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Towards A Sustainable Mining Industry: Actions and Tools

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ABSTRACT: This paper examines the sustainability concept within the mining industry and additionally aims to briefly discuses available tools for making the mining sector actions more sustainable on project, orogramme and policy level. The first section of the paper looks at the early works and actions aimed to .ntegrate and intertwine the concept of sustainability into mining operations. While second section focuses on the possible tools, which can be implemented on the organizational and project levels, as well as on the policy, programme and plan levels. Strategic Environmental Assessment (SEA), although not long in the practice, has so far shown promising results when implemented on the highest decision-making levels, policy, programme and plan levels. While the implementation of Environmental Management Systems (EMS) and Environmental Management Plan (EMP) in the organizational practice, together with the Environmental Impact Assessment (EIA), as a part of EMS, can significantly contribute to the mitigation of environmental impacts on the project level.

1 ACTIONS TOWARDS A SUSTAINABLE MINING INDUSTRY

Rather than trying to give a new definition of sustainable development, this section aims to discuss the sustainability concept in the mining industry operations and early actions towards making the industry more 'sustainable'. In the text, 'sustainable' means that "economically viable, financially profitable, environmentally sensitive and socially responsible" operations (UNEPMD et al. 2001-2002: 11) on project, plan, programme and policy levels.

The section starts with brief discussion about why the concept of sustainability is important and necessary for the mining industry. Following parts look at what sustainability covers in the context of the mining industry and the cursory literature research, focusing on the different approaches aiming to integrate and intertwine the concept of sustainability into mining operations.

1.1 Why a sustainable mining industry?

Due to the environmental degradation caused by its operations, social tension-conflict within different interest groups, and also some badly managed operations, the mining industry is one of the most criticised industries in the public and thus the public opinion is widely negative (Horsvill et al. 2001, IIED 2002, UNEPMD et al. 2001-2002).

Although this fact is partly true, it should also be considered that today's industry and economic development is still highly dependant on the non-renewable resources, because the mining industry supplies not only the raw materials, such as iron, copper, lead, aluminium, zinc, to the industries, but also the energy production highly rely on some mining products, such as coal and lignite in many parts of the world.

For instance, approximately 40% of the world electricity was produced from coal and lignite in 2001 (EA, 2004). Additionally, the US Department of Energy, Energy Information Agency's study on "International Energy Outlook 1997" shows that the use of the coal for energy production had steadily increased from 1970 to 1997, and this trend will most probably continue until 2020 (USDE 2000, cited in Fay & Golomb 2002: 15). Therefore, it is clear that the need for the mining products will continue in the near future.

Additionally, the economically extractable reserves in less sensitive areas have already been exploited or are being exploited. Therefore, the activities of the mining industry would shift from ecologically, socially and culturally less sensitive to high sensitive areas, or around them. As a result, for

the potential mining operations around sensitive areas, the operations must be "economically viable, financially profitable, environmentally sensitive and socially responsible" (UNEPMD et al. 2001-2002: 11).

Furthermore, as Hinde (2000 cited in Nippa & Lindsay 2001: 27) comments that the exploration activities shift more to remote and less developed geographic regions, which are rich in mineral and metal resources, such as Zambia, South Africa, Niger and Guinea in Africa, Brazil, Chile, Peru in Latin America, and China Indonesia and India in Asia (IFC & WB 2002, IEED 2002). In some of these regions and countries, the distribution of the mineral wealth benefits to different interest groups is generally problematic (IIED 2002). This also contributes the diminishment of the trust for the mining industry and its operations in many parts of the world.

In addition to these, the consequence of environmental consciousness in developed countries, the legislative structures of these countries has been changed, with the aim to reduce the environmental footprint of production and consumption behaviours (UNEP 2002). For instance, actions aiming to 'reduce', 'reuse' and 'recycle'; the standards and the directives on eco-management, environmental taxes and eco-labelling and similar actions should be considered in this context.

Therefore, industries, which are doing business with/in these countries, have to follow and fulfill these codes and guidelines. If to achieve all these requirements, a 'sustainable' management approach has to be also implemented by the mining industry.

In recent years, the rapidly rising environmental consciousness in developing countries and relatively slow rising in non-developed countries, public opinion and participation is becoming more important for all the development projects. As a result, successful mining operations highly require the acceptance and support from the public (ICMM 2002), and besides not only from the communities where the operation will take place but also from the regional and national public in general.

For these reasons, the mining industry is facing a great challenge to meet the concept of sustainable development, set at the UN Conference on the Environment and Development in Rio de Janeiro (1992) and in Johannesburg (2002).

To meet this challenge, it is important to take into account public concerns, such as the environment, the social welfare and cultural heritage of the communities, where the activities are carried out, because as Horsvill et al. (2001:1) discusses that "environmentalists believe that we [the mining industry] are major polluters, and social activists believe that we [the mining industry] don't contribute our fair share to society's well-being".

In short, to contribute to the sustainability, and consequently become a 'sustainable' industry is not a choice for the mining industry but a compulsory action to rebuild its reputation and re-establish the trust in mining operations, their contributions to economic endowment and social welfare with a less environmental footprint.

However, for achieving the goal of "an economically feasible, financially profitable, environmentally sensitive and socially welfare" (UNEPMD et al. 2001-2002: 11) mining industry development, firstly understanding of what sustainability means in the context of the mining industry and secondly sector and political willingness to introduce and implement necessary tools into action, are needed.

1.2 Earlier works on sustainable mining mdustry

On the one hand, the pressure from the external stakeholders, including citizens of mining communities, special interest groups, aboriginals, regulators and investors (Decision Partners Inc. 2000), to contribute to a transition for reducing negative impacts of the mining mdustry on environment and society, rises currently on the industry.

The internal stakeholders, on the other hand, including CEOs, mine managers and sustainable industry experts (Decision Partners Inc. 2000), who have the aim to strengthen the industry's image, competitiveness and market accession, also put pressure on the mining industry's actions.

As it is clear that the priorities of these two groups are different and as it is pointed out in the MAC'S Internal and External Stakeholder Analysis Research on Sustainable Mining Initiative (Decision Partners Inc. 2000:1) "a consensus also emerged, and was clearly understood by members [of the initiative], that these challenges are not simply a communications problem."

Therefore, the members of the mining industry must consider these priorities and critics about their actions in the future operations because "the mining industry is facing growing challenges to its social license to operate" due to the different priorities of the different stakeholders groups (Decision Partners Inc. 2000:1).

As it is mentioned earlier in this section (sec. 1.2), the problem is not sourced simply from lack of communication and misunderstanding of mining

operations in the public. The problem is basically sourced from the badly planned and managed operations in the past, which can be termed as non-sustainable actions.

The cyanide spill into the river Tisza from the damburst at Baia Mare goldmine in Romania, 2000, created a poison plume of pollution in Donohue; or the Aznalcollar accident in Spain, 1998, where a tailings dam failure poisoned the environment of the Coto Donana National Park (COM-265 final 2000: 8) and caused visible effects on the surrounding ecosystems are only two examples of these non-sustainable actions of the industry in the near past.

Other than these two examples, as Commission of the European Communities' report on "Promoting sustainable development in the EU non-energy extractive industry" (COM-265 final 2000: 8-9) mentions "a legacy of abandoned mine sites and unrestored quarries bears witness to the unsatisfactory environmental performance of the industry in the past".

As a whole, these and similar reports and studies prove that the mining industry has to stop considering the watchdogs, environmentalists and NGOs as the source of increasing social resistance against operations, and at the same time, to see and to accept the emerging prejudice about the industry's operations in the local and global level. These prejudices should be taken as indicators of sustainability issues for the mining industry.

In this respect, in the recent years, several workshops, conferences and researches have been carried out and a number of reports, scientific articles and directives have been prepared and published by governmental, non-governmental and international organizations.

The summary of the early actions aiming and contributing to the 'sustainable' mining industry can be found in Table 1. Although all activities, studies, projects, conferences and initiatives had been tried to consider and mentioned in Table 1, it is not possible to say that this aim could be completely achieved.

1.3 Sustainability concept in the mining industry operations

Regarding the highlighted points in the studies given in Table 1, in the context of the mining industry, the concept of sustainability can be framed as a group of activities, contributing to economical and social development at the local, national and global level, that aim to supply today's mining and mineral needs in a way that

- protects the environment,
- » ensures an equitable distribution of its costs and benefits,
- <• takes into account the social and cultural values,
- ® considers the public opinion, covering different interest groups, i.e. aboriginal and indigenous people, through the decision-making process of whether or not to mine,
- » optimizes the contribution to the well-being of the current generation without reducing the potential for future generations to meet their own needs (extended from IIED-Executive Summary (ES) 2002: xvi)

For the mining industry in particular, achieving sustainability primary means the minimization of negative impacts on the environment and the society. Secondly, the mining industry should guarantee the creation of benefits for the local societies that extend long after mining activity has ceased (Horsvill et al. 2001). Additionally, an equal distribution of both the costs and benefits within the society must be also considered.

At the same time, as a business, economical viability and financial profitability of the mining operations must be considered within the sustainability concept in the mining industry.

1.3.1 Environmental Issues

First, when the environmental issues are considered, some mismanaged and badly operated projects or simply due to the lack of willingness and awareness of the investors and governments for protecting the environment have caused adverse impacts of a large magnitude in the natural resource rich regions, especially in developing countries.

As a result of these, strong environmental movements that promote environmental protection and protest against the industry have been created in the global public opinion in last decades (Thanh and Tam 1992).

Most of the environmental problems sourced from the mining industry are currently well known. The negative environmental impacts of a mining operation can be summarized very shortly as; land-degradation and ecosystem disruption due to the top soil and sub soil removal, slope failures, loss of productive land and soil erosion because of the removal of the vegetation, change in existing topography, acid mine drainage, dust, emissions, tailings, ground water removal, chemical leakages,

Table I The summary of the early works contributing to the sustainable development in the mining industry

Organization	Contributor's)	Direetive/Projeet/Report	Year	Content
EU*	European Commission	Council Directive 85/337/EEC	1985	The Directive on environmental impact assessment (E1A)
		Council Directive 89/391 /EEC	1989	Introduction of measures in the health and safety of workers
		Council Directive 91/156/EEC	1991	Amending Directive 75/442/EEC on waste
		Council Directive 92/104/EEC	1992	The minimum requirements for improving the safety and health protection of workers in surface and underground mineral-extracting industries
		Council Regulation (EEC) 1836/93	1993	Eco-Management and Audit Scheme (EMAS) (voluntary participation by companies)
		Council Directive 96/61/EC	1996	The Directive concerning integrated pollution prevention and control (IPPC)
		Council Directive 1999/31/EC	1999	The Directive on the landfill of waste
		COM (2000) 66	2000	White Paper on Environmental Liability
		Council Directive 2000/60/EC	2000	Water Framework Directive (WFD)
		Council Directive 2001/42/EC	2001	The directive on Strategic Environmental Assessment (SEA)
		Council Regulation 2001/761	2001	EMAS II
		Council Directive 2003/4/EC	2003	Public access to environmental information
		Council Directive 2003/35/EC	2003	Public participation directive for drawing up of certain plans and programmes relating to the environmental and amending with regard to public participation and access to justice
		Proposal for a Directive of the European Parliament and of the Council on the management of waste from the extractive industries	Proposal	The proposal seeks to introduce EU-wide rules designed to prevent water and soil pollution from long-term storage of waste in tailings ponds, waste heaps etc
IŒD & WBCSD **	HED, WBCSD	The Mining, Minerals and Sustainable Development Project (MMSD) (2000-2002)- Breakmg New Ground Mining, minerals & sustainable development	2002	The report proposes an agenda for change with recommendations for immediate and future actions, such as creating a 'Declaration on sustainable development' embodying a commitment to a 'Sustainable development code' and also encourages companies to adopt a 'Sustainable development policy', a 'Review of end-of-life plans at existing operations' and Community sustainable development plans'

Table **1** (continued)

Organization	Contributor(s)	Directive/Project/Report	Year	Content
UN***	UNDESA UNDESD/DSD, UNEP, CDG, DSE, HBS, German Government	Berlin Guidelines - The first edition of Environmental Guidelines for Mining Operations	1994	These Guidelines address mining and sustainable development, regulatory frameworks, environmental management, voluntary undertakings, and community consultation and development, as applied to all stages of a mining operation
		The Berlin Roundtable on Mining and the Environment	1999	
	UNEP, COCHILCO	Abandoned Mines Workshop	2001	The workshop was the first international meeting to consider the many issues surrounding the topic of abandoned mines
	UNEP, Australian Government	Mine Regulators' Workshop 1	2000	Workshop on environmental regulation for accident prevention in mining-tailing and chemicals management
		Mine Regulators' Workshop 2	2002	Workshop on how government regulations interface with voluntary initiatives to improve the environmental performance of the mining sector
	UNEP/DTDE, UNEPFI, WB, IFO, MMSD	Finance, Mining and Sustaınabılıty Workshop	2002	The Report provides an overview of the UNEP, World Bank, and Mining Minerals & Sustainable Development (MMSD) initiative investigating the role of financial institutions in improving the environment and social performance of the mining sector
UN*	UNEP/DTIE, UN/OCHA, ICME, EU, Romanian Government, EPA, ILO, WHO	Accident Prevention and Emergency Preparedness in Mining Initiatives	2000	Aims to reduce risks associated with die use of cyanide
		Code for Cyanide Management in the Gold Industry- Cyanide Workshop	2000	Aims adequate local awareness and preparedness for emergencies, which can help to ensure that me critical first response is rapid and effective
		Emergency Preparedness and Disaster Response- Awareness and Preparedness for Emergencies at Local Level (APELL) Workshop		
		Improving the Effectiveness of Regulation for Accident Prevention in Mining Regulators' Workshops	2000 & 2002	
		Contingency engineering or 'fail-safe" features for Tailings Storage Facilities		

Table 1 (continued)

Organization	Contributor(s)	Directive/Project/Report	Year	Content
MAC*	Member Canadian Companies engaged in mineral exploration mining smelting refining and semi fabrication	Towards Sustainable Mining Initiative (TSM)		A strategy for improving the mining industry s performance A process for finding common ground with MAC communities to build a better mining industry today and in the future
ISO******		ISO 14000 series standards	From 1993	ISO standards lay out tools and systems for the management of numerous environmental obligations and the conduct of product evaluations

Sources *EC http //europa eu ınt/comm/envıronment/polıcy_en htm <Ł COM 2000 265 final
** 1Ü3D http //www ned org/mmsd/ & WBCSD http // www wbcsd org
***MRF (Mineral Resources Forum) http //www mmeralresourcesforum org/workshops/mdex htm
**** MRF http //www mmeralresourcesforum org/news_events/whoswho/whoswho htm &
http //www mmeralresourcesforum org/mitiatives/index htm
***** MAC http //www mining ca/enghsh/
******Casio et al (1996 1 9)

toxic dusts, compounds of carbon/sulphur/mtrogen metal particulates and creation of new land use for dumping, storage and construction purposes (Auty & Mikesell 1998, Dutta et al 2004)

These impacts affect the local communities directly and they can also contribute to some regional and global environmental problems

Additionally, as Kiss & Shelton (1997 37) highlight "inequalities sharpen when environmental problems increases and poorer areas often suffer disproportionately" Therefore, the environmental consideration is one of the most important essentials in the sustaınabılıty issues of the mining industry

13 2 Social Issues

Secondly, the mining industry operations affect the society widely in two different ways The first group of effects are sourced from the environmental impacts of mining operations While the second is sourced from the economical impacts of the operations on the society

The local society is directly affected from the negative environmental impacts of the mining operation, some of these impacts are given earlier m section 1 3 1 Loss of agricultural land, changes in surface and/or ground water access, quality and quantity, impacts on air quality, disturbance of scenic views, noise and vibration are some examples for the direct impacts of a mining operation on the locals (Dutta et al 2004)

In contrast to the negative impacts, possible positive environmental impacts of the operation are potential gain for the society For instance, reclamation and post mining use of a site, creation of recreation opportunities, such as fishing, boating and picnicking, promenade sites are just some examples for possible positive outcomes of the environmental changes on the society (Dutta et al 2004)

The second group of effects is sourced from the economic impacts of the operations on the society that should be also discussed as positive and negative changes On the one hand, in their study on the "Social impact" Becker et al (2004) point out some examples of the positive social and organizational indicators as new job opportunities, higher income and social security occasions for the local employees, developments in the infrastructure, such as, better motorway connections, social services, including health, safety and education can be given

On the other hand, change in community population, rise of living cost, change in ethnic diversity and prevalent values of community, changes in family stability, customs and lifestyle, crime and community safety, quality of political and civic leadership, trends in family farming and farm size and also the change in dryland farm income and ability to respond to change are some of the negative social and organizational indicators related with mining operations

The first positive effect of economic changes on the society is the increasing economic diversity of the area Besides traditional activities, such as agriculture or fishery, the operation itself and the

auxiliary industries in and around the mining area support economic and consequently social improvements

As an example, in their article "Case studies in mining and sustaınabılıty", Horsvill et al (2001) give a number of examples from North America where mining was the key element to economic growth and development of cities, towns and communities and they add also that this economic growth and development has played a major role m the growth of nations

However, the decision-makers must also consider that once the mining operation decision is given the economy of that region will most probably become highly dependent on the operation, which means the local economic activities would change dramatically Possibly, such a transformation of the local economic activities would followed by next generations during lifespan of the mining operation

But "the cycle of rapid economic growth during development and operation followed by severe economic downturn after closure has been the rule rather than the exception for natural resource development in the rural areas" (Horsvill et al 2001 9)

Therefore, as Thanh & Tam (1992 2) discuss "[ ] considering environmental impact m the physical and biological context-such as tropical forests, tropical wild life, the mangroves, the corals- is not adequate The human factor - humans themselves, their behaviours, structures- also needs to be considered " Based on this discussion, it can be concluded that together with environmental issues, social issues must also be seriously considered for the future operations of the mining industry m the sustaınabılıty issues

2 TOOLS FOR A SUSTAINABLE MINING INDUSTRY

This second section focuses on the possible tools, which can be implemented on the organizational and project levels, as well as on the policy, programme and plan levels, to contribute to the sustaınabılıty issues in the mining industry operations

2.1 Contributing to the sustainability issues on the project level

Minimization of the negative impacts of the operations on the environment and the society needs different actions and tools at local and regional level Before to discuss more in detail about project level environmental protection and mitigation tools, Environmental Impact Assessment (EIA), Environmental Management Plan (EMP) and Environmental Management Systems (EMS), and how these can improve the sustaınabılıty performance of the mining industry on the project level, to have a look at what EIA, EMP and EMS are may help for further discussions

"EIA is a procedure to ensure that adequate and early information is obtained on the likely environmental consequences of development projects and on possible alternatives and measures to mitigate harm" (Kiss & Shelton 1997 123-124)

"EMS is that facet of an organization's overall management systems that address the immediate and long-term impact of the organization's products, services and processes on the envuonment " (Cascio 1996 8)

The definition of EMP given by World Bank (WB) (1999) is "the set of mitigation, monitoring and institutional measures to be taken during implementation and operation to eliminate the adverse of the environmental and social impacts, offset them, or reduce them to acceptable levels The plan also includes the actions needed to implement these measures "

The EMP includes following components (WB 1999),

- Mitigation procedure EMP identifies feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels Summary of the significant adverse impacts can be taken directly from EIA Whether or not EIA considers, each mitigation measures, designs, equipment descriptions, and operating procedures must be described with technical details
- Monitoring The EMP identifies monitoring objectives and specifies the type of monitoring, with linkages to the impacts assessed in the EIA report and the mitigation measures described in the EMP
- Capacity development and training The EMP provides a specific description of institutional arrangements—who is responsible for carrying out the mitigatory and monitoring measures (e g , for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training) To strengthen environmental management capability m the agencies responsible for implementation, most EMPs cover one or more of the following additional topics (a) technical assistance programs, (b) procurement of

equipment and supplies, and (c) organizational changes

- Implementation schedule and cost esti .ration For all three aspects (mitigation, onitonng, and capacity development), the EMP provides (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans, and (b) the capital and recurrent cost estimates and sources of funds for implementing the EMP.
- Integration of EMP with project the institutional responsibilities for integrating and implementing the EMP should be assigned within the overall project plan

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To enable to answer this question, the characteristics, weak and strong points of EIA, EMP and EMS should be examined Concerning this, the characteristics and comparison of EIA, EMP and EMS can be seen in Table 2

At the local level, in other words on project level, EIA is the most widely known and used tool for environmental impact prediction and mitigation of development projects since 1969 (Kiss & Shelton 1997, Dutta et al 2004)

The introduction of EIA gave significant acceleration to environmental consideration and protection in development projects, for instance mining projects, because "it is generally a prerequisite to decisions to undertake or to authorize designated construction, processes or activities"

Table 2 The characteristics and comparison of EIA, EMP and EMS

	EIA	EMF	EMS
Type of instrument	Obligatory for the mining and mineral operations in many countries, systematic process	Detailed, systematic process, not obligatory except specific projects of development banks and aid agencies	Voluntary, consensus, private-sector standard
Project stage	Design	Implementation	Operation
Objective	Attempt to ensure that proposed actions environmentally sound	To describe ail the relevant actions taken by developer to ensure that proposed actions environmentally sound	Guidance for developing a comprehensive approach to environmental management and standardizing some key environmental tools for analysis
Focus	Environmental analysis and impact consideration	Maximum efficient use of resources, identify, evaluate the adverse impacts and prevent, attenuated, or, compensated	Focuses on continual improvement, lay out tools and systems for the management of numerous environmental obligations
Application	Project specific activities that seeks to blend administration, planning, analysis, and public involvement in assessment trough the decision-making process	Project specific, integration of EMP with project for implementing and for supervising the responsibilities within the overall project plan	Organization decides to apply to the whole or part of the organization, or its activities, products and services
Structure	Proposal, normative activity, adheres to 'analyse-consider- plan-act'	Part of EIA following the process scoping or as a separate document, EIA is a part of EMP	Part of the overall management system, adheres to 'plan-do-check-act' type to business model
Elements	Screening, preliminary analysis, scoping, review of alternatives, identify significant issues, impact assessment, identify impacts, predict and evaluate impacts, scrutiny of findings, decision on proposal, implementation, monitoring	Several technological and managerial interventions, such as, recycling and conservation of resources used m the operations, pollution control measures, monitoring, capacity development and training, implementation schedule and cost estimation	List of potential environmental impacts, environmental policy and planning, management system documentation, document control, operational control, training, monitoring and measurement, corrective action, internal auditing communications and emergency preparedness and response
Action by competent authorities	EIA review and approval Approval of the EIA and EMP at the project approval stage	Implementation, monitoring and ex post evaluation Audit/monitor during and after implementation	Environmental audit-internal and external Audit/inspect/monitor throughout operation

Sources Cascioetal (1996 3 8 24 26 27) Borrow (1997 1 5 101) Moddk& Biswas (1999 124 127), George (2000 179) (Kiss & Shellon 1997 124)

At the same time, developments in technology and modern practices contribute to reduce or to avoid environmental impacts of the mining operations with an EIA on the project level.

Unfortunately, different studies (see Ortolano and Shepherd 1995, Russo 1999:363, George 2000, Joyce and MacFarlane 2001, Partidario and Clark 2002:3, João 2005: 6) show that EIA is insufficient on its own for covering some major negative impacts through the stages of the development projects, such as cumulative, transboundary and social impacts (Barrow 2003: 65, Modak & Biswas 1999: 6-9, 209-211, Glasson et al. 2004 cited in João 2005).

However, aim of the environmental impact assessment should be to ensure that the environmental impacts, during all steps of the project(s), are understood and are acceptable before the project is approved. Therefore, the effective EIA needs to include provisions for further checks throughout all the stages of the life cycle of the project (George 2000).

Although it is an application problem, EIA is often seen as a way of justifying a development, not reducing problems (Barrow 2003) and putting the main effort on the preparation the paper documentation that reduces the efficiency of the EIA for consideration of entire project life cycle.

Additionally, as Kiss & Shelton (1997:123-124) and George (2000:179) mention, EIA ensures early information and impact prediction of the project on the design stage. For this reason, to enable to improve environmental sensitiveness of mining projects, consideration and monitoring of entire steps of a project must be covered by the EIA with the help of EMP and also the performance of the operator should be followed with EMS.

The life cycle of a mining project consist of 6 main steps, which are

1. Exploration
2. Project Design
3. Project development
4. Mine operation-Extraction
5. Processing
6. Mine closure and reclamation

When these steps are considered, EIA is insufficient on its own as a comprehensive environmental management tool. Therefore, EIA must be supported with other tools, i.e. EMP and EMS, enable to consider the whole project life cycle and to improve the efficiency of controls that can be named as integrated environmental management (IEM).

IEM is a combination of a group of actions that aim to consider the whole activities and their consequences of a project on the environment. Also it intends avoiding or reducing the negative consequences to the acceptable levels during the entire project life cycle.

The elements, EIA, EMP and EMS, of IEM and how these elements can contribute to the environmental consideration for different phases of mine operation cycle are demonstrated schematically in Figure 1.

As it is demonstrated in Figure 1, EIA covers the activities before die project approval stage comprehensively. In some cases preliminary EIA is necessary for exploration step as well.

Commonly used way of EIA through the project design is; environmental impact prediction of the project, determination of design alternatives to mitigate negative impacts or reduce them to acceptable levels and also including the necessity and willingness of the project owner regarding mine closure and reclamations, generally without detailed

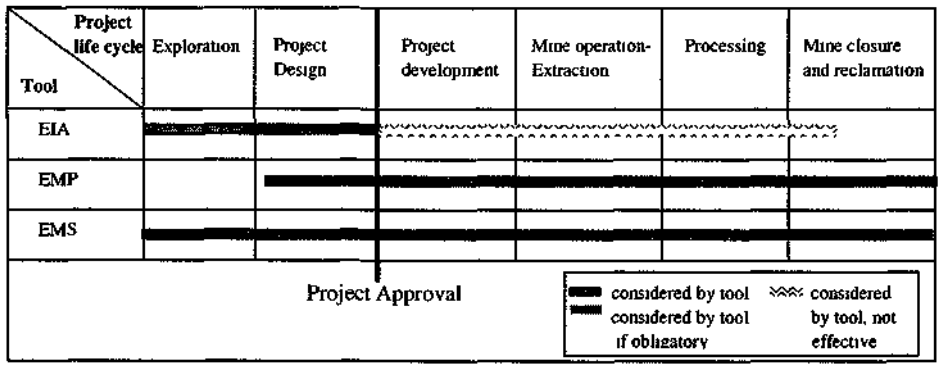

Figure 1 : Compression of EIA, EMP and EMS based on the project phases and elements of IEM

plans. Based on the selection of the 'best' of all alternatives, project is approved or not, by the responsible authority.

But due to the limited or lack of consideration of monitoring, remedial action and reporting of the mine development, operation and mineral extraction and processing steps after project approval, and, in addition, generally no detailed studies on what is the most efficient, useful mine closure and reclamation and how to finance them; EIA does not guarantee the success of the prevention and mitigation of the negative environmental impacts, so showed with dash lines after project approval in Figure 1.

On the contrary to EIA, as it is discussed in the early part of the section 2.1, components of EMP cover the entire steps of the project life cycle with a detailed plan. In addition to the summary of potentially significant adverse impacts, which can be taken directly from EIA, monitoring and reporting, training the staff, to define the responsibilities that who (project owner, the main contractor or sub-contractors) will carry out these responsibilities and proposed mitigation measures' cost estimation procedures are clearer in the EMP procedure.

Therefore, clear responsibility distribution within the project management, covering project owner, main contractor and sub-contractors; clear environmental impacts liability of the operator, regular and efficient control of the project cycle, financial guarantee, which would be bonds obtained from the project owner for the complete and successful mine closure, reclamation and long term monitoring, EMP would cover entire project life cycle as it is given in Figure 1.

Additionally, as it is shown in Figure 1, EMS covers all the projects steps from the exploration to mine closure and reclamation because operator must consider the environmental policy of the organisation for all its operations that means it is not project specific so shown by continuous line. The details of EMS are discussed in section 2.1.3.

In short, integrating the Environmental Management Plan (EMP) and Environmental Management Systems (EMS) on the project level, with the EIA as an integrated environmental management, will most probably give satisfactory results in terms of sustainability issues of the mining industry.

2.1.2. What EMP promises for sustainability issues in the mining industry operations?

"Effective environmental assessment should be a process rather than an isolated event and is itself part of the broader process of environmental planning and management" (George 2000: 179). For that reason, after the project approval, EIA process must continue on the implementation and further stages of the mining project.

In this regard, to force the future environmental protection liability, EIA;

- must totally cover monitoring and mitigation measures, after project approval and,
- must contain detailed planning and cost estimation of the mine closure and reclamation activities with bonds or guarantees that is given by the project owner

To explain these in details; firstly, the monitoring and mitigation measures during the project development and operation stages are problematic within EIA. As George (2000:180) points out "although several developing countries and countries transition include requirements for monitoring in their EIA procedures, few are as explicit as they might be."

Additionally, in many of the developing and under-developed countries, the monitoring activities within the EIA procedure are not followed through a schedule or a programme. This makes EIA inefficient, because there is no guarantee that the EIA recommendations will be considered during the implementation of the project; due to the lack of coordination, overlapping of responsibilities between numerous authorities and lack of staff of the authorities (George 2000).

As a solution, George (2000: 186) highlights that "if monitoring reports are being provided by the developer in accordance with a sound EMP, and if there is a close coordination between the competent authorities, a small number of spot-check visits by the appropriate authorities should be sufficient" for environmental protection of a development project.

Secondly, detailed planning with an implementation schedule and cost estimation obligation of EMP, makes the environmental protection and prevention of negative impacts more realistic because the cost estimation could prevent some unrealistic promises for mitigation actions given by developer before project approval. In other words, for a satisfactory, or 'sustainable', mine closure and reclamation requires not only enthusiasm and plans but also money.

As it is known that mitigation, mine closure and reclamation actions might be very costly so these costs must be included in the developer's financial appraisal for project viability. Otherwise, project could be unsuccessful due to the miscalculated costs so the negative environmental impacts would not be

prevented and mitigated. Therefore, at the project approval stage, responsible authority should ask bonds or guarantees from the developer to avoid the risk of bankruptcy before or during the mine closure and reclamation activities (George 2000).

Due to the fact that, EMP is more comprehensive and realistic than EIA regarding to the monitoring and mitigation of negative environmental impacts of the whole project cycle that converts the environmentally sound design to environmentally sound operation.

At the same time, EMP may help to reduce potentially significant adverse environmental impacts to acceptable levels by identifying feasible and cost-effective measures and it ensures that resources are used with maximum efficiency (WB 1999, Modak & Biswas 1999).

2.1.3. Environmental Management Systems (EMS)

"EMS is the part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy" (ISO 2004).

Different than EIA and EMP, EMS is not a project specific action because it is a part of the overall management system of an organization, which can be "a company, corporation, firm, enterprise, authority or institution that has its own functions and administration" (ISO 2004).

EMS is a voluntary action, aiming to improve the environmental performance of an organization. Environmental performance is measurable results of the EMS, related to an organization's control of its environmental aspects, based on its environmental policy, objectives and targets.

Additionally, EMS is also about improving the organizational aspects, such as, minimising liability risks, better organization and documentation ability, improving energy and resource use, cost reduction and achieving better image.

The purpose of the EMS is basically preventing the badly managed operations. Therefore, EMS's real benefit is that an organization should follow its environmental policy, which is a statement that shows the organization's intentions and principles related with its overall environmental performance, providing a framework for action and for the setting of the organization's environmental objectives and targets, without distinguishing any of its operations, to enable to fulfill the EMS certification procedure.

As a result, EMS is a very effective tool for prevention and reduction of the negative environmental impacts of a mining operation, because it forces the operator to think about whether or not his normal management procedures are really suitable to achieve the environmental policy of the organization.

Additionally, why EMS is an effective tool is that EMS is a continuous approach (see Fig. 2) not an event. It aims to improve the environmental performance of the organization during its operations with the help of the internal and external audits controls.

For these reasons, as it is pointed out in Figure 1, the activities of whole project cycle of a mining project would be followed and considered by project owner (internal audits) and also external bodies (external audits) from exploration to end of reclamation effectively.

Other than effective monitoring of the operation; improvement in the internal and, most importantly, external communication and cooperation between the operator, regulatory authorities and public is another potential positive outcome of EMS for the mining industry because some problems, sourced from overlap or missing responsibilities in legislation and lack of public participation, can be effectively overcome even in developing and under-developed countries.

2.1.4. How to integrate EMS with EIA and EMP?

Integration of the EMS with EIA and EMP can be summarized within a framework, given by George (2000: 179). As a design stage action by developer or operator, EIA can provide all potentially significant adverse impacts of the proposed project to the EMP process and "at the project approval stage, the competent authority for environmental assessment can ensure that the developer makes suitable provisions for appropriate management and monitoring during all the later stages of the project's life cycle by requiring an EMP at the same time with EIA."

The audit and monitoring procedures of EMP, such as, checks of approval conditions and contract requirements, during and after the implementation of the project, can support to achieve the environmental policy of the operator's EMS during whole project life cycle (George 2000). In other words, outcomes of the EMP feed into the continuous improvement process of EMS (see Fig. 2) (AusAID 2003).

As it is given in Figure 2, EIA findings can be used in the EMS planning stage for the project. At the same time, EIA findings might be useful for the implementation and also for the control stages of the EMS as a database and baseline study. In addition,

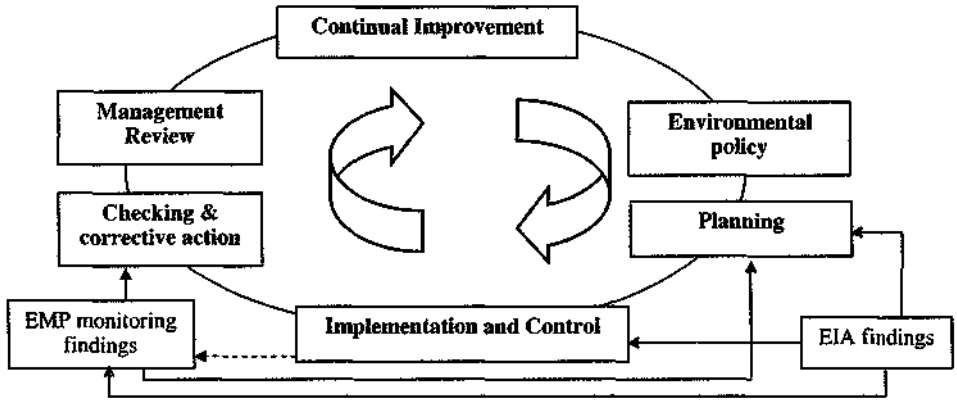

Figure 2: The major components of an EMS and integrating EMP and EIA with EMS (modified from: Harbour 2000)

EMS's environmental policy is a guarantee of implementing the EIA's findings and predictions for avoiding losses of environmental resources and values.

The monitoring mechanism of EMP is another important contributor for the EMS's continual improvement system because as Modak & Biswas (1999:125-126) point out "appropriate monitoring mechanism and in-plant institutional reporting system of EMP would provide a regular and continuous assessment".

At the same time, with implementation of EMS and its regular control findings would be useful data to improve the EMP's monitoring and reporting system. Together with these findings from EMP monitoring and EMS controls will be used for the checking and corrective action purpose as it is seen in Figure 2.

Additionally, one of the most important pillars of EMS is documentation. In this respect, regular reporting of the monitoring actions with EMP will most probably be helpful for a successful EMS in the organization.

As a result of this simple hierarchy between EIA, EMP and EMS, providing the information from detailed impact studies of EIA and monitoring and reporting procedures of EMP during the operation and than feeding the continual improvement circle of the EMS of the mining operator with this information improves the sustainability performance of the mining industry.

2.2 Contributing to the sustainability issues on policy, plan programme level

In addition to project level, policy, programme and plan (PPP) level consideration is necessary to enable to avoid and mitigate negative impacts of the mining industry on the environment and society. In other words, concerning the environment, the relevant alternatives, the society priorities and the public participation at the possible earliest stage in the planning and in the decision-making process, PPP level consideration can contribute to the sustainable development in general and also in the mining industry actions.

In this regard, Strategic Environmental Assessment (SEA) can be a very useful tool for contributing the sustainability issues in the development projects, plans, programmes, and policies (Modak & Biswas 1999).

SEA can be described as "a systematic, proactive process for evaluating the environmental consequences of policy, plans and programme proposals in order to ensure that the environmental consequences are fully included and addressed at the earliest appropriate stage of decision making on par with economic and social considerations" (Miller 2001:33).

After widely acceptance of the benefits of EIA for projects, the growing belief that EIA for policies, plans, and programmes (PPPs) is also necessary to consider alternatives and impacts which can not be completely covered on the project level (Modak & Biswas 1999).

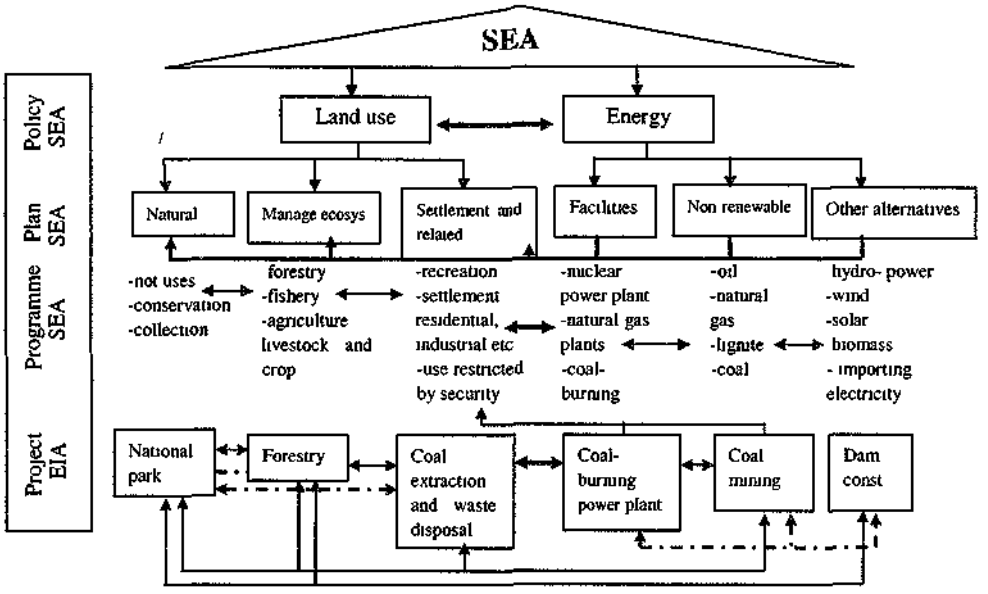

Figure 3 Tiering and links between SEA and EIA within energy and land use policies

Consequently, during 1990s, although it is much slower than EIA, SEA regulations and practices have been expanding not only in developed countries but also in developing and under-developed countries (Lee 1995, Sadler & Verheem 1996, Thérival & Partidario 1996 cited m Lee & George 2000)

There are two key principles of SEA for environmental protection and hazard mitigation of different PPPs are pointed out by Joâo 2005 7,

- "SEA -must- clearly identifies feasible PPP options (or alternatives) and compares them in an assessment context
- SEA -must- improves, rather than just analyse, the PPPs"

Different than EIA, SEA decision making hierarchy for alternatives, considers if development can be obviated firstly, and if not, than considers how it can be done more environmentally friendly This stage is followed by the consideration of alternatives and where and when development investment will be made (Joâo 2005)

Another important point of alternative consideration and comparison in SEA process is that SEA does not cover only "either-or" alternatives (ı e coal burning power plant-renewable energy) but also "mix-and-match" options (ı e isolation of buildings and reduce energy demand, and so reduce coal extraction) (Thérival 2004 12 cited in Joào 2005 8) Hence, with SEA "no action" option becomes more applicable for the decision-makers

Additionally, as Partıdârıo (1999 cited in Joâo 2005 6) points out "EIA enters decision-making process too late that decisions at PPP level that could influence the type and amount of the projects have already been taken"

Therefore, to enable to cover the cumulative and transboundary impacts, indication of development alternatives for the mining related industries, such as, energy projects, primary raw material user and recycling industries, land use alternatives and priorities of different stakeholders in the decision-making process, should also be considered together at whole decision-making levels (see figure 3)

As it is illustrated in Figure 3, the decision-making processes for different PPPs and also for projects are complex As an example, when land use and energy policies are considered, both may affect the mining industry operations directly or indirectly Additionally, for these two policies, there are several different plan and programme alternatives and thus a great amount of project options, such as, dam construction, wind farms or electricity import, coal mining and coal-burning power plant, agriculture or forestry projects so on, exist

Some of these options have direct impacts on others, which are showed with solid rows in Figure 3 For instance, if energy policy and consequently

plans are developed for non-renewable energy alternatives, than the impacts of coal, lignite and/or gas extraction projects would have direct impact on land use plans, such as on forestry. Other than direct impacts, some decisions about energy have indirect impacts on other options, showed with dash lines.

For instance, electricity demand can be supplied from either non-renewable (e.g. coal) or renewable (e.g. hydro power) resources. In this regard, once coal burning power plant has been chosen than dam construction may not be necessary. Therefore, the connection between these two alternative projects relation is showed with a dash line.

Shortly, the complexity and interdisciplinary characteristics of most of the development PPP and projects, a wider consideration of alternatives and impacts are necessary. Additionally, with higher level consideration allows for a systematic and effective reflection of environmental and social consequences at higher tiers of decision-making. Finally, more consultation and participation of the public from the possible earliest stage can be achieved with SEA (Fischer 2002 cited in Joâo 2005).

2.2.1 The importance of SEA for the mining industry

SEA is a strong tool for the consideration of cumulative impacts (Modak & Biswas 1999). Firstly, on the project level polluter pays policy is used for avoiding or mitigating the impacts of an activity. However, at the regional level, for instance, although pollution of several operations may be separately lower than the accepted limit, the accumulation of the pollution might be higher than regulated limit.

In such a case, the polluter pays approach on project is not effective to overcome the problem because without earlier analysis and higher level of planning, the cumulative impact prediction may be inefficient. In addition, as Barrow (2003:113) discuses "cumulative impacts may be experienced after long delays and at a distance from their causes". Therefore, SEA can deal with these difficulties with its ability of looking from the top.

Secondly, to enable to avoid serious future pollution, the activities must be followed as early stage of the operation as possible. This is important not only for the environmental protection but also for the economically feasibility of the operation, because once pollution appears; it would be very costly to cover it.

For example, recovering the acid mine drainage (AMD) costs multimillion-dollar for the mining industry and for the governments in North America (Ersan et al 2003). Also Tremblay and Hogan (2001 cited in Ersan et al 2003: 12) estimate that the total world wide AMD liability is around US$100 billion. Therefore, SEA can serve as an early warning system to such environmental impacts (Nierynck 2000:4).

Thirdly, the mining industry operation has social impacts as a consequence of environmental and economical changes in the operation area as it is discussed in section 1.3.2. As a basic rule of the sustainable development, welfare of the society must be considered as much as economic development.

As it is discussed in section 1.3.2, due to operation itself and auxiliary industries, traditional economic activities is changing and economy of the area becomes highly dependent on the mining operation, especially in rural areas. For this reason, to avoid serious social welfare loss after operation ends, realistic development plans, programmes and projects must be developed by governments and competent authorities.

By itself, EIA is not enough for an effective social impact consideration (Ortolano and Shepherd 1995); therefore social impact assessment (SIA) could be useful with EIA. However, these two assessments consider the problem on the project level and the possible solution options are limited and most of the time insufficient to transform the society from a mining dependent to self-sufficient society.

For this reason, before implementation of projects, long term planning should be done by governments with the cooperation of state agencies, academicians, mining and society experts, locals and so on. In addition to insufficient social impact consideration of EIA on policy, plan and programmes (PPPs), the need of the public participation at the possible earliest stage for such decisions become more and more important in decision-making process towards sustainable mining.

For instance, the control, the use and the management of land is one of PPP needed key areas for the mining industry concerning the public participation. This is because there are many actors, including government, governmental agencies, investors, NGOs, local communities, indigenous people, having vital interests how land is used and who gives the decisions regarding the land use (IIED 2002: 25).

Therefore, instead of the project level, with SEA, PPP level public participation on such topics, i.e. use and management of land and energy connected mining investments, may be more effective to get reasonable results for all the stakeholders.

Finally, as a PPP assessment, SEA is a useful tool for economic development of countries, because in highly cyclical and capital-intensive industries, like the mining industry, with a long lead time between initial investment and commercial production, investors prefer economically and politically stable countries for the investment.

Therefore, the countries where the social and political instability is a problem, long-term mining policy would be very useful to guarantee the no change in the conditions. According to this policy, plans and programmes could be developed by regional and local governmental agencies and projects would not be postponed or cancelled due to the later politically instability, public rejection due to the lack of trust in the public, speculations, misguidance and prejudice against to the mining industry.

As an example, after the change of the related mining law in 1985, there were 17 international gold companies started to search gold deposits in Turkey. However, the political instabilities and public rejection against the Bergama-Ovacik goldmine project after project approval due to the lacking sense of public trust and credibility in the decisions of agencies, in 2000 only three of these international gold companies have started to investment. The other 14 companies left Turkey after deciding conditions were not suitable for investment (General Directorate of Mineral Research and Exploration of Turkish Republic 2004).

As it can be seen in this example, before considering and discussing proposals on the project level, a platform is needed to discuss costs and benefits of the extraction of the minerals and to prevent mismanagement of the non-renewable resources. In addition, such a platform would also help to build a consensus among different or opposing interests through the different levels of the PPPs, before specific project proposals.

Therefore, SEA does not serve only as environmental protection and social development tools but also an effective economic development instrument in countries, where the political and social stability is lacking.

As it is summarized above, due to capacity of considering cumulative impacts, avoiding future environmental pollution, early public participation and also as an economical development tool, "decision-makers increasingly believe that Strategic Environmental Assessment has the capacity to influence the environment and sustainability nature of strategic decisions" (Parfidârio and Clark 2000:3).

3 CONCLUSION AND RECOMMENDATIONS

Due to the changing patterns of production and consumption for the sustainable economies, the industry, as one of the most important actors of the environmental, social and economic issues globally, has to revise its actions considering the broad principles and spheres of sustainable development.

As a part of the global industry, the mining industry has also been changing for better manage - environmentally and socially sensitive, economically feasible and financially profitable - operations in the context of sustainable development.

Consequent of this change, several international organizations, such as WB, UN, OECD, institutions, such as, HED, WBCSD, chambers of the industry, i.e. MAC, and companies world wide had been organized conferences, implemented projects and prepared reports for understanding, developing and implementing the sustainable development principles and actions for the mining industry.

The outcome of these studies towards a 'sustainable' mining industry can be summarized as, the mineral and mining sector have to

- protects the environment,
- ensures an equitable distribution of its costs and benefits,
- takes into account the social and cultural values,
- considers the public opinion, covering different interest groups, i.e. aboriginal and indigenous people, through the decision-making process the whether or not to mine,
- optimizes the contribution to the well-being of the current generation without reducing the potential for future generations to meet their own needs

To enable to take into consideration these highlighted points in the future operations and so to improve the mining industry's environmental performance and its image, different actions are needed on the project level as well as policy, plan and programme (PPP) levels.

On the one hand, an integrated environmental management should be developed and implemented to contribute to sustainable development principles on the project level. As a very widely used environmental management tool, environmental impact assessment (EIA) must be strengthen with social impact assessment (SIA) and environmental management plan (EMP) for exercising and considering the social and economic consequences as well as environment on the project level.

Environmental management systems (EMS), on the other hand, most probably improve performance of such an integrated environmental management approach by integrating environmental responsibilities into everyday management practices It provides a structured method for company management and the other authorises to control the performance of the project through the life cycle (IIED 2002)

Additionally, EMS might be a very useful tool to develop and contribute to the sustainable development policies for operators by its environmental policy and the continual improvement circle through the project cycle

Besides these, it must be also considered that implementation of EMS in an organization or any of its operations does nf ' mean immediately and completely 'sustainable' business, in fact, "EMS is a universal indicator to assess an organization's good-faith effort to achieve reliable and consistent environmental protection" (Cascio et al 1996 8)

On the PPP level, strategic environmental assessment (SEA) provides the potential opportunity to avoid the preparation and implementation of inappropriate plans, programmes and projects At the same time, it assists in determination and evaluation of project alternatives and prediction of transboundary and cumulative effects of the project

Additionally, SEA would help to build a consensus among different or opposing interest groups and also help to build a sense of public trust and credibility in the decisions of the department or agency by the possibility of public participation before the vital decisions have been given, such as, control, use and management of land, social and economical development alternatives after mining operation and management of the mineral resources

Recommendations

Governments should review, develop and implement effective policies to make the access to information and public participation easier and effective with clear procedures for more transparent decision-making processes, especially in developing and non-developed countries It will also improve the communication and coordination between governmental agencies and public

Additionally, governments and international community should support the voluntary initiatives, aiming to implement environmental standards, ı e the ISO 14000 series and EMAS, especially in small and medium scale mining companies For the products, eco-labels and life cycle assessment applications for the mining and processing sector should be applied widely especially by international companies

On the business side of the sustainable development issues m the mining industry, "organizations should establish sustainable development policies that incorporate other company policies such as those on worker health and safety, employee integrity, human rights, community relations so on" (IIED 2002 393)

Furthermore, for more effective environmental and social assessment on the project level, instead of two different assessments, EIA and SIA should be implemented as a combined environmental assessment "Such an assessment should become an inclusive, dynamic, on going process of integrating knowledge of on potential impacts into decision-making and management practices" (IIED 2002 399)

Last but not least, contributing to the sustainable development issues for the mining industry, regional and national partnerships, effective governance systems at the national level and further studies, workshops and initiatives at the global level should be initiated This is also needed for increasing the number of efficient, effective and successful examples of environmentally sensitive, socially welfare, economically feasible and financially profitable mining operations, concerning the sustainable development in the mining communities

Acronyms and Abbreviations

AMD	acid mine drainage
CDG	Carl Duisberg Gesellschsft (Germany)
CEO	chief executive officer
COCHILCO	Chilean Copper Commission (Chile)
DSE	Deutsche Stiftung fur Internationale Entwicklung (Germany)
EIA	environmental impact assessment
EMAS	eco management and audit scheme
EMP	environmental management plan
EMS	environmental management systems
EPA	Environmental Protection Agency (United States)
EU	European Union
HBS	Heinrich Boell Stiftung (Germany)
IEM	integrated environmental management
Œ D	International Insututed for Environment and Development
IFO	International Finance Corporation
ILO	International Labour Organisation (Switzerland)
ISO	International Organization for Standardization
MAC	The Mining Association of Canada
MMSD	Mining, Minerals and Sustainabl Development (UK)
NGO	non-governmental organization

OECD	Organization for Economic Co-operation and Development
PPP	policy, plan and programme
UN	United Nations
UNDESA	UN Department for Economic and Social Affairs
UNDESD	UN Decade of the Education for Sustainable Development
UN/OCHA	UN Office for the Coordination of Humanitarian Affairs
UNEP	United Nations Environmental Programme
UNEP/DTIE	UNEP Division of Technology Industry and Economics
UNEPFI	UNEP Finance Initiatives
SEA	strategic environmental assessment
SIA	social impact assessment
WB	World Bank
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organization

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