

Project Risk Management in Mining

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ABSTRACT : *Every business sector carries some risk and mining anywhere in the world has its own particular set of risks. Mining project activity is subject to high risks because of its size, uncertainty, complexity and high costs. Particularly for international mining projects, risks (political, operational, legal, transportation, marketing, etc.) make decision of investment more complex. Mining projects are commonly implemented in distant locations, which explicate its need for careful risk management. Major mining projects generally have five distinct stages; exploration & discovery, feasibility, planning, production and reclamation. By the timely detection of risks and taking the necessary precautions, it is thought to increase the success of a mining project.*

KEYWORDS -*Investment, Management, Mining, Project, Risk*

I. INTRODUCTION

The word "risk" descends from the Italian "risicare" which means "to dare". The term risk is defined in PMBoK®, from Project Management Institute, as an uncertain event or condition that, if occurs, has a positive or negative effect on project's objectives [1]. Every business endeavor carries some risk and mining anywhere in the world has its own particular set of risks, in the form of commodity prices, engineering puzzles, and geologic uncertainty [2]. Project risk is defined by the Project Management Institute (PMI) as: Project risk is an uncertain event or condition that, if it occurs, has positive or negative effects on at least one project objective, such as time, cost, scope or quality [1]. Risk Management can be defined as the systematic process of identifying, analyzing and responding to project risk. Risk management is a core element of sustainable development. The three pillars of sustainability—social, economic and environmental—present various risks and thereby provide a complex and often inter-related mix of risks and opportunities that mining companies need to address [3].

II. RISK MANAGEMENT

Today, project risk management practices are necessary, as they can provide a systematic process that aims to identify and manage risk in order to act if it arises. In this way, risk management may improve project control, increase the chances of project success, improve communication between project participants, facilitate decision-making and prioritize actions [4]. Risk management assures that

almost all problems are discovered early enough so that there is time to recover from them without missing schedules or overspending the budget [5].

Risk management has five steps;

Risk identification – process of determining risks that may affect the project;

Risk analysis – process of assessing risks'probability of occurrence and impact on project success;

Risk evaluation – process of prioritizing risks based on the probability of occurrence and impact on project success;

Risk mitigation – process of developing actions to reduce the occurrence and/or impact of the negative risks.

Risk monitoring – process of implementing risk mitigation plans, tracking identified risks, monitoring residual risks, identifying new risks, evaluating overall risk management process effectiveness throughout the project [6].

Risk assessment and risk management is about the management of unplanned events. Unplanned events which occur on a mine site, or within the surrounding environment or community, have the potential to impact on the viability of a mine or community. The process of assessing and managing these risks is aimed to reduce possibility of negative events while increasing the possibility positive outcomes [4]. It is expected that during the risk monitoring and control phase, the collection of more data about the risks and about the risk management plans will improve gradually the risk management plan, and establish confidence on risk management practices among the project management team and administration.

Fig. 1 illustrates six processes of risk management and their relationships. Among these processes, RM planning is the starting point of the entire RM procedure. It is generally useful to regulate four successive processes in the core RM cycle to roll forward with management system in the whole project development flow from project inception through design and construction to project completion. RM reporting is the finishing point of the entire RM procedure; it is generally useful to summarize the RM with regular outputs with regard to predefined risk control points and helps organizations to understand current situations and take corresponding measures in their RM practice [7].

The RM procedure summarized in Fig. 1 indicates a normal RM system, which can be led by RM planning and driven by RM reporting. With its forward rolling process engine to implement a core RM circle at different stages of construction project, it is gradually possible to reduce uncertainties and adverse impacts.

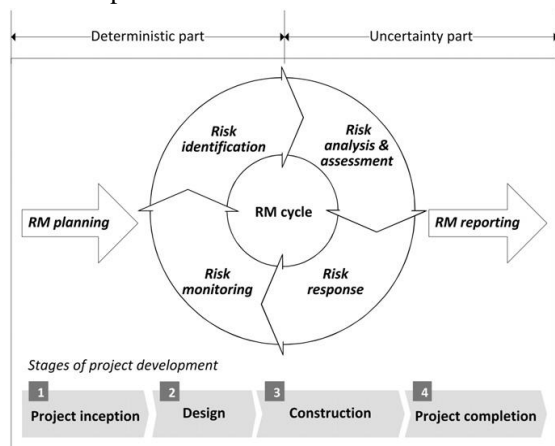


Figure 1. Typical Risk Management Procedure for a Project

III. SEQUENTIAL STAGES OF A MINING PROJECT

Unlike other resource industries, mineral resources are hidden. Finding a deposit worth mining is very difficult. Large areas of land are necessary for mineral exploration. Finding a new ore deposit that can be mined is not quick and easy. Mining companies spend a large amount of money to carry out mineral exploration. They employ geologists and prospectors to gather field data, and utilize satellite imagery, geophysical surveys, and innovative technologies to help make a discovery.

The mining industry operates through a sequence of stages: exploration & discovery, feasibility, planning, production and reclamation (Fig. 2). Exploration can take place in many forms, by both

prospectors and exploration companies, and usually begins with research to select target areas. Once the targets are selected, geological mapping as well as many types of geochemical and geophysical surveys can take place. This type of activity, even in its simplest form, can lead to discoveries of the economic mineral deposits that society requires for much of the raw materials and manufactured products that we use every day. Exploration activity on a property rarely leads to a new mineral discovery.

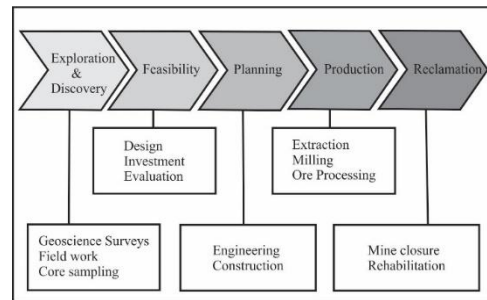


Figure 2. Stages of a Mining Project

Discovery happens when something of value is found. Discoveries rely on good fieldwork, quality geoscience, investment and planning to bring them to the development stage. New discoveries are crucial because our growing society increasingly consumes more manufactured products, and our known mineral deposits become depleted. Very few discovered mineral deposits become producing mines. At this stage permits, leases, and licenses are required and the project may be referred for environmental assessment.

In feasibility stage, if all of these outcomes are favorable and all approvals are in place, the company decides if they will go ahead with the project. At this stage, the company raises money in order to begin construction and develop a mine. This is the most expensive phase of the mining cycle. The production phase includes extraction, milling and processing of raw materials, such as coal, metals, industrial minerals and aggregate. The length of mine life depends on production capacity, total mineable reserve and profitability of the operation. Mine site reclamation and protection of the environment starts at the beginning of a project and continues after closure. Mines must have closure and reclamation plans and are required to post a bond for the estimated cost of reclamation.

IV. PROJECT RISK MANAGEMENT IN MINING INDUSTRY

Every business sector carries some risk and mining anywhere in the world has its own particular

set of risks. Mining project activity is subject to high risks because of its size, uncertainty, complexity and high costs. Particularly for international mining projects, risks (political, operational, legal, transportation, marketing, etc.) make decision of investment more complex. Mining projects are commonly implemented in distant locations, which explicate its need for careful risk management.

The nature of mining can often present a range of uncertainties. Uncertainty arises due to the complex inter-relationships among project, political, legal, economic, business and operational risks. Therefore, these risks of mining must be well identified and managed. Establishing a mine is a very lengthy, expensive and complex process. In Fig 3, it can be seen that risks can occur in different stages of a mine. The list of risks below sets out risks that might arise in any mining project. There are some risks that are common "or especially acute" especially in international mining transactions. For a mining project, it is very clear that the "incorrect mineable reserve" is the highest risk that contributed to project failure. Also inaccurate geological reports, drilling and assay result of exploration bring high risk to mining projects. Political risks must be handled very carefully. Also legal, economic, business and operational risks must be analyzed with all details. These major risks' details can be seen Table 1.

V. CONCLUSION

Mining companies are very complex business enterprises, operating throughout the world. They routinely apply the methods of risk management discussed above. During all stages of a mining project all risks must be well defined and analyzed. It provides succeed of a detailed mining project. No matter how much analytic force a company bring to bear on its risk assessment, the future will remain uncertain until it become the present. Mining companies will therefore always require a certain amount of daring. Additionally, countries must prepare guidelines to assist the minerals industry standardized risk management processes to protect the health and safety of people.

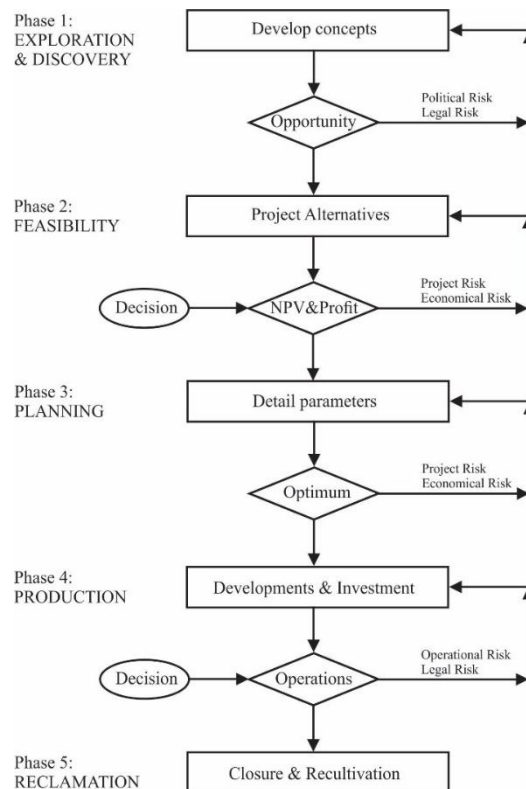


Figure 3. Projects Risks in Different Stages of a Mine

Table 1. Risk Classes in a Mining Project

MAJOR RISK CLASSES				
Project	Political	Legal	Economic	Business & Operational
Mine reserve	Political stability	Environmental aspects	Financial solution	Infrastructure
Technical				power supply
Cost analysis	Reliability	Regulations	Competitive sales price	Manpower
Budget limit	Risk insurance	Legal pressure	Potential of	Skilled labor
Credit viability	Government impose	Forest rules	Supply-Demand balance	Professional management
Feasibility	Work permit	CED activation	Inflation, fluctuation	Working Culture
Environmental treat		Property rights	Investment	Work Safety, precautions
		Tax reduction	Global trade competition	Organisation coordination
			Transportation, location	Replacement
			Marketplace research	Cost control
			Optimum design	Closure, reclamation

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