THEME :

Technology Trend : Shaping Future Engineers

Theme Papers

INDEX

KEYNOTE ADDRESS

Technology Trend : Shaping Future Engineers

Hon. Dr. Anand Deshpande
Founder and CMD, Persistent Systems, Pune

As we look ahead to the next five years where our Prime Minister Shri Narendra Modi has set us an aspirational goal of a five trillion-dollar economy, it is clear that technology will play a vital role in helping us get there. Engineers are nation builders and their ingenuity in applying technology to address some of our most critical problems across various industries will be crucial to making growth possible. We are a large country and our demographics require us, engineers, to think differently and build solutions that can scale and be available at the right price point so that they are affordable for our population.

Engineers are best placed and must move from being jobseekers to being job-creators by becoming entrepreneurs and lead technology-led innovations and transformations that will be essential to make our Prime Minister's dream a reality.

Context

We are a young country. More than half of our population of 1.3 Billion is below the age of 25. Over the next twenty-five years, we have the advantage of the demographic dividend where a large proportion of our population would be in the working age, that is between the ages of 20 and 60. The sheer number of young people we have in our country creates an excellent opportunity for us. To ensure that the demographic dividend does not become a demographic disadvantage, we must ensure that our young population is gainfully and meaningfully employed. The current wage disparity in our country is an enormous challenge. The top 1%of our population earns 30% of the total wages and makes over Rs 1.5 lakh a month, the next 14% of population earn 30% of the total wages and make around Rs 20,000 a month each, the next 30% of our population earns 30% of the total wages and make Rs 8,000 per month each and the poorest 55% of our population earns just 10% of the total wages and make only Rs 1,500 per month each.

It is important that we take wage disparity into account and focus on policies, innovations and technologies that are inclusive and will provide an opportunity for the broader population to improve their earning potential and lead a better life.

Technology and Automation Paradox

It is not hard to observe the inefficiencies and brood over the time we spend in doing simple day to day activities in our country. The inordinate amount of time we all spend in waiting in

queues, or jumping them, is a huge waste of our national resources. Our roads are clogged, and despite the fancy cars we may own, the traffic on our roads does not permit us to move beyond the bullock cart pace. Energy, both in terms of fuel and in context of productive human energy is sapped because of these inefficiencies on an everyday basis. A visit to any government office or the municipal corporation is enough to demonstrate the paper work and the archaic processes we have inherited and continue to follow to get things done. Inefficiency and complexity breed "agent culture" are the root cause of "speed money" which must be systemically be eradicated in our country.

The dramatic changes we have observed over the last fifteen years in the way our Banks operate gives me some hope. The queues, form filling and the hours spent waiting in banks has reduced substantially and they have been replaced by ATMs and mobile apps. Undoubtedly, this must happen across all industry segments.

Clearly, to accelerate our GDP growth, we must invest in technology and automation to improve the efficiency of operations across multiple processes across the country. Automation will enable us to get things done efficiently, potentially with less resources. Improved efficiency can have the unfortunate consequence of needing fewer people to complete the job and will cause reduced employment. This leads to a paradox where the benefits of increased GDP and wealth creation are not distributed evenly and tend to benefit the rich more than they benefit the poor, thus further increasing wage disparity in the country. Also, it is not difficult to observe that when the rich get richer, the new wealth is invested in the stock market and other financial instruments and is not spent in the economy to increase consumption and to increase jobs across the country.

As policy makers and entrepreneurs, it is important that we keep this paradox in mind. As we focus and explore new ideas to improve efficiency, we must consider the potential loss of jobs and the need to reskill employees to enable them with the opportunity to be ready for new jobs. As job creators, it is important that we consider income generated in the context of the effort spent and focus on creating employment that pays decent wages to create an aspirational lifestyle.

The Foundation of our Technology Platform

The widespread adoption of mobile phones has been the cornerstone of technology deployment in our country over the last decade. Mobile coverage is now available in every village in every part of our country. There are more than a Billion mobile phone connections in our country and over the last three years, the proportion of smart phones and internet enabled phones has gone up significantly. A widely-deployed and reliable internet enabled smart phone infrastructure provides us an excellent platform to work with for technology development and deployment as we look ahead.

In addition to mobile phones, there has been another very significant development over the last five years. More than half of our population which was completely unbanked now has bank accounts, thanks to the ambitious Jan Dhan scheme. With encouragement from the Government, changes in limits for opening bank accounts and need to have a bank account to take advantage of

Government's direct benefit schemes, most our population now has bank accounts. The Aadhaar program was critical in providing verifiable identity to individuals who did not have the basic credentials to open a bank account. More than 98% of our population has the necessary Aadhaar based credentials. Thanks to the Supreme Court judgement and the subsequent legislations the Aadhaar infrastructure is reliable and robust and is available for various banking transactions.

This JAM trinity– Jan Dhan accounts, Aadhaar based identification and Mobile devices has created a unique and robust infrastructure that will be the basis of technology deployment across our diverse population.

Innovation in Payments

The above infrastructure has created some very exciting and innovative solutions in the country. Innovation in payments has been critical in providing that additional impetus to make these innovations possible.

To start with, Cash on Delivery was an important innovation that has spurred e-commerce in India. E-commerce has benefited from the cash on delivery model and as a consequence mega e-commerce sites such as Amazon and Flipkart have flourished. They have inspired numerous specialized e-commerce plays across every industry from pharmacy to furniture. As we look ahead the future of retail will be based on hybrid retail solutions combining e-commerce with traditional brick and mortar stores.

Over the last 3 years, UPI has transformed the payment industry. While credit cards dominate in the rest of the world, we have leap-frogged beyond cards by creating the UPI infrastructure that enables cardless, cashless payments in a seamless way. The ability to use BHIM and other UPI applications to seamlessly transfer money between to two peer bank accounts with zero fee, at least at this time, has spurred innovative applications that would not have been possible without UPI.

It is heartening to see the innovation in food delivery such as what we see Swiggy, Zomato and Food Panda and the relentless focus on providing customer convenience that has created phenomenally successful businesses such as Ola and Uber in transportation, MakeMyTrip and Yatra in travel, Oyo in the hospitality industry and Naukri and Monster in job search markets and Bharat Matrimony and Shaadi.com as the first place to go for getting hitched!

The e-Commerce industry and associated delivery industry has created numerous new jobs; the key would be to ensure that these jobs are sustainable and create good income. One can observe that these new jobs have been created by entrepreneurs who have had a dream and have executed well to scale their business. They are an inspiration to the next generation of entrepreneurs. I believe we are just at the beginning of a transformation!

GST etc.

In the last two years, we have moved to the GST regime. The GST regime has simplified the way we calculate and pay our indirect taxes. From the numerous different kinds of taxes, we have

moved to single standard tax regime. GST will force all businesses to adopt electronic invoicing and electronic payments as this will be necessary to help businesses track their transactions and file returns.

Electronic toll payments and seamless movement of goods between states has improved the logistics and supply chain industry. I anticipate further innovations in this industry as most of the components of this electronic infrastructure are starting to fall in place. Improved logistics and supply chain have a significant impact in all industries. For example, predictability in the transportation of perishable food items helps in building robust cold chains and ensures better value for farmers.

Lending

While banks have improved on their payment and banking infrastructure through ATMs and mobile payments, banks continue to follow archaic methods for making lending decisions. I believe that with widespread use of bank accounts, electronic payments, GST and other financial innovations, businesses will be able to build a robust book of transactions which will be the cornerstone of innovations in transaction-based lending that are starting to happen in the country.

Healthcare Industry

The Ayushman Bharat scheme will disrupt the healthcare industry and with our large population as the market, the healthcare industry is ripe for innovation and disruption. Sensors connected to mobile devices are starting to become robust and are now getting deployed at various stages in the healthcare industry. There is no argument about the need. With new policies, attention and source of funding from the Government, I expect new opportunities for technology-led innovation in this market.

Engineers should partner with healthcare professionals and explore ways to address some of the challenges in the healthcare industry.

Continuous Skill Upgrade

With the automation and technology driving efficiency in the economy, it will be imperative for every individual to be constantly upgrading their skills. With the internet-enabled smart phones in the hands of nearly 600 Million people, the mobile phone will be the platform for individuals to continuously upgrade their skills.Numerous technology platforms such as Byju for school education and UpGrad and SkillPro are building on a new market for continuous skill upgrade.

Machine Learning and AI

The JAM infrastructure coupled with the move to electronic transactions is helping create data in the electronic form in the country. Until recently, we as a country, have been extremely data poor. Lack of good quality of data both at micro and macro level meant that most decisions were based on "gut-feeling" and were not substantiated by the reality that data demonstrates. The

availability of data coupled with the maturity of machine learning techniques has created a new set of opportunities for innovation in our country.

Voice interfaces are getting better and are starting to become very viable in Indian languages. Interactive voice bots and chat bots have immense potential especially when we consider the diversity of our population with different languages and different levels of education.

Mobile based augmented reality also has great potential. The ability to personalize and annotate to provide additional context will be spur innovation and new solutions.

Security and Privacy

As we move to a digital economy with more and more transactions in digital form, security and privacy become critical. We live in a world where we are surrounded by individuals with evil intentions. Unfortunately, security attacks are not just being created by stray individual hackers, but nation, states and organized cartels are systematically involved in cyber crimes and espionage. It is important that we invest in innovations and building skilled and trained professionals to help secure our networks and data infrastructure.

With all our information including intimate personal details on the internet, privacy becomes crucial. There is a need to educate users to understand the pitfalls and challenges of their data in the internet and what can individuals do to protect their privacy to prevent fraud. At a national level we need to establish a national privacy policy that clearly defines who owns what data and protects our citizen from misuse and fraud.

Entrepreneurs and engineers should consider information and cyber security as a fertile and a growing area for innovation, research and product development.

Conclusion

Engineers as Entrepreneurs will play a crucial role in transforming our future. It would not be possible for the Government and established businesses to experiment, innovate and move as fast as is expected to meet our requirements and needs without our support. We must encourage our entrepreneurs to experiment and explore multiple options to find scalable solutions that are right for us in our country.

I believe that the next few years are critical for our country. We have numerous challenges, but technology is available and with innovative use of technology we have this one opportunity to transform our country. Unfortunately, we don't have much time and don't have other options. It is important that we – government, academics, businesses and entrepreneurs work together to ensure that we can make the most of this opportunity.

Jai Hind !

• • •

Technology and Engineers

Padmavibhushan Hon. Dr. Vasudev K. Aatre
Ex. Director General, DRDO

We live in a period where Science and Technology have become the greatest enterprises of humanity. Science and technology are the engines that drive the progress & prosperity of a country. It is technology, especially science driven technology, which generates wealth for a country.

The impact of S&T on society is forever getting amplified. Wireless Communication and Cell phone connectivity, Interconnection of computers and World Wide Web, Robotics and Artificial Intelligence, and Micro and Nano technologies, among others, have changed our lives unbelievably and sure to have greater impact in the coming years and decades. Driverless cars and autonomous vehicles, household robots, flexible electronics systems, personal health monitoring devices and wearable systems, Internet of things are all set to enter the markets. On the larger and global scenario, human colonies on the Moon by the middle of the century, and on Mars by the end of the century are clear possibilities. With R and D attempts on photonic propulsion, it is probable that we will finally attempt interstellar travel and send probes to visit the closest celestial neighbor. Science and technology will lead us to think about the unthinkable and do the undoable.

Of course, S&T have a role beyond providing us creature comforts and leading us to science fiction like activities. Today humanity faces several predicaments due to our unwise use and abuse of earthly resources. In doing so, we have severely and adversely affected the very environment that made the earth a habitable planet. The result of mainly anthropocentric activities has led to deforestation, soil erosion, reduction in biodiversity and biomass, to name a few. We are already facing somewhat of a crisis in the availability of potable water and in what seems to be a runaway global warming. We talk of extracting water from desert like environment (about 20% humidity), of extracting Carbon-dioxide from the atmosphere and burying in deep under water. Science and technology have to find solution for such predicaments and soon.

While science and technology are the game changers, it is engineers who finally implement these breath taking developments and flood the market with products. Clearly the challenges faced by the engineering profession in fulfilling this role, provides ample opportunities for engineers to be creative and innovative.

Engineering is a problem solving profession which requires in depth knowledge of the problem and its implementable solution. On the other hand technology development requires a broad canvass of knowledge. The emerging engineering educational scenario has to cater for this dichotomy and train the future generation of engineers to cope with the challenges.

India has thousands of engineering and technological institutions and graduate lakhs of students every year. A good percentage these are highly talented and motivated. However, equally large percentage of them is ill prepared and lack sufficient motivation. Here is where the engineering profession and industries have to play an important role in the coming years. They have to play an active and a participative role in training and mentoring both the faculty and the students, in funding and building infrastructure in the educational institutions.

It is essential for India to excel in Science and technology, and by inference in engineering, to achieve its goal of becoming a fully developed country and a World Power. This cannot be responsibility of only the Government alone. Entire society, and indeed the engineering profession, has to play their respective roles.

• • •

Gandhian Engineering : More From Less For More

Dr. Raghunath Mashelkar, *FRS*
National Research Professor
Former Director General, CSIR

What Engineering would be most crucial for the 21st century? Chemical Engineering? Computer Engineering? Electronics Engineering? No. None of these. It will be 'Gandhian engineering', which is all about "getting more from less for more and more people of the world"!

How did the term `Gandhian Engineering' arise in the first place? A few years ago, the Australian Academy of Technological Sciences and Engineering (ATSE) honoured me with the Fellowship of this Academy. I instantly decided that I must enlighten the audience about 'my India'. I decided to speak to them about something that we as Indians are particularly proud of.

I asked myself, what was India's greatest gift to the world in the 20th Century? I remembered what Einstein had said' "Generations to come, it may be, will scarce believe that such a one as this, ever in flesh and blood walked upon this earth". Yes, it was, Mahatma Gandhi, that was India's greatest gift to the world in the 20th Century.

Then I asked myself, what could be India's greatest gift to the world in the 21st Century? A world that is deeply divided due to stark inequalities. A world, where 800 million people go to sleep every day without a meal. A world, which is threatened with crisis such as global warming, global economic melt down, terrorism and so on.

And then I remembered two of Gandhi's tenets: "I would prize every invention of science made for the benefit of all" and "Earth provides enough to satisfy every man's need but not every man's greed". The first tenet referred to affordability. The second tenet referred to sustainability. And I felt they so relevant for solving all the problems that the world was facing today – so it was Gandhi's way based on these two tenets -- his solutions – his engineering – Gandhian Engineering – that would be the saviour for the world. And Gandhian Engineering could be India's greatest gift to the world in the twenty first century.

The title of my talk in Canberra on 28 April 2008 to ATSE was decided there and then. It was `Indian Innovation: From Gandhi to Gandhian Engineering'.

I explained to the audience the essence of Gandhian Engieering. The Industrial enterprises strive for getting `more from less for more'. What did it mean? That meant getting more (performance) from less (resource) for more (profit). But Gandhian Engineering has a different message. It means getting more (performance) from less (resource) for more (people), not just for more (profit). Remember, what Gandhi had said – benefit of all – not for just a few but for more and more people. Getting More from Less for More (MLM) became the mantra that I would repeat from Delhi to Washington over the five years after I gave this lecture in Canberra in April 2008.

The concept of MLM got enriched to an extent that the legendary C.K. Prahalad (CK as we fondly called him) and I wrote a paper `Innovation's Holy Grail' in the July-August 2010 issue of Harvard Business Review. Unfortunately that was the last paper written by the legendary CK. We

explained what MLM meant in terms of business perspective. We showed how industry could do well as well as do good by following the MLM strategy through technological innovations, business process innovation, work flow innovations and so on. MLM is getting further traction now.

Getting it for billions of `have nots' means making products and services available not just at `low cost' but at `ultra-low cost' – and that too at the same level of performance!

For instance, can we make a laptop costing $ 2000 available at $ 100? Can we make a Hepatitis-B vaccine costing $ 20 per dose available at 40 cents per dose? Can we make a psoriasis treatment costing $ 20,000 available at $ 100? Can we make a comfortable, safe and fuel efficient car available, not at $ 20,000, but at $ 2000? Can an artificial foot costing $ 10,000, be made available at $ 30? Can we make a high quality cataract eye surgery made available, not at $ 3000, but at $ 30?

All these sound impossible. But all these have been made possible. And that too, in India.

Such innovations should not just be `affordable' but `extremely affordable'. This means not just `incremental innovation' but `disruptive innovation'. The lecture will discuss the drivers for such innovations and also the generic lessons.

'More from less for more' can also be achieved by more & more participants in the innovation process. How do we move from 'national laboratories' to 'nation as a laboratory'? Grand co-creation of products & services can involve grass root innovation, open innovation, crowd sourcing, patent pools, etc.

The MLM strategy forces us to measure an 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 break-through improvements in the quality of life—alongside the usual objective of competitiveness.

The objective of MLM type of innovation would not be just to produce low performance, cheap knock-off versions of rich country technologies so that they can be marketed to poor people. Rather, the objective is to harness sophisticated science and technology know-how to invent, design, produce and distribute high performance technologies at prices that can be afforded by majority of people.

The Indian MLM Strength :

Contextual factors have undoubtedly facilitated the growth of Indian MLM capacity. There are five factors that stand out.

First, the country's political leaders experimented with socialism for more than four decades, which kept out foreign capital and technologies, but spurred local innovation on trying to get `more performance from less financial resources'.

Second, the Indian economy didn't start growing until the 1990s, so local companies were small. Indian entrepreneurs, therefore, developed a penchant for undertaking small projects and using capital carefully. In bad times we develop good habits. When the times are good, we should keep these good habits. So in the post-1991 era, Indian enterprises, while growing large, managed

to maintain their good habits, namely an unwavering focus on capital efficiency, again achieving `more from less'.

Third, local companies know that while India has both rich and poor people, catering only to the rich limits their market. They were forced to develop value-for-money products and services by changing the price-performance equation. So they worked on giving value for money as well as value for many.

Fourth, the mix of miniscule research budgets, small size, low prices, and big ambitions had created the need to think and manage differently. The combination of extreme scarcity and extreme aspiration ignited the Indian innovation.

And finally, the audacity of out-of-the-box thinking by some of the iconic industrial leaders showed the way. Dhirubai Ambani said `phone call at the cost of a post card'. And it was achieved. Ratan Tata said `a car at the prize' `a one lakh car'. And it was achieved. G. Venkataswamy set a target of doing a cataract surgery at one by hundredth of a cost in USA. It was achieved.

Mahatma Gandhi had favoured "production by the masses", rather than mass production. While mass production is dominant today, there is a strong countertendency towards smaller, more nimble custom-manufacturing facilities. Consumer tastes -- a preference for a differentiated, "special" products -- are changing, driven by technological advances that make it possible to get away from a "scale". Gandhian engineering can be facilitated by technologies that facilitate dispersal and decentralization. Earlier, the issues connected with logistics, the availability of talent, and infrastructure had favoured agglomeration and centralisation. Large industrial complexes and industrial townships were established. Size seemed critical for success.

Now, thanks to new information and communication technology as also the expansion of transportation networks, with widespread availability of power, and education -- it is possible to set up factories in smaller towns and more remote parts of the country.

The movement of raw materials and finished products has become simpler, more efficient, cheaper and practically -- location independent. Appropriate human resources too are now widely available. The task of setting up facilities in a dispersed and decentralized manner has been made much easier as a result.

This trend is very much evident in service industries. Take for example, the IT-BPO (Information Technology and Business Process Outsourcing) sector. First, as in most knowledge industries, the continuous stream of new start-ups is its lifeblood. In addition, being talent-intensive, and comparatively less dependent on physical infrastructure, new ventures tend to start-up wherever there is talent and entrepreneurship -- which means, anywhere in the country. This ensures geographical decentralisation. This has now been taken much further -- again, thanks to technology -- and the BPO segment, in particular, is now beginning to set up facilities in small towns and even rural areas, so-called "rural BPOs". Communications technology has made this possible by assuring high-reliability and large-bandwidth to networks, while IT has provided the ability to slice-and-dice work and later re-integrate it. These developments have made it possible to move work to wherever there is electronic connectivity. The level of expertise and education required has been reduced by breaking up a task into various components, some of which require a lower level of skills and training.

Another catalyst for the move to decentralisation has been costs: moving to small towns and rural areas can result in huge cost-saving, especially on real-estate, since this cost is practically proportional to the size of the city/location. While this pushes decentralisation, it also ensures small size, since it is just not feasible to hire thousands of people (with the right talent) in small towns or villages. Thus, new technologies are driving the trend towards decentralisation, dispersal and smaller-size organizations. While duplicating hardware in multiple locations means a near-linear multiplication of costs (hardware in ten locations will practically cost ten times as having it in one location), this is not true of software: it can be replicated any number of times -- easily and quickly -- at only marginal cost. This too could provide a further impetus to decentralized and local industry.

MLM Leadership :

For creating MLM business innovation models, we require leadership of special quality. First, MLM CEOs must develop a deep commitment to inclusive growth, which will force them to think of unserved customers, be they rural or urban poor. Companies often start by asking: "Given our cost structure, which segments can we serve? "They should ask: " Given that we need to cater to the unserved, what should our cost structure be?

Second, MLM CEOs must have clear vision with a human dimension: for example, helping poor Indians travel safely and affordably with their families; using connectivity to improve people's work and lives; and enabling patients to buy cheap medicines.

Third, MLM CEOs must establish ambitious goals and clear time frames for achieving them. Companies should ask: "What is our on-the-moon project?" Or, as they do in India's boardrooms: "What is our Nano project?"

Fourth, MLM CEO's must continuously ask "What if we change the way we operate to reduce costs and focus on return on capital employed, not just on operating margins? If we reduce prices enough and make our products available to the poor, won't there be explosive growth as they quickly find uses for and buy our offerings?"

Finally, MLM leaders must force project teams to work within self-imposed boundaries that stem from a deep understanding of consumers. That will result in a novel, outside-in view of innovation. The language inside their organizations should be about consumers as people, suppliers as partners, and employees as innovators.

I am sure that the very message of Lal Bahadur Shastri's inspirational life and monumental work is Gandhian Engineering for creating a better world for all, not for some privileged few.

After all Gandhian Engineering is all about getting more from less for more people. MLM way of innovation is anchored on the solid foundation of affordability and sustainability. It is all about creating a more equitable society. It is all about designing a sustainable future for the mankind.

• • •

Technology Trend : Shaping Future Engineers

Dr. Sanjay Dahasahasra
Former Member Secretary,
Maharashtra Jeevan Pradhikaran, Mumbai

Dear Friends!!

This year, we are marking the 51st anniversary of the *Engineers Day* in India and 158th birth anniversary of Sir Moksha GundamVisvesvaraya.

It is widely known that Sir MV was internationally popular for his brilliance and his great achievements in harnessing water resources in India. He had successfully designed and constructed several river dams and bridges. He has revolutionized the irrigation system all over India.As a tribute to this greatest Indian Engineer, the Engineering Community across India celebrates Engineers Day. "Technology Trend: Shaping Future Engineers" is the theme of this year's Engineers Day.

Distortionary definition of an engineer is- *a person who uses scientific knowledge to design, construct, and maintain engines and machines or structures such as roads, railways, and bridges.*

In fact, the primitive man who chiseled out the *first cave* can be recognized as "The First Engineer". Since then, the development took place leading to present luxurious life style in every direction. This is due to the shape given by engineers to humanity and the society.Engineers convert the theoretical knowledge of basic sciences into actual products and thus make our life easy.

In 1960-65, India was solely dependent on ships bringing wheat and other food cultivable from USA, but due to efforts of M. S. Swaminathan and C. Subramanyam, ***Green Revolution*** took birth and now the country is not only self-reliant, but exporting too. 50 years back, it was difficult to get half a liter milk scheme ration card, now due to Varghese Kurian and others ***White Revolution*** has been successfully evolved. India is now second largest country in the world in the field of producing milk products. For last 2-3 decades, our IT and computer experts spread all over the world. This may be a ***Colorless Revolution.*** But what about the ***Blue Revolution?***

Since, I am from the Water Supply and Sanitation sector, I am focusing my views on the vital subject of water. On our planet, only 0.01% fresh water is beneficial for human needs. Water is a finite quantity; it never reduces or increases, but changes its status.

In India, it is estimated that by the turn of 2050, the population shall reach a figure of 1.7 billion, for which water demand will be 1425 Km^3, while availability would be 1125 Km^3, thus there will be a gap of 300 Km^3, to be bridged. Generally, we require, 80% water for Irrigation purpose, 13% for domestic purposes, 5% for Industrial and 2% for recreation and environmental flow. Since, large quantity of water is required for irrigation, it important to improve water use efficiency in irrigation, cutting down Non-revenue water in domestic uses, water conservation for developing ground water potential and Reuse and Recycle of Waste water are the avenues, which will have to be tackled.

Our Prime Minister has declared a program of *Jal-Se-Nal* or *Water-to-Taps* for every home. It is a great challenge to all the engineers, as India is a vast country and there is a great variation of time and space of annual precipitation. On one side,Jaisalmer district of Rajasthan gets the lowest amount of rainfall measuring only 83 mm and, on another side, in north-east state of Meghalaya, nature pours about 11,873 mm. When north-east rivers are flooded, rivers in south have less water. Thus, due to unequal distribution of water across the country, it is more important- how best *Water Management Practices* are adopted. In this august gathering, I discuss some of these *Water Management Practices.*

***First** of water management practice is to adopt advance technology of GIS and Remote Sensing.*

As a part of this policy, GIS maps showing all rivers, dams and other water retaining structures like Kolhapur type gates should be prepared. There are about 62,000 micro water sheds in the Maharashtra. GIS maps along with the attributes like water level in such water sheds should be made available to the planners. The demands of drinking water, water for irrigation and industries should be computed for next 50 years. For this, a population forecast of each of 646 urban local bodies that comprises of cities, census towns, Nagar Panchayats, Corporations and Cantonments should be made. Knowing supply values, the gaps between the demand and supply should be computed and all our planning should be based on how to bridge such gaps. This gap analysis study should be made for each sub-basin. As per *Jal-Ayog,* there were 25 sub-basins in Maharashtra. After study committee of Godavari, now there are 40 sub-basins.It is necessary to find out status of each sub-basin, whether it is surplus or deficit in water for next 50 years and then the planning should be based on factual findings. For example, Marathwada Water Grid in which water can be moved from the surplus dam to the needy dam, so that equitable water can be available for both urban and rural areas. Marathwada scarcity problem can be tackled by the technique of *Swapping Reservation*. For example, 67 TMC water from Koyana hydro electricity generation is wasted in *Vashishti* river which finally meets Arabian sea, this water can be transmitted to Mumbai. Simultaneously, water that Mumbai gets from the dams in Nashik area can be let out in Godavari river to fulfill demands of the thirsty Marathwada. It is possible to divert water flowing to west-ward rivers in Konkan to the Marathwada area. For this project, it is necessary to accurately create contours using Remote Sensing and GIS technology.

***Second** water management practice, I propose is Improving Water Use Efficiency in Agricultural Irrigation.*

It is important to change Cropping Pattern so that we get more crops per drop of water. The canal system of supplying water to the crops involves many disadvantages- like 75% losses, problem of land acquisition and high cost of structures in areas of Black Cotton soil. It is important to use pipe distribution network for supply of water to agriculture fields rather than conventional canal system. Another important measure would be to use of Sprinkler and Drip methods. States like MP and Telangana are leaders in using these methods. We can utilize partially treated water for dry area, fruit trees. This system can be developed for the rural areas.

Third *water management practice, I propose is Improvements in Domestic Water Supply System.*

Reducing Non-revenue water, popularly called as, NRW in system water network is an important task. Average NRW values for Indian cities are 50%. NRW reduction program must be undertaken by each city. Water Audit must be carried out by each city. For effective water audit, metering should be made compulsory in water systems.Water literacy should be spread by the techniques of Information Education and Communication.

Fourth *water management practice, I propose is Conservation of Water.*

Jalyukta Shiwar is one of the important works that are being developed in Maharashtra. Apart from this, Percolation trench, Contour bunding are important tasks that would develop and increase ground water potential.

Fifth *water management practice, I propose is Reuse and Recycle of used Water*

There is a challenge to dispose of the Grey Water (waste water from Kitchen and Bathroom). With Small Bore technology and Sewerage network design using modern softwares, this challenge can be addressed. Treated effluent from the Sewage Treatment Plant (STP) can be reused. Nagpur's Bhandewadi STP is the show case example. Treated water from this STP is reused for the purpose of cooling water in Koradi thermal electric generation station.

Future Engineering :

India produces largest number of engineers in the world. Indian engineers have done remarkably great work in the field of technology and have played a major role in the development and growth of our nation. Many Indian engineers are working all over the world in various disciplines and leaving an impact.

Important multi-national companies have set up their R&D departments in India to utilize the services from the *talent-pool* available in our country. When we talk of new age cars, nano technology or renewable energy for the future, or 24x7 water supply, this all requires vision. Indian engineers of the tomorrow will be doing much more than they are doing today. It is, therefore, important that the engineers concentrate on their communication skills, problem solving aptitude and willingness to learn new things in order to be better prepared for the challenges of tomorrow.

At the end, I congratulate Forum of Nagpur Engineers for organizing this remarkable event.

• • •

Innovation for Holistic Evolution : VNIT's Success Saga

Prof. Pramod M. Padole
Director, VNIT, Nagpur

Visvesvaraya National Institute of Technology, Nagpur prides itself on the ethos of creative innovation for the benefit of society at large. Over the decades, the Institute has contributed greatly to the cause of holistic development by developing technology for the general masses, especially the rural sector in central India.

The Institute has maintained a strong interface with local industry and NGOs and closely studied the dynamics of rural operations over several grass root industries. This has enabled the institution to identify inadequacies accurately and then offer ingenious solutions for the same. The technical research and expertise available with VNIT Nagpur will give impetus to strengthen business acumen of MSME's. This bilateral interface will further strengthen the Indian economy and will increase the GDP of the Nation. The technologies develop by VNIT will also create a platform for entrepreneurs of the unorganized sector.

The following technologies, which began as prototypes, have the potential for mass scale production. Further, they are crafted particularly to allow technology to become the beast of burden, thereby erasing the fatigue and dullness brought about by ceaseless manual labour. The technology developed is extremely user-friendly and can be maintained easily by the rural populace. In many cases, local construction of the technology is also possible, thereby leading to self-sufficiency, one of the most emphatic aims of rural development. In this regard, VNIT has collaborated with the Khadi and Village Industries Commission (KVIC) which is nodal agency working to plan, promote, facilitate, organize and assist in the establishment and development of khadi and village industries.

VNIT worked as a Technical Interface of KVIC for rural Industrialization (For northern and eastern Maharashtra and Chhattisgarh.) Dr.P.M.Padole (Director, VNIT) and Dr. D. R. Peshwe (Dept. of Metallurgical & Materials Engineering) worked as the coordinators of this project. The Institute has developed number of technologies for the improvement of quality and productivity of rural based activities, reduction of fatigue and generation of employment in rural areas. Some of the technologies, developed under this project have also been patented.

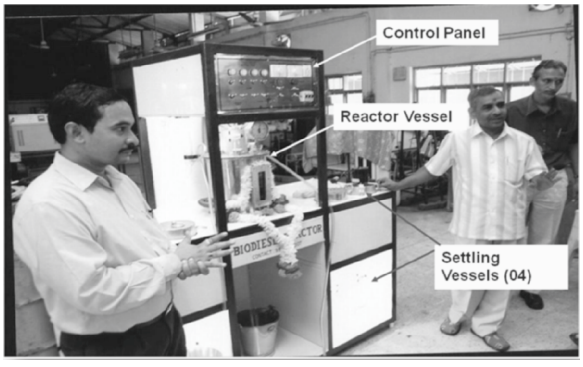
The details of sum of the projects are as follows

1. Stirrup Making Machine : The Present manual process for Stirrups suffers from many drawbacks like lack of accuracy, low productivity, monotonous and results into severe fatigue to operators and also in 5-8% wastage of bars. The process also requires skilled operator to get precise bending to achieve exact size and shape of the stirrup. Hence a motorized and pedal driven stirrup making machines are developed to overcome all these problems. The machine can produce more accurate stirrups with production rate of about 700 stirrups/ 8 hrs shift.

2. Mosquito repellent Coil Manufacturing Machine : The machine is designed to produce non-toxic mosquito repellant coil. The low cost hand operated machine is developed to produce the coils using ingredients like cow dung, *neem, tulsi, raal,* rice, oils etc. This mixture is a good disinfectant, antioxidant, incense producer and above all a mosquito repellant. The main objective of this project is to design a die & press to manufacture mosquito repellant coil.

3. Dhoop Stick Making Machine : The dhoop sticks are presently prepared by hand rolling which leads to unequal sizes of sticks and the shape depending upon the skill of the laborer. The process is very slow and painstaking efforts are required. Hence there is a need of hand operated extruder to increase the productivity and maintain the uniformity of the product.

4. Rural Blacksmith Furnace/ Process : In India, various tools like sickle, spade, pick-axe, ploughing blade, etc are predominantly used in practice as traditional agricultural tools produced by traditional black smithy. This traditional black smithy process has grown more on skill and experience of artisans. The steps followed in such a process are quite lengthy and involves expenditure of more energy than required by modern processing techniques that are used to produce a tool. Hence a new technology related to tool development and enhancement of life was developed and implemented.



5. Biodiesel Reactor : A program for the development of energy from raw material, which grows in the rural areas, will go long way in providing energy security to the rural people. Now a day's use of biodiesel as a substitute fuel in automobile and in engineering machines is becoming more popular and economical. Biodiesel is methyl or ethyl ester of fatty acid made from virgin or used vegetable oils (both edible and non-edible) and animal fats. The main commodity sources for biodiesel in India can be non-edible oils obtained from plant species such as *Jatropha Curcas* (*Ratanjyot), Pongamia Pinnata(Karanj), Calophyllum inophyllum (Nagchampa), Hevca brasiliensis (Rubber*)etc. Biodiesel contain no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend or can be used in its pure form. Just like petroleum diesel, biodiesel operates in compression ignition (diesel) engine; which essentially require very little or no engine modifications because biodiesel has properties similar to petroleum diesel fuels. It produces 250 liters/8hrs shift.

6. Modified Double Roller Gin : Existing double roller ginning machine has complicated drive system, requiring very large number of bearings and also requires large amount of grease for lubrication. It requires large amount of grease per ginning season. This grease, due to leakage, falls on the ground, which damages the cotton lint and deteriorates quality. It also needs more running cost with very high starting current. Hence a double roller gin is modified, redesigned and fabricated.

7. Mechanical Bailing Press : Ginning industries are many while composite units are few in number. For pressing of lint cotton from these industries, lint filled bags are transported either to pressing machines or to composite units. In one of the study made by CIRCOT, it was found that contamination, during transportation deteriorates the quality of fiber to great extent. Hence small size ginning and pressing machines could be designed to solve this problem, which not only reduces the multiple handling at ginnery but would improve the quality and would also be economically feasible. Hence a mechanical press which can produce a bale of 90 kg has been developed by VNIT.

8. Use of Gobar Gas in Diesel Engine : Most of the *Goshalas* / villages are using Gobar gas for cooking purposes only and it was also observed that there are 8 to 10 hours of load shedding in most of the villages. Hence to overcome these problems, a new technology was developed by which we will have alternative source for power generation. This will reduce the burden of alternate fuel consumption and will help in complete utilization of gobar gas.

9. Laminates : India being an agricultural country faces a major problem for disposal of agricultural and forest wastes for effective techno-economical utilization. The various agricultural wastes include cotton husk, pea stalk, kadba, baggasse, dried leaves etc. By using all these agricultural wastes along with plastic, paper and other waste, it was found that a laminate similar to plywood can be produced by using a little amount of binder with minimum pressure.

10. Agarbatti Making Machine : VNIT has indigenously developed an incense (agarbatti) making machine that is expected to replace the machine that was so far being imported from Vietnam. The machine was developed by Dr. P. M. Padole and Dr. Dr. R.V.Uddanwadikar. The new machine is extremely handy and easy to operate. It does not cause fatigue as it can be operated by hand or foot. Four of these machines, designed by VNIT and fabricated by Precision Tooling Engineers Pvt. Ltd at MIDC Hingna, initially handed over to TSK Reddy the Gadchiroli circle chief conservator of forest. The department is already running an agarbatti unit in different villages of the district as a part of the Integrated Action Plan and Human Development Mission since 2012.

The Government of India has recognized VNIT's outstanding contribution and bestowed it with the prestigious 'Best S&T Innovation Award' for its services.

Thus, the VNIT is paving the way for rural growth by developing resourceful models of self sustaining technology which is leading to employment generation, cost-cutting, and increased output. This is an important step towards the ideal of holistic socio-economic development, where all rounded expansion of opportunities and profits shall be achieved, and rural Bharat shall confidently keep pace with urban India.

• • •

Explore the Myriad Applications of Blockchain

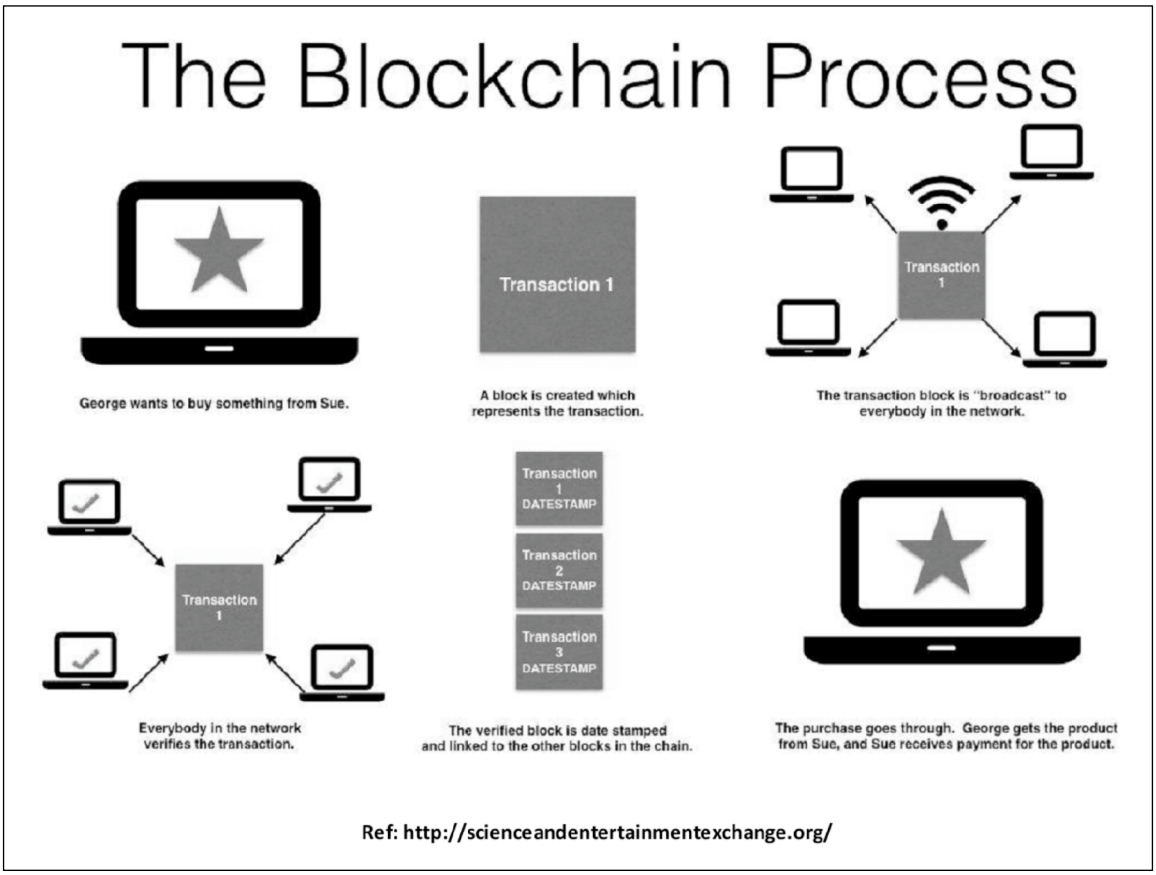
Dr. Bharatbhushan Joshi
Principal, Cummins College of Engineering for Women, Nagpur
bhushanpjoshi@gmail.com

Blockchain is the disruptive technology which is emerging as a great challenge to the mankind. It reminds me of a statement made by Steven Jobs, Co-founder of Apple, ‘‘Everything around that you call life was made up by people that were no smarter than you are. You can modify it, you can influence it, and you can build your own things that others can use’’. The Blockchain, which is the brainchild of Satoshi Nakamotoand a group of people known by the pseudonym, is a highly resourceful invention. It was originally devised for the digital crypto-currency, which is popularly known as 'Bitcoin' or 'Digital Gold'. The technology of blockchain is the latest safe and secure way of transaction on internet. Blockchain is fast becoming the backbone of a new type of internet, where it allows digital information to be distributed but not copied.Now the tech community is finding other potential uses for the technology. Blockchain is also getting into non financial areas and is creating several new career opportunities also. Read this article to get some basic knowledge of this new technology so that you can understand why it's considered to be ground-breaking and revolutionary technology.

'Blockchain is the internet of values. It transfers not only the information but also the value' said Rahul Raj, co-founder and CEO of Koinex. Blockchain are nothing but distributed ledgers that are placed geographically apart but are publicly accessible, unlike the information on internet which is stored on a central server. The data when stored on one server may result into data loss either due to hardware breakdown or due to hacking. The benefit in blockchain technology lies in the way the information is transferred. All the connected devices retain the same copy of information. This makes it almost impossible to hackor destroy it.

To know how Blockchain Works, let's have a basic understanding of the technology, think of a spreadsheet that is duplicated thousands of times across its networkof computers. If this network is designed to regularly update this spreadsheet, the Information held on the spreadsheets will be available as it is shared, due to continuously reconciled database. Structurally, the blockchain database is not stored in any single location but the records it keeps are truly public and easily verifiable. It is therefore impossible for hacker to hack into information because there is no centralized storing of information. Since data is hosted by millions of servers simultaneously, it is is accessible to anyone on the internet connected to the chain.

The diagram in adjoining figure explains the Blockchain technology of information processing and maturing of transactions. A node is a computer connected to the Blockchain network using a client (software) that accomplishes the task of authorizing and communicating transactions. A network of such computing 'nodes' builds up the Blockchain. When all put together, it creates a dominant second-level network, giving a wholly different modus operandi for functioning of the internet. Here, every node is termed as an administrator in the Blockchain, keeping or making the network decentralized. Decentralization means the network functions on a peer-to-peer basis.



The basic features of Blockchain are its robustness along with durability, transparency along with Incorruptibility. The design of Blockchain has built-in resilience and robustness because it stores chunks (blocks) of information that are identical across its network, which can neither be controlled by any single entity nor has any single point of failure. For Example, bitcoin since its invention in 2008, has operated without any significant disruption. Blockchain is indeed a revolutionary mechanism to keep everyone to the highest degree of accountability. All exchanges are done with the consent of the parties involved without any missed transactions, human or machine error.

The blockchain network is in continuous mode of self-auditing and reconciliation where it checks itself every ten minutes. Each assemblage of the transactions is noted as a "block". The first important property of the ecosystem is transparently embedded data within the network and second feature is its incorruptibility due to requirement of huge computing power to override the entire network. So, hacking into system to seize Bitcoins, would effectively result in destroying their value. The enhanced security is achieved by not storing data centrally located but by distributing it over the network. Unlike present system of 'Username/ Password' the Blockchain security methods use encryption technology. The foundation for this is the public keys and private keys. A 'public key' is a longstring of numbers that are randomly generated, is a users' address on the Blockchain.

Transactions done are sent across the network get recorded as belonging to that address. The 'private key'acts like entry password to get access to their Bitcoins (or other digital assets).

So now question being asked is, Is Blockchain a new Web 3.0? It's true in a sense that one of the biggest job portals in the world 'Indeed.com' sees exponential rise Blockchain related job offers. The expected growth is outstandingly 207% within last one year period. Some of the areas likely to rapidly attract technology of Blockchain are discussed below. There are countless and myriad applications of Blockchain technology. A few are enumerated below.

- **Smart contracts :** Ethereum is an open source Blockchain coding of simple contracts having distributed ledgers. At the current level of progress of technology, 'Smart Contracts' can be automated to payout the derivatives when the financial instrument meets certain benchmark.
- **Sharing Economy :** The Blockchain would open the gates of direct interaction between the dealing parties by enabling peer to peer payments. For example, Open Bazaar uses the Blockchain to create a peer-to-peer eBay, where vendors can transact without paying transaction fees.
- **Crowdfunding :** Blockchain is gaining interest in the financial transactions like Crowdfunding. Funds like 'Kickstarter' and 'Gofundme' are into advance level of work for the developing peer-to-peer economy. Blockchains will be able to generate a new paradigm of economic co-operation by taking development to the higher level, possibly creating crowd-sourced venture capital funds.
- **Governance :** It is possible with advent of Blockchain that Board's decisions can be made fully transparent, and its digital assets, equity and information be made publicly accessible with distributed database technology.
- **Supply chain auditing :** Distributed ledgers offer a simplest way to certify the genuineness of product by providing transparency that comes with blockchain-based time stamping and geo tagging. Just to give example about the genuineness of sustainably harvested fish in Indonesia, is truly traced when sold in Sushi restaurants in Japan. Consumers, can get complete information of the raw material used in preparation of the food item. This will improve food safety, prevention of fraud specially for the nonvegetarian food item. Just By reading a simple QR code, complete data about the livestock such as its date of birth, used antibiotics, vaccinations and location of harvesting can easily obtained.
- **Education :** This is one field where Blockchain can help all in 360 degrees. It can help to eradicate problem of fake documents, certificates, degrees if issued to the student with digital archiving and linking employing Blockchain technology. This will not only make certificate verification easier, but also save on printing of hard copies. Blockchain technology can help control of plagiarism and protect intellectual property.
- **Healthcare :** The technology of Blockchain can provide a source for storage and access to electronic health records (EHRs). It provides secured lifetime access to doctors in seconds. With patient's permission information can be shared from wearable devices to outpatient wards to hospitals. Blockchain can also provide more secure, accurate and less expensive method of

billing the patient, can help prescription disbursement and sharing it with pharmacists, drug administration and drug traceability.

- **Blockchains for NGOs :** It is being realized that Blockchain can have impact on humanitarian work too. It can help reduce heavy transaction fees, secure privacy of their beneficiaries and may enhance more donor funds. As per studies carried out by Caroline Dragsdahl, Usability engineer at Novo, Denmark, has come up with seven advantages of usage of Blockchain and Big Data by NGOs. These are Increase in independence, Ease in collaboration, Empowerment of beneficiaries, Ensuring of authenticity, Verification of decisions, Setting Target funds and Quick response time.

There are umpteen number of more application areas for the technology of Blockchain such as 'File storage', 'Protection of Intellectual property', 'Prediction Markets', 'Internet of Things', 'Control of Microgrids for renewable energy sources', 'Identity Management', 'Data Management', 'Digital Record archive', 'Land ownership records','Stock trading', Automotive, Aviation, Financial services, Global logistics and shipping, Manufacturing, Media, Music, Security and Transportation.

However, there are significant number of challenges in its implementation. The first is the amount of information that can be processed is limited. Moreover, in order to maintain certain level of confidentiality, several agreements between organizations would be needed to be laid. The technology of Blockchain is still in its embryonic stage and most people are indefinite about its potential. The next important challenge is participation of all the involved parties for the complete adoption and full implementation. The other challenges that can be listed are Adoption cost for the technology, Integration with existing Legacy Systems, Public Perception, Scalability of the implementation, Inefficient Technological Design that needs to mature, Energy Consumptions and last but not the least the Criminal Connection in crypto-currency. In spite of these challenges Blockchain in the most evolutionary technology of future so let's explore it for best use of for betterment of mankind.

Bibliography

- https://blockgeeks.com/guides/what-is-blockchain-technology/
- http://blockgeeks.com/guides/what-is-ethereum/
- Five Challenges Blockchain Technology Must Overcome Before Mainstream Adoption January 03, 2018, 08:58:27 AM EDT By Bitcoin Magazine, By Alex Lielacher
- Top 5 challenges with public blockchain, Posted on 3 July, 2018 By Toshendra Kumar Sharma
- Don & Alex Tapscott, authors Blockchain Revolution (2016)
- William Mougayar, author The Business Blockchain : Promise, Practice, and Application of the Next Internet Technology (2016)

• • •

Technology Trend : Shaping Future Engineers

Paresh Patil
Asst. Manager, POWERGRID, Solapur

It is no mystery that since the advent of time, Technology has been the guiding light for Mankind's Development. It is evident from human history that it can be classified into 3 eras in terms of technological growth. Of very primary significance the INVENTION OF WHEEL, Around 3500 BC in Mesopotamia, Homosapiens (Early humans) accidently innovated something of a miracle "THE WHEEL". As a modern Human we may not agree with the Miracle part since we have moved way ahead of the times. However, the wheel is often described as the most important invention of all times. As quoted the invention turned out "WHEEL of fortune" and had a fundamental Impact on transport, agriculture and industry eventually. To begin with mankind always had a craving for technology and were engineered for it from the very beginning per say, although it was merely a tool for simplification initially, today it has evolved to become a necessity for our survival.

Time changed and we evolved so did our technologies. Along the way we created the foundations for the society like education, medicine, culture, religion and most important technology, but we believed nothing was enough for us. We had outgrown ourselves in numbers than any other civilizations in the history. The demand and supply was shifting towards a huge difference. Which is what led to the Industrial revolution in 17th century. The revolution created a boom in the global era as it opened various avenues like textile, steam power, manufacture of iron, the Concept of Supply chain, mass production.

And finally leading us slowly to the 19th century which changed the way we perceive technology because we introduced the computers to the world. The Computers were a huge leap for us, with them performing everything complex a 100 times faster than we ever could. We were now sure that we had found the new leaders of technology.

The strength of computers integrated with the internet and machines has led to the creation of modern world. Today we have successfully created access to all luxuries and securities of life just at our fingertips. We boost about our Mac books, iPhones as if they were your companions. We have created networks to connect to anyone 5 miles to 5000 miles apart. We have established Electricity networks which run without manual intervention. We can literally command a machine and it works for us. Although it would have sounded fascinating a couple of decades back, today it is a common reality. But the most important question isn't what we have today but what your future holds for us.

The modern era sees technology as a creator, as a savior. As we mentioned earlier it has

established itself as leading authority in every industry, which in turn has put engineers in a different light. Engineers today are the drivers of technology. Not only your scopes have widened for us but we hold the power to completely transform the industry itself. For example, a few years ago banking, finance, investment used to be cumbersome affairs. Even people with exposure to it found it difficult to cope with the delays, complications involved with transactions. Today a person sitting in New Delhi can make a transaction to New jersey with a just a click and just in seconds. The convenience is definitely one of the best things engineers aspire for, but as an outcome it will be creating more equality, simplicity and accessibility in the future. How it is shaping future engineers is that it is creating plethora of knowledge platforms to showcase their talents. The domain for work has widened its horizons, the limitations we had once which made us stick to only one field of expertise are slowly vanishing.

Starting from education, business, fashion, design, marketing and even automotive industry the future for engineers will be invested in streamlining all this aspect. What might be of intrigue is the fact that even the field of medicine, researchers are taking advantage of advancements to take on problems which were once considered insurmountable. The future in all probability for us is going to be about integration of technologies.

With advancement in fields like Artificial Intelligence, Machine learning the exposure for engineers will be immense. Although there has been a long going debate globally that with such advancements will lead machines to be eventually replace humans. Although machines are outgrowing in intelligence compared to its human counterpart is a concern out there. But I think that would simply be changing the nature of jobs we will be doing and it won't be affecting the employment in terms of number.

Finally, to conclude we could say that the pace at which we are growing the future is definitely uncertain but one thing is certain and that is progressive growth. And it wouldn't be surprise that engineers would be holding the key to it. The opportunities would better, opportunity to grow, to sustain and the best one, the opportunity to leave an impact and to make this world better place.

• • •

- *Engineering is the Professional Art of applying science to the optimum conversion of natural resources to the benefit of man.* *- Ralph J. Smith*

Courtesy : Ascent, Times of India

How Artificial Intelligence can Fuel India's much needed Growth

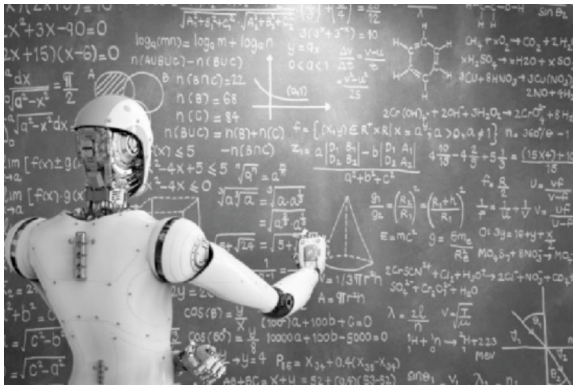
Surajkumar Senapati, *Sr. Manager*
Mahendra Pratap Singh, *Dy. General Manager*
Vidarbha Industries Power Limited (Reliance Power)

Since the invention of steam engine, mankind has progressed at such a rapid pace which the Cave man could not have ever envisaged, but this was possible solely on the basis of technological developments in all walks of life. Many machines have been developed since then which have helped improve the lifestyle of the society and promise to continue in the future as well. But can you imagine how transformed world would be if machines started learning themselves? This has been made possible by Artificial Intelligence (AI), which enables machine to learn and think like humans and act accordingly.

Recent reports by business houses have predicted that AI holds the potential to add more than $1000 billion to the Indian economy thereby increasing its annual growth and bringing the dream of achieving a $5 trillion economy closer to reality. India's think tank – NITI Aayog has also been emphasizing the role new technologies will play in boosting the economy. Being invested in "Digital India", the government is also optimistic about AI's future and has decided to invest heavily in research, training and skill development. However, the real picture is that India is lagging behind the G20 countries in AI development due to the lack of skilled workforce in this domain. This throws open an opportunity to all the budding engineers of the country to contribute their bit in the nation's progress by getting adequately skilled and thus curb the issue of rising unemployment by addressing this demand-supply gap effectively.

In Agriculture, AI can be used for various applications like – AI powered drones can administer pesticides by harnessing data on crop health and soil conditions to increase output. AI powered solutions can enable smarter production, processing, storage, distribution and consumption of agricultural products. Site-specific and timely data about crop condition would help farmers in conditioned use of fertilizers and chemicals and maintain desired crop health, thus reducing his input cost and enhancing yield per unit land. AI can also help farmers by notifying them of the optimal time for sowing in order to reap a good harvest.

In healthcare, AI enabled robots can assist surgeons in conducting precise surgical procedures, aid in early identification of potential pandemics and tracking disease incidence to contain spread, and image processing and diagnostics for radiology and pathology. AI can also help the industry address the problem of re-admission due to lack of post-operative care by assisting care providers in taking extra precautions. It can help in better management of emergency situations by efficiently planning processes and functions. In the field of telemedicine, a wonderful opportunity is provided by accurate remote health monitoring and predictive diagnosis, leading to cheaper and effective remote health management. This will thus make healthcare accessible to all sections of the society.



Educating the rising youth in India is a challenging task for the administration, for which AI can offer solutions which can help the youth grab the upcoming opportunities by learning, unlearning and re-learning, thus continuously upgrading their skills. AI has been assisting teachers in grading standardized assessments but the future holds bright chances for more advanced assessments as well. It can also identify weaker sections of the classroom through various tests and can develop and cater to the needs of students having different learning abilities. The data collected from tests can help students work on their past mistakes through a process of feedback and personalized recommendations. By identifying areas where students lack clarity, AI platform can help teachers act on their knowledge and rectify the gaps. Thus learning philosophy will undergo a tectonic shift with the advent of AI in the industry.

The most important Energy sector can also tap the potential which AI offers, the concept of 'Smart Grid' has been much heard of in the recent past. AI optimized energy system modeling and forecasting decreases unpredictability and increases efficiency. This will also aid in using more renewable energy sources as power balancing can be done taking AI's forecasting support. The upcoming Smart Cities project can explore AI by using smart sensors in offices and homes for increased safety in case of calamities, improved energy efficiency by switching heating and air-conditioning at times to exploit off peak energy charges, installation of intelligent energy monitors which can learn electrical signatures and send alerts at pre-defined limits.

More than 1000 companies in India claim to be working on AI in some or the other form. Unlike the common belief that AI will snatch jobs from humans, it will actually generate more jobs in the future. But, for this all countries including India need more AI professionals, and given that many companies in the future will leverage AI for growth, this skill demand will increase drastically. India had witnessed the IT/ITes industries growth in the past and it was supported basically its low cost highly skilled workforce. The time has finally come when all enthusiastic engineers of the nation need to pull up their socks and make the best use of this disruption and be at the forefront of this development.

"You must embrace change before change erases you"
– Rob Liano

• • •

Nagpur Smart and Sustainable City Development Corporation Limited (NSSCDCL)

Uday V. Ghiye
General Manager (Infrastructure), NSSCDCL

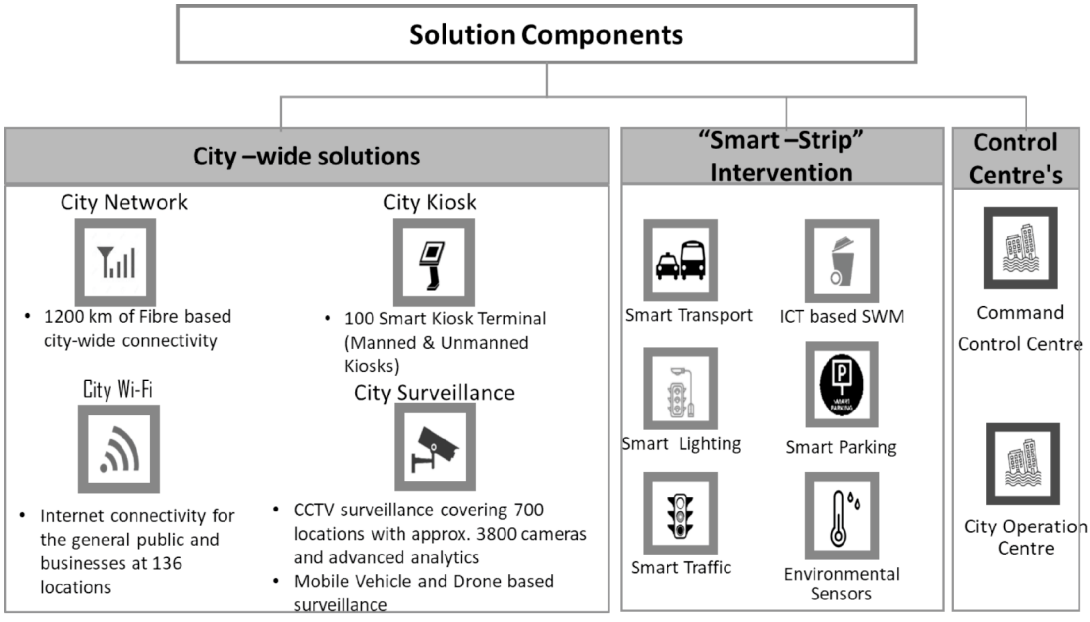
Technology trend has changed drastatically over last few years and our country is going through this era of new technology trend by sustainable applications for common people thereof. "SMART CITY" concept is one of them.

Nagpur City, in the heart of nation has been selected for "SMART CITY" project . Nagpur Smart & Sustainable City Development Corporation Limited has been formed. Some highlighted features are given below :

Nagpur Safe & Smart City Project - Safety in Nagpur using data

Nagpur has been selected under Smart Cities Mission (SCM) launched by the Ministry of Housing and Urban Affairs, Government of India. The Smart City Proposal (SCP) sought to develop Nagpur a truly inclusive city by removing the dichotomous growth and enhance the city's profile by improving the quality of life in vulnerable areas to bring them at par with the rest of the city, through implementation of Town Planning Scheme (TPS) based on the principle of retrofitting under Area Based Development component and implementation of ICT enabled solutions under Pan City Component.

Vision: "e3i - To transform India's heart Nagpur into the most liveable eco-friendly, edu-city that electronically connects people with the government to co-create an inclusive ecosystem".



NSSCDCL believes that the development in the field of Information and Communication Technology (ICT) can be effectively leveraged to deliver a various services to the citizens effectively and efficiently. In line with this, following are some objectives considered during implementation of ICT enabled solutions :

- To provide safe and sustainable environment to citizens.
- Enable Urban Local body to function more efficiently and move towards a paperless environment.
- Enable citizens to avail various services online or at a place near their home, without having to visit government offices at minimum possible cost.

City Operation Centre (COC) - City Operations Centre has been developed with functionalities Including 32 software's installed and integrated to common application platform to ensure Interoperability, Seamless User Experience, Prompt Response with large-scale integration of COC and IOT.

- ✓ Video Surveillance System
- ✓ Video Analytics & Facial Recognition (FR) System
- ✓ Automatic Number Plate Recognition (ANPR) / Red Light Violation Detection (RLVD)
- ✓ Centralized Wi-Fi Management System
- ✓ Variable Message Signboard
- ✓ Public Address System
- ✓ Smart Lighting System
- ✓ Adaptive Traffic Management System
- ✓ Solid Waste Management System
- ✓ Smart Parking Information Systems
- ✓ Environment Sensors
- ✓ Citizen Mobile Application
- ✓ Enterprise Management System (EMS)
- ✓ Helpdesk
- ✓ Investigation
- ✓ Emergency Response
- ✓ Video data storage and retrieval
- ✓ Integrated Operation Platform (IOP)
- ✓ Smart Transport

Nagpur City Surveillance - Protecting citizens and ensuring public safety is one of the topmost priorities for any Government agency. It requires advanced security solutions to effectively fight threats from activities of terrorism, organized crime, vandalism, burglary, random acts of violence and all other forms of crime. CCTV based video surveillance is a security enabler to ensure public safety. In vision of this, City Surveillance System has been implemented under Nagpur City Police Commissioner's Jurisdiction and it's infrastructure comprises of: -

- CCTV based City Surveillance – 671 locations
- IP based Public Address System with 2 speakers – 56 Locations
- Variable Message System – 51 Locations
- Video Management System and Video Analytics

- Automatic Number Plate Recognition (ANPR) – 55 locations
- Red Light Violation Detection (RLVD) – 41 locations
- Facial Recognition System (FRS) – 20 locations

This system is playing vital role for the administration and citizens of Nagpur by various ways and means. Specifically, officials of Nagpur Police are monitoring CCTV surveillance system from COC for maintaining Law & Order situation in the city. Video footages and evidences extracted from the surveillance system are providing early leads and directions for the crime investigations.

City Wi-Fi - In a society with a high demand for digital connectivity "on the move", there is an increasing demand for public Wi-Fi services to be made widely available. Understanding this need to provide public Wi-Fi services, various locations have been identified across Nagpur city. These locations include Market Places, Government Offices, Recreation Spots, Parks, Lakes, Educational Institutes, Holy places etc. This increased digital inclusion and extension of last mile connectivity, improving public safety and real-time municipal services. Installed 141 Hot spots and 877 Access Points for free Internet to citizens.

Smart Strip- Interventions - Embarking further on its digital journey, NSSCDCL has implemented ICT enabled smart strip of 5.60 Kms from Japanese Garden Square to Orange City Hospital Square. The smart strip includes smart parking, solid waste management, street lighting, adaptive traffic control, smart transport solutions, environmental sensors, variable messaging signboards and Public Announcement systems. Detail information is as below:

1. Smart Street Lighting - 383 Smart Lights
2. Smart Environment - 10 Strategic Locations
3. Smart Parking - 1 Location, opp. Tuli Imperial, Ramdaspeth
4. ICT enabled Solid Waste Management - 10 Locations, 20 Smart Bins
5. Intelligent Transport - 218 Buses and 158 Bus stops
6. Adaptive Traffic Control System - 10 traffic junctions

Smart lighting - Using wireless technology and web based architecture; Smart lights are controlled & managed from City Operation Centre (COC) to avoid human intervention to ON & OFF the individual / group lights. Light intensity levels are reduced automatically according to the vehicle movement; hence energy consumption is considerably reduced. 383 Controller & Sensor based Smart LED Lighting to support automated lighting, sensing and motion detection installed.

Smart Transport - Automated Vehicle Locator System (AVLS) with GPS / GPRS functionality is installed in Nagpur city buses to provide Scheduled Time of Arrival (STA), Expected Time of Arrival (ETA), display ETA, STA in bus stops & allot driver duty from central location. It is implemented in 218 buses, which gives On Board real time information of the buses.

Going forward, more and more data could be collected based on the safety data points to achieve an all-encompassing safety milestone for the Nagpur city.

• • •

Technology Trend : An Overall Scenario

Compiled by
Vrushali Karkare, *M.E. (Computer Science)*
Nagpur

The year 2019 and onwards is going to be more about the evolution of the existing technologies than about innovation. Rapid changes are going to characterize the technological trends impacting all the fields of engineering including manufacturing and service sector.

In order to face changes, engineers must upgrade their existing skills and learn other new ones that will help them collaborate with the new technologies that they are going to adopt it in their all work activities. The many emerging technologies today are redefining the way workplace functions. It's not just the engineers who have been affected by the advancing technology but also the entire population and human resources. In this process, the human being is a key factor and it must deliver the decisions accordingly.

There is quite a long list describing the technology trends that will define various fields in near future. These Technology trends goes from automation to 5G to cyber risk and soon.

The trends described below will be the major factors that continue to shape the future in the age of digital transformation. It means now digital and automation era begins.

1. 5G connectivity

5G connectivity is going to make possible the Vision 2020 we have been talking about for the past years. Engineers have to keep an eye on 5G network developments and 5G adoption around the world. 5G connectivity is what is going to power everything that the different engineering branches are going to be working with starting in 2019 and onwards.

From the manufacturing assembly line to how to illuminate smart cities to city infrastructure and machine-to-machine (M2M) connectivity, the 5G network is going to change the way we work, live, and interact with people, cities, and machines. Hence, the groundwork is being laid so that in 2020 we will be able to browse the Internet on a smartphone at a speed that will reach 10 gigabytes **per second**. Data from Statista, a provider of market and consumer data, indicates that by 2024, 5G mobile network technology will have reached more than 40 percent of the global population, with close to 1.5 billion users.

Artificial Intelligence (AI) :

This trend has appeared in all the lineups and we'll see its democratization. Artificial intelligence (AI) makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks. It is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.

Most AI examples that you hear about today – from chess-playing computers to self-driving cars – rely heavily on deep learning and natural language processing. Using these technologies, computers can be trained to accomplish specific tasks by processing large amounts of data and recognizing patterns in the data. Some believe that new and emerging technologies such as

Artificial Intelligence (AI) will eliminate some jobs. Yet, AI is going to create a huge demand for new skills that many engineers don't have today.

2. Internet of Things (IOT)

One of the biggest technology trends to emerge in recent years is the Internet of Things. IOT is the idea that all technological devices can be connected to the internet and to each other in an attempt to create the perfect bond between the physical and digital worlds. Impact of IOT will depend on your type of industry. For example, for those who work in marketing, advertising, media or business management, IOT could provide a wealth of information on how consumers engage with products by tracking their interactions with digital devices. In turn, this data could be used to optimize marketing campaigns and user experiences. The really cool thing about IOT is that it's not only changing the way we do business but also the business models we use to do it.

3. Automation, M2M (Machine-to-Machine), and H2M (Human-to-Machine)

Automation in the Industrial Revolution is going to take the central stage in smart manufacturing and digital transformation. In order to remain relevant, manufacturers need to embrace change, automation, and offer training to their traditional workforce in order to fill the skills gap existing today.

A recent report found that in the next three years automation is going to take over manufacturing. IoT and AI are going to make manufacturing more agile and smarter. Engineers are going to be tasked to supervise the machines with the help of smart devices. Traditional workforces are going to see change due to automation, yet they need to develop skills to execute the digital transformation that automation brings to the manufacturing sector. Forward thinking leadership is going to be in high demand in this sector with humans driving the change that it is needed for success.

Human-to-Machine (H2M) is the emerging collaboration between humans and machines. The rise of the factory of the future with more automation and robotics incorporated to the manufacturing process brings an integrated systems approach. Factory automation opens exciting possibilities as well as challenges in the industrial environment. The next Industrial Revolution brings digital, physical, and biological systems together. This Industrial Revolution is going to bring all sorts of change at a speed, scale, and force unlike anything you have seen before.

4. Engineering design with AR, VR and MR

The adoption of Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) technologies in the manufacturing sector is closing the gap between the digital and the real world. Automotive engineering designers are going to experience a positive boost. Thanks to the help of new advances in AR, AR, and MR and more practical applications of the R+ technology (AR, AR, MR) powered by 5G.This means that engineers are going to work with more powerful tools assisting them in their job. Augmented Reality is going to grow exponentially and is going to help engineering designers and many others work and collaborate across multiple geographies.

5. Smart city planning and designing

Smart City design is going to take a longer view into the future. The first step into building toward the future is through building a smart infrastructure that can support all Smart City applications today and tomorrow.

Doing things in the right way from the beginning is the smart thing to do, so existing applications such as surveillance cameras (CCTV), traffic sensors, smart lighting, smart parking, and others can be easily updated at the same time others are incorporated into the infrastructure.

Smart city planning and design is a space engineers much watch closely. The combination of these technologies will dramatically change our perception of the world that surrounds us by creating smart spaces where more immersive, interactive, and automated experiences can occur for a specific group of people or for defined industry cases.

6. Blockchain

Blockchain technology is another topic that frequently appears on these days. It has now broken free from an exclusive association with the world of cryptocurrencies; its usefulness has been proven in other areas. We will witness many blockchain projects get off the ground as they try to address challenges that still face the technology in different fields like banking and insurance. It will also be a decisive period for the roll-out of decentralized organizations that work with intelligent contracts.

7. Cyber security engineering and risk management

Last but not least, one of the most important spaces security engineers must watch is advancements in cyber security research and how to stay ahead of the game before vulnerabilities turn into serious breaches. Ensuring that networks and security systems are updated has to always be a priority. Designing systems to deal with disruptions such as natural disasters or malicious cyber attacks must be done with vision into the future and updated often. Cyber security engineers must be alert and carry out frequent threat analysis and risk assessment at an early stage during product development ensuring that security is a strong feature of every product and device. With the global broad adoption of the Internet of Things (IoT) taking a front seat now, analysts have anticipated that IoT is going to create new security risks for enterprises and also for consumers. By using tools such as Artificial Intelligence (AI) and Machine Learning (ML) enterprises can sooner predict and protect from cyber attacks.

True "Engineering" by Engineers

Engineers must be at the forefront of innovation and emerging technologies as well as the new technologies that have become important tools for engineers and designers. Learning of new technology trends may be easy for engineers but application and adoption of the same should be focused on better and better development of human beings. Simultaneously, the factor for balancing with global environment, which is on red alert now, should be of prime importance.

In this changing era of the engineering, the man behind it is a key factor and he must be a superpower operator. So, he needs to act with certain skills and moral thinking. This factor will have ultimate effect on value adding performance of engineers.

With Best Wishes for 21st Engineers Day of Engineers Forum.

Source of Compilation :

- https://www.bbva.com/en
- www.wayup.com
- www.comptia.org
- https://cpoinnovation.com
- www.simplilearn.com

• • •