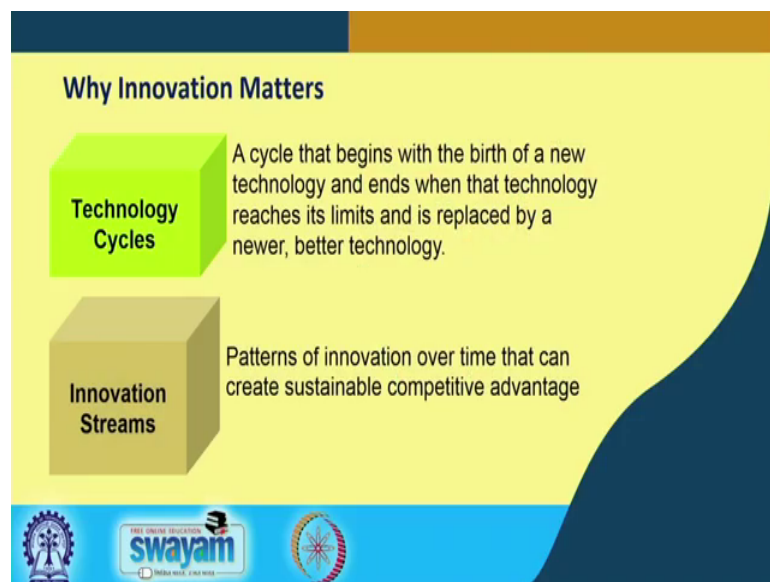


**Managing Change in Organizations**  
**Prof. K. B. L. Srivastava**  
**Department of Humanities and Social Sciences**  
**Indian Institute of Technology, Kharagpur**

**Lecture – 32**  
**Innovation and Change (Contd.)**

So, welcome back to the next session on this (Refer Time: 20:00) seventh week on Managing Change in Organizations and previous to this session, I have been talking about Innovation and Change. Now, we are going to further discuss about this that, how innovation and change could be linked with each other and I will give you some examples, especially related to the products in the technology field.

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Now, one question that comes out that why innovation is important right; so, the innovation basically as I told you happens either in product processes or services. And this could be related to one thing that we call the technology; it means technology is an important parameter so far an innovation is concerned right.

And there is a technology cycle and when we are talking about technology cycle is you know that, there is a technology which comes out initially and then, this technology matures at one stage and then this technology goes out. And that technology is replaced by either a new technology or a better technology. So, this is known as technology cycle right.

Now, this technology cycle is very very important, because of the change in the technology whether you going for a new technology better technology, lot of changes happens in the organization; in terms of products, in terms of services, because you are using a new technology for providing the same services.

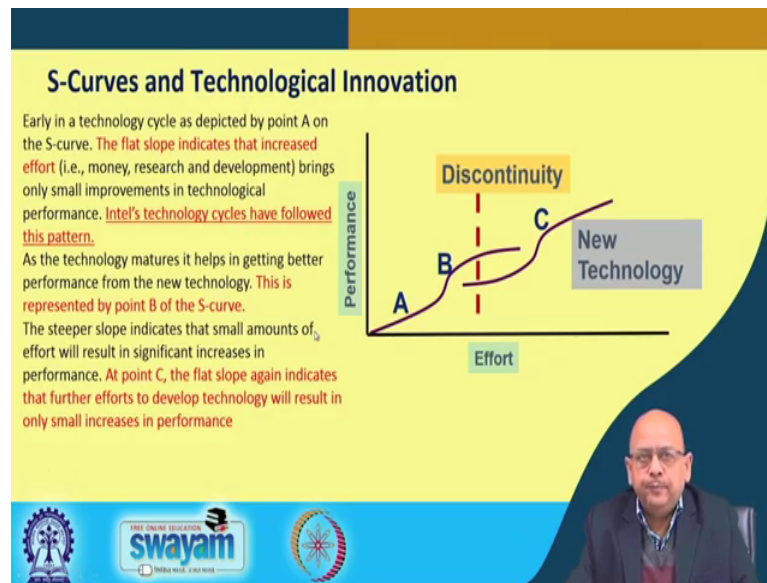
Look at some of the examples like, the kind of technology the banks used to have earlier and the kind of technology, that bank use today in terms of providing better services to their clients and the customers, in terms of online services, internet banking right. Maybe tomorrow they are going to bring about a new technology and is going to replace the existing technology; to further provide more quality services to their employees right.

So, this technology keep on changing right; for example, if you look at say televisions, you know that earlier you used to have ah TV's which you have the different kind of TV's like the they were manufactured based on say analogue principles, then you know that, LCD TV comes, then you have say LED TV's, now you have ultra HD TV's right.

So, this you can say that, this is a technology cycle which keep on changing. And with this change lot of changes also happens right. So, we will talk about how the technology cycle changes, because it is related to innovation. And this is the most important innovation that happens, second is the innovation streams right. What is the innovation that is happening, what kind of innovations are happening over a period of time, which is going to help the company to have some kind of advantage on a sustainable basis right.

So, basically in this lecture, we will be talking about, technology cycles and innovation streams in a detail.

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Now, coming to the technological innovations and that is where we will talk about, what actually happens, when you are going to replace an old technology with a better technology or a new technology right. So, if you look at the technology cycle, you get a curve something which is known as S-curve. See if it looks like an S and here also it looks like an S right and this is where the technology keep on changing.

This is the discontinuity, it mean this technology has changed to this, this is the old technology and this is this is the new technology. Now, if you look at the performance of the old technology, there is a steep slow you can see, starting with a beginning point A in this curve, S-curve right; it means that this technology has been given good results, in terms of efforts that you are going to put in, but up to a certain level right.

So, it has been giving good results up to a this point beyond that it is not going. So, one example that is given (Refer Time: 04:44) Intel, they have followed this kind of pattern ok. So, if you look at Intel chips is incremental changes that they are trying to bring about right. So, like you happen to 1, 2, 3, 4 so keep on changing the technologies right. So, there is a, this kind of slope is achieved. What next? Once this technology matures, then it gives you better performance. So see, how the performance is improving up to this point, there is a slope to performance is more or less consistent, but once the technology is established then it gives better results.

So, the slope changes right, this is represented by this point that is B, on this S-curve right. So, a steeper slope indicates what, that a small amount of effort will give significant increase in the performance. So, the performances suddenly gone up, but what happens then? Then you go for discontinuation, the technology changes right; it means that you further a develop this technology it is not going to provide a good result. So, you go for discontinuation so, you bring a new technology. So, the new technology is supposed to perform better, but it would also have a similar characteristics.

Initially it give consistent results, then it improves at is measures and then again given casting results. And then again, beyond this again you need to go for some kind of discontinuity to bring about a new technology. So, at point C what actually happens; it means, that if you want to further develop this technology it is not going to help.

So, you need to bring a new technology, because it is not going to increase your performance any further. So, if the result is like this right. Now, when you are going to see the performance of the technology and the effort, that you put in to continue with the same technology and the new technology, you can see the relationship you find a curve something that is called S-curve, right which is related with technological innovations.

So, what does it basically indicates is, that you need to bring about new technology and you need to say go for some kind of modifications in your present technology to ensure that, it consistently works and provide you effective performance, right and that is where this technological innovation is very very important and you need to see that, continuously you keep on changing.

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**Innovation Streams: Technology Cycles over Time**

To sustain a competitive advantage firms need to create a stream of its own innovative ideas and products.

It begins with a **technological discontinuity**, in which a scientific advance or a unique combination of existing technologies creates a significant breakthrough in performance or function.

It is followed by a **discontinuous change**, which is characterized by technological substitution and design competition.

**Technological substitution** occurs when customers purchase new technologies to replace older technologies.

**Discontinuous change** the old technology and several different new technologies compete to establish a new technological standard or dominant design.

Discontinuous change is followed by the **emergence of a dominant design**, which becomes the new accepted market standard for technology. The emergence of a dominant design signals a shift from design experimentation and competition to **incremental change**, a phase in which companies innovate by lowering the cost and improving the functioning and performance of the dominant design.

The slide also features logos for Swamyam (Free Online Education) and a video inset of a man speaking.

Now, if you look at this technology cycle over a period of time and how this is related with innovation. You can see that, if the companies want to the really achieve some kind of competitive advantage, then they need to ensure that new and innovative ideas and products keep on coming from the companies right. So, it comes it starts with what, what you call the technological discontinuity right; it means that here you have gone for some kind of discontinuity, you need to bring about new technology by replacing older technology; and this new technology is a better in terms of its performance right.

So, moving further, when we are talking about a technological discontinuity; what actually happens, that you want to bring about a new technology right which is related to better performance right. Now, this technology is related followed by what, discontinuous change. What I mean by discontinuous change is that, you want to bring about a change which is not a continuous change; it means that you have change the technology, you have gone out with a new technology right. It means that you have substituted old technology with the new technology which is which has a different design right.

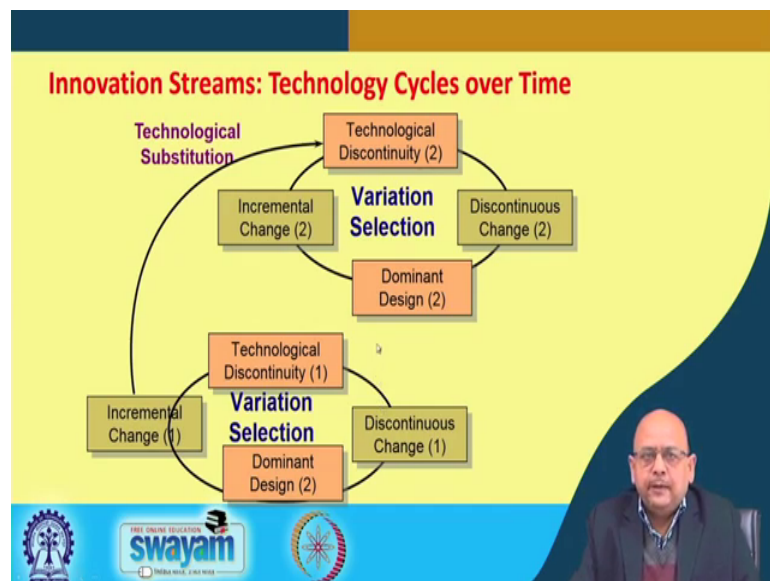
So, it this is actually leads to what you call technological substitution; it happens when organizations go for new technologies to replace the old technologies right and this is what we call the discontinuous changes; it means that old technology and the new technology compete to establish a new technological standard right.

So, you are moving from old technology to the new technologies. So, the old when old technology also complete, but it is not going to survive in the long run, because you have substituted it with a new technology right. And this is followed by emergence of a dominant design; what does it mean? It means that, now the market has accepted the new standard for the technology right.

So, this new technology is now the emergent, the new design, the new technology right; it means you have move from experimentation and competition to incremental change; it means that you have gone for a new technology right, where companies are going to innovate, how by lowering the cost and improving the performance.

The idea is that if you innovate, it is going to help you to cost effective, increase your efficiency and quality right. And all this is related to either discontinuous changes or continuous changes, this is what you call incremental changes right.

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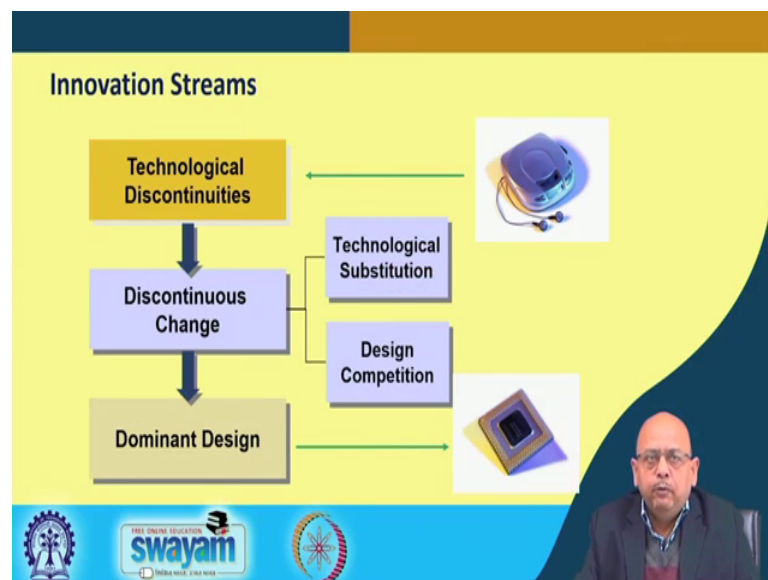
It happens like this, see what actually happens? So, you starts with what; technological discontinuity right. It is related to discontinuous changes the, it is then you have a dominant design which is related to incremental changes right. So, you start with here, technological discontinuity, discontinuous change, dominant design this.

So, this is the one, then again you move to when you substitute this technology with the new technology, you selected new technology, then you go for some kind of substitution

of the technology. It means from this technology you have move to a new technology, but new this new technology again need to be replace a substituted by a new technology. So, if this again you can have these kind of things, you move further and you can make a graph like this here you have a what you call technological substitution and you will have the same cycle of this technology.

So, this is what we called the technology cycle. You go for discontinuity replacing the old one, it is called discontinuous change, this is going to be accepted and becomes a part of what you call the incremental change in the organize. Then again you go through the same process or the same cycle, we are going to substitute a technology with a better or new technology right.

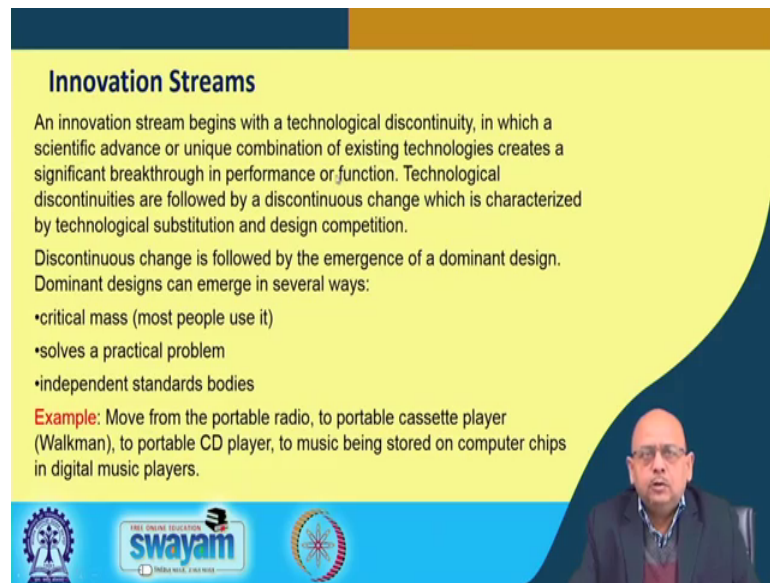
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Moving further, if you look at this is what actually happens; technological discontinuities, discontinuous changes, dominant design right. Now, discontinuous change is related to technological substitution and design competition. These are the examples see, how things this how this is being replaced by another technology, how this is the new standard technology which has been accepted now, right.

So, when we are talking about innovation streams and technology cycle, it is very much linked with change whether you talk about incremental changes or say discontinuous changes.

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**Innovation Streams**

An innovation stream begins with a technological discontinuity, in which a scientific advance or unique combination of existing technologies creates a significant breakthrough in performance or function. Technological discontinuities are followed by a discontinuous change which is characterized by technological substitution and design competition.

Discontinuous change is followed by the emergence of a dominant design. Dominant designs can emerge in several ways:

- critical mass (most people use it)
- solves a practical problem
- independent standards bodies

**Example:** Move from the portable radio, to portable cassette player (Walkman), to portable CD player, to music being stored on computer chips in digital music players.

The slide also features logos for 'THE ONLINE EDUCATION swayam' and 'MEDIA WISE, LEARN WISE' at the bottom, and a video inset of a man speaking in the bottom right corner.

So, when we are talking about innovation stream and we say that it starts with a technological discontinuity, where you are going to have a new technology right, when you created a new technology which is followed by discontinuous changes right; again characterized by substitution and design competition. Now, when we are talking about discontinuous changes which is followed by emergence of a dominant design, that is the accepted new standard accepted in the technology, field of technology right. How it is emerging? These are the parameters; it means that most of the people are have started using it.

Now, if you look at the mobiles; now people have moved and most of the people today are using smartphones. So, the technology that is being used by smartphones are different from the earlier phones. So, most people use it and it is helping them to solve their problems related to different kind of activities and it is independent standards bodies right.

Another example that is given here, where you have moved from the portable radios, you know that earlier used to have radios which you can take from one place to another place, to cassette players, a video cassette recorders, a what you call walkman. Now, that is being was that was replaced again by CD player right, where you can store music on computer chips, then you move to the digital music players today right.



So, see how technology keeps on changing. So, this is an example where technological discontinuity happens right and this technological discontinuation leads to what you call emergent of a dominant design and that is accepted by everybody, but this is a cycle which keeps on changing. So, this shows that how technology keeps on changing right.

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The slide is titled "Managing Sources of Innovation" and features a yellow background with a dark blue curved shape on the right side. It contains two text boxes:

- Creative work environments**  
Workplace cultures in which workers perceive that new ideas are encouraged
- Flow**  
The psychological state of effortlessness in which you become absorbed in your work and time seems to pass quickly

At the bottom of the slide, there are logos for "swayam" and other educational institutions, along with a small video inset of a man speaking.

Moving further, if you look at the sources of innovations as I, I talked you earlier also. Creativity is very very important; so, management has to see that how they are going to create an environment which is creative; it means that you need to develop a culture, where people perceive that new ideas are encouraged. One example that I would like to give here is of a company like 3M, 3M is one of the most innovative companies in the world which basically come out with the maximum number of patents and products. Now, if you look at the work environment in 3M, you will find that even risks if people take and they fail, that is equally celebrated it means, even if you experiment with a new idea do not succeed, management is going to support you.

So, this kind of culture is required where you are able to encourage new ideas for people to experiment with right, we talked about three strategies go for experimentation, go with the new ideas right. So, from the inventors you to champions you make sure, that the people to support, then their sponsors to provide resources and their critics who are going to see that whether your ideas going to work on certain parameters or not right.

So, it is very very important to ensure that, you are able to create a work environment which is good, it means that you are going to create enabling culture, to ensure that people are ready to risk; take risk right and accordingly you need to bring about a change in a structure and culture, to ensure that people come out with new ideas.

And the second thing is, flow. It is basically is a state of state psychological state of effortlessness you become absorbed in your work and time seem to pass quickly; it means that, unless this flow is ah there, it is not possible to for you to get involved in your work wholeheartedly and come out with something that could be called as new. So, we will discuss these two points further to see how it happens.

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**Managing source of Innovation**

Innovation begins with creativity

- Creativity is the production of novel and useful ideas.
- While companies can't command creativity from employees ("You will be more creative!"), they can jump-start innovation by building **creative work environments**, in which workers perceive that creative thoughts and ideas are welcomed and valued.
- Challenging work promotes creativity because it creates a rewarding psychological experience known as "flow".
- Flow is a psychological state of effortlessness, in which you become completely absorbed in what you're doing and time seems to fly

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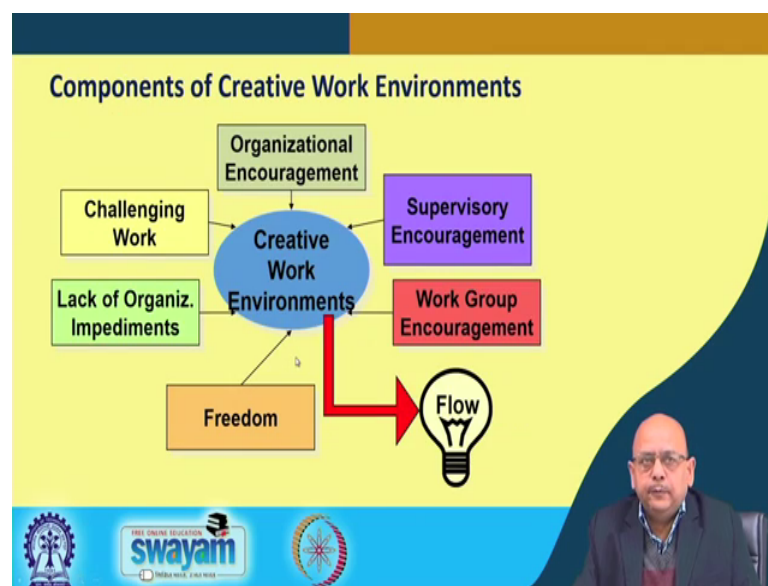
So, we start with creativity as we have already talked about it. So, creativity is the production of novel and useful ideas. So, creative is called as a process and innovation is the outcome right. Say; so, you also need to ensure that employees are going to be more creative right and if they are creative only then they you can think about the innovation. So, and for that you need to create a work environment which is creative right, where the thing that yes, their ideas, their thoughts are welcomed and valued and organization ready to support a sponsor it right.

So, you need to provide them challenging work opportunities, because that is required for creativity. So, it is it becomes an you can say (Refer Time: 17:28) creativity right and also go for some kind of rewarding experience. So, make sure that they get absorbed in it

by providing all kind of support which is required and there is no obstacles and then only this flow could be created right. So, that you are involved in what you are doing and there is no obstacle a barrier for you to think anything else right.

So, that people can focus and concentrate on, what they have been doing right. So, that they could be more creative and innovative. So, this creative creativity and this flow is very very important.

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This is what actually happens ok. So, how the flow comes out, look at it; support from the top management team is very much required, then support from the organizations, organizations encouragement you have gone for a challenging work and also there is a lack of organization impediments; it means there is no obstacles and barriers.

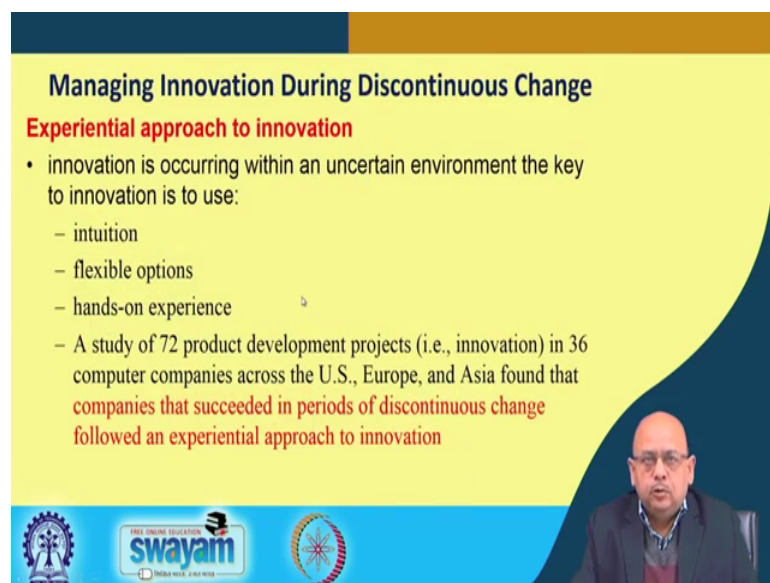
So, if you look at these factors which is very very important and that is what I have been taking about earlier also. Especially for innovation, what you require? A person who comes out with a good idea right which can be testable, to ensure that its whether it is viable for the companies to go for this kind of product or services right, then you need people who are going to support.

So, idea champions are required, they will come over here right, then you also need sponsors who are going to provide you all kind of supports and then also require freedom. Freedom in the sense that you should in their structure, you need to see that this

hierarchy or the control system is not going to interfere in the activities that you are doing. So, you are given full freedom autonomy is required, empowerment is required so, that you can take decision or related to what you what to do.

And then, this would enable you to create a environment which could be considered as a creative work environment. And if this happens only then this flow will come out; it means people uninterruptedly work on their problems without any hesitation take risk and come out with something that could be called as innovative in nature right.

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**Managing Innovation During Discontinuous Change**

**Experiential approach to innovation**

- innovation is occurring within an uncertain environment the key to innovation is to use:
  - intuition
  - flexible options
  - hands-on experience
- A study of 72 product development projects (i.e., innovation) in 36 computer companies across the U.S., Europe, and Asia found that **companies that succeeded in periods of discontinuous change followed an experiential approach to innovation**

The slide features a yellow background with a dark blue curved shape on the right side. At the bottom, there are logos for 'THE UNION EDUCATION swayam' and another circular logo. A small video inset of a man speaking is visible in the bottom right corner of the slide.

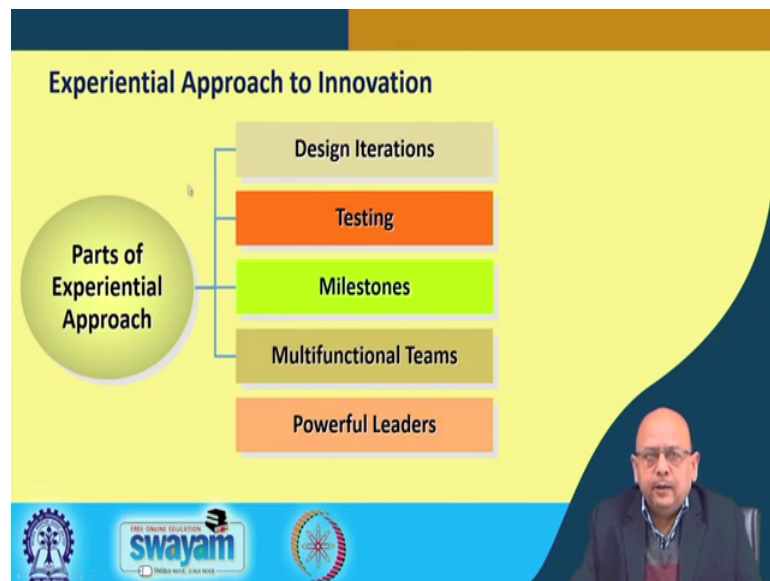
So, what we are going to discuss now, is what are the approaches that is taken, especially during continuous changes and discontinuous changes or what you call discontinuous changes which is more radical in nature and incremental changes. Now, when we talk about managing innovations during in discontinuous changes, we adopt a experiential approach. Experiential approach is where the person himself is going to experience, that learn from his experiences in tuitions right.

So, these experiences are what you call the intuitions and other things are experiences that the people have, they are going to come out with something that could be called innovative right. One research study I have quoted here, where it was found that 72 product development projects, so related to innovation specially, in 36 companies, especially computer companies across the U.S., Europe and Asia is not a single country, but then 3 continents you can see, U.S, Europe and Asia. It was found that, companies

that succeeded in periods of discontinuous change followed and experiential approach to innovation.

It means, some the innovations have come out of this innovation where they have a flexibility and also experience. So, these are very very important when it comes to innovation right.

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Then moving further if you look at this, what does it include, when we are talking about experiential approach. It include that, yes they could bring about a change, they can think about whether they can bring about a change in the product design, they can test it, they could also identify milestones to ensure their success at each stage, they can define some tangible outcome, that need to be achieved and that could show whether they are progressing on the right path or not and they also need a team multifunctional teams and powerful leaders; powerful leader is actually is going to encourage and support these kind of things.

So, if a person is allowed to use his intuition and experience to come out with something new, in terms of products, process, services let him try ok, test the idea, identify the milestones of success, create a team which is going to support and be a part of it and it is to be supported by the powerful leaders. So, that he is able to come out with something which could be considered as new or innovative in nature; it could be anything, it could be product, it could be a process, it could be a service also.

So, you can see that, how this experience of the employees is going to facilitate innovation provided these figures are available in the average.

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**Experiential Approach to Innovation**

- **Design iteration** is a cycle of repetition in which a company tests a prototype of a new product or service, improves on the design, and then builds and tests the improved product or service prototype.
- A **product prototype** is a full-scale working model that is being tested for design, function, and reliability.
- **Testing** is a systematic comparison of different product designs or design iterations. **Milestones** are formal project review points used to assess progress and performance.
- **Multifunctional teams** are work teams composed of people from different departments, accelerate learning and understanding by mixing and integrating technical, marketing, and manufacturing activities.
- **Powerful leaders** provide the vision, discipline, and motivation to keep innovation process focused, on time, and on target

The slide features a yellow background with a dark blue curved border on the right side. At the bottom, there is a blue banner with logos for 'swayam' (Free Online Education) and 'INDIA MADE 2.0' (Digital India). A small video feed of a man in a suit is visible in the bottom right corner of the slide.

So, look at this, what does it mean, when you are talking about the experiential approach. Design iterations means that we are going to test a prototype of a new product or service or when you want to improve on the design and then build and test it, to see whether they improved product or service is working or not. So, this is what we called design iteration; it means you go through lot of repetitions where we are going to test a new product or services, you go by improving the design and then again building and testing it, to ensure it is functionalities right.

Then coming to the product prototype; it means based on these design iterations, you have come out with a product which you want to see whether it is working or not, say full scale working model which is tested for design, function and reliability. Because unless you develop a prototype and test whether it is really working you cannot move further right. And if you find that yes, it is working, it is functional, it is consistently giving good results, then you can go for commercialization of this kind of product. I will find that it is not working at this stage then you can leave it.

So, from product prototype you move to the next stage that is testing you are going to test it right. For example, when a new drug is developed right, it is tested on animals to start with, to see whether it is really working or not. So, any product prototype which is



their need to be ensure that whether it is going to work or not and then you have review points milestones where you look at the progress right. So, that drug is tested on certain periods or animals to ensure whether the drug is working effectively or not and then it is used on humans and then a you do go for some kind of experiment and experimentation of these drugs with the human population to ensure it's functionalities right.

And then you have a team which is going to be a multi-functional team which is going to see that, how they can use your prototype for commercial activities. So, you will have people from the technical department, marketing department, manufacturing department who is going to see that how your product can be worked out, to ensure that it is going to be viable right.

And then you also need support from the powerful leaders, those who want to encourage innovation who want you to take risk right and they want to see that, this is a continuous process where you keep on innovating production processes. So, experimental approach is very very important, when it comes to innovation and why we talk about here, specially related to change because any kind of innovation is related to change only where you are trying to bring about a change in the product process or services.

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**Managing Innovation During Incremental Change**

- **Compression approach to innovation**
  - assumes that innovation is a predictable process that can be planned in steps.
  - Can be used during periods of incremental change, in which the focus is on systematically improving the performance and lowering the cost of the dominant technological design
- **Generational change**
  - based on incremental improvements to a dominant design and achieving backward compatibility with older technology

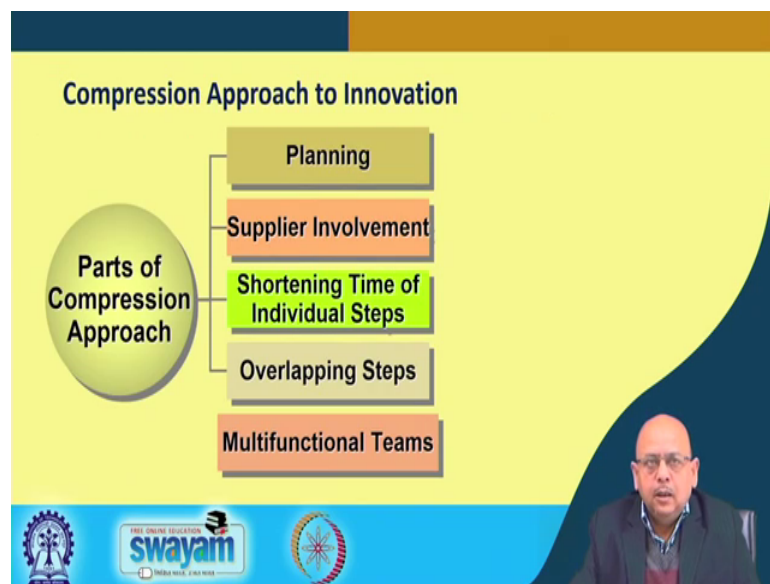
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Then as we have talked about discontinuous changes, we also need to look at what happens during incremental changes. So, adapt a compression approach; it means that yes, is a predictable process which is very much planned ok.

So, when you go for incremental changes, what happens to systematically improve the performance of the current product? By improving the cost, sorry lowering the cost, improving the efficiency, increasing the productivity; it means that the dominant technical design is there, a standard accepted design is there, what you do? You bring about some changes in the features of the technology or the product. For example, there is a smartphone; so, you add a new feature to it right. You do not change the phone or the characteristics of the phone because this is standard accepted technology that you have used to make a product right ok. For example, it is 3 GB you make it 4 GB ok, you can increase the capacity from 32 GB to 64 GB right.

So, if these kind of incremental changes happens, the idea is that it is going to help you to improve the performance by lowering the cost, but the dominant design remain same right. It means, you are talking about generational change, incremental improvement to a dominant design, achieving backward compatibility with it is older technology. So, that your technology is not changing, but you ensure that while the new feature is added with the product, the technology remains same and it is compatible. So, it works right; otherwise, what will happen? You move to discontinuous changes where you come out with a new technology or a new product or services right and that is the major difference when you are talking about incremental changes and discontinuous changes.

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Moving further, what happens in this incremental changes; so, you plan about the change involved others see what are the steps that is required and then you have a team which is going to support you right. So, when we are talking about incremental changes, you also go through its process through which you are able to bring about some kind of changes in the existing products by either modifying it or adding certain new features and you have a support team which is going to be from marketing R and D and say manufacturing which is going to ensure that this new product are the modified product is coming out.

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Approaches to Managing Innovation		
	Experimental	Compression
Environment	Uncertain discontinuous change: technological substitution and design competition	Certain incremental change established technology (i.e., dominant design)
Goals	Speed Performance Improvements New dominant design	Speed Lower costs Incremental improvements in performance of dominant design
Approach	Build something new, different, and better	Compress time/steps needed to bring about small improvements
Steps	Design iterations Testing Milestones, Multifunctional teams, Powerful leaders	Planning, Supplier involvement, Shorten time of steps, Overlapping steps Multifunctional teams



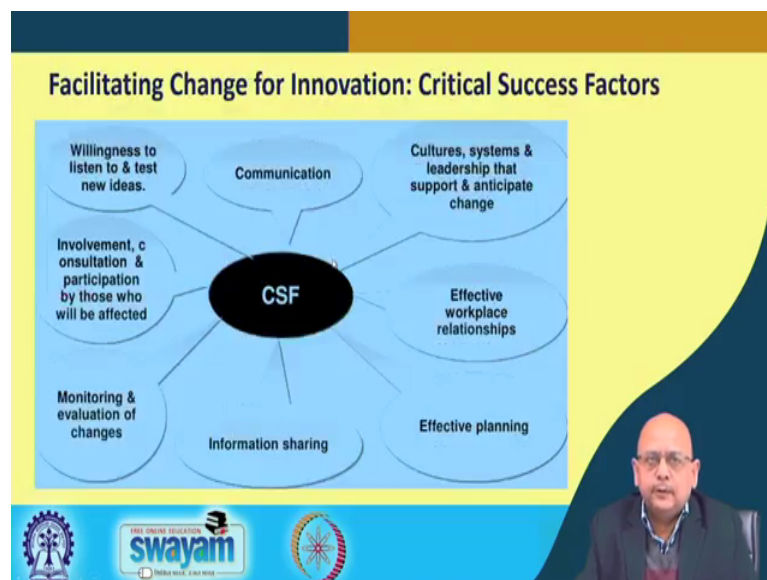
Now, if look at the differences between experiential approach, the compression approach; it is related to what you call, discontinuation that is related to incremental changes right. It means, here you are going to substitute technology and here going to make some changes in the established technology right. The goal here is the speed, performance improvements, new dominant design. Here, the goal is speed, lower cost, incremental improvements in the product in terms of performance so, design of the product remain same, but here you go for a no design; a new product right, that is with the difference between what you call a discontinuous change and a continuous change or incremental change right.

The approach here is that, you are going to build something that is new different and better. Here you compress time, steps that is needed to bring about small improvements

right and that is why compression takes place right, that is related what you call incremental changes. Then the steps it means, that you go through these steps, that we talked about design iterations, testing, the prototypes, looking at the review points having a multi functional teams to ensure that the product is developed properly and support from the leaders.

And here, in compression you also have this say steps through which you ensure that, you are able to bring about some changes incremental changes in the technology. So, what we have been talking about is two kind of changes, discontinuous changes and incremental changes right. And how this discontinuous and incremental changes takes place with the help of innovation in products, processes and services right.

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And finally, we are talking about what are the factors which facilitate innovations? These are the critical success factors, they are known as critical success factors. And this could be correct for both kind of technology whether you are going for discontinuous change or technological discontinuity or whether you are going for incremental changes right.

So, these include willingness to listen and to test new idea; it means, this talks about the idea champions where the sponsors and the idea champions are ready to accept or listen to people who are coming out with new ideas and ready to support them so, that they are able to test it. Communication is very very important, I have already discussed about it.

So, you need to ensure that it is communicated well to the top management and top management is going to accepted right.

Then you also need to have a very strong culture, cultural strong culture in terms of the culture of the organization, then you also need to see that, the systems and leadership practices that is adopted by the top management and the kind of support which is required. And, what kind of change is you are looking forward to, then relationship at the work place the (Refer Time: 31:54) relationship, because this kind of relationship, actually helps you to establish co-ordination mechanism vertically and horizontally both.

So, that is related to the structure of the organizations you need to ensure, that your structure also facilitates innovation for change right. So, you need to see that, you have a vertical and horizontal linkages for better co-ordination across roles and responsibilities right. Then it has to be planned effectively, especially in case of incremental changes and also in case of radical changes you need to see, what kind of technology you want to bring, what kind of innovations in products and services you want to bring about.

Then sharing the information, it is very very important because if want to get people involved in the process and you want the support to the team, then this must be the information related to anything, any new idea must be shared with everybody.

And finally, monitoring and evaluation. So, if you come out with new product modified product, you need to see and monitor the performance, that how this change product is working in terms of its performance and if it is doing well then you can say that yes it is successful. So, we need to ensure that, these critical factors are identified and the management is able to take care of these factors to ensure that, innovation happens. So, that organization is able to change itself for better future.

Thank you very much.