from waste organic matter (from sources such as vegetables, fruit, food) using the plasma method of energy conversion.

This innovation is much superior and differentiated from conventional combustion since this technique is much more efficient and cleaner. It also includes a solar pre-drying of the organic wastes to add efficiency.

Impact	It's a two-pronged solution that attacks the organic waste problem as well as generates energy, and can be valuable for municipal utilities and agro-processing industries.

Vortex Power Generation	
Primary Innovator	Aravind Venukumar
Location	Kerala
Contact	aravindpvk@gmail.com
Website	www.point5.in/arvo.html

This invention is a hydroelectricity generator that directly harnesses the kinetic energy of rivers to generate electricity.

The innovators unique design provides the ability to utilize vortices in flowing water to extract energy without creating dams or storage, which quells the concerns over the huge displacement of settlements and other issues.

Impact	An insightful solution to extract hydroelectric energy without the environmental impact of dams.

Zimba: Automatic Chlorine Dispenser			
Primary Innovator	Suprio Das		
Location	Kolkata	**Contact**	firefly.power@yahoo.com
Website	www.zimbawater.com/technology-2/		

Zimba is a device that automatically mixes chlorine into water in the correct proportions, regardless of the flow rate of the water. This can be fitted to the consumption point: a rural community's existing water source like a hand-pump, or the faucet of a piped water system.

This product developer has created a unique intellectual property wherein the mixing happens in the correct ratio using only gravity to operate. Besides it does not require electricity and has no moving parts to fail.

Impact	A viable solution to provide water purification at the consumption point and reduce water-borne diseases; especially suited to rural areas which have poor electricity supply.

SolarEx: Highly Efficient Solar to Power Generation	
Primary Innovator	Gaurav Dahake
Location	Kharagpur
Contact	adypooja@gmail.com
Website	www.cleanoventions.in/index.html
"SolarEX", harnesses the entire spectrum of the light giving an efficiency of 44% compared to 10-12% in Solar PV and 25% in CSP technology. It provides power generation, making it a product of utmost utility in rural India where millions of dollars are spent by Government every year for kerosene subsidy. It also can be used to heat water.	
Impact	An ingenious approach to maximize the solar energy utilization for the highest power output.

i-Solarlite: Solar Powered Lighting	
Primary Innovator	Rahul Pushp
Location	Mumbai
Contact	rhl.pushp@gmail.com
Website	www.i-solarlite.com/products.htm
A solar lantern that is highly portable and is very robust. It uses LEDs and batteries with a very long life and is tested to withstand shocks and loads of upto 80 kg. The key differentiating features of this product are its rainproof and shock proof design and the provision of mobile charging USB socket as a value add to the consumers.	
Impact	It brings a cost effective and eco-friendly source of light to remote areas.

Toys from Trash	
Primary Innovator	K.V. Potdar
Location	Pune
Contact	kvpotdar@yahoo.co.in
Website	www.arvindguptatoys.com/k-v-potdar.php
This innovation is about developing interesting toys from simple material such as straws, strings, paper, pins, refills etc. found around the house. Many of these toys can also serve as a great teaching aid about science principles. The innovator has created designs of many toys that are so easy to make that even children enjoy making them in their spare time and as a form of play.	
Impact	These toys provide children with a source of joy and learning, while also imbibing in them the value of recycling and conserving resources.

B-dream: Sustainable Low Cost Housing	
Primary Innovator	Binesh Desai
Location	Valsad
Contact	binish.r.desai@gmail.com
Website	www.sparktherise.com/projectdetails.php?pId=6174

This innovation is about using chewing gum and paper, including waste and scrap paper, to manufacture construction material such as bricks. These are lightweight, water proof and fire resistant, besides being stronger and much more eco-friendly compared to the conventional clay and cement bricks.

As the bricks cost just INR 2.5 which is nearly half to one third of clay bricks, it allows a 200 sq. ft. house to be constructed for less than INR 40,000 for lower income buyers.

The innovator's intellectual property is the unique process of creating highly robust construction products like bricks using the composite of fibers derived for chewing gum and paper.

Impact	The innovation is a remarkable effort to provide a very cost effective housing and building solution that also reduces the environmental impact of construction by promoting eco-friendly materials.

El-Rhino: Wood-free Paper from Rhino and Elephant Dung	
Primary Innovator	Mahesh Bora
Location	Assam
Contact	nisha@elrhinopaper.com
Website	www.elrhinopaper.com

This innovation is about creating articles such as stationery items, diaries, greeting cards and coasters, in a wide variety of styles and colours from elephant and rhino dung.

The trigger for the unique process and intellectual property behind this innovation came out of the creator's realization that the digestion process of these animals mimics the first stage of any paper-making process, and that their dung can be used to make paper that is uniquely textured and has a papyrus-like quality and can make the output look artistic.

Impact	It's an out-of-the-box idea to create artistic products of value from waste, and can significantly reduce deforestation needed for producing paper products.

Recycling of Rexine	
Primary Innovator	Ankur Vaishnav
Location	Rajkot
Contact	vaishnav.ankur1@gmail.com
Website	cache-www.intel.com/cd/00/00/47/92/479240_479240.pdf

The innovator has come up with a creative method of converting discarded / torn rexine and reusing it for other useful products in construction and manufacturing.

Impact	The innovation turns the vast quantities of scrap rexine being burned in a highly polluting manner currently into a productive resource.

Pine Needle Gasifier to Generate Electricity	
Primary Innovator	Rajnish Jain
Location	Pithoragarh
Contact	rajnish@avani-kumaon.org
Website	www.avani-kumaon.org/our-work/renewable-energy/pine-needle-gasifier/

In the Himalayan region, pine needles cover the ground which create many problems, as they prevent water from percolating, depleting the water table, and since they are inflammable, cause forest fires, which are all serious environmental threats. This innovation is a pine needle based generator which can scale to produce 9 kW, out of which 7.5 kW can be used for domestic purposes.

A differentiating intellectual property of this product is the design of the gasifier to effectively extract the maximum calorific value from pine needles.

Impact	A breakthrough for the sub-Himalayan region that solves a major environmental hazard provides renewable power and a significant income generator for underprivileged populations.

Road Energy Generation System	
Primary Innovator	Srinivas and Sasiprabha
Location	Hyderabad
Contact	hsrinu@gmail.com

It is an innovative device to tap energy from roads where there is sizeable volume of vehicular movement and the vehicles are always required to slow down a lot or come to a halt using brakes, such as gates, toll points, airport terminals and parking lots, or even safety speed breakers etc.

This ingenious IP uses the energy that would have been wasted in slowing down by braking by converting it into electrical energy through a compact and simple system of plates and mechanical linkages coupled to a generator. A working prototype is ready.

Impact	It is a completely new untapped alternative energy source, and has a potential to meet in a self-sustaining manner the local electricity needs at high traffic areas.

Novel Fuel Cell	
Primary Innovator	Ashish Lele
Location	Pune
Contact	ak.lele@ncl.res.in
Website	www.ncl.res.in

This innovation is a design for manufacturing fuel cells with a minimum of imported components in a cost effective manner. It is especially designed for use in remote areas like cell phone towers or can be used in plants that manufacture caustic soda.

Impact	An effective renewable resource that can conserve much needed fossil fuel required for running DG sets etc.

6. Innovations from Pune

"Inclusive Innovation enterprises can fulfill unmet social needs by profitably and competitively engaging citizens at the bottom of the economic pyramid. In doing so, they can create both social and economic returns. And to build such sustainable ventures, it is important to seed early stage businesses which require more than just money to succeed - they require close mentoring and inputs on strategy as well as execution. And this is where angel investors plug the acute gap."

Padmaja Ruparel,
President, Indian Angel Network

Pune has emerged as a preferred destination in India for academia, industry and the Government by leveraging on various factors such as the available talent pool, cost, quality of life, climate and the proximity to Mumbai making it an ideal hub for innovation in the country. Truly called the "Oxford of the east", the presence of internationally recognized educational institutes for engineering, management and design makes it easier to attract the best talent and to collaborate with universities for fundamental research and knowledge. Its intellectual leanings are accentuated by a strong cultural tradition, especially in music, literature and theatre.

Pune is home to many of the innovation centers of MNC such as Emerson, DuPont, TATA and Reliance. Even the public sector has chosen Pune for its innovation parks such as the world class NCL Innovation Park which has a clear charter on innovation and technology development for value creation. 110+ MNCs have built their R&D centers in Pune employing more than 24000 people in the city[24]. Pune is also the manufacturing capital for domestic and foreign automotive giants such as Tata, Bajaj, Mahindra, Mercedes, Volkswagen, and GM among others who have made large investments in this region. Many of the global IT and software firms have their regional and international headquarters in Pune taking advantage of the SEZ areas. India's most progressive and sustainably built towns, Magarpatta City and Amanora, stand as a model for both innovative and forward-looking city planning, as well as a thoughtful example of inclusive urban development[25].

Revolo: Plug-in Parallel Hybrid Solution	
Company	KPIT Technologies
Key Person	Ravi Pandit (CEO)
Website	revolo.kpitcummins.com/

KPIT Technologies has been bringing innovative solutions and products to the market in the area of automotive engineering. Its innovation record of accomplishments includes filing of 50 patents, over 65 research papers, and over 15 global awards.

The company has developed innovative plug-in parallel hybrid solution, Revolo. It transforms vehicles, allowing motor and engine to work seamlessly for a completely fuel efficient, green automobile. This innovation includes a clever battery management system, proprietary software, and mechanical assembly and coupling. Revolo can work with all types of batteries, from lead acid batteries to lithium ion batteries. The solution has been designed to work without any interaction with a vehicle's existing Engine Management System (EMS). This makes it highly adaptable, and suitable for cars without electronic engines.

Impact	Revolo improves fuel efficiency by 35%, reduces greenhouse gas emissions by 30%, and reduces travel costs by 25%. KPIT has filed for 14 patents on this revolutionary technology and received over a dozen awards including the Wall Street Journal Technology Innovation Award and best implemented sustainability innovation of the year 2011 award at global Knowledge@Wharton tournament.

KBL Sodium Pumps for Prototype Fast Breeder Reactor	
Company	Kirloskar Brothers Limited (KBL)
Key Person	Sanjay Kirloskar (Chairman & MD)
Website	www.kirloskarpumps.com/pdf/SELECT-GLOBAL-REFERENCES.pdf

Company nurtures and facilitates by way of individual, cross functional team approach. During the journey KBL has completed many innovative projects as in best in class solution to customer. The company has filed 23 patents including 2 US patents and presented more than 100 technical research papers in International conferences and journals. KBL is not only the largest pump manufacturing company in the country but it also has more than 100 years of domain expertise in the field of hydraulics[26].

Innovations of KBL at Sardar Sarovar (devised a siphon creating and siphon breaking arrangement resulting in energy saving; this was granted a US patent), Godavari Lift Irrigation Scheme (alternate design resulting in huge cost savings) and canned motor pump (import substitution) are pride of the nation.

The first-of-its-kind 500 MW, Prototype Fast Breeder Reactor (PFBR) project is underway in India. Government of India is constructing India’s first 500 MW pool type, sodium cooled nuclear reactor in the country at Kalpakkam, 70 kms away from Chennai in Tamil Nadu. The three Primary Sodium Pumps (PSP) supplied by KBL weigh 135 tons and will handle 5.16 lakh liters of liquid Sodium per minute when installed at PFBR. At 590 RPM (rotations per minute), these pumps will handle liquid sodium at 400 °C to 550 °C.

Impact	This is one of the largest plutonium-based fast breeder reactor in the world. This asserts India's capability in development of high-tech pumps and pumping solutions for future nuclear projects.

Solar Biomass Hybrid	
Company	Thermax
Key Person	M. S. Unnikrishnan (CEO & MD)
Website	www.thermaxindia.com/solar.aspx

Thermax has demonstrated many technologically innovative concepts which are socially relevant, technology-wise appropriate and sustainable in the Indian eco-system.

Thermax, along with the Department of Science and Technology, Government of India and the inhabitants of Shive village, executed and commissioned India's first solar biomass hybrid distributed power generation project at Shive village in Pune. The plant of capacity 256 kW is designed to demonstrate technology development in solar thermal power generation and also to provide a solution to the country's rural electrification concerns. The plant is intended to utilize solar thermal energy for power generation during sunny hours and is hybridized with a biomass system for power generation during non-sunny hours, thus producing 24x7 electricity. Electricity is supplied within the village as per the load demand and to the local electricity grid during off-load hours. The Solar Island comprises of rows of parabolic troughs.

Impact	This proof of concept project is envisioned to create a sustainable solution to India's rural energy needs.

MoboMoney & FightBack	
Company	Tech Mahindra
Key Person	C.P. Gurnani (MD)
Website	www.techmahindra.com

Tech Mahindra helps companies innovate and transform by leveraging its unique insights, differentiated services and flexible partnering models. Tech Mahindra has won several awards for its MoboMoney and FightBack solutions.

MoboMoney is the first of kind commercial implementation of Contactless Payments in the Indian market & is expected to be the game changer, bringing the latest innovations in payments from the global markets for use by the masses in India.

FightBack solution uses mobile capabilities like GPS, SMS, location maps, GPRS and integration with social networking website, email to bring in maximum participation in the Women Safety drive. It shows Live data of alerts generated by the user on to the portal, overlaid on Google map and send SOS alerts information along with location information to Security Agencies as well as to mobile user's family and friends. It captures data and shows the unsafe places in India based on Alerts data captured over the period of time.

Impact	Bring about latest innovations using mobile platform to serve the masses.

PACE: Praj Advance Cellulosic Ethanol	
Company	Praj Industries
Key Person	Pramod Chaudhari (Chairman)
Website	www.praj.net

Praj Matrix - The Innovation Centre of Praj Industries has developed a viable (2nd generation) technology to process ligno-cellulosic raw materials (like sugarcane and corn residue) to bio-ethanol. Viability of this patented process has been made possible due to the following attributes of the technology developed by Praj Matrix: higher yields, low energy and low water use.

The technology is easily replicable across various geographies for various locally available ligno-cellulosic raw materials like rice straw, wheat straw, wood chips, palm kernel cake, palm empty fruit bunches, various energy crops like napier grass, miscanthus, etc.

110 highly qualified process technologists at Praj Matrix worked on laboratory scale to bench scale and finally to the pilot scale for more than 5 years to develop this technology. Praj is also validating the technology for production of a variety of bio-chemicals (also called green chemicals) from cellulosic raw materials.

Impact	It has the advantages of drastically reducing CO_2 emissions (thus mitigating climate change), enhancing energy security and significantly enhancing economic activity in the rural areas.

7. Analysis of Innovations

"It is not only large enterprises that can create truly disruptive innovations (touching more than 2-3 of the "10 Types of Innovation"). Grassroot players are often best positioned to see real need gaps and then develop cost effective ways of addressing these."

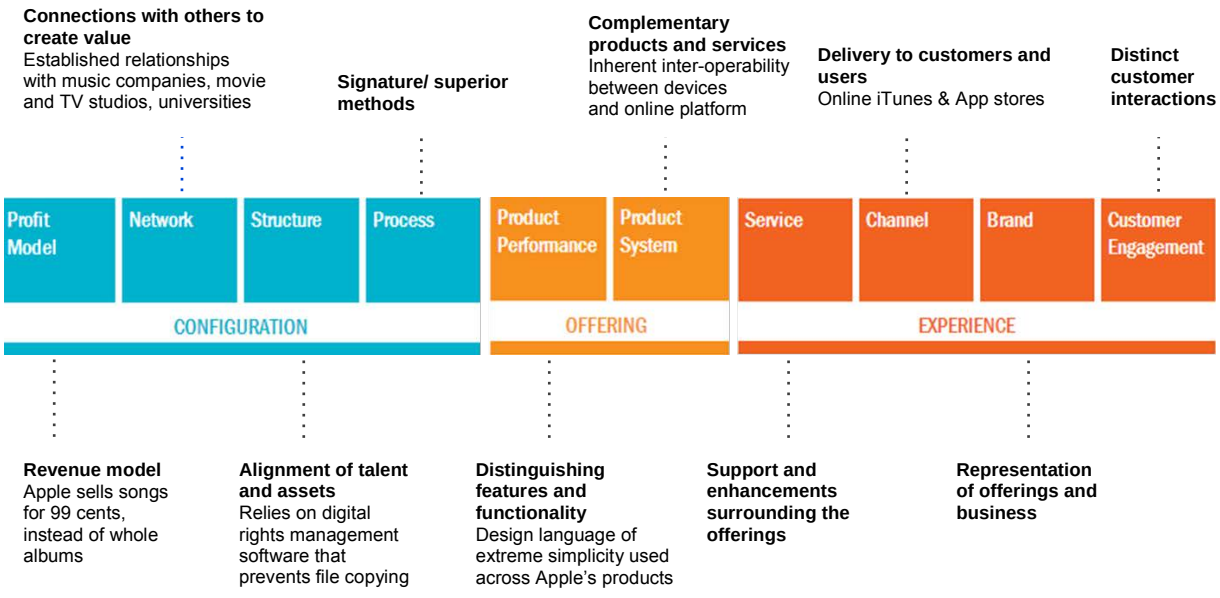
Ambar Chowdhury,
Senior Director, Deloitte

Given the ongoing dynamic changes in the global competitive environment, companies are increasingly relying on innovation to remain relevant in the marketplace. While innovation is a key lever for enhancing competitiveness, as a discipline it remains narrowly understood. Innovation is not just about coming out with new products, where successes are notoriously few and even if achieved, are often copied by competitors. For a real breakthrough companies must look beyond products and core offerings, and incorporate innovations across multiple aspects of the business.

Monitor Deloitte's proprietary **Ten Types of Innovation Framework** enables organizations to innovate in Configuration, Offering or Experience. Each one of the ten types of innovation is valuable and the value creation through a particular type depends on the quantum of effort in each type.

Thus, for instance, Apple iPod's continued success goes beyond its novel product line and encompasses multiple types of innovation that have helped create and defend its sources of value.

Figure 2: Monitor Deloitte's Ten Types of Innovation™ Framework

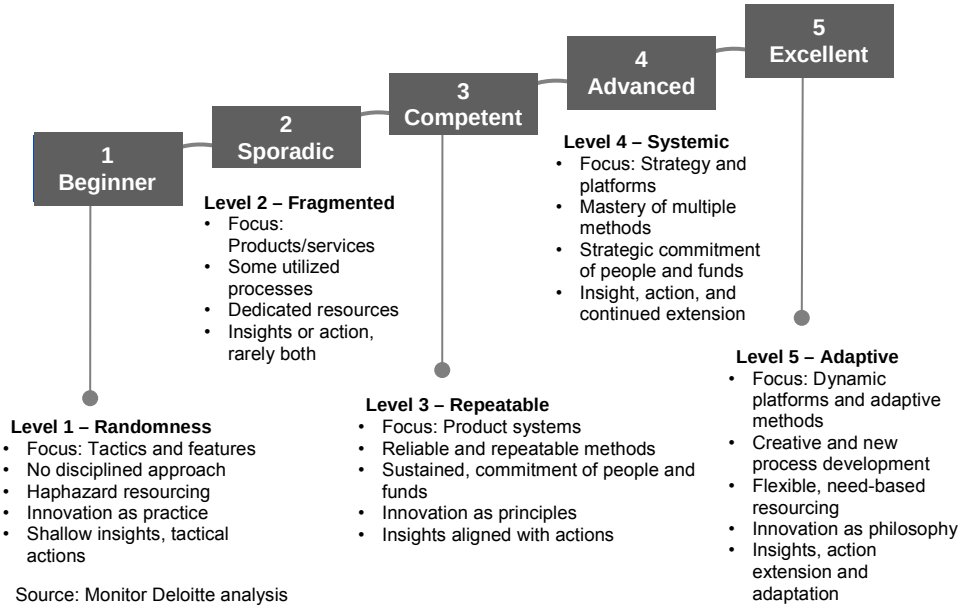


Source: Doblin's Ten Types Innovation Framework™, Monitor Deloitte analysis

Successful innovations are not predicated on germinating numerous ideas – fewer ideas based on the organisation's capabilities and customers' unmet needs are more critical. Incremental change is where conventional innovation tends to take root. However, companies that aim to conquer a new market or want to radically reshape their position need to be brave and think big.

But, how does an organization become a better innovator? Monitor Deloitte's **Innovation Maturity Model** is a useful tool for determining an organization's innovation level and helping the organizations evolve through the 5 basic levels of innovation "maturity".

Figure 3: The innovation maturity model



Source: Monitor Deloitte analysis

Figure 4: The four building blocks for enabling innovation

PROCESSES
A clear definition of the work to be done in producing innovations—phases, activities, and deliverables

STRUCTURES
Organizational units, decision rights and interfaces to house the capability and connect it to the broader enterprise and external world

RESOURCES & COMPETENCIES
The individuals and teams who perform the work of innovation, the skills, tools, and training they need to do it competently, and the funding to fuel it

METRICS & INCENTIVES
The targets to guide performance, the measures to evaluate progress, and the programs to incent contributory behaviors

Source: Monitor Deloitte analysis

In order to change innovation outcomes, change must be brought in individual, team, and organizational behavior through the use of multiple, integrated and self-reinforcing levers. We refer to these levers as "building blocks". Deliberate actions across these building blocks can directly influence the company's innovation capabilities and help move it across the different "maturity levels".

Building an innovation discipline is also predicated on the role of effective leadership. Setting the strategic direction and organizational conditions for innovation is the responsibility of the business leaders.

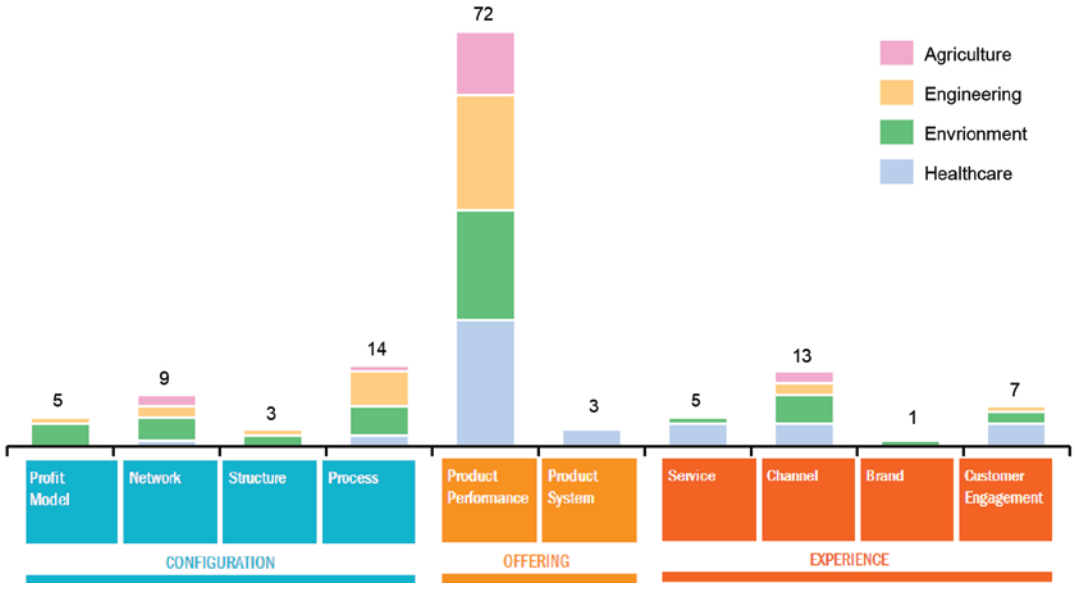
Analysis of Inclusive Innovation Case Studies

In order to understand the types of innovations used in conceptualizing, producing and delivering inclusive solutions, a team from Monitor Deloitte performed detailed analyses on a set of 72 India-based innovations showcased in the Inclusive Innovation 2013 Conference. These innovations are spread across the broad categories of Healthcare, Environment, Engineering and Agriculture. Some of these innovations have seen commercial success, while others are at a more nascent stage.

While product invention is one key element, for the idea to succeed long-term in the market, it requires several other elements as well. It needs a deeper understanding of gaps in customer needs, effective delivery models and robust revenue sources.

Our analysis reveals that although the showcased innovations covered one or more of the Ten Types, innovations around 'Product Performance' were the most common. Many of these innovations also involved patented technology or design; hence Process was another common theme. Since the end-user in most cases was the Bottom of Pyramid (BOP) segment, innovators have experimented with unconventional and low-cost distribution channels like SHGs, NGOs etc.

Figure 5: Category - wise number of each innovation type



Source: Monitor Deloitte analysis

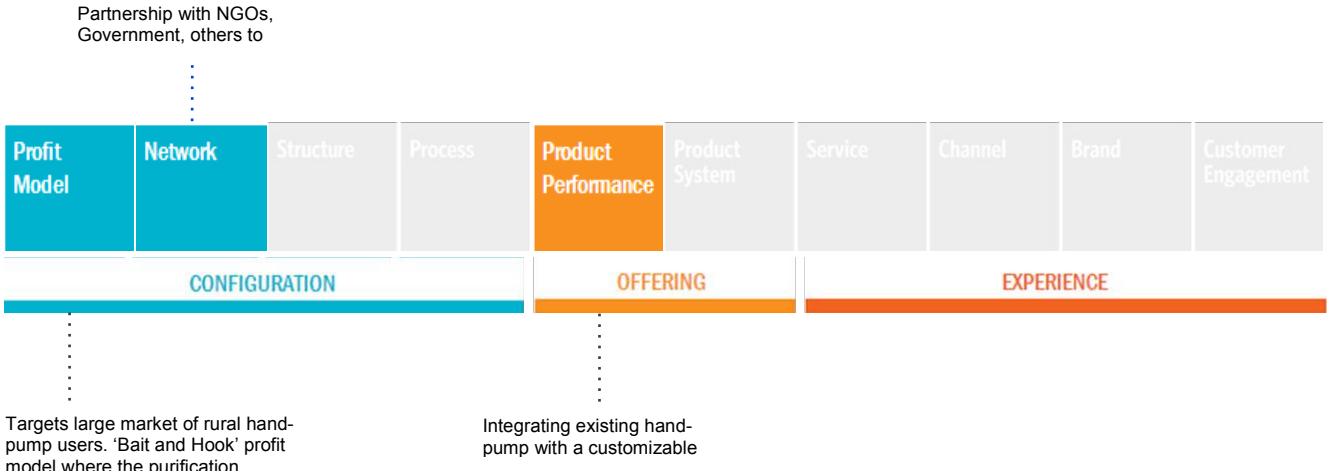
Across the four categories, Environment cases have an average of 2.2 types of innovation, followed by Engineering (1.7 types), Healthcare (1.6 types) and Agriculture (1.5 types). A study done by Doblin (the innovation experts at Monitor Deloitte) in 2011 on the top global innovators[II] showed that the average number of types integrated by them is around 3.6 types.[III] Making it clear that in order to create a more robust business case, innovators need to think holistically on the 'Configuration' and the 'Experience' parameters of innovation.

[II] 'Top innovators' were defined by lists of the world's most innovative companies compiled by BusinessWeek, Fast Company, Forbes, and Technology Review.
[III] 'Ten Types of Innovation- The Discipline of Building Breakthroughs' by Larry Keeley, Ryan Pikkel, Brian Quinn and Helen Walters.

In the Environment category, one of the cases observed, Jeevan Dhara, a hand-pump based water filtration system by PayJal is one such nascent stage example where innovation has been restricted to Product Performance. One doesn't have to look too far to gain useful insights from other success stories in water filtration innovation. Lessons from the success of Brita, a market leader in portable household water filtration, can be leveraged in order to integrate more innovations for Jeevan Dhara:

1. **Profit Model:** Brita offers water filters for pitchers, kettles and faucets. It uses a classic 'Bait and Hook' profit model where it gives away the pitcher, the attachment for the faucet or the fridge for very low costs and make money up the filter consumable.
   Brita targeted the largest market – consumers who needed potable household water filtration at low prices. Similarly, Jeevan Dhara should continue to target the large market of rural hand pump users who need low cost filtration device.
2. **Network:** Brita has formed partnerships with numerous refrigerator companies like Whirlpool to offer Brita filters integrated into consumer fridges. Similarly, Jeevan Dhara could partner with NGOs and government agencies to integrate water filters in the hand-pumps provided by them to the rural villages.

Figure 6: Proposed innovations for Jeevan Dhara

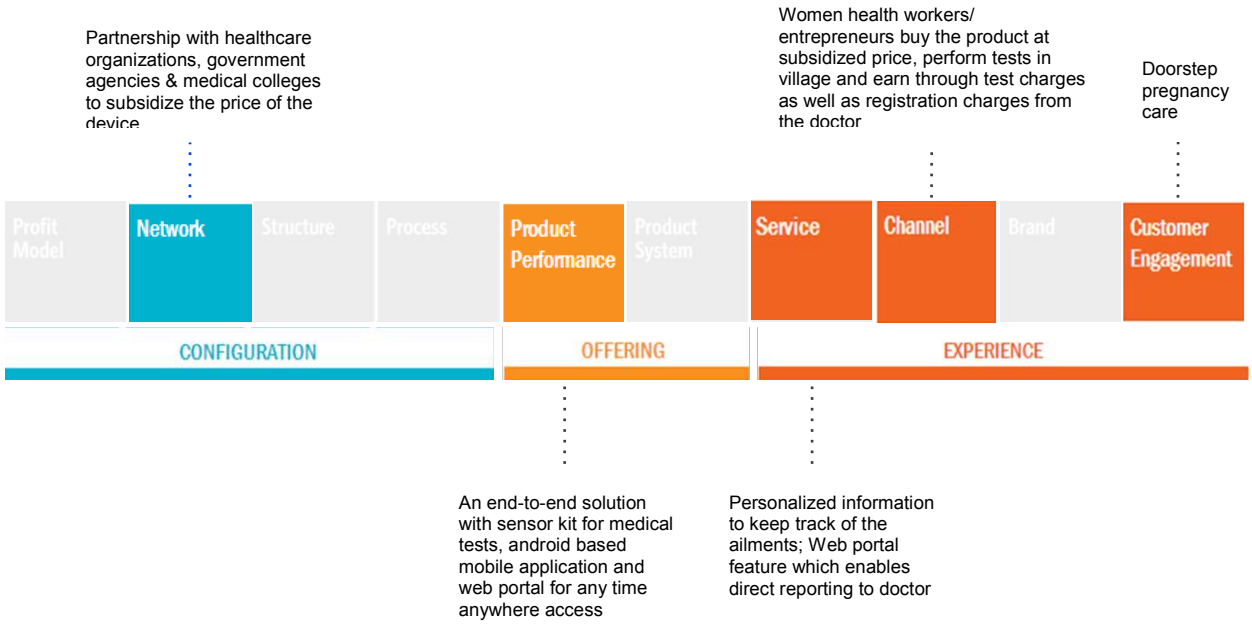


Source: Monitor Deloitte analysis

From within the set of 72 case studies, we have illustrated an example from each of the other three categories – Healthcare, Engineering and Agriculture.

CareMother by Science for Society (Healthcare)

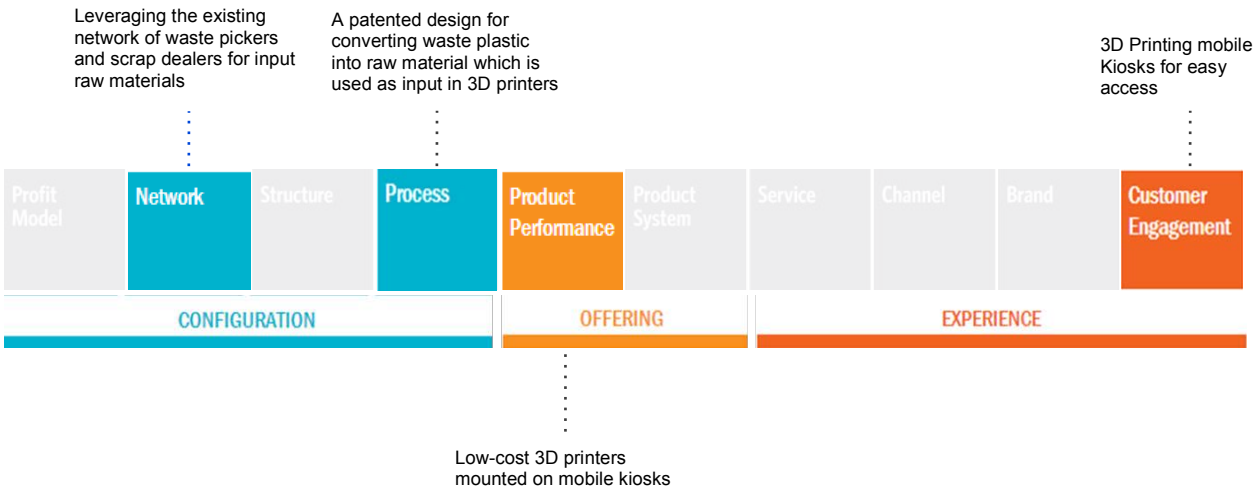
Figure 7: Science for Society goes beyond product to encompass multiple innovations



Source: Monitor Deloitte analysis

3D Printing by ProtoPrint (Engineering)

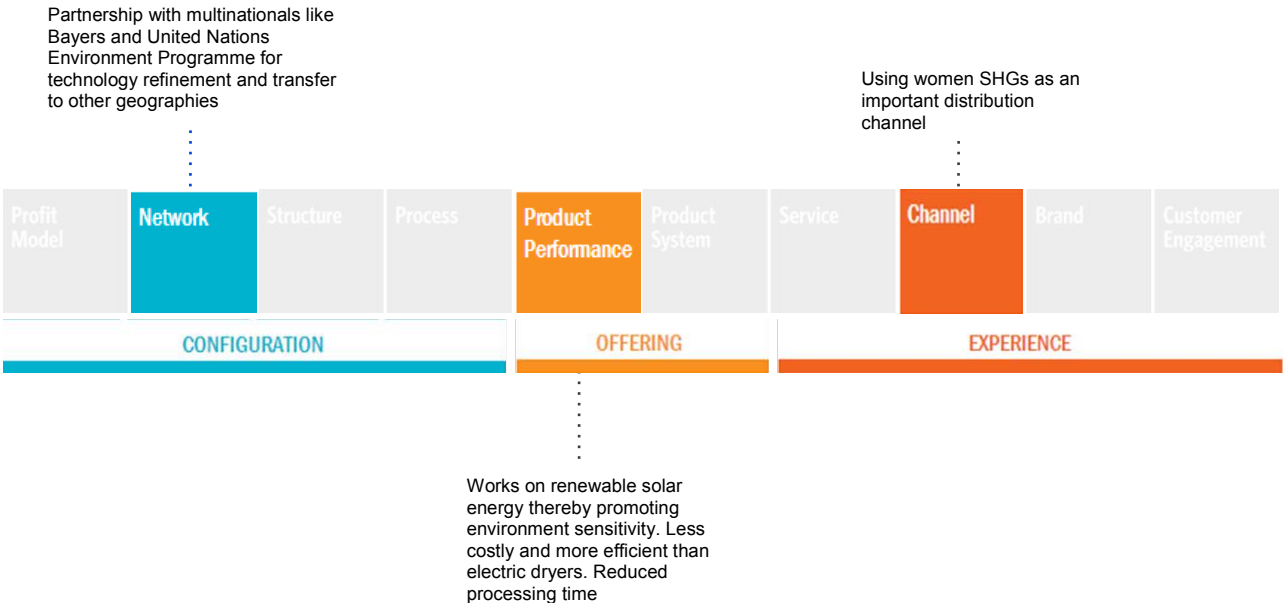
Figure 8: ProtoPrint goes beyond product to encompass multiple innovations



Source: Monitor Deloitte analysis

Solar Conduction Dryer by Science for Society (Agriculture)

Figure 9: Science for Society goes beyond product to encompass multiple innovations



Source: Monitor Deloitte analysis

In conclusion, as markets become more competitive, innovation has become an imperative for firms to survive and win. Organisations have to think beyond 'just product' and ensure that the innovation, while rooted in a particular aspect of the Ten Types, spans multiple other aspects. The global examples demonstrate this and highlight the key principles that help an organisation innovate across the Ten Types: focusing on fewer, bolder concepts; challenging industry orthodoxies; leveraging internal and external networks; de-risking through prototyping; adopting a disciplined approach; and thinking beyond product.

Contacts

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The details of all the inclusive innovations included in chapters 2, 3, 4 and 5 of the report have been compiled by the team from Persistent Systems.

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