Innovation, Business Models and Enterpreneurship
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Lecture - 23
Technological Innovation Management Planning

Welcome friends. So now, continuing the discussions related to technological innovation management. We now discuss the planning process of technological innovations. Now in the planning process as we know from our other management subjects that planning can be divided into different type horizons.

Planning can be done for the immediate periods, which are may be within a week, within a month or so. You can do planning for intermediate periods where planning is done from 3 months to one-year duration. And then you do planning for long term periods also, where the planning horizon can be more than one year also.

So, planning activity is actually depending on the time horizon; we do for immediate purpose, we do it for intermediate purpose and we do it for long term purpose.

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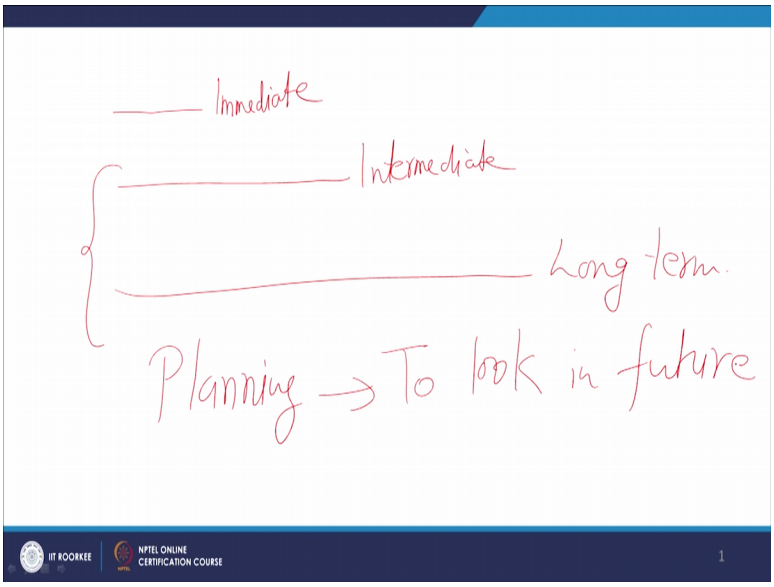

The scope of planning depending upon the time horizon is different. Normally the discussions related to technological planning, for innovation management is related to intermediate and long term plans.

Because for the immediate purpose, you cannot do because the time horizon is so small that you cannot do any kind of planning for the immediate purpose, but you can certainly do planning for the intermediate purpose you can do planning for the long term purpose.

And if you remember in our previous sessions, we discuss that nowadays product life cycles are excusing, and when product life cycles are excusing it is very important, that your technological planning your technological planning process should also be equally efficient and aisle and responsive. If you take too much time for developing new technologies, or using new technologies, you will be always a follower, you will always be reacting to the technological development.

So, to enjoy the technological leadership, you enjoy the position of competitive advantage, competitive leader because of technological innovation, you need to understand that how to cut short the period of technology development.

And that is what we are going to discuss, in this session that the technological planning process and particularly how to make this planning process, a smart how to make this planning process within the limited time frame because once you develop the technology then this technology will go to the next stage that is of the product development. And then product development will go to the diffusion stage.

So, there is an entire process of technology innovation. But the first step of that is the technology planning, that we need to plan for feature and planning is we all know is a futuristic activity. Planning is a futuristic activity to look in future.

And when we are looking in future, so how far you are looking in future? And if you remember our previous discussions we all have prediction disability, when we have prediction disability, we cannot see very far in future. And therefore, this particular topic becomes very important that how do we develop new technology, how do we plan for technology planning management for innovation activities.

Now, for that purpose let us see how technology evolve, the process of technology evolution because that will help us in planning the technology for innovation. On the basis of technology evolution, you can have these 4 different categories. These are not standard words, different authors, different thinkers may give you different words we use these terminologies.

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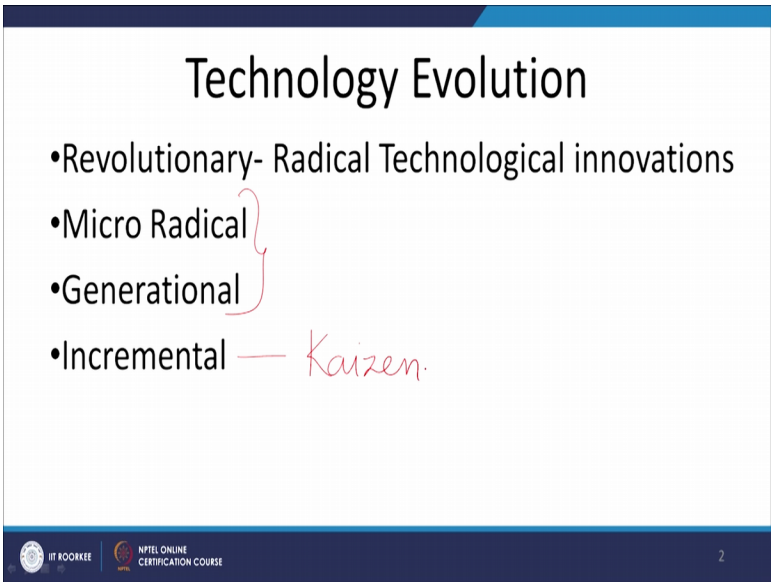

Now one of the technology which is related to innovation, is revolutionary innovations, this is radical technology, something breakthrough happens; that is, revolutionary radical technology, then micro radical, it is not going to change the entire way of working of an organization. It is not going to give you birth of a new industry, rather some small small radical changes are happening. And you can combine those micro radical technological innovations with generational innovations also, generational technological innovations also.

So, you can club actually micro radical and generational technological innovations as one category of technology evolution. And then you have very common technological evolution which is incremental evolution, which is inspired by Japanese system of Kaizen. So, these are the different ways of technology evolution. Now let us see the characteristics of all these 3 types of technology evolution in more detail some examples also.

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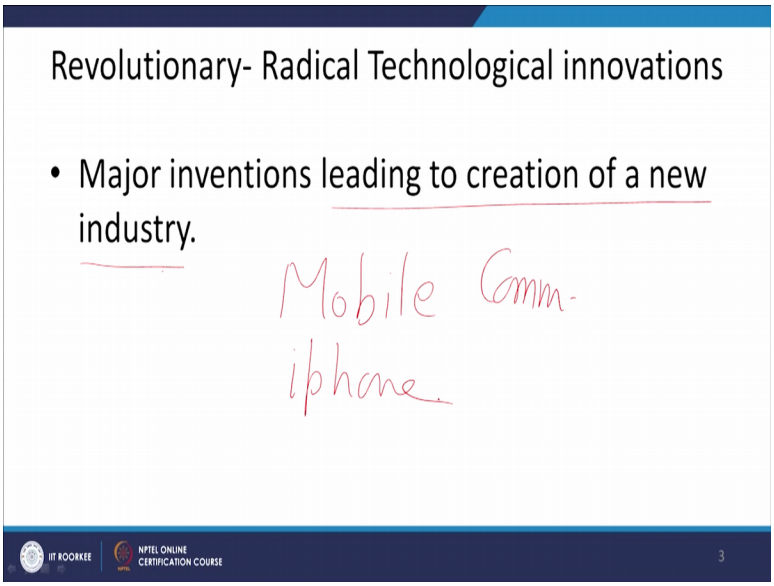

So, the first is radical technological innovations, and radical technological innovations are major inventions. These are inventions which lead to creation of a new industry. A new industry may develop because of these inventions.

And some of the breakthrough technological innovation is like the innovation related to flying machines. The innovation of helicopter, and you thought of that there can be a machine which can fly, and that is a type of technological innovation radical technological innovation and the entire industry the aircraft industry, the air force, and all transportation using air as mode of transportation it started with this innovation of aircraft.

So, altogether a newness will came, James Watt invented steam engine and as a result of a steam engine we had an entire industry of using the mechanical power. How you can use the mechanical power for running your factories, your looms your other production activities? So, the development of steam engine lead to creation of an entire industrial revolution, the creation of supercomputer better computing powers; that is giving birth to entire information technology industry.

So, these are some of the examples of radical technological innovations, but the point is these radical technological innovations are rare innovations. You will not find these types of innovations happening on regular basis these innovations take place slightly over a

period of time, and these innovations create new industries. Sometime these innovations have deeper impact on our social and economic lives also.

Because of it now, we have a very different kind of world. It has become a big enabler for large number of other technologies. So, therefore, the importance of this radical technological innovation is that, it may change the course of your movement. It may give a very new path, which is not thought of before. The next is micro radical and generational kind of technological innovations.

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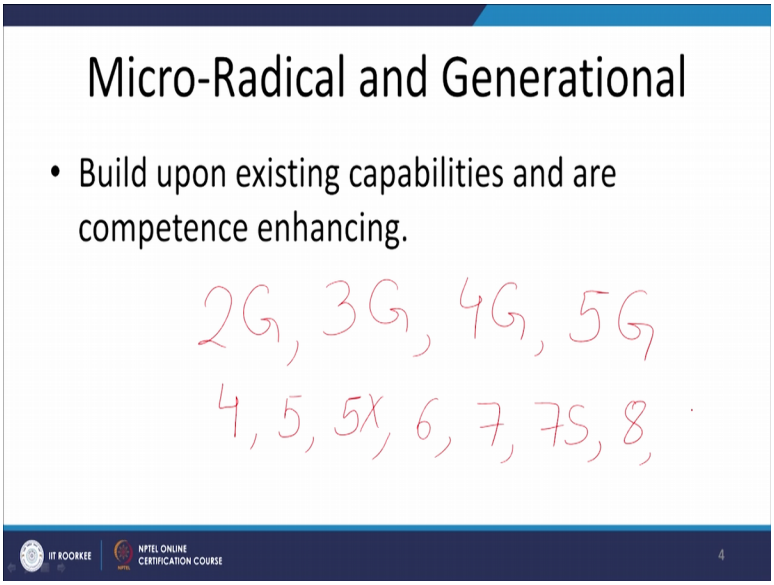

Now these are kind of competence enhancing innovations. These innovations actually build upon existing capabilities. Like for an example, the radical technological innovation can be mobile communication. This can be for us 1 example of radical technological innovation.

And now when we have mobile communication 2G spectrum, using 3G technique, 4G technique, 5G technique. These are micro radical technological innovations. Or you can say generational improvement. If you think iPhone, it may be a debatable issue, but if you consider iPhone to be a example of radical technological innovation, then in case of iPhone you have iPhone 4 you have iPhone 5, you have 5 x, you have 6, you have 7 S, you have 8 and so on. So, these are the generational iPhone.

So, similarly the way we use computers. Now we all using the window environment. So, the development of window as an operating system can be the radical technological innovation, but over a period of time we have so many new versions of windows; which are either micro radical or generational technological innovations.

Because these are enhancing the competency of your existing product, these are enhancing the capabilities of your existing technology, your technology becomes more cost effective, it becomes more efficient it is able to fulfil more requirements of the target group.

So, all these are the objectives of micro radical and generational technological innovations. Then you have the normal technological innovations, which are part of routine activity.

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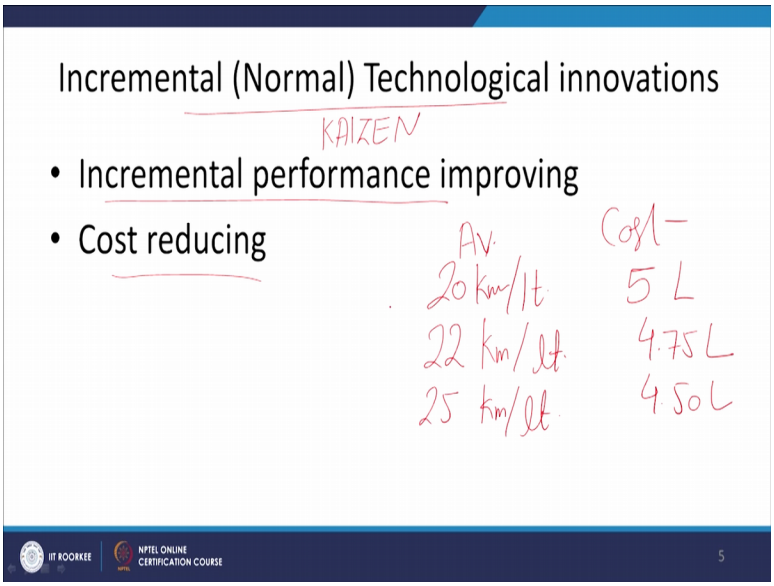

Incremental technological innovation, as we discussed just now that Kaizen is a very appropriate term to describe these incremental technological innovations. Because under this kaizen, you are continuously improving you are doing some kind of small small incremental steps to improve the output of your organization.

So, that is kaizen, and in this incremental technological innovation our performance is improving, my car is giving a mileage of 20 kilometres per litre. Tomorrow with a better performance with some kind of incremental innovation, when I purchase a new model of

the same car, this car is giving 22 kilometres per litre then year after I purchase another car of the same company, now it is giving 25 kilometres per litre.

So, that is incremental increase in the performance, and it is also possible that the first car, which I purchase for which the average was 20 kilometres per litre the cost was 5 lakh. Then the second car, which I purchase, the performance improved it becomes 22 kilometres per litre, and prices actually reduced to 4.75 lakhs. Then another car after 2 years which I purchase, the performance improves to 25 kilometres per litre, and price may actually decrease 4 to 4.5 lakhs.

So, both these parameters are improving, your performance is also improving, and your cost is also reducing so, I say that we are working on both these aspects, and these are possibilities because of your regular incremental innovation. When you want to improve your performance, on regular basis these type of results these types of outputs are possible.

So, these are the different ways, now in our short term if I take planning process. In our short term, we look for incremental technological innovation, we set our targets that we want to achieve this level of performance by the end of one year, by the end of 6 months, by the end of this quarter. And for that purpose we design our efforts.

That is how we plan technological innovations in our organization for the short term. For the longer term we go for generational kind of or micro radical type of changes, where we see that in one years time, 2 years' time, we should come with a new version of this product.

Today if apple launches, iPhone 8 8 x or 10. So, apple must have planned that after 2 years, I must bring iPhone 12 in the market.

So, that is a long term technological planning that after every one year or 2 year or 3 years, I must come up with a new kind of product, new kind of technology in the market. And this is how you plan technology for short term and long term. Now once we understand this thing, it is important to understand one more concept related to technology planning and the this is a very popular word which is the S curve of technology evolution.

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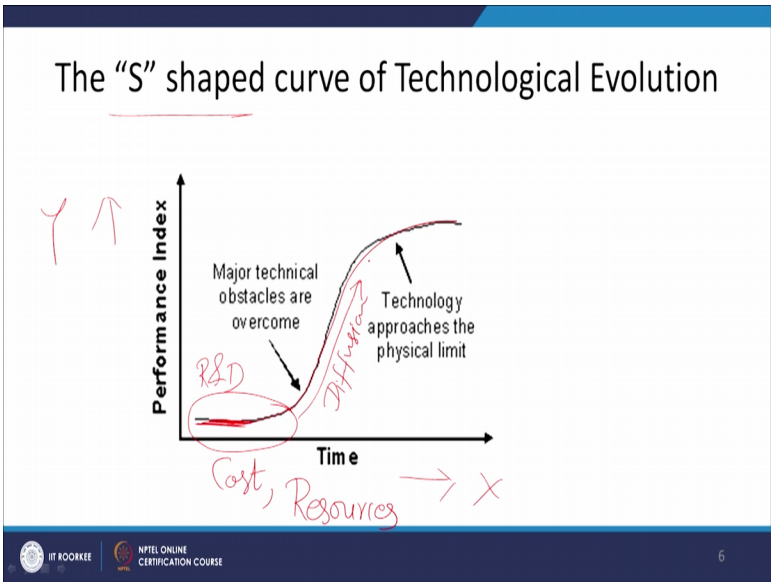

This S curve of technology evolution is the half S type of a picture which you see this diagram, which is half S type of diagram. Now this is very interesting. On x axis, you have time, on y axis you have performance; now when a new technology, you are introducing in the market. So, you have some kind of major obstacles.

And if you see in the beginning in this period, in this period if you see, here you are putting lot of efforts, these efforts are may be with respect to time, these efforts are may be with respect to cost, these efforts may be with respect to your other kind of resources.

So, you are putting all these efforts, but your performance is not improving. You see for initial some period, your performance is very much stagnant, and stagnant at the low end of this y axis. There is not much improvement in the performance of the organizations technology.

But after sometime when you reach to a point of threshold, that now during this second phase without much efforts without much effort of cost, without much effort of other type of resources, all of a sudden your technology improve tremendously. The meaning is the people, the beneficiaries they start adopting the technology.

Initially because the performance of the technology is not up to the mark, there are lot of technical issues involved in the beginning of the technology. So, you can say that this is the transient phenomena.

Initially it is the transient phenomena, and as soon as you overcome those transient phenomena, you take the advantage of rapid growth of technology, and then with very minimum effort all of a sudden your technology diffuses to large number of markets, your technology diffuses to different types of products so, that is what happens.

So, initially this is the period of R and D. And this is the period of diffusion. And then your technology starts a kind of maturing. Technology approaches the physical limit.

Now, you feel, you feel means now it is being realized that further improvement in this technology is not possible. You cannot go beyond a particular limit you have touched that level of optimum level. So, this is the S curve, but how this S curve is relevant to technology planning that will be clear to us in the next slide; where we have 2 technologies.

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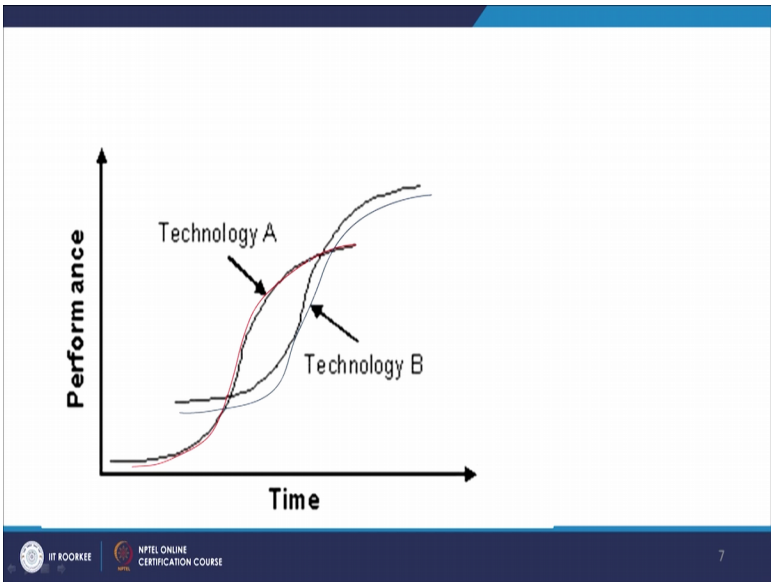

Because your one technology A this technology A is here and I represent the technology B with blue colour, this way you try to develop your new technologies from your existing technologies.

Similarly, when B is started maturing, you will start working on a technology C. So, this type of cyclic phenomena or you can say it is not a cyclic phenomena rather it is a chain phenomena, that keeps going from A to B, B to C, C to D and therefore, you will be able to take the advantage of this development of technology for very long period.

So, when I am talking of long term technology planning, the objective is we should be ready, we should have a plan that at this time we should be moving to technology B. At what time we should be moving to technology C? At what time we should be moving from C to D?

For an example, if we see this previous curve, and if we talk of wireless communication, the concept of wireless communication is started as back as in 1902, when Marconi developed radio. And when Marconi developed radio, this was the purpose of that you have a transmitter, and from that transmitter, the signals will be transmitted and whoever has a radio set the radio set, will receive the signal, and then you come to know about news you come to know about songs, music etcetera.

But over a time, we all have seen that radio has achieved a level of saturation, but the concept of wireless communication migrated to another industry; that is, wireless communication between 2 individuals. And the entire industry of mobile communication is started.

And now, when this industry of mobile communication was about to saturate, we started communicating data from one mobile phone to another mobile phone. So, you see that from one S curve, we are giving birth to second S curve, from second S curve we are giving birth to third S curve, and that is the important thing in the long term technology innovations.

If there so, we discussed, different types of technological innovation, where we have radical technological innovations, where we have generational technological innovations, and where we have incremental technological innovations.

Now, incremental innovations are required on routine basis, which are for immediate and intermediate purpose. Micro radical and generational technological innovations are required for long term. And the phenomena related to radical innovations, these are slightly rare phenomena, which are difficult to plan on the basis of these S curves.

But it is for sure that we can plan for 1 year, 2 year down the line, but there may be some trends which are far away, and we need to see that how to adopt those technological changes. So, to summarize, the discussion of technology planning, that normally the first and second generation companies, R and D is treated as an expense.

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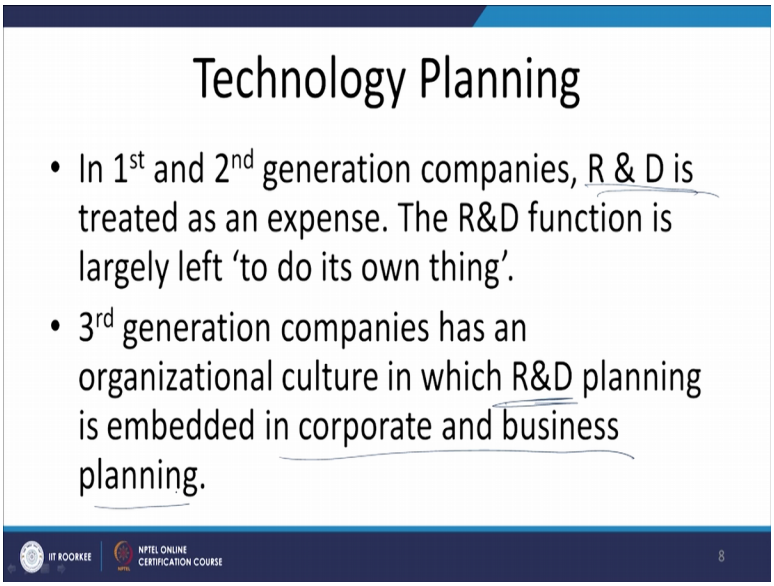

If I see the environment we can say that, first and second generation companies in these companies, and particularly I am very sorry to say; that in India we have these types of companies only, where R and D is considered as an expense.

Where we do not want to invest money for research and development and therefore, we are not able to deliver technologically advanced products. So, we feel that we should have one R and D department in the organization, and therefore, we have an R and D department, and in these companies R and D department is left on it is own that they are doing something.

But they are not concerned with the main stream activities of the organization. They are doing something because we need to have one R and D we need to show in our annual reports that we have an R and D department, but unfortunately, there is little linkages of this R and D department with rest of the organization.

So, that is one type of organizational setup which is there in our existing organizations. But the new organizations, the third generation organizations and the future organizations, 4th generation organizations, the R and D department is highly integrated to various other functions of the organizations.

It is part of corporate and business planning, like production like marketing like human resource like finance, R and D function is also very much integrated part of corporate level and business level planning.

So, therefore, the technology planning in third generation and 4th generation organization is really possible because here you are giving enough importance to R and D activities. So, if we want to take the advantage of R and D if you want to take the advantage of technological innovations, we need to bring R and D departments to the central department central function of the organization.

If you keep R and D department as a liability to your organization, as a cost to your organization, you cannot take the advantage of R and D department. For better technological planning for innovation management, you need to think that R and D is an investment it is not cost. And then only R and D will give good fruits to the leadership to the competitiveness of this organization.

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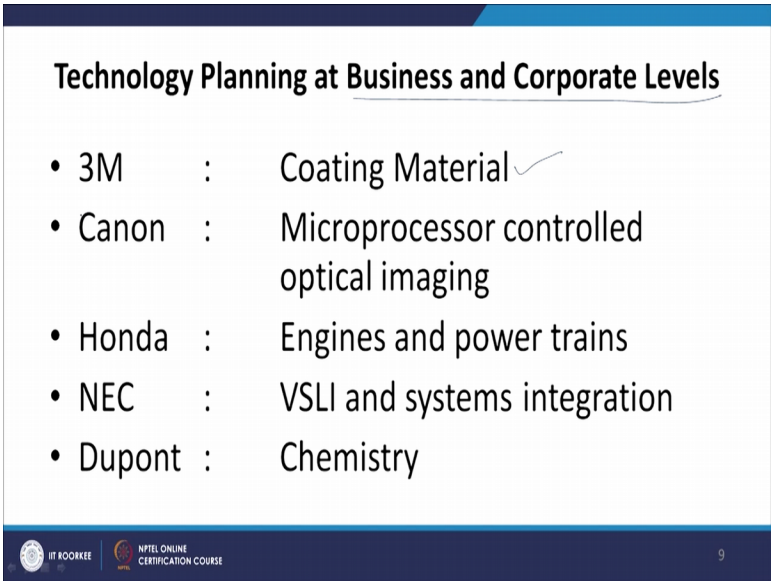

So, in third generational companies R and D becomes one of the core activity with any other functional activity of the organization, and therefore, the focus of third and 4th generational companies are on technological innovations.

And therefore, in our present environment we see that new company's start-ups are focused they are developed around some kind of technological innovation. Now when

we are talking of this technologic planning so, this technological planning can be done at 2 levels in a firm. These are; one is at the business and corporate level and other at the SBU level.

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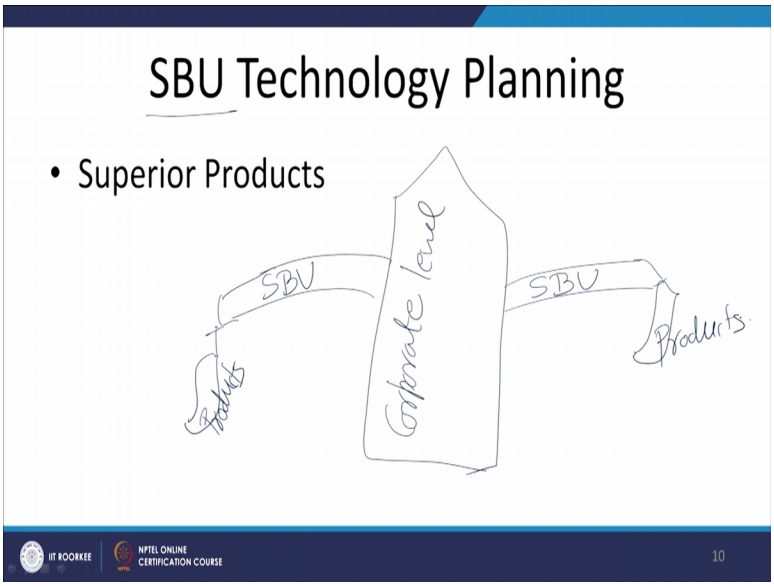

Now some of the examples, where we see that companies are known at a macro level, because of their superior technological competence, like 3M.

Some of the examples I have mentioned, 3M, we know 3M as soon as this name comes, that this is a company which is having the technological leadership in coating materials. Name of cannon as soon as it comes in our in front of us, we know that this is for the microprocessor controlled optical imaging.

Honda other name Japanese name, which is known for engines and power trains NEC VSLI and systems integration. All these 3 are Japanese name, and you know that, because of their this corporate level technological planning; that we need to work on this broad area, they are able to establish as the technological leader all through, the globe take the name of DuPont. It is chemistry related technological innovations.

So, some of these names are there, you can have more names and as a part of a forum, we can actually discuss some other examples, and I request the participants to write that this example belongs to which type of technological leadership.

So, these companies have develop the technological leadership with a very systematic technology planning at the corporate level. And then you have strategic business unit level technology planning, SBU level technology planning, and in this SBU level technological planning. We are trying to give products as per the requirement of the location or as per the requirement of the target market of that SBU.

So, you can understand that this corporate level technological planning is like a stem of a tree. And SBU level technological planning is branches of a tree, these are the branches so, these are SBU level. And the fruits which are coming from this branch, these are the products, these fruits are the products.

So, in this way you can understand the different types of planning which are required to integrate the entire planning process in the organization. I am talking of some big company which has multiple SBUs. And all those SBUs muse may not be working in the similar kind of product.

So, depending upon the target market, their product ranges will be different. But they all will be guided by one corporate level technological planning. Similarly,, you have SBU level, and then SBU level planning will finally, result into the superior products. So, that is the technology planning process and when we see this process of technology planning, it can be divided into 3 important steps.

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And these 3 important steps are; first is forecasting evolving technological possibilities. You need to do a kind of swot analysis, that what are the opportunities and what are your strength with respect to future technologies, and with respect to technology know how you presently have.

So, first is that assessment, and then you need to desegregate technology market matrix, because we have discuss this point, time and again that technology has a very close connection with socio economic aspects. Technology means science and engineering plus management.

So, for this technology planning process, we need to disaggregate technology and market matrix, into it is various components. So, it is requiring the knowledge of that systems concept. That in that subsystem what are the elements which are related to technology and what are the elements which are related to marketing. So, you need to disaggregate the technology market matrix.

And finally, you need to formulate a technological innovation mission or plan based upon a selection from these options. The alternatives which are available to you out of those alternatives, you select a particular technology strategy for your organization. In our next session, we will be discussing about various options, how to select from various options so, what are those options available to us? What are the different types of technology strategy that all we are going to discuss in our next session?

But just to summarize the technology planning, that we need to have a good assessment, then we need to disaggregate we apply the systems approach, and then we see that what are the available options and which option is most suitable for my conditions. So, that is the simple technology planning process for innovation management. So, with this we close the session.

Thank you very much.