

Business and Sustainable Development
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Lecture - 09
Cleaner Production

Hi, welcome to second week of this course. In this week, we learn about Cleaner Production process, we learn about the sustainability tools, few sustainable tools in each category of this tools. So, I will tell you in brief what are the different kind of tools that is available in this sustainability domain; few of them are for management, few of them are for assessment and few of them are for reporting. So, we will try to cover at least one tool, from each kind of this sustainability tools.

But before getting into the sustainability tools, let us understand what is cleaner production process. So, in this session, we will try to see try to explore what is cleaner production, what are the different ways of the cleaner production options.

Now, before again getting into this cleaner production, the basic question what the businesses they face or the agenda. What the businesses they have is that how do they incorporate the principle of sustainability into every day's business activity.

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Steps to Display Environmental Responsibility

- **Re-define company vision, policies and strategies to**
 - include the 'triple bottom line' of sustainable development
- **Develop sustainability targets and indicators**
 - economic, environmental, social
- **Establish a Sustainable Production and Consumption programme**
 - with clear performance objectives
 - to take the organization beyond compliance in the long-term
- **Work with suppliers to improve environmental performance**
 - extending responsibility up the product chain and down the supply chain

 Source: Barbut, M. and Van der Lugt, C.T. "Corporate Responsibility: The UNEP Experience"

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So, since last week, we are trying to justify that why they consider this is as important and why should they do this. Now, since we are talking about tools, since we are we have started talking about the intervention in their business because of the sustainability. We will see the agenda for the businesses is that how do they incorporate the principle of sustainability into everyday business activity.

So, here, this is given by Barbut and Van and through their article on “Corporate Responsibility and UNEP Experience”. Here they have listed down what are the steps to display this environmental responsibility. So, the first thing is when it comes to step, when it comes to that what is the first action point or what the first agenda, what the company they should do to display or to do the environmental responsibility?.

First thing is that they need to redefine their vision, policy and strategy and how do they redefine? They have to include their triple bottom line of the sustainable development in the vision, in their policy and their strategy. So, first thing is that they have to redefine company's vision, policies and strategy.

Then, the second point is that or the second step is to develop the sustainability targets and indicators and this target should be in the domain of economic sustainability, environmental sustainability and social sustainability and once they decide the targets, they will next work on the indicators that how to achieve whatever the targets, they have given for all these three domain.

Then, establish a sustainable production and consumption program with clear performance objective, what they want to do for sustainable consumption, what they want to do for the sustainable production. And because of this, since they are talking about also sustainable consumption, beyond the sustainable production, this is typically a long term and in the long run.

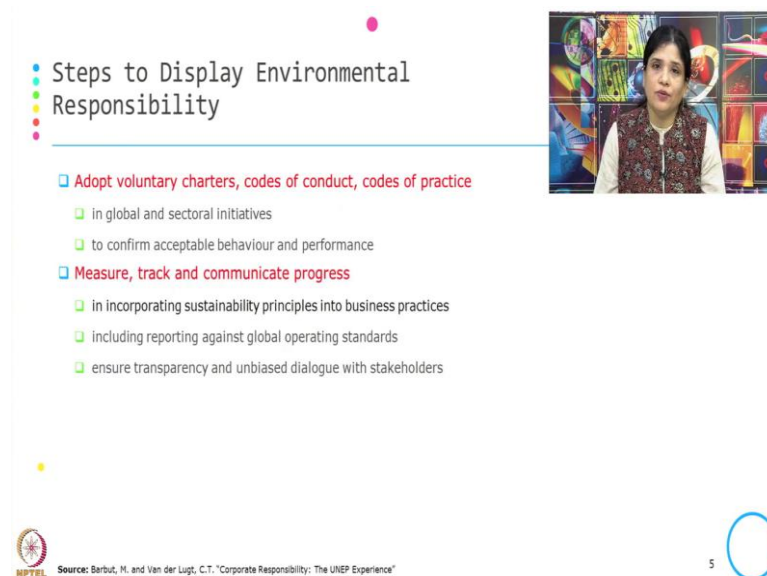
When the responsibility becomes the environmental responsibility for the company becomes mandatory beyond the boundary of their firms, the sustainable consumption program will help them to achieve the compliance in the long term.

Then, since you are talking about boundary of the firms, this is also another step to work with the supplier to improve the environmental performance. So, extending

responsibility up to product chain down the supply chain, how do you source the raw material typically through the supplier?

So, beyond the boundary or when they received the raw materials inputs for their production process, they can still display the environmental responsibility when they are sourcing it and at that point of time, they can work with the supplier to improve the environmental performance. So, when we talk about the supply chain, we will see that how company, they have extended their responsibility into the different loop of the supply chain that includes also the supplier of the raw materials.

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The slide is titled "Steps to Display Environmental Responsibility" and lists two main steps:

- **Adopt voluntary charters, codes of conduct, codes of practice**
 - in global and sectoral initiatives
 - to confirm acceptable behaviour and performance
- **Measure, track and communicate progress**
 - in incorporating sustainability principles into business practices
 - including reporting against global operating standards
 - ensure transparency and unbiased dialogue with stakeholders

The slide includes a video inset of a woman in the top right corner. At the bottom left is the NPTEL logo, and at the bottom center is the source text: "Source: Barbut, M. and Van der Lugt, C.T. 'Corporate Responsibility: The UNEP Experience'". A small number "5" is visible in the bottom right corner.

Then, going further, they need to adopt the voluntary charters, code of conducts, codes of practice; both in the sectoral level and also in the global level and by doing this, it will be confirmed that they have acceptable behavior and performance in the sustainability whatever the agenda or sustainability, responsibility.

And whatever they are doing, whether they are re-defining their policy, re-defining strategy; whether they are developing the indicator, developing the targets; whether they are working for all loop of the supply chain or developing a code of conduct. At the end how they are actually doing the environmental responsibility that can be done through major track and communicate the progress.

So, this measure the measurement tracking and communicating progress, how it needs to be done? In incorporating sustainable principle into the business practices includes the reporting of the performance against the global operating standards and also, ensure the transparency and unbiased dialogue with the stakeholders.

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Key Tools

- **Assessment / audit tools:**
 - Environmental impact assessment, Environmental risk assessment
 - Technology assessment
 - Life-cycle assessment
- **Management tools:**
 - Environmental management systems
 - Design for Environment
- **Reporting and communication tools:**
 - Corporate environmental reporting (CER) and sustainability reporting
 - stakeholder dialogue

NPTEL Source: Barbut, M. and Van der Lugt, C.T. "Corporate Responsibility: The UNEP Experience"

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Now, these are the key tools; typically, the businesses, they use for different activities or the different intervention for the sustainability and these tools are divided into three types. One category of tools which comes under assessment and audit tools and what this category of tools they do? Typically, they do the impact assessment, they do the technology assessment and also, they do the life cycle assessment which measures the environmental impact across the value chain of the product.

Then, the management tool, where typically the environmental management system which is also the standard in term of ISO and also, the design for environment, where the environment consideration is incorporated during design of the product. Those comes under the management tools.

And the last tools that is reporting and the communication tools, typically this deals with the corporate environmental reporting and the sustainability reporting and in each kind of the tools. You will find few of them are mandatory and few of them are the voluntary in the different economy context.

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Passive Environmental Strategies

Dilute & disperse: Passive End-of-pipe approaches: Reactive On site recycling: Reactive

Source: <https://www.un.org/esa/sustdev/issuues/technology/cleanerproduction.pdf>

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Now, these tools, we will discuss little later. But before that, we will understand what is the cleaner production strategy. So, this is beautifully summarized in Ivan, you will find that in one of the report of the Ivan that what are the different environmental strategy, that is taken by the firms.

So, you will find either you put them into passive, you put them into reactive and or depends again the even if you are doing a recycling that also comes under the reactive. So, what is the example of a passive one? You dilute and disperse.

Then, few of the company they do the end-of-pipe approach which is again reactive. Because why they go for end-of-pipe approach? Because they realize that this is where the somehow the so called waste or the so called impact is going outside the firms. And also, there are some on site recycling happen which is also coming under the reactive. So, most of the company will find at least if you go back to the history, their environmental strategy is passive or reactive.

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Proactive Environmental Strategies:
Cleaner Production

Prevention of Waste generation:

- Good housekeeping
- Input substitution
- Better process control
- Equipment modification
- Technology change
- On-site recovery/reuse
- Production of a useful by-product
- Product modification

Source: <https://www.un.org/esa/sustdev/issuetechnology/cleanerproduction.pdf>

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But what cleaner production process says that you have to or the businesses have to show a proactive environmental strategy and whenever there is a proactive environmental strategy that leads to the cleaner production process or the production process become cleaner.

Now, what are the proactive environmental strategy? Few of them are listed here that is prevent prevention of waste generation by doing a good housekeeping, by doing input substitution, better process control, equipment or the technology modification, on-site recovery and reuse, production of useful by-product and product modification.

So, cleaner production, the context to cleaner production is that there has to be proactive environmental strategy, then only the whatever the waste generation or whatever the impact is created beyond the firms or whatever the to the environment that become that can be controlled.

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What is Cleaner Production?

- Continuous application of an integrated preventive environmental strategy
 - to processes, products and services
 - to increase eco-efficiency and reduce risks to humans and the environment
- Production processes:**
 - conserving raw material and energy,
 - eliminating toxic raw materials,
 - and reducing the quantity of toxicity of all emissions and wastes at source
- Products:**
 - reducing negative impacts along the entire life cycle of a product, from design to ultimate disposal
- Services:**
 - incorporating environmental concerns into designing and delivering services

MPTEL Source: UNEP IE 1989

Now, what is cleaner production? Here, in fact, if you want to highlight, possibly two things needed to be highlight in case of cleaner production; one there is continuous application, it is not one time and second, it is a integrated preventive environmental strategy.

So, continuous application of integrated preventive environmental strategy to the processes to the product and to the services and why do it is needed or why do we do that? Because by doing this, there is a increase in the eco efficiency and reduce the risk to human and the environment.

So, we learn more about eco efficiency when you talk about strategy; but for the time being the understanding of eco efficiency is that when we are able to deliver the goods and services better quality goods and services with less of impact to the environment, typically that this is known as a eco efficiency strategy.

So, cleaner production is the continuous application of integrative preventive strategy to process, to product, to services because at the end, we want to increase the eco efficiency and also, risk to the human and environment.

Now, how do we do this? At least few of them or few of the strategy is in the production process should the way the action or the way the intervention should happen because of cleaner reproduction is that conserving the raw material and the energy. So, the way we

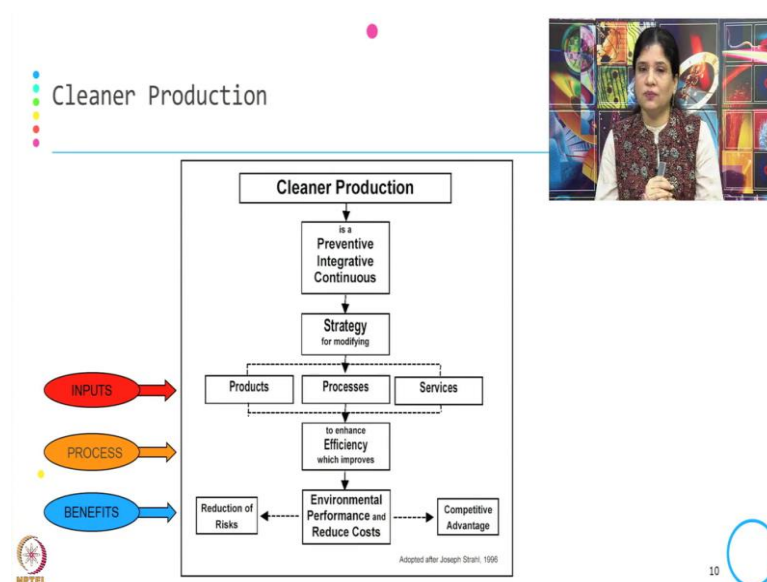
use materials and energy in the production process, how do we conjure or how do we use less of them. Eliminating toxic raw materials; whatever toxic, whatever hazardous, we need to take it out.

And reducing the quantity of toxicity in all emission waste at source; rather than looking at the end-of-pipe, how to reduce the quantity of toxicity of emission of all emission and waste at the source. Now, how this is being done in product? We reduce the negative impact along the entire life cycle of the product from the design of the product to the end of life disposal.

So, in case of product, cleaner production aims to reduce the negative impact across the product life cycle and services, mostly looking at the after the product is being produced into with respect to distribution to the reaching to the consumer incorporating the environmental concern into designing and delivering services. The typical example is that how do we package our goods, when we send it to the consumer.

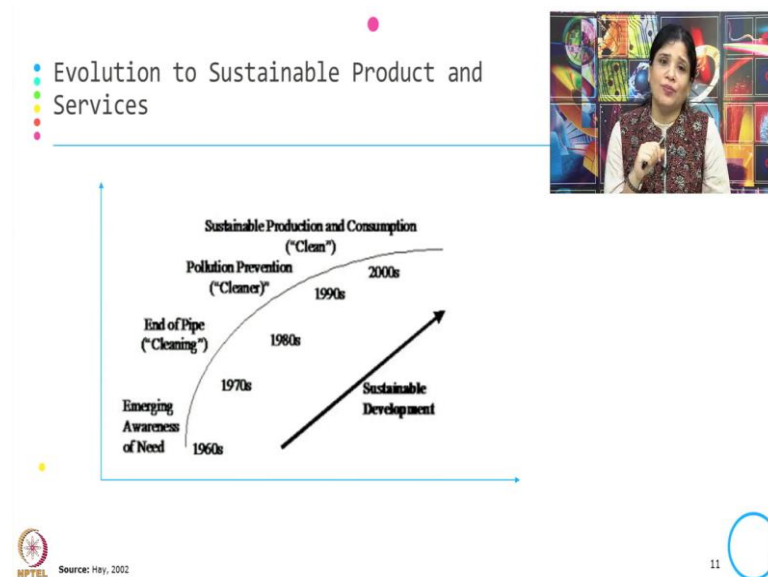
And typically, whether environmental concern is whether we can address the environmental concern over there or not. Because production process and product mostly talking about what would be the how do we incorporate the environmental concern in the process. Product starting from the design to the disposal and also, the services associated with the product.

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Now, this is what is the cleaner production. So, cleaner production is as we discussed in the last slide, preventive, integrative, continuous strategy for modifying product, process and services to enhance the efficiency which improves the environmental performance, reduce cost. At the end of it, what the businesses they get is that competitive advantage.

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Now, if you go back to the history, let us say from 1960s, how the entire concept of cleaner production is being incorporated by the businesses or let us see how there is a evolution of this sustainable product and the services. So, this talks about only till 2000 because this is the time, when we got into the cleaner production process.

There is lot more improvement lot more development after that. So, 1960 that point of time, there is a emergence of or the awareness or the need of that we should think of sustainable product or there is a need of the sustainable product.

1970s, the businesses, they started getting into end of pipe; it is more into cleaning zone of it. 1980, pollution prevention, it is more cleaner and between nineteen or let us say 2000, we got into the era of sustainable production and consumption. So, if you look at it is not that one fine day or it is because of one particular event, there is a cleaner production.

Somehow this cleaner thing is being addressed from 1960, when we are till the time we are talking about cleaner production process as the integrative preventive strategy moving from 'awareness' to 'cleaning', to 'cleaner' and finally, to the 'clean' one ok.

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Types of Cleaner Production Options

- **Housekeeping**
 - Improvements to work practices and proper maintenance
 - Significant benefit
 - Typically low cost
- **Process optimization**
 - Reduction in resource consumption by optimizing existing processes
 - Typically low to medium cost
- **Raw material substitution**
 - Replacement of hazardous materials with more environmentally benign materials
 - Require changes to process equipment

HPTEL 12

Now, these are the types of cleaner production options. The first is housekeeping. Improvement to the work practices proper maintenance and typically, if you get into this cleaner production option, there is a significant benefit; but the cost associated with this options is low. Then, the second cleaner production option is process optimization, where we reduce the resource consumption by optimizing the existing processes and what is the cost involved over here?

The cost involved over here is that typically low to medium cost. Why it is medium cost? Because we need to optimize the process so that we use less of the resources, then the third type of cleaner production option is raw material substitution. So, where we replace the hazardous material with more environmental-friendly material and this requires change to process requirement, process equipment.

So, we need to change the process equipment and by doing this, we can get into the cleaner production options and typically, the cost associated with this is medium to high.

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Types of Cleaner Production Options

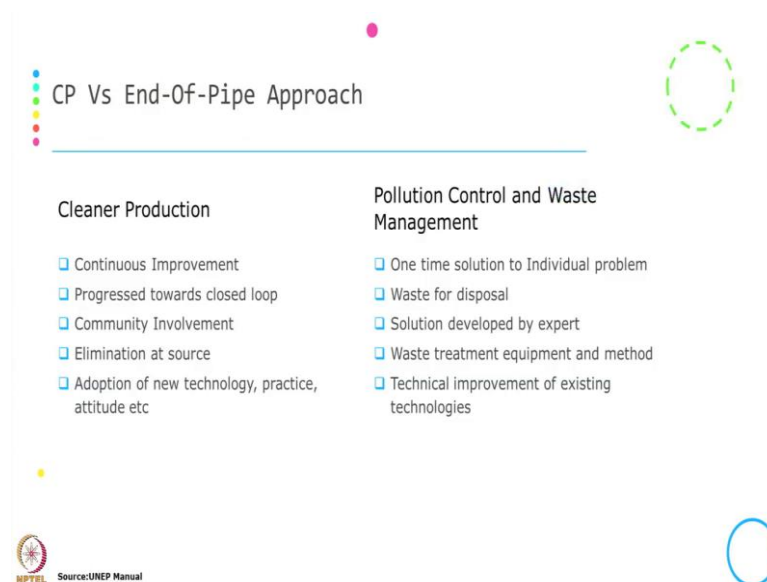
- **New technology**
 - Adopting this can reduce resource consumption
 - Minimise waste generation through improved operating efficiencies.
 - Highly capital intensive
 - Short payback period
- **New product design**
 - Long-term strategy
 - Require new production equipment and marketing efforts
 - Paybacks can ultimately be very rewarding

NPTEL 13

Then, the next type of cleaner production option is new technology and by adopting new technology, this is known that we can reduce the resource consumption because we are using a advanced technology. We can minimize the waste generation through the improved operating efficiency. But this option is highly capital intensive and also, it may require more of cost, but the payback period is typically short in this case of the cleaner production options.

Then, the next cleaner production option is new product design. Typically, this cannot happen over time over a day or overnight. It is an long term strategy. It requires the new production equipment and also, the marketing effort and here, also if you look at it may be capital intensive, but the payback what we get from such product if the market does this if the product does well in the market, it ultimately the whatever the payback we get it ultimately very rewarding.

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Now, when we compare between cleaner production and end-of-pipe approach, there is end-of-pipe approach also at some point of time by the businesses in order to address this concern, but cleaner production is more integrative. Let us see what is the difference between the cleaner production and the pollution control and waste management.

So, the first difference is that cleaner production gives a continuous improvement; whereas, pollution control and waste management is just one time solution to the individual problem. And cleaner production through the strategy to strategy by strategy of incorporating environmental concern in product, process, then it progress toward a closed loop.

It means whatever is being taken out of the loop that is through the production process, in this case in case of cleaner production options. We try to bring back all this whatever the waste product bringing back into the loop again production loop by recycling and reusing. But typically in case of pollution control and waste management options, we find that there is always waste for the disposal.

There is some amount of the waste that is coming out of the disposal and you will find in the end-of-pipe, even if you do end-of-pipe treatment, some of the disposal is still which need to be disposed.

In case of pollution control and waste management the solution is developed by the expert and mostly, by the individual expert or by the technology expert; but in case of cleaner production, there is a community involvement or there is a involvement of the stakeholders in case of the cleaner production. In case of cleaner production, the elimination happen at the source.

So, whatever the toxicity associated with raw material, with the energy or with the emission or the waste whatever is there, it is being tried to eliminate at the source; but typically, when it comes to pollution control and waste management, the treatment happen with respect to a specific using a specific equipment or with respect to a specific method.

Then, in case of cleaner production, we adopt new technology, practice and attitude like the typical example is that if there is stop management attitude is not towards the cleaner production, it is difficult to adopt the cleaner productions options. And if you look at in case of pollution control and waste management, it is mostly about the improvement that is being done with the existing technology, not with the all the technology or the practice or the attitude.

So, this is more like making the effort or making the intervention with respect to one of the specific technology, one of the specific equipment of doing a technical improvement of the existing technology. One of the basic differences what is not being listed over here is that typically you will find that there is a active participation in case of the cleaner production.

However, when it comes to pollution control waste management or end-of-pipe approach, you will not find the entire process or the entire each intervention, there is a active participation you will find. It is only with respect to equipment or only with respect to technology, there is a not exactly passive, but not so active improvement or there is no so active involvement in this case ok.

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Barriers for Cleaner Production Option

- Internal
 - Lack of awareness, information and know how
 - Inertia of employee and management
 - Lack of priority
 - Cost/Finance issues
- External
 - Availability of Technology and Finance
 - Lack of stringent and Efficient regulation

NPTEL 15

Now, what are the barrier for this cleaner production options? So, this is being categorized by two types; one are one is internal barrier and second one is the external barrier. The first barrier which comes under internal is that there is lack of awareness information and know how.

So, you will find that in most of the cases, possibly the company, possibly the business, they are having no awareness or even if they are having awareness, it is low and what actually it is going to give by doing this, the benefit associated with this, why should they do this and the information to do this and also, the know how the processes, the technology needed for this that is not available. So, typically that comes under the internal barrier.

Second one is also I was discussing in the previous slide, this that about the we need to change the attitude also. It is not about only changing the technology or improvement in the technology is bringing the cleaner production options. It also needs the change with the attitude and in most of the cases; one of the barrier that comes is that there is a inertia of employee and management.

So, with respect to any change, there is a inertia with respect to employee and management and that is why they find that this is one of the barrier when it comes to the cleaner production option.

The third factor or third barrier is that there is lack of priority because typically, when it comes to business, possibly they say that what is the short term profit; what is the benefit associated with this and in case of cleaner production options, as we discuss in case of different option also in few cases possibly the payback period is early payback period is short, but in few cases the payback period is long.

And when the payback period is long, that is not coming to the priority list of the businesses or priority list of the company and the bigger barrier which comes from the internal source is that this cleaner production options as we discussed, few of them are having a low cost implication, few of them are having a medium cost implication and few of them are capital intensive.

So, in this case, there is also a need of cost, there is also a need of finance from internally which sometimes not available or most of the time not available in the regular basis to the company which creates as a barrier.

When it comes to external barrier of the cleaner production options, mostly this is with respect to two thing; one, why do the company go for cleaner production options, one if they find that there are technology, there are finances available to adopt the cleaner production options; second, there is a regulation which is driving them to go for the cleaner production options.

So, the in case of external barrier, these two points typically comes; one there is lack of technology and finance or the availability of technology finance that decides whether they should go for a cleaner production option or that poses as a barrier to the cleaner production option and second, there is a lack of stringent and the efficient regulation.

If there is no stringent or efficient regulation, then businesses always even if they see that there is a benefit associated with this, they try to push it for further and say that ok possibly this is not now, at a later point of time, they are going to get the cleaner production option whether they are trying to adopt a cleaner production options.

But if there is a stringent and efficient regulation and if it is not now, maybe in next 2 years, 3 years possibly they feel that yes, this is the time they need to do it and they go for it. So, when it comes to external barrier, the lack of availability of technology and finance and lack of stringent and efficient regulation that creates the barrier.

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Motivators and Drivers

- Internal
 - Improvement in Productivity
 - EMS and Continuous Improvement
 - Environmental leadership
 - Performance and Communication
- External
 - Changing Regulation
 - Innovation and Technology
 - Soft Loan
 - Economic Incentive
 - Stakeholder Involvement

NPTEL 16

Now, what are the motivators and drivers? So, there is a internal; again, internal cluster, we have a external cluster. So, the motivator when it comes to motivators and drivers, the first one which comes internally is that there is a improvement in the productivity. the There is a standards what they need to follow that is EMS, Environmental Management Standard.

There is a need of the continuous improvement, then also the environmental leadership of the if they are doing it, then the environmental leadership becomes the part of the business, part of their company and in the market space, they can show that they are the leader because they are the one who have adopted the cleaner production. Then, the also because of this cleaner production there is a benefit which is associated with the performance and the communication.

So, internally, the drivers and motivators for cleaner production option is that it improves the productivity. It provides a environmental leadership in the market. There is a this is a implication with respect to the corporate performance and also, how do they communicate about their performance in the market and also by doing this, they can have a continuous improvement and also, they can get a certification of the EMS that is environmental management standard.

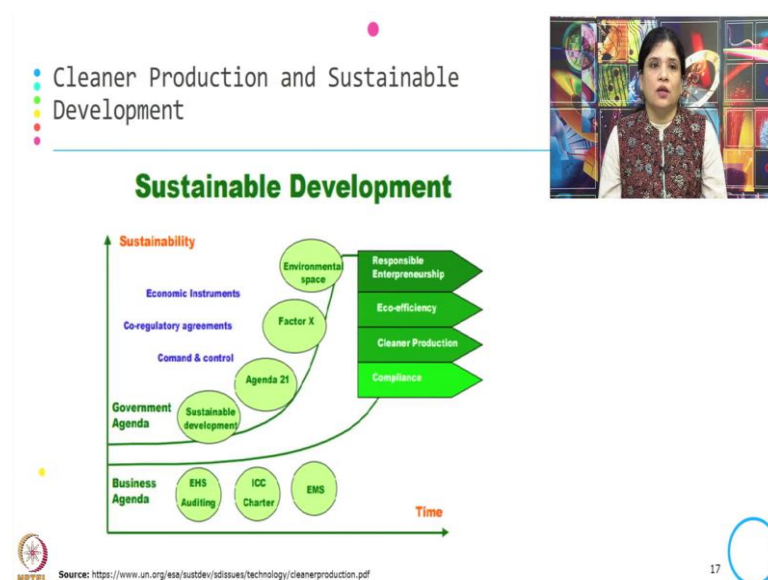
When it comes to external drivers, the major points possibly what we are discussing from the beginning is that the driver is changing regulation. If the regulation is moving

towards adopting cleaner production or the stringent regulation that is what the drivers or the motivators for cleaner production option. The development in the innovation and technology motivates the company to take the cleaner production options. If the loans, soft loans are available in the market or the finances available in the market what the company or the business they can afford to that creates as a driver.

Then, there is a economic incentive because you get some subsidies because you are going for a cleaner production options, you get the incentive in the other form tangible and intangible from the regulator from the government that becomes the driver for the company to the adopt the cleaner production options.

And finally, if the stakeholder creating a pressure or the stakeholders is helping out in adopting the cleaner production options that goes as a driver for the company to adopt the cleaner production option.

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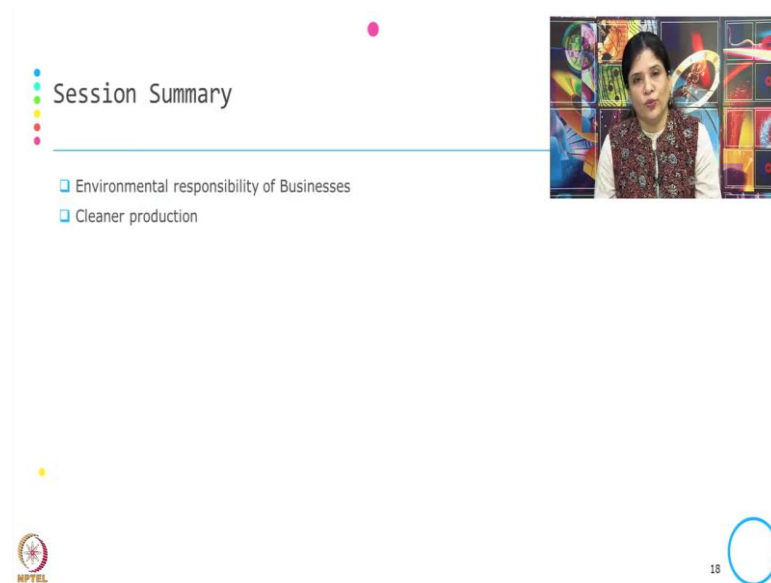
So, this is how the change is happening. Both if you look at this graph shows that how cleaner production and sustainable development over a period of time, how the journey have been. So, if you look at there are two agenda over here; one is government agenda, second one is the business agenda.

So, over a period of time, when the business agenda was just about environment and health auditing, now they have moved into the getting into environmental management

standard and when it is coming to the government agenda, they are moving to the environmental space through their economic instrument, through their co regulatory agreement and through the command and control approach, they are trying to control the business that how this they how the so called sustainable development can be achieved through all this intervention.

And what are the; what are the options or what are the intervention, those are being done from the business side? There is compliance, there is cleaner production, there is eco-efficiency and there is responsible entrepreneurship. So, in if you look at over a period of time, the agenda is getting added and with each agenda, we are inching towards we are inching more towards the sustainable development ok.

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The screenshot shows a presentation slide with the title 'Session Summary' at the top. Below the title, there is a list of topics: 'Environmental responsibility of Businesses' and 'Cleaner production'. A video inset in the top right corner shows a woman speaking. The slide has a blue and white color scheme. In the bottom left corner, there is a logo for 'HPTCL' and in the bottom right corner, there is a blue circle with the number '18' inside it.

So, in this session, what we have tried to understand is what are the environmental responsibility of businesses and how they incorporate into their day to day businesses; mostly, through these three tools that is tools associated with impact, tools associated with management, tools associated with report reporting and then, we have learnt what is cleaner production process, how it is different from the end-of-pipe approach and what are the different options available for the firms with respect to cleaner production process options.

Thank you.