

SUSTAINABLE MINING AND GEOINFORMATION

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Week – 06

Lecture 28: Sustainable Development for Mining Industry-II

Welcome, students, to the NPTEL online certification course on sustainable mining and geo-information. Today is Lecture 28 and the topic is sustainable development for the mining industry. We are continuing from the previous lecture. The previous lecture was Lecture 27.

It was the first lecture on sustainable development for the mining industry. Today's lecture is the second lecture on the same topic. So, we are continuing from where we left off yesterday. So, in today's class, the concepts that will be covered are sustainable development for the mining industry, how we are going to implement the concept for the mining industry, and what the framework of sustainable development concepts is. For the mining industry, there are several aspects in the framework. So, we will be discussing all of them. One is scientific mining or technological advancement. We will also discuss environmental protection to be taken for sustainable development. Then, we are going to discuss the socio-economic policy.



And measures for sustainable development. We will also discuss the governance issues associated with sustainable development and sustainability reporting to different

stakeholders. Now, just to take you back to the previous class, we have discussed. How the concept of sustainable development was introduced in the Brundtland Commission report in 1987. The report's name was 'Our Common Future.' If you remember, sustainable development was defined as. "A developmental process that meets the needs of the present generation without compromising the ability of future generations to meet their own needs." Now, we have discussed how, in this definition, the issues of the needs of the present society, particularly the poorest section of society, have to be incorporated.



Sustainable Development

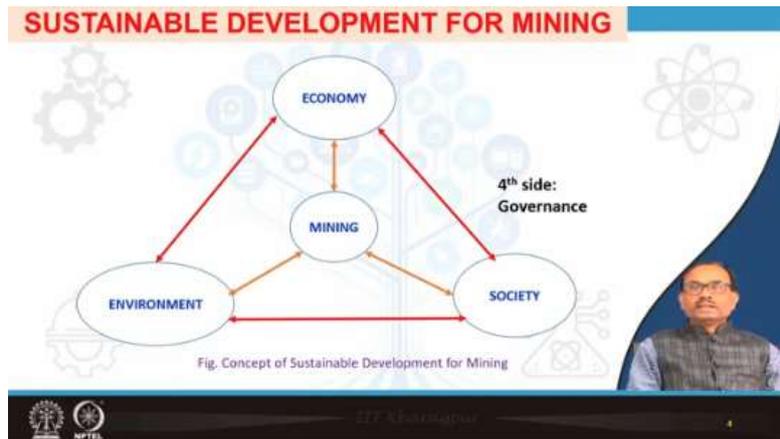
- World Commission on Environment and Development report- **Our Common Future** (Brundtland Commission, 1987)
- Coined and defined "Sustainable development"
- "Developmental process which meets the needs of the present without compromising the ability of the future generations to meet their own needs".

Key features:

- a) Needs of present society especially poor;
- b) resource availability;
- c) intergenerational equity;
- d) "limits" or the ability of the environment

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How the resource availability is very critical for development was discussed. How the intergenerational equity, the requirements of the present generation and the requirements of the future generation, and how the resources have to be shared in such a manner that every generation will have a share of the resources for their development, was discussed. And then any development that will be done has to be within the carrying capacity of the ecosystem or the limits of the environment. So, all these concepts and features are incorporated in the definition of sustainable development. With respect to the mining industry, we discussed in the last class that there is a triangle where mining is at the centroid, and there are three components or three vertices: one is the economy, another is the environment, and another is society. So, how the mining industry will achieve a balance between the environment, society, and economic development is what we are trying to achieve in sustainable development.



Of late, the recent definitions of sustainable development also include a fourth component, which is governance. The governance mechanisms, governance institutions, and governance methodologies that are required to achieve sustainable development. What is the need for sustainable development in the mining industry? Because the local community is dependent on the mining companies or mining industries for providing them with socio-economic facilities, services, and infrastructure. So, the local economy and social infrastructure and services are dependent on the mines or on the mining company.

NEED OF SD FOR MINING INDUSTRY ?

- Local community dependent on mining companies for providing (subsidizing) social facilities and services.
- Local economy and social infrastructure and services dependent on mines.
- Significant socio-economic implications of mine closure
- Employment, income, education, health services etc.
- Objectives of SD: Minimize adverse impact on the local economy;
- Provide for long-term needs of the local communities.

So, when the mining company is existing, they are providing the facilities to the local community. But what happens when the mine closes? So, what are the economic and socio-economic implications of mine closure on society?

So, because then the employment, income, and the different services like education and health services may not be available. So, in that context, the objective of sustainable development is to minimize the adverse impact on the local economy when the mine

closes. So, that is also, for that purpose, we have to think about how to implement sustainable development so that the mines can provide long-term needs and requirements of the community while the mining business becomes sustainable itself during the active phase of the mining life as well as beyond the mine life when the mine is closed. So, if you can develop the sustainable development measures, then what is the benefit? What are the benefits?



BENEFITS OF SUSTAINABLE DEVELOPMENT

- Economic benefit: Efficiency, productivity, increase/conservation of natural resources
- Environmental Benefit: Preservation of physical, biological and ecological resources (air, water, soil, flora fauna etc.);
- Environmental degradation within ecosystem's assimilative capacity.
- Social benefit: Quality of life, health and safety, socio-economic upliftment in remote areas.
- Compensating investments in society and community.
- Constructed assets, social capital in case of damaged natural capital.
- Governance Benefit: Good relation between industry and community; License to operate.

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So, the benefits are economic benefits. So, efficiency of production, productivity, and because of the implementation of efficient measures, scientific technology, and innovation. So, you will see that the natural resource, particularly the mineral reserve, may also increase because your product is becoming very, very efficient. So, the reserve that is present, the economic reserve, will also increase when our research and development, our technological development takes place, and our research positions become better. So, that is the economic benefit. Environmental benefit: we know that as a part of sustainable development, we will take measures for the preservation of physical, biological and ecological resources.

Air, water, soil, flora, and fauna will be preserved. We will take measures so that the degradation of these resources is minimized. Environmental degradation should be within the ecosystem's assimilative capacity. Now, social benefit: because of sustainable development measures in the social sector, our quality of life will improve, the health and safety situation of the community will improve, and socio-economic upliftment in the remote areas will take place. Now, because in sustainable development with respect to the adverse environmental impact or the degradation of the physical, biological, and ecological resources, we have to provide compensating investment to create social and economic infrastructure for the society, for the community. So, we have to construct

socio-economic assets like schools, colleges, skill centers, training centers, and hospitals. So, social capital in lieu of damaged natural capital. What is the natural capital? This air, water, soil, groundwater, these are all.

Forest, flora, and fauna, these are all natural capital. We are damaging because of the mining. So, in lieu of that, we have to provide the socio-economic capital. That is the infrastructure, the hospital, school, hospital, market, all the services, connectivity, these are all the services that we have to provide now. Governance benefits when we are implementing the sustainable development measures, so when we are establishing good relations between industry and community, industry and other stakeholders, so confidence of the people of the society in the mining industry will improve, and then mines will get positive feedback and they will achieve the license to operate because now this topic has become very, very important, the license to operate. So now, to implement sustainable development in the mining sector, in the international arena, there are different mining organizations, they have conducted, carried out a study to develop the sustainable development framework. What are the basic principles on which sustainable development will be implemented? So, the ICMM, International Council of Minerals and Metals, they have developed these 10 principles for the implementation of sustainable development in the mining and mineral sector. So, what are they? We will go one by one.



One is to maintain ethical business practices and sound governance. So, our business has to be ethical. Actually, this has a historical context that, you know, when these international companies they are working in different countries. And in many cases, the mines are located in developing or poor countries like Africa, South America, Papua New Guinea, and so on.

And sometimes what happens is that the mining companies, the multinational companies, they... They exploit or they mine and extract the resources, but sometimes the benefits of the mining do not percolate to the local society. So there is a lot of environmental degradation, and the local people suffer. So that is why the mining business has to be ethical, where some of the benefits of the mining have to percolate down to the local society, to the local community, and they get some benefit out of it because wherever there is mining, there will be some environmental degradation that will take place invariably, so the local community will bear the brunt of the environmental degradation, but in lieu of that, at least they should get some socioeconomic benefit in terms of education, skills, or healthcare. So, if that doesn't happen, then that is not ethical practice. So ethical business practices are the first basis or first principle. The second principle is to integrate sustainable development principles with corporate decision-making. So now, when these companies, which are big companies, have a corporate structure and a mine operating at a local level. Now, sustainable development is not only when you are planning at the local level, in the mine level, but at the corporate level, you have to do some planning, develop some programs, and some schemes, so that wherever we are going to open a mine, we will invest some resources, part of the budget, on creating better socio-economic infrastructure in the area where the mining is operating. So, this thinking has to be incorporated at the corporate level. Now, the third principle is to uphold human rights, respect culture, customs, and values of the community. Now, again, the first principle I have discussed is that these multinational companies are working in various developing countries, poor countries, and sometimes there are allegations by environmental activists and social activists that these mining companies are not respecting the rights of the local people; they are violating their rights because of the mining business. To address this allegation, the third principle is that we have to respect the human rights, the cultural identity of the local people. We have to respect the customs and values of the communities. So, because mostly the mines are located in tribal-dominated places, areas where the tribes have a different lifestyle, a different value system, and different customs. So, that has to be respected.

Because otherwise, these multinational companies bring a lot of standardization in the culture and behavior. So, we have to respect the identity of the people. So, the fourth principle is to implement risk management strategies based on valid data and sound science. The fifth point is the continuous improvement of health and safety performance. Now, as part of the mining, we have to carry out continuous measures so that the health and safety of the workers who are working in the mine, as well as the general public in

the community, are ensured. So that it is not affected. Rather, the company will be investing part of the budget to create health and safety infrastructure so that the people are taken care of. Benefit in health and safety. Continual improvement of environmental performance.

So, the environmental performance of the mining is a very critical component, and there are many regulations prescribed in our country and in many other countries as well. They have different regulations, and the mines have to perform continuously to meet the requirements of the environmental statutes. Now, in many cases, the mines can take measures that will not only meet the environmental statutory requirements but sometimes exceed them, and the mines will perform better in environmental performance. Conservation of biodiversity through integrative approaches to land use planning. This biodiversity is very important in mining because most of the mining is located in forest areas, and because of the mining, there is sometimes an adverse effect on the biodiversity, an adverse effect on the flora and fauna, and an adverse effect on the biodiversity.

So, the mines have to take sufficient measures to conserve the flora and fauna and conserve the biodiversity. The eighth point is to facilitate responsible product design, use, recycling, and disposal of products. This concept of the RRR—reduce, reuse, and recycle—and the concept of circular economics. Now, it is becoming very important.

Now, the mining companies can use some of the concepts of the circular economy so that we use different products which can be reused, and any waste that we are disposing of can be used as a resource. So, if these concepts are used, then it will help in the sustainable development of mining. contribute to social, economic, and institutional development for communities. So, these are the issues that we will be discussing in the governance issues.

Particularly, the mining companies have to develop some institutional mechanisms so that the benefits of mining can be shared with society and the community, and mining will contribute to social upliftment and economic upliftment through these institutional measures. The last point is effective engagement, communication, and reporting with stakeholders. Sustainability reporting can be done; the mining company can take many measures, but You have to communicate to the community, society, and all stakeholders regularly through different publications, reporting, and newsletters, so that the community, society, and stakeholders are aware of the different measures the mining

company has taken towards environmental conservation and towards the socio-economic upliftment of the local community and society. That is called sustainability reporting.

It is also a very important part of sustainable development measures. So, among these ICMM 10 principles, these ICMM 10 principles were mostly developed by multinational companies on their initiative, and many of these multinational companies are following these ICMM 10 principles. But, from the Indian context, some of the principles from ICMM have been taken, and there are certain framework. issues that have been selected. So, this can form the sustainable development framework in the Indian context.



SUSTAINABLE DEVELOPMENT FRAMEWORK

Dimensions of implementation of SD:

1. Scientific mining (Technological advancement, innovation)
2. Minimise ecological footprint (Water, waste, emissions, GHG)
3. Protection of biodiversity,
4. Mine closure and reclamation
5. Shifting to circular economy
6. Local community development, and engagement
7. Transparency and accountability

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So, what are the dimensions for the implementation of sustainable development? One is scientific mining. Scientific mining means we are continuously incorporating technological advancements in mining, mineral processing, and the digital economy sectors. New developments are taking place in mineral processing and mineral exploration.



SCIENTIFIC MINING

- Scientific mining - innovations in technology and management and operational practices.
- Scientific mining will lead to improvement in:
 - resource utilization;
 - conservation, recycling.
 - environmental performance
 - waste management
- Mining industry must go beyond regulatory compliance to develop innovative methods.
- Improved technology: machines and software to improve efficiency and productivity.

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New equipment is also being developed using different sensors. For efficient mining. So, if you use the advancement of technology and different innovations that are taking place in mining, mineral beneficiation, and environmental treatment measures for mining. This will be called scientific mining, and using scientific mining, our mining will be much more efficient and productive. Also, environmental degradation will be minimized by the implementation of scientific mining. The second aspect is minimizing the ecological footprint.

That means minimizing the adverse impact on the environment in water, air, soil, waste emissions, and greenhouse gas emissions. So, minimize the emissions. And minimize waste generation. The third most important aspect is biodiversity protection. What measures are we taking for the protection or conservation of biodiversity? The fourth important point for mining is mine closure and reclamation. This is now our regulation. The government is giving more focus on more stress on mine closure and rehabilitation. That is, when your mining is closed, what are the different environmental measures you will be taking to reclaim the mining area, to reduce pollution, and shift to a circular economy? So, the current linear economy model of using something and disposing of it as waste has more adverse impact on the environment. But if you shift to a circular economy where you are using the principles of reuse, reduce, and recycle, and we are doing scientific innovation, that will be termed as a circular economy, and a circular economy is very environmentally friendly. The impact on the ecosystem is less compared to the linear economy model. The sixth point is local community development and engagement. So, how will you engage with the local community to listen to their problems, and what measures, policies, or schemes will you implement for their upliftment or the socio-economic benefit of the community and society? That is for local community development and keeping the communication lines open, institutionalizing channels for having interactions with the community. That is the engagement, which is also very important. Lastly, the governance issue: transparency in the mining companies' business, accountability, and responsibility. Who will be responsible for implementing the sustainable development measures? Who will be responsible for hearing the grievances of the local community? Who will be responsible for addressing their problems? So, these are all transparency and accountability issues. So, these are the main seven sustainable development frameworks that we can consider for the Indian context. Scientific mining: I have discussed: innovations in technology, innovations in operational practices, and different innovations in the management of the mines.

So, we have to continuously innovate for more efficient mining, and scientific mining will lead to improvement in resource utilization. It will lead to the conservation of resources. It will lead to more recycling, better environmental performance, and better

TECHNOLOGICAL ADVANCEMENT

- Mining industry need to develop and foster technological innovations to maximize economic efficiency, safety and sustainability
- AI, IOT, Data analytics
- Automation and Robotics, UAV,
- Sensors for safety, environmental monitoring, monitoring system
- Remote sensing, GIS, Image Processing
- Specialised software for mineral resources planning.

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waste management. The mining industry should continue to go beyond regulatory compliance to develop innovative methods so that the mining product becomes more productive, more environmentally friendly, and more profitable.

If you use improved technology, machines, equipment, and software, they will enhance the economic efficiency of mining. They will improve the productivity of the mines. Now we all know that a lot of technological advancements are taking place in the information technology sector. And in sensors, in UAVs, unmanned aerial vehicle drones, remote sensing, and satellite technology. So, if you can use these technology, for mining, for surveying, for environmental monitoring and measurement, and for safety monitoring.

So, this will have a huge beneficial effect on the productivity, safety, and environmental performance of mining. So, we can use the recent new technology of artificial intelligence, machine learning, data analysis, automation, robotics, UAVs, and sensors for safety and environmental monitoring, Then remote sensing, GIS, image processing, and different specialized software for mineral resources planning, surveying, and volume calculation. In disaster management, identification of, let's say, slope failure taking place.

So, how are the slopes changing? So, there are many image processing technologies we can use, and radar technology we can use. And if we use all this technology, our mining will be much more efficient and environmentally productive. And it will be much, much safer. And all this will lead to sustainable development in the mining sector.

Environmental sector. So, environmental protection... Particularly, we have to focus on land reclamation. Land degradation is a major problem in open-cast mining. So, we have to reclaim our land.



Water use is another problem. An important area is water. You know, water is becoming a precious resource, and the Third World War could be due to water. That is the prediction of many intellectuals. So, water use and efficiency are very, very important. Energy use and efficiency are also crucial because energy use is associated with greenhouse gas emissions and climate change. So, energy use and efficiency in energy use are vital. Waste minimization is another key area. How can we reduce our waste? And if some waste is generated, how can we convert that waste into a resource through technological research and development? Tailings management is a particular problem in mining areas, along with air pollution, liquid effluent, and solid waste. Noise and vibration control, biodiversity loss, and mitigation measures for biodiversity preservation are also important. Environmental compliance with statutory requirements prescribed by the Central Pollution Control Board is mandatory for mining companies.

But beyond that, they can also take many voluntary environmental protection measures, which will give them better mileage and help in developing confidence among the community, society, and all stakeholders. So, apart from this, conformity to different environmental standards like ISO 14001 is essential for the environment. So, the mining company can take measures to achieve ISO 14001, and that will give them good environmental credit. So, mine closure is very, very important for sustainable development.

MINE CLOSURE

- Flora and fauna management, preservation
- Surface and groundwater quality;
- Water storage facilities for consumption, process supply.
- Volumes/ types of wastes to be managed
- Designs for waste storage facilities and costs to rehabilitate and close.
- Stability of ground surface and engineered structures.
- Social and economic development and sustainability issues, such as local enterprise, post-closure use of land and infrastructure, and other community development programs



So, how are we going to manage our flora and fauna, and how will we preserve them, how to Protect our surface and groundwater quality. How to store our water for consumption and process supply. What is the waste that we are generating, and how are we going to handle our waste in an environmentally friendly manner. Then, the stability of ground surfaces and artificial structures.

Socioeconomic development, sustainability issues, local enterprise, post-closure use of land. And infrastructure and different community development programs, these are all part of the mine closure. We will take a separate class on the mine closure. So, different socio-economic measures we have to take because the mine will have an impact on the social life, it will have an impact on the cultural life, it will have an impact on the economies of the community. Basically, we have the EIA and EMP that we have discussed, and in the environment management plan, there is also a component of social impact assessment and management plan to deal with the social issues. So, as a part of the environment management plan in the socio-economic sector, the mining company has to prepare a strategic vision, A long-term plan and operational projects or schemes.

SOCIO-ECONOMIC MEASURES

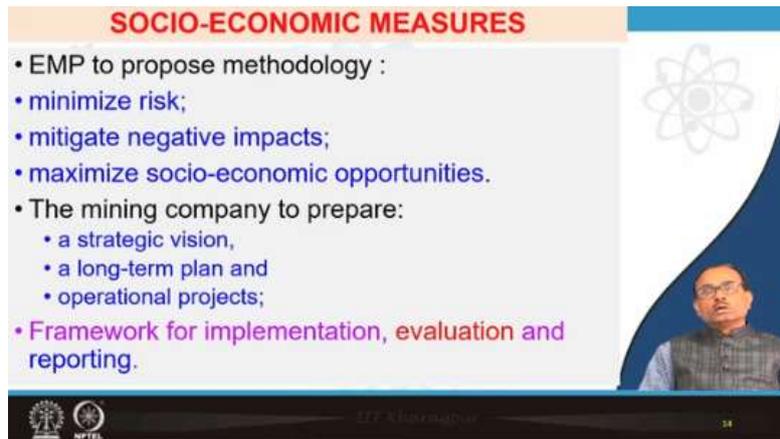
Impacts of mining on local community:

- social,
- cultural and
- economic life of the surrounding community.
- Socio-economic-cultural profile of community by baseline study.
- Identify competence and institutional framework
- Positive and negative impact of mining



SOCIO-ECONOMIC MEASURES

- EMP to propose methodology :
 - minimize risk;
 - mitigate negative impacts;
 - maximize socio-economic opportunities.
- The mining company to prepare:
 - a strategic vision,
 - a long-term plan and
 - operational projects;
- Framework for implementation, evaluation and reporting.



So, these schemes will be used for the socio-economic development of the community. So, in those schemes, particularly, there will be how the mining companies are going to share their profits or the benefits with the local community in an equitable and transparent manner. Because the mineral resources belong to the country, belong to the community, and the mining company is using these resources, having a business out of it, and making some profit. So, some part of the profit must go to the community who are actually in the democratic polity. It is the ownership that is with the society or with the communities, some benefit should accrue to the community.

ECONOMIC BENEFIT SHARING

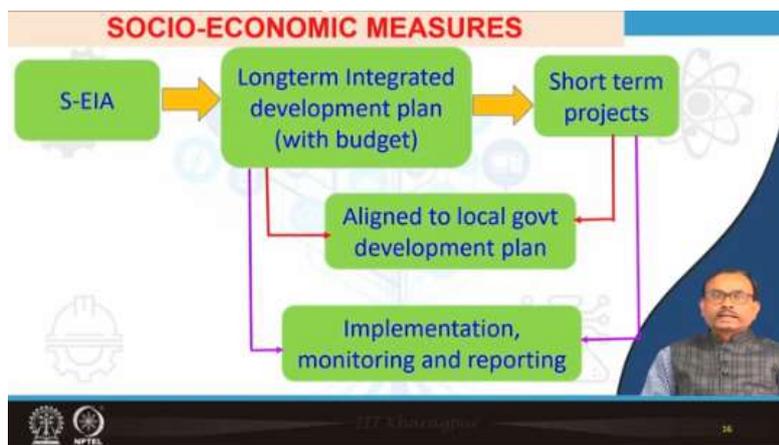
- Benefit-sharing of mineral resources revenue with community in equitable and transparent manner;
- Equitable share to be decided by discussion and agreement.
- CSR mechanism or DMF
- Industry may use the mechanisms of "trust" and "foundation" to provide funds to develop :
 - community infrastructure;
 - create local businesses, help groups;
 - education and health facilities, skill centers, sports complex



So, what is the share? The equitable share should be decided by discussion and agreement among different stakeholders. Who are the stakeholders? Mining companies are one part, society is another part, and the third part is the government. So, among All these three stakeholders, there should be discussion to find out the equitable share to be distributed among all three stakeholders. Now, we have the CSR mechanism, or we have

the District Mineral Foundation, where in the DMF, a certain budget of the company's profit goes to the District Mineral Foundation fund. And even the company can also take up some socio-economic measures through corporate social responsibility. So, these are the mechanisms.

Now, the industry may use the trust or foundation route and provide funds to the trust or the foundation. And these trusts and foundations can execute socio-economic projects which will benefit society and the community. And these funds can be used to develop community infrastructure, to create local businesses, to help self-help groups like artisans, women's help groups, and so on. They can create education and health facilities and infrastructure, skill centers, sports training complexes, and so on. So, these socio-economic measures—how can the company initiate socio-economic measures?



They can study, they can take up a socio-economic impact assessment study. Through this study, they can establish the profile of the community: what is their skill level, what is their education level, what is the requirement of training that is needed, and they can develop short-term projects as well as they can develop long-term integrated development plans. And the company can allocate a budget. Now, sometimes the company can also align with the government. Because the government has an independent development plan. So, they should be aligned together, not going in opposite directions.

So the company can have an interaction with the government agencies. And together they can develop projects. Projects and a long-term development plan can be implemented through a trust, foundation, the company itself, or NGOs. This developmental activity can

be executed, and of course, the company has to monitor it. Those projects have to be monitored and reported to all the stakeholders, including the community and local society. So, community development is very important. Structured or institutional mechanisms for undertaking socio-economic projects, as I have mentioned, through trusts and foundations, procedures for assessing the needs of the community. This is through a socio-economic impact assessment study. Mechanisms for execution, monitoring, evaluation, and reporting of those projects. Then, execution of socio-economic development around project areas, if taken up, will help the company in obtaining a social license to operate.

COMMUNITY DEVELOPMENT

- Structured/ institutional mechanisms for undertaking socio-economic projects.
- Procedures for assessing the needs of community, planning and preparing project proposals.
- Mechanism for execution, monitoring and evaluation, reporting.
- Execution of socio-economic development around project areas closely connected with 'social license to operate'.
- Most mines undertake local development works as CSR activities.
- The law mandates: contribution to District Mineral Fund (DMF).
- Success of development projects will help build beneficial partnership between communities and mines.

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If these projects are taken up, they will help the company in obtaining a social license to operate. Most mines undertake developmental activities either through CSR activities or they contribute to the district mineral fund, where the money goes to the district authority, and then the district authority can spend this fund for the development of the local community. So, engagement with the community and interaction with the community is very important for the mining company. So, the engagement of the mining company with the local community throughout the different stages of the mine is crucial.

COMMUNITY ENGAGEMENT

- Engagement with local community (through all stages of mine life)
- Dedicated community liaison teams with professionals, structured mechanisms and procedures for engagement with local community.
- Grievance-redressal mechanism.
- Engagement and consultation must be community-centered.
- Inform community of benefits and negative impact of mining project.
- Help to secure the social license to undertake mining operations.

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A dedicated community liaison team should be established in the company, where they will have professionals who can have a dialogue with the local community. They should be aware and have knowledge of the local languages because the community language may be different. So, the people in that department should be familiar with the local language so that they can understand what they are saying and what their requirements are. And there should be a proper grievance redressal mechanism. Some official or department has to be identified that will be responsible for listening to the grievances of the local community and addressing their grievances. They will be responsible for informing the community of the different beneficial programs that the company is taking and what are the impacts of the mining? What are the positive impacts of those programs on the community? They should, from time to time, have interaction with them and make them aware so that when the people understand, they appreciate the different programs the mining companies are undertaking and the benefits that are happening to the community. So they will have a confidence and trust in the company, and this, in turn, will help the company to obtain a social license to operate from the local community. Governance issue is the last issue that I am to discuss: transparency and accountability about the economic, environmental, and social impacts of the mining project. When the mines, what are the social impacts? What are the environmental impacts? What are the economic impacts? What is the adverse effect on the physical resources and biological resources that is taking place? So the people should know, and what measures are you taking to alleviate those problems?

GOVERNANCE ISSUES

- Transparency and accountability about economic, environmental and social impacts of a mining project.
- Helpful to obtain social license to operate.
- Public disclosure of mining enterprises on sustainable issues;
- **Corruption and lack of transparency and governance may create suspicion and lack of trust.**
- Sustainability reporting: Publish reports on activities relating to sustainable development.

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That is very, very important. Now Corruption and lack of transparency and governance may create suspicion and lack of trust. Now the company may have different schemes for

the socio-economic upliftment and for environmental protection, but it may not happen at the ground level because of a lack of transparency and because of corruption. In that case, the company is spending a lot of money, but that money is not spent on the ground, so then there will be a lack of trust. That is why, accountability and transparency are very, very important. And then, lastly, it is the sustainability reporting.

SUSTAINABILITY REPORTING

- Integral part of a sustainable development framework.

Sustainability reports to contain information on:

- corporate sustainable strategies and policies
- management approach to development issues;
- economic, environmental and social performance of the organization.
- Technological innovations adopted
- Steps in mineral conservation, recycle.
- Mitigation measures for environmental degradation, climate change, energy efficiency

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Now it is an integral part of the sustainable development framework that whatever measures we are taking, what are the programs, plans, and schemes that we are undertaking for the socio-economic upliftment of the society and community. Now we have to, from time to time, produce a report and bring this report to the community, to other stakeholders, and send it to the government offices, send it to the civil rights activists, environmental activists, so that they know. So this sustainability reporting is very, very important so that it will bridge trust, it will build trust among different stakeholders for the mining company. This is the last slide to summarize what we have discussed today. We discussed the sustainable development framework, the ICMM framework, and some important frameworks which may be applicable to the Indian context. Some of these important framework points are technology and innovation, environmental protection measures, socio-economic measures, governance issues, and sustainability reporting.

SUMMARY

- SD Framework for mining
- Technology and Innovation
- Environmental Protection
- Socio-economic measures
- Governance issues
- Sustainability reporting

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So these are the references from which we have taken this. You can go through these reports. And thank you for your patient hearing. Regarding the sustainable development issue for mining industries, we have taken two lectures. That is the last lecture, Lecture 27 and Lecture 28.

REFERENCES

- Breaking New Ground- The Report of the Mining, Minerals and Sustainable Development Project, May 2002, Earthscans Publication Ltd, London.
- Sustainable Development - Emerging Issues in India's Mineral Sector, ISID, Planning Commission- Government of India (2012).

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This slide has a dark blue header with the word 'REFERENCES' in red. Below the header is a white box containing a bulleted list of two references. To the right of the list are several decorative icons: a stylized atom, a gear, a tree, and a chemical flask. At the bottom left, there are two circular logos, one of which is the NPTEL logo. The number '22' is in the bottom right corner.

So, we have discussed the sustainable development issues for mining. Now, in the next classes, we will be specifically discussing more about the sustainable development framework. In the next class, and thank you for your patient hearing. I hope it was informative and interesting for you. Thank you.