Entrepreneurship
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Part 3

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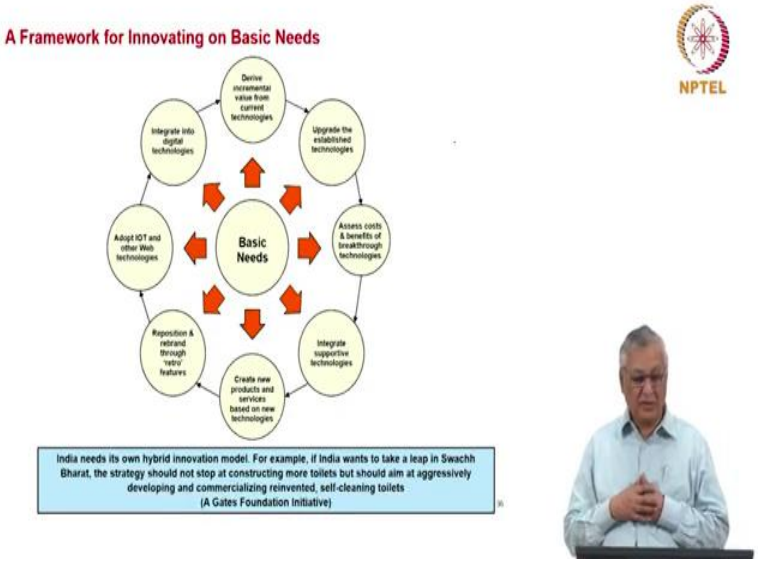

And when we look at those wave 4 technologies, we must focus on the basic needs. As I said every innovation has fulfilled a basic need. Today if we talk about digital laundries, what is it? Nothing but washing clothes, it was a basic need, if you look at food delivery, what is it except getting food supplies to house, earlier person maybe going out and buying it from a restaurant.

Today restaurant is supplying to you. So, basic needs are always basic, essential needs which are always there. What digitization is doing? It is deriving incremental value from current technologies, it is upgrading the existing technologies, getting a new cost benefit relationships through breakthrough technologies, integrating whole lot of supportive technologies under its banner.

Creating new products and services as a result, repositioning and rebranding at times keeping the retro features proper. And finally connecting itself to every other device,

every other human being therefore there is one digital ecosystem which is continuous and together. So, when we try to fulfill the basic needs, we need our own hybrid model, the hybrid model being for example, we talk about Swachh Bharat program.

Not only have we done great by constructing for the first of all by recognizing this as a social and economic problem, and for which we had to say hats off to the Modi government. India took a leap in Swachh Bharat by creating the whole number of toilets and then ensuring that this moment takes physical shape, but the next phase or even the current phase is to see how waste can be eliminated at the generating point.

Therefore, self cleaning toilets which can be installed at homes, so that there is no need to do any further treatment or the entire waste of the home can be managed within the home by means of certain zero waste technologies, how do we do that? So, innovation must focus on these kinds of things, which will reduce the transactional cost of carrying on with life's activities in a very dramatic way.

And ensure that our resources, our energies, and our quality of life activities are diverted to more pressing requirements, which is agriculture, which is energy and which is education, health, etc. So, the framework for innovating on basic needs requires a new startup thinking one would say.

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So, to decide or to deliberate on what could be the impact areas for the current times, I thought that I should look at some stalwarts in the field. As we are all aware, Bill Gates and Paul Allen made a complete metamorphosis of the computing industry with their Microsoft company which has done phenomenal work in the disc operating systems and overall computer operating systems.

And the kind of transformation that has happened in the computing industry because of Bill Gates and Paul Allen is obviously very well known. Now, Bill Gates has moved into philanthropy and he has got the Bill Gates, Bill and Melinda Gates Foundation. In an open message to the graduating seniors of 2017 Bill Gates said I would read from this 'If I was starting out today and looking for the same kind of opportunity'.

Obviously, he meant the computing change he made. 'To make a big impact in the world, I will consider three fields. One is artificial intelligence, we have only begun to tap into all the ways it will make people's lives more productive and creative. The second is energy because making it clean, affordable and reliable will be essential for fighting poverty and climate change.

The third is the biosciences, which are ripe with opportunities to help people live longer, healthier lives.' I think it is very reflective of the need to change with the times or change the times in a way that human life is made productive, more helpful.

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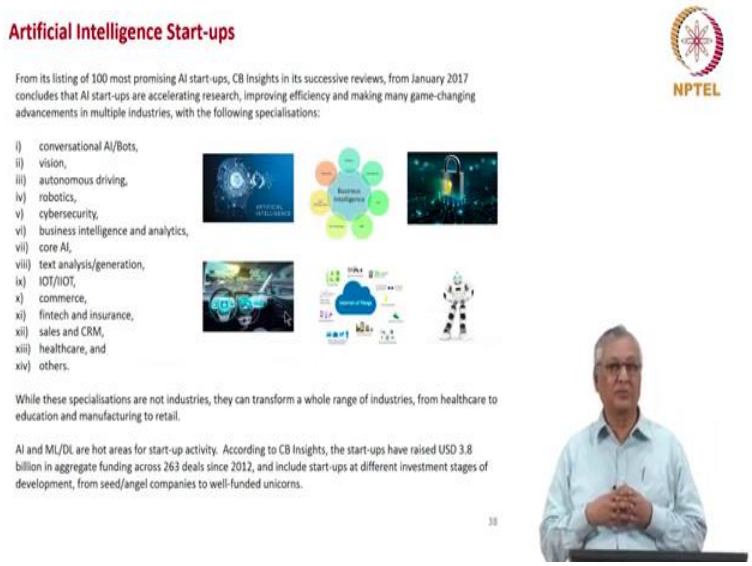

So, I will consider this part in terms of three significant areas which could be offering great opportunity for startups, one is artificial intelligence. Second is the whole gamut of clean energy and clean mobility and third is medical sciences. Obviously, we will not be able to dwell deep into any of these subjects except provide certain peeks into the way the developments could occur.

So, from the listing of hundred most promising startups in the AI field, as presented by CB insights from January 2017 research has been accelerating as also startup activity has been accelerating in these areas one conversational AI bots, vision, autonomous driving, robotics, cyber security, business intelligence and analytics. Core AI, text analysis generation, internet of things, industrial internet of things, commerce, FinTech, and insurance sales and CRM, healthcare and others.

In this some of them have been there for several years. For example, customer relationship management has been there ever since programming came into being and customer relationship management always was the philosophical underpinning of good

marketing. Certain things like autonomous driving are newer areas of activity for artificial intelligence.

But while these specializations are not industries by themselves, they can transform a whole range of industries from healthcare to education and manufacturing to retail. I would therefore say that artificial intelligence and machine learning, deep learning are hot areas for startup activity, these startups have raised 3.8 billion dollars in aggregate, funding across 263 deals since 2012.

And this number goes on increasing day by day and they include startups at different investment stages of development from seed, angel companies to well funded unicorns.

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So, there are some companies which have actually performed very well. So, I have provided some logos for visual impact. Obviously, as I said earlier the logos are the property of the individual companies and they are being presented only for educational purpose or visual connectivity with the concepts that are being discussed. So, you can see the kind of focus of these AI startups.

One company has predictive capability as its objective, then another company thinks of interactive verbal personality for coding. Another company looks at complex data reading and report writing, developing stories from spreadsheets, how do you predict disasters,

how do you understand the emotional intelligence of a patient through data centric approach, how do we convert text interfaces to natural voice interfaces.

How would you do customer DNA fingerprinting? Not the human physical DNA fingerprinting, but customers personality DNA fingerprinting from millions of data points. How do you develop cognitive content for execution? How do you have deep analytics and predictive data modeling fit for several fields, how about health bots for doctor patient interactions?

How can somebody do scheduling, email organization without having human requirement? What kind of learning interface can have for students for artificial intelligence? And how do we have personalized virtual assistant.

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And in AI itself, we have got predictive modeling using neural networks, data analytics using AIDA product, better informed business and user interfaces coming up with data analytics, personalized learning experience for students and institutions. This is very important.

So, when we say that a tech, a tech no longer means converting from offline to online. That is, minimum now but we have to now recognize that the learning patterns of

different students are different. Their ability to absorb or their willingness to absorb and their positional context to absorb are different.

So, if you are able to understand the learning capabilities of different students and then create modules, which will customize themselves to the learning required, pattern requirements, that is the application of artificial intelligence. So, the online education is going to go up one step higher with the application of artificial intelligence and machine learning.

Then we have got chat-bot and personal assistant, intelligent logistics automation platform, driver assistance and monitoring, real time cardiac diagnosis, legal contract lifecycle management to ensure that your contracts are understood and read through intelligent means by the programs and then suggests ways and means by which you can negotiate good contracts, data driven energy efficiency management etcetera.

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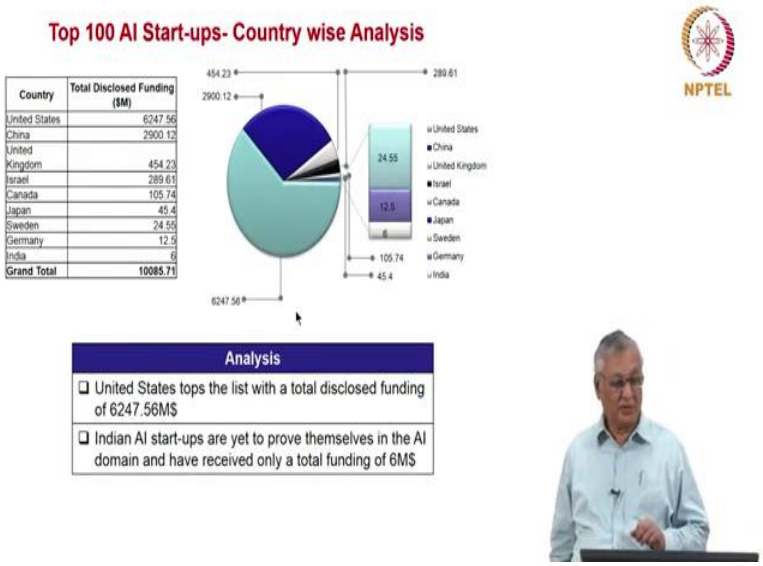

So, if you look at the top 100 AI startups, the United States is leading the pack followed by China and India is somewhere below. So, the spread between India and the rest of the countries, particularly the ones which are wanting to make a global impact is very high. So, India needs to really double up in terms of developing itself in artificial intelligence and machine learning.

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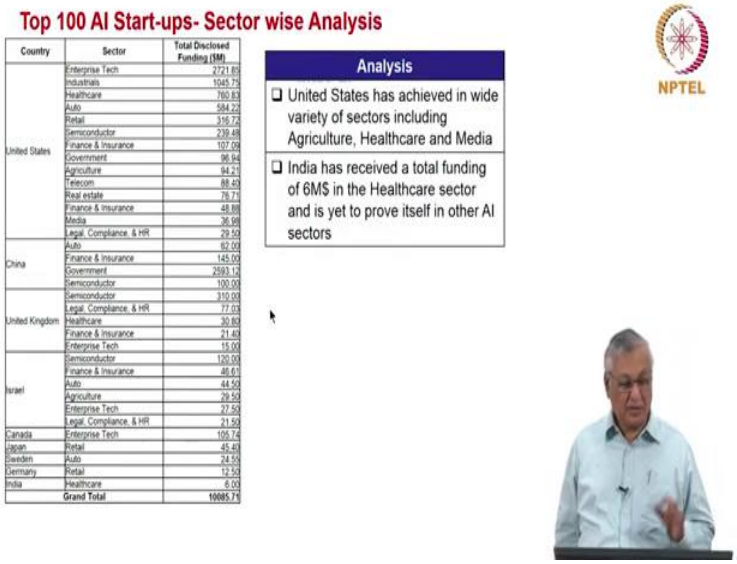

And if you look at the AI startups, as I said earlier, they are available for deployment in virtually every field. You have them in enterprise technology in industrials, healthcare, automotive, retail, semiconductor, finance and insurance government, agriculture, telecom, real estate, finance and insurance, media, legal compliance and HR.

Therefore, there is a huge scope every industry, every business process, which is today digitized will be digitized to an even greater extent by a combination of artificial intelligence, machine learning and deep learning. And in some cases, augmented reality, virtual reality also will get integrated into this.

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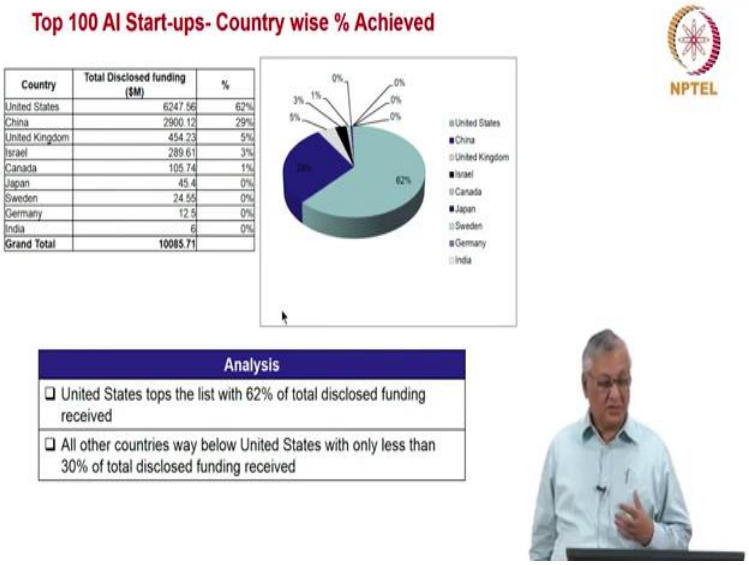

So, given that this is the kind of potential, how do we really make this?

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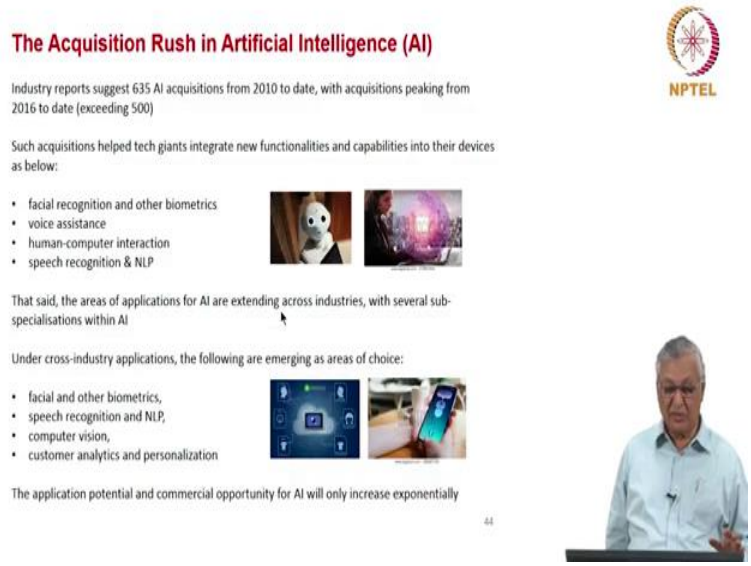

We can make this happen only when, within the startup movement we have, we create a new vertical for the newer technologies, the three priority areas which will gets identified and which we also identified in terms of wave or technologies earlier.

We should be able to create new sub verticals for startup movement to create a clutch of companies in the artificial intelligence area, which again comes to the basic requirement of up skilling the people who are in the computer science and in info information technology spaces and also integrating newer developments in electronics, electrical engineering and various other fields.

So, would EdTech be the first area for startup development? Or should we have artificial intelligence modules taken from already developed startups in other parts of the world and create our own products? Probably a mix of strategies have to be adopted. But whatever it is very clear that artificial intelligence must be one prime area for development for startup movement in India.

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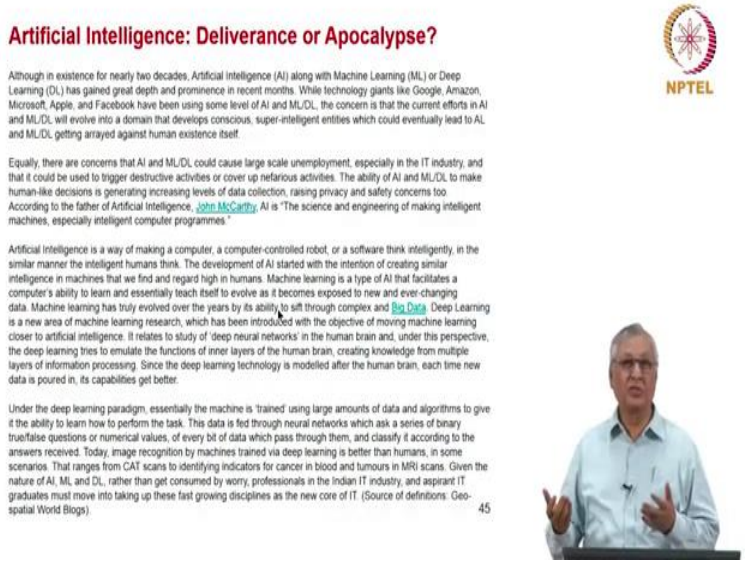

Ofcourse, there are two views, is artificial intelligence going to be deliverance or apocalypse? A person has involved in this industry of high tech as Elon Musk believes that artificial intelligence could be posing certain dangers, whereas very many other scientists and technologists believe that the dangers can be mitigated by appropriate risk mitigation strategies.

But rather than look at the philosophical undertones, I believe that professionals in the Indian IT industry, aspirant IT graduates must move into taking up this fast growing

disciplines as the new core of information technology, I think that was very important and essential.

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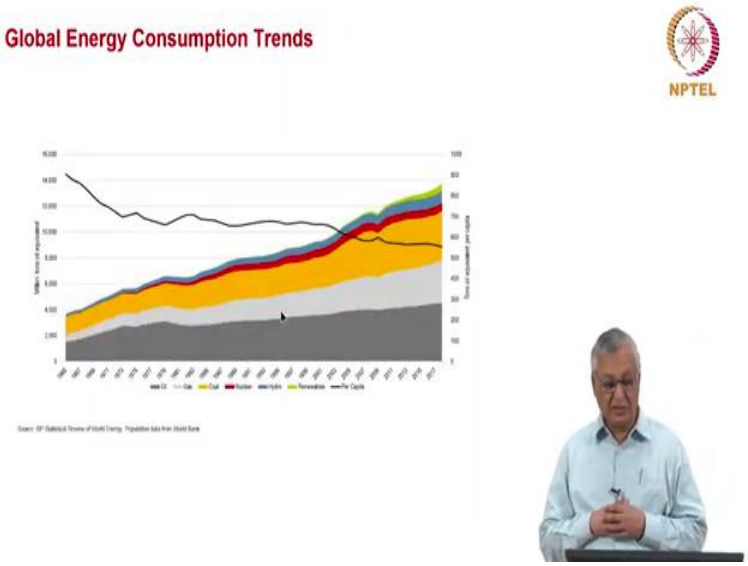

Then we come to the clean energy, you can see the kind of growth which has been there, if you look at oil, gas and coal. That is the bottom gray, light gray and the deep yellow, you will find that there still are the most dominant areas of energy development and consumption. And not only that the consumption of these fuels, the energy has been growing up going up significantly higher.

While we have got the newer generation like nuclear, which is not considered very safe anyways, we have hydro and which is subject to cyclical vicissitudes of monsoons. Then we have renewables, you can see the alarming situation on fossil fuels led energy development as well as energy consumption and renewables is but a small speck of the total energy development and consumption.

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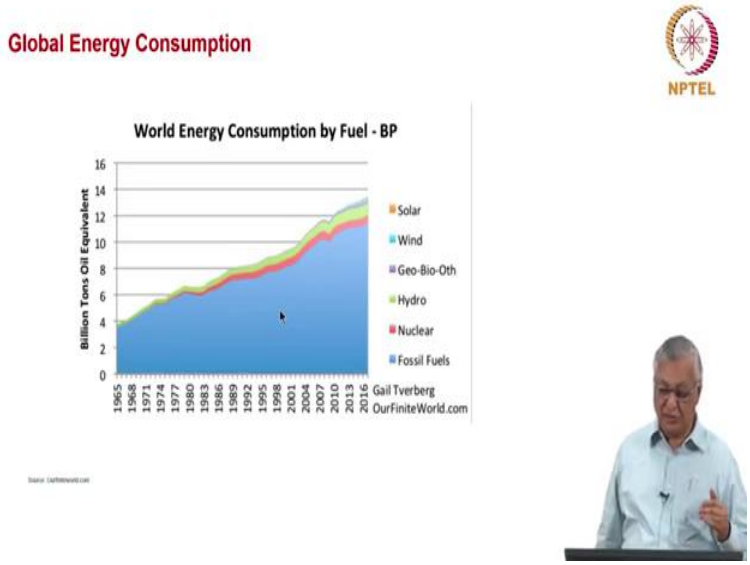

And if you really look at the same situation, in terms of three years of horizon, you will get a better picture more granulated but position is the same solar, wind, geo bio, others hydro, they are still a small portion and that is where the maximum impact needs to be there.

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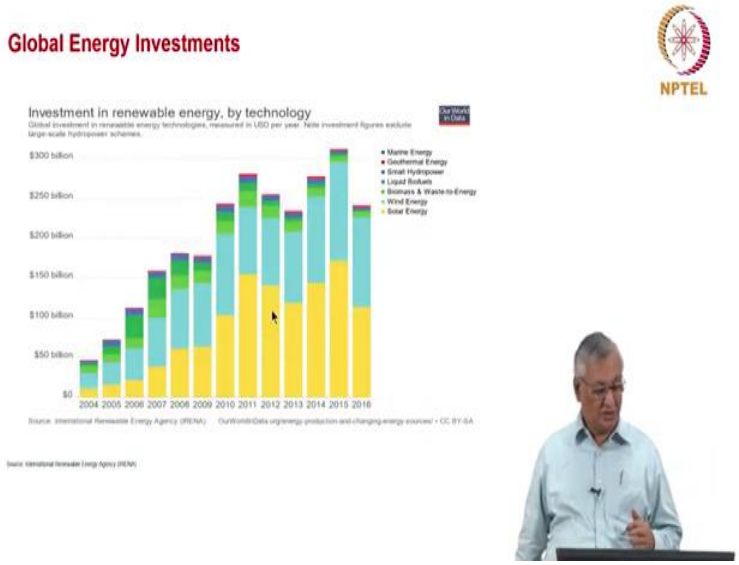

And the investments in renewable energy by technology. They are definitely going up but they are kind of oscillating within the within a particular band. There should be a higher investment in renewable energy and hopefully that would lead to more activity.

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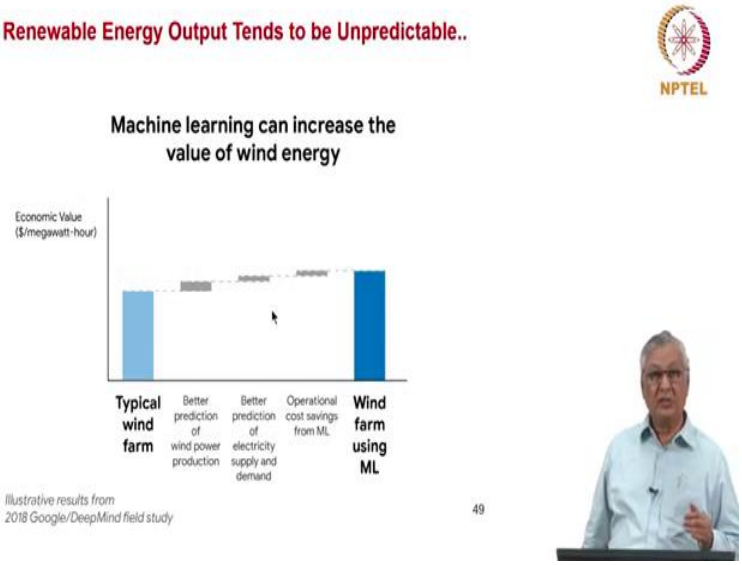

But the issue is that even in having renewable energy, there could be application of artificial intelligence and machine learning because when you look at a country which has got as diversified as India, renewable energy cannot be produced at the same cadence

in all parts of the country. There are deserts where the renewable energy can be produced, the solar energy can be produced much more than in cooler places or cloudy regions of the country.

Even a country such as Germany, which has got more homogenous weather structure, and is possibly the poster boy of renewable energy in the world is finding it difficult to adjust the renewable energy and the fossil fuel energy developments because renewable energy is subject to the cloud cover subject to the temperature which is available weather conditions, monsoon conditions etc.

Therefore, there could be situations when renewable energy is over produced relative to the demand and the fossil fuel energy thermal plant energy has to be scaled down with all the penalties to the utilities or suddenly the renewable energy is not produced to the extent required when the schedule of thermal power energy is clocked at a particular level.

Now, if you are able to predict the requirement of renewable energy by bringing in big data and analytics in weather forecasting for several years and for the current seasons, and then have at least 36 to 48 hour advance notification of when how renewable energy production will go up or down, it will be possible for the grids to adjust their thermal power, energy production and consumption and match it exactly, properly.

And that would be very helpful for saving millions of dollars of investment. So, machine learning is a completely different subject as we have seen today, but when it comes to optimizing clean energy machine learning has got a position.

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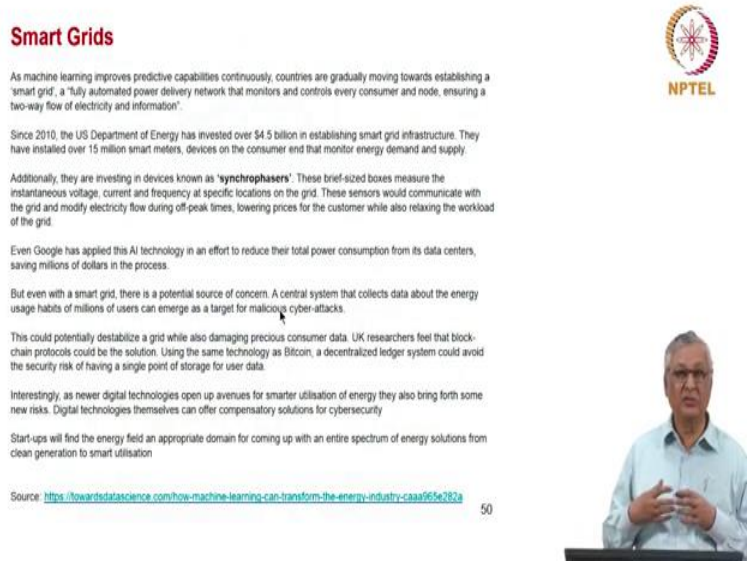

Similarly, we can use these kinds of developments in creating smart grids. Smart Grid means connecting every home with the grid by means of demand and consumption. Right now, it is a push factor. The grid pushes out electricity, makes electricity available for the entire society and all the residences all the factories etc. Because it thinks its responsibility is to produce and generate and then transmit this level electricity.

But if only the utility knew, if only the grid knew, that the demand pattern is going to vary like this, it would be able to optimize its own production. So, smart grid is a grid, which is a fully automated power delivery network that monitors and controls every consumer and node ensuring a two way flow of electricity and information.

Information goes out from the user points and electricity comes in from the generator and the transmitter. So, it is no longer you know push out system, it is a kind of pull system is akin to the Japanese way of manufacturing automobiles rather than push type demand management, it is a pull type supply management. So, smart grids are being conceived as part of smart city programs the world over.

Additionally, people are developing synchro-phases, these grid size boxes measure the instantaneous voltage, current and frequency at specific locations on the grid. These

sensors would communicate with the grid and modify electricity flow during off peak times, lowering price for the consumer while also relaxing the workload of the grid.

Even Google has applied this AI technology in an effort to reduce their total power consumption from its data center saving millions of dollars in process. Now, institute's, technological institutes, institutes, startups, they can develop these kinds of meter synchro phases, other information providers on electricity usage and generation and also provide smart bridging solutions for these smart grids.

So, these are the areas where startups can work in ensuring that apart from production of clean energy, through better solar energy and wind energy and other forms, whatever is produced by various means optimize and the demand for energy and the supply of energy or optimized in the relationship.

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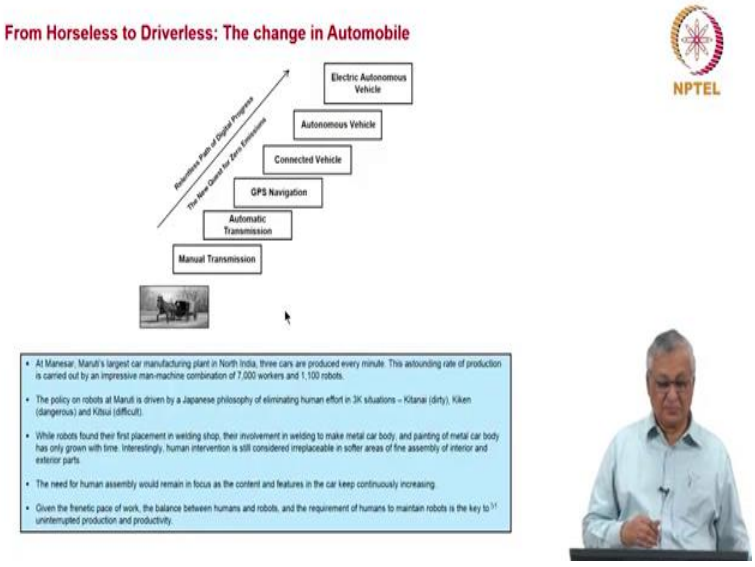

Now, we come to the other portion of energy, which is the consumption, which is the mobility. From horseless to driverless the change in the automobile has been continuous and one way towards sophistication. And originally it was manual transmission, then automatic transmission came then we have got GPS navigation.

Then we are having connected vehicle and eventually we will have electric autonomous vehicle. In this there has been a relentless path of digital progress. And more importantly,

there is a new quest for zero emissions as we go forward. And in this process, we also have got maxi robots working in Maruti plant, I believe, which is Maruti's largest car manufacturing plant in North India, three cars are produced every minute.

And that is accomplished with a combination of 7000 workers and 1100 robots and they are being deployed in three situations. One where work is kitanai (dirty), kiken (dangerous), kitsui (difficult). First, the robots find their way in to the welding shops because they were the most hazardous areas in the automobile manufacture. But now they are into various forms of assembly, this assembly.

But finer parts are still made by human hands. Will micro robots come into those areas? Just as surgeons' hands are replaced by the surgical robot, will micro robots come and help fit the glass and the interiors, we do not know but it is a possibility. So, this could be an area where a startup could think how to make micro robots for finer car assembly.

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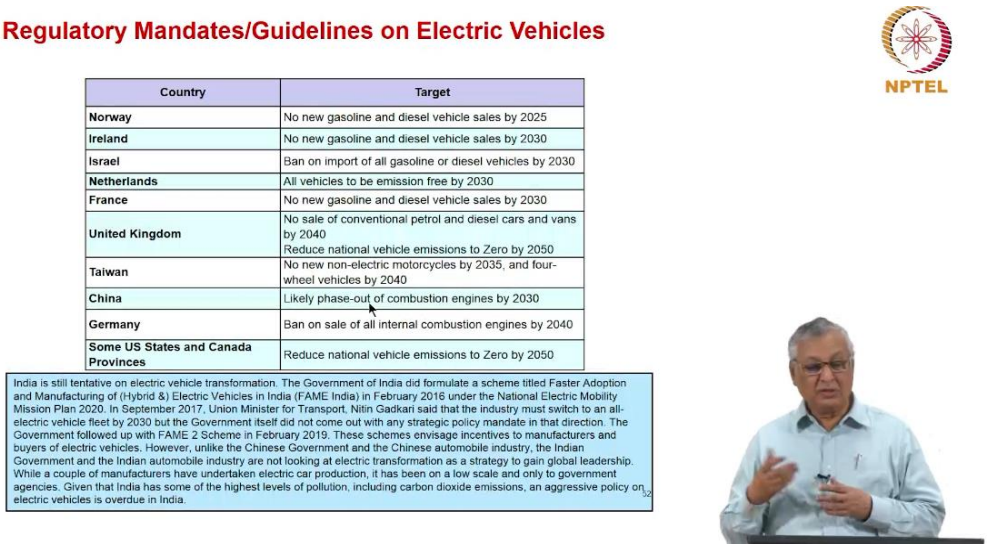

Now, when we think of electric vehicles, clearly the world is moving towards electrical vehicles, some countries specify that there should be zero emissions by this day. Some countries say that there should be phase out of diesel vehicles by this date and phase out of petrol vehicles by this day, but whatever it is secularly, it is very clear that everybody wants the phase out of IC engine vehicles and the concomitant pollution that is happening.

In India we have had certain ambitious goals earlier that it should be all electric by 2030 not really put in the form of a guidance or mandate. Another guidance recently more recently came saying that we should have some electric vehicles in two wheelers and three wheelers far ahead 2020 to 2023. Again, not a mandate or guidance.

There are also subsidies and incentives by the Government of India frame to policy to support the electric vehicle development these things are happening.

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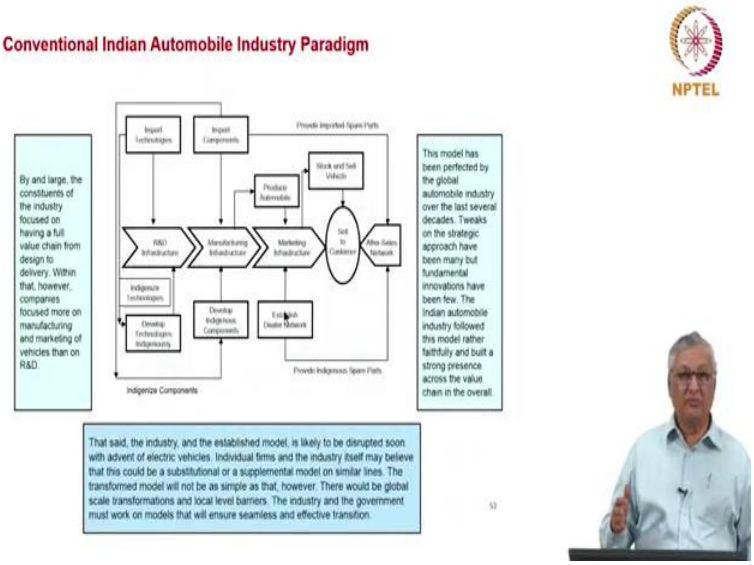

When we look at the conventional automobile industry paradigm, we have R & D, we have manufacture, we have marketing and this cell and there are two components always in the automobile industry given that the automobile industry in India has been recipient of technologies from outside. We had imported technologies and imported components. We also have indigenous technologies and indigenous components.

In the 50s, 60s and even the 80s when the new generation of Indian automobiles companies came in, the imports were far higher than the indigenous components. But today you can say that the import dependence of automobiles is very less and largely it is indigenous industry and the industry is also able to produce to global requirements and export its products.

But this industry, as we know is likely to be disrupted very soon with the coming in of electric vehicles. And electric vehicle is not like an additional product or a new product. Electric vehicle is the same product to be used by the same customer in the same manner, but using different kinds of technologies.

And there is no way in which you can predict at this moment whether the customer would go in for IC engine vehicle or an electrical vehicle, how would he respond or how would she respond to different kinds of cost and price parameters and the operating parameters of the vehicle.

So, this itself the whole gamut of demand forecasting and supply management for electric vehicles, and the substitution is a huge quantitative predictive analytics exercise for the Indian automobile industry. And this itself is one area where startups can own their approaches in terms of developing.

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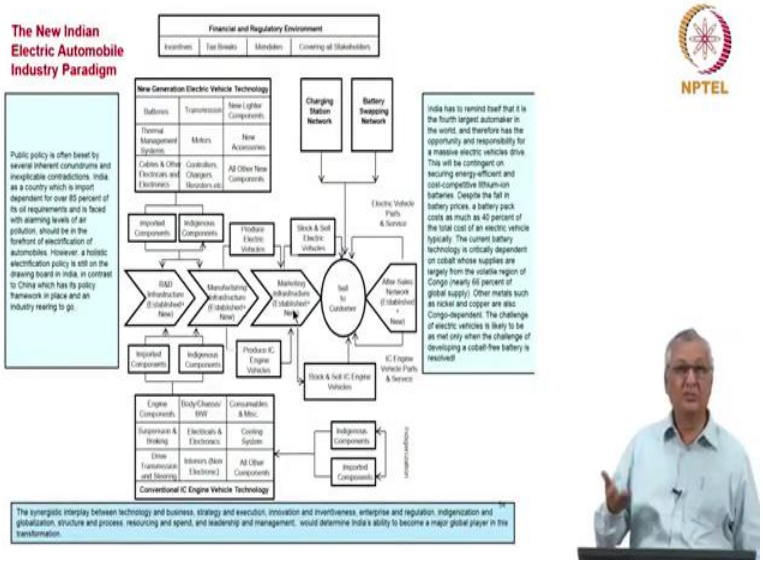

But if you see the hardware, which is shown in this slide, you will find that you will have a mirror image of the current Indian automobile industry in terms of the electric automobile industry, we will continue to have all the parts which we have today, which is engine components, body, chassis, BIW, consumables, suspension, braking, electricals,

electronic, cooling system, all of these things will be there, which is I put them under one bracket, conventional IC engine vehicle technology.

It will have indigenous vehicles as well as imported vehicles, and we will be using them to produce IC engine vehicles which we sell to the customer. But at the same time, we will also have new generation electric vehicle technology having completely different parts, they will have different batteries, they will have different transmission systems, the components will be lighter.

Even if have to be a little stronger they have to be designed to be stronger, there will be new thermal management systems, motors, new accessories, complete rewiring, cables and electric systems will be different, controllers, chargers, resistors will be new and all the new components which are associated with the new generation electric vehicle technology.

And then once the vehicles are put into the market, you require a charging station network, you need a battery swapping network, which means that the entire electric automobile industry is going to run in parallel with the IC engine vehicle system. And you can imagine that the companies will have to manage double the investment which they are actually managing now.

And with half the demand for each of those classes. And we are also getting into a situation, we cannot drive demand of any particular segment beyond prudential norms because the planet also cannot take more, the roads also cannot take more in the Indian situation.

So, the interplay between technology and business strategy and execution, innovation inventiveness, enterprise and regulation, indigenization and import dependence or globalization these are becoming big activities by themselves also, it is not that solutions are apparent at this stage, technologies have to be developed within ourselves.

The Indian automobile industry in the past particularly in the 80s and 90s took technologies from abroad indigenous, today, probably the whole world is only at the

similar level as far as electric vehicle development is considered, we do not have models which can be brought in and indigenized because technologies are still evolving.

So, India has an opportunity to develop its own electric vehicle ecosystem, which means that India also has an opportunity to be a global leader in this electric vehicle development phase which is occurring. Again, a great opportunity for startups to be there.

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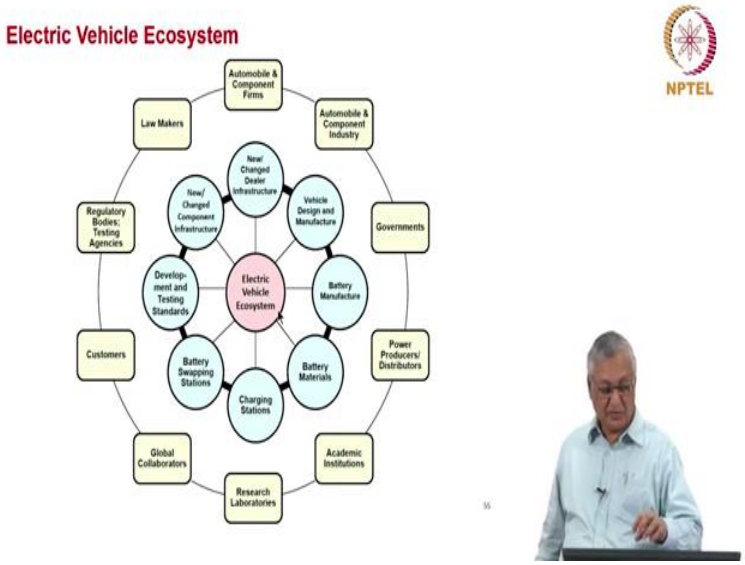

So, when we look at electric vehicle ecosystem, we have battery infrastructure, delivery infrastructure, charging stations, testing standards, then we have a whole series of people like lawmakers, component firms, governments, power producers, academic institutions, global collaborators will be involved in this ecosystem.

So, we require an industry level effort so, these others sub vertical which could be considered for initiation of an accelerated and time titrated the startup development activities, so that some of these problems which are inherent in this kind of industry transformation are addressed.

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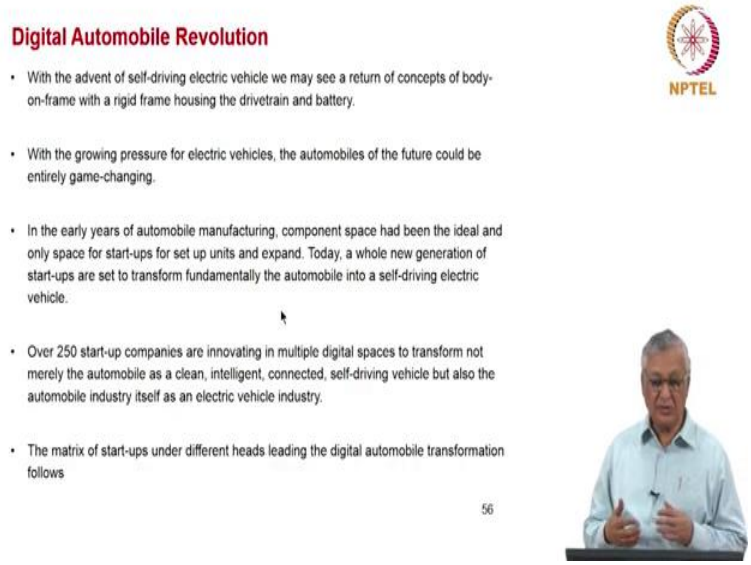

Now, therefore, there will be a digital automobile revolution, there are 250 startup companies which are already investing significant amounts of money in developing clean intelligent connected self driving vehicles. And automobile industry itself is becoming an electric vehicle industry as we go through.

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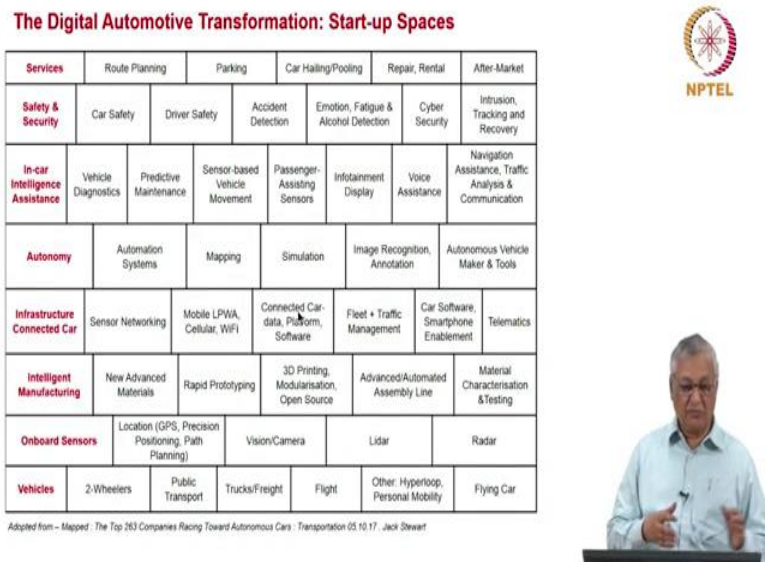

So, if you look at the next slide, you will find that a whole set of startup spaces are available for digital automotive transmission, one in safety and security. Second is in car

intelligence systems, autonomy, infrastructure of connected cars, intelligent manufacturing, onboard sensors and these are all segmented according to the vehicle type, great set of opportunities which are available.

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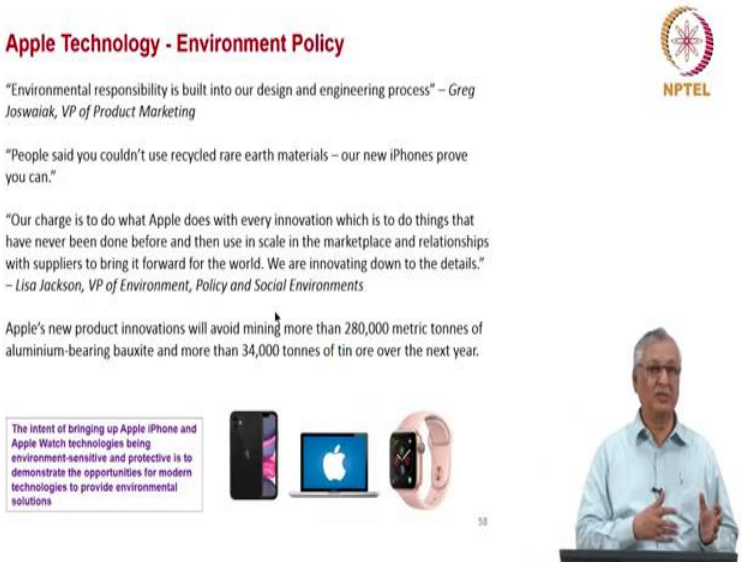

We talked about clean energy generation of clean energy, distribution of clean energy in an optimal manner. And we also talked earlier about zero waste, but what about established products which looked like being driven by strong consumer trends? But then it is possible, if you look at the Apple technology, the latest environment policy statements.

The VP of product marketing says environmental responsibility is built into our design and engineering process. People said you could not use recycled rare earth materials our new iPhones prove you can, our charges is to do what Apple does with every innovation, which is to do things that have never been done before and then use in scale in the marketplace and relationships with suppliers to bring it forward for the world, we are innovating down to the detail.

According to them, Apple's new product innovations will avoid mining of more than 280 thousand metric tons of aluminum bearing bauxite, and more than 34,000 tons of tin ore over the next year. The intent of bringing up Apple iPhone and Apple Watch

technologies being environment sensitive and productive is to demonstrate the opportunities for modern technologies to provide environmental solution.

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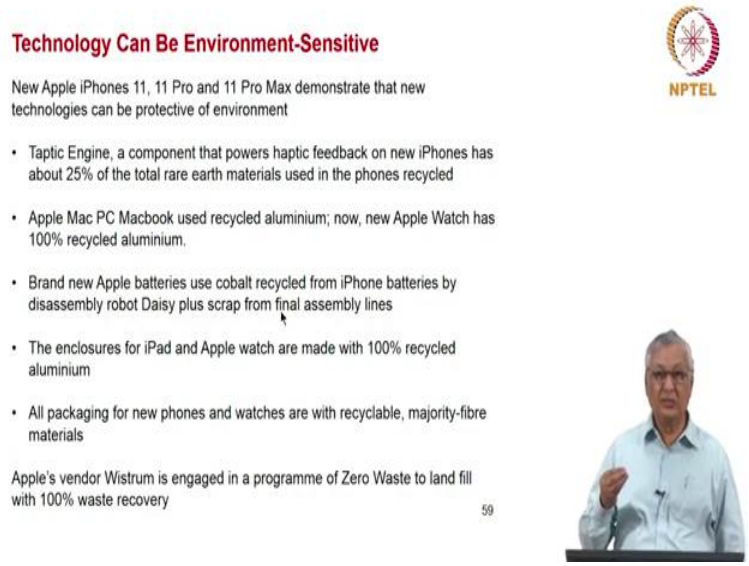

As I said, even recycling of material could be a startup opportunity. Some examples here, the taptic engine, a component that powers haptic feedback on new iPhones has about 25 percent of rare earth metals which are used in the recycled phones. Apple Mac, PC MacBook use recycle aluminum, now Apple watch also has got 100 percent recycled aluminum.

Brand new Apple batteries use cobalt recycled from iPhone batteries by disassembling robot Daisy plus scrap from final assembly lines. The enclosures for iPad and Apple watch are made with 100 percent recycled aluminum, all packaging for new iPhones and watches are with recyclable and majority fiber materials.

Therefore, there is some technology which is getting established, integrated in the established manufacturing space as well to ensure that technology is environment sensitive again opportunities for startups.

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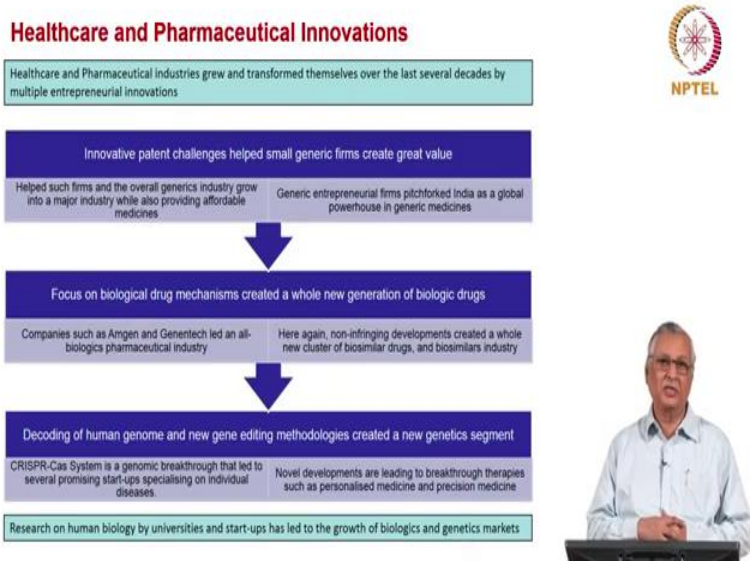

We have considered until this stage several examples of products in engineering industry, products in electronics industry and certain service in infrastructure, benefiting from technological innovation and creating new entrepreneurial ventures, the interrelationship between technological innovation and entrepreneurship has been very well established by way of those examples.

Now, we will turn to two industries which are very intimately tied up with human living. These are healthcare industry and pharmaceutical industry. These are especially distinguished and differentiated because they make living enjoyable for people, they cure diseases they avoid wellness, for long science was considered the mainstay of these industries however in recent times, we have seen biology getting merged with engineering.

And engineering contributing a whole lot of new developments to pharmaceutical. The pharmaceutical industry over the last several decades has transformed itself from small molecule based industry into an industry which is based on global generics growth and industry which is based on biologics growth, and more recently, into an industry which is based on genomic sciences.

The global generics industry has grown based on the legal protection and potential provided by the Hatch Waxman act in the US for generic companies to enter the generics industry on an exclusive basis based on the unique patentability of their products or processes that has enabled several startups in the generics field to create great value for themselves and also create a whole new generics industry.

It has enabled the generics industry fund itself admirably and provide a huge range of affordable medicines to the world. And in this process has also pitchfork India as the global generics powerhouse.

The other structural change that has happened in the pharmaceutical industry is the biologic research. Several companies are today in engage in the biologics research compared to two decades or three decades ago. Amgen and Genentech were the early pioneers which focused on biological pathways to cure vexatious diseases.

And today those biological mechanisms are considered much more significant in curing certain diseases which are hard to cure by the regular small molecule mechanisms. The third development is the decoding of human genome and the acquisition of technology to be able to edit the genes which means that the problematic genes can be edited by certain enzymes, supplicating the CRISPR mechanisms that have been discovered.

And together they can conduct better biological research and together they can also help cure certain long standing diseases and unpredictable diseases such as cancer. These novel developments are also helping the pharmaceutical industry, create new avenues for personalized medicine and precision medicine.

Wherein, a person is able to be given the kind of drugs which are suitable for the person's genetic profile. So, for which cancer which medicine out of the suite of medicines available could be very well provided by the personalized medicine.

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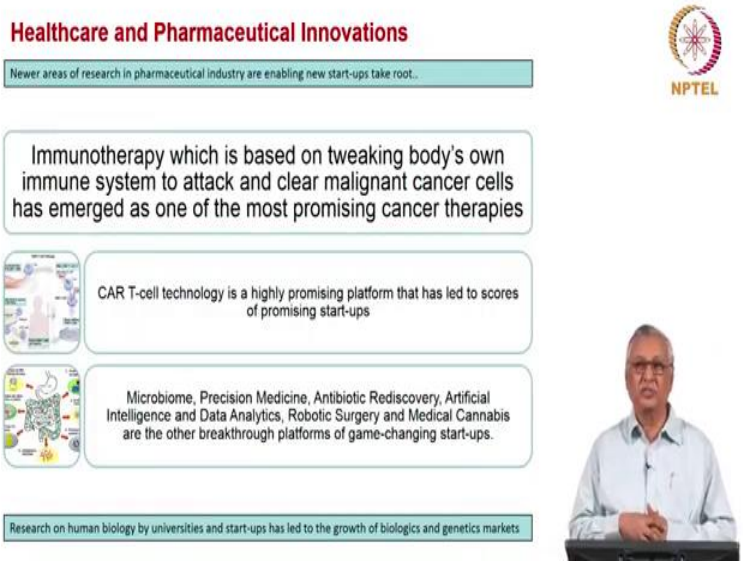

Apart from this, there is a new branch of knowledge which is focusing on utilizing the human immunogenicity in utilizing the human immuno capabilities to tweak the body's immune system to attack and clear malignant cancer cells. This has emerged as one of the most promising cancer therapies. CAR T-cell technology is a very highly promising field in this area.

Quite apart from this focus on gut based microbiome, antibiotic rediscovery, artificial intelligence, data analytics, medical cannabis besides robotic surgery all emerging as new frontiers in pharmaceutical and healthcare industries.

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In terms of the diagnostic technological innovations, we always saw the smaller diagnostic capabilities which are based on analytical chemistry that is which do the blood picture analysis. We also saw X ray imaging as one of the fundamental diagnostic tools that was available for surgeons.

But today we have PET scanners, PET CT scanners and MRI instruments and these are all developed, these equipments are high cost equipment. These are all developed by giants such as GE, Philips and Hitachi. However, when you dig deep into these developments, you will find that much of this technology has been developed in the universities, University of Pennsylvania, Washington University School of Medicine, Massachusetts General Hospital and Brookhaven National Laboratory for example.

So, the point here is that it is possible for a group of scientists and for clusters of laboratories to develop a newer diagnostic methods which could evolve over period of time into mainstream diagnostic technologies capable of making fundamental changes to how the disease are diagnosed or how the body's systems are understood.

Over a period of time there could be many more developments that could occur in terms of the radioactive or non-radioactive imaging. And in also understanding the soft tissues situations much better, which cannot be done with except through the dye contrast

mechanism at this stage, and the overall real time 3D body imaging, and also non-invasive testing for several disease conditions. All these things are potent areas for startups to work on.

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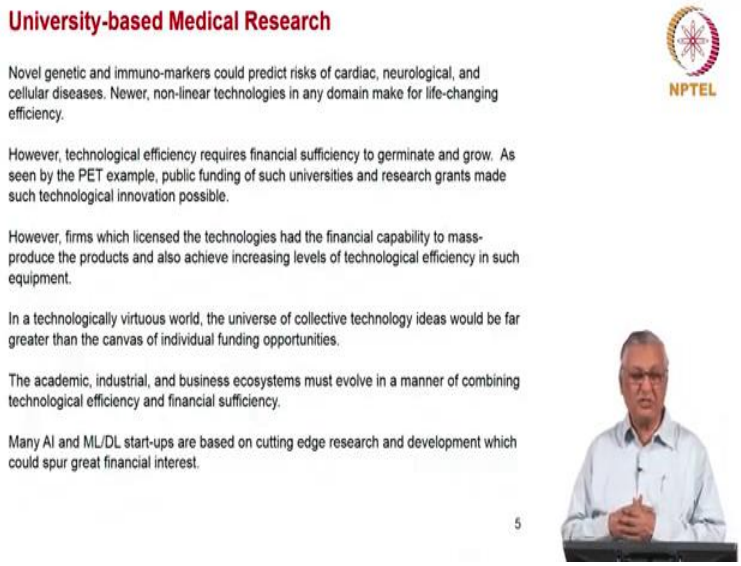

So, University based medical research has been a big boost to medical developments and pharmaceutical developments, in a technologically virtuous world if startups and the universities combine, and they take these University based research areas to commercial fruition, it would be a great contribution to the pharmaceutical and healthcare industries.

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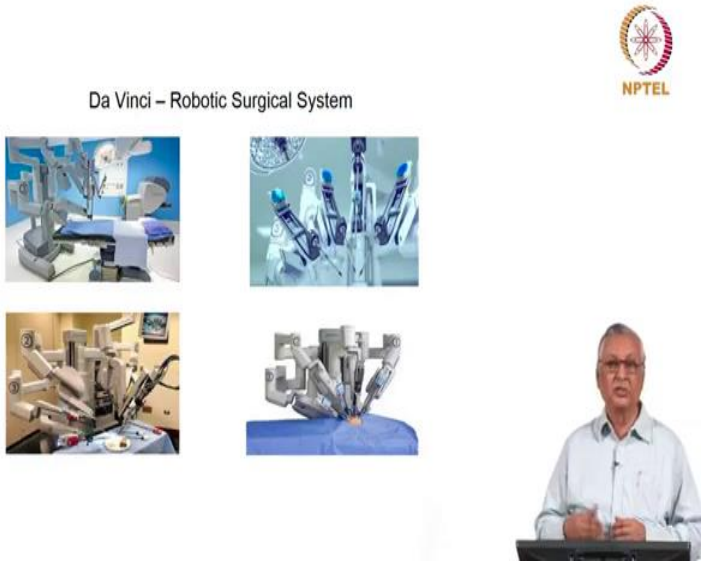

The other thing which I mentioned briefly earlier was the robotic surgery, laparoscopic surgery was the first embodiment of robotic surgery but it was virtually done with significant human intervention. But today we have robotic surgery, wherein the human intervention is at for lower degree and the surgical manipulation of the operations is at a far higher level. And how is this made possible?

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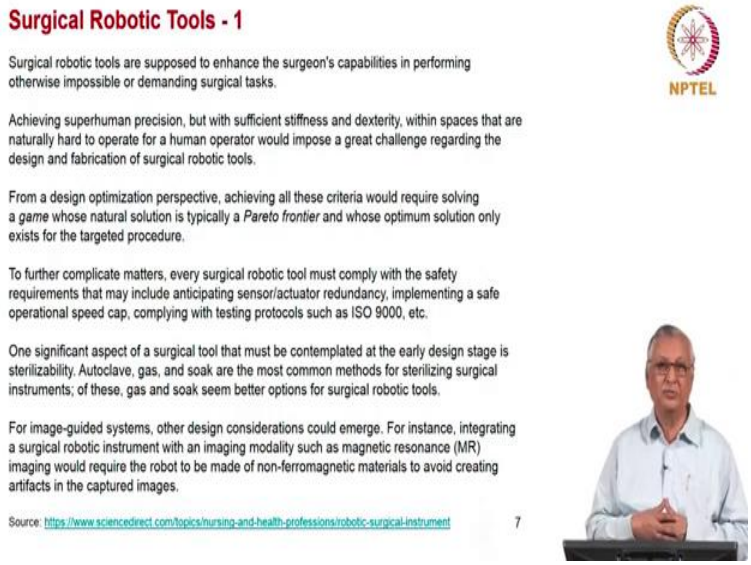

This is made possible by a number of developments the science behind the robotic surgery is given in this slide as well as in the next slide.

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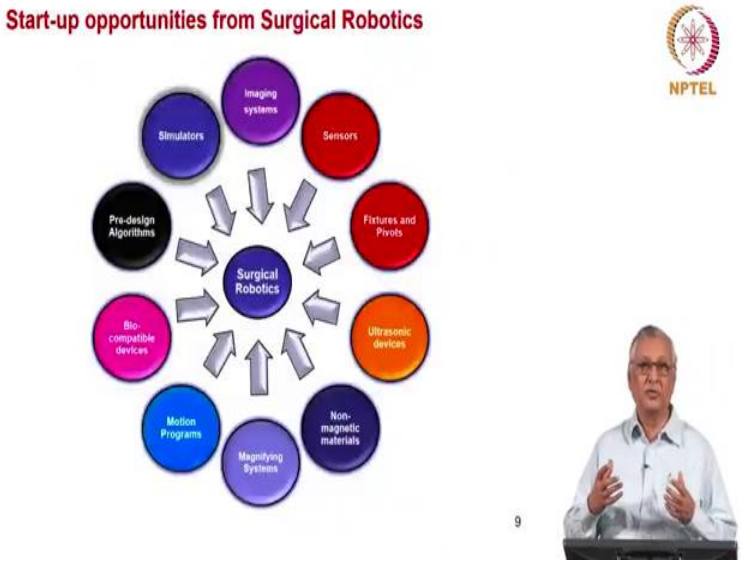

But what is relevant for us is that the surgical robotic development is offering number of opportunities for imaging systems, high definition imaging systems, number of opportunities for sensors which are sensitive to whether the surgical probe is going to be

affecting any of the tissues and sensory mechanisms and the deep learning mechanism related to that.

The fixtures and pivots because you require complete degrees of freedom to be able to manage the movement within the body, but at the same time these fixtures have to be both physical as well as virtual, physical in terms of the robotic arms and virtual in terms of the software programming.

Then we also need ultrasonic devices or magnetic devices and the materials that are used in the surgical instruments have to be completely non-magnetic, the magnifying systems have to be a different level, they will magnify different types of tissues, the blood composition and the molecular structures in the body in much more sophisticated way than the motion programs.

How do you program the motion of the or the movement or the kinetics of the surgical instrument, the biocompatible devices that are required as part of the robotic surgery, the pre-designed algorithms and the simulations that could take place before a robotic surgical device is finally made available for commercial use. These are all the opportunities which are available for startups in the surgical robotic field.

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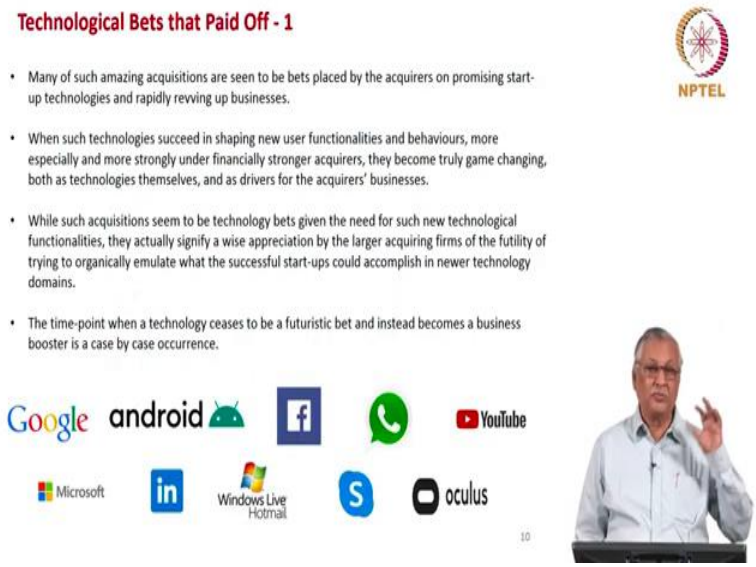

So, we have seen the electronics developments, we have seen the mechanical developments, we have seen the electromechanical developments, we have seen the service developers in the logistics area, and a whole number of new developments that are taking place in the pharmaceutical and healthcare fields.

All of these things have created value in terms of this startup scenario. And when big companies have seen these startups creating value, they have begun to make

technological bets on such startups. One of the very fundamental bets that has taken place was when Google acquired the Android operating system.

At that point of time, Google had no presence in the mobile telephony. Yet it saw acquisition of an operating system, which will work with mobile devices as integral to its having some kind of hegemony in the evolving smartphone ecosystem. Similarly, its acquisition of the YouTube was another path breaking activity, Facebook acquiring WhatsApp, Microsoft acquiring the business social media network, LinkedIn, acquiring the hotmail several years earlier, Skype later and Oculus.

These are all examples of mainstream companies focusing on value building startups to create new technologies that would supplement their core businesses. And several of these bets have paid off from a strategy perspective acquisition of such promising these technologies and businesses is validated because the acquired businesses have performed in a superior manner after the acquisition.

The market share of Android has grown substantially and overshadowing the other mobile operating system that was there at that point of time, that is the Windows Mobile system, and now it shares the ecosystem with Apple's iPhone system. So, there is a lesson here that the bets on novel technologies tend to be game changers for businesses.

And for doing that, there should be a clear understanding that this technology is going to add value to the core mainstream technology that the company has. And depending upon this bet, the valuation that is placed on the acquired companies varies significantly.

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The same level of technological bets do not happen in the established industrial space, but even here, there are occasions where certain novel ways of manufacture or the novel developments could be from the startup area when bus body manufacturer was being undertaken in small scale, use of integral construction akin to the car monocoque construction was brought in.

And that has helped bus body makers develop buses which were lighter, more strong and also having different kinds of floor construction. In future as we discussed earlier electric and automotive technologies are going to be completely different based on the contributions that would come from startups.

Similarly, the autonomy in the automobile business is also like to be transformational based on the contributions that would be made by the startups. Therefore, every industry has to be watchful of the technological bets that it could take over a period of time that is emerging and ensured that the core industries are transformed in the right manner possible.

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Technological Innovation + Commercial Success Boosts Financial Valuation

Acquirer	Acquired	Year	Domain	Valuation (USD Bn)
Microsoft	LinkedIn	2016	Professional social media	26.2
Facebook	WhatsApp	2014	Social networking	19.0
Google	YouTube	2006	Online video streaming	1.65
Google	Android OS	2005	Mobile operating system	0.05
Microsoft	Hotmail	1997	Email platform	0.50
Microsoft	Skype	2011	Video calls	8.50
Google	Instagram	2012	Social media	1.0
Yahoo	Tumblr	2013	Micro blogging website	1.10
Apple	Beats	2017	Music streaming	3.0
Microsoft	Mojang	2014	Game developer	2.5
Amazon	Twitch	2014	Video game streaming	0.97
Facebook	Oculus VR	2014	Virtual reality	2.0
Google	Nest	2014	Home automation	3.2
Walmart	Jet.com	2016	Ecommerce	3.3
Cisco	AppDynamics	2017	IT operations analytics	3.7
Adobe	Marketo	2018	Marketing automation software	4.75
Microsoft	aQuantive	2007	Online ad network	6.3

As I said earlier, depending upon the potential for Business Edition, the potential for strengthening of the core business, the valuation bets are placed, and they are not only based on the chronology but also based on the potential. In certain cases, the companies could be for fortuitous in having certain path breaking innovations acquired at reasonable prices. Whereas, in certain cases hefty valuations have to be paid for getting those companies integrated.

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But all through these acquisitions, it has been established that the companies have been able to retain the founders touch even after the acquisition, the acquired companies and the acquired the technologies grew in a much more significant and in a much more helpful manner. Big companies have understood this philosophy and have begun to retain the founders in their ecosystems even after the acquisition.

At times analysis has proved that about two thirds of the startup founders that accepted jobs at Google between 2016 and 2014 has still been with the company which means that Google has been able to create and sustain an ecosystem which is based on creativity and which is still inspirational for the acquired company founders so that they could continue to do their work at Google and ensure that their own brainchild grew further under Google's parentage.

Amazon has retained about 55 percent of its founders over the same time period while Microsoft retained at around 45 percent. Facebook had a much higher retention rate for its founders at 75 percent is beating the old competitors in this game. Apart from the monetary incentives, the core of the Google’s pitch for founders is the opportunity to use its bountiful resources and scale up their ideas and operations.

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Investments by Global Tech-Giants in Indian Tech Start-ups

Acquirer/Investor	Acquired/Invested	Year	Domain	Valuation
Facebook	Meesho	2019	Ecommerce	Undisclosed
Facebook	Little Eye Labs	2014	Mobile app developers	$9 million - $15 million
Walmart	Flipkart	2018	Ecommerce	$16B
Amazon	Tapzo	2018	Aggregator app	$40M
Mercer	Mettl	2018	Talent assessment	$2.5B
Samsung Venture Investment Corporation	OS Labs Gnani.ai Silvan Innovation Labs	2019	Technology	$8.6M
Tradus	BuyThePrice	2013	Ecommerce	Undisclosed
Twitter	ZipDial	2015	Marketing platform	$30M
Yahoo	Bookpad	2014	Cloud data services	$15M
Ibibo Group	Redbus	2013	Online bus ticketing platform	$138M
Oracle	Bitzer	2013	Mobile app service provider	Undisclosed
Hitachi	Prizm Payment Services	2013	Payment services	$250M
Brillio	Marketelligent	2014	Data analytics	$70M
Amazon	Junglee	1998	Shopping comparison site	Undisclosed
eBay	Baazee	2004	Ecommerce	$50M

This trend of mainstream companies acquiring the companies is no longer confined only to the Silicon Valley or the other innovation clusters and hubs in the US. Many of the global tech giants are looking at Indian startups to see how they can add value to their own mainstream businesses. We have had Walmart acquiring Flipkart, which is one of the largest acquisitions in India.

But we also have Samsung venture Investment Corporation investing in OS labs, Gnani.ai and we also have a Ibibo group acquiring Rebus. So, there are a number of acquisitions that are happening in the Indian startup space of companies which are tech based.

As Indian startup companies go more product oriented or come up with more market savvy digital applications, this trend of global tech giants taking a piece from the Indian startup scene to strengthen their global businesses only bound to enhance in future.

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Technological innovation is very important, and so does financial sufficiency. So, however brilliant technological startup is the financial requirements for the operationalization and later commercialization of the idea, and the prototype could be significantly higher than what the startup can ever manage.

So, those were the points of inflection which made the companies which we discussed earlier, cede the control to the global giants and benefit the overall tech ecosystem in that process. Similarly, Indian startups have to be wary of they are trying to do all by themselves for a greater length of time.

If the Indian financings system which we will consider at a later point of time is strong enough and robust enough to support startup founder's dreams that is well and good. But if there are financial constraints, startups have to look at an appropriate merger of the technological innovation they have with the financial sufficiency that the mainstream companies could provide, that would be a win-win.

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Similarly, for the technological innovation, to be sustainable, there should be financial solvency, it is not possible to fund technological innovation based on financial insolvency because prototype development is iterative, idea refinement is iterative. Making a big jump from an electromechanical device to a completely digital device, for example, could be expensive it requires that the startups are founded in an appropriate manner.

Therefore, the inventiveness and passion of techno-entrepreneurs, while driving the generation and conversion of new ideas into innovative products, the operationalization of such products must seek financial solvency. And to be able to do that, we have to see when the timing is right to reap appropriate value from the technological developments that have taken place.

So, entrepreneurship is not merely taking the product all through the lifecycle till the final and scaled up sale, it also lies in seeing when the monetization could be appropriate to be able to launch the product with much greater scale and scope. So, the choices are always intriguing whether to continue the development and take the company to the commercialization within organic organizational framework, or to look at collaboration or to look at acquisition by a more capable entity.

These are all choices that entrepreneurs would have, as they try to convert their technological inventiveness, their technological innovation into financial propositions as we go along. But without doubt the technological innovation is the foundation of entrepreneurship and the more technologically innovative Indian startup ecosystem becomes, the more financially vibrant the Indian startup system would emerge to be.