A FRAME WORK FOR DEVELOPMENT OF SUSTAINABLE INDICATOR SPECIALLYSUFACE MINES

Dr.Suranjan Sinha*

Shatrajit goswami**

Sustainable Measures are providing to consulting services or communities and organizations who are working on sustainability, but we unable to give you a quick solution. Economist also cannot do all the work for societies. Sustainability cannot be developed and imposed on a community by someone outside that community. It needs to be developed and implemented by the community itself other wise it will not work . The concept of sustainable development is an important focal point for decision makers in the industry. As per Brundtland report the sustainable development as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (WECD,1987). There are number of sustainability methodologies exist in practice for evaluating the performance of companies (Ramchandra , 200.0). The World Business Council for Sustainable (WBCSD,1997), the Global Reporting Initiative (GRI, 2002 a, b) and development of standards (OECD) Indicators are the key driver for a adoption of sustainability management in the industries . According to KEI (2005), Indicators and composite indicators are increasingly recognized as a useful tool for policy making and public communication in conveying information on countries performances in fields such as environment ,economy , society , or technological development. The indicators are adopted to summarize and demonstrate the complexities of a dynamic environment to a meaningful information.(Godfrey and TODD (2001). By conceptualizing a dynamic scenario and by identifying hotspots , indicators simplify , quantify , analyze and communicate complicated information (Warhurst,2002). Now question is how can we provide sustainability in mining area ?

* Prof of mining department IIEST

** IIEST

We know that Mining is an industry of operations are temporary economic activity extending over a finite period of time . Poorly closed mines and derelict landform leave behind a legacy that brings forward several sustainability issues. Abandoned mine sites , degraded environment around the mine site and loss of livelihood of local people shatters the local economy . The local people remaining in ghost mining townships lose their food and social security. This is the post mining general scenario seen in a closed mine sites in India. Such legacy of unsustainable mining violates the basic tenets of sustainability, that is, inter and intra generational equity. To ensure long term environmental , economic and social sustainability of mining activities and the benefits from any ongoing mining activities may be invested in social , human and natural capitals of the peripheral areas of any mining area The ultimate aim is to enhance livelihood of local people , improvement in natural capital in the area and build up of social capital in the region , which are likely to stimulate long term economic growth in the region. This growth will be sustained even after mine closure. Any policy designed to implement these programs is necessary comprehensive research and framing some comprehensive indicators . The sustainability indicators should be developed with the in consultation stakeholders, i.e all economic agent directly or in directly relate to mining activities and allocate financial resources to implement these programs and review of the existing policies on affected people and policy suggestions are central to the research work. This necessitate implementation of sustainable mine closure plan at the mining regions , starting from mine inception. If mine closure plans are implemented at the closing stage, under limited cash flow situation, there will be shortage of funds. To obviate this problem mine closure plans will have to be implemented progressively starting from mine inception. In many countries a comprehensive mine closure systems have been developed. In India relevant policies are being framed and implemented ,however, how far these policies are not so effective in attaining both intergenerational and intra generational equity so it necessitates comprehensive policy research to developed sustainable indicators in mining area.It is the not problem for mining area but the problem of world is that explosive rise in population, spread of the consumerism and pace of industrial, agricultural and other activities to serve the huge market demand, have now put a tremendous pressure on the scarce natural resources. This is similar to the analysis by Ehrlich who provided the famous IPAT expression, $I = P \times A \times T$, Where I = impact o pressure on natural resources, P = population, A = affluence or level of consumption and T = technology. With rise in either of P, A or T, impact or stress on natural resources rises. It

has given rise to the great question of sustainability of human race itself over a longer time horizon. Since the last quarter of the 20th century, these factors have started to render a negative twist to the otherwise positive sensational results of development. The adverse impacts of these factors are evinced in the damages to the environment and ecology that have been caused over these years in the pursuit of fruits of unmindful and over ambitious industrial and agricultural activities. Acid rain, desertification, global warming, air/water pollution, biodiversity extinction, natural resource deterioration etc. are some of the serious consequences that have begun to threaten the very existence of mankind if not controlled properly in time. Until the last quarter of the 20th century, most of the attention were put on implementing the feature of economic development – economist were till then concerned about the of the phenomena of poverty, inequality and unemployment. But these environmental and ecological concerns were soon integrated together with the concept of economic development – giving rise to the notion of sustainable development.

Sustainability in a general sense implies maintenance of a certain state in its present form or improved form. Now to speak in simple terms sustainable development implies the maintenance of present level of human well-being in undiminished or possibly in enhanced form over future generations. Human well-being in a broad sense is intimately connected with the consumption of goods that are turned out in the production sphere. Consumption and production from the backbone of all economic activities which are linked together by the market institution. But there is also an intimate interrelation between economic activities and flow of environmental services that sustain the former. First the environment provides all kinds of minerals and natural resources which are transformed by the production sector into consumable goods. Second the environment provides a very vital service by acting as a receptacle or sinks for the hazardous air/water pollutants, industrial and agricultural wastes as well as domestic garbage. Third it provides direct benefits to human beings by providing life support services like oxygen that we require for breathing, water that we require for drinking. It also caters to the aesthetic, spiritual of recreational hankering of human beings, for example by making provision of enjoyment of swimming or boating in a water course, or enjoyment in a sanctuary or the natural beauty and serenity enjoyable in a mountainous region etc.

Majority of the available literature , on indicator development focus on conceptual frameworks for sustainability indicators are developed by various research agencies. of different countries .

Few examples are EPA , USA, MMSD , ICUMN OECD

.

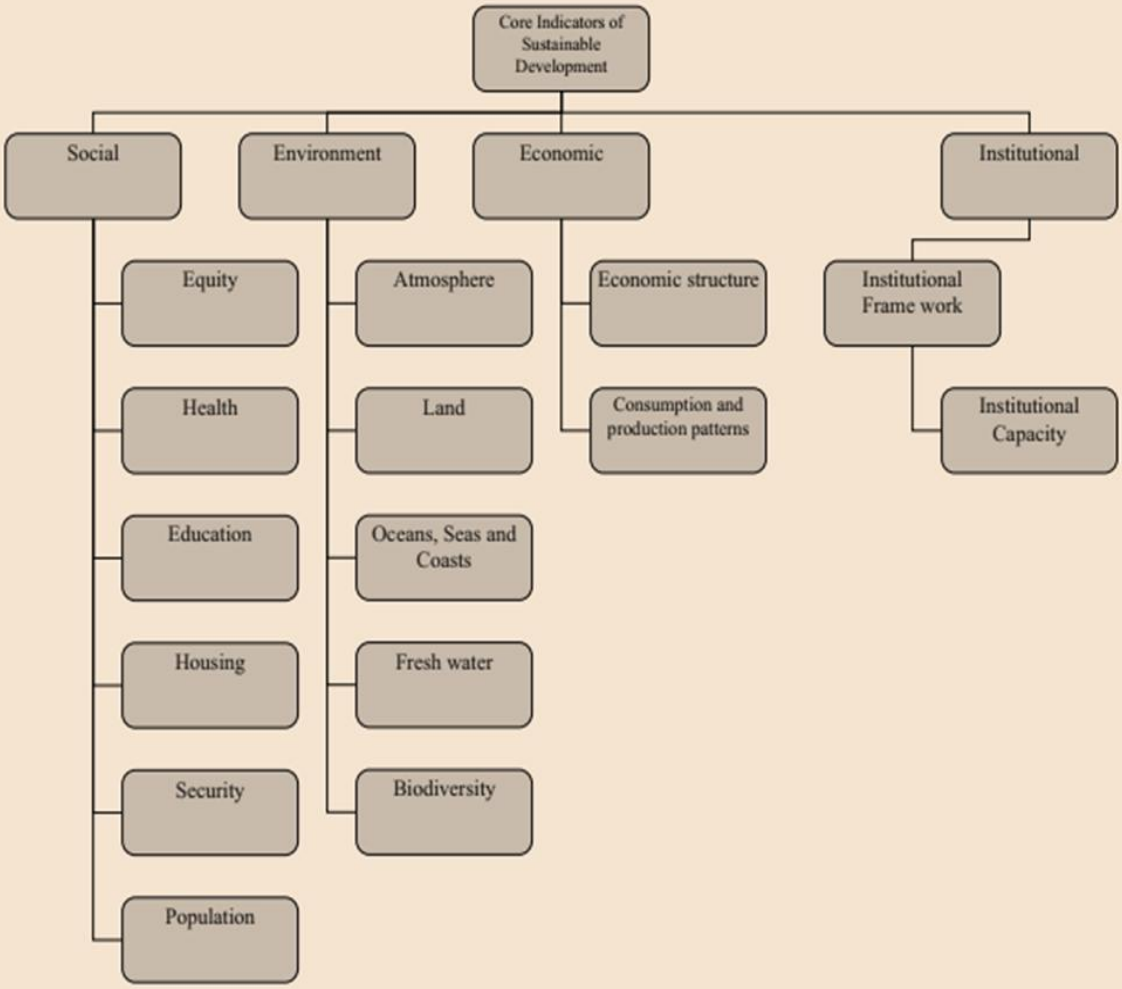

Fig. 5. The United Nations Commission for Sustainable Development (UNCSD) theme indicator framework.
Source: Labuschagnea et al. (2005).

Here we provides some of literature for framing indicators for sustainability in mining area .

These Indicators are three general categories: economics, environmental, and social. These categories are sometimes referred to as the three-legged stool of sustainability, with each category representing a leg of the stool. Just as all three legs of the stool are necessary for the stool to stand up, a healthy economy, environment, and society are necessary for a healthy community. Issues and problems in these categories rarely occur independently of each other and

require analysis and solutions that address their interconnected nature. Indicators analyze different aspects of a community, shedding light on the quality of life in those areas.

Indicators can provide crucial guidance for decision-making in a variety of ways. They can translate physical and social science knowledge into manageable units of information that can facilitate the decision-making process. They can help to measure and calibrate progress towards sustainable development goals. They can provide an early warning, sounding the alarm in time to prevent economic, social and environmental damage. They are also important tools to communicate ideas, thoughts and values because as one authority said, The 1992 Earth Summit recognized the important role that indicators can play in helping countries to make informed decisions concerning sustainable development. This recognition is articulated in Chapter 40 of Agenda 21 which calls on countries at the national level, as well as international, Indicators can provide means of measurement to calibrate and monitor sustainable development . In earth summit (1992) recognized the role sustainability indicators in decision making in matters related to sustainability development across the countries.in cotext Mori Koichiroand ChristodoulouAris (2011) has discussed conceptual requirements for a City Sustainability Index (CSI) and to review existing major sustainability indices/indicators in terms of the requirements. The following indices are reviewed: Ecological Footprint (EF), Environmental Sustainability Index (ESI), Dashboard of Sustainability (DS), Welfare Index, Genuine Progress Indicator (GPI), Index of Sustainable Economic Welfare, City Development Index, Human Development Index (HDI), Environmental Vulnerability Index (EVI), Environmental Policy Index (EPI), Living Planet Index (LPI), Environmentally-adjusted Domestic Product (EDP), Genuine Saving (GS), and some applications of composite indices or/and multivariate indicators to local or regional context as case studies. LászlóPintér et.al. (2005) viewIndicators can provide crucial guidance for decision-making in a variety of ways. They can translate physical and social science knowledge into manageable units of information that can facilitate the decision-making process. They can help to measure and calibrate progress towards sustainable development goals. They can provide an early warning, sounding the alarm in time to prevent economic, social and environmental damage. The 1992 Earth Summit recognized the important role that indicators can play in helping countries to make informed decisions concerning sustainable development. In contestSustainable development European Regional Science Association (2002) is viewed as comprising the environmental, socio-cultural and economic dimension. About thirty-five key

indicators have been defined to measure the three dimensions of sustainability, such as air pollution, consumption of natural resources, quality of open space, population exposure to air pollution and noise, equity and opportunities and economic benefits from transport and land use. (Alyson Warhurst). In his paper discussed the development and use of Sustainability Performance Indicators (also referred to as Sustainability Indicators) to communicate to the internal and external stakeholders of mining companies the extent to which their mining activities are contributing to, or detracting from, sustainable development goals. In particular, it highlights the potential of such indicators to promote sustainable sound investment decisions. His paper also places Sustainability Performance Indicators in the wider context of Sustainability Performance Management Systems, and briefly reviews the other tools available for the development of these systems. It emphasizes that indicators can assist in the actual assessment, management and monitoring of impacts of mining on sustainable development goals, as well as the reporting of performance, if they are developed within an overall Sustainability Performance Management System. For this reason, the paper argues that tailor made approaches to developing indicators, that address specific stakeholder concerns and that inform mainstream corporate strategy and support companies' future approaches to managing sustainable development issues, are more likely to contribute to sound investment decision processes than approaches which priorities reporting against generic 'off the shelf' indicators. Indicators have been widely used for monitoring and assessment of numerous environmental impacts of operations, and are increasingly used in social and economic areas. To emphasis of the vast majority of indicators has-been placed on reporting, rather than management of impacts on mining on sustainable development. Consequently, to date, the most important criteria that define useful indicators are the capacity to simplify, quantify, analyse and communicate otherwise complex and complicated information, and the ability to make particular aspects of a complex situations and out and thus reduce the level of uncertainty in the formulation of strategies, decisions or actions.(Nadine Ancrien, Marc pirawxetall) Their study based on the north-eastern semi-arid area of Brazil, also design of sustainability indicators they consider following thing

* the definition of a conceptual framework based on a flow-oriented approach that enable to design sustainability indicators

* the characterization of the biomass flows that exist within the farms of the target people of the diagnosis in order to specify this framework and extract relevant indicators

* the validation of the indicators selected comparing them with those used by the farmers.

On the other hand(Camacho-Sandoval and Duque,2001; Nambiar et al., 2001). Identified Four main selection criteria for indicators are mentioned: facility of analysis; ease of use for decision making ability to reflect the transformations of the environment and the effect of the practices; and validity at several scales of analysis These indicators arise mainly from the three `pillars' of sustainability: ecology, society, economy. In other words, the performances of the farms are evaluated according to a broader concept of economic effectiveness, minimal ecological costs and participation in local dynamics. Based on these three pillars, different authors have proposed different frameworks to analyse the performance of production systems.And(Landais :1998) identified four main components of systems performances: viability, which depends on the technical and economic performances of the system and on the security of the market and prices; viability, which reflects the farmer's quaity of life; transmissibility, which is related to the possibility of succession; and finally, reproducibility, like Design of sustainability indicators in Brazilian semi-arid area.

For Mineral extraction .(Aureliechamaret,etall) explained that complex sustainable-development issues that are subject to international and local controversies. Debates and decisions need to be based on objective and comparative elements. Defining strong indicators for assessing impacts and performances of mining sites thus appears necessary to inform and support the decision-making process of stakeholders. In recent years, many indicator sets have been developed on an international level based on top-down approaches, but they commonly lack legitimacy for stakeholders and adequacy to specific site issues. They need to be complemented by the consultation of local actors concerned by such mining activity, in order to define indicators that are closer to the needs and contexts of the specific sites. Again it is also explained indicators and `databases of indicator' is also observed during the implementation of the MONET indicator system (de Montmollin and Scheller, inthis issue); these authors define three separate objectives: `Establishing the frame of reference, developing the systemic structure and selecting the sustainable development indicators'. This distinction can also be noted in Le Fur's paper (in this

issue) when he defines `a common information platform used as an effective basis for a multiparty exchange'.For developing indicator ( Zittoun(2006), Provided a tool which is useful for contributing `to resource reallocation as well as to the reassignment of power and governing practices'. According to this author, `not only indicators have the faculty to measure a problem but they also build it as much as they are built by the problem itself'. This refers to observed constraints from the 'division of labour' mentioned by DesrosieÁres (2004): `some objectives are negotiated(by politicians), and expressed by means of words denoting indicators. Then, the latter are transcribed using negotiated procedures (by statisticians) in aim of harmoniously quantifying these indicator. These procedures are as similar as possible in the various countries'. This distinction between political and technical issues requires `the creation and implementation of hybrid forums where these evaluation methods may themselves be assessed' (DesrosieÁ res, 2004), such hybrid forums arealso considered by Callon et al. (2001). In fact, the author (DesrosieÁ res, 2003) further mentions the difficulties associated with the assumed lack of need for connecting information production issues and issues generating information demand: `these two stories, concerning economic policies and statistics, respectively, are rarely presented, and above all, investigated simultaneously'. Implementing this connection may be one of the needs explaining the importance given to the indicator issue .Introduction to the key issue of using sustainable development indicators That reflect about the social role played by indicators lead to considering indicators as a tool for government policies, which is necessarily related to the development of these policies. Initially, indicator supply is `taken over' by the government and the great supranational institutions: indicators are a government attribute and a way for expressing its power, as well as being a management tool for its policies. Their Another paper was prepared.(Laszlo pinter,Peter Hardi-Dec2005) for the United Nations Division for Sustainable Development(UNDSD) expert meeting (New York, 13-15 December 2005) on sustainable development indicators (SDIs). Their paper provides a review of key achievements and emerging trends in the field of SDIs, reflects on the role of the indicator system developed by the United Nations Commission for Sustainable Development (UNCSD)and offers a set of options and suggestions for the way forward. As strategic policy tools, SDIs have the potential to turn the general concept of sustainability into action. Today, however, we are far from achieving this potential.

Among emerging trends, the paper highlights that

• Continuing interest in the development of aggregate indices;

• Interest in core sets of 'headline indicators';

• Emergence of goal-oriented indicators;

• Measurement of sustainability by capital ('green') accounting systems; and

• Emphasis on making better use of indicators in performance measurement.

In these case authors, view other international legal mechanisms, such as the Aarhus Convention indicators may play a catalytic role, because of their influence on the enabling conditions required for the sustainable development .The Aarhus Convention itself is open to accession by countries outside of the Economic Commission for Europe (ECE), subject to approval of the Meeting of the Parties, so its applicability goes beyond ECE members and the regional level. Its combined emphasis on strengthening access to information and facilitating public participation is directly applicable to the systematic development and use of SDIs as key information tools. Parallel to, though not necessarily derived from international commitments, there are other examples of national and sub-national legislation requiring the establishment and reporting of SDIs. The SDI agenda was accompanied and directly or indirectly influenced by several other global trends that authors have seen unfold in the last decade. Among these trends, the following were particularly relevant—for different reasons—for SDIs:

• undisputable evidence of the growing cost, but also some benefits of globalization on environmental and social conditions, at national and international levels;

• improved understanding of the interactions between ecosystems and human wellbeing, particularly poverty;

• increasing number of state of the environment (SOE) and integrated assessments, reports, multilateral environmental agreements (MEAs) and use of economic and other instruments for environmental policy, all of which require a quantitative evidence base;

• rapid development of information and communication technologies (ICTs),including the Internet and geographic information systems (GIS), with manycountries still left, though, on the wrong side of the digital divide; and

• increasing emphasis on strategic initiatives, including national strategies for sustainable development (NSDS) and the Millennium Development Goals(MDGs) that involve time-bound targets and require systematic monitoring of progress.

Again (Pintér 1998; Parris and Kates 2005)explanation is different they stated that SD could be interpreted to mean the maintenance of aggregate stocks, inventories or qualities of economic, social, ecological or institutional assets overtime. However, operationally, this works only if we have information on these stocks, inventories and qualities, their substitutability and safe limits to their depletion. Indicators can provide this information, and thus they were often used to collectively define key aspects of sustainability in specific contexts (During the last 10 years researchers have seen a remarkable expansion of interest in SDI systems, both in industrialized and, albeit to a lesser extent, in developing countries. SDIs are seen as useful in a wide range of settings, by a wide range of actors: international and intergovernmental bodies; national governments and government departments; economic sectors; administrators of geographic or ecological regions; communities; nongovernmental organizations; and the private sector. SDI processes are underpinned and driven by the increasing need for improved quality and regularly produced information with better spatial and temporal resolution. On the other hand(Laszlo pinterandPeterHardi-Dec 2005) used Headline indicators (HI) is a term adopted by some countries and organizations to describe an SDI approach where short core sets of indicators closely linked to policy priorities are compiled. While not a framework per se, this approach reflects pragmatism in terms of the number of SDIs and the need to link the SDIs to issues high on policymakers 'and the public's agenda. Core indicators provide signals to high-level policy-makers and to the general public. Their combined use helps raise the profile of priority policy issues and in particular provide early warning about imminent trends. Such indicators have been recently published, among others, by the Government of the United Kingdom, the EuropeanEnvironment Agency (EEA) and the Australian Bureau of Statistics (UK 2005; EEA2005;AusStats 2005), among others. Some international agencies, even those which havedeveloped other sets of SDIs, like the World Bank and OECD, have published headline indicators in different sect oral and SD reports. The interest in HIs is rooted in the perception that robust core sets of measures are easier to understand, and they help track progress (or lack of it) towards selected policy goals. It also reflects an understanding that working with a long list of indicators can be counterproductive, as in all-inclusive indicator sets real priorities tend to be lost. AginSteinemann (2000, p.640) defines a holistic approach as one which facilitates "moving away from analyses of isolated risks and toward a broader understanding". Most of the efforts

made towards developing such approaches have come from the application of Health Impact Assessment or Social Impact Assessment, precisely because the reductionist approach requires existing knowledge and understanding amongst affected communities which is often lacking (see, for example ,Arquette et al., 2002; Kemm, 2000; Mindell et al., 2001). Both Bell and Morse (2008) and Lawrence (1997) call for a more systems-based approach in order to implement holistic assessment, and this requires process where communities are systematically involved in defining visions of sustainability and also the means to achieve the vision. There are different degrees of reductionism whereby complex systems are reduced to ever fewer measures, with the extreme being a single value (e.g., Barrera-Roldán and Saldívar-Valdés, 2002; O'Reganet al., 2009). Advice in both England (Office of the Deputy Prime Minister, 2005) and Western Australia (Government of Western Australia, 2003) suggests that a number of disaggregated indicators should be used; whilst not reductionism to the extreme of using single indices, this is still a form of reductionism. In England, an Institute of Environmental Management and Assessment forum on SEA , A.J. Bond, A. Morrison-Saunders / Environmental Impact Assessment Review 31 (2011) want to review progress with the Government advice and concluded that too many objectives are full filled each associated with a number of indicators were being set.

A framework of indicators from bottom up apporach

Sustainability Dimension	Indicator	Remarks
Social	Percentage of population living below poverty Gini's index for income inequlity Unemployment Rate Ratio of Average Female Wage to Male Wage Poverty gap index Net migration rate due to mine opening	A separate study may be conducted along with SIA from consumption pattern of the respondents
	Number of persons trained by total population between 20 – 30 years	Separate data for the study are is not available
	Total budget for building social capital / Total budget allocated for mine rehabilitation	Not available

Health	Mortality rate below 5 years Life expectancy at birth Percentage of population with free access to primary health care center Number of doctors per ten thousand population	Not available with respect to the study area
Education	a) Primary school enrollment rate b) Secondary school enrollment rate c) Adult literacy rate d) School drop out rate e) Percentage of tax collected from the mining companies spent on primary , secondary education with breakup f) Distance of college from villages g) Total budget for building human capital / Total budget allocated for mine rehabilitation	
Infrastructure	Infrastructure expense per capita Percentage of tax collected from the mining companies spent on infrastructure development Percentage of population with access with adequate sewage facility Percentage of population with access to safe drinking water Floor area per capita	
Ground Water	Annual Withdrawal of Ground and Surface Water as a Percent of Total Available Water	

	Concentration of Faecal Coliform in Freshwater Domestic consumption of potable water per capita Domestic consumption of water for daily per capita Biochemical oxygen demand in water bodies Number of months water bodies (pond, well and tube well) run dry Size of recharge lagoon created for recharge of aquifer Extent of ground water aquifer recharged by rainwater harvesting (based on scientific study)[1] Annual water drawn in dry seasons from rain water harvesting facilities created near a mine site Quantity of surface runoff stored/ Total surface runoff from mined watershed	
Agriculture	Total agriculture land / Total land available Total agriculture land covered by irrigation / Total agricultural land Total agricultural land supporting multiple crops / Total land supporting single crop Total agricultural land with chemical fertilizer application/ total agricultural land Total agricultural land with natural fertilizer / total agricultural land Agriculture yield / hectare	
Environment	Ecological footprint / active mining zone Dump area rehabilitated naturally/ Dump area	

	rehabilitated by scientific technical and biological reclamation techniques Excavation area / area backfilled Excavation area / area backfilled and agriculture established Backfilled area brought to some land use in consultation with stakeholders / Total backfilled area Area used for water storage / Excavation area Ratio of number of native species used for afforestation / Number of exotic species used for plantation Overall survival rate of planted trees Total budget for building natural capital / Total budget allocated for mine rehabilitation 95 th percentile value of environmental parameters / Standard values either stipulated by government or expert knowledge Mean value of environmental parameters / Standard values either stipulated by government or expert knowledge Ratio of water flow in the surface nallahs / (mine water pumped + surface flow due to rainfall) Ratio of air quality at the working zone and outside the green belt area.	
Community development	Total villagers trained/ Number of adults in the village Number of SHG functioning in the area Number of loans provided by bank for SHG and entrepreneurship development	

In this contest we require some approach and principle that are follows

Strategic approach to sustainable development

Having outlined the indicators, question emerges as to what strategy to follow to attain the sustainable development path that is evinced in the attainment of target values of multiplicity of indicators. It is now evident that sustainable development is based on Sustainable Development: Context, Concept and Related issues .

Systematic approach towards attaining mutually consistent socio-economic and environmental goals which is conditioned by following a set coherent strategies. An approach towards the sustainable development path involves a process of transition which is full of uncertainties and hence requires a spirited drive, vision, courage and forbearance. This is also well supported by a strategic apparatus which is flexible, adjust, creative and communicative while requiring alteration to cope with uncertainties. A strategic planning involving coordination action plans foresight, consensus and iterative processes to achieve the set of objectives needs to incorporate planning mechanism which should be more participatory, flexible and integrated. In this context the DAC policy guidance on strategies for sustainable development defines a strategy as "A coordinated set of participatory and continuously improving process of analyse, debate, capacity strengthening, planning and investment which integrates the economic, social and environmental objectives of society seeking trade-offs where this is not possible."

Based on a number of UN regional workshops and consultations with developing countries during OECD-DAC dialogues there have emerged a number of key principals which should govern any reasonable strategy for sustainable development :

An effective strategy requires peoples centered approach.

All the stakeholders should have consensus on the major issues and a long term vision with a clear time frame for attaining the set objectives. This is conditioned by the commitment of all political parties not to reverse implementation of strategy despite it being initiated by some rival predecessors.

Social, economic and environmental objectives should be integrated and mutual inconsistency must have to be avoided such that entitlements of future generations do not come into conflict with that of the present.

The strategic priorities should be well matched with budget allocation.

Monitoring and assessment on the basis of performance of indicators are necessary to keep track of the progress and signal adjustment whenever necessary.

High level Government commitment on a long term basis for making provision of financial resources and implementation of strategies is necessary.

Multi-stakeholders interface covering the interaction, debate and communication, for setting needs and priorities are required and there should be broad based participation of not only Government But also decentralized authorized, private agencies, civil society as well as impoverished groups.

Before the initiation of a strategy assessment of political, institutional, human, scientific and financial capacity of a state is extremely important and whenever required provision should be made to develop the capacity as part of the strategy.

B. Importance of natural capital

It is viewed that for ensuring undiminished well-being or utility, the productive capital specifically the natural capital should be substitutable by other forms of wealth as it is exhausted and degraded over time. However in reality the scope of such substitutions rather poor and the high degree of unsubstitutability enhances the concern for keeping the level of well-being intact. Barbie and Markandya (1990) suggest that natural capital is only partly substitutable and therefore put stress on the maintenance of a certain positive level of natural capital in order to conform to the resilience of the ecological system. They consider the maximisation of a discounted utility, $U = F(C, E)$, wher C = consumption and E = natural capital. This concept is akin to the maintenance of certain critical capital having preservation values and associated with the character of irreversibility and asymmetric technology. The maximisation is done subject to deterring E from falling below the level marked by loss of resilience of the ecological system. The dynamic evolution of the natural capital over time should involve $\frac{\delta E}{\delta t} = g(C, e)$ with $\frac{\delta g}{\delta C} < 0$ and $\frac{\delta g}{\delta E} > 0$, t stands for time (provided E exceeds the threshold level) in order to give sustainability the system.

C.The relevance of the human resources and environmental carrying capacity(social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions. Increasing evidence shows that social cohesion is

critical for societies to prosper economically and for development to be sustainable. Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together.)

Since it is the human resources that ultimately combine artificial and natural resources to produce consumption goods, it is highly imperative to control and monitor the quality of such human resources. This cannot be achieved unless their number be checked at certain critical level. The more their number beyond this limit, the more the pressure on existing non- human resources. Growth of human resources is generally taken to be a function of growth of population. It has been observed that population growth can be of two types: it might rise exponentially (like a J-shaped curve) or it might tade the shape of a sigmoid curve rising gradually and stabilising at a certain level. In practice, however, it is the J-shaped corve that more often explains the growth pattern of population. It shoots up the optimal level, and then on its own comes below that level and thenafter a certain time gap again shows the tendency of shooting up, thus fluctuating around the optimal level, butneverstabilisingatit,This optimal level indicating the figure of a self-sustaining human population is akin to the concept of environmental carrying capacity. It is defined as the level and combination of human and animal population that can be maintained even in the long run by the endowed natural and environmental resources. Maintenance of carrying capacity of this planet is intimately related to the concept of sustainable development. Proper upkeep of carrying capacity of earth backed by related concept of resilience, concern for searce resources and fundamental goal of improving the state of human well-being characterize the attributes of sustainable development and differentiate it from the traditional notions of growth andeconomicdevelopment.

The indicators developed, so farm, mostly focuses on macro level performances of different countries to ensure sustainability. Conceptual frameworks for sustainability indicators are developed by various research agencies. of different countries as EPA , USA, MMSD , ICUMN OECD but they prepare the indicators in the macro economic concept . So it is very difficult to set up sustainable in dictators for specific region by perception of local people and other stake holder analysis as villagers needs priority surroundings the mine areas are very difficult to determined as they can not identify their need priority clearly due to their lack of education ,They also not identify social effects from mines. So it is difficult to prescribe the certain

indicators which help them long term sustainability. So our suggestion is that ,there needs some community development both from social ,environmental side and build up three types of capital that is natural capital, human capital and man made capital during mining period. On the other hand it is also say that local people automatically search sustainable like other livelihood in the economy as animal plant etc .Actually when people are deprived from their needs they automatically search other policy to fulfill their needs in holistic approach. Another way sustainability use the exhaustible resources in strategic manner that is here we want to say strategic approach sustainable development approach. And grow awareness people not wasting nonrenewable resources ,and understand the proper valuation of non renewable resources so that extraction rate nonrenewable resources equals to regeneration rate by proper recycle manner following thermodynamic law.

Bibliography

1. Adisa, Azagic. ,(2004). Developing a framework for sustainable development indicator for mining and mineral industry, Journal of Cleaner Production ,12, 639-662.available at website , siteresources.worldbank.org/INTOGMC/Resources/notoverwhenover
2. Botin, J.A ,(2002).Sustainable management and mining operation, available at website address http://www.iied.org/mmsd/finalreport/index.html
3. Brereton, D. et al., (2003). A Risk Management Approach to Improving Sustainability Performance at the Site Level, MineSafe Conference, Perth.
4. Chamaret , M. O‟Connor, G. Récoché, (2007). , available at website http://hal.archives-ouvertes.fr/docs/00/19/45/05/PDF/Article_IJSD_Chamaret.pdf.
5. Chambers, N., Simmons, C. and Wackernagel, M. (2000), London ISBN 1-85383-739-3 available at website www.sciencedirect.com/science/article/pii/S1876610211011325
6. Chauhan, S.S., (2010). Mining, Development and Environment: A Case Study of Bijolia Mining Area in Rajasthan, India, J. Hum. Ecol. Volume 31(1), 65 - 72.
7. Clark. ,(2000). Legal Framework for Mine Closure In Mine Closure and Sustainable Development,Workshop organized by the World Bank and Metal Mining Agency of Japan, Washington D.C.
8. Cooke, J.A. , Johnson. M.S., (2002).Ecological restoration of land with particular

reference to the mining of metals and industrial minerals: A review of theory and practice, available at website , www.ingentaconnect.com/content/nrc/er/2002/00000010/.../art00002

9. Cooke, J.A. and Limpitlaw, D. ,(2003).Post-Mining Site Regeneration: Review of Good Practice in South Africa, available at website www.csmi.co.za/papers1/Post_mining_landuse_Collieries_jul05.pdf.

10. CPCB. ,(2009). Criteria for Comprehensive Environmental Assessment of Industrial Clusters, Ecological Impact Assessment, Central Pollution Control Board, Ministry of Environment and Forests, CPCB publication No. EIAS/5/2009-2010, available at website http://www.cpcb.nic.in/upload/NewItems/NewItem_152_Final-Book_2.pdf

11. David, I., Stern. , (1995). The contribution of the mining sector to sustainability in developing countries. Ecological Economics, 13, 53-63.

12. Davy, A., Community development Toolkit, published from International council on mining., available at website www.icmm.com/document/2.

13. Dhar, B, B , (1999). Environmental management systems for closure and best practice in the Indian mining Industry, Environmental policy in mining corporate strategy and planning for closure , Lewis publishers.

14. EPA. , (1992). Framework for ecological risk assessment, Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, DC 20460, EPA publication No. EPA/630/R-92/001, available at website http://rais.ornl.gov/documents/frmwrk_era.pdf.

15. Ghose, K.M., (June 2005). Soil conversion for rehabilitation and reservation of mine degraded, Journal of Scientific & Industrial Research, 63 , 1006-1009.

16. Graeme Hancock andAniTopurua, 2000) available at website pubs.iied.org/pdfs/G00541.pdf

17. Graymore, M.L.M.. , (2009) Sustaining Human Carrying Capacity: A tool for regional Sustainability assessment, Ecological Economics,available at website ideas.repec.org/a/eee/ecolec/v69y2010i3p459-468.html

18. Hilson, G. (2000). Sustainable development policies in Canada‟s mining sector: an overview of government and industry efforts, Environmental Science &Policym 3, 2010-

11.

19. Hilson, G., Murck, B., (Dec, 2010).Sustainable development in the mining industry: clarifying the corporate perspective. Elsevier, Resources Policy, 26, 4, 227-238.

20. Hodge, R. A., Hardi, P., (1997). The Need for Guidelines: The Rationale Underlying the

Bellagio Principles for Assessment.available at website

http://www.sustainability.at/easy/pdf/essay/Bellagio_Principles_p7-20.pdf

21. Hodge, R.A., (2003). Post Mining Regeneration Best Practice Review: North American Perspective.Mining Department, The World Bank Group, Sustainability throughout the

Mine Life Cycle Mine Closure, The World Bank Perspective Sullivan Round Table: Lessons in Sustainability Kimberley, British Columbia, Canada.

22. Julie, L, Hass, et.al. , (2002). Overview of sustainable development indicators used by national and international agencies,OECD, statistics working paper /2.

23. László, Pintér., et.al., (2005), Indicators of Sustainable Development: Proposals for a Way Forward, International institute for sustainable development., available at website, www.iisd.org/pdf/2005/measure_indicators_sd_way_forward.pdf

24. Laurence, D., (2001).Classification of risk factor associated with mine closure. , available at website, www.idrc.ca/uploads/user-S/11198973051laurence.pdf

25. Mamta, P. and Bassin, J. K., (2010). Analysis of ambient air quality using air quality index - a case study. , International Journal of Advanced Engineering Technology, 1, 106

- 114., available at website

http://technicaljournalsonline.com/ijeat/past%20issue/Article%2011.pdf

26. Ministryof Finance (2010) available in website address

http://toolkit.pppinindia.com/start-toolkits.php?sector_id=4

27. MMSD (Mining, Mineral and Sustainable Development)., (2002), Research on Mine Closure Policy , World Business Council of Sustainable Development, International Institute for Environment and Development. , available at website www.iied.org/mmsd-

28. Mudder and Harvey , 1999 available at website pubs.iied.org/pdfs/G00541.pdf

29. National Environmental Policy (2006), MOEF.,aailable at website

http://www.envfor.nic.in/nep/nep2006e.pdf.

30. Nazeri (1999) available at website pubs.iied.org/pdfs/G00541.pdf

31. Oelofse, S., (2008). Mine water pollution - Acid mine decant effluent and treatment: A consideration of key emerging issues that may impact the state of the environment, Paper prepared for: Department of Environmental Affairs and Tourism (DEAT), Republic of South Africa. , available at website http://www.hsph.harvard.edu/mining/files/South_Africa.pdf.

32. Panwar, S., Sinha, R. K. and Singh, G., 2011, "Time sequential surface change analysis of Talcher-Angul region of Orissa using Remote Sensing and GIS", International Journal of Geomatics and Geosciences,1(4). Available at: website http://www.ipublishing.co.in/jggsvol1no12010/EIJGGS2043.pdf.

33. Rábago. K. R. , . et.al., (2001) Energy and Sustainable Development in the Mining and Minerals Industries Rocky Mountain Institute, Colorado, USA, Mining, Minerals and Sustainable Development, IIED., available at website, pubs.iied.org/pdfs/G00540.pdf.

34. Tewary, B.K. et.al. , (1995),Ecological stability and biodiversity of disturbed land., Proceedings of the First World Mining Environment Congress, eds B.B. Dhar& D.N. Thakur New Delhi, India, 11-14 December, 1995, AA Balkema, Rotterdam.

35. Warhurst, A.. , (2003). Planning for closure: Towards best practice in public policy and corporate strategy for managing the environmental and social effects of mining. , in: , Environmental policy in mining corporate strategy and planning for closure , Lewis publishers.

36. Warhust,A.,(2002).Sustainability Indicators and Sustainability Performance Management,available at website , pubs.iied.org/pdfs/G01026.pdf.

37. World Bank., (2002).It‟s Note Over When It‟s Over: Mine Closure Around the World., Analysis of Ecological Footprint and Ecological Rucksack of a Open-pit Coal Mineap