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Risk Management Practices in the Mining Sector of Ghana: The Case of Goldfield Ltd, Damang

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Abstract
Risk management practice, in developing countries, is at its infant stage and often neglected in most companies. This study focused on the risk management practices of Goldfield Ltd in Damang in the Western Region of Ghana. Questionnaires were employed as the data collection instruments. The study made use of quantitative survey design. All the 41 staff who directly dealt with risk and its management in the company were considered and made part of the study. The breakdown of the 41 staff members used for the study includes 6 Heads of Departments, 10 Superintendent, 10 Supervisors and 15 Contractors. Employing a quantitative descriptive survey design, the result of the study reveals that risk assessment tools used for risk management are probability method, qualitative and decision tools. The recommendations made were to for mine management to place equal attention to all the methods for risk assessment.
Keywords: risk, risk management, safety, mining, Goldfield

INTRODUCTION

In a quest to correct macroeconomic challenges which struck Ghana in the early 1970s, the country had no option than to bow down to the stringent measures of the Bretton Woods. International Monetary Funds (IMF) opted for the adoption of globalization, privatization and liberalization of the economy of Ghana (Agbesinyale, 2003). One of such areas the government of Ghana was advised to liberalize was the mining sector. Large influx of corporate mining companies entered Ghana to operate, not forgetting the small scale mining companies too.

Increased number of mining companies will directly increase mining related risks in Ghana. It is generally accepted that the ability to discern the emergence and management of risk is a prerequisite for organisations and individuals to safely survive and operate. In recent times, Ghana has experienced several risks within the mining sector, causing the death of lots of bread winners of families. As a hazardous operation, mining comes with itself many safety risks to the miner. Globally, mining companies have recorded serious forms of accidents which have resulted in deaths, permanent disability and injuries. This then calls for the protection of labour in the mining sector, because mining accidents affects the families of the victim (especially if he is the bread winner) and the country at large. It has become imperative for governments and management of mines to put in place and constantly maintain high safety standards, through some measures to alleviate safety risk frequency.

The occurrence of mine accidents are intrinsically linked to cost. When mine accidents occur, the mine needs to pay for compensation. The mine may permanently loss key workers, or loose key workers for a very long time due to maiming or disability. The mine, as a way of replacing victims, will spend huge money to educate new workers for replacement. Replacing destroyed equipment, due to mine accident, is also a drain on money. Interruptions, as a result of accidents, together with psychological factors, after mine accidents, also affect productivity. With the advent of technology, direct cost may be estimated accurately. However, indirect cost becomes a challenge to estimate. Indirect cost such as worth of human life cannot be quantified.

Safety and health risk continues to be a challenge to most mining companies located in the developing countries leading to high numbers of serious accidents. Employers are the prime people to ensure safe and healthy working environment, devoid of hazards and threats. Ghana Labour Act, Act 651 (Section 118, sub section 1) emphatically states that: *''*...[an employer's responsibility is to provide a] *...safe and healthy and healthy conditions [for employees]''*.

PROFILE OF GOLDFIELDS LTD, DAMANG

Goldfields Ltd, Damang is located in southwestern Ghana near the southern end of what is commonly referred to as the Tarkwa Basin, 300 kilometers by road west of Accra, the capital of Ghana. The mine exploits oxide and

fresh hydrothermal mineralisation in addition to Witwatersrand-style palaeoplacer gold. The hydrothermal mineralisation is located in Tarkwaian sediments and is the only deposit of its kind located on the eastern side of the Ashanti Belt in south-west Ghana. Damang's main ore body is located close to the closure of an antiform, while all other known palaeoplacer mineralisation is located on the eastern and western limbs of the anticline. Since its existence, the mine has faced a lot of safety risks of different levels and kinds. It is in the light of this that this study was embarked to unearth the safety risk management practices by the company.

OBJECTIVE

The general objective of the study is to assess the risk management practices in the mining industry with specific reference to Goldfields Ltd in Damang. Specifically, the study achieved the following sub-objectives:

- To evaluate the risk management strategies of Goldfields Ltd, Damang mine;

LITERATURE REVIEW

Risk Management Process

Occurrence of risk is unavoidable, however, impact related to risk can be managed to a considerable levels (Latham, 1994). Known ways to management risk spans from: minimized risk, shared risk and transferred risk. This underscores the need for an effective risk management system. For simplicity, risk management process has been presented in Figure 1.

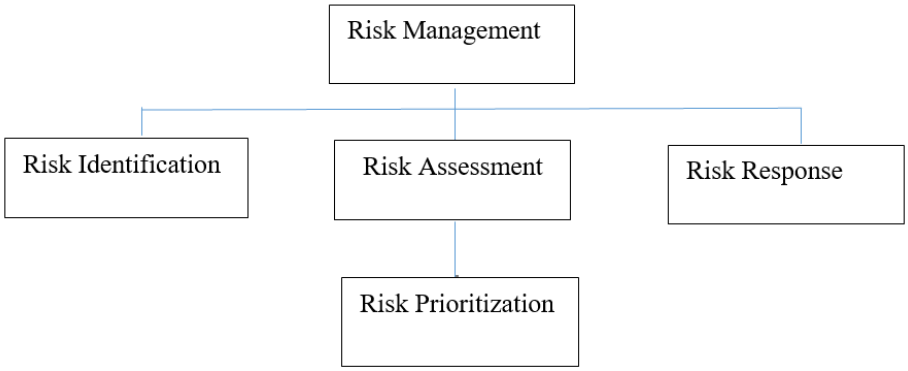

Figure 1: Risk Management Process
(Source: Adopted from Ejohwomu, 2014)

Figure 1 depicts the risk management process. From Figure 1, risk management has three levels: risk management, risk identification, assessment and response, and risk prioritization. The first level Risk Management, deals with the prioritization of the actual risk. At this level, the principal strength and weakness of known procurement models are tested against the cost of project contingencies. Examples of these contingency include lack of management control, poor definition and unclear linkage between risks and overheads. The second level of the risk management process covers risk identification, assessment and response. In particular, the risk analysis and management process is continuous and iterative. It starts with a project briefing that helps in identifying the risk, as well as, assessing the risk exposure. The third level Risk Prioritization, is concerned with the process of reiteration. This level ensures the process is repeated at every phase of the construction project (Thompson & Perry, 1992).

Definition of risk

Risk is defined in several ways, thus have no single definition, probably because the perception of risk varies from person to person and organization to organization. According to Holton 2004, risk is the exposure to a proposition of which one is uncertain. This is reiterated by Anonymous (2008), which defined Risk as an uncertain event or condition that, if it occurs, has an effect on at least one project objective. The mining industry is full of risks due to its unique activities; which are abominable environment, long period of work, financial intensity, complicated processes and dynamic organization structures (Smith, 2003).

Methodology

The study adopted the quantitative methodological approach (Kothari, 2004). This quantitative approach follows the scientific approach in conducting research where phenomenon is believed to exist devoid of the researcher. Thus there is the need for the researcher to distant him or herself from the objects researched. It also has a laid down approach for conducting the scientific enquiry.

Subject to this approach, the study adopted the quantitative survey design. To Gray (2014) a survey involves a detailed description and supported by quantified described population. This involves systematic data

collection through methods such as observation, interviews or questionnaires. The study made use of quantitative descriptive survey. Data was collected from a precise sample of Goldfields Ltd, Damang mine staff who deals with risk management. All the 41 staff who directly deals with risk and its management in the company were considered and made part of the study. The breakdown of the 41 staff members used for the study includes: 6 Heads of Departments, 10 Superintendent, 10 Supervisors and 15 Contractors. The result of the Cronbach alpha was 0.75 making it acceptable within research confines (Pallant, 2005).

Primary data was collected with the use of questionnaires. Likert Scaling tool for data analysis was employed in this study. Scale of 1 to 5 was provided for respondents to rank their views on certain issues. The meaning attached to the ranking of 1 to 5 was provided on the questionnaire used for the study as shown in Appendix A. Relative importance index was used to rate the responses.

Frequencies were attached to the responses provided by the respondents for the study. The frequencies were multiplied by its corresponding ranking values (that is 1, 2, 3, 4 and 5) for each factor (W). Relative importance index was calculated using the formula in Appendix A.

ANALYSIS AND DISCUSSION

Risk Management Practices of Goldfields Ltd in Damang

This section presents information on risk management strategies of Goldfields Ltd, Damang mine. As presented in Figure 1, the study analysed the risk management practices of Goldfields Ltd, Damang mines from three dimensions. These dimensions captured risks from ‘‘strategies for risk identification’’, ‘‘risk assessment’’ and ‘‘risk response strategies’’. This study compiled all the risk management strategies, under the three dimensions presented above, practiced by Goldfields Ltd, Damang mines and presented them in this section. The details have been presented in Tables 1, 2, 3 and 4. Scaling, with the support of Relative Importance Index (RII), was employed, as an analytical tool, to assess responses in order of importance (rank) the risk management strategies that are practiced in Goldfields mines in Damang, Western Region of Ghana.

Table 1: Risk Identification Strategies of Goldfields Ltd, Damang

Identification of risk-techniques used	1	2	3	4	5	Sum	∑W	RII
Check list	0	0	0	16	25	41	189	0.92
Visiting of sites	0	5	0	10	26	41	180	0.88
Brainstorming	1	11	7	13	9	41	141	0.69
Using previous risk data	0	12	2	27	0	41	138	0.67
Case-based approach	0	16	10	8	7	41	129	0.63
Falling on consultants for expert advice	3	26	3	9	0	41	100	0.49

Source: Field Data, 2017

Risk management practices of Goldfield Ltd, Damang mine, was analysed using the framework in Figure 1. Thus, the study addressed risk management from three dimensions: risk identification, risk assessment and risk response. Questionnaires were designed to elicit information to answer or address all these three issues in Goldfields Ltd, Damang mine. The study on risk management begun with risk identification (Table 1).

Check list and visiting of project site were the major risk identification methods. Brainstorming, using previous risk data and case-based approach were the next important methods employed for risk identification. The least method used, according to the respondents, was the use of consultants for expert advice. Further information is presented in Table 1.

In a similar study, using constructions projects, (Ejohwomu, 2014), identifies brainstorming, site visiting and consultant use as the major risk identification strategies employed within the Nigerian construction industry. This result is similar to this study. However, the third option, (which is the use of expert advice through consultants), is hardly used in Goldfields Ltd, Damang mine in the western region of Ghana.

On the tools for assessing risk in Goldfields Ltd, Damang mine, various tools were outlined. These include the probability tool, the decision tool, risk premium, decision tress and Monte Carlo simulation. Other tools includes quantitative, qualitative, expert consultations and semi-qualitative. The result of the calculations has been presented in Table 2a and Table 2b. The breakdown of the Table 2 into two parts ‘‘2a’’ and ‘‘2b’’ made the analysis very simple.

From Tables 2a and 2b, probability tool were considered the most important tool for risk assessment. This was followed by qualitative approach (Table 2b) and decision tools (Table 2a). The rest, in order of importance, were experience and sensitivity.

Table 2a: Tools for Assessing Risk at Goldfields Ltd, Damang

Tools for assessing risk	1	2	3	4	5	sum	∑W	RII
Probability	0	3	0	20	18	41	176	0.86
Decision analysis	2	4	5	14	16	41	161	0.79
Institution/experience	0	7	4	16	14	41	160	0.78
Sensitivity	5	2	2	18	14	41	157	0.77
Risk premium	4	12	8	17	0	41	120	0.59
Monte Carlo	18	4	16	3	0	41	86	0.42
Algorithm	18	7	11	5	0	41	85	0.41

Source: Field Data, 2017

The least risk assessment tools used, from the survey, are the Monte Carlo simulation (Table 2a), Algorithm (Table 2a) and the Computer software /modelling tools (Table 2b).

In evaluating risk assessment strategies of construction firms in Nigeria, Ejohwomu (2014) made the following observations from a survey. These are: Qualitative, expert consultations and decision analysis was the frequently used risk assessment tool. This result is close to this study, which had only one most frequently used risk assessment tools (qualitative), which is also used mostly in the construction industry in Nigeria. The least used risk assessment tools were algorithm and Monte Carlo simulation (Ejohwomu, 2014). The same was confirmed for this study.

Table 2b: Additional Tools for Assessing Risk at Goldfields Ltd, Damang

Methods for analyzing effects of risk	1	2	3	4	5	sum	∑W	RII
Qualitative	0	5	3	22	11	41	162	0.79
Expert consultation	0	16	6	12	7	41	133	0.65
Semi-Qualitative	2	13	11	11	4	41	125	0.61
Quantitative	2	21	2	10	6	41	120	0.59
Computer software/modelling tools	10	15	0	13	3	41	107	0.52

Source: Field Data, 2017

The study further reports risk response (Table 3) and monitoring (Table 4) methods. The results proves that risk consequence reduction, insurance and reducing the likelihood of risk occurrence were the response measures of risk used in the mining company (Table 3). Periodic risk status reports were the major risk monitoring methods at Goldfield Mines in Damang (Table 4).

Table 3: Measures for Responding to Risk at Goldfields Ltd, Damang

Risk response	1	2	3	4	5	Sum	∑W	RII
Risk consequence reduction	0	3	9	11	18	41	167	0.81
Insurance	0	5	5	15	16	41	165	0.80
Likelihood of occurrence reduction	0	1	10	17	13	41	165	0.80
Risk retention	0	10	8	18	5	41	141	0.69
Contingencies	4	8	6	19	4	41	134	0.65
Risk transfer	11	8	12	4	6	41	109	0.53

Source: Field Data, 2017

Table 4: Methods for Monitoring Risk at Goldfields Ltd, Damang

Methods for monitoring risk	1	2	3	4	5	Sum	∑W	RII
Risk status report: Periodic	0	2	5	11	23	41	178	0.87
Trend reporting: Periodic	0	0	5	15	21	41	180	0.88
Document review: Periodic	0	8	2	12	19	41	165	0.80

Source: Field Data, 2017

CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

Risk management strategies (risk identification, assessment and response) employed in Damang mines, in order of importance, includes:

For risk identification

- The use of checklist, visiting of site, Brainstorming and the use of previous risk data are the common methods mostly used for risk identification. From Table 1, checklist recorded an RII of 0.92, visiting site recorded RII of 0.88, Brainstorming recorded an RII of 0.69 and using previous risk data recorded RII of 0.62.
- The least method used for risk identification is the falling on expert advice, which recorded an RII of 0.49 (Table 1).

For risk assessment

- The risk assessment tools mostly used by Goldfields mining company are: the probability, qualitative and decision tools. From Table 2a and Table 2b, Probability recorded an RII of 0.86, qualitative recorded RII of 0.79 and Decision Tools recorded an RII of 0.79.
- The least used tools are the Monte Carlo and algorithm tools. From Table 2a, Monte Carlo recorded an RII of 0.42 and Algorithm recorded an RII of 0.41)

For risk response

- The methods mostly used to respond to risk includes risk consequence reduction, insurance and likelihood of occurrence reduction. Risk consequence reduction recorded RII of 0.81, insurance recorded RII of 0.80, and Likelihood of occurrence reduction recorded RII of 0.80 (Table 3).

Conclusions

Being an old profession with great number of risks, fatalities and deaths, mining risks continues to attract attention due to its high levels of disasters. Mining risk, fatalities and death has resulted in family breakdown. This study has provided an overview of the state of risk management within the corporate mining industry in Ghana, with focus on Goldfield, Damang mines, in the Western Region of Ghana. The study has provided the picture of the risk management practices as it pertains in the mines. It was observed that rigorous methods for assessing risks were less employed in the risk management practices of the mines. Specifically, tools like Monte-Carlo, algorithm, quantitative and computer modelling techniques, which are efficient in giving accurate quantities of risk and making a reliable prediction of future risk were less employed. If risk is considered as unforeseen phenomenon and present in every activity of the mine, it is important that all methods, quantitative and qualitative risk assessment, are given equal consideration. However, as the information stands, this is not the situation in Goldfields Damang mines.

Risk management practices at the mines are rigorous. Risk identification tools employed (From Table 1, checklist recorded an RII of 0.92, visiting site recorded RII of 0.88, Brainstorming recorded an RII of 0.69 and using previous risk data recorded RII of 0.62.) are strong together with the risk assessment (From Table 2a and Table 2b, Probability recorded an RII of 0.86, qualitative recorded RII of 0.79 and Decision Tools recorded an RII of 0.79) and the response tools (Risk consequence reduction recorded RII of 0.81, insurance recorded RII of 0.8, and Likelihood of occurrence reduction recorded RII of 0.80, Table 3). Most of the least used risk assessment tools such as Monte Carlo and the algorithm (Monte Carlo recorded an RII of 0.42 and Algorithm recorded an RII of 0.41, Table 2a) should be given equal attention and it use intensified. Since they are good tools which can help the mining company to assess its risks accordingly.

Recommendations

- Management of Damang mines should integrate all the risk management strategies of all the departments in Goldfields mines, Damang;
- Management of Damang mines should put down mechanisms to monitor and control risk in Damang mines;
- Monte Carlo and Algorithm tools should be considered and its use intensified by the management of the mining company.

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APPENDICES

Appendix A: Calculation of the Relative Importance Index (RII)

$RII=\frac{\Sigma W}{A \times N}$, $(0 \leq RII \leq 1)$

Where:

W – Is the weight respondents' attached to a question (options ranges from 1 to 5)

Sum of weights = W1+W2+W3+ W4+W5

The meanings attached to the weights (1, 2, 3, 4, and 5) have been provided on the data collection instrument

A – The highest weight (in this case is 5 in this case) and;

N – Is the sample size