DECISION MAKING PROCESS OF MINING PROJECTS WITH REGARD TO ENVIRONMENTAL MANAGEMENT IN MYANMAR

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Abstract

Mining is a foundation industry on which the critical materials on which all global development and human progress are based, however, the exploration, extraction and processing of mineral resources are environmentally and socially disruptive and mining clearly depletes the planet's limited stock of natural resources. These factors contribute to a view by some that mining is an unsustainable and environmentally challenged industry. However, in many developing countries, mineral development should be the engine for growth. Modern mining and mineral industry operations are environmentally aware although conflicts can arise in all mineral development projects due to differing perceptions of the owners, investors, consumers, and other stakeholders. On the one hand, it must be accepted that much remains to be accomplished to ensure compatibility between environment and mining with the current arsenal of new technology tools available. This research is to investigate the impacts caused by Kyaukpahtoe Gold Mine and to draw guidance for future use, based on the available data, equipment, and knowledge. It is to initiate and accelerate the practice of Initial Environmental Examination (IEE) in Kyaukpahtoe Gold Mine. Then the research will help find the environmental control or management procedures by studying world standards.

1. Introduction

The scope of the paper is mainly on the state of environmental problems in Kyaukpahtoe Gold Mine Project and adaptation of international environmental management measures into state owned mines and artisanal mining activities. Although it sounds better and more valuable to conduct a wide range research on major gold producing areas throughout the country in Myanmar, the present research would only examine the most well known Kyaukpahtoe Gold Mine Project. The problems were checked in the field by using Initial Environmental Examination (IEE) Checklist. The problem assessments were also based on legally released data from the mines, visual inspection, some formal requests and informal conversations with local people and miners. New technologies and expensive modern equipment of analyzing physical, chemical, biological and socio-economic environment could not be applied due to research funding and time constraints. Moreover, this research was carried out on individual scale and consequently, could not be a perfect or complete one. In practice, assessments are usually conducted by many experts.

2. Initial Environmental Examination (IEE) Mining Industries

2.1. Propose Of IEE

IEE is an important tool for incorporating environmental concerns at the project level. IEE should be carried out as early as the project planning stage as part of feasibility thus it can assure that the project will be environmentally feasible. The general objectives of IEE study should at least cover the following:

(i) to provide information about the general environmental settings of

the project area as baseline data;

(ii) to provide information on potential impacts of the project and the characteristic of the impacts, magnitude, distribution, who will be the Affected group, and their duration;

(iii) to provide information on potential mitigation measures to minimize the impact including mitigation costs;

(iv) to assess the best alternative project at most benefits and least costs in terms of financial, social, and environment. It is not always necessary to change location of the project, but changes be made in project design or project management; and

(v) to provide basic information for formulating management and monitoring plan.

The IEE is conducted if the project is likely to have minor or limited impacts, which can easily be predicted and evaluated, and for which mitigation measures are prescribed easily. However, the IEE is also used to confirm whether the project, requires an EIA.

2.2. Outline of an IEE

2.2.1. Description of The Project

The IEE report must furnish sufficient details to give a brief but clear picture of the following:

(i) type of project;
(ii) category of project;
(iii) need for project;
(iv) location (use maps showing general location, specific location, and project sites);
(v) size or magnitude of operation;
(vi) proposed schedule for implementation; and
(vii) descriptions of the project, including drawings showing project layout, and project components. This information should be of the same type and extent as is included in feasibility reports for proposed projects to give a clear picture of the project and its operations.

2.2.2. Description of The Environment

The report has to furnish sufficient information to give a brief but clear picture of the existing environmental resources in the area affected by the project, including the following:

(a) Physical resources
(b) Ecological resources
(c) Economic development
(d) Social and cultural resources

2.2.3. Screening of The Potential Environmental Impacts And Mitigation Measures

Using the checklist of environmental parameters for different sector projects, this section will screen out “no significant impacts” from significant adverse impact by reviewing each relevant parameter. Mitigation measures, where appropriate, will also be recommended for environmental problems due to project location, project design, construction, and operations (Table 2.1). If the approved IEE concludes that the project will not have any significant

adverse environmental impacts, then the environmental assessment is deemed complete (i.e.D1 stage). If there are unresolved issues, the recommendation should be either that further studies be undertaken to resolve the issues, or that a full EIA is required (i.e.D2, D3 and D4 stages).

3. Development of the Environmental Assessment Model

3.1. Modeling of Analysis of Geographic Information For Environmental Problems of Kyaukpahtoe Gold Mine

3.1.1. Assessment of the Impacts

In practice, the checklist in Table 2.1 is used to determine if a project has potential or significant environmental impacts. A team of experts or at least an expert is involved in the process.

3.1.2. Collection of Public Opinions

For impact assessment, no direct measurement could be made. The assessment was based on visual checks, opinions, and experiences of some people. In conducting this research, some questionnaires were used to illicit opinions, information from a number of people, grouped into three levels. The levels were ranked on the basis of education, experiences and reliability. Numbers of level were described into three groups as follow:

(1) High Expert Level
(2) Medium Expert Level
(3) Low Expert Level

3.1.3. Development of Computer Program

Depending on the number of participants, level of trust, parameters of impacts and actions affecting environmental resources, the three levels of magnitude of impacts are determined by the use of a computer programme (ALTPG)

From the interview results, the degrees of impact (D_1, D_2, D_3, and D4) are determined by using a computer program. Depending on knowledge, involvement and competency, three levels of interviewees are grouped. In practice, there can be many more levels as needed. Similarly, more other questions relating to actions affecting on resources than used in the program can be added in actual cares. For example, although there are seven actions in stage A that can cause environmental impacts, items may need to be considered depending on the scale of the project.

The weight of importance regarding the reliability of participants in the research can also vary in practical works in such as way as 60 % for level 1, 30 % for level 2 and 10 % for level 3. In this program, equal weight is given to all three levels. In the same way, all types of actions from A to F are given the same weight of importance in this model program; in practice, are on any particular types of actions can be more significant and thus given more weight.

3.2. Basic Concept of Modeling Of Geographic Information System (GIS)

The combination of human and computer based resources that results in systems that are capable of the collection, storage, retrieval, communication and analysis of spatially referenced data for the purpose of efficient management and planning of resource mobilization are called Geographic Information Systems (GIS). In this program, procedures of data analysis were

described layer by layer as shown in Figure 2.2 and situation of each action affecting environmental resources and values (Actions) need to be considered layer by layer.

Table (2.1) The Checklist of Environmental Parameters for Initial Environmental Examination (IEE)

Action Affecting Environmental Resources and Values	Result of Interview for Public Opinions (Number of Response out of 10 Persons)			
A. Environmental Problems due to Project Location	No Significant Effect	Significant Effect		
1. Disruption of hydrology				
2. Resettlement				
3.Encroachment on ecology				
4.Encroachment on historical / cultural value				
5. Encroachment into forest				
6.Conflicts in water supply rights				
7. Regional flooding and drainage hazards.				
Total				
B. Environmental Problems Relating to System and Design	No Significant Effect	Significant Effect		
	D1	D2	D3	D4
1. Liquid waste				
2. Solid waste				
3. Gas waste				
4. Mineral processing				
5. Dangerous waste				
6. Quality of Operation and Maintenance assumed in design				
7. Occupational health and safety				
8. Mine drainage				
9. Tailing				
10. Noise and Vibration				
11. Dust and other emission to air				
Total				
C. Environmental Problems during Construction Stage	No Significant Effect	Significant Effect		
	D1	D2	D3	D4
1. Loading, Hauling problems				
2. construction silt runoff				
3. accident				
4. Continuing silt runoff from non-replanted areas				
5. Noise and Vibration				
6. Dust and Smoke				
7. Exploitation hazards				
8. Erosion of unprotected exposed areas				
9. Other construction stage hazards				
Total				

D. Environmental Problems relating to Inadequate Operations	No Significant Effect	Significant Effect		
	D1	D2	D3	D4
1.Adequacy of O&M funding				
2.Funding of occupational ealth and safety				
3.Erosion and aesthetics				
4.Pollution from spoils deposition				
5.Land use damage				
6.Inadequate operation monitoring				
Total				
E. Other potential environmental problems	No Significant Effect	Significant Effect		
	D1	D2	D3	D4
1.Trerrestrial				
2. Aquatic				
3. Land				
4. Surface water				
5. Atmosphere				
6. Health				
7. Socioeconomic				
8. Aesthetic				
Total				
F. Overall critical review criteria	No Significant Effect	Significant Effect		
	D1	D2	D3	D4
1. Loss of irreplaceable resources				
2. Accelerated use of resources for short term gain				
3. Endangering species				
4. Promoting Undesirable rural to urban migration				
5. Increase affluent				
6. Poor Income Gap				
Total				
G. Realization of feasible enhancement measures	No Significant Effect	Significant Effect		
	D1	D2	D3	D4
1. Adequacy of O&M fundings				
2. Inadequate Operation and Monitoring				
3. Socioeconomic				
Total				

3.3. Key Components of GIS Model

In the Geographic information system for development computer program, generally, there are numbers of key components. Included factors in Geographic information system (GIS) are as follow:

(a) Digital image processing of remote sensing data
(b) Reports and publications
(c) Analog Maps

The Degrees of impacts (D1, D2, D3 and D4) are determined by using a computer program. To use a computer programme, users must use environmental information data and then, decision making of each section and each level should be done systematically. The program logic of GIS is adopted for determining the magnitude of impacts such as D1, D2, D3 and D4. Key components of GIS used in the program are mentioned in Figure 2.3.

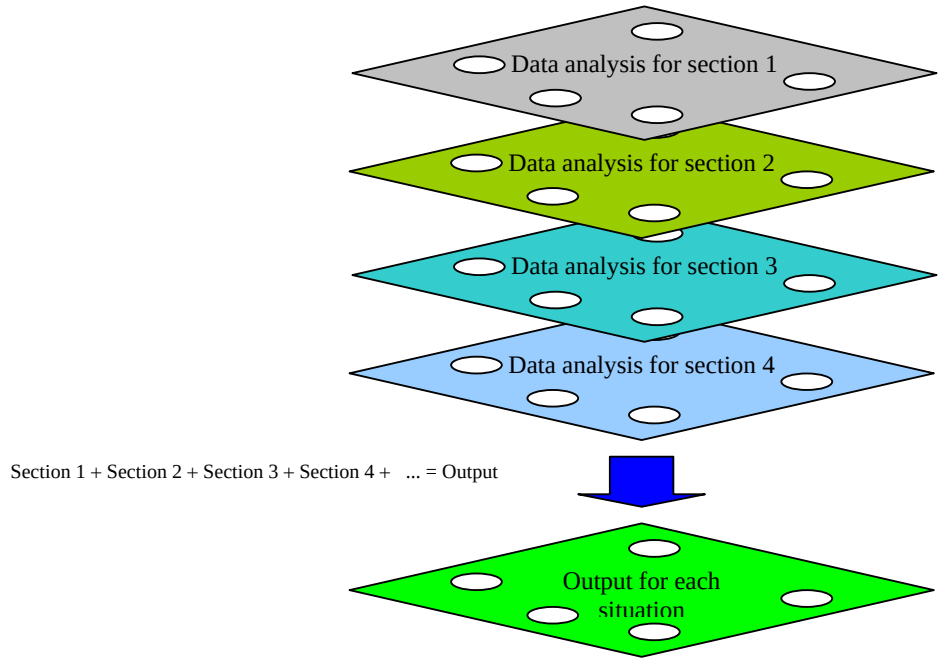

Figure 2.2 Procedure of Data Analysis

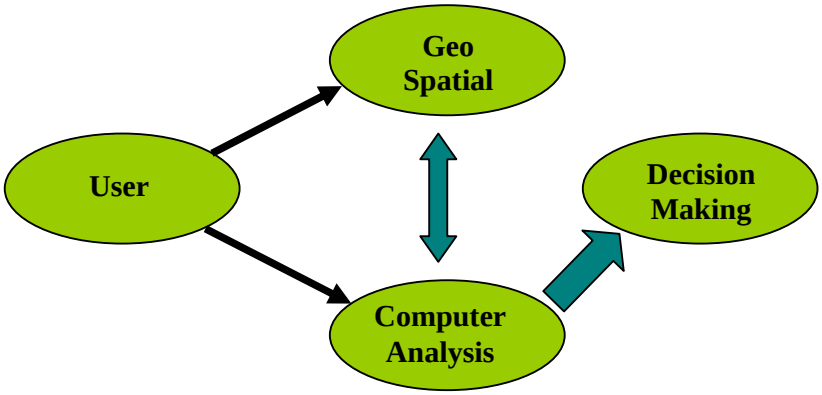

Figure 2.3 Components of GIS Model
Source: University of Moratuwa (2005)

3.4. Logical Sequence of Environmental Development Program

Programme of statistic analysis considered constraints, objectives, and geo spatial data. Functions in the logical sequence used in the program are shown in Figure 2.4.

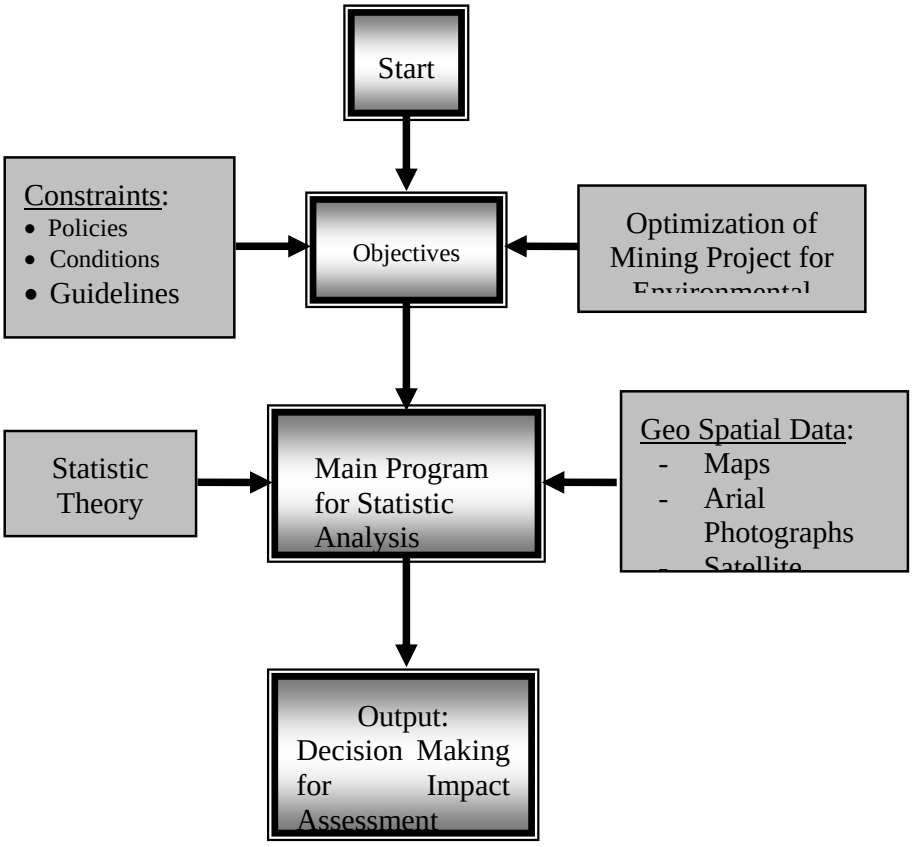

Figure 2.4 Logical Sequence of Program ALTPG for Statistic Analysis

4. Decision Making of Environmental Impact Assessment

4.1. Decision Making of Environmental Impacts Assessment by High Expert Level

Decision making of environmental impact assessment by High Expert level (Level 1) is based on equal weighted value for each action. Rating values of action affecting environmental resources and values (from A to G) of High Expert Level can be calculated by using the program and is shown in Table 2.2. The impact assessment by High Expert level can be clearly seen in Figure 2.5.

The relationship between the numbers and the actions are as follow:

1. means action A (Environmental problems due to project location)
2. means action B (Environmental problems relating to system and design)
3. means action C (Environmental problems during construction stage)
4. means action D (Environmental problems relating to inadequate operations)
5. means action E (Other potential environmental problems)
6. means action F (Overall critical review criteria)
7. means action G (Realization of feasible enhancement measures)

Table 2.2. Description of Action and Rating Value of High Expert Level

Action	Rating
(1) A	28.57
(2) B	39.55
(3) C	32.64
(4) D	31.67
(5) E	30
(6) F	23.75
(7) G	29.17

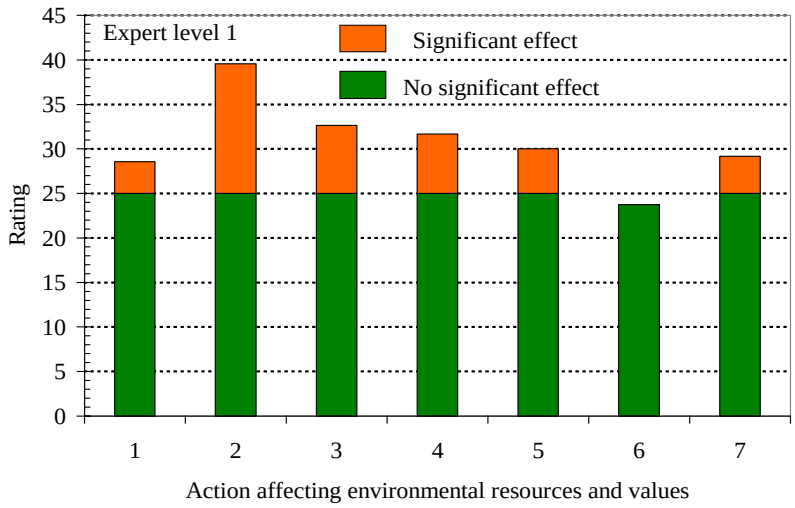

Figure 2.5. Impact Assessment of Level 1for Equal Weighted Action

Figure 2.5 shows that the experts at level 1 decided Kyaukpahote Gold Mine Project had caused significant effects in actions 1, 2, 3, 4, 5 and 7, and it thus means the project needs to make improvements in these areas.

4.2. Decision making of environmental impacts assessment by medium expert level

Decision making of environmental impact assessment by Medium Expert level (Level 2) is based on equal weighted value for each action. Rating values of action affecting environmental resources and values (from A to G) of Medium Expert Level can be calculated by using the program and is shown in Table 2.3. The impact assessment by Medium Expert level can be clearly seen in Figure 2.6.

Table 2.3. Description of Action and Rating Value of Medium Expert Level

Action	Rating
(1) A	26.61
(2) B	25.45
(3) C	20.14
(4) D	22.29
(5) E	21.87
(6) F	20.62
(7) G	15.42

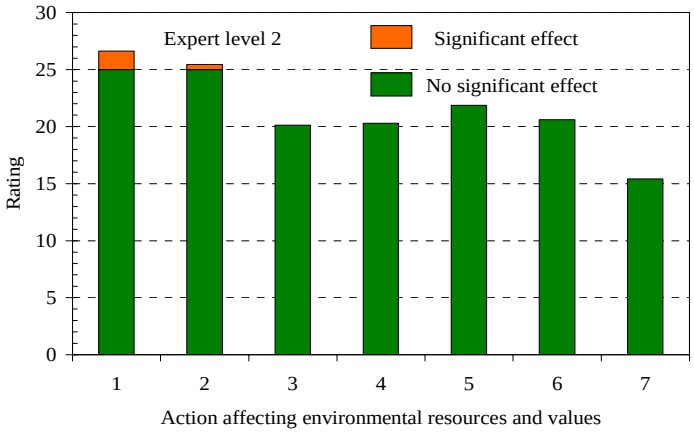

Figure 2.6 Impact Assessment of Level 2 for Equal

Figure 2.6 shows that the experts at level 2 decided Kyaukpahote Gold Mine Project had caused significant effects in actions 1and 2 and it thus means that the project needs to make improvements in these areas.

4.3. Decision Making of Environmental Impacts Assessment by Low Expert Level

Decision making of environmental impact assessment by Low Expert level (Level 3) is based on equal weighted value for each action. Rating values of action affecting environmental resources and values (from A to G) of Low Expert Level can be calculated by using the program and is shown in Table 2.4. The impact assessment by Low Expert level can be clearly seen in Figure 2.7.

Table 2.4. Description of Action and Rating Value of Low Expert Level

Action	Rating
(1) A	26.9
(2) B	28.86
(3) C	22.87
(4) D	23.61
(5) E	27.60
(6) F	12.5
(7) G	12.5

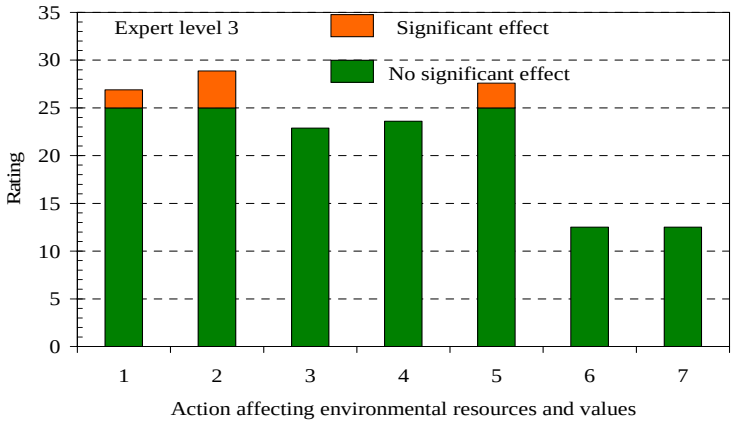

Figure 2.7 Impact Assessment of Level 3 for Equal Weighted Action

Figure 2.7 shows that the experts at level 3 decided Kyaukpahote Gold Mine Project had caused significant effects in actions 1, 2 and 5, meaning that the project needs to make improvements in these areas.

4.4. Environmental Impacts Assessment for Kyaukpahtoe Gold Mine by Total Expert Level

As case study, types of actions from A to G, that can have environmental impacts by Kyaukpahtoe Gold Mine Project, are given the same weight of importance in this program and equal weight has been given to all three levels. If rating is greater than 25, it is decided that this action has significant effect and if the rating is less than 25, this action is decided not to have significant effect In Figure 2.8, the number 1 to 7 represent actions A to G affecting environmental resources and values and from 0 to 35 is referred to rating of environmental impact assessment for each action by the experts at three levels.

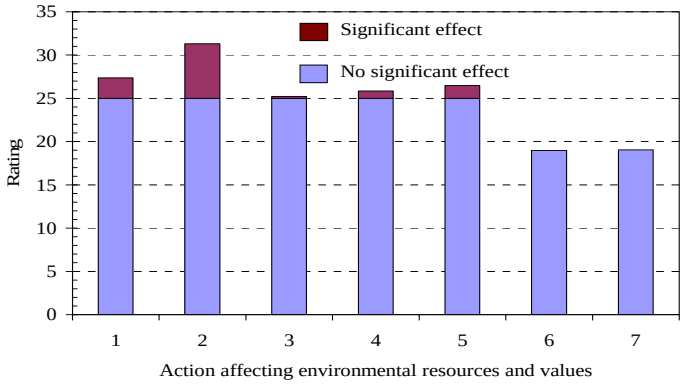

Figure 2.8 Impact Assessment of each Action Affecting Environmental

From Figure 2.8, Kyaukpahote Gold Mine Project needs to improve its system of operation and some mechanical designs throughout the process in mining and metallurgical portions. To reduce the impacts likely to be caused by project location, it is recommended that the mine has to pay special attention to shrinking the tailing pond area, curbing the flows of tailing in cultivated lands and limiting the working boundary.

5. Conclusion

In general, this research is an initial attempt to make environmental impact assessment for a mining project by the help of a computer program. It then necessarily focuses on laying down some management procedures, which would be beneficial to Myanmar mines as guidelines for environmental management guidelines.The computer program has been based on a number of variables such as different actions of a project that could generate environmental impacts, the sensitive changes of opinions in assessing the magnitude of impacts, the possibility of increase or decrease in numbers of related important parameters and the shifting nature of vitality of different actions. The program output presents different degrees of environmental impacts (D1.D2, D3, D4) with statistical basis on a wide range of assessment opinions. The rating graphs simply show which actions have allowable or no impacts and which actions need to be optimized by making appropriate remedial measures. All in all, the public and the responsible personnel in Myanmar mining industry should be more aware than ever before of the possibility and assessment of environmental impacts that the mines may cause. It is strongly recommended that the computer program developed in this research be expanded by imputing more logical and related variables described earlier in this chapter. For this purpose, a team of experts or skillful resource persons has to be formed. The environmental guidelines are to be reviewed and updated regularly in accordance with the progress of environmental policies, laws and community attitudes in the country.

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