Transformation of India from a beleaguered nation to world’s fourth largest power in gross domestic product (GDP)

Gist: This is a story of people who dreamt the undreamble, tread the path of untreadble, did the undoable and finally achieved the unacheivable. Their hardwork, dedication and perseverance transformed India to what it is today. Their achievement is truly inspiring.

Introduction:
The success of India as a nation is success to humanity. This may sound strange to hear, but it is a fact. If we closely analyze we will understand why this statement is relevant. India is a continent size country with population of over one billion people. This is bigger than all of Africa and all of Europe put together. India has planet earth’s 2.4% of surface area but sustains 16.7% of world population. Perhaps, no country has as much cultural, religious and linguistic diversity as what we see in India. With 22 officially recognized languages and unofficially more than thousand of languages spoken as mother tongue, India represents most linguistically diversified country. The culture in India changes drastically every 100 kilometers with change in dialect. Sometimes even the language changes when we travel short distances making India culturally diversified to the highest degree.

There are people belonging to every religion on the earth and they have been living cordially together for millennia. Apart from that, there is caste system (division of society based on labour) in Hindu religion.

In India all sorts of people live courteously, like rich and poor, atheists and theists, educated and uneducated. Though there are some skirmishes here and there, but for a population of over a billion with diverse culture, language etc, these appear just small aberrations, which can be ignored. Society as a whole is peaceful, hospitable with a sense of belonging.

What facilitated this? – Indian democracy. The leaders at the time of Indian independence from British in 1947, sought to uphold humanity and spirituality through democratic way of life. Democracy advocates personal freedom – Freedom of speech, freedom to practice religion without harming others, freedom to move and live in any part of the country, freedom to express one’s opinion about anything and many more like that. There is equality – equality in the eyes of judiciary as it upholds rule of law. In the eyes of law, every individual is equal – be it Indian citizen or a foreigner.
These democratic values united Indian society, which resulted in peace. Generally when there is peace in the society, people do not have to worry about their existence. They can focus all of their energies in working towards prosperity to live happily. The society, as a whole will succeed as a result. This happened in India and hence we see so many success stories in all spheres. For any country to succeed, its leaders should strive first to achieve societal peace through various means. When that is done, success will follow naturally like tail following the dog.

Now consider a hypothetical case of India opting to have strong religious identity at the time of its independence. This identity could have divided the Indian society along the lines of religion leading to perpetual fights between people of various beliefs. When the people are fighting, society cannot be at peace and as a result, India would have been a backward, aid dependent country with the begging bowl in her hands all the time. With poverty and hunger for food, the next natural step is extremism leading to terrorist activities, which would have created mayhem across the world. We can’t imagine the kind of trouble the world would have to face, had India failed as a country. But, ‘Yes’ with democracy at heart, society is at peace; the Indians are making strides in every field they are operating in. Over one billion aspiring people with majority being young has transformed India into a potential market for goods and services. This has made India darling for companies across the world. As per the 2013 ranking of world billionaires, India ranks 5th with 109 billionaires and with over USD 190 billion in total wealth, next only to USA, China, UK and Germany.

Some smart people made use of India’s huge burgeoning market to sell and amass the fortune. This answers why it is everyone’s interest to see countries like India and China with huge population and massive markets succeed. They are forming growth engine for the entire world in the new millennium. India’s infrastructure alone will see an investment over 1 trillion USD (60 lakh Crore rupees) by 2022, consuming all kinds of materials and machines sourced across the world. That gives the compelling reason as to why world needs a stronger India.

**Is India a perfect democratic country?** ‘NO’, there are unsurmountable problems glaring at her – be it poverty, poor hygiene, poor infrastructure, malnutrition, corruption, illiteracy so on and so forth. But the biggest hope is that her young and aspiring people - over 50% of them less than 28 years old, have begun taking responsibility to fix it. Earlier, young people
never bothered to having their say or opinion in the governance. They are now showing interest in government’s policies, as these policies will ultimately hit them. They are expressing their frustrations through huge public rallies and with the media unveiling more corruption and rut in the polity. India is facing more of such rallies off late. The government is now taking their rallies seriously and started responding positively. The result - people will eventually make government work. This is how democracy meant to function. It (democracy) is always “for the people, by the people and of the people”, and it can happen only when people truly involve in it. Just by voting some people to power doesn’t end voters’ responsibility. They have to make sure these politicians and bureaucrats work too. Good news is that, it has started happening in India in a small way.

Add to these developments is the formation of a party called ‘Aam Aadmi Party (AAP)’ or ‘People’s party’ to be precise, by ordinary citizens of the society. The mandate of AAP, formed by the people, is to give clean governance by involving common man. AAP wants to be the true representative of people unlike their counterparts. This new approach of AAP is giving other big parties - 120 years old Congress, slightly younger ‘Bharatiya Janata Party (BJP)’ and others, enough nightmares. Team at AAP used crowd-sourced funding for meeting their poll and publicity expenses. They (AAP founders) went even to the extent of writing their poll manifesto or their policies by keeping people in the loop. This means, people had their say in framing AAP policies, especially those that touch their (People) lives. Media has covered this posturing of AAP team very extensively, and this made rival parties to take cues from AAP to do similar things. They too have started involving people in framing rules of governance.

In fact AAP came to lime light by taking strong opposition to corruption, as they vowed to go after every corrupt politician irrespective of his or her background, if they come to power. This stance of AAP team attracted wide media publicity, and as a result people from all walks-of-life, frustrated by unending corruption in the government, started joining the party in all ranks, to fix the polity and to make administration more open.

However the much-needed punch to cleanse the polity has come in the form of a recent note circulated by Indian Supreme Court (SC) to all lower courts asking them to finish trials on each of the corrupt politicians/officials within one year flat. This means, if any government official found guilty, he or she has to immediately relinquish the offices and undergo the punishment. On the contrary, if the person under trial is an aspiring politician, and yet if any
court finds him guilty of wrongdoing, he will be debarred from contesting election for a minimum period of 6 years plus he has to face other punishments simultaneously. This has tremendous impact in the society. This is because, earlier the trials used to drag for years and sometimes for decades encouraging the rot to thrive in the government. Officials used to commit crime with impunity disregard of any moral values and fear and now their party, it looks like, will end soon.
This move of SC will certainly enable organizational cleansing by deterring those in high offices - bureaucrats/ politicians and the like, to stay clear of corruption or face the ire of courts.
So finally, the journey to fix the governance has begun and miles to go before we can even see some visible changes. However one point to note is that there is hope that India can change and will change for better in the future.

The hard work of the government and the citizens resulted in the slow metamorphosis of India from a beleaguered nation to fourth largest global power as of 2014. In the process they have created some islands of excellence. The remaining section of this chapter tells inspiring stories of people who made this possible. However before that lets us know in brief about the conditions that were prevailing in India, which made people do things that resulted in her transformation.

(a) India's transformation story – history in brief
India with a population of over a billion people got independence from British Raj on August 15, 1947. Two years earlier world had just got out of the clutches of World War II. The mood around the world was somber with the death of millions of people during the war. India too had a fair share of deaths due to the bloody violence, as a consequence of partitioning of continent sized country to create ‘Muslim majority’ Pakistan in 1947. As if it was not enough, at that time there was acute poverty with rampant cases of malnutrition. Majority of Indians lived in villages with absolute disregard for hygiene and farmers were using antiquated agricultural practices, and because of that agricultural yields were very low and hence the poverty. Farming was depending mostly on rain fed water as major dams for irrigation were built much later. There was scarcity for everything, be it food, milk, water, medicine, electricity, sanitation, motorable roads etc. The government had no money to import from other countries. Conditions prevailing then were so miserable that it came to
‘do or die’ situation for the leaders. That means, either they had to go back to British seeking their help or do something to come out of mess on their own. It was shameful for these leaders to go back to the British seeking their help in governance, as it was them (leaders) who led the freedom movement to oust the British from India. They instead chose to fix it by themselves. With fire in their bellies and utmost enthusiasm in their minds, these leaders – most of them in mid forties and early fifties - decided to build a modern India from the scratch. India, which they envisioned, would be a self-sustaining one with democratic principles and with scientific outlook.

Given below is the list of major initiatives that transformed lives of Indians for better.
(b) **Agriculture transformation: From food deprived to food surplus state**

The world's one of worst recorded famines happened in British ruled India in 1943/44 and it was a disaster. An estimated 40 lakh or 4 million people died in 2 years. Though there was failure of rains on those years, what led to the famine was acute shortage of food. British were deeply involved in World War II and did not bother much to the deteriorating situations in famine-infested Bengal (an eastern state of India). So when British left India in 1947, food security was the top priority for Indian leaders.

The leaders of the newly independent India, in the first decade, focused their energies in building dams and canals as a means to control floods, and direct excess water for irrigation purpose. Over 1000 dams small and large dams were built across the country, but the food shortage did never seem to diminish. In fact the food scarcity reached crisis level by mid sixties with domestic wheat production hovering around 12 million tonnes and another 10 million tonnes were being imported from America annually under its public law 480.

America was giving wheat as a life saving, limited handout to India.

That was when these leaders got into thinking mode as to what was needed to triple or quadruple the food production. This was because making just the water flow to the agriculture land alone was not raising food production; there was something more than that. After the series of brain storming sessions, they came out with a 10-year plan, which they coined it as *'Operation Green Revolution (OGR)'*. OGR had brains of several intellectuals, agricultural specialists, strategists and others behind it. There was no similar operation elsewhere for them to copy the idea; hence it was an indigenous attempt. So, all they had with them to begin with was child like enthusiasm and big hope that's all.

OGR was kick started in 1967/68 silently, giving a sustained focus to agriculture for a period of 10 years. By 1977/78, the mission was such a success that it turned India from food deficient nation to one of leading world's food surplus nations.

Let us try to know what OGR all about.

OGR: It is some kind of prioritized action and execution plans to bring about sea change in agricultural growth. OGR comprised of following.

- Usage of high yielding variety of seeds.
- Bringing state-of-the-art irrigation techniques.
- Use insecticides and pesticides
- Land reforms
Peak Performance Solutions

- Improved rural infrastructure.
- Supply of agricultural credit.
- Use of (chemical) fertilizer.
- Opening of agriculture Universities and colleges.

Prior to OGR, Indian farmers were using low quality seeds; hence they were suffering from low yield. This was fixed by using imported high yielding seeds that were distributed by the government. Irrigation systems were archaic and the canalized irrigation was not common even after so many dams were built prior to OGR. This was fixed by building modernized network of canals from the dams to the parched lands. Water started flowing into the agricultural lands across India as a result. The crops were prone to insects and pests earlier, and farmers used to respond using age-old remedies whose effects were limited. This was fixed by using modern insecticides and pesticides, based on the extensive studies of pests and insects that affect the crops. Earlier the land ownership was unusually skewed towards rich landlords. That means, a handful of landlords owned thousands of acres of farming land, while hundreds or even thousands either had no land or insufficient land to make a living out of it. The Government had to bring ordinance to land ownership by limiting the land one can own. Excessive holding of lands were taken over by the government and distributed among landless peasants. By this, Government helped spread out wealth among various peasants. This acted very well in increasing the rural income among poor people. Rural infrastructure like markets where crops could be bought and sold were established, roads were built connecting these markets to cities, villages. Electricity was dished out to farmers at discounted rates; as a result farm-produce reached the markets easily. Prior to OGR, farmers were suffering from acute shortage of funds. They had no money to buy even the seeds, let alone buying other things. Government recognized this genuine problem of farmers and initiated doling out cash to the cashless farmers for their immediate needs as credits at low interest rates. The cash in the hands of farmers helped them move away from seeking money from local, blood-fleecing moneylenders bringing much needed financial independency.

Also, Indian farmers were suffering from lack of fertilizers, as what they used was of age-old type without the study of soil. So there was rampant usage of wrong fertilizers and because
of this, produce lacked nutrients. This was fixed by distributing modern fertilizers based on the result of the soil test.

The government started up many agricultural colleges across the length and breadth of the country. The result was - increased agricultural professionals who in turn passed the modern knowledge of farming to the farmers.

The collective efforts of the government, volunteers, and private players made OGR a thumping success.

As a result, quantity of coarse grain, sugarcane, vegetables, and fruit cultivation grew phenomenally high. Similar tasks were taken up to boost vegetable oil, fisheries and poultry output. By 2014, India became world’s second largest producer of sugar, wheat and rice. Also in fruits, India ranks one in top 5 in the world.

Similarly, ‘Operation flood (OF)’ was kick started in the late sixties to boost milk production, with a mission to make India a milk surplus nation. OF too became great success, as it helped in boosting milk production to great heights.

So, success of OGR and OF programs made headlines in many international dailies and it changed the image of India for better permanently. Officials from many countries even today visit India to understand these programs and see how they can adapt in their countries.

M S Swaminathan, who is fondly called as ‘father’ of green revolution led OGR mission from the front and became a national ‘hero’. He had very supportive government officials, bureaucrats, Industry leaders, volunteers and others. They all worked in cohesion to make India’s mission OGR a grand success.

Likewise Varghese Kurien is termed as father of OF, as he led the team of bureaucrats, officials, farmers and others from the front to make India a milk deficient nation to world’s largest producer of milk, surpassing the USA in 1998.

Tireless efforts, perseverance and hard work of these dedicated people made them finally achieve what they set out for.
© Manufacturing Industry: Transformation from low-end to high-tech knowledge based.

Massive investment on agriculture necessitated government to build dams and network of canals. This led to the investment on infrastructure industries like cement, steel, fertilizers, coalmines, power, heavy equipments, defense to guard the borders etc. By the end of 2014 India became fourth largest steel producing country in the world, fifth largest power generation country in the world, has third largest road network in the world, so on and so forth. Though things could have been much better, yet it is not that bad to be rubbed off either.

Newer railway lines were laid to connect these manufacturing industries to the markets; airports were built in 4 metro cities initially and extended to all the state capitals later on. Sophisticated defense industries were started up with Russian collaboration to manufacture battle tanks, fighter aeroplanes, ammunitions, electronics panels, radars and many more like that. Big industries were put up to make electrical equipments and machineries required to produce and distribute the electricity across the continent sized country. Some of the big industries that were started by the government were Bharat Heavy Electricals Limited (BHEL), which makes giant electrical transformers, turbines, switchgears etc. Similarly, Bharat Earth Movers Limited (BEML) was started off to make earth moving equipments like dumpers, loaders etc. They are used in mining industry. BEML has got into a collaboration agreement with a South Korean company to locally manufacture urban metro train coaches. The government began generating and selling of thermal based electricity to distribution companies through National Thermal Power Corporation (NTPC). Also many factories to manufacture railway coaches, engines and tracks were started. Steel mills to process raw steel were built. Ship building units like Cochin shipping limited, Garden Reach shipbuilders ltd were commissioned. Likewise many more government owned companies were established throughout the country to usher in the prosperity.

In the private sector, players like Larsen & Toubro (revenues: over USD 12 billion, Rs. 72,000 Crore), setup in a small way in pre-independence era, steadily expanded throughout the 20th century and became multibillion dollar conglomerate. So are Hindustan Construction company (revenues: over USD 1 billion revenues, Rs. 60,000 Crores), Reliance Industries (revenues of USD 70 billion, Rs. 3.5 lakh Crore), Shapoorji Pallonji (revenues USD
2 billion, Rs. 12000 Crores) so on and so forth. The private companies were started by individuals to tap the local opportunities. However they were operating strictly under the government’s license regime, as license was required to get into any sort of business by private parties. This compulsory licensing affair had put a lid on to their soaring aspirations, as getting licenses involved splurging money and having connections with government officials.

This license saga continued till government partially opened up Indian economy through reforms in 1991. It was then private companies saw no-holds-bar growth in their business, as India opened up her economy for business to external world. Sensing the opportunities, all the world’s major machinery makers made beeline to sell in the Indian market. They spent billions in building local manufacturing setup as importing the machines was a prohibitive affair. This was how India saw her manufacturing sector maturing from pre-Independence days in the early 20th century till the dawn of 21st century. However the full throttle takeoff of this sector hasn’t happened yet, and following policy changes/ projects will usher in the same.

**Policy on National Manufacturing Investment Zone (NMIZ)**

What seems to lend credence to the belief that India’s manufacturing sector is poised for a big takeoff is the NIMZ policy. Manufacturing is being given perk up by government by unveiling slew of incentives through a new NMIZ policy. Under NMIZ, companies that want to manufacture in India catering to local as well as export markets will get great support in the form of tax breaks. Land acquisition laws are being amended to suite this action plan. Even the much politically painful labour laws too are being tinkered to suite the requirement.

**Delhi Mumbai Industrial Corridor (DMIC) Project**

Government’s most ambitious project so far is DMIC, which involves linking of Indian political capital with financial capital through expressways, high-speed cargo and passenger trains. The entire stretch will have manufacturing zones of various sizes, futuristic cities, offices etc and is being declared as NMIZ. This project will be implemented through public and private initiatives with active participation from the Japanese government. The project will see more than USD 100 billion (Rs. 6 lakh Crore) investments and may take 10 years to complete. Already activities for the first phase of this project have begun.
Chennai Bangalore Industrial Corridor (CBIC) Project

Similar to DMIC, another infrastructure project that is taking off the ground is CBIC. Through CBIC 2 South Indian state capitals, Chennai and Bangalore will be linked. CBIC too will involve similar infrastructure facilities as DMIC and may end up drawing more than USD 100 billion in funding. The due diligence for this project is done and found to be viable. So, the first stage work will start by the end of 2015 or early 2016.

High speed Rail (HSR) Project

Japan’s Bullet trains which can travel at 500 Kms (315 miles per hour), which Indians fancied all these years, will finally see the light in India too in a decade or two. Government is seriously considering giving it a shot, by building high-speed corridors across India. HSR was earlier not considered for implementation due to its high costs. Now the realization has set in the corridors of power that in order to surge ahead in 21st century, HSR network for a country as big as India is must. Hence concerned authorities are working to chalk out the finance, land and other details and preparing preliminary report for the project.

So, for all those who are generally negative about India, there is a hope that all will be well in the future. India will see lots of jobs opening up through NMIZ policy initiatives in the coming years. Added to this are the southern and western industrial corridor projects – with innovative cities, offices, schools, five star hotels, malls and others. This will change India for better permanently. It may take more than 2 decades to get implemented, but it will indeed happen.

Though innumerable people contributed to revolutionize Indian manufacturing sector, a few of them are listed below for convenience. These people worked with passion, dedication and determination to make this happen.

- Dhirubhai Ambhani & sons - founders of Reliance Industries,
- Founders of Larsen & Toubro (L&T) – a US$ 11 billion conglomerate as of 2013 and its current chairman A Naik
- Jumsetji Tata – founder of USD 100 billion TATA Empire,
- JRD Tata – Founder of Tata Consulting Services, Titan Industries, Tata Motors, Tata Tea & Voltas – Infrastructure company
- Ratan Tata – former chairman of Tata group
Peak Performance Solutions

- Pallonji Mistry of the Shapoorji and Pallonji group
- India political leaders like Pundit Jawaharlal Nehru, Sardar Vallabhai Patel, Indira Gandhi and many others including the bureaucrats.
- Founders of government owned Steel Authority of India (SAIL), Bharat Heavy Electricals (BHEL), Bharat Earth Movers Ltd (BEML) etc.

**Automobiles Industry, India’s fast lane to success:** From the 1940s to mid 1990s, India produced only 3 varieties of cars under controlled environment. People had to wait for years to lay hands on their cars. If someone wants a car on urgent basis, he has to shell out extra, as cars were available at a premium. Even used cars could fetch good returns if maintained well. There was similar situation for scooters, bikes and other varieties of automobiles. It was such a pathetic situation to be in India back then. Several suggestions made by eminent industrialists to the Government for opening up automobile industry fell on deaf ears. It looked like government was not relenting to the idea of open economy.

However as destiny wanted it, things started looking up after the government partially opened up Indian economy in 1991 to tide over economic crisis. Thus began India’s modern automotive revolution when the Industry started taking baby steps towards excellence. What speeded up this journey was the government’s initiative to strengthen the foundation of automotive industry by deepening and widening it. The government gave tax-breaks for all locally manufactured automobiles and also gave huge incentives to private players for doing automotive Research and Development (R&D) in India. The incentive package extended to all sorts of automobiles, be it Commercial Vehicles (CV), passenger cars, scooters, motor cycles etc.

This refurbished investment environment attracted who’s-who of world’s biggies to base their manufacturing units in India. With the availability of cheap yet talented labour force, they (automobile companies) even started exporting Indian made products to more than 180 countries, including the quality conscious western nations. The acceptance of India made products by these nations is certainly a big achievement in itself, as Indians never got exposed to modern manufacturing practices earlier. This talks about the sheer diversity of talent available in India as they (talented manpower) can churn out good quality stuff at low production cost.

Peak Performance Solutions
National Automobile Testing and R&D Infrastructure project (NATRIP)

For any country to become hub for global car and CV, the country should have sophisticated quality infrastructure for testing and proving the roadworthiness of newly designed automobiles.

Government is setting up NATRIP precisely for that and these centers are being established at various places at an outlay of US$ 1 billion (Rs. 6000 Crore). NATRIP is being touted as world-class infrastructure with first world facilities at third world rates. This project has created curiosity all over the world.

With the efforts from government agencies, private entrepreneurs, engineers and many others, India became world’s 6th largest passenger cars and commercial vehicles manufacturing country by 2014. India manufactures over 4 million automobiles as of 2014. It is expected that by 2025, India will be world’s third largest automobile market.

Not only India manufactures passenger vehicles, but also lot of research work is happening there too. Almost all the International automobile giants like Daimler Chrysler, Ford, General Motors (GM), Hyundai, Renault Nissan, Fiat, Suzuki, Toyota have their research centers in India. These centers work with their counterparts in other countries in building state-of-art futuristic vehicles.

India’s frugal engineering prowess.

It is generally said that when it comes to cost of production, China, Vietnam, Thailand and others beat India hollow. However when it comes to cost of innovation, India beats them down. That means, Indian workforce may not be as disciplined as others when it comes to mass production, but when there is a knowledge based manufacturing that requires constant changes in the design and innovation, India offers the best value for money.

Indians’ frugal engineering skills came to the limelight when Tatas launched ‘Tata Nano’ the world’s cheapest, yet modern car. It is available for USD 3000 (Rs. 180,000) now. When Ratan Tata announced in 2003 his intentions to make and sell cars at a price of USD 1800 or Rs.1 lakh per unit, people thought he was joking. No one took his statement seriously as people in the industry felt that with escalating cost of commodities; it was just his wishful thinking to sell at that incredibly low cost.

However as adage goes, “Great leaders will not follow others path, but they create one”, Ratan never thought conventionally like others to make this car. He had his own way to do it. It was the totally out-of-box thinking by his amateur designers and engineers that brought
this car from design board to road. The car when launched had slight cost variations due to unavoidable circumstances, yet the actual price on road was not much higher than US$ 1800 that he promised in 2003.

After Ratan Tata did it, others followed him to work on similar products. Big automotive MNCs wanted a car that is inexpensive yet state-of-the-art. These cars, they wanted to launch in emerging markets including India where the demand for such low priced car is great.

In fact, boss of Renault Nissan – a combined entity, has already formed a crack team in Chennai, India to work on frugally engineered low cost car. This car, he claims, is being conceived, designed, developed and manufactured in India for the world.

Frugal engineering is not limited to automobiles; GE R&D in Bangalore has brought out many India designed medical equipments that cost one-tenth the normal cost. It is true with Phillips, Samsung, Sony and many more companies like that.

Though government bankrolled the automobile industry initially, the current buzz in the industry can be attributed to the successful local automakers like Tatas, Mahindras and Marutis along with thriving auto component makers. Not to miss is the contribution of hardworking, and intelligent manpower.

A small list of people handpicked from countless ones who were directly responsible for this change is given below.

- Anand Mahindra: Chairman and Managing Director of Mahindra & Mahindra (M&M)
- JRD Tata: Chairman of Tata Sons, Founder Tata Motors, Tata Steel,
- Ratan Tata: Ex Chairman of Tata Sons, Tata Motors & Tata Steel
- Cyrus Mistry: Chairman of Tata Motors
- R C Bhargava: Chairman Maruti Suzuki Ltd.
- Jagdish Kattar: Former Managing Director of Maruti Suzuki Ltd.
- Baba Kalyani: Chairman of Kalyani Group of Industries- Makers of auto components
- Venu Srinivasan: Chairman TVS Motors.
© India and her proposed General Sales Tax (GST):

Though continent sized India is democratic with independent state governments and Central government in Delhi, all the economic policies, External affairs, military force are handled by the center. States and center have their own tax structures like Octroi – A tax levied in some states on various goods that enter a town or city, Excise duty – It is tax levied on good manufactured within the country or a tax levied on production or sale of products. It is even called as ‘Central Value added tax’ or ‘Cenvat’, Value Added Tax (VAT) – It is the tax imposed by states at the consuming end, Service Tax – Tax on service rendered at consuming end.

The colonial mindset and working style exists even in post independent India in government and bureaucratic circles. Hardly there has been any radical tax policy revamp in the last 70 over years. Whatever tinkering was done with the tax structure was like band-aid or plaster approach with the core remained untouched.

As a result, each state government levied multiple indirect taxes for revenue at varied rates and resorted to taxing the entry of goods at the border. So the net result is that, prices of the Products and Services (P&S) shoot up phenomenally high, making them unaffordable to the buyers. Also, because of states tax the P&S at varying rates, the cost of P&S varies from state to state. This divides Indian markets into small fragments leading to competitive disadvantage making India a group of states with small markets with several tax policies.

What is the solution for this? How to fix it? – Answer is GST – A unified General Sales Tax (GST) - GST may be defined as a tax on goods and services, which is levied at each point of sale or provision of service, in which, at the time of sale of goods or providing the services, the seller or service provider may claim the input credit of tax which he has paid while purchasing the goods or procuring the service. This simplifies the tax structure, as P&S is charged only at the point of consumption. As the tax rates are same, the price of P&S will be common in every state. This unifies the states into one common big market.

Though the discussions have been carried out from the year 2000, nothing concrete could emerge, as GST structure had to take into account the complexities of continent sized country.

However as of 2014, most of all the major issues have been ironed out except for the fact that states are demanding compensation from central government for five years from the
date of implementation of GST. The state governments fear that they may lose out on tax revenues due to new GST regime. There needs to be an "independent mechanism" to look after the perceived revenue loss and compensation issues, current central government is building one as of 2014.

If governments work in tandem, India should see the launch GST latest by 2015/16. The Information Technology infrastructure is being readied at brisk pace for this. Government has contracted Tata Consulting Services (TCS) the multibillion-dollar, task of computerization of all income tax offices across India, and connecting each of them with a central hub through fiber optic. Digitization of all previous data, which is in the paper file format, is going on at rapid pace, and if no new issues crop up, GST should roll out finally in 2015 after more than a decade of discussions.
How GST will benefit the Indian economy?

GST will benefit all stakeholders – Industry, Central and state governments, traders and consumers.

- It will reduce the cascading effect of taxes on cost of P&S, which in turn makes P&S competitive and cheaper. GST will free up the barriers for the flow of goods freely within the country with improved supply chain and logistics. This will lead to accelerated Gross domestic product (GDP) as economy grows further.

- GST will reduce the overall cost of P&S by 15%, reducing the inflation by increasing the supply due to free movement of goods. Cost of P&S will be same across the country.

- GST will increase the revenue of the government by increasing the tax base. State and central governments will get an additional of USD 30 billion (Rs. 180,000 Crores) every year. This figure is based on 2012 GDP numbers and it could grow as economy grows.

- GST will remove the tax distortion from the economy leading to sustainable higher growth. Simple tax system will attract more productive investment and growth.

GST itself will increase the GDP growth by 1.5% on an average. So, Indian business tycoons, government officials and common man are obviously anxious to see the implementation happening successfully latest by 2015.

A few of the key players

- Sushil Kumar Modi and all others who have been relentlessly working hard to ensure India enter into GST regime at the earliest.
(d) **Infrastructure: marching at snail pace into the future**

**Highways/ Expressways**

From the post independence period, there was hardly any investment on roads. At that time leaders must have thought that having some kind of road connectivity is important, not the quality of it. So, most of the roads were either single way or two ways ridden with potholes. Traveling from one place to another was a pain in the back. The industry was losing millions of dollars because of the snag in the infrastructure. Government decided to fix it, so in 1998, the former Prime Minister Mr. Atal Bihari Vajpayee initiated huge expressways and highways building program. His government called it as ‘Golden quadrilateral’, meaning the expressway that connects 4 largest metropolitan cities in the 4 corners of the country. The length of the expressways that were built was of 6000 kilometers (3728.23 miles), out of which 99% is completed as of 2014. This brought the cities nearer and made travelling a pleasure. Now Indian government has embarked upon making all the roads connecting each of the cities into 4 ways. It is also true that progress of some of the road projects have been abysmally low due to many factors including the bureaucracy. Difficulty to acquire lands, obtaining loans at low interest rates, project management issues are some problems that are glaring at stakeholders, and they have resolved to solve. The projects are expected to pickup the speed in 2015 onwards. By the end of 2015/16, majority of these projects will see the light, thus boosting India’s GDP up by an estimated 1.5 notches. These road projects are being implemented with huge investments – in billions of USD.

**Port infrastructure**

From the beginning, India lacked modernized ports. When other countries were flaunting their advanced ports with state-of-the-art automatic loading and unloading machines, India was stuck with its age old labour intensive inefficient ports. It was the muscle power of these labourers and their discipline that determined the turnaround time of the ships. Having realized the pitfalls, Indian government initiated great investment drive in capacity building in the port sector in the late nineties. This involved enhancing and expanding the existing ports and creating new ones at strategic locations. This work is still going on as of 2014. Though there have been lots of hurdles earlier, they are being cleared one after another, slowly paving the way for inflow of big money into port sector in the coming years. Already existing ports have seen some amount of automation; still they do not match the
efficiencies that western ports have. However, Indian ports are getting there. Already the journey towards excellence has begun, and it is a matter of time before Indian ports too become as efficient as those, which have been Internationally benchmarked for highest efficiencies.

**Metro rail Infrastructure (MRI)**

Indian cities always lacked the punch when it came to public transportation system, when compared to their counterparts in other countries. Post Independence, somehow Indian leaders never felt the necessity to overhaul the Infrastructure of Indian cities. So, there was huge chaos with littered neighborhoods, congested roads, traffic jams, power and water supply cuts etc in the cities. This could be because, Indians were poor and their entire struggle earlier was to survive somehow. So, naturally the quality of infrastructure was least of their priorities.

All these changed in the 1990s with the opening up of Indian economy to foreign capital and their products and services. This resulted in the creation of huge jobs in India making Indians richer compared to their earlier generations and made them assertive. They now started demanding for better infrastructure facilities in the cities and started voting for those people and parties who can bring about this. So, the political leaders saw the 'writing-on-the-wall' that to get reelected they have to do something about it. The government finally loosened the strings of its wallet to fund infrastructure projects.

This was how Indian cities started seeing billions of dollars to beef up their infrastructure projects. One of them was state-of-the-art local MRI. There are more than 12 cities where MRI work has gotten off the ground with an average investment of USD 7 billion (Rs. 42,000 Crores). This has thrown up big business opportunities for the companies all over the world. Government is trying to provide better transportation facilities to smaller cities that do not qualify for metro rails. In the future, living and travelling in cities will be that much comfortable.
**Power sector:**

**Generation Issues**

One of the main complaints any visitor to India makes is about the power outage that plagues the cities on a daily basis. Though India generates 242.5 Giga watts (4th largest in the world) of power through hydro, thermal, gas, atomic, wind power and solar-based medium, there is still unquenched thirst for more power and results in power outages. These outages if analyzed properly, we come to know that they are because of shortfall in power generation and inefficient management. This inefficiency led to Transmission and Distribution (T&D) loss and power theft at consumer end.

There are some policy glitches with respect power generation as of 2014. The coal mining is in Government’s control and due to old mindset and labour union issues; coalmines haven’t seen much of modernization. The policy to let private companies into coalmining hasn’t brought in new private investments either, due to various other issues. This resulted in subdued new power addition.

However the government has woken up from slumber and started working to clear the coalmine mess. The actions that have been taken by the government of late have slowly started boosting the investment sentiments as of 2014. Since the intent is there, there is certainly a hope that government will continue mustering enough strength in the future too to clear the coalmine mess. Shortage of locally available good quality coal was said to be one of the main reasons for under performing of power sector.

**Transmission woes**

Apart from generation issues, nearly 30 percent of power produced is lost while transmitting and distributing to the consumers. This inadequate power generation and inefficient power distribution resulted in power blackouts to the tune of 15 hours in worst cases and 2 to 3 hours a day in best cases in Indian cities. This loss has hit the power sector bottomline by USD 6 billions (Rs. 30,000 Crore) annually.

T&D representing Demand side management is the key to the efficient usage of power. We have to use power responsibly as it is not endless like sunlight or the sea waves. Reckless usage of power is causing ecological degradation too. This has become a drag on the world economy. All the transformers, and the components that go into substation grids are very obsolete in India. Some even dates back to fifties and sixties and because of this, substation...
management has been laborious process and is very inefficient. This adds to the transmission loss.

**Distribution anomalies**

Also, distribution loss is due to wide spread power thefts and pilferage. The faulty meters at homes have become serious migraine to the power utilities. Government has realized the issue, though very late, started taking steps by piloting ‘smart grid’ concepts at few of the cities. This involves replacing old mechanized power meters at homes with the latest ones and educating people about efficient power usage by teaching them the best practices. This smart grid also involves modernizing substations and transformers by adding intelligent systems, which can route the power from surplus side to deficient side automatically. At any given time, we can know the exact information of power units produced, units consumed on a real time basis. So, the key to minimize T&D loss is to manage T&D smartly. When that happens T&D losses can be brought down to international level.

**Power sector Reforms (PSR)**

Power sector in India is plagued by competitive populism (CP) to appease people for voting political parties to power during election. CP means, doling out electricity at low rates to people irrespective of high production, transmission and distribution (T&D) costs. The distribution agencies (DA) are government owned and they take loans from International agencies to bridge the losses. Because T&D is considered as service to people and not as profit oriented venture, DA’s kitty is always empty. This explains why transformers, substation and other gears are obsolete and inefficient in India. They need urgent overhaul in order to save the entire power sector from brink.

International agencies have stopped extending loans to the government, as funding such a leaky sector is like throwing good money into bad. They instead are ready to fund if India reforms her power sector. Thus started power sector reforms in 2003 and it is still going on amidst push and pull of various political parties due to varied reasons. However these political parties are more willing to execute it now than earlier days. So, PSR will see the light soon.
As such PSR entails huge efforts to make DA operate on a commercial terms rather than on an obligatory basis - offering services to citizen. PSR emphasis taking whatever steps required turning power sector into efficient and self-sustaining one.

**Smart Grids (SG)**
PSR also advocates piloting of SG - A smart grid is a modernized electrical grid that uses analogue or digital information and communication technology to gather and act on information. The information can be about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity, in small way and if found ‘OK’ use it across the country.

So, ball has been set to roll already, pilot projects of SG are showing encouraging results, and with this, central government eventually push PSR harder at state level. In fact it is heading in that direction, and may take 10 to 15 years to fully revamp the Power Sector (PS) of Continent size India for good.

The PS will see an investment spree to the tune of US$ 1.25 trillion (over Rs. 10 Lakh Crores) between 2015 till 2030. Whenever a government takes up in the center with heart to reform the power sector with clear policies, there will be no stopping the turn around of power sector. So naturally corporates are excited about it with fingers crossed till such a government is formed.

**Internet Infrastructure**
From the beginning Indian villages lacked the kind of infrastructure Indian cities always boasted of. Be it in housing, clean drinking water, electricity, good roads, schools, hotels, telecommunication and now Internet connectivity.

For decades Government tried to bridge the gap between urban and rural, but no substantial improvement could be brought upon there. Some of these projects failed either because the policy framework was bad or because the delivery to the last mile was erratic. Either case, the money invested went into drains, benefiting none.

When world entered the mobile communication and Internet era, Indian government well determined this time, wanted to play its card right. While auctioning the airwaves to grant mobile communication licenses, government's tender document had exclusive clauses for obligatory servicing of rural areas. This was a well thought out plan to bring the
connectivity to remote India, and it did exactly that. The mobile companies laid fiber optic cables connecting village panchayats (councils) to taluks (Tehsil or subdivision of district) and each taluks to districts and each districts to state capitals. This created a mesh of network connectivity across the length and breadth of the country.

As a result of this, by the beginning of this millennium, rural folks started flaunting their mobile phones as cost of ownership fell to record low. The wholesale markets (Mandis) are far away from villages, so there are Internet kiosks introduced in every village. Paid operators manning every kiosk assist villagers to know the pricing of their agricultural crops on the computer. There is connectivity between the Mandis and to the district headquarters. With 2nd Generation (2G) mobile network in place and smart phones are available cheaply, farmers are able to transact their farm business over mobile phones, that too sitting at home. What is aiding these is the available of the farm business applications in local languages. However connectivity is still an issue that is being fixed slowly.

**National Optic Fiber Network (NOFN) project**

To take internet connectivity to the door step of the common man in the rural areas, Government has drawn up another ambitious plan to roll out fiber optic network and provide 3G and 4G broadband connectivity to 250,000 village panchayats (councils). This is because; inspite of private players investing in billions of dollars to roll out network connectivity, still massive areas of rural India remain unconnected. The private players show keen interest when there is nice remuneration for every penny invested on such network. Unless there are urban centers like business opportunities in rural areas, private telecom players won’t show keenness in the rural investment. Creating business opportunities takes time as it is linked to lot of other activities that stimulate some kind of income generation in rural people.

Government cannot treat rural areas that way as they have obligation to fulfill. That was how NOFN project was conceived.

The investment required for NOFN is to the tune of USD 5 billion (Rs. 30,000 Crores) and this will give massive boost to local manufacturing industry. As per the clause, whoever wants to bid to this project, has to have local manufacturing operations, as government wants to pick up only ‘Made in India’ products for this project. The mandate is to complete this project by 2015 ~ 2016. Once completed, this will change the face of villages in India.
forever. With the Internet infrastructure ready, people can create incomes out of it and this in turn results in boost in the income of the rural people. So, there is certainly a glimmer of hope at last to bridge the urban and rural divide and rural side of India too will see prosperity, albeit lately.

**RuPay: India's own e-commerce payment gateway**

**Hard cash based payment system:**

In India the business payment has always been through hard cash. It will not be wrong to say that this has been the case from over a Millennium. There is however a problem in this kind of cash transaction system – it is cumbersome to operate and expensive to handle. The cash in the form of notes needs to be printed, and the cost of printing sophisticated, security enabled notes is going over the roof. Once printed, it requires huge areas to store, with increased risk of stealth. Once the cash is released in the market, it moves from person to person and in between, to the banks. So, in the process, cash may get soiled or physically damaged, which demands trashing and reprinting. Also, the cash based transaction is slow and cumbersome – the merchants have to physically deposit the cash in the bank on a daily basis. Even the buyers need to carry cash before leaving home to the market, which involves risk of stealth. The soiled notes – this happens when notes exchange hands, may carry bacteria and virus. So, if we touch notes, hands may get dirty and require washing to keep hands clean. If not, there is serious risk of health hazard.

Also, it is a big deal to deposit hard cash into the accounts of banks located in another cities. Cheque deposit takes minimum of 3 working days to complete the transactions. If the bank accounts are in rural areas, it may take minimum of 10 days for cash to get physically transferred. In between money is on the move, neither banks benefit nor the customers.

**Electronic Payment system**

World over the difficulties associated with conventional payment system were mitigated by introducing electronic payment system. Payment gateways like Visa and MasterCard have come up in a big way to handle business transaction across the globe. They handle cash electronically rather virtually. This has dramatically reduced cash transaction across the western world. The transactions, the above-mentioned payment gateways handle is in billions of USD. The Visa and MasterCard gateways enable electronic transactions in India too. Their network is restricted to only Metros and big cities, that too with big merchants.
This is because their charges are too high. Petty shop owners even in big cities find it expensive to accept payments through cards. The money charged by the above said foreign payment gateway companies take it outside India, resulting foreign exchange outgo. It is a loss to government’s exchequer.

**RuPay: Indian Electronic Payment Gateway**

Government of India lately recognized the problems faced by not having own electronic payment gateway initiated indigenously developed payment gateway network called – RuPay. It was developed and launched in April 2012 by NPCI - National Payment Council of India – A pioneer organization promoted by Reserve Bank of India (RBI) – India’s central bank, to provide anytime, anywhere payment solutions to citizens. RuPay is similar to Visa or MasterCard, except that it will be widely used for payments within India and accept Rupees. The mandate of RuPay is to make electronic payment affordable and accessible to all and sundry across the length and breadth of India. RBI has released RuPay accredited debit card, which enables micro transactions. One can withdraw money below 100Rs. denomination from ATM and pay in similar denomination to merchants.

This will encourage even small merchants to accept electronic payments. As the cost of ownership is next to nothing, it will encourage people to use their debit cards for purchases. It has happened in big cities and now it will happen in small cities and villages too. To make this happen, government is trying to procure 2 million point-of-sale (POS) terminals – the instrument that enables payment through cards, and distribute to merchants across India.

The ongoing broadband rollout, optical fiber connecting 250,000 panchayats (councils) and wireless broadband taking on the last mile challenge, will provide connectivity. Now, with RuPay based payments, India could well soon see a cashless revolution unimagined even a year ago, which would lower costs and enhance security and transparency, all leading to better governance.

**Contribution**

Lot of people's hardwork, dedication and passion has gone into modernizing India's infrastructure and bring it to where it is today. Their relentless hardwork with never-say-die attitude has worked wonders for India. There are many who still are silently working
even to date amidst all the gloom-and-doom driven by corruption and economic stalemate. Hats off to such people and Indian people should be grateful to all of their sacrifices. A few of them are listed below.

- A M Naik – Chairman of Larsen Toubro,
- Founders and other leaders of Bharat Heavy Electricals Limited (BHEL), a Government owned US$ 10 billion enterprise.
- E Sreedharan – One who built railway network on seemingly impossible Konkan region of India’s west coast. He also was responsible for putting up one of the few best-managed Metro rail networks in Delhi.
- Founders and other leaders of National Thermo Electric Corporation (NTPC) – a government owned US$ 13 billion entity.
- Dhirubhai Ambani – Founder of Reliance Industries and its leaders.
- Many Corporate and Government owned companies and their star performers.
- Reserve Bank of India (RBI) past and present governors and all others officials have been working in ushering in financial reforms.
- N. R. Narayan Murthy – Ex Chairman of NPCI and founder of multi billion dollar Infosys limited.

(e) Pharmaceutical Industry: Transformation of India’s pharmaceutical industry into the world’s 3rd largest by volume and 10th largest in dollar value.

Birth of Pharma Industry – Initial years
In the 1940s and 1950s India had severe shortage of drugs and even medicines to treat common fever, cough and cold were imported. This was costing a lot to the exchequer as worldwide the majority of pharma sector has been in the private hands and they charged sky high for their drugs because they claim it takes them a lot to invest on researching and developing the same. So India, with its poor masses never had the wherewithal to buy such costly imported drugs to survive. Few individuals sensed this opportunity and started making simple drugs locally. They learnt to make copycat products by reverse engineering the drugs and vaccines imported from big pharma companies, and were quite successful. These reverse engineered products are called ‘Generics’ in Pharma lingo. Their success
didn’t go unnoticed by the Government, so it framed the laws that encouraged patenting of product process not the product itself. This was because; India was a poor country with huge population. Patients couldn’t afford the high price for the patented products, which the original innovator justified for recovering the millions of dollars spent on the product development. So, Indian then Prime Minister Mrs. Indira Gandhi finally passed the law in 1970 that protected the product process paving the way for the birth of vibrant indigenous pharma generics industry.

**Growing up blues**

Though India’s pharma Industry was born in the early 1960s, it acquired the necessary strength and maturity only in the coming decades. Throughout 1970s and 1980s pharma industry grew at phenomenal pace and acquired the respects from everyone. By the turn of millennium, there were over 20,000 pharma companies in India and several of them were World-Class by International standards. They have been supplying inexpensive yet high quality drugs and vaccines to the world.

In 1960s and 1970s, the Government with the aim to have self-reliance in pharmaceuticals started a couple of scientific institutes, like National Institute of Pharmaceutical Education and Research (NIPMER), Central Drug Research Institute (CDRI), Hindustan Antibiotics to make penicillin and others to do research on diseases and ailments that have been common in India. The diseases included Malaria, TB, cholera, chickenpox etc. and the ailments like Diabetes, cardiac treatment, blood pressure, Arthritis and many more.

A few drug and vaccine manufacturing companies were set up by the government and encouraged private players to invest heavily in drug research and manufacture facilities. Though none of the Indian pharmaceutical companies came out with innovative drug so far, but they did reverse engineering of patented drugs and turned India to be a hub of generics.

**Maturing of Pharma Industry**

Technologically strong and totally self-reliant, the Indian pharmaceutical industry in the new Millennium became world famous for its low production costs of high quality drugs, while having low R&D expense. This was achieved due to the availability of superior scientific manpower, strength of national laboratories and government policies. Indian pharmaceutical industry today is ranked world class, in terms of technology, quality and
range of medicines manufactured. From simple headache pills to sophisticated antibiotics and complex cardiac compounds, almost every type of medicine is now made indigenously. In fact, Indian generics account for 30% of the US market and are critical to President Barack Obama’s affordable healthcare program. Data from the 2013 Generic Drug Savings in the US report shows generics saved the US health system a staggering $1.3 trillion in the most recent decade.

The Indian pharma industry accounts for 6% of the global pharma industry in value and 25% in volume. And vaccines made in India immunize one in every three children around the world. Indian drug industry is called "The Pharmacy to the World", as she caters to the affordable drug requirements of all most all the countries around the globe.

Accomplishments

Achievement of Indian pharma industry has been phenomenal. It is not just Indians who are reaping the benefits of it but the industry’s ripples are felt elsewhere too. Though pharma industry achieved many feats earning international accolades, a handpicked few of them listed below.

HIV/ AIDS drug

If worldwide the number of HIV infected people is down to 2.3 million in 2012, a record low in a decade, it is because of highly quality affordable Indian drugs.

United Nation Program for HIV/ AIDS (UNAIDS) – the world body that assists in eradicating HIV/ AIDS epidemic, has credited India for helping world battle AIDS. When UNAIDS called for help on behalf of poor nations, India responded by extending the helping hand and supplying the generic version of patented ‘antiretroviral’ drug. This immediately brought down the cost of AIDS treatment from USD 10,000 per person per year in 2001 to USD 69 per person per year in 2013. More than 85% of the high quality, low priced drugs for battling HIV/ AIDS come from India. African countries have benefited a lot from this.

Polio Vaccine

Government achieved major breakthrough when dreaded disease like polio was eradicated from India in 2012. Success was brought after a long drawn battle for more than 10 years. The mission was carried out by combined efforts of Indian government and its private drug
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makers. Over two million volunteers went door to door of over a billion people vaccinating the children. The result is eradication of polio from India by 2012. The World Health Organization (WHO) hailed it as “being the most impressive global health successes that has ever been”. WHO wants to replicate it in Pakistan, Afghanistan and Nigeria, the remaining 3 countries in the world that suffer from Polio.

**Anti Diarrhea vaccine - Rotovac**

Another milestone for India is the launching of indigenously developed ‘anti-diarrhea’ vaccine that affects kids from poor families living in unhygienic conditions. The vaccine is christened as ‘Rotavac’ that costs only a US$ (Rs. 54), a fraction of what similar vaccine costs in western countries.

The vaccine Rotovac is affordable, safe and effective, besides being specific to the virus that causes diarrhea in India. Rotavac is a new rotavirus vaccine that consists of a strain of the virus that was isolated, manufactured and tested in India. The trial represents a significant victory for India’s scientific community. This vaccine will benefit more than 100,000 children who die due to gastroenteritis - stomach infection in India alone.

**Tuberculosis (TB), Malaria & Cholera eradication program**

After the roaring success in eradicating the polio in 2012 from India and now the success of Rotovac, government is ecstatic about the prospects of developing vaccines to tackle TB, Malaria, cholera and other tropical diseases that affect Indians. Since tropical diseases per se do not receive much attention from multinational companies, there is a need for Indian pharma and vaccine makers to focus on them.

This shows how a simple need for cheaper medicines led to making of vibrant pharma industry. When government and people collectively wkr for common cause with no selfish gains, universal health can be achieved. India is showing the world how it can be achieved inspite of all the hurdles. Though the Indian pharma policies are not as good as expected, but it is getting better. With the involvement of private sector, government hopes to achieve excellence in healthcare in the future.

**Whirlwinds in Pharma Industry (PI)**

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PI is seeing some troubles with respect to series of product rejections in USA as of 2012/2013 and 2014 by FDA. These events have created severe dent in the credibility of Indian PI and stakeholders are seriously discussing on how to overcome these quality issues. Somehow they figured out that awareness about quality standards is not percolating to the shop floor worker level the way it should. Also quality cannot be just the mantra of management alone, rather it should be in the DNA of the organization to seep into every department, into each and every individual. So, unless quality becomes an obsession with every one connected to the Industry, the problems cannot be solved on permanent basis.

Having identified the root cause now, the PI majors have begun slowly fixing the product quality issues to close the chapter once-and-for-all.

Contributions
The contribution to the PI from private sector individuals and the visionaries from the public sector has been outstanding. One point to note is that these people achieved this feat when odds were totally against them. They continued their hardwork with passion without getting bogged down, and ultimately raised the profile of PI to international level. Their sacrifice attracted worldwide accolades with United Nation (UN) partnering PI of India to tackle the diseases affecting poor countries. Though there are many who contributed to the pharma success, a selected few are named below for convenience.

- Dr. K. A Hamid – founder of Cipla limited
- Dilip Shangvi – founder of Sun pharma limited.
- Dr. K. Anji Reddy – founder of Sr. Reddy’s laboratories
- Bhai Mohan Singh – founder of Ranbaxy limited
- Kiran Mazumdar – Shaw, founder of Biocon limited, and many more people like them.

Transformation of Health Care (HC) Industry
Brief history
With the success of pharma sector, another sector that is raring to go is the sector of medical treatment or healthcare. This sector is making giant strides as the demand for quality medical treatment is going up and so are the opportunities. Earlier Indians used to
travel abroad for almost all of the medical treatments, and this trend was more or less, continuing till mid eighties. Most of the government hospitals lacked expertise in the treatment and were ill equipped. They were plagued due to the paucity of funds. India, post independence severely lacked good hospitals. There were a few hospitals started by private businessmen and trusts in mid seventies. These hospitals were only catering to rich and privileged. They were not equipped to treat all the ailments, but for only a few. So, flying abroad for treatments was very common among the rich people while poor used to just either live with the ailment or die.

**Beginning of private hospitals**
Since the government couldn’t provide quality healthcare, in the eighties it encouraged private players to set up hospitals. Way back in 1983, Pratap C Reddy an internationally recognized cardiologist started corporate hospital “Apollo Hospital” in southern Indian city Chennai. Being in the private sector, he could draw young and aspiring doctors to his team at Apollo. His new venture created buzz in the corporate circle and encouraged others too to do similar things. Government finally noticed Dr. Reddy’s venture and his ability to provide high-class medical treatment in India at Indian costs, decided to support it.

**Mushrooming of private hospitals**
With the backing of Indian government, others too started corporate hospitals in almost all the metro cities like Mumbai, Delhi, Bangalore, Hyderabad, Kolkata and Chennai. These hospitals under the management of young doctors turned entrepreneurs, with lots of inner fire and enthusiasm, brought in technologies from the west and improved upon them. They introduced systems and processes such that cost of medical treatment fell drastically even when quality standards were inching upwards. Brimming with confidence, these hospitals decided attracting patients from abroad, even from western countries. To do that they quickly got their hospitals accredited to international healthcare quality standards. Later they tied up with advertisement agencies to market their quality healthcare services abroad. This brought in enough international patients to make medical tourism industry as big as 2 billion USD (Rs. 12,000 Crores) as of 2014.
Innovation in healthcare services
The story of Indian corporate hospitals offering international quality services is old news now. However, latest news that is making rounds in international healthcare circle is that, one of these hospitals is providing same quality services at incredibly low cost. This is very interesting, as it attracted professionals in hordes to learn the secret. Let's know in brief about this hospital.

‘Narayana Hrudyalaya (NH)’ – A hospital in Bangalore, which has championed itself for bringing factory model of mass production to its hospital chain, claims to have brought down the cost of cardiac surgery to mind-blowing USD 1,300 dollars. That is one-tenth the cost of what it would incur in USA. The package includes 2 days patient’s stay in the hospital too. This is unbelievable, yet true. The story has made into headlines of the major business and medical journals across the globe. There are many books written about Dr. Devi Shetty of NH and his incredible leadership skills that made NH what it is today. Let us not delve into it here.

Spread of HC facilities beyond Metro cities
The corporate hospitals after establishing in Metro cities are moving to Tier II cities starting up hospitals there too. This is making quality health care accessible to the people in smaller cities. Though it is a commendable job, yet it touched only miniscule section of the society. Now government has roped in ISRO, Narayana Hrudyalaya and other hospitals to bring in telemedicine facility in order to increase the reach. This is very innovative approach, which Indian scientists and doctors brought to health care Industry. It is still in piloting stage. If this is successful, government has plans to replicate it in a massive way. So, more people in the remote and small cities can get low cost quality health care facilities in the future. These hospitals in Metros, after specializing in the treatment of ailments are now attracting patients from various countries by flaunting their low cost and high quality treatment model.
So, what was started-off as a small initiative by Indian government to attract private players into HC sector really paid off, and went on to become an industry on its own employing millions.

A few of the key people who helped shapeup India’s healthcare sector are listed below.
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- Dr. Anji Reddy – Founder of Dr. Reddy's Laboratories.
- Dr. Habib Khorakiwala – Founder of Wokhardt limited,
- Dr. Kiran Majumdar – Founder of Biocon Limited.
- Dr. Desh Bandhu Gupta – Founder of Lupin laboratories
- Dr. Devi Shetty – Founder of Narayan Hrudayala
- Dr. Pratap C Reddy – Founder of Apollo Hospitals.
- Many founders of other private and government run companies/ institutes.
(f) **Education sector:** From the state of deprivation to creation of world class Institutions like IITs and IIMs.

**The beginning**

In the late 1940s there were no good educational institutes in India. The leaders understood that for India to prosper, establishment of Higher Technical Institutions are must to propel industrial development. On a recommendation by a 22-member committee headed by Nalini Ranjan Sarkar, first of India's 16 Indian Institutes of Technology (IIT) was started way back in 1950 at Kharagpur in West Bengal state.

In a matter of few decades, several of now famous IITs were quickly set up and were governed through an act called Institutes of technology passed in 1961. Government took all efforts to make IITs the 'temples of modern India' and strived to remain so for generations.

**Accomplishments of IITs**

IITs are now known for their outstanding students who are famous for their leadership skills and risk taking abilities. Their contribution to the corporate world is significant, and they are behind some of the major startup success stories in Silicon Valley of America. Mrs. Hillary Clinton, who was secretary of state in American president Mr. Obama’s first presidential cabinet, endorsed the IITs in 2011 for their power to produce world-class engineers.

In fact, in its latest research report titled "Top Universities Producing Venture Capital (VC)-backed Entrepreneurs", PitchBook – providers of Private Equity, Venture database and Research reports, has claimed that IIT Alumni (IA) started 77 companies, which received first round of VC funding between 2010 and 2013 in USA. So, IA ranked 10th in the PitchBook’s research while Stanford University topped the ranking with 190 companies. (Source: [http://blog.pitchbook.com/top-universities-producing-vc-backed-entrepreneurs/](http://blog.pitchbook.com/top-universities-producing-vc-backed-entrepreneurs/)). Surprisingly no alumni from other country are listed in their top 10 ranking. Such is the contribution from IIT alumni and they command lots of respect in VC circle.

So, it is natural that many TV documentaries have been made on these institutes in America and elsewhere and, it explains their stature in brief.

**Indian Institute of Management (IIM)**
In 1950s when many banks, manufacturing units, power plants and the like were started as public sector enterprises (PSE), government faced dearth of managerial talent in India. That was when, under the guidance of Professor George Robbins (PGR) of University of California; All India Institute of Management Studies (AIIMS) was established. Also government started 2 elite business schools in 1961, one in Calcutta city called IIM-Calcutta (IIMC), and other in Ahmedabad city called IIM-Ahmedabad (IIMA) as per the recommendation of PGR.

IIMC was established in collaboration with MIT Sloan School of management, USA and IIMA with collaboration from Harvard Business School, USA. In the later decades another 12 such premier management schools were started in India, and they collectively went on to produce some of the best managers, leaders, entrepreneurs and thinkers. In the span of 25 years, some of these IIMs became most sought after business schools in Asia Pacific Region (APAR). In fact, IIMA, IIMC and IIM Bangalore have been listed in top 10 business school rankings of APAR for the year 2013/2014 (Source: http://www.topmba.com/mba-rankings/region/asia/2014#sorting=rank+custom=298491+order=desc+search=). This is really a great achievement for a country that once had no business school and had to take outside help to establish one.

However after establishing these temples of education, there were no attempts to create similar institutes in other domain. Somehow, education got slipped out of the priorities of the policy makers. Though there were a few institutes started later by the government, but quality leaves much to be deserved.

Similarly elementary education too got slipped out of priority list of the government and has been in shambles.

**Earlier attempt to privatize education met limited success**

Private sector stepped in to fill the demand-supply gap by establishing some institutes, but they too didn’t create any impact in the society. With no proper policy for private participation, most of these players started the institutes for only availing tax breaks. Since their aim was to invest in education sector for tax saving, they (private players) didn’t show interest in providing research driven quality education. Hence, the curriculum got obsolete and over the years, infrastructure got creaky too due to the sheer neglect. As a result, entire
education sector got into rut. Students found it worthwhile to study elsewhere. So there was exodus of Indian students to foreign shores. Government, having realized the policy anomaly in education sector has begun to set it right. But it is too little too late. The cost of hard infrastructure like campus, buildings and teachers has become prohibitively expensive now. It requires billions of dollars of investment and is time consuming to build ground up. The soft infrastructure like contemporary curriculum is very difficult to come by over night. So, government is in tight spot.

**Use of Broadband to deliver education**

In the meanwhile some leaders came by and proposed a revolutionary concept. That is to record the best lectures of eminent teachers, lecturers and professors, digitize and use broadband to deliver them. The curriculum for higher education can be hosted at education websites and delivered to the students' computers through broadband. This can be done with least investment, as what it needs is technology - third generation (3G) and fourth generation (4G) broadband connectivity and application to make these lectures interactive. It is inexpensive and does not take much time to implement. The idea was wholeheartedly accepted by the government and has immediately started piloting this in some institutes. The result has been encouraging so far and it requires ironing out some small issues. When perfected this has the ability to create ripples in the society as it could bring IIT class education to even institutes in smaller cities. Government is serious about changing education sector landscape in the years to come.

**Delhi University’s unique experiment**

In order to reform higher education, in 2013, government owned Delhi University (DU) came out with remarkable changes with its under graduate (UG) curriculum. The UG program is now extended to 4 years instead of 3 years earlier. The curriculum is made more practical and contemporary with emphasize on project work. Students get to learn during the project work in the live environment. This way they will be more employment-ready than earlier.

If this DU’s experiment is successful, other universities in the country too will follow suit. When that happens, more and more youth will be employed, which in turn lead to prosperity of the society.
**Private Educational Institutes and Universities**

Government is now encouraging corporates to get into education sector to setup private universities by collaborating with reputed International institutes. Necessary policy incentivizing the corporates to strengthen the ailing education sector has been in the making for quite sometime and will be passed anytime soon.

Already Azim Premji, the founder of Wipro Technologies, India’s 3rd largest IT Company, has pledged USD 2 billion (Rs. 12,000 Crores) to create environment that trains teachers. His charitable trust has spent money in building primary and secondary schools in remote places of India. His university is being implemented outside of Bangalore in an area of 500 acres. The university will offer contemporary higher education on par with the best Universities of the world at fraction of cost.

Similarly, Manipal group has also got into building University City near Bangalore with schools, colleges etc. So is Amity group, Shiv Nadar group, Tata group so on and so forth. Many more companies are waiting to get into education sector and looking at government for clear guidelines. Some even are offering infrastructure to train the teachers.

Government’s clear policies with tax breaks to lure business houses into education sector will do the trick this time around. Lot of deliberations are going on with respect to the proposed policy.

The government is also negotiating with banks to make sure students, especially poorer ones get education loans at very low interest rates. The intent is to make quality education affordable to everyone, not only to rich and privileged ones.

**Contribution**

India has taken baby steps towards overhauling its education sector once-and-for-all, and the changes will take, may be, 10 years or more to be felt. This is because for a continent sized country with over a billion people, things cannot turnaround overnight. So, by 2025, India’s education will certainly be looking lot better.

Though many people have contributed passionately to strengthen the education sector, a few of them have been listed below for convenience.

- Founders of Indian Institutes of Technology
- Founders of Indian Institutes of Management
- G D Birla – founder of BITS Pilani group of educational institutions
Peak Performance Solutions

- Dr. T Madhav Pai – Founder of Manipal group of institutions
- Mr. Azim Premji – Founder of Azim Premji University.
- Mr. Shiv Nadar – Founder of Shiv Nadar University.
(g) **India’s Space Odyssey**: From modest beginning in the 1960s to world’s sixth largest space power in 21st century.

**Brief history**

The space race between Americans and Soviets in the 1950s and 1960s, and the subsequent Neil Armstrong's lunar mission to the moon created tremendous interest in many countries. Other nations too wanted to have their own space agencies to explore the outer space. One among them was India. Though Indian space program was started in 1962 under the leadership of Dr. Vikram Sarabhai, it was in 1969 the program got credibility when Indian Space Research Organization (ISRO) was established by the Indian government. Initially ISRO worked on building experimental satellites and launched them into the space with the help of Russians. But later on when the geo politics, due to cold war reached the dizzy heights, collaboration suffered. Hence ISRO had to have its own program to design, develop and propel satellites into space. What was started as a pilot project to build and launch small satellites with Russian help in the 1960s, went on to become one of India’s greatest success stories. ISRO became the sixth largest space agency in the world by 2013 with even sending satellites into moon and mars. The kind of recognition and adulation ISRO has earned from its peers internationally is commendable.

**ISRO spearheading India’s Information Technology revolution**

ISRO does all sorts of sci-fi works locally and has become India’s backbone, supporting her successful journey towards the future. Consider this. Telecommunication, cable television, radio broadcasting, Internet connectivity, Tele-medicine, E-education, E-Commerce, weather forecast and other revolutions, which India is witnessing now, has been made possible by ISRO. Though undersea cable connectivity is also helping India in ushering these communication breakthroughs, but majority of contribution is coming from space infrastructure through ISRO. India has one of the largest constellations of remote sensing satellites exclusively launched for the civilian purposes. It has built and launched metrological satellites into the space to study earth's atmosphere.
**Exploration of celestial bodies**

**Mission to moon**
In 2008, ISRO successfully launched unmanned mission to the moon to probe its atmosphere and conduct experiments there. Also ISRO has plans to land a rover on the moon by 2017. The gap till 2017 is justified to perfect the technologies and build the infrastructure required for it. If that happens, it seems more likely so, India will be 4th nation to launch such a mission after USA, Russia and China.

**Mission to Mars and Venus**
ISRO has now set its eyes on ‘Mars’ by launching unmanned vehicle to Mars on 05th November 2013. The satellite is speeding very fast on its 6 months journey towards that celestial planet. By September 2014, the same is likely to reach Mars.
The objective of India's Mars mission is to understand Martian atmosphere using indigenously developed scientific instruments. Through this mission, ISRO team wants to get experiences in deep-space communication & navigation, inter planetary mission planning and management.
The exercise is enormously complex, as India has never done it before. However the team at ISRO is cautiously optimistic that it will be successful.
Also, in the near future, there is a program to send experimental satellites to Venus to study the atmosphere there, and launch a solar mission to probe and study the Sun.

**GPS and Geo-Augmented Navigation system (GAGAN)**
Also in the cards is the launch of series of satellites to the space to create Indian version of European Union’s European Geostationary Navigation Overlay Service (EGNOS) or Japan’s Multi-functional Satellite Augmentation System (MSAS). Indian version is called GAGAN. It is to enable the aircraft pilots to have better maneuverability over the air space of South and South East Asia, Middle East and even extend till African continent.
GAGAN will help by providing tailor made data for all the airlines flying over South East Asian airspace in general and South Asian airspace in particular.
Jointly developed by the ISRO and the Airports Authority of India (AAI), the GAGAN system will offer seamless navigation to the aviation industry.

**Benefits of GAGAN**

Peak Performance Solutions
GAGAN will improve flight efficiency for airlines, it can get direct point-to-point flight routes; can help airlines save on fuel. Also GAGAN can help airlines by giving vertical guidance at airport runways. There will be significant cost savings due to withdrawal of ground aids and reduced workload of flight crew and Air Traffic Controllers.

**ISRO's International recognition**
In two to three decades of establishing ISRO, the organization has gained such versatility that many foreign space agencies seek ISRO's help to launch their small satellites cost effectively. ISRO helps in detecting and tracking cyclones, hurricanes and other such disastrous phenomena and provides data to various countries so that they can make contingency plans. ISRO is also launching satellites to map Indian cities to do better planning.

One thing that makes people sit-up and look through amazement is the fact that ISRO does all the works at one-tenth the cost of other space agencies.

**Contribution**
ISRO Leaders, Scientists, Government officials and Private players worked shoulder to shoulder to bring ISRO to where it is today. Governments changed, years rolled on, world changed but for the people working at ISRO, their zeal to bring success never diminished, but rather grew. Ultimately the sacrifices of these people have propelled India to 6th largest space power in the world – a feat, which a few countries can boast of.

Though legions of people contributed to the success of Indian space program, a small list of luminaries are listed below for convenience.

- (a) Dr. Vikram Sarabhai
- (b) Homi Jehangir Bhaba
- (c) Dr. Satish Dhawan.
- (d) Dr. U R Rao
- (e) Dr. Kasturi Rangan
(h) Information technology (IT): Backbone of India’s multibillion-dollar service industry

**Brief History**

By late 1950s the world was transforming from manual labor to automation. International Business Machines (IBM), a maker of mainframes computing machines had successfully launched early mainframes to process huge data and to run critical applications. Along with punch card systems, mainframes started becoming central to everything - be it Industries, government departments and Institutes.

Realizing the importance of modern education, with the blessings of the then Indian Prime Minister late Pundit Jawaharlal Nehru, first Indian Institute of Technology (IIT) was established in 1950 on the lines of the famous Massachusetts Institute of Technology (MIT) of USA. Soon, in a span of a decade, 6 such IITs were opened in various parts of the country. Within a decade of their establishment, by 1970s, India could produce third largest scientific manpower after USA and Soviet Union. Students who studied in IITs went to USA and other developed countries as they (those countries) had liberal immigration policies. They became very successful there. So, in 1960 around 10,000 Indians immigrated to USA and took citizenship.

**IT Revolution: The beginning**

With the forward thinking technological leader Mr. M G K Menon at the helm in 1970s, and with the support of United Nation Development Program (UNDP), a policy was formulated to plan and strategize setting up of regional Informatics centers in India. The purpose was to bring the awareness among the public about the informatics related technological revolution, which started sweeping the western world. National Informatics center (NIC) was launched in 1975 and was his (Mr. Menon) brainchild. NIC centers at various Indian states started having linkup with academia in 1980s to impart knowledge of Information Technology. Government later set up wide area computer networking schemes, like INDONET (To connect various Mainframes in India), NICNET (network to connect various centers of NIC) and ERNET (a network connecting various academics and R&D centers).

The launching of these institutes made tremendous difference in the informatics education in India. By late 1990s, its success resulted in global leadership of Indian entrepreneurs and
computer scientists in software development. It is said that the American technological lead is contributed by the brainpower of immigrants; among them a majority are Indians and Chinese. The immeasurable contribution of thousands of highly educated and brilliantly trained Indian immigrants, in every area of American scientific and technological developments, led the unleashing of the Information technology (IT) revolution in the USA. They were mostly associated with Silicon Valley startups in California during 1980s and 1990s.

**IT Revolution: The maturity**

Though Government sowed the seeds of Indian IT industry, these seeds germinated and grew up to become gigantic trees through private initiative and support. The small startups in 1970s and 1980s like Tata Consulting Services, Infosys Technologies Ltd, Wipro Limited, Cognizant limited and many more such companies went on to become Multinational companies (MNC) by 2014 employing hundreds of thousands of engineers bringing USD billions in revenue. The overall revenue of Indian IT industry is about USD 110 billion (Rs. 6.6 lakh Crores) in 2014 and is expected to reach USD 250 billion (Rs 15 lakh Crore) by 2022. The revenue of the same was nothing to write about till late 1980s. From almost nothing to 110 USD billion in revenues in 30 years flat, is mind blowing.

Most of the Indian entrepreneurs - founders of the above mentioned (MNCs), in 1970s were all highly educated, very ambitious and were raring to go. Some went to USA for higher studies and got into working on Mainframe projects and later on started their ventures there. Some others had their humble beginning in India, though they used to travel abroad on work initially. This was followed with launching of their small ventures in India. Throughout eighties and nineties, American and Indian business horizon was dotted with many startup companies founded by Indians, either on part or full ownership basis. Throughout the eighties Mainframe work was ruling the roost, later Internet phenomenon began, these companies quickly adapted to work on Internet technologies and by the end of the last century, Y2K projects drew Indian companies in droves to work in USA. In the process they made a lot of money and in the new millennium, their focus got into newer technologies like

- Enterprise Resource Planning (ERP) implementation,
- IT Consulting, Business Consulting,
- E-Commerce, Cloud applications,
Peak Performance Solutions

- Internet Security,
- Software as a service (SaaS),
- Data mining and Analytics,
- Integrated chip (IC) design,
- Social media,
- Electronic Engineering Design and Manufacturing (EEDM),
- Mobile applications and many more technologies like that.

**MNCs who lined up to exploit Indian brainpower**

To take the advantage of the technically qualified and hard working manpower, IT biggies of the world like IBM, HP, Accenture consulting, Dell computers, Cap Gemini, Intel, AMD, CISCO, Yahoo, Google, Microsoft, SAP, Texas Instruments, Siemens, Motorola, Huawei Technologies, Lenovo computers, Samsung, Sony, Alcatel, Nokia, General Electric (GE) and many more such companies based their largest or second largest employees in their Indian subsidiaries. They all make use of Indian manpower to bring about innovation in their products and services they offer to their clients at the least possible time.

In fact, Indian IC design or semiconductor design industry, which does pure vanilla engineering design for MNC IC companies, has revenues exceeding USD 15 billion (Rs. 90000 Crores) in 2013. This chip design industry employed approximately 200,000 engineers in 2013 with quite a majority of them doing high-end, sophisticated and state-of-the-art technology work.

By 2014, India has who's who of world's finance and consulting biggies like J P Morgan Chase, Price Water Coopers (PwC), Bain and Company, Standard Chartered bank, United bank of Switzerland, Rabo bank, Credit Suisse, Goldman Sachs and many others who have established backend units in India. These organizations do backend jobs on their own in India or outsourced to any company with Indian base. The employees at these backend centers, called ‘Business process outsourcing’ (BPO) units help their parent companies to have ‘lean and mean’ operations, so that they can cut across the choppy waters of international competition with relative ease.

CISCO has globalization center – it is termed as second world head quarters at Bangalore. Some of their key business leaders work out of Bangalore center. Similarly GE has its second largest research center in Bangalore. Scientists in this center do research on pure science and develop technologies that will be launched five to ten years from now. Shell, Exxon,
Saudi petrochemical company (SAAB), DuPont so on and so forth have based their huge research campuses in India with scientists hired in thousands to conduct cutting edge research and development.

**Indian IT’s Hollywood connection**

It is known that legions of Indian employees do the west’s busy work – filling out tax forms or transcribing doctors’ dictation or help industries streamline their operations etc. What is relatively unknown is India’s romance with Hollywood that has started very recently. Read on.

India is now quietly entering a preserve of high-end creativity previously out of its reach: Hollywood. While Los Angels sleeps, Indian visual effects artists are silently making Superman fly, Spiderman climb up the high rise building, convert horses into centaurs for Narnia, and plant animated Garfield in the hands of a live actor. In 2009 when ‘The chronicles of Narnia’ was nominated for ‘Academy award’ for the best special effects, there was a mood of upbeat in India. This was because; a 75-member team in India significantly contributed to the visual effects for the film.


It is not just visual effects work happens in India. Animation work, post and pre-release editing work; supplementary work like quality control (cleaning up of non-digital prints), translation, dubbing and even subtitling happens too.

The attraction or lure of India is that, it is very cost effective to get the work done there. Hollywood studios find it very lucrative to use young, hardworking and talented Indian manpower, as they can provide “low cost – high quality work”, which is comparable to the ones done in Los Angeles, but at a one tenth the cost. Going forward the Hollywood’s association with the Indian companies will get bigger and bigger, brining in the much-needed efficiency, innovation and cost saving to the world’s largest film industry by revenues and profits - Hollywood.

**Indian IT services support to pharma and healthcare industries of the world.**
Apart from what mentioned above, Indian IT and BPO industry is helping world's big pharma giants to conduct clinical trials for their drugs very efficiently at low cost. Many companies in India have Pharmaco-informatics divisions exclusively catering to this opportunity and are doing a good job. Health care Industry in the west too has Indian contribution for their efficient operations. So, in a nutshell, we can roughly say Indian software companies and Indians are helping companies around the world prosper. This tells how ‘indispensable’ the Indian IT service industry has become to the world. It is said that, if hypothetically any country attacks India and if these companies’ operations are disrupted, share prices of their parent and client companies will tank globally. Such is the dependency of Indian engineers for these biggies. The doomsayers however write obituary to Indian outsourced IT business as they claim outsourcing is getting peaked and will be history soon. But these young Indian engineers in the late twenties or early thirties, having tasted success, will not embrace the ‘failure’ and go back to their homes to sleep forever. They will come back and adapt to the newer model that will replace outsourcing eventually, and may lead it from the front. Such is their confidence and hunger for success.

**Contribution**

What a transformation Indian IT industry has seen in a span of 40 years. What seemed impossible was made possible by the legends whose names have been listed below.

- Narayan Murthy - Founder of Infosys Technologies,
- Nandan Nilekani – Co-Founder of Infosys Technologies,
- Phaneesh Murthy – Ex-CEO of IGate,
- N Chandrashekar – CEO and Managing Director (MD) of Tata Consulting Services,
- Azim Premji – Chairman of Wipro corporation,
- Ashok Soota – Former founder of Mindtree technologies and Current founder of Happy Minds technology services.

There are many more leaders who have shouldered the responsibility of transforming IT industry in India. In fact, the IT industry rests firmly on the solid foundation these leaders have laid and continue to attract hordes of youngsters with incredible fire to succeed.

(h) **Engineering services: India’s latest money spinning sector**

Peak Performance Solutions
India produces the world's highest number of graduate engineers – half a million, every year. Unfortunately majority of them need proper grooming to be employable in the industry. However those who are good to be employed are really good and talented, and it is they all companies scramble to hire. These folks are easy to be groomed, trained and deployed on projects of significance to the companies.

Many MNC and Indian Engineering companies use them to design and engineer their Petrochemical plants, oil refineries in India and elsewhere. Looking at the huge talent pool, even products engineering companies across the board have started hiring local engineers for their works.

Generally works in following domains are outsourced to India.

- Aerospace,
- Automotive,
- Construction,
- Electronics & Tele Communication,
- Semiconductor design services,
- Electrical engineering,
- Pharmaceuticals

**Why do companies outsource?**

Companies outsource in order to bring their products to the market at lower cost and at increased speed & efficiency. This is because their work is getting increasingly complex; hence they (MNCs) require more helping hands to finish their job on time. So, these MNCs look for talent around the world and take their work wherever they see the skilled manpower. India with her large concentration of English speaking engineering talent outside UK and USA, falls naturally in their top 5 list. That’s how many MNCs are located in India doing all sorts of engineering works in the domains listed above.

However to feel the pulse of intricate work that is happening in India, let us consider Aerospace domain and briefly study the works of MNCs – Honeywell Inc and Airbus Group, happening there.
**Aerospace engineering: Honeywell’s experience in India**

India has huge talent in the aerospace engineering. One needs to listen to Honeywell’s global president ‘Shane Tedjarti’ to believe it. His company’s aerospace engineering strength in Bangalore is highest in its worldwide operations. As per him, aerospace strength is India is 3000, and what excites him is that 150 out of 2000 of Honeywell’s worldwide flight control engineers are in India. Flight control engineering is very complex and sophisticated, and it takes atleast 10 years of grueling hardwork to get there. Flight control is the nervous system of the aircraft. To work on it one needs to understand the aero structure, the electronics, every element of aircraft design and its flying behaviors and figure out how to control it. All these intricacies need to be incorporated into the flight software to operate and control sitting inside the cockpit cabin. Imagine the complexities these engineers are subjected to.

The kind of work that happens in Honeywell’s Indian operations is breath taking; consider this, The Boeing 777 airliner’s cockpit including the avionics, the other electronics and the display units have been done in India. Also Boeing 787-Dreamliner – the most sophisticated and largest aircraft ever attempted by Boeing, had 80% of flight control work done in India. Some of their flight control engineers get their flying licenses before they actually begin working with the machines themselves. So, it is now understandable why every tom-dick-and-harry can’t become a flight control engineer.

Highlighting the importance of India for companies like Honeywell, Shane adds “if you want a few hundred engineers, you can get them in any country, but if your need is in thousands, India is the only place to be”. Honeywell Technology Solutions (HTS) is an R&D division that works on futuristic products and technologies. HTS has a center in Bangalore with over 11,000 engineers. Unbelievable, yet it is true.

As a market for aircrafts, India with a population - over a billion with 500 million people whose mean age is below 25, is huge. These aspiring and restless young folks will become future air passengers. So, India needs approximately 1000 aircrafts to service its mobile citizens by 2022. It is very exciting time for anyone to be in airline business in India.

**Aerospace engineering: Airbus group’s experience in India**

Quality of aerospace engineers and the big Indian market for aeroplanes - both civil and military, has attracted many aerospace firms to establish sales, manufacturing and R&D
operations in India. One among such companies is Airbus – Europe’s largest aeroplane maker.

India primarily houses 2 global R&D centers and they are as follows

- **Airbus Defense and Space Engineering center** – This center was setup in 2011 to do engineering work related to Defense and Space industry. The center is located in tech capital of India – Bangalore. The ingenuity of the engineers working here was demonstrated when they indigenously designed and developed ‘Reduced Vertical Separation Minimum’ (RVSM) compliant Altimetry system. RVSM provides highly accurate altitude readings to aircraft systems through a structurally integrated antenna for aircrafts. This has been quite a big achievement for the team, as the product was developed in record time of 2 years from the day the center was inaugurated. India made RVSM is being sold worldwide.

Similarly, Engineers at Airbus group Innovations – a group working on cutting edge futuristic technologies, are working on state-of-the-art research projects like Cognitive Radars. Many patents have been filed for this work and also many articles have been published in reputed journals.

- **Airbus Engineering Center (AEC)** – This center was setup in 2007 in Bangalore to utilize the abundantly available local talent to develop products and services for aerospace industry. The center specializes in high-tech aerospace engineering and works close with AECs around the world. The skilled engineers and scientists at AEC India work in developing advanced capabilities in Flight Physics and Structures. They also work on validation and verification through DMU as well as system simulation testing, which are critical factors in design and production of high performance aircraft such as A380 and A350 XB.

Also, engineers at Airbus R&D center, co-located in AEC, work in areas such as Aerothermics and Cloud computing.

- **Airbus offshore software development centers (OFDSC)**: Airbus houses 2 OFDSCs in India; one is co-located at CADES – Product Design and Research Company for Aerospace Industry, center in Bangalore, which is working on Fuselage. Other center is co-located at the premises of Quest Ltd – Product Design & Engineering Company, in Bangalore too. This center works on aircraft wings.
Apart from these, Airbus group collaborates with many Indian universities and other institutes to jointly work on projects. As a matter of fact, it has tied up with Tata Institute of Fundamental Research (TIFR) and opened a chair entitled “Mathematics of Complex Systems” to work on advanced mathematics. With IITs, group is working on many research projects, which have applications in Homeland security and Unmanned Arial Vehicles (UAV). Also, in October 2013, the group signed a letter of intent with Indo-French Center for Promotion for Advanced Research (CEFIPRA) to fund Aerospace related projects in Indian Universities and Institutes.

As per Yves Guillaume - India president Airbus, having robust engineering footprints in India helps Airbus to bring their products to market faster at a competitive price. The team in India also helps Airbus develop custom made solutions to their clients in aerospace and defense sectors for global markets. This talks about the kind of raw talent India has to offer to Boeings and Airbuses of the world. In fact, NASSCOM – National Association of Software and Service Companies of India, has stated that India’s current outsourced Engineering Research and Development (ER&D) industry is 15 billion USD (Rs. 90,000 Crores) as of 2015. The figure is likely to touch staggering 45 billion USD (Rs.270, 000 Crores) by 2020, so naturally a money-spinning sector.

Contributors
The credit to make use of abundant talent should certainly go to local IT czars, who first spotted opportunities for these skilled people in outsourced engineering work. Looking at the strides made by Indian companies by using locally available raw talent, MNCs too joined the bandwagon to utilize local talent. This kicked in the outsourced engineering revolution in India and it happened in mid 1990s.

A few of the trendsetters are listed below for convenience

- Narayan Murthy, founder of Infosys Ltd,
- Shiv Nadar, founder of HCL Technologies,
- Ajit Prabhu and Aravind Melligeri, founders of Quest engineering solutions,
- Azim Premji, founder of Wipro InfoTech.
(i) **Biotechnology: India’s baby steps to the future of healthcare**

**Brief History**

Before the advent of modern pharmaceutical industry - a system based on synthesized chemicals, man was always relying on nature for treating all his ailments. The herbs, fruits, berries, twigs and nuts always formed the backbone of his therapy from time immemorial. Even living animals like fish; birds and insects were being used in rare occasions though to treat ailments.

It was from mid 19th century after when man learnt the fine art of synthesizing chemicals; a foundation for modern chemical based pharma industry was laid. The pharma industry got a leg up during World War II when most of the vaccines to treat Malaria, Cholera, Chicken/small pox and others were invented. With the coming of anesthesia to treat and operate wounded soldiers in World War II, and its effectiveness in managing pain, pharma industry got well established. Added to this is the arrival of painkillers, steroids and other drugs, which deepened man's dependency on this novel industry, relying less on his traditional biology based treatment.

**Why this switch happened?** – Answer is biology-based treatment using herbs, berries etc. takes time to treat the ailment, unlike chemical based. Also what aided the switch is that there is hardly any database on this kind of treatment and not much is known about ingredients used. The previous generations passed on the knowledge mostly through word of mouth, though there are a few written records available. But the modern pharmaceutical industry has extensive data recorded on each of the elements used in the drugs, their application, clinical treatment records, side effects if any, so on and so forth. This increased the confidence and so is his reliability on the drugs.

However man’s quest for biology based treatment was always there and it was during the World War II, when the structure of genes was well revealed, his curiosity to tweak and play with the DNA inside the genes resulted in what is now called Biotechnology (BT).

**Biotechnology (BT)**

BT is an area, which deals with genes - every living being has genes – they are akin to videotapes, which are long and where data is recorded in the form of magnetic particles.
The genes too are long, but here the genetic data is encoded in the form of DNA. Both the video and genes data can be copied (cloned), edited (recombined). The DNA can be briefly explained as follows,

DNA - It consists of long strands of nucleotides linked together in a structure resembling a ladder twisted into a spiral. DNA is self-replicating, plays a central role in protein synthesis, and is responsible for the transmission of hereditary characteristics from parents to offspring.

The tweaking of this DNA of microbes, plants, animals and humans with the purpose of getting better result is broadly classified as biotechnology. Following are the main application of BT.

**Microbes:** Changing of DNA of microbes has resulted in better yeast for breads, bacteria for making yogurt that has enhanced shelf life. Also modified DNA microbes find their application in ecologically balanced industrial detergents and cleaning up city's pollution like sewage.

**Plants:** The genetically modified rice or wheat variety can grow rice and wheat enriched with vitamin ‘A’, which helps in prevention of child blindness. Iron can be enriched in cereals to help boost iron content in the blood of consumers.

**Animals** The biotechnology can increase the ability for livestock and pets to overcome diseases. Also genetic modification can help boost the nutrition in the animal feed which leads to healthy livestock.

**Humans:** Through advancement of biotechnology, we can know what factors determine the wellness or disease in humans. By knowing the conditions that leads to disease or ailments like diabetes, arthritis etc. we can intervene in between and change the condition that leads to ailments. This is possible through lifestyle changes, better nutrition and other approaches. Diagnostic tests will determine this in humans.

**Indian biotechnology scene:**
India with its huge pool of scientists and engineers, cost effective manufacturing, enterprising people and supportive government makes an attractive biotechnology destination. India ranks one in top twelve bio hubs of the world. In Asia pacific it is ranked third after Japan and China and has recorded a revenue figures of over USD 5 billion (Rs. 30,000 Crore) in 2014.

The Indian biotechnology can be divided into following segments
Bio-Pharma: Pharmaceutical companies introduce innovative and patented drugs in the world market. Generally they are priced high initially for some period to earn back the billions spent in developing the drugs plus some profits. These drugs are too expensive for the poorer nations to buy for their patients, so generics products evolved. Generics are reverse engineered products of patented original innovator drugs. They cost much less and are sold in those countries where pharma product and process patenting rule is not applicable. India is one of them, though there are some changes made to its patent laws as per World Trading Organization’s (WTO) requirements lately. These generics too are chemical based and are subjected to lengthy clinical trials. It is because of this, some complex generic drugs are still out of reach of many, as they are expensive.

On the contrary, Biopharma, comprising of Biosimilars is bio-engineered products of animals or microbes and are atleast 25% to 40% cheaper than generics, as they require less stringent clinical trials. Since it is biology-based drugs, the rejection ratio by the human body, which is also biology based, is less. These biosimilar drugs will be more effective for treating the human ailments than the others, as the body accepts them easily. However since these genetically engineered products are complex to make, they require world-class expertise, state-of-the-art infrastructure using expensive and futuristic equipments.

There are 15 companies in India that make Biosimilars and they find their usage in Human insulin, Erythropoietin, Human growth hormone, GCS-F and Streptokinase. Indian Biosimilars are atleast 40% to 80% cheaper than their counter parts in the west.

To know the achievements of Indian biotech companies, consider this.

There are 4 companies that make bio vaccines. They are

- Serum Institute,
- Shantha Biotech,
- Bharath Biotech,
- Panacea Biotech.
They together export to over 150 countries with Serum Institute being world’s 5th largest vaccine maker and export 50% of its produce to UNICEF/WHO.

The cost of Hepatitis B vaccine fell from USD 15 per dose to USD 0.3 per dose because of the innovations of Shantha Biotech.

Serum Institute’s ‘Nasovac’ – Influenza vaccine is priced at USD 3.5 per dose when the current market prices were hovering around USD 10 per dose. As a result, vaccine price came down drastically in the international market. Bharat Biotech (BB) launched India’s first indigenously developed, cell cultured H1N1 Swine Flue vaccine ‘HNVAC’. This vaccine is first to be manufactured in cell culture, a highly sterile and controlled manufacturing process, instead of eggs. BB has also indigenously developed ‘ROTOVAC’, rotavirus vaccine at USD 1 per dose. This vaccine will prevent a part of approximately 100,000 child deaths due to Rotavirus diarrhea, and improve global access to better Rotavirus vaccine. There are many more similar stories attached to the accomplishments of Indian companies.

Key players in Biosimilars are as follows

- Glenmark,
- Biocon,
- Intas,
- Reliance Lifesciences,
- Avestagen,
- Lupin,
- Dr. Reddy’s,
- Cipla,
- Bharath Biotech
- Shantha Biotech.

**BIO Services:** Bio services comprise of outsourced Contract Research (CR) and Clinical Trials (CT). India is major center for conducting outsourced CR in biotechnology sphere for the global and domestic Biotech companies, as a part of drug discovery chain. Following are the new companies that have been started up with the intention to use Indian brainpower to conduct contract research.

- Semler,
- Advinus,
- Aurigene,
Clinical Trials (CT): Whenever a drug is developed and found to be promising after it is used on animals like mice, the pharma companies start conducting trials on humans. Generally there are 3 phases in CT, but in rare cases it may exceed it. The minimum criterion for conducting CT in any country is that, the country should have patients in big numbers. India qualifies to be hub for CT. The Phase I & II of CT take place in any country, and having established the effectiveness of the drugs on the patients in two phases, the phase III is conducted. The phase III is conducted in all the countries where the drug will be sold. This is because; the success of the drugs largely depends on race of people and genes. What is effective on patients in India or any tropical country may not be effective in cold countries like Canada, USA, Finland etc. They need tuning up of the drugs to cater to their race, living conditions etc. India has good number of qualified companies that can handle all the phases of CT for companies. They are listed below

- Quintiles,
- Omnicare,
- Manipal Acunova,
- Ecron Acunova,
- Siroclinpharm.

Indian Bio services industry (CR and CT) is about USD 1.2 billion as of 2014 and is expected to reach approximately USD 5 billion in 2020. With more than 10 companies actively involved in Bio services, future looks promising for Indian Bio services industry.

Bioinformatics and Computational biology (B&Cb): Computational biology is the study of human body and it's functioning using computational techniques. Its goal is to learn biology; knowledge about living beings using computers. It is basic science by discipline.
Bio informatics on the contrary is creation of computational tools (algorithms, databases) to solve the bio problems. The goal is to build tools on the computer to work on enormous amount of biological data. It is pure engineering by discipline.

Indian B&Cb market is more than USD 75 million (Rs. 450 Crores) in 2014 and is projected to cross USD 100 million (Rs. 600 Crores) in 2015. Some of the key players are

- Ocimum,
- Strand Lifesciences,
- Connexios,
- Cell works,
- Xcelris,
- Molecular connections,
- Reverse informatics,
- Persistent systems,
- Genotypic.

**Bio Agriculture** (BA): India uses more than 90% of cotton cultivation using bio-engineered cotton seeds. These seeds are more pest resistant and high yielding in nature yet consume less water. Bt-Brinjal, Bt-Rice, Bt-Maize, Bt-Tomato and Bt-Cauliflower are the products that have been hit in the Indian market. They have been grown on Indian soil and export to many countries. Indian BA market is about USD 900 million (Rs. 5400 Crores) in 2013 and has great potential to grow.

Following are the key players

- Metahelix,
- Nuziveedu seeds,
- Rasi seeds,
- Mahyco,
- Ankur seeds,
- Krishidhan seeds.

**Bio Industrial** (BI): Biotechnology has been used to produce eco friendly enzymes that find usage in detergent, starch markets and rest (food & feed, textile, leather, paper and pulp). Biotech is also extensively used in producing bio fuels using Jatropha, Algae and Biomass.

The list of BI players is as follows.
Biotechnology as an industry is very young in India compared to the others. The Indian players like Biocon sensed the opportunities as early as 1970s when the word Biotechnology was not even heard in India. Only by late 1990s government recognized it as an Industry and gave incentives, but by that time several players were already established. Inspite of no support or whatsoever, enterprising businessmen went on to start a new industry and helped nurture it on their own. Support from government came only later, and that too not of what the industry expected. Even now, Indian players face high taxation, high interest rates on loans, and little or no venture capital/private equity (PE) prospects due to India’s policies, half-baked Intellectual Property (IP) laws etc. Despite all the hurdles, India’s Biotech industry is as vibrant as any other and the story throws up amazing case study for B-School students to do research on.

Though there are many Biotech czars who contributed to shaping up of Biotech industry, a few are listed here.

- Cyrus S Poonawalla – Founder of Serrum Institute
- Dr. Habil Khorakiwala – Founder of Wockhardt Limited
- Dr. Vinod G Daftary – Founder of Bharath Serrum & Vaccines Limited
- Founders of Indian Immunological Limited
- Dr. Kiran Majumdar – Founder of Biocon Biotech

(j) India’s flirtations with supercomputers

**Brief history**
As and when any country grows, there is need for large computing machines. This is because the economic growth brings with it large amount of data that requires special machines to process it. India too faced similar requirement in its early phases of growth. In 1980s when Indian population was growing and so was the food economy; policy
mandarins at the government felt the need for forecasting weather. Forecasting required processing of large amount of atmospheric data and calculations, which in turn required a supercomputer – a mainframe computer that is largest and fastest. India never had the wherewithal to build it and it approached the only supercomputer maker ‘Cray computers Inc’ in USA. However, the US government debarred Cray computers from selling supercomputers to India due to arms embargo imposed on India. So, India had no other option than to look internally for resources (manpower and money) to build one locally.

**Super Computer: Beginning of Indian innings**

Thus started India’s obsession with supercomputers. In 1991 India’s high profile research institute ‘ Center for development of Advanced Computing’ or simply ‘C-DAC’ built first supercomputer ‘PARAM 8000’. It was built within record time of 3 years – from nothing to a supercomputer built indigenously at a fraction of cost. At that time, it was considered second only to USA when it came to processing speed. Throughout next 20 years saw many versions of supercomputers like ‘PARAM 8600’, ‘PARAM 9900/SS’, ‘PARAM 10000’, ‘PARAM PADMA’, ‘PARAM YUVA’, and ‘PARAM YUVA II (PYII)’. PYII was launched on 8th February 2013 and operates at speed of 524 teraflops - a measure of computer speed, equal to one trillion floating-point operations per second, and consumes 35% less energy compared to its predecessors. It is ranked 62nd in the top 500 supercomputers when it comes to performance. With respect to power efficiency, it is ranked 33rd in top 500 green supercomputers of the world. These supercomputers were built by CDAC and there are other institutes that have built supercomputers too.

‘SAGA-220’ was built by ISRO with 224 teraflops processing power. ‘EKA’ supercomputer with processing power of 132 teraflops was built by ‘Computational Research Laboratories’ owned by Tatas. ‘Indian Institute of Technology, Madras’, built ‘VIRGO’ supercomputer and it has a processing power of 91.1 teraflops.

Indian Institute of Tropical Metrology owns a supercomputer called ‘PRITHVI’ with a speed of 45 teraflops.

So, fastest supercomputer India ever to have built is PY II with 540 teraflops. However that is not the end of it. The Department of Science and Technology (DST) of India has a blueprint to invest USD 1 billion (Rs. 6000 Crore) to build fastest supercomputer in petaflop and exaflop range by 2017. Petaflop is higher than teraflop and exaflop is higher than petaflop. The world’s fastest supercomputer as of 2014 is ‘Sequoia’ with a processing speed...
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of 16.32 petaflops per second. Such a power can be simulated when 7.8 lakh (780,000) high-end laptops are connected together to harness computing power simultaneously. If Indian government’s initiative takes shape, then India will have a locally built supercomputer that will be 61 times faster than Sequoia by 2017.

**Why is the hurry to build or own larger and faster supercomputer?**

‘Weather forecasting’. World is seeing increasingly unpredictable weather patterns with frequenting of ELNINA, ELNINO and other phenomena. This is resulting in droughts/ famine in some parts of the world and floods, hurricanes in some other parts. So, to minimize the effect, weather forecasting assumes importance and this needs enormous amount of data (mountain size) to process. An ordinary desktop computer may take more than 5 years to process it, where as supercomputers can process in days, So bigger and faster the better. Apart from weather, forecasting of world economy is also becoming difficult with world getting into and coming out of recession more frequently in the last 20 years. Proper economic prediction helps nations manage their economy far better by planning accordingly. This too has too much of data to process, too many calculations to make and it is only the supercomputer that can handle it. Drug design in pharmaceutical industry, vehicle design in automotive industry, aircraft design and simulating virtual flight requires supercomputers. Even space industry like ISRO and NASA require sophisticated high-end supercomputers.

India, though not in an ego-backed race to be in top 10-world supercomputer ranking, is doing a fairly good job in this field. For all its applications, India built supercomputing machines will be suffice for foreseeable future.

**Grid connected supercomputers:**

To make supercomputing power affordable to all the sundry researchers in India, a new initiative to create a grid of dozens of formidable supercomputers is being set up. This grid will connect some of the finest educational and research institutions across India from 2014 onwards. This 2-year project with a budget of USD 750 million (Rs. 4500 Crores) going to place India in the league of leading supercomputing powers of the world. As we have seen earlier, supercomputing service is the need of the hour for not only government institutes, even the private companies. Hence this initiative makes sense, as member institutes need-not own any supercomputer, rather pay for using the services. In fact, government’s plan is
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to train the scientist community on supercomputer technology, so that they can pass on the knowledge to their colleagues. The intention is to spread that know-how to as many people as possible across the length and breadth of India and at the least possible time duration.

Many people’s hard work, dedication and perseverance has brought India’s super computing program to where it is today. In the years to come, its relevance will go up when more institutes join the supercomputing bandwagon. Though the list of contributors is endless, a few of them are listed below

• Founders and all the scientists who worked day-in-day-out at CDAC.
• Scientists at Indian Institute of Madras (IIT-M)
• Scientists at ISRO
• People from all other Institutes and government departments who made it possible

(k) India’s Antarctica mission

Brief History
Antarctica has always been a fascination for humans when the expeditions around the Cape of Good Hope and Cape Horn in 15th and 16th centuries detected huge, ice covered continent sized land mass. They called it as ‘Terra Australis Incognita’ or ‘unknown southern land’. That set many sailors on motion to get to the land and among them was captain James Cook – Explorer, navigator and cartographer, who while exploring the sea in 1773 went around Antarctic Circle and discovered various small islands, but could not spot Antarctica itself as the continent was 150 miles away from the place where he landed. The snow-capped continent was appearing hazy for him and some how he didn’t pursue to the land, but instead headed back to England and reported Royal Navy about it. This didn’t quench the thirst to hunt for Antarctica and sailors kept heading towards southern hemisphere looking for it.

It was reportedly discovered in 1820 by the crews of 3 ships – ‘Fabian Gottlieb’ of Imperial Russian Navy, ‘Edward Bransfield’ of Royal Navy, and ‘Nathaniel Palmer’, an American sealer – seal hunter who hunts for seals in icy waters. The first time man ever set foot on

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Antarctica was on 07-Feb-1821 by another American sealer, John Davis. From then onwards Antarctica saw thousands of expeditions from several nations across the globe.

**Brief introduction of Antarctica Continent**

Antarctica – is planet Earth’s southernmost continent containing the geographic South Pole – it is southernmost point on the surface of earth and lies exactly opposite side of the Earth from the North Pole. It is 5th largest continent after Asia, Africa, North America and South America. Antarctica is double the size of Australia and about 98% of its land is covered by ice that averages around 2 mile (3.2 kilometers) in thickness.

Antarctica on an average is the coldest, driest and windiest continent having highest elevation of all the continents. The average temperature hovers around -89 degree centigrade (-129 F). There are no human settlements there except for some 5000 researchers who have been camping there for sometime now. Only that vegetation, plants, microbes, animals and others, which can survive the harsh cold temperatures, can be seen there. It is planet Earth’s uninhabited continent – without any man made pollution, and it is because of this, researchers find it very useful to study the planet there.

Though Antarctica was discovered more than one-and-half centuries ago, the nations took the research-based expeditions seriously only when United Nations (UN) chartered a treaty in 1959. The treaty, jointly drafted by almost all the big nations contains the following

- No country can claim territorial sovereignty over Antarctica, thus making it accessible to all the nations.
- No military testing and dumping of waste is allowed in Antarctica.
- Treaty prevents nuclear explosions and disposal of radioactive waste.
- Continent is used only for research purpose and cooperation shall continue.
- No one will disturb the natural way of life of animals there.
- All disputes should be settled by the parties concerned or brought to International court of justice.
- All treaty states discourage activities by any country in Antarctica that are contrary to the treaty.

**Why are nations interested in Antarctica?**

Research purpose. Antarctica has world’s 70% of fresh water at its icy caps. Incase, if a portion of this ice is melted, all the coastal cities of the world will get flooded, such is the
impact. Ice has been deposited for the last millions of years and that explains why the thickness of ice deposits is over 2 miles. The icy particles or ‘ice cores’ contain air locked inside and when such air is studied, we will know what the earth’s atmosphere looked like around 20,000 years back. By studying the locked-in air, we can better understand how the planet Earth could have been formed, and when it was formed. The global warming due to release of carbon dioxide and methane from burning of fossil fuels (coal, petroleum and natural gas) is resulting in heating up of oceans. This phenomenon is called greenhouse effect. The effect of such a phenomenon on Earth’s land mass can be studied easily there.

Also newer varieties are living beings, which were hitherto unknown to mankind have been found. There are insects, which have survived for the last millions of years. One of such insects is ‘Belgica Antarctica’. This species has survived millions of years, faced some of the harshest of harsh environmental changes and yet survived. This amazes the researchers and they go to Antarctica to study the insect’s incredible surviving skills. They (these insects) can tolerate freezing, dehydration (upto 65% of their body fluids) and changes in salinity of water and PH.

Another project that is of great interest to scientific community is the research project called ‘DMS, a love story’, conducted by Dr. Ron Kiene of USA. He calls his project by the name because he loves what he is working on. 

\textit{DMS - Dimethyl Sulphide} is a gas produced deep in the oceans. Some DMS gas escapes into atmosphere, which is important as little bit of molecules affect the cloud. This in turn affects how much sunrays can reach the earth’s surface, and as a result, can have cooling or heating effects on climate. Dr Ron’s project is to study how the DMS molecules in the atmosphere are affecting the nature cycles. Are there any link between these on ELNINO, ELNINA and other such phenomena? – His work is to look for answers.
India’s First Antarctica expedition:

India’s first experimental expedition to Antarctica lasted for one year, between 1981 January and 1982 February. There were 21 scientists, technicians and naval persons who were selected after thorough physical and mental examination. The expedition started from Goa in an icebreaker vessel on 06th December 1981 and landed on Antarctica on January 09 1982. India thus became the 13th consultative state to land there.

Discovery of Indira Mount:

During their voyage from Mauritius to Antarctica, Indian explorers discovered Seabed Mountain in Antarctic Ocean. The seabed mountain raises 4.5 kilometers (4500 meters) to 1.2 kilometers (1200 meters) from the seabed under water with high number of peaks. The same mountain raises upto 0.8 kilometers (800 meters) above the surface of water at one place. The multiple peaks with high magnetic anomalies indicate that the mount is largely composed of volcanic rocks. Magnetic data indicate heterogenic in the magnetic property of the mount perhaps due to more than one episode of volcanic activity. It is one of highest seamounts ever recorded in any ocean of the world and is named after Indira Gandhi, the then Indian Prime Minister. India's first exploration itself came out with such a flying colors that it made its name in the world exploration records. That’s how India began its Antarctic mission with a bang, and became member of League of Nations who could do research there by signing Antarctic treaty in 1983.

India’s Antarctica Program

This program is spearheaded by National Center for Antarctic Ocean Research (NCAOR) with active participation from ministry of Earth Sciences and Government of India. India is always enthusiastic when it comes to researching on earth and oceans, and setting up permanent station in Antarctica proves this point. Following are Indian interests, 'ice–ocean interaction and the global processes; Paleoenvironment and Paleoclimatic studies; geological evolution of earth and Gondwanaland reconstruction; Antarctic ecosystems, biodiversity and environment physiology; solar terrestrial processes and their coupling; medical physiology, adaptation techniques and human psychology; environment impact assessment and monitoring;
enabling low temperature technology development; and studies on ‘earthquakes’ are among the areas of study under the Indian Antarctic program.

Following explains research work in brief.

**Paleclimatology (PC)** – It is the study and description of ancient climates using information from both non-biotic factors such as sediments found in lake beds and ice cores, and biotic factors such as tree rings and coral, and can be used to extend back the temperature or rainfall information for particular locations to a time before various weather instruments were used to monitor weather conditions.

Whatever climate we see in the planet earth today is not same as what earth had some 5000 or 10,000 years back.

**PaleoEnvironment (PE)** – Today’s climate is different than that of earlier periods; in fact climate, including vegetation, temperature, and relative humidity, has varied considerably during the time of human habitation of planet earth. Paleoenvironmental reconstruction refers to the investigations, which are undertaken to reconstruct the climate and vegetation of a specific time and place.

**What will we achieve in researching on PC & PE?** – Answer is, we can know how earth looked like, say, 5000 years back – during the epic period of Mahabharata. Did the earth have regular seasons like what we have now or different? What was the average temperature during the seasons in Indraprastha city or modern Delhi?

PE will talk about how environment looked like those days? What were the kind of plants and trees around? What kinds of flowers were blooming then? General weather information, what kind of vegetation cattle and sheep were rearing on back then so on and so forth. With the help of PE, we can attempt to reconstruct artificially, say 5000 years old Indraprastha city, and go back in the memory lane into the bygone era. It is always exciting to work on these research projects.

Indians have done a phenomenal job in this area. Over 2000 engineers have worked on the Antarctic program from the day expedition started till 2014. Indians have done over 30 expeditions to the icy continent as of 2014 and around 300 publications were made so far. Out of 150 microbes that were discovered by mankind in the Antarctica, 20 were of India’s contribution.
How this was achieved? – Indians did that by establishing research stations. India is one of 9 nations as of 2013 to have multiple research stations. The latest station being 'Bharathi' – a full-fledged research station, well funded to carryout all sorts of exotic researches. 'Maitri' is another station, which is now converted into logistical base for researchers. Bharathi’s research mandate will focus on oceanographic studies and the phenomenon of continental breakup. It will also attempt to refine the current understanding of the Indian subcontinent's geological history. The scientists at Bharathi work in conjunction with fellow scientists from other countries on equal footing basis for a common cause.

When Indian government started off its Antarctica program, the critics raised eyebrows, as each expedition would incur millions of dollars (Crore of rupees). People criticized government’s priorities to spend money on some fancy projects when there was acute poverty that was glaring at leaders. However, for Indian leaders, Science and Technology (S&T) was always a priority and never wanted to let go off an opportunity. This is because S&T forms the foundation for any country. There has been enough evidence from the past to prove that the countries that have embraced S&T open heartedly have prospered. Be it in peacetime or at the time of war.

**What India has achieved by going behind S&T?**

By embracing S&T whole heartedly, Indian science program induced 'interest in science' in the minds and hearts of young Indians. Consider this, India is third only to USA and China when it comes to producing numbers of scientists and engineers. And if we consider English speaking ones, India stands next only to USA. What makes India tick? – Its fascination for S&T. Government’s association to grandiose research activities makes R&D sexy. Indians are naturally fascinated and attracted towards it, and it is part culture, and part government’s promotions making Indians take up S&T. Let us look at the statistics.

India accounts for about 10% of all expenditure on R&D in Asia and the number of scientific publications grew by 45% over the past five years, yet it lags behind China and other western countries significantly. Despite this, five Indian Institutes of Technology (IIT) were listed among the top 10 science and technology schools in Asia by Asia week magazine.

However, the number of publications by Indian scientists is characterized by some of the fastest growth rates among major countries. India, together with China, Iran and Brazil are
the only developing countries among 31 nations with 97.5% of the world's total scientific productivity. The remaining 162 developing countries contribute less than 2.5%.

About one third of 1000 global corporations have R&D centers in India. About 30% of those companies with Head Quarters (HQ) in Europe have India R&D presence. Similarly 15 percent of companies with HQ either in Japan or APAC are in India, and the list is growing every year.

Semiconductor or software line has highest number of R&D head count in India and Automotive and Aerospace is seeing significant jump in R&D head count now a days.

All these achievements couldn't have happened if government hasn't given importance to S&T. However, experts say that India's research potential is not realized to the full extent and they blame the government for half-hearted attempt in encouraging R&D. They also blame Indian businesses for being slack on R&D investments. One thing to note is that R&D neither happens just because of government's incentives nor happens because businesses have deep pockets. Research happens when there is absolute necessity for innovation. It is this deep desire to innovate drives them (businesses) towards R&D. The government’s policy will certainly be of some help to them, not everything. So, in the Indian context, till now companies never faced that much need to innovate to survive, as India still is not a very open country for foreign competition. So, the life goes on for Indian businesses without spending much on R&D. However things won’t remain same forever, as and when government removes the hurdles to foreign competition, Indian companies will face enormous heat, which in turn will push them to embrace S&T in a big way. The adage, “necessity is the mother of invention” will be applicable in the truest sense by then.

So, there is certainly light at the end of the long and dark tunnel as for as horizon of Indian research is concerned.

Many scientists and explorers have contributed to the Antarctic mission, a few of them are listed below.

- Founders of Dr. U R Rao of National Antarctic and Ocean Research
- Personnel of Indian Navy
- All others who contributed to the mission.
Indian films: The buzz behind India’s soft power

An incident
It was in the year 1995; Japan was deep in recession with lots of job losses creating negative sentiment in the society. Japan recorded ‘suicides’ at unprecedented rate due to economic depression. There was general gloom due fear of losing jobs. Everyone was working very hard to make sure they remain valuable to the company so that they can retain their jobs. This led to exhaustion, stress and general negativity in life. People had so much pent up emotions in their minds, which they wanted to remove either by crying or laughing their hearts out. Strangely Japanese or Hollywood movies never gave them a chance to do that then. That was when an Indian Tamil language film ‘Muthu’, which was dubbed in Japanese as ‘Dancing Maharaja’ was released. Though the film had nothing extraordinary in it to make it to the Oscars, it just had enough spice to make people cry, laugh and dance so that they could forget their negative emotions and enjoy the moment.

In the movie the protagonist’s sphinx like rise from rags to riches and getting to marry one of the most beautiful ladies around, connected with them very much. The movie rekindled their hope that they too could make it big in life some day beating all the odds. The movie filled them with the hope that, though they were in poor state then, times would change and their good time would come, as it did to the protagonist of film ‘Muthu’. The film made a roaring business and created impact that the movie was shown house-full for more than 400 days in Tokyo and 100 days in other major centers like Osaka and Kyoto. After Muthu, many other Tamil movies were successfully exhibited in Japan.
Through these movies, Japanese came to know about Indian culture in general and Tamil culture in specific.

Another incident
Similarly, it was in October 2011, Germany was in the midst of ‘Oktoberfest’ celebrations and there was general mood of jubilation across the Germany. It was biting cold outside one of the big auditoria, but inside the temperature was soaring high with the dance of 15 white German women, all dressed up in Indian saris dancing to Bollywood tunes. They were dancing amidst cheering crowd through claps, shouts and whistles. Though it was the festival of belly dance, which organizers were conducting, Bollywood Dance (BD) was introduced in between, as no cultural festival is complete without BD thrown into it. Such is
the influence of Bollywood – India’s Hindi film industry on young Germans. More women seem to be attracted towards Bollywood movies (BM) than men, as they claim BM deals with love, romance, family values, culture etc. This is projected through dance and song sequence, which is much appreciated by the Germans.

**Spread of Indian films across the globe**
Likewise, Bollywood has reached the shores of other countries, for example: Russia, Poland, Sweden, Finland, UK, USA, Canada, Switzerland, South Africa, Middle East, Pakistan etc. In all these countries Bollywood dance (BD) is on high demand and so are the movies. BD, people say, portrays the sensual side of woman’s beauty without exhibiting vulgarity unlike belly dance, salsa, disco etc. However it (BD) may not be as divine and gracious as Indian classical dance though. The acceptability by the locals (non Indians) for anything linked to Bollywood is amazing. There are stores in some of the major cities of Europe selling key chains, Souvenirs, wallpapers and pictures of popular actors, CDs and DVDs of movies and songs. The craze for Bollywood is unimaginable; only one needs to see to believe it. Even the regional (Tamil and Telugu) films too, make up to foreign shores and they too draw quite a bit of viewers from there.

**What is this phenomenon called?**
Projection of soft power – It is a way by which countries introduce culture of their societies to the people of other countries. It is done through movies, theater shows, food; festivities etc. Soft power is also defined as persuasive approach to international relations, typically using economic or cultural influence.
Historically India’s soft power has been Buddha – Icon of compassion and peace, Mahatma Gandhi – India’s freedom fighter, who was the man behind India’s peaceful independence movement decades ago, Yoga - A system of exercises practiced as part of this discipline to promote control of the body and mind for perfect health and tranquility, Meditation and Ayurveda. To this list, following has been added: Bollywood dance, Indian classical dances (Bharatanatyam, Kuchipudi, Odissi and Kathak), classical singing (Hindustani and Carnatic), food items Punjabi Chicken Tikka, Pappadom and South Indian Masala Dosa.
Similarly American soft power has been Hollywood, Michael Jackson, McDonalds, Pizzas, Starbucks, National Basketball Association (NBA), NASA etc. Like wise every country tries to influence (directly or indirectly) others through various means. It is said India, China and
Japan represent eastern culture while America, Briton, Canada and Europe represent the western culture.

**How has Indian film and media Industry transformed over the years?**
The transformation happened by the efforts of individuals who are into producing and directing movies, the actors, the publicists etc.

Soon after the India’s independence, film industry was at its infancy. During the forties and fifties, Indian films were depicting the poverty and survivability of individuals irrespective of the mountain sized problems those days. Patriotism was also used to be the theme – Indian struggle during the British Raj, the independence movement etc. Till fifties, India and Indians lacked confidence and it was depicted in the movies. However from sixties onwards when the survival was no more an issue, films turned their attention towards newer genres – Romance, love, spy thriller etc. The seventies and eighties saw the fresh genre of movies portraying confident India. The film industry attained international status from nineties onwards and the rest they say is history.

The film industry itself kept reinventing all along from fifties, as there were stringent problems plaguing the industry then. The finance for making movies were private – film producers used to mortgage their personal belonging and borrow at very high rates to finance the films, risking their lives. There was high debt in the film industry back then. The process of making films were very amateurish and because of that, films used to take long time to make, which in turn used to jack up the cost. The film shooting, production and publicity lacked professional touch. This made life very strenuous to everyone involved in film making those days. Stunts in the movies used to be performed live by artists without any precautionary measures. This resulted in fatalities leading to deaths or disabilities. The actors, artists, crewmembers – makeup, clothing, set designers, cameramen were paid pittance. Hence they had to depend on other professions too to make their living, so they were not regular at the sets of film production. This prolonged the film production.

It was total mess and chaos in film making Industry those days, and with all the difficulties, some of the blockbuster movies like ‘Sholay’, ‘Deewar’, ‘Bobby’, ‘Johnny mera naam’, ‘Don’ etc. were made.

However Hindi movie industry reinvented one last time and acquired the name ‘Bollywood’ in mid nineties. Apparently Indian film industry (representing Bollywood and regional films) became world’s largest film making industry surpassing even the much-hyped
Hollywood. In 2013 the Indian film and media industry has crossed USD 25 billion (Rs. 150,000 Crore) and is growing at a fast pace. With a population of over one billion (more than 100 Crores) and film and media yet to touch all of them, there is tremendous scope. With the recent Indian Supreme Court’s order to replace TV broadcasting from analogue to digital, the sales of digital TV set-top-box are shooting over the roof and so are flat TVs. They sell like hot cakes bringing revenues in USD billions in the near future. By 2025, Indian Media and Film Industry has the scope to become as big as USD 200 billion (Rs. 120 lakh Crore) and that is certainly jaw dropping.

What helped the modernization of Indian film industry?
The stakeholders of this Industry made the transformation happen along with Government’s policies. The highly educated younger generations of film producers, directors and others came to Industry’s rescue. First step they took was to cleanse the malaise of being non-professional. They strongly appealed to the government to give ‘Industry’ tag to the Filmmaking and Exhibiting (F&E) profession. They highlighted the importance of F&E being professional, and how government can boost its kitty by announcing incentives. The convinced government gave ‘Industry’ tag to F&E profession, which led to banks and other financial institutions lending loans to F&E Industry at low interest rates. That set the ball rolling for good, thus bringing in much needed changes and money to the Industry. Now Indian film industry is very professional and the movies made using latest equipments are of international standards catering to the worldwide audience. This resulted in movies raking in revenues in millions of USD.

When the film industry was in dire need for revival, these young folks never blamed government and others for the plight. They instead folded up their sleeves and worked towards cleansing the mess themselves. They went to the government seeking incentives when they were done with their work.

The younger generation could have dumped the film Industry and opted to work in some other industries sensing the gravity of the problem. Had they done this, Indian film industry would have been irrelevant in this Internet age, and may be, would have been shut down for good. However, these people worked with fire in their bellies to fix the industry first, and continued to work at the same pace with the purpose of making the Indian film Industry relevant even in the twenty first century.
There is a lesson to be learnt here; running away from the problems or issues won’t be of any help. Instead being there, in the midst of problem, and fixing them one after another with the intention of bringing excellence in the mid to long term will help.

Thousands of people contributed heavily to make Indian film industry a multi billion dollar one with largest number of movies in the world. A small list is given below.

- Guru Dutt – Bollywood director
- Raj Kapoor – Film producer and director
- Mani Ratnam – Film director of Tamil and Hindi language films.
- Sanjay Leela Bhansali – Film producer and director
- Kamal Hassan – Actor, Producer and Director
- Amitabh Bachchan – Actor
**Indian Neutrino Particle Research: India’s swipe at high-energy particle physics**

**Brief information about European project to ‘Hunt for God particle’**

In the year 2012, media all over the world carried interesting news about high technology experiment conducted by Council of European Research on Nuclear science (CERN). The Large Hadron Collider (LHC) which was used to collide atoms at the speed of light \(299 \, 792 \, 458\) miles per second inside a 27 kilometers long tunnel laboratory located 100 meters below the ground. It costed billions of dollars to conduct this earth shattering experiment.

The laboratory is located across the border spanning France and Switzerland. The intent of this experiment was to find the most elusive particle in the subatomic world, called ‘HIGGS’ or ‘God particle’ using which the universe is thought to be made of.

More than 1000 physicists from over 50 countries worked day-in-day-out for more than a decade in a closed network to detect the God Particle. At the end, they proudly declared that their experiment was ‘successful’. They claim that it is the just the beginning of the infinitely long journey to understand the universe.

**Indian similar project to find ‘Neutrino Particle’**

Indian government too along with physicists are planning to conduct similar experiment in India, and the Intent is not to find so called ‘God Particle’, but another equally elusive particle called ‘Neutrino’. Neutrinos are one of the fundamental particles that make up the universe, yet they are least understood. To have more insight into these particles, India Neutrino Observatory Laboratory (INOL) is being established.

INOL – It is a multi institutional project aimed at building world-class underground laboratory with a rock cover of approximately 1200 meters for non-accelerator based high-energy nuclear physics research in India.

This project involves technologies that were never attempted in India, and all the participants are very excited to work on this project, as they get to learn new things. One of the foremost requirements is to build 50,000 tonnes of special steel for building CERN like underground detector. This project is being built to house world’s largest magnet, about 4 times bigger than the one, which was used in Compact Muon Solenoid (CMS) detector at CERN Geneva, Switzerland.
INOL is being touted as the next frontier to take particle physics beyond the standard model, which led to search for the elusive ‘God particle’ or the Higgs boson.

The project is being executed by Bhaba Atomic and Research Center (BARC) in association with over two dozens institutes like Mumbai’s Tata Institute of Fundamental Research (TIFR), Saha Institute of Nuclear Physics (SINP) and Variable Energy Cyclotron Centre (VECC) in Kolkata. The project will study properties of neutrinos and use magnetized iron calorimeter (ICAL) as detector. These value added special steel plates for the INO project will be tailor-made by Steel Authority of India (SAIL), a government of India owned steel maker.

The experiments will involve high-end technology on a scale that has not been tried out earlier in India. SAIL has the mandate to indigenously develop the technologies that are required to build such a massive sized special magnet. The construction work for this project has just begun and by 2017 it will see the completion of initial phase, and series of experiment will begin there after. Apart from the 2 kilometers underground tunnel, it will involve setting up an underground lab complex to conduct research in high-energy particle physics. Other than the steel plates, the INO project will also outsource high performance glass for 30,000 particle detectors and nearly 3.5 million fabricated chips or electronic channels using cutting edge electronics. The end of this research will make many hitherto unknown technologies made known to the Indians, either through collaborative research or on their own.

**What is the significance of such high-tech projects?**

It will keep people interested in science and develop scientific mindset, which is required for any nation to prosper. India has been doing this kind of high-end research works for the last 60 years and all the important programs like Space, Antarctica mission, Super computer research, National automobile testing and research infrastructure project (NATRIP) and many more like that were built to take science to the next frontiers. The government's such science missions have resulted in India producing world’s third largest scientific manpower along with USA and China.
Conclusion

What have we understood reading all the narrations so far? –

Answer is that, India inspite of being difficult country to govern with all the contradictions – super rich and abject poverty, atheists and theists, Liberals and narrow-minded people, Educated and illiterates and diversities – religious, linguistics, cultural, caste etc has performed not that bad. There are many countries inspite of being not as diverse as India haven’t done as good as India.

Goldman Sachs’ forecasted in 2010 that the group Brazil, Russia, India, China and South Africa (BRICS) to contribute significantly to the world economy in the coming years. There are also studies, which say that, by 2050 India would be world’s third largest economy by Gross Domestic Product (GDP). Also, Deloitte – a world renowned consulting firm, in its report "India matters: Winning in growth markets" has reported that India is expected to emerge as the world’s largest consumer market with aggregate spending of USD 13 trillion by 2030, surpassing the likes of China and the US today. They also add that, by 2020, India is projected to be the world’s third largest middle income consumer market behind China and the US, and in a span of another 10 years, it is likely to posses largest market for consumer goods.

These analysts haven’t done crystal gazing to come to this conclusion; they have spotted all the inherent trends that can propel India to whatever they are predicting, even if her Gross Domestic Product (GDP) grows at an average 5 percent for next forty years.

However experts always crib that India is not growing to its potential considering difficulties surrounded, they are less optimistic. The truth is that, India was never bereft of problems right from the day it got independence in 1947. Consider this, India faced 4 wars from neighbors; assassinations of two prime ministers, continuous mayhem perpetuated by cross border terrorism, religious riots (though occurrence has become rare now a days), negative media, elections (any given time, somewhere some kind of elections take place), hurricanes, earthquakes and other massive natural disasters, poverty, lack of unity among politicians as they indulge in bitter fighting instead of concentrating on governance, and as if it is not enough there is no department in government where corruption is not touched and it (corruption) has become ubiquitous in India. It is a trouble galore and it is equally true that we get disgusted and want to migrate to other countries where life is much better.
“But wait a minute, aren’t there people who did it big in India inspite of all the difficulties glaring at them?” There are people both in government departments and private companies who achieved the unachievable through their hard work and iron resolve to bring success, come what may. They are responsible for bringing India to where it is today. The islands of excellence discussed above, were achieved by their selfless service, and these are the people we all have to ‘salute’ for their accomplishments despite so many issues. It is easier for anyone to excel when one is working in a pampered environment that is conducive, supporting and ideal. However excelling in hostile environment certainly requires lots of ‘guts’, unflinching fire, passion, hard work and perseverance. These people had all of that and more. They were big dreamers and just lived their dreams by working conscientiously to realize them. There is no dearth of such people even now in India, and it is their relentless work that will propel India from where it is today.

Apart from the achievements from the high wire achievers mentioned above, there is another phenomenon that has started working to make India change for better. It is the phenomenon of younger (average age being less 28) population taking steps to transform India. It is said that by 2020, average age of Indians will be 25 or lesser and such people constitute 50% of the population. These young, restless yet aspiring Indians cannot be lured by the politicians the way they did to their forefathers way back in the nineteen sixties or seventies. These young folks are well exposed to Internet and satellite TVs. Like their counterparts in developed countries, they too want good roads, clean drinking water, quality power supply and above all jobs to maintain their life style. If government cannot give these, they (young Indians) will certainly take mass rallies to pressurize the government to give them. These kinds of rallies have already begun and going forward they will intensify. So, India can change and will change for better in the future.

**Why does Indian success matter much to the world?** – Answer is, success of India with all the contradictions may promote democracy and rule of law across the non-western world. If India could achieve success with all the problems, other smaller countries in the gulf and African regions with lesser complexities can achieve too. After all everyone wants quality life – good food, housing, education, jobs and security, and whichever way it is
possible to achieve, people would try that. So, by this, world will see lesser strife, lesser violence and more peace by developing the mindset of accepting the differences. The developed western world too has to engage BRICS nation as they represent huge chunk of young population. These advanced nations should build relations with BRICS, which are other than just buyer and seller. One of them could be co-development of technologies. Talented people can be anywhere; so engaging them actively irrespective of the location makes lot of sense. This is because providing power, clean drinking water and nutritious food to the expanding population of the planet earth is becoming a serious challenge in the future. The pace at which we are exploiting the nature now, it seems we may require another 2 planets to satiate our needs by 2050 if our growth is through abusing of the nature, which is dangerous.

All the past or existing technologies need to be done away with slowly as they are highly polluting and creating environmental degeneration. If at all world needs a collective effort it is now.

So, let the world unite and work together to develop power, water, drugs, transportation etc. in newer ways that are eco friendly and recyclable. Somehow we have to again start living with nature as friends not as foes, and that is where our collective future is.