

# SUSTAINABLE MINING AND GEOINFORMATION

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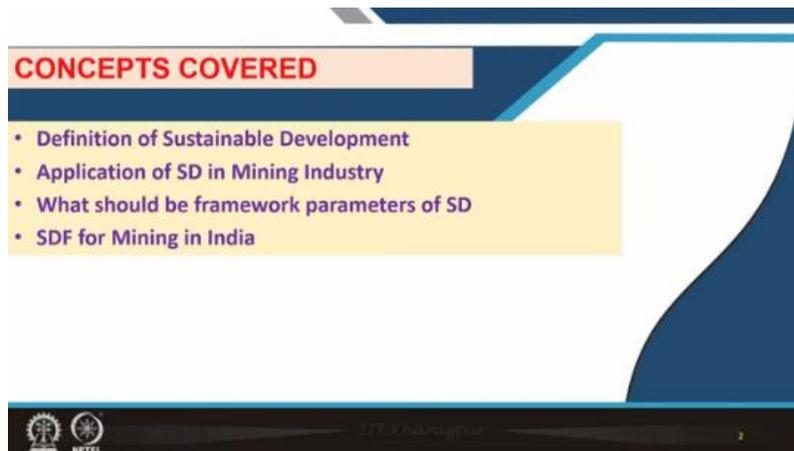
**Department of Mining Engineering**

**Indian Institute of Technology Kharagpur**

**Week – 06**

## **Lecture 29: SDF for Mining Industry-I**

Welcome students to today's lecture, which is the lecture 29 in the NPTEL online certification course on "Sustainable Mining and Geoinformation". Today, we shall talk about sustainable development framework (SDF) for mining industry. So, this topic of sustainable development framework of mining industry, we shall cover in two lectures. Today's lecture and the next lecture. We shall start today's lecture on "Sustainable development framework for mining industry - lecture 1".



The topics that will be covered in today's lecture is definition of sustainable development, we have defined the what is sustainable development previously. Today also we will define and give some elaboration. Then application of concept of sustainable development in mining industry. What should be the framework parameters of sustainable development and then we will talk about how this framework parameters are developed, what are the considerations? Next class we will be talking in detail.

**SUSTAINABLE DEVELOPMENT**

- Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- Four requisites are hidden for achieving SD as per the definition.
- *Material needs for a better quality of life have to be fulfilled for people of this generation.*
- *Equitable distribution of resource and services;*
- *Development respecting ecosystem limits and*
- *Creating the socio-economic environment on which future generations can meet their own needs.*
- A core principle of SD is to improve human well-being and to **sustain those improvements** over generations to come.

Dr. Shivraj

For today's class, we come back to the definition of sustainable development. You are familiar with the definition and to refresh your memory, I am stating the definition again: "Development that meets the needs of the present generation without compromising the ability of the future generations to meet their own needs". This is the original definition which was given in the Brundtland Commission report. We have discussed about this previously. If you look at this definition, so there are four components that are hidden in this definition. What are they? First thing is that about material needs for a better quality of life. For the development of present or any generation, we require raw materials which comes from the mining industry. These should be available for a better quality of life for the present generation. We will use the raw material to manufacture different essential goods or services and which will be used to provide a good quality of life of the present generation. The second concept which is hidden in this definition is that equitable distribution of resources and services for better quality of life. We, the present generation requires raw material and so also the future generation. Using the raw materials, they will produce different finished goods, different services. The raw materials, goods, services will make their quality of life better. So, we require equitable distribution between different sections of the society and also among different generations. Equitable distribution among different sections of the society and among different generation is also inherently present or hidden in this definition. Using the raw materials, we are undertaking different developmental activities, producing different goods using industrial processes. While executing industrial processes, these processes are producing different types of environmental degradation. The environmental degradation should be within the carrying capacity of the ecosystem. That means our development should be respecting the boundary which has been provided by the ecosystem. Concept of ecosystem limit is also present hiddenly in this definition. Now, we have the resources and we are exploiting these

resources. We are processing these raw materials by industrial activities and these industrial activities should be within the ecological boundaries. The last condition hidden in this definition is creating socio-economic environment on which future generation can meet their own needs. We shall leave sufficient raw material for the future generation, we will produce socio-economic infrastructure or the capital. We will leave those capital for the future generation and using those socio-economic capital and natural capital and human capitals, the future generation will use these raw materials to produce or to enjoy a good quality of life. So, these are the four principles that are hidden within this definition of sustainable development. You now appreciate that the core principle of sustainable development is to improve human well-being, improve quality of life, and to sustain this improved quality of life over generations to come. So, the present generation life should be improved and this improvement should be sustained over future generation. So, that the future generation can also enjoy the similar or better quality of life. This is the concept of the sustainable development.

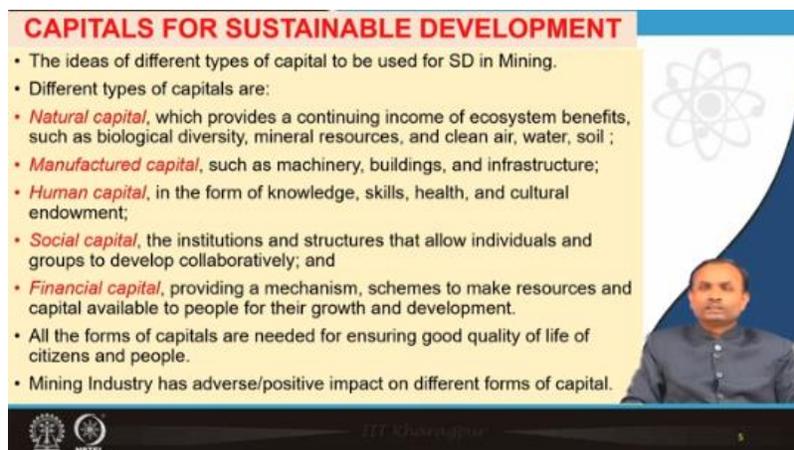
**SUSTAINABLE DEVELOPMENT**

- Passing the means of survival and good life on to future generations unimpaired and building, or at least not diminishing the total capital.
- SD requires the integration of social, economic, environmental, and governance goals in decision-making.
- SD requires development of regulation, mechanism, institutions for implementing, monitoring, evaluation and reporting.
- Idea of different types of capital to be used for implementing SD in Mining.
- Mining Industry is unique because it depletes natural capital.
- Depletion of natural capital will lead to lowering of quality of life;
- Total capital have to augmented by creating other forms of capital such as human, social, manufactured and financial capitals.

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Now to continue passing the means of survival and the better quality of life to future generations unimpaired, our resource base should not be depleted, or if possible, we can build on some capital. We can provide some additional capital to the future generation so that they will have a improved quality of life. If we are not able to provide additional capital, then at least, not diminishing the total capital that is available to our present generation should not be depleted. This is the concept of the sustainable development. About the capital we shall discuss in the next slide. Sustainable development requires integration of social, economic and environmental and governance goal in decision making. We shall discuss with a diagram. Sustainable development requires regulations, mechanisms, institutions for implementing, monitoring, evaluation and reporting of sustainable development. We shall have to have institutions, procedures, protocols,

governance mechanism so that the sustainable development can be implemented, it can be measured, it can be monitored and then it has to be reported to various regulatory agency, various stakeholder like society, community. So, these are the critical part of the sustainable development and they will be part of the sustainable development framework as well. Idea of different types of capital to be used for implementing sustainable development in mining. Now mining industry is a unique industry which is responsible for depletion of natural capital. When we are executing the mining industry, we are exploiting the natural capital that is the natural resources, mineral resources. During this exploitation and extraction of these natural resources, we are damaging, depleting natural capital like natural resources like air, water, soil etc. So, mining industry is responsible for depletion of natural capital. And as you know when the natural capital is depleted, it will lead to lowering of quality of life. This is obvious. And our objective of sustainable development is that we have to improve the quality of life not only of the present generation, but also of the future generation. Because we are depleting the natural capital, so how we can ensure sustainable development for mining industry? This is a unique challenge for mining industry. Now what is the thought process or the solution? It is that total capital have to be augmented by creating other forms of capital. While the natural capital may be depleted, but we can augment or create other forms of capital like social capital, human capital, manufactured capital, financial capital, so that total capital of the future generation or the present generation will not diminish. That is how, we can ensure that while natural capital is depleted, our total capital is not depleted, not diminished rather in some cases it will be enhanced.



**CAPITALS FOR SUSTAINABLE DEVELOPMENT**

- The ideas of different types of capital to be used for SD in Mining.
- Different types of capitals are:
  - *Natural capital*, which provides a continuing income of ecosystem benefits, such as biological diversity, mineral resources, and clean air, water, soil ;
  - *Manufactured capital*, such as machinery, buildings, and infrastructure;
  - *Human capital*, in the form of knowledge, skills, health, and cultural endowment;
  - *Social capital*, the institutions and structures that allow individuals and groups to develop collaboratively; and
  - *Financial capital*, providing a mechanism, schemes to make resources and capital available to people for their growth and development.
- All the forms of capitals are needed for ensuring good quality of life of citizens and people.
- Mining Industry has adverse/positive impact on different forms of capital.





So, capitals for sustainable development: the idea of different type of capital to be used for application or implementation of sustainable development in the mining industry. The different type of capitals can be classified into four or five type of capitals. For example,

natural capital which provides a continuing income of ecosystem benefits to the people. Examples of natural capital are biological diversity, mineral resources, forest resources, clean air, clean water, good soil. These are the natural capital and using these natural capital we produce goods and services using which our quality of life is becoming better. Second type of capital is manufactured capital, so we know that the humans are creative in their nature and using the intelligence that has been bestowed upon us by nature, by God. We (humans) are creating different machineries, buildings, infrastructures, roadways, internet, telephone, and many things. We are creating infrastructure and using this infrastructure we are creating employment opportunities. And we are creating income and we are creating services and using those services and income our quality of life is becoming better. This is called as manufactured capital which is manufactured by the humans. Third form of capital is human capital. Now you can have the natural resources but if you don't have the human intelligence and endeavor and effort, you cannot use them for your betterment. That is where, the human capital comes in the form of skilled people, educated people, healthy people. So, using the good human resources, skilled human resources, educated human resources, laborious resources, hardworking human resources, we can use those natural resources, natural capital to produce goods and services using which our life will be better. That is called human capital. Third form of capital, it is the social capital. That is the institutions and structures that you are using to develop the human capital for example the schools hospitals libraries training centers these things are social capital so society creates the society or the government creates the social capital so that the human can be trained, human can be developed> So last form of capital is financial capital this is the providing a mechanism for development of the human resources and to provide the means and capital to the people so that they can manufacture capital, so that they can create industry, they can generate employment . Now because of these reasons, our society will be developed. People will have better quality of life. Now the mining industry will have impacts on the different capital, some impact are positive and some impact are negative. The mining activity will have adverse effect on the natural capitals. It will have degradation effect on: air, water, soil, biodiversity, heritage structures etc. It will have adverse effect on the natural resources, forests, groundwater, water, all of that. Through mining industry, we can create lot of other capitals: human capital, social capital , manufactured capital , financial capital . The mining industry in collaboration with the government can create other forms of capital. While the natural capital will be adversely affected, the mining industry and government together through different policy initiative, through different regulatory mechanism, can help in creating the other forms of the capital.

### SD FOR MINING IN INDIA

- Mining Sector in India has tremendous potential for growth.
- Challenge of Mining Industry: **integrating economic activity with environment protection and addressing social concerns.**

**Sustainable Mining:** that is, **financially viable;**

- socially responsible;
- environmentally, technically, and scientifically sound;
- with a long-term view of development;
- uses mineral resources optimally; and,
- **ensures sustainable post-closure land uses.**

• Mining should create **long-term, genuine, mutually beneficial partnerships** between the government, communities, and mine based on **integrity, cooperation and transparency**".

• **Effective governance** key to achieve integration of socio- enviro- economic factors and "Sustainable Development in Mines".




Some of the considerations of sustainable development for mining in India that mining sector in India has tremendous potential for growth. Challenge of mining industries is how to integrate economic activity with the environmental protection while addressing the social concern. Sustainable mining is basically mining that is financially viable, socially responsible, environmentally, technically and scientifically sound with a long term view of the development. This is very important. Mining industry is for a fixed time period, short term, say 30-50 years. But for planning for the society and implementing the sustainable development, they have to plan for the long term. Now, use of mineral resources optimally, that is a responsibility of the mining company. Another responsibility is to ensure sustainable post closure land use after the mining is completed. The mine have to provide a sustainable post closure land use so that the economic land use can be continued even after the mining. One of the objective of the sustainable development is that post-closure, the mining land can continue to generate some economic uses. Mining should create long term genuine mutually beneficial partnership between the government, community, and the mining company based on integrity, cooperation and transparency. For sustainable development, effective governance is the key to achieve integration of social, environmental, and economic aspects. For sustainable development of mines so we have discussed about the three pillars of the sustainability.



Coming to sustainable development framework, there will be another pillar or side, which is governance. So, sustainable development has three sides, but the sustainable development framework, has four sides, that is economy, environment, society and governance. So, the fourth side, that is the governance mechanism to ensure sustainable development measures are implemented in the mining. Governance also includes monitoring and reporting.

The slide, titled "MINING IN INDIA", contains a list of five bullet points on a yellow background. A small inset video of a man in a blue shirt is visible in the bottom right corner of the slide.

- Minerals, forests and tribal tracts along with rich bio-diversity zones are concentrated in the same geographic areas
- Several areas with very high mining activity are in the poorest districts.
- Status of Mining Areas: Mining activities have resulted less local benefit, and have caused significant environmental degradation.
- Undervaluation of lands that were acquired by the government or otherwise for development of mines.
- Increased development of natural resources is driving large-scale internal displacement of indigenous communities in India.

Mining in India generally involves forests and tribal areas. If you see, most of the mining area, they are in the forest area where there is a lot of tribal people are living within a rich biodiversity zone. Also, several mining regions are the poorest regions of the country. If you look at the recent or near past historical data, you may see that mining activities have resulted less local benefit and, in some case, have caused significant environmental degradation like degradation of water, degradation of land, degradation of ground water, degradation of the forest cover, etc. When the mining companies or the government on behalf of the mining company, sometimes they have acquired the land. Previously, many instances, the project affected people, who lost land to the mining company, they might not

have got the right price of the land. Proper regulation were not existing to ensure fair compensation to the land losers. Increased development of natural resources is driving large-scale internal displacement of indigenous communities. Tribal people in the forest area, not only by mining projects, but also by hydroelectric dam projects, tourism and other projects are going on in the forest area. All these projects cause displacement of local community, tribal people.

**ISSUES OF SUSTAINABLE MINING**

- **Community concern:** Irreversible impacts on their lands and livelihood; **Depletion of natural capital.**
- Not enough **demonstrated commitment** to manage environmental impacts of mining. Some mining areas facing **critical environmental problems (groundwater, land etc.).**
- In many cases, **economic benefits of mine may not trickle down** to people who have been affected by the projects.
- Mining is now moving into more complex geology and social environment.
- For mining companies, **it's about protecting investments more effectively, and for long- term, It's about earning the social license to operate.**

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So, issues of sustainable mining, what are the issues? Community concern, irreversible impact on their land and livelihood and depletion of natural capital, depletion of water quality, depletion of soil, depletion of forest cover, depletion of biodiversity. These are adverse effect of large scale mining. Not enough demonstrated commitment to manage environmental impact of mining. Some mining areas are facing critical environmental problems of water or groundwater, biodiversity loss, etc. In many cases, economic benefits of the mining activity may not trickle down to the people who have been affected by the project. Project affected persons, they sometimes they do not get the proper benefit and they bear the brunt of the pollution. Mining is now moving into more complex geology and social environment. For mining company, it is about protecting investment more effectively and for long term it is about earning the social license to operate.

### HOW TO IMPLEMENT SD IN MINING ?

- How to implement Sustainable Development in Mining Industry?
- Mining Industry as contributor to **inclusive growth**, without adversely affecting the **social, financial, and environmental well-being**, at present and also in the future, in accordance with **section 20 of MMDR Act 2021**.
- We require **framework of sustainability parameters** to be identified which can form the basis of implementation of SD in Mining, reporting and objective measurement.
- SDF should be based on an agreed set of principles (among key stakeholders).
- SDF to be based on **understanding key challenges of industry and the action needed to address these problems**;




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How to implement sustainable development in the mining industry? By ensuring that the mining industry as contributor to inclusive growth, without adversely affecting the social, financial and environmental well-being of the present generation also the future generation. Now, for implementing the sustainable development in the mining, we require a framework of sustainability parameters. These parameters are to be identified and on basis of these parameters, the sustainable development can be implemented, monitored, reported, and also can be measured. Sustainable development framework should be based on an agreed set of principles or parameters. The agreement should be among key stakeholders: government, regulatory agencies, the mines, and the society. Also, the Sustainable development framework to be based on understanding of key challenges of the industry. The mining industry is facing some key challenges. Those challenges should be there in the framework. Also, what are the actions that needed to address this problem for the mining industry.

### HOW TO IMPLEMENT SD IN MINING ?

- SDF to include steps for **protecting rights and interest of people (PAP, local community)** involved;
- SDF to include **set of institution and policy instrument** to ensure **minimum standards of compliance as well as responsible voluntary actions**.
- SDF to include use of **critical measures to evaluate progress and enable consistent improvements in sustainability of mines**.




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Sustainable development framework to include steps for protecting rights and interest of the people. People means project affected persons, the local community involved. Their

concern should also be considered in the sustainable development parameters. Sustainable development framework to include set of institution and it should prescribe policy instrument to ensure minimum standard of sustainable development compliance is made. What are the responsible voluntary actions that can be taken by the mining companies? They should be part of the Sustainable development framework. SDF should also include use of critical measures to evaluate the progress of the sustainable development in mining and to enable consistent improvements in sustainability of the mines.



The image shows a presentation slide titled "SD FRAMEWORK FOR INDIAN MINING". The slide contains a list of bullet points and a small inset video of a man speaking. The text on the slide is as follows:

- A committee set up in 2005 under Chairmanship of Mr. Anwarul Hoda, Member, Planning Commission.
- Committee suggested to include: **best international practices and reporting standards** which could be measured objectively.
- SDF should be tailored to Indian context.
- Committee view: Mining should contribute to economic, social and cultural well-being of indigenous host populations and local communities creating stakeholder interest in mining operations for the Project-affected Persons (PAP).
- SDF to provide guidance for mining companies to **improve performance** on environmental and social aspects.
- SDF in long-run, can become **common benchmark** against which mining operations **may be evaluated** in terms of their comparative performance on sustainable development terms.

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To develop the SDF for Indian mining industry, a committee was set up by the Government of India in the year 2005 under the chairmanship of Mr. Anwarul Hoda, member planning commission. The committee suggested to include the international best practices followed in the mining industry, and the reporting standard that is also followed internationally. Also, the SDF should be able to be measured objectively. Although they studied the international best practices, SDF for India should be tailored for Indian socio-economic condition. The committee's view was that mining should contribute to the economic, social, and cultural well-being of the indigenous and local communities, creating a stakeholder interest in the mining operation for the project-affected people. So, when they were selecting the SDF parameters, they thought that it should provide guidance for mining companies to improve their environmental and sustainability performance in social and environmental aspects. The SDF, in the long run, can become a common benchmark against which mining companies may be evaluated in terms of their comparative performance on sustainable development terms.

### SDF FOR MINING IN INDIA

- SDF to comprise of principles, reporting initiatives and good practice guidelines for the three sectors of Indian mining i.e. **SME, captive and large stand alone sectors**.
- The SDF to be monitored through **regulatory mechanism and institution**.
- Institutions should be assigned to monitor and ensure implementation of sustainable development in Mining.
- SDF to be used by mining companies to demonstrate commitment to SD, and may be used by **regulators at the time of seeking clearance or renewal or extension**.
- SDF may be used by regulators to **evaluate the mining company's commitment to achieving environmental and social goals**.
- **Investors and financiers** may use SDF to assess risk and could use it to demand **better performance** of the mining operations.



Dr. Manoj Kumar

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So, the SDF comprises principles, reporting initiatives and best practices for three sectors in mining. What are those three sectors? Small and medium sectors. There are a lot of small mines in the country. They have different economic and environmental statuses. Captive mines and large standalone mines like Coal India Limited (CIL), Singareni (SCCL), Hindustan Copper, etc. The SDF should be monitored through a regulatory mechanism and also by creating certain institutions. The institutions should be assigned to monitor and ensure the implementation of sustainable development through these SDFs. SDF is to be used by mining companies to demonstrate their commitment to sustainable development. SDF may be used by regulators while the company is seeking clearance, no objection, or extension. SDF may also be used by regulators to evaluate the mining company's commitment to achieving environmental and social goals. Now, investors can also use the SDF to assess the socio-environmental risk of the project, and they could use this framework to demand better environmental and social performance from the mining companies. So, these are the importance of the SDF and how different agencies. Including the mining company, the regulatory agencies, and the financial agencies, they can use the SDF for various uses.

### SDF FOR MINING

- Committee studied SDF models of:
- International Council of Mining and Metals (ICMM),
- International Union for the Conservation of Nature and Natural Resources (IUCN).



Dr. Manoj Kumar

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Now, considering all these, this committee studied the sustainable development framework models of different countries, reputed mining companies of the world, and also the SDF model of the International Council of Mining and Metals (ICMM). ICMM is an association of big mining companies in the world. ICMM has developed SDF for member companies. The Hoda committee also studied the SDF model of the International Union for Conservation of Nature and Natural Resources (IUCN). They studied the SDF model of these international agencies and also some other models used by some of the western countries, developed countries. Finally, they tried to develop the framework which will be good for the Indian mining industry.



**ICMM PRINCIPLES FOR SD OF MINING**

1. Maintain ethical business practices and sound governance.
2. Integrate SD principles with corporate decision-making process.
3. Uphold human rights, respect cultures, customs and values of community.
4. Implement risk management strategies based on valid data and sound science.
5. Continual improvement of health and safety performance.
6. Continual improvement of environmental performance.
7. Conservation of biodiversity, integrated approaches to land use planning.
8. Facilitate responsible product design, use, recycling and disposal of products.
9. Contribute to social, economic and institutional development of communities.
10. Effective engagement, communication and reporting with all stakeholders.

The slide features a list of 10 principles for sustainable development in mining. It includes a logo of a stylized atom on the right side and a small portrait of a man in a blue shirt at the bottom right. The footer contains the NPTEL logo and the text 'NPTEL'.

So, these are the ICMM principles for sustainable development in mining. There are 10 principles. They tried to take the points which will be relevant for the Indian mining industry. Not all 10 points are taken for the SDF of the Indian mining industry, but features which are relevant for the Indian mining industry have been taken. So, we will discuss these ICMM principles in the next class as well.



**SUMMARY**

- Present lecture defined and elaborated the concept of SD with respect to Mining Industry.
- Basis of application of SD in Mining taking the help of capitals.
- Considerations for selecting the SDF for Mining.

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Today's class is coming to an end, and to summarize what we discussed in the present class: we defined and elaborated the concept of sustainable development with respect to the

mining industry. What are the challenges for implementing sustainable development in the mining industries? The basis of the application of sustainable development in mining is taking the help of capital, capital enhancement, so that the total capital is not depleted or diminished. That is the basis on which sustainable development is implemented for the mining industry. The different sustainable development framework criteria for the mining industry.



These are the summaries, and two references I have given. I have used two good reports: one report is the Report of the Mining, Minerals, and Sustainable Development Project, and the other is the Planning Commission report. These are the two reports that we have followed, and you can go through these reports. So, this was today's class, and I will continue this discussion in the next class as well. Next class, we will talk more about the sustainable development framework for the Indian mining industry, what parameters are there, so that it can be implemented in the mining industry. I hope this lecture was informative for you, and I will see you in the next class. Thank you very much.