Product Design and Innovation
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Lecture - 01
Introduction to Innovation

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Hello friends. So I am trying to experience the pain in sharpening pencil with the help of knife. It is really painful and it needs a different skillset.

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To solve this problem, we used to have this kind of sharpener till 90s and then lot many other organizations, different companies explored different kind of form.

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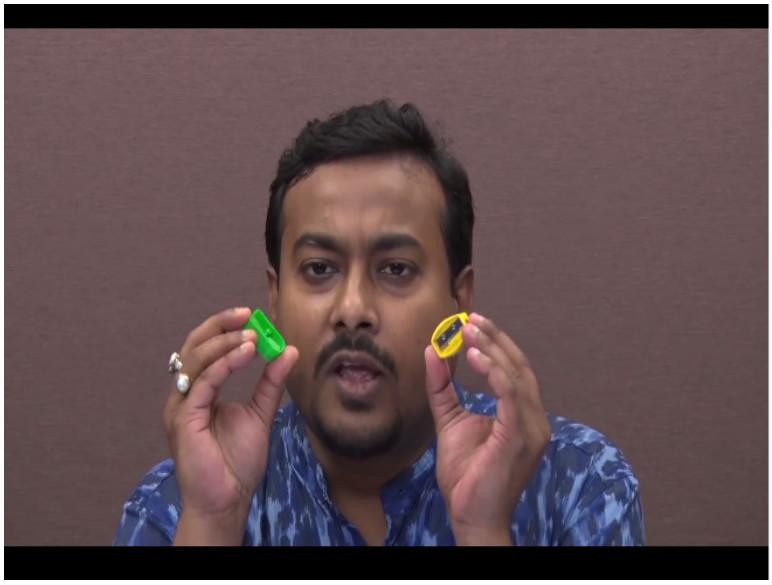

And they gave us this kind of products but in 2018 when I went to market I saw different kind of sharpeners.

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Sharpeners with storage chamber where all those scraps will be stored.

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Here in this also there is a storage chamber and as well as eraser and here there is a sharpening option.

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There are other designs available. Here you can sharpen your pencil and as well as oil pastels and all those scraps will be stored here.

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Then, most interesting is this one, you can sharpen your pencil and it will create an interesting sound and at the same time all the scarps will be stored here. Why there are different kinds of products? It is because to go ahead in the market and how they are achieving in it? They are achieving it by innovation and innovation by design.

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If it is so why all the organizations are not adopting innovation that is explained by the magazine innovation leader. You can see here in the cover page of the innovation leader where they explained very nicely that many CEOs undermine innovation and many CEOs understand innovation and because of that there is lot of difference. So in this context, it is very important to understand innovation. So here in this module 1, lecture 1 will discuss about innovation.

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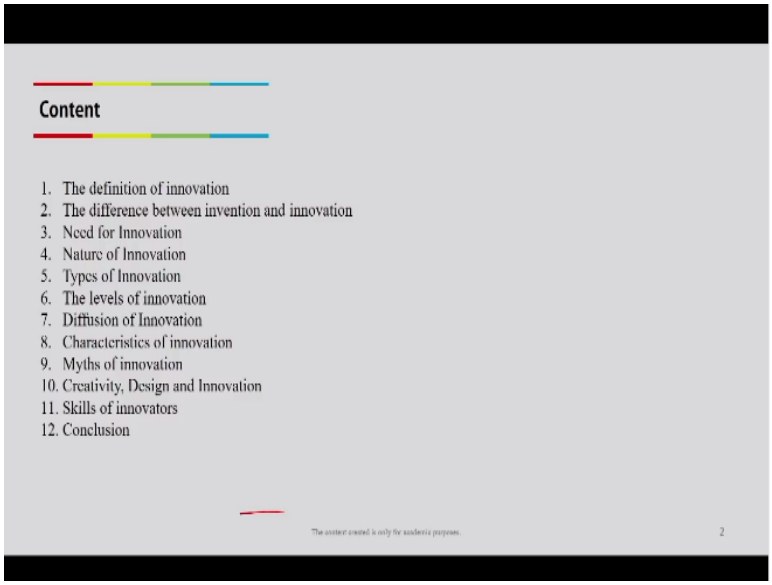

So in this lecture we will be discussing about the definition of innovation and the difference between invention and innovation, need for innovation, the nature of innovation, the different kind of innovation, the levels of innovation. How innovation gets diffused in the market, society so the characteristics of innovation, myths of innovation, how creativity, design and innovation is related and at last skills of innovators.

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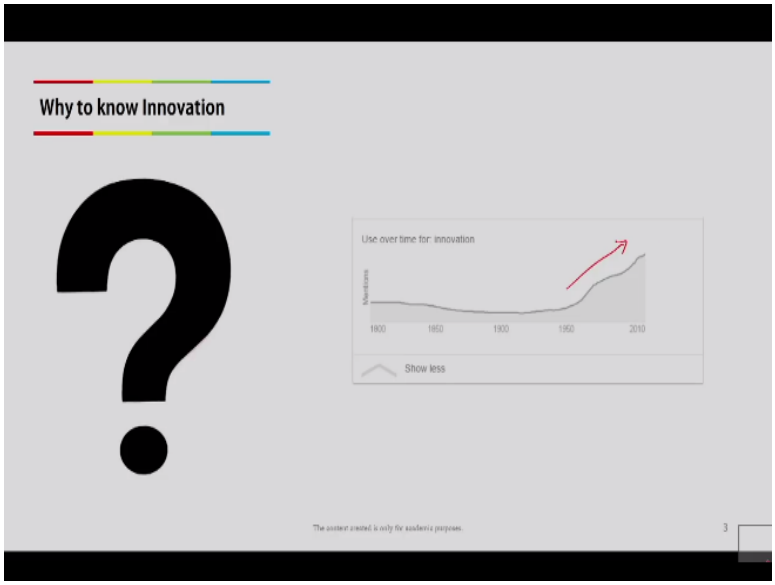

Why to know innovation? If you search in Google, you can see in 21st century the use of the word innovation increased exponentially. Why is it so? It is because innovation is the key word, key transforming factor in the economic growth. How?

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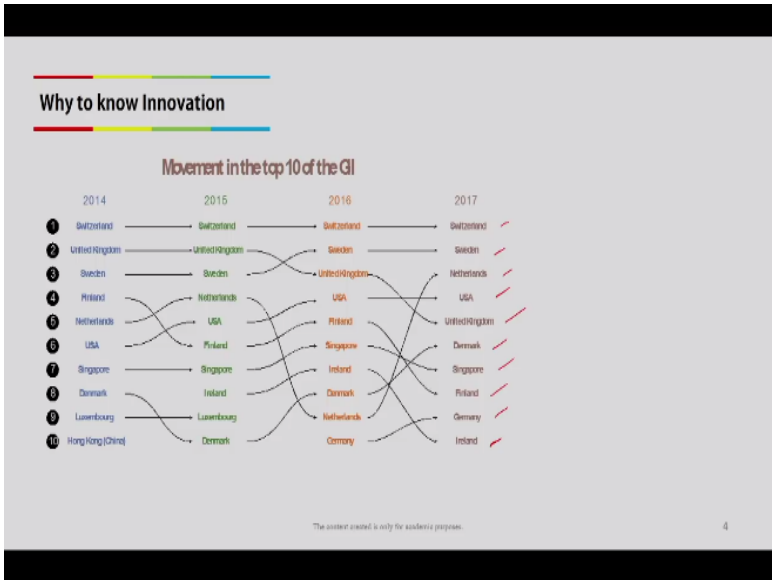

Let us see the global innovation index. In global innovation index, there are many companies, Switzerland, Sweden, Netherland, USA, United Kingdom, Denmark, Singapore, Finland, Germany and Ireland.

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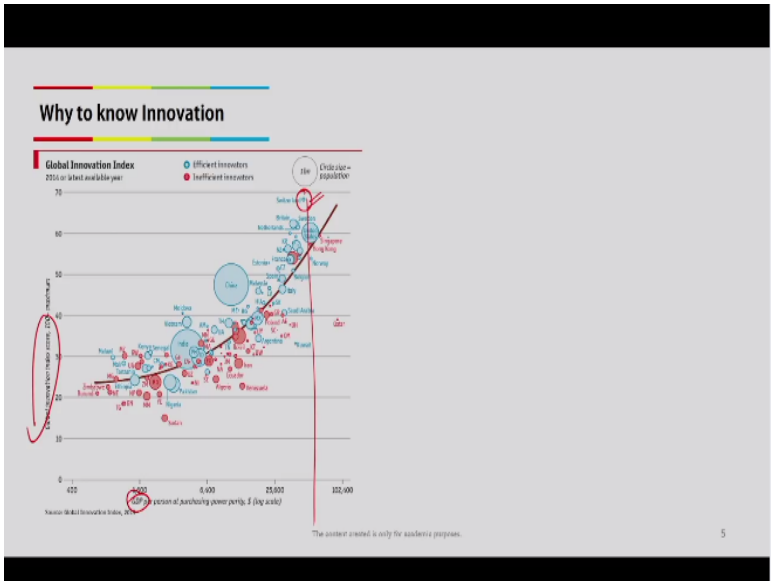

So these companies swipe their position over years and if we see the graph between global innovation index and GDP, we can see the countries who are having highest global innovation index as highest GDP. So there is a huge correlation between global innovation index and GDP. So in this context, it is very important to understand what is innovation.

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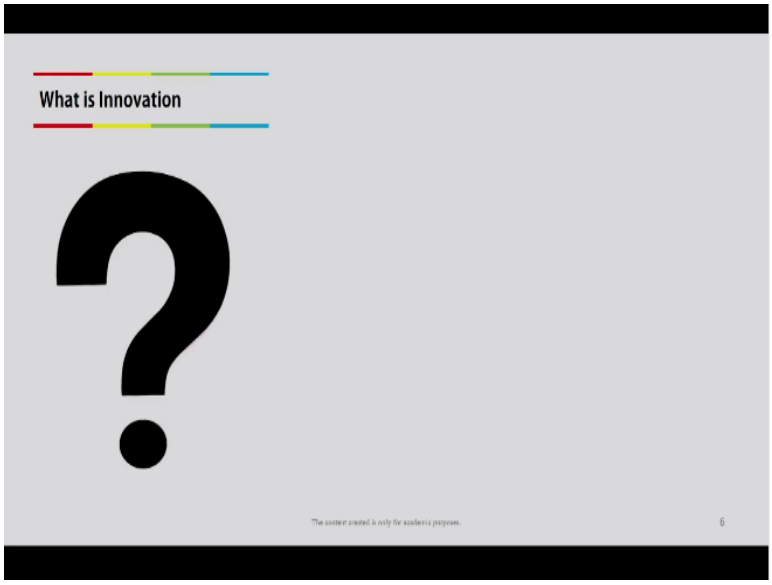

So there are many definitions given by academician, industry experts. So we have to see, we have to find out a simple definition to understand.

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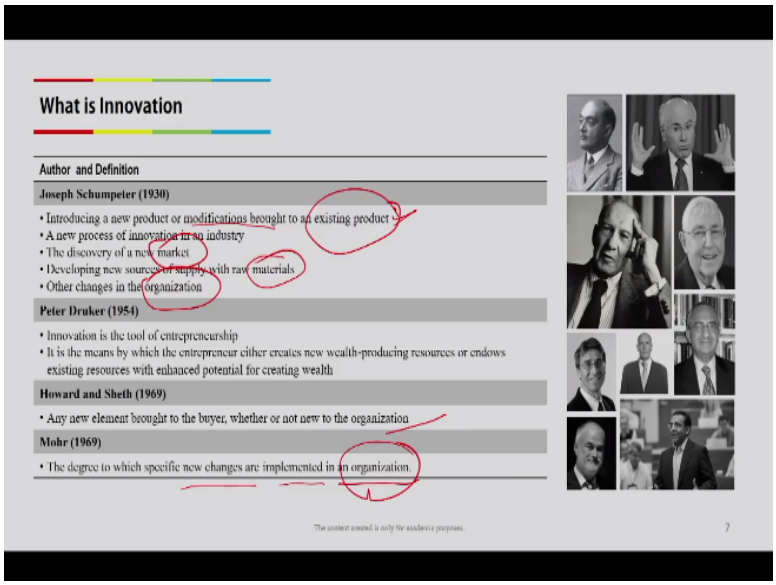

So Joseph Schumpeter told that introducing a new product or modification brought to an existing product is innovation. In new process of innovation in an industry is innovation. The discovery of a new market is also innovation. Developing a new source of supply with raw material is innovation and any kind of other changes to achieve that in the organization is also innovation.

Peter Druker later told that innovation is the tool of entrepreneurship and it is the means by which entrepreneur either creates new wealth producing resources or endows existing resources. Later Howard and Sheth told that any new element brought to the buyer whether or

not new to the organization is innovation and the degree to which specific new changes are implemented in an organization is also innovation.

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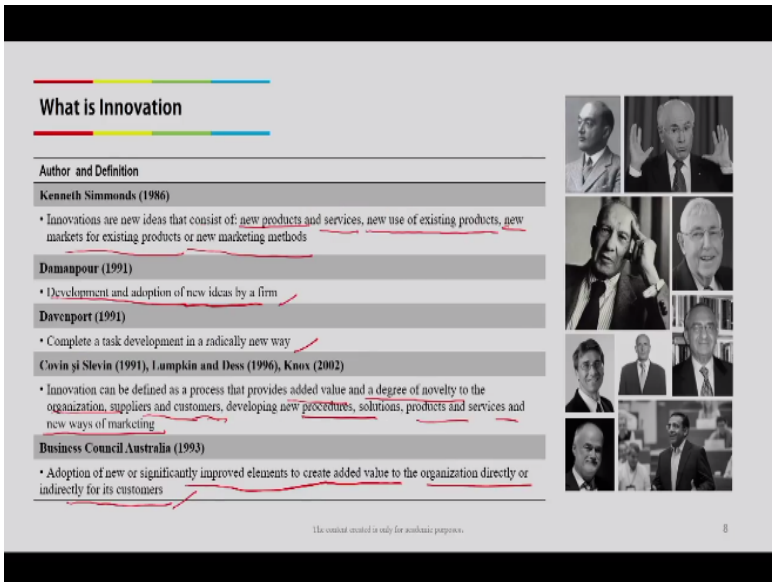

Simmonds told that innovations are new ideas that consist of new product and services, new use of existing products, new market for existing products or new marketing method. So they emphasized on product, service and new use of the existing product, new market and new marketing methods. Damanpour told that development and adoption of new ideas by a firm is also innovation.

Davenport told that to complete to task development in a radically new way is innovation. Innovation can be defined as a process that provides added value and a degree of novelty to the organization and supplier and customer to develop new producer, solutions, product and services and new ways of marketing is part of innovation. Adoption of new or significantly improved element to create added value to the organization directly or indirectly for its customer is innovation.

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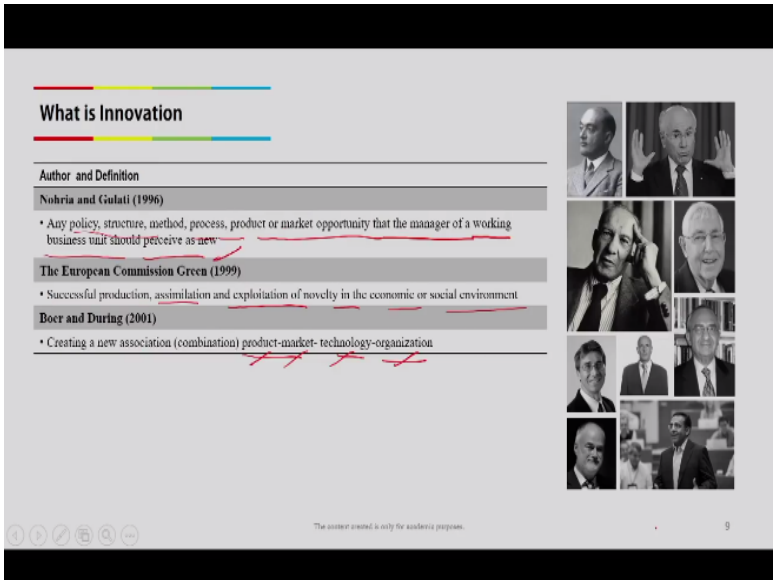

Any policy, structure, method, process, product or market opportunity that the managers of a working business unit should perceive as new is innovation. Successful production, assimilation and exploitation of novelty in the economic or social environment is innovation. Later Boer and During told that creating a new association is basically combination of product, market, technology and organization is innovation.

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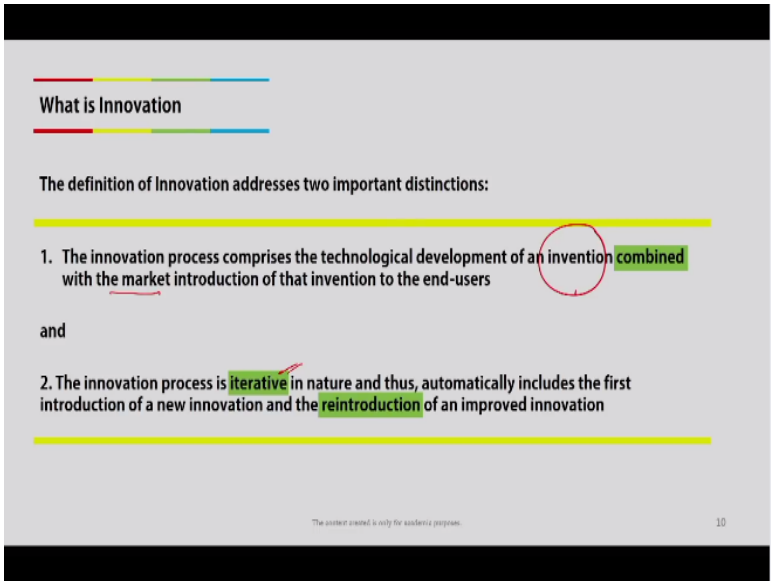

So from all these definitions, I have derived this two things, two points, one is the innovation process comprises the technological development of invention combined with the market introduction to the invention to the end-users. So invention should go to the market then only it will consider as innovation and the innovation process is iterative. You have to continuously develop your product.

While you introduce one product, it goes to society. Society accepts it and then slowly their behaviour changes and new sorts of needs comes out. So again to fulfill that you have to come up with a new product or you have to modify the existing product. So the process of innovation is iterative.

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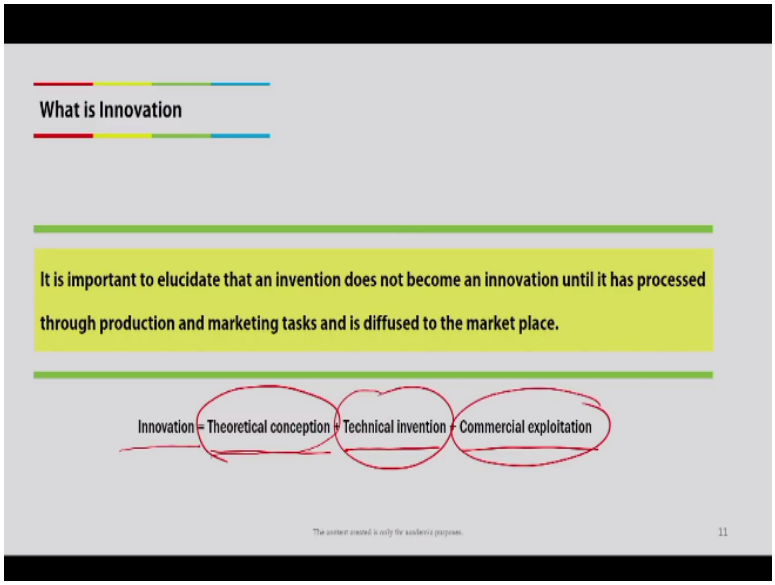

So it is important to elucidate that an invention does not become an innovation until it has processed through production and marketing tasks and is diffused to the market place. So innovation if I see any simplest form, innovation is theoretical conception plus technical invention and commercial exploitation, so now we know what is innovation.

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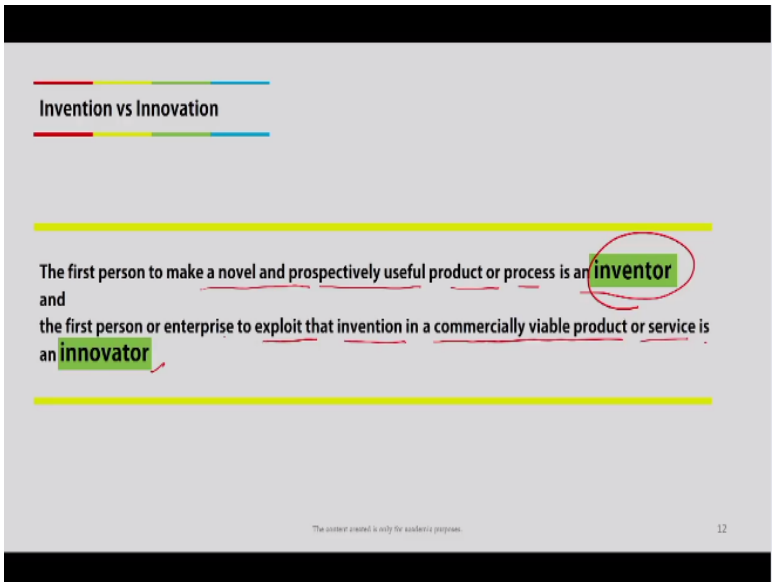

Let us see invention versus innovation. The first person to make a novel and prospectively useful product or process in an inventor and the first person or enterprise to exploit that

invention in a commercially viable product or service is innovator. So this is the difference between inventor and innovator so now we will see the relationship between inventor and innovator.

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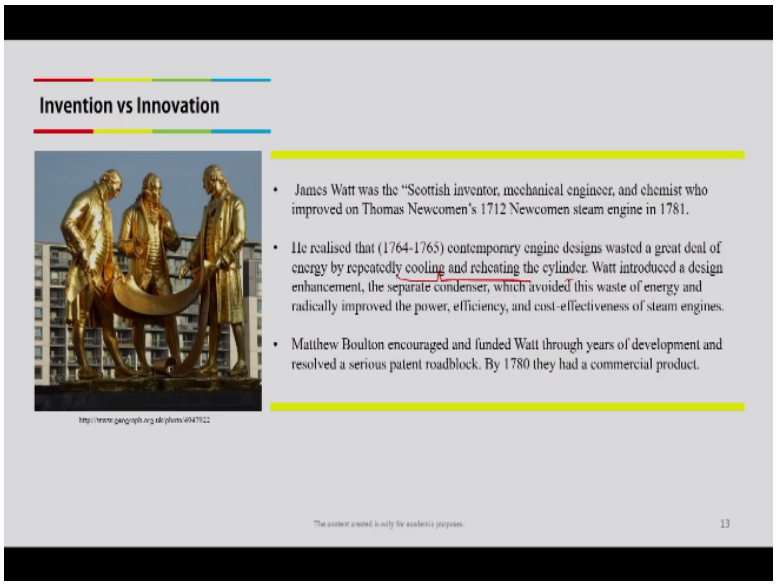

So first story of James Watt. So James Watt was a Scottish inventor, mechanical engineer and chemist. So once he got the Newcomen's engine and he understood that the contemporary engine design wasted a great deal of energy by repeatedly cooling and reheating the cylinder. So what introduced a new chamber, it is basically a condenser and increase the efficiency and to make a model of it, prototype of it he approached Matthew Boulton and Matthew Boulton was facing bankruptcy.

But Matthew Boulton understood that the important of the invention and then he helped James Watt. What is the moral of the story? The moral of the story is the skills of both participants were required. James Watt provided the technical knowledge and the motivation to create a technical improvement and Matthew Boulton encouraged and funded. The second point is many successful products or services extend far beyond the vision of their creator.

But they must all have at least one sustainable application to get them started.

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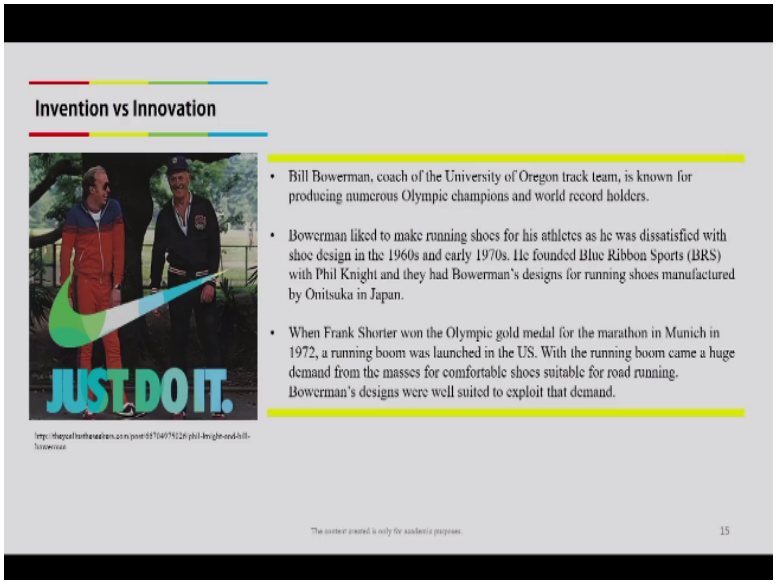

Next story is of Nike. Bill Bowerman, coach of University of Oregon track team is known for producing numerous Olympic champions, but he was not happy with the sports shoes in the market in 60s and 70s and then he started making a new kind of sports shoe which will help athletes and he along with Phil Knight produced shoes for athletes. So they produced by Onitsuka in Japan.

When Frank Shorter won the Olympic gold medal, there was a boom, there was a demand in the market for sports shoes and they exploited the market. So what is the moral of the story?

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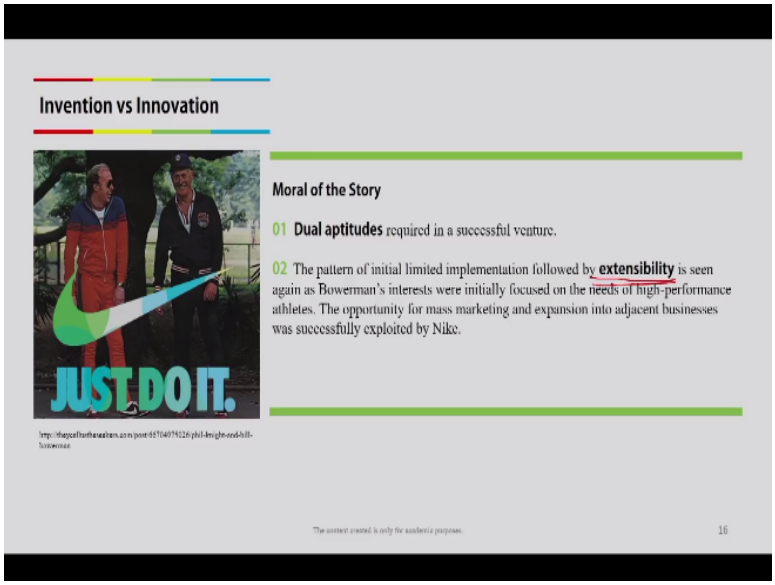

The moral of the story is dual aptitude required. The pattern of initial limited implementation followed by extensibility is seen again as Bowerman's interests were initially focused on need of high performance athletes. He initially started with catering athletes only. So when

they got this opportunity to cater masses, they exploited the market. So they should see how they can get the extensibility.

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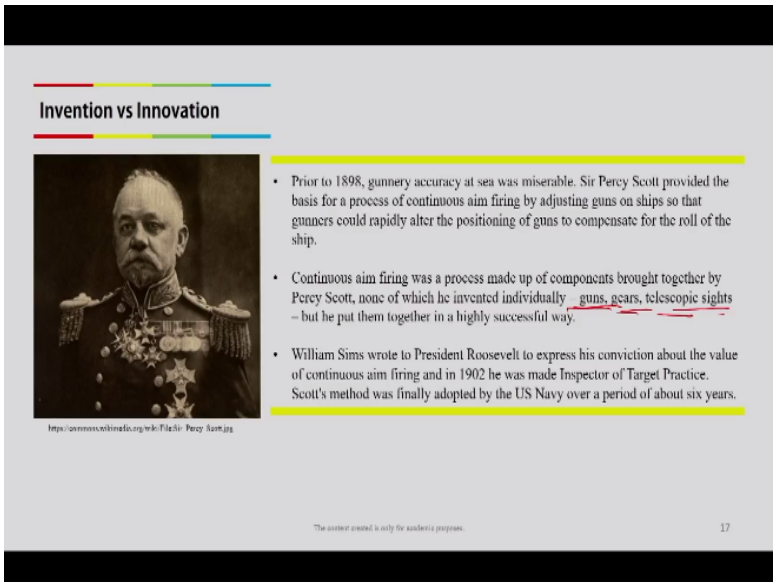

Next story is from navy. Sir Percy Scott was in British Navy and he invented the continuous arm firing with the help of guns, gears and telescopic sights. None of them was invented by him but he combined these 3 things in such a way that he can get better accuracy. Then, sometime later Sir Percy Scott met Williams Sims who was in US navy. Williams Sims was impressed with the technology and he wanted to introduce in US navy.

But when he asked the authority, he was fired. He was fired with an allegation for falsifying the information. He was confident. He wrote a letter to President Roosevelt. President Roosevelt appointed him for Inspector of Target Practice and they got better result.

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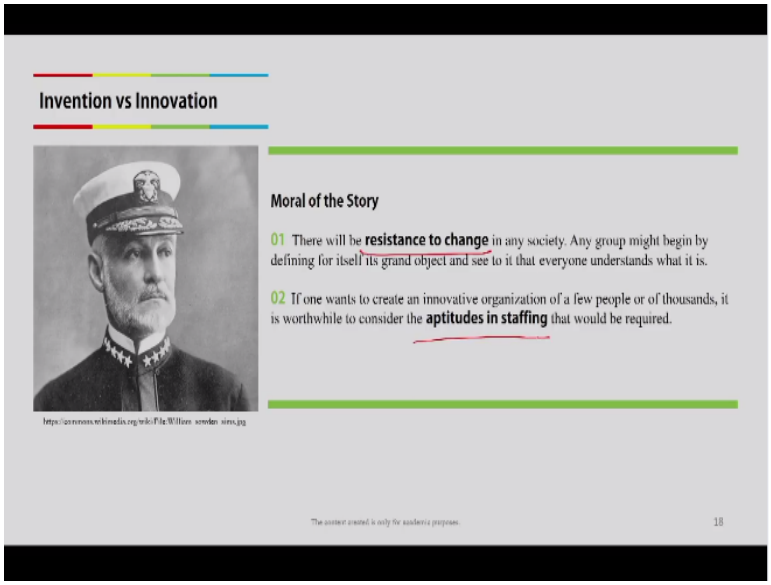

So what is the moral of the story? The moral of the story is there will be resistance to change in the society but you have to overcome it. Next is if one wants to create an innovative organization of a few people or of 1000s, it is worthwhile to consider the aptitudes in staffing that would be required.

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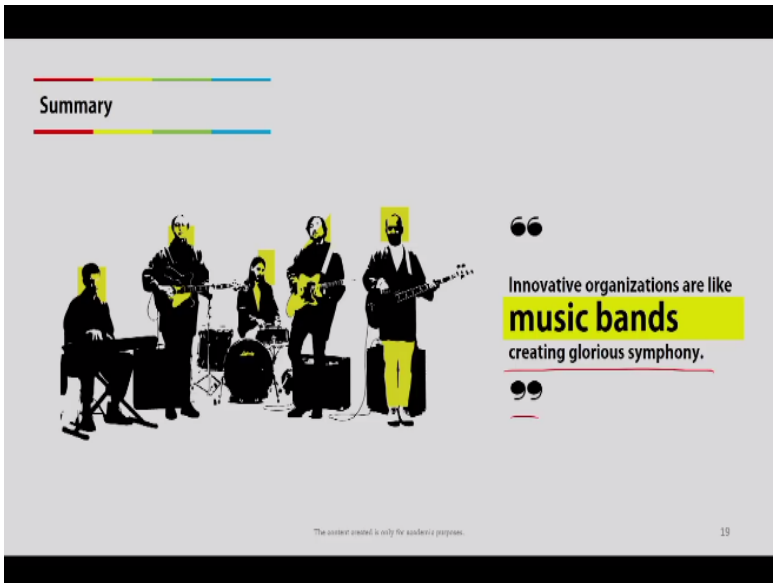

So innovative organizations are like music bands where everybody in the group is playing a different kind of instruments but still they are creating symphonies.

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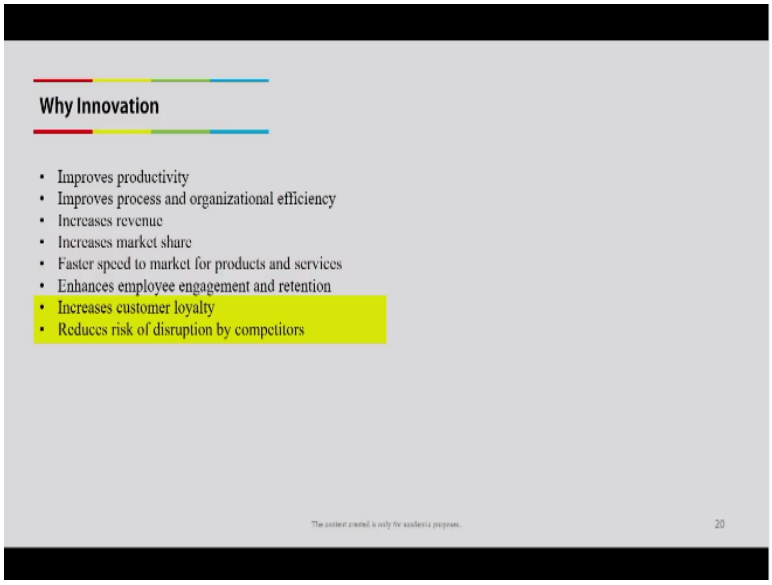

So why innovation? Because innovation improves productivity, it improves the process and organizational efficiency, it increases revenue and market share, the fastest speed of market for products and services and enhance employee engagement and retention and the most important is it increases customer loyalty because of the continuous improvement in the product, it increases customer loyalty. It reduces a risk of disruption by the competitors.

There will be yen number of players in the market. They will be introducing different kind of product. So there is a chance of disruption. So if you are continuously innovating, there is a less chance of disruption.

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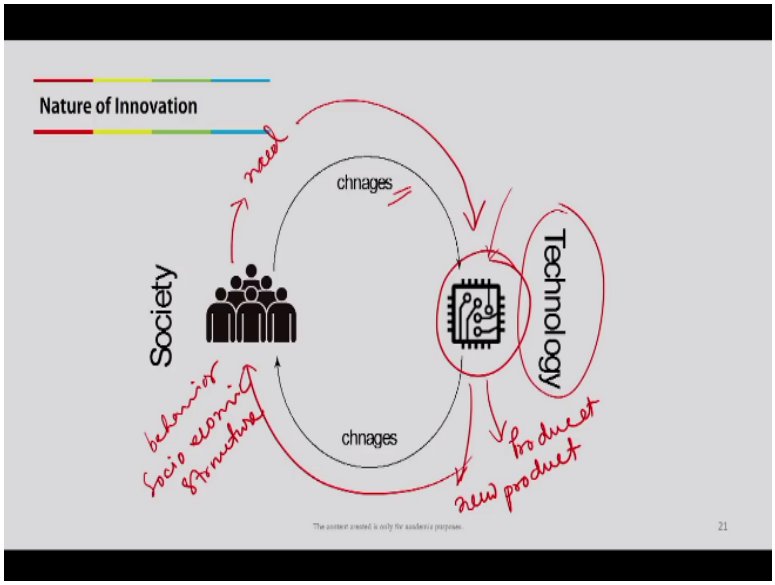

Let us see nature of innovation. How society and technology influence each other. So a new kind of technology comes and with the technology they make a different kind of product and

this product changes the society. It changes the behaviour, socioeconomic structure and hence there will be new need and to cater that need the technology should come up with a new kind of product.

If technology is not reacting to it, the old product may get absolute. This phenomena is called technician and when technology is reacting to these changes and introducing a new product, this phenomena is called reaction because of this continuous reaction of the technology and society innovation happens.

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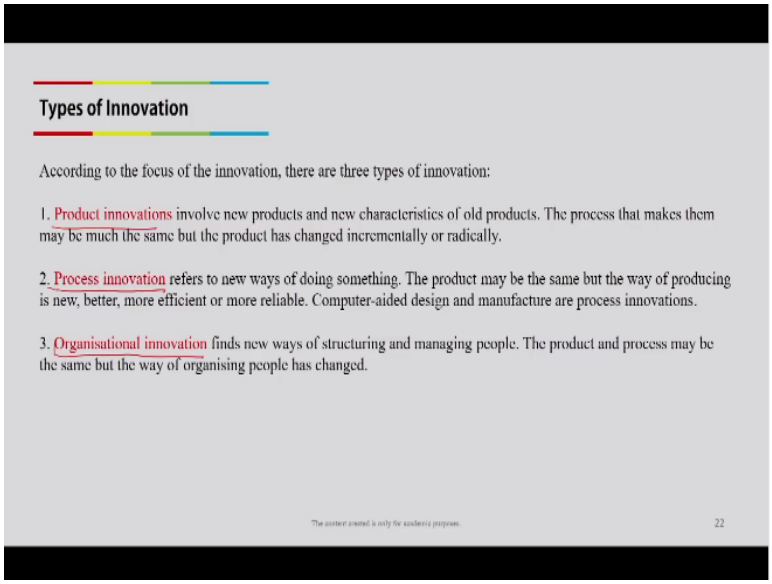

So now we will discuss types of innovation. So we can see there are 3 types of innovation. One is product innovation, process innovation and organizational innovation. Any kind of improvement in the product or to produce that product, some sort of modification in the process is product innovation.

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So initially this kind of sharpener is to have with aluminum and later other companies figured out different kind of material and they introduced plastic sharpener. So if you are changing the material definitely you have to change the process. So this kind of product and process innovation we saw in the product innovation.

What is process innovation? In process innovation, we will see difference kinds of innovation to get new, better or more efficient reliable process. For example, computer-aided design. Initially, it was hand drafted and then computer-aided design came which is new, better and more efficient. Next is organizational innovation, organizational innovation finds new ways of structuring and mapping people.

So in most of the organization which are maintenance team, production team, RND works isolately but a new kind of approach towards innovation is cross-functional team working together where different kind of people from different domain are coming together and working for better and innovating result. So these are organizational innovation. There are many other innovation people consider like production innovation.

So production innovation is nothing but TPM total productivity maintenance. So this also comes under process innovation and there are other innovation like management innovation which is total quality management. So these are also will come under process or organization. Some people also include service innovation. Service innovation actually will come under product innovation only because nowadays product and service is not in isolation. Product, service and system are integrated. So we saw different type of innovation here.

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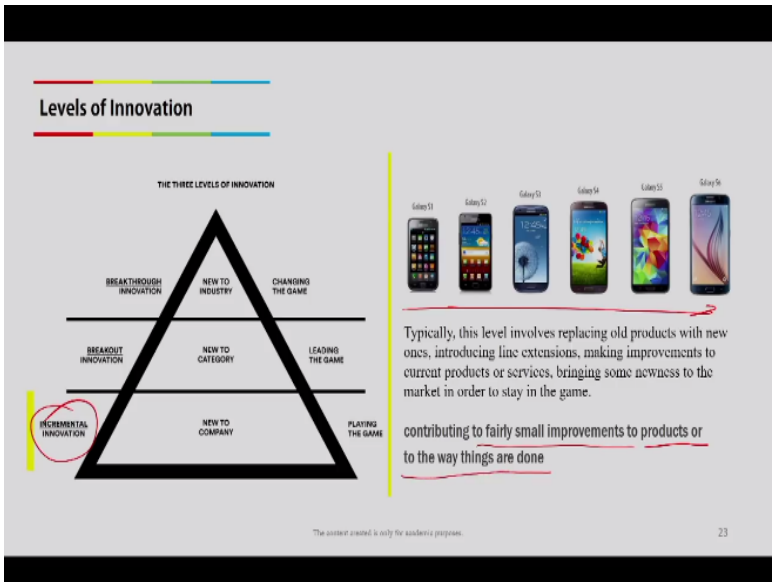

Now we will discuss different levels of innovation. The first one is incremental innovation, small modification and after that you are introducing that product in the market is incremental innovation. So one of the example is nowadays you can see in the line of mobile phones, you are getting everyday new kind of mobile phones with small modifications. So incremental innovation is contributing to fairly small improvement to products or to the way things are done.

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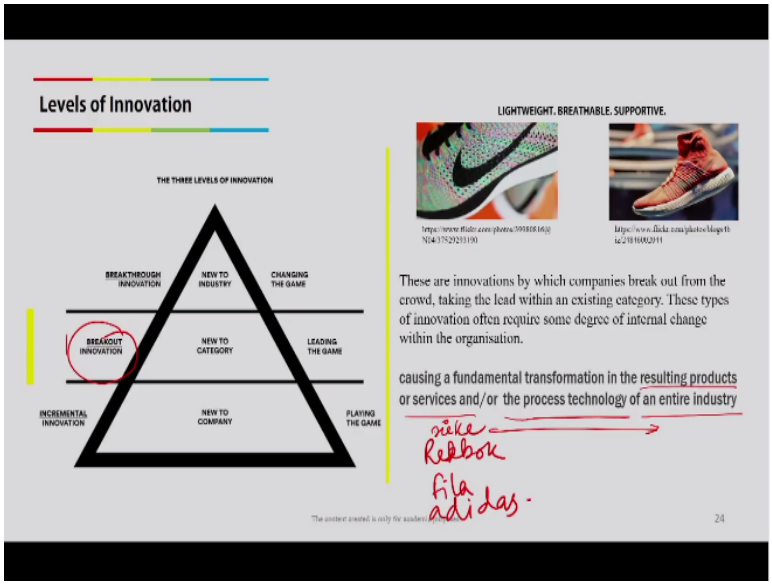

Next is breakout innovation. In breakout innovation, it causes a fundamental transformation in their resulting products or services and the process technology of an entire industry. For example, in market nowadays there are many sports shoemakers, Nike, Reebok, Fila, Adidas,

but what Nike did they produced a different kind of product in same line with different kind of technology where the shoe is giving a feel of socks and lightweight.

And now Nike is going ahead, so this kind of innovation is breakout innovation where the organization will lead the market.

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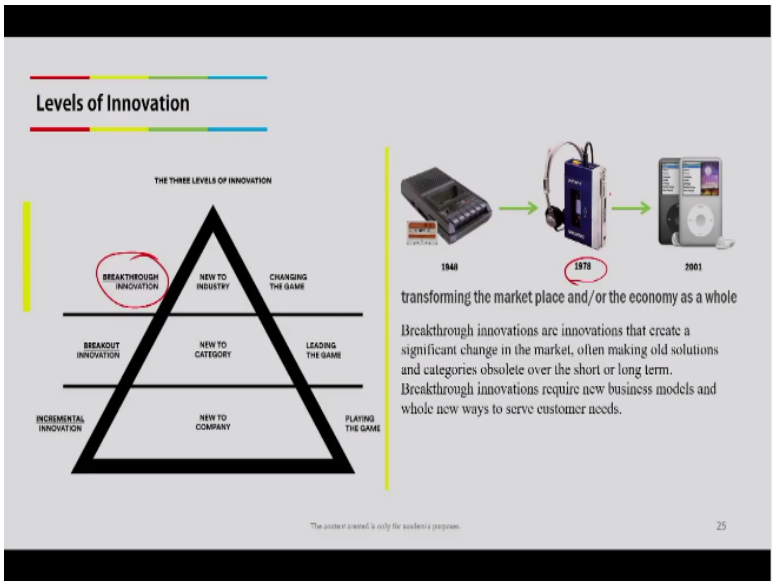

Next is breakthrough innovation. In breakthrough innovation, the example is the tape recorder, the way we use to listen music before 40s are gramophone and then in 48 we had tape recorder but later on in 78 Sony understood that there should be a new kind of design and they introduced Sony Walkman with the help of Sony Walkman you can walk and you can listen music.

And in 2001 Apple introduced iPod. In this kind of innovation, they are completely changing the game. They are changing a new product. They are transforming the market place or the economy as a whole. So this is the nature of breakthrough innovation.

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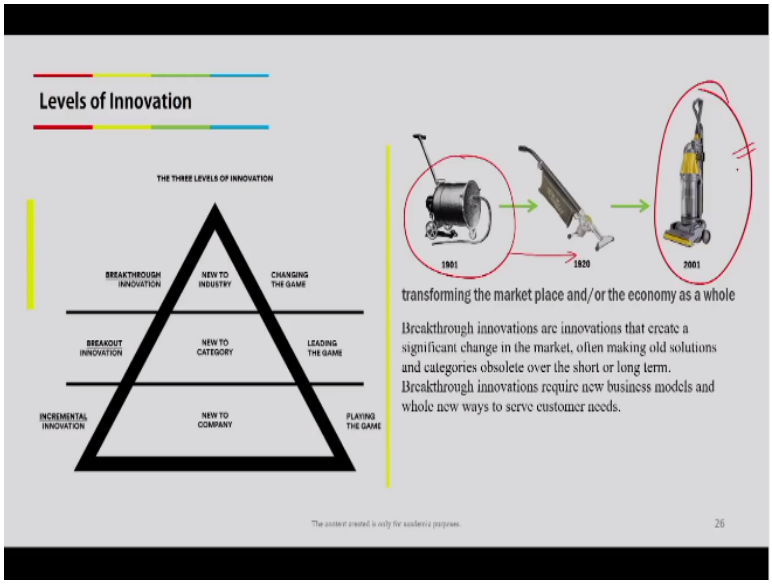

So another example is vacuum cleaner. So James Dyson introduced this particular kind of design with cyclone technology. Previously, it was that we had huge and cumbersome design. A slight modification done over years but it was not that efficient, so this product created a complete difference in the market. So most of the time breakthrough innovation causes old products, it causes obsoletion, so old product goes obsolete.

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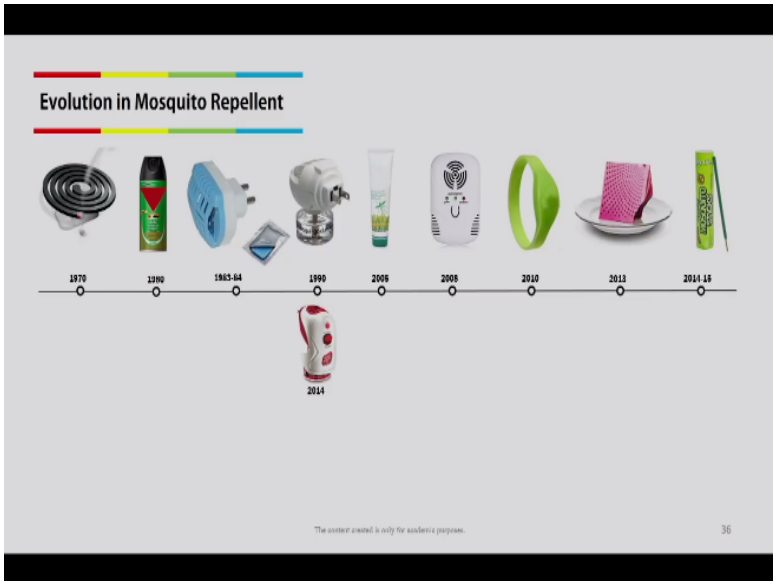

So now we will see evolution in mosquito repellent to understand incremental breakthrough and breakout innovations. So we had mosquito coil in 70s and then somebody realized that smokes are not going in all the corners, so spray is required. So spray came out in 80s and then mosquito mat but because of the health hazard it was introduced mosquito liquidator and then somebody realized that I am safe in house but what about outdoor.

So they introduced mosquito repellent cream and then a new technology came with ultrasonic sound how to kill mosquitos. Then, mosquito cream may not be suitable for all type of skin so somebody introduced mosquito repellent band and then in the same line of mosquito coil faster and efficient way with paper and then we had incense stick for mosquito killing. Then, in the same line of liquidator we had different kind of design.

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If we see this is one design where you can increase and decrease the amount of fumes coming out.

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And in the same line it is like modification in the form and slight modification in the switch.

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And similarly there are other products also from different brand where you can increase and decrease. So this kind of products innovation are considered as incremental innovation.

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One more design came in the line of mosquito liquidator where they used fan. So these kinds of products are trying to create a big difference in the same line of the product. So they are changing the process. So these are on the verge of breakout innovation.

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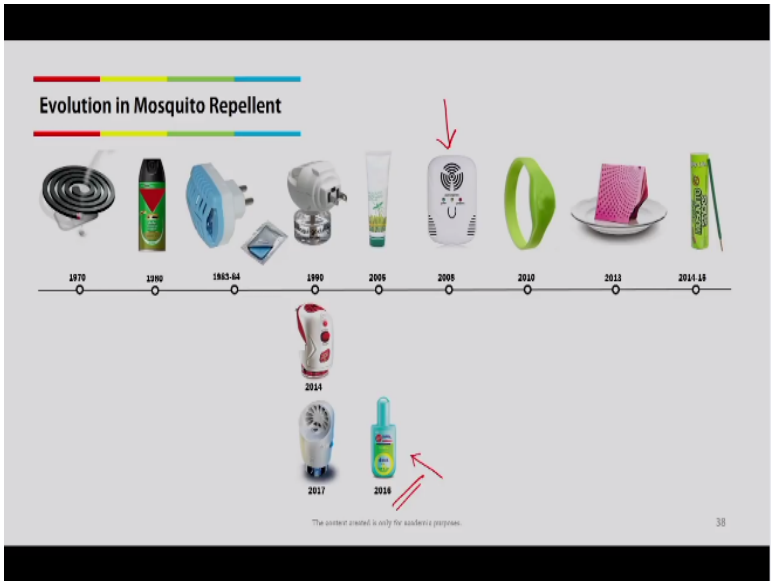

And if you see later different kind of other products also came, roll on so you have to roll on this gel on the body on the cloth so mosquitos will not come around you. So if you see this particular kind of technology and this kind of technology these are on the verge of breakthrough innovation.

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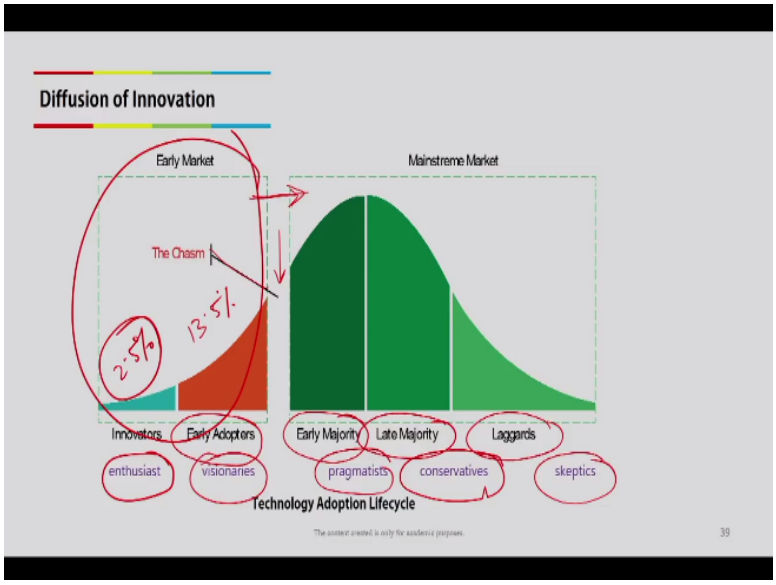

So now we will discuss diffusion of innovation. So Everett Rogers gave this diffusion of innovation theory, so he gave this model where he told that there are 2.5% of the people who are innovator and they are enthusiast because of that they are trying to innovate continuously and after that there are few people who are early adopter and who are visionaries also. They are always in front of the door.

And they are approximately 13.5%, so this is early market and after that the product goes to the mainstream market. Here it faces early majority, early majority people are pragmatists, they check the product, they enquire about the product and then they use it. Next is late majority, they are conservatives, it is very difficult to convince those kind of people but they wait sometime for price reduction or you know feedback from early majority.

And then the last community is Laggards who are skeptics, so when it goes from early market to mainstream market there is a chasm, there is a risk. So when it goes from early market to mainstream market, so early majority try to check different kind of characteristics and based on that they decide whether they will accept this innovation or not.

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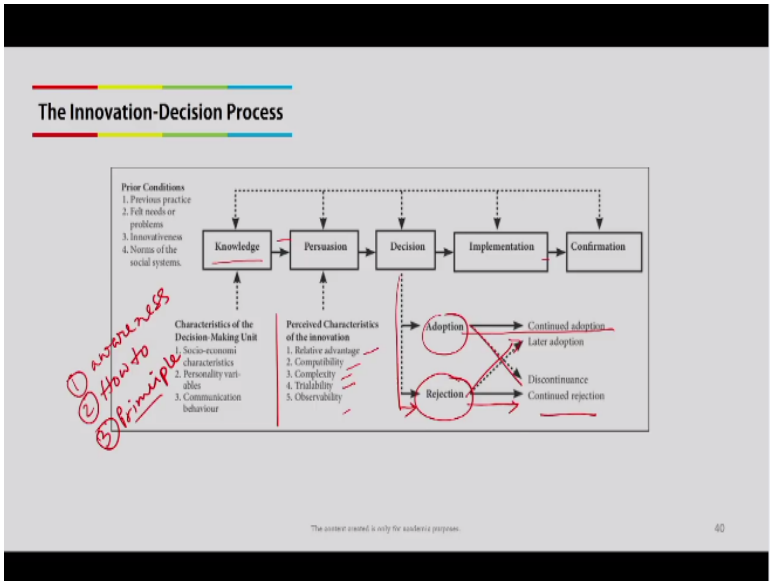

So now we will see how they actually judge about the innovation. It is through a process. The first process is knowledge, knowledge gathering. So first type of knowledge is awareness knowledge where they will try to understand what is this innovation and how that will create difference in their life awareness knowledge. Second is how to knowledge, so in this they will try to know how this particular product or innovation works. How they will use it?

Third one is principle knowledge. In principle knowledge, they try to understand how it actually functions. When these 3 things, 3 knowledge, they gather they go for persuasion. They try to perceive few characteristics of innovation. One is a relative advantage, compatibility, complexity, trialability and observability and based on this persuasion, they take decision, decision to adopt or reject.

After this decision implementation comes. In this they decide whether they will continue with the product or they will reject it. Another thing may happen so they have rejected the product and then slowly over time they realized that the product is good so they will adopt it and it may also happen that they got feedback about the product that it is not good and they will continue rejection.

So this is the process through which they gather information about the product and the perceived few information though the perceived few characteristics of the innovation, so we will discuss about these characteristics now.

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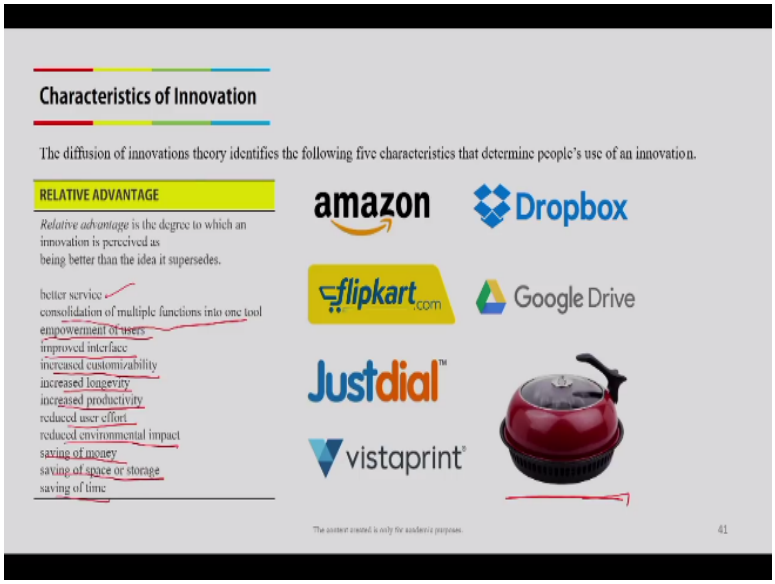

One is relative advantage. Relative advantage is the degree to which an innovation is perceived as being better, so one good example is Sanjeev Kapoor's Wonderfhef Tandoor. So making tandoori chicken is really difficult task at home. So they introduced a completely different kind of product. So here these are some characteristics of relative advantage.

If we are getting better service, if there is consideration of multiple functions into one tool, if we are giving empowerment to the user, if there is improved interface, increased customizability, increased longevity, increased productivity, reduced user effort, reduced environmental impact, saving of money, saving of space or storage, saving of time then it is considered as relative advantage.

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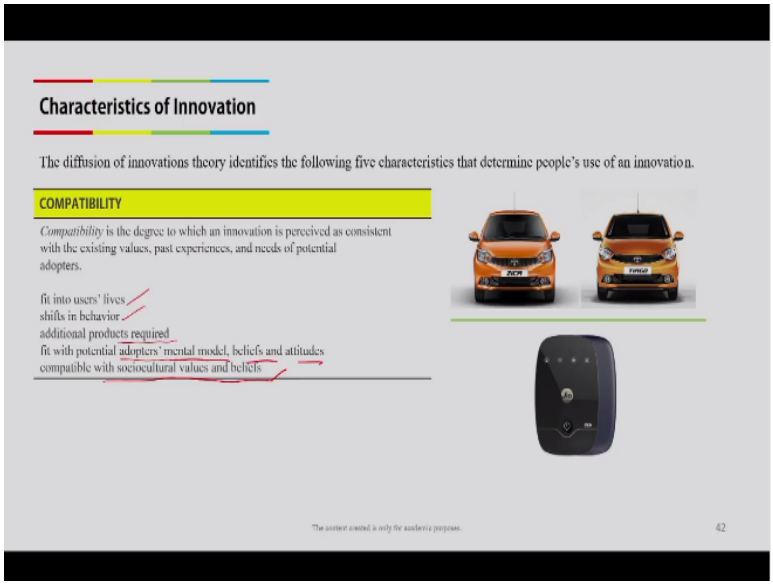

Compatibility, compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences and need of potential adopters. In this, we have to check fit to user's lives whether the product is fitting with the existing products available. Is there any kind of behavior change required, is there any kind of other products required fit with potential adopters, mental model belief and attitude, compatible with the social structural values and beliefs so this must be considered.

So one of the example is when TATA wanted to launch the model Zika, it is also pronounced as Zica but during that time in African countries Zika virus attacked and quickly they changed the name Tiago and they launched it because they knew that if they launch with this name Zika then they may face problem. Another example is Jio adapter. See if you have 2G or 3G phone also you can access 4G internet with this product, so this is also, is example of compatibility.

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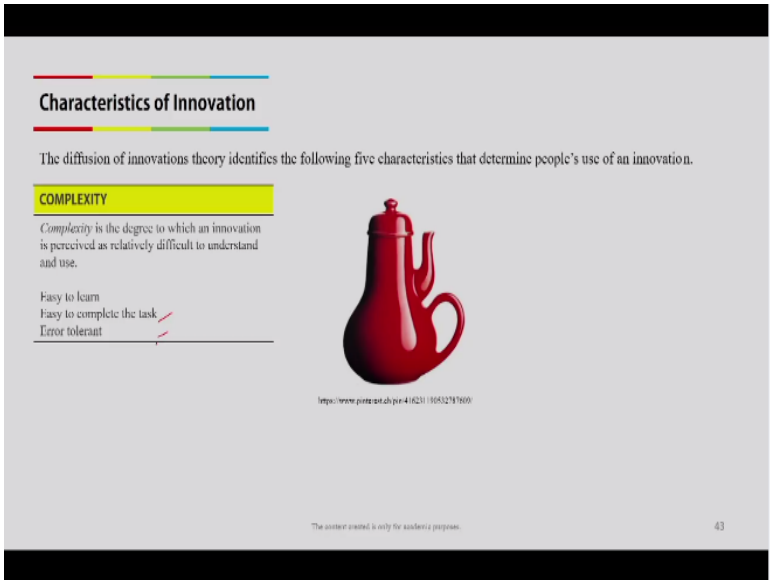

Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. Here these 3 things should be considered, easy to learn, easy to complete the task and error tolerant. If you are adding one more information booklet to understand the product the process of using it then it is very difficult. It should be intuitive. The affordance should be there.

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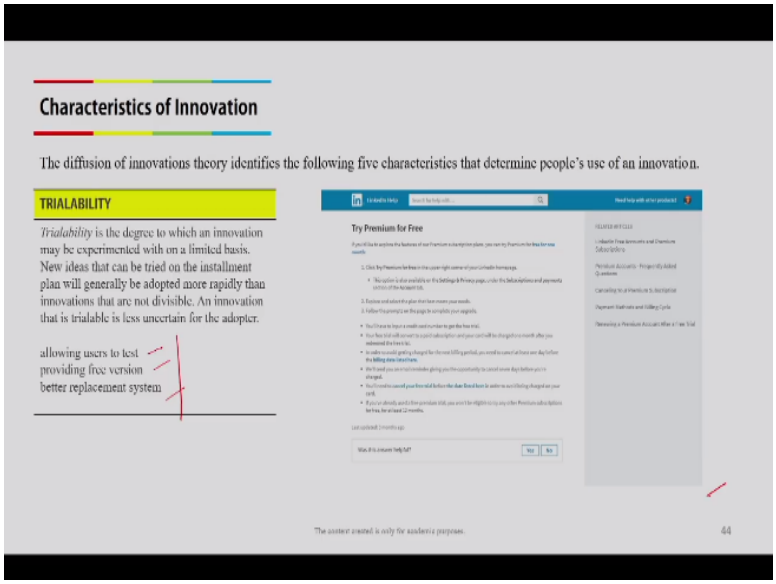

Trialability, in trialability these 3 things are considered. One is allowing a user to test providing free version, better replacement system. So if one example is though it is a service based it is not physical product example but I am giving this example to understand trialability. So in Linked in if you go you can see this option, you can try premium for free for a month.

So you got to shopping malls to buy clothes, you try in the trial room, so this is also kind of trialability.

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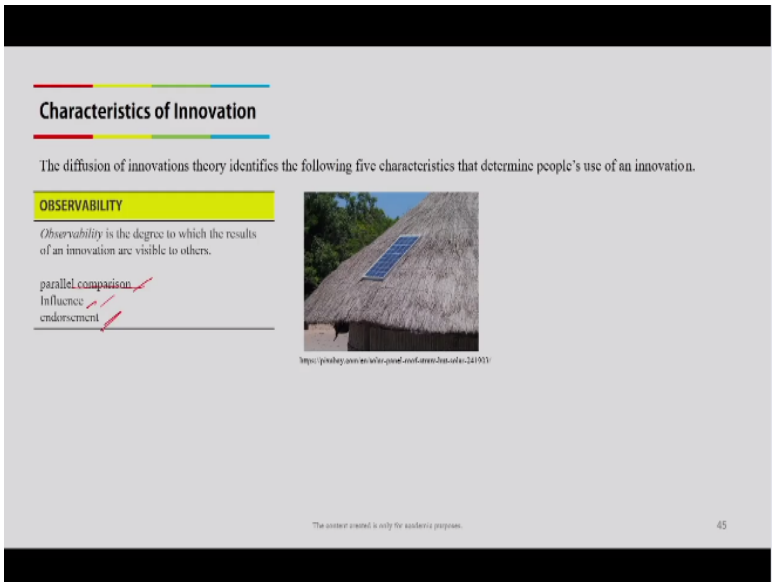

Observability; observability is the degree to which the results of an innovation are visible to others. If the innovation is visible to others then it acts as endorsement, it also influences other users and sometimes it gives you opportunity to compare with other products. If you go to an electronic showroom, then you can see different kind of television are on so you can compare their picture quality and other aspects there. So parallel comparison is possible, so this parallel comparison influence and then endorsement.

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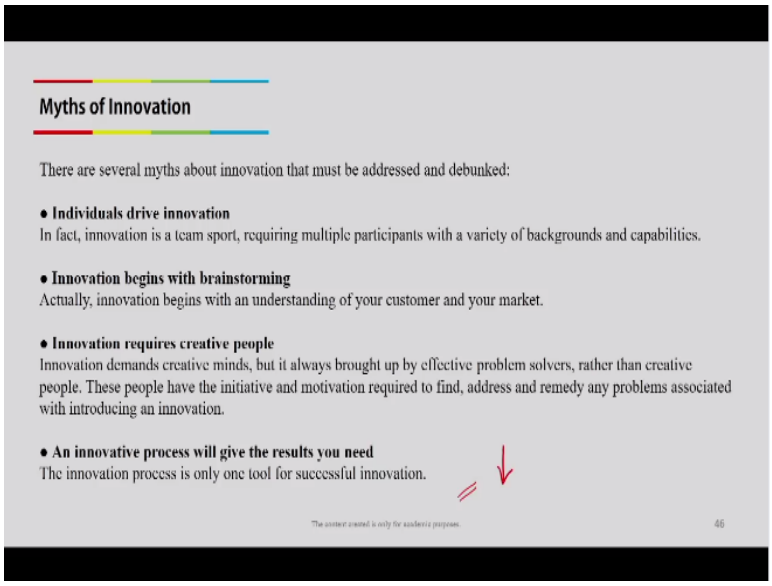

Now we will discuss needs of innovation. So there are several needs which has to be debunked. One is individuals drive innovation. No, it is a team effort which drives

innovation. Innovation begins with brainstorming, so actually innovation begins with an understanding of your customer and market. So this will be explained in module 2. Innovation requires creative people.

Innovation demands creative minds, creative problem solvers, you have to have initiation and motivation to solve particular problem and innovative process with give the results you need. So innovation process is only a tool towards the successful innovation. You can get a successful result or you can fail also but you have to keep on experiment.

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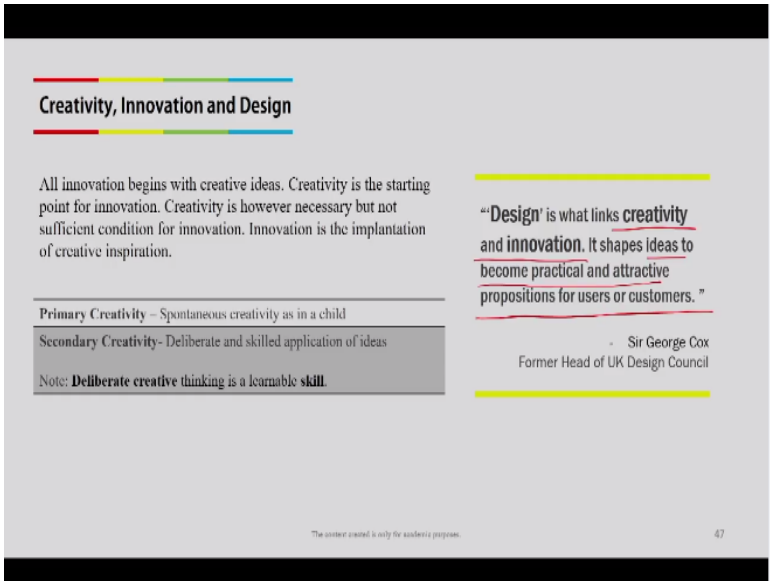

So how creativity, innovation and design is related? So innovation is better fostered by design and design can be achieved by creativity. So design is what links creativity and innovation. It shapes ideas to become practical and attractive proposition for user or customers. So there are two types of creativity. One is spontaneous creativity as in child or artist, secondary creativity deliberates and skilled application of ideas.

Here you have to remember that deliberate creative thinking is learnable skills, so through systematic approach you can achieve creativity also. Now I will discuss about the 5 skills of successful innovators.

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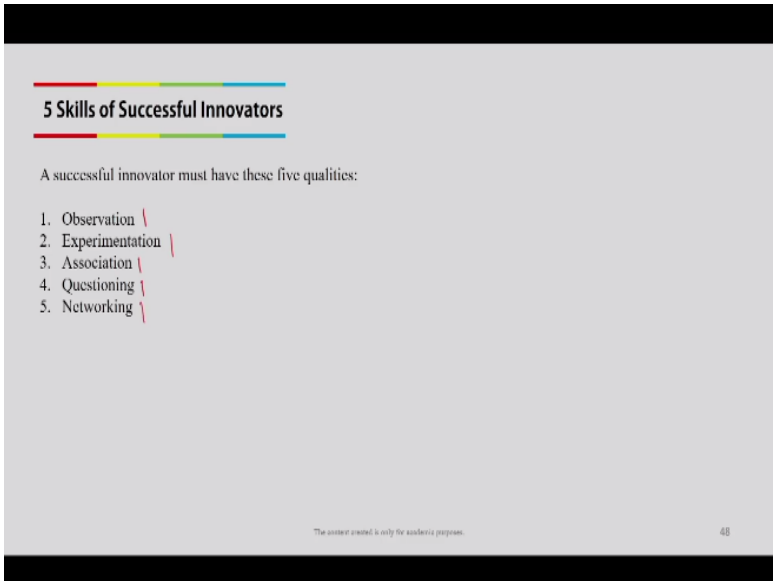

A successful innovator must have these 5 qualities. One is observation, in an usual environment also you should find out unusual behaviour of the users. It is because you have to find out a problem, so observation is very mush required. Next is experimentation. You have to experiment with technology, material, process and everything. Another thing is association.

So you have to associate with peoples with different kind of people may be from different domains, so here I would like to give one example of Steve Jobs. When Steve Jobs went to California and met one graphic design company and he associated with them and later they created an organization Pixar and rest is history we know the movies, toy stories and other, so you have to associate.

Another story from association is Steve Jobs also attended calligraphy classes and later he used his this knowledge in different kind of Apple products. So fourth skills required is question. You have to ask question continuously. Sometimes people around you may think that you are stupid but you should not stop asking questions. Networking, you should network with people, most of the time networking is two kinds, resource networking and idea networking.

In resource networking, you talk about moneys and different kind of associations related to resources but in idea networking which is very important, you should discuss about your ideas with different kind of people where you will get fresh looks to your concepts.

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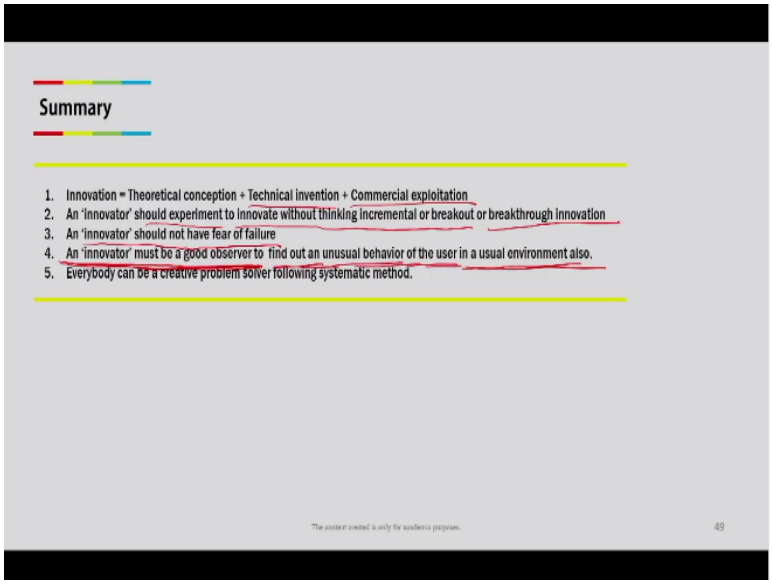

So now I will wrap up with this summary with these 5 points. So innovation is theoretical conception plus technical invention and commercial exploitation. Second point is an innovator should always experiment to innovate without thinking incremental breakout or breakthrough innovation. An innovator should not have fear of failure; you should always experiment even you see failure you should keep on experiment.

An innovator must be a good observer to find out an unusual behaviour of the user in a usual environment also. Fifth point, everybody can be a creative problem solver following systematic method. If you think that I am not a creative person then start believing that yes you are a creative person because very soon you can be a creative problem solver because you are going to follow a systematic method.

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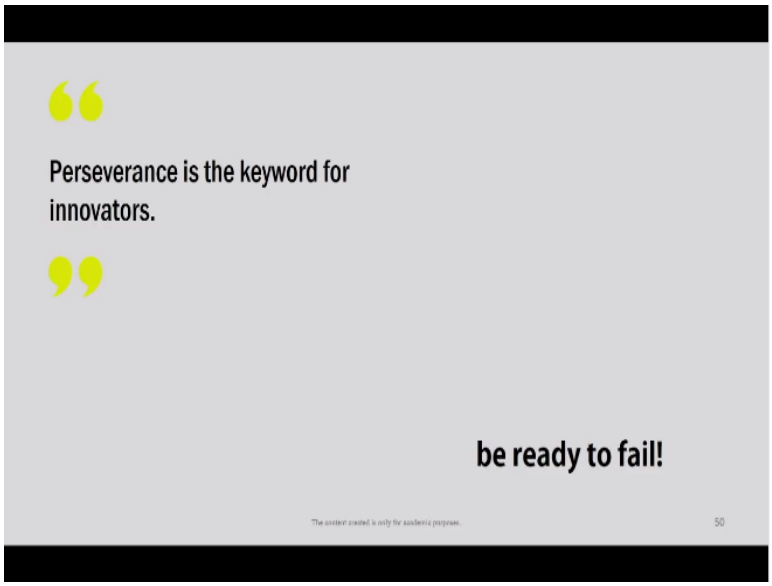

So now I will finish with this quote, perseverance is the keyword for innovators. See you have to continuously try, you have to continuously experiment, so be ready to fail not in the exam but in experimentation. Thank you.