

A Decision can be a Disaster: A Descriptive Analysis of a Case Study

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Abstract

Decision making is one of the important activities in every industry and it becomes more important in safety critical industry like mining, chemical, aviation etc. The success of an industry is critically linked with its effective decisions and decision-making process. In this paper, authors explain how a decision can be a disaster. One case study disaster due to the wrong decision in Indian scenario is analyzed and discussed. The gaps and weakness in the decision-making process are identified and lessons learned. Towards the end, a hybrid concept of decision making has been suggested in the hope of preventing similar future disasters.

Key words: Accident; Disaster; Man-made disaster; Root cause; Decision making process

1. INTRODUCTION

When we compare mining industry with other industries, the mining industry and related energy resource industries are associated with high rates of occupational injuries and fatalities including disasters (Sari et al., 2009; Groves et al., 2007; Donoghue, 2004). The workplace in a mine is not fixed as like other industries, rather it moves and change with time so mining is a hazardous profession and considered as war against the unpredictable forces of nature. As a result, the mining industry continues to be associated with a high level of accidents, injuries, and illness. Major accidents and disasters in Indian mining industry are still continuing at some disturbing rate (Dash et al., 2014; 2015-b; 2016a; Bhattacharjee et al., 2014). All of us know that most accidents in the workplace result from unsafe work behavior. An accident is a result of multi-failure in the system. Usually accidents are caused by

major sources. The first source contains totally exogenous factors such as bad weather, hurricanes, tsunamis, earthquake or other types of forces which cannot be control by man or management and goes under “Natural disaster (Acts of God)” and second source, includes human factors such as incompetency, poor judgment, poor working condition, poor maintenance of equipment and/or the negligence of the operators, poor workplace inspection, poor supervision which will lead to a so-called “Man-made disaster” (Park, 2010).

A disaster can be a natural one or man-made like disaster due to rain, wind storms, flood, earthquakes, volcanic eruptions etc. that goes under natural disaster whereas disaster due to wrong decision (poor judgement, choosing wrong equipment, person, place, poor management plan, poor safety culture etc.), water (broken pipes, leaking roofs) building deviancies (structure, design, environment, maintenance) etc. are man-made. All the disasters cannot be possible, in other words it may not be possible to prevent natural disasters but we can take some preventive measures against man-made disasters to eliminate or reduce its effect. But we can eliminate (if possible) or reduce the effect of man-made disaster. During this study we reviewed and analyzed several investigation report of different level of accidents such as incident, accident, major accident and disasters in India. Indian coal mining industry experienced a number of disasters (Topa coal mine disaster in 1982, Bhatdee in 2006, Anjan Hill in 2010) in past due to poor judgement, wrong decision, Less Than Adequate (LTA) safety barriers etc. We observed that the Less Than Adequate (LTA) decision making process (such as ineffective plan, poor judgment, poor decision, risk taking behavior without proper risk assessment etc.) was the turning point of that incidents / accidents / disasters. “How a wrong decision or judgment can be a disaster?” to answer this question a disaster have been reviewed and analyzed as a case study. To better understand the case study disaster, brief description, identified causes and recommendations of the disasters is provided as per the published Report of Court of Inquiry. Then a gap analysis is conducted to identify the gaps and weakness in decision making process and the failures to learn from the past.

2. LEARNING FROM PAST IS NECESSARY

From here if we look back to our past we found a number of disasters due to failure in equipment, technology, procedure, method, management etc. in different high risk industries like nuclear plant, aviation, mining, chemical industry etc. including the Fukushima nuclear power plant (2011), Deep water Horizon oil rig explosions (2010), the AF447 flight crash (2009), Longmei Mine (2009), Xinyao coal mines (2007), the BP Texas City (2005), the Columbia shuttle explosions (2003), and few decades ago, Piper Alpha (1988), Chernobyl (1986), Challenger (1986), Bhopal (1984), Chasnalla (1975), Prince of wales mines (1966) and Honkeiko colliery (1942) (Rasmussen and Batstone, 1989, Dash et al., 2016a, 2016b). From the incident/accident we know the level of our safety standard. We can also learn from incident/accident. Thus “learning from incident/accident/disasters” is emphasized in this article, and by the reactions that one could make incident/accident/disasters as an ideal case study for specific

causes to prevent the reoccurrences.

3. HISTORY OF INDIAN COAL MINING INDUSTRY

According to Directorate General of Mine Safety (DGMS, 2016), there were 218 major accidents (accidents with 4 to 9 fatalities per accident) and 60 disasters (accidents with 10 or more fatalities per accident) occurred due to different causes like roof fall, inundation, explosion, fire etc. in Indian coal mines between 1901 and 2016. Out of these 60 disasters there are 25 disasters only due to explosion, 18 cases belongs to inundation, 11 disasters contributed by roof fall/side fall, collapse of pillars, 3 disaster from fire and rest 2 disaster because of other causes like air blast, rope and chain breaking in the shaft etc. This can be evidenced by the major accidents including disasters are the function of those 4 causes which repeat time to time and play a significance role from 1901. Indian coal mining industry alone has experienced 278 major accidents including disasters killing 2223 persons from 1901 to 2016 due to some specific regions like Roof fall/side fall, Explosion, Inundation, Shaft accidents, Fire and Others causes which accounts 58.6%, 14.02%, 11.87%, 7.19%, 1.43%, 6.83% of the total accident respectively.

4. CASE STUDY DISASTER: THE TOPA ROOF FALL DISASTER IN 1982 KILLING 17 WORKERS

4.1. Brief Description

The accident occurred during depillaring of Seam VIII B (2.58m) in panel D having a parting of less than 15m below the top seam. When the Mining Sirdar asked the loaders to collect the coal lying scattered inside the unsupported goaf and load their tubs, some of the loaders hesitated. Others protested, saying that they would not like to take the risk. When the loaders refused, the Mining Sirdar threatened and himself went into the goaf and stood there saying that the roof had not come down so long and was unlikely to fall. After that, seeing the Mining Sirdar himself standing inside the unsupported goaf, some of the loaders ventured into the goaf and started collecting the scattered coal. Others followed them. The loading work had thus been going on for 10 minutes. All of a sudden and without any apparent warning, a large mass of shaly sandstone roof came down from the unsupported goaf and fell over the workers, including the Mining Sirdar. All the 17 people including the Mining Sirdar died.

4.2. Identified Causes (statutory inquiry)

The accident was on account of an error of judgment of Mining Sirdar not consulting superior authority before taking decision of compelling workers to work under unsupported goaf area (violation of CMR, 1957). The following causes were identified by the Investigator during the investigation.

1. Management was fully responsible for the accident for the reason that for more production it adopted several illegal, unscientific and dangerous method of coal extraction.
2. Violation of different provisions of the CMR, 1957.

4.3. Recommendations as per the Statutory Inquiry

Following are the recommendations made by the Court of Inquiry against the Topa coal mine disaster.

1. The management should take care of the safety and they have to take care of his own all possible actions.
2. There should be for each area an area planning officer and one safety officer for safety of the mines.
3. The management should appoint a work man inspector.

4.4. Gap Analysis of Topa Investigation

The direct causes and the root causes in the above disaster were identified using the Accident Causation Tree (ACT) analysis technique as shown in figure 1. The disaster resulted in loss of 17 lives because of occurrence of roof fall while the loaders were collecting coal (wrong decision to collect coal under the unsupported roof). Presence of work persons in that unsafe area was due to poor judgment of sending workers to unsafe area without proper risk assessment (Organisational Failure), wrong decision to forcing them to work (Organisational Failure), poor culture about production pressure and lack of culture of risk assessment prior to taking any critical decision (Organisational Failure).

From the analysis of accident investigation report it is observed that only the direct causes like wrong judgment of Mining Sirdar, poor culture about the production were identified as the cause of the accident.

Had the investigator asked the following questions during the investigation, such contributory factors could have been identified.

1. Why the Mining Sirdar failed to identify the potential hazards?
2. Why the views of workers (loaders) were overruled and ignored?
3. The role and responsibility of higher authority and Mining Sirdar was not examined during the investigation before fixing responsibility.
4. Whether or not there was any documented procedure for such unsafe work.
5. Was there any procedure for separation like "NO GO ZONE" for high risk work place?
6. Was there any procedure/practice regarding "Self-withdrawal" of workers from unsafe workplace?
7. Whether there was any history of similar accident in that mine?
8. Whether such incidents were investigated and recommendations were implemented in that mine?
9. Whether or not there was dominance of production pressure over safety leading to risk taking attitude to work in unsafe conditions.

As a result no recommendations were made to improve the system based safety of the mines which could have prevented this type of accident.

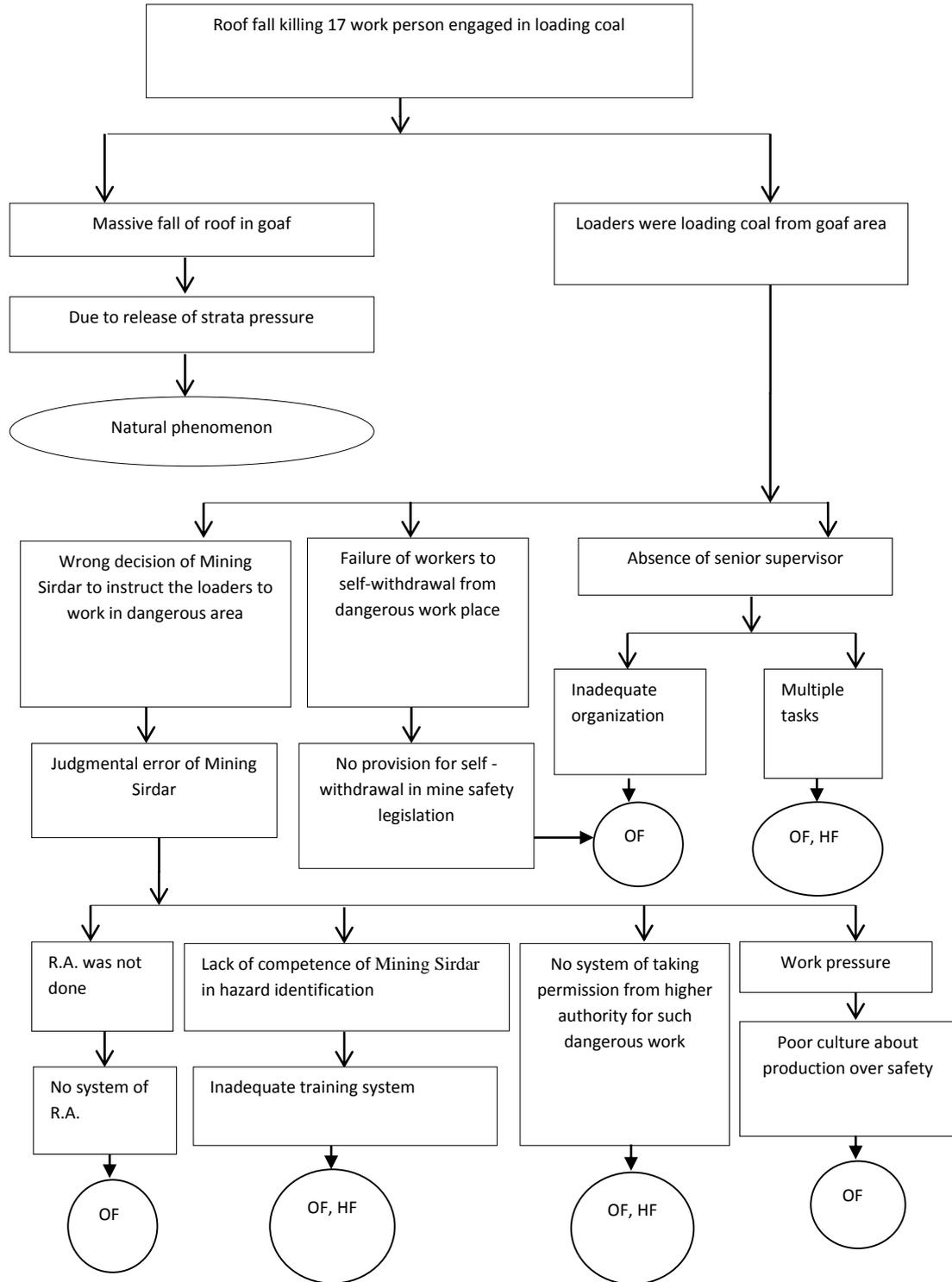


Figure 1: Accident Causation Tree of Topa Coal Mine Disaster

(Note: RA: Risk Assessment, OF: Organizational Failures)

After identification of all possible causes of the accident by using RCA technique, a comparison between the causes identified by the statutory inquiry and the causes identified through application of RCA technique, reveals that

- As per the statutory inquiry, the accident took place due to (1) judgmental error of Mining Sirdar, i.e. not consulting superior authority before taking decision of compelling workers to work under unsupported area in goaf (violation of CMR, 1957) (2) poor management culture of violating rules and adopting illegal, unscientific and dangerous method of coal extraction, and (3) violation of different provisions of the CMR, 1957.
- However, the possible/potential causes identified by application of RCA technique are (1) Poor management culture of thrust on production over safety, Lack of permit system for high risk work, Lack of competence of Mining Sirdar in hazard identification, Absence of culture of risk assessment and Tolerance of risk taking attitude of supervisors led to wrong decision of Mining Sirdar to instruct the loaders to work in dangerous area; (2) Failure of the work persons to withdraw them-selves from dangerous work place to a place of safety due to lack of provision for self-withdrawal in mine safety legislation and absence of senior supervisors at work place.

From this it can be observed that the root causes of the disaster was the wrong decision and wrong judgment. Organizational failure like lack of availability of procedure related to decision making, lack of competency, Less Than Adequate (LTA) risk assessment etc. were found as the root latent causes of the root causes. There is no such standard method or procedure available in Indian mining industry which can guide in making decision. Therefore Indian mining industry need a standard method or procedure. Some standard method are reviewed and an approach is made in following paragraphs.

4.5. Accident Causation Pathway

To give a clear view about the case study disaster accident causation pathway diagram has been plotted based on the above analysis and the identified root causes, are presented in figure 2. This figure shows how one or more causes led to other causes and finally led to the failed defenses resulting in the catastrophic disaster with a time line. For example, Organisational Factors like absence of decision making procedure, absence of culture of risk assessment, Less Than Adequate (LTA) competency resulted in to Wrong decision / Wrong judgment (Mining supervisor's instruction to collect coal) and which compelled the workers to present (loaders) at that area.

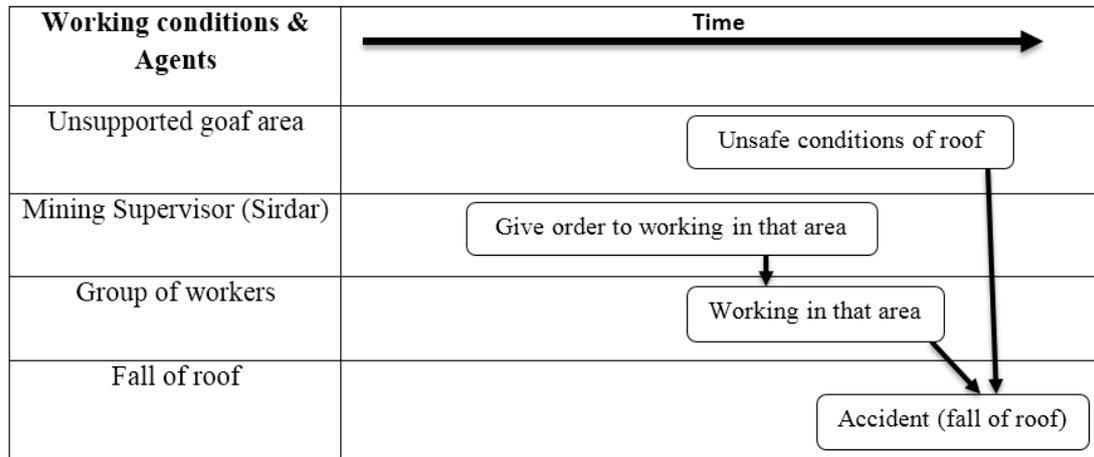


Figure 2: Accident causation pathway Diagram of the case study disaster

5. A DECISION CAN BE A DISASTER

As we all know that an incident/accident is a result of multi-level failure within the system and it can be control in a by taking suitable action against the causes. In the above case study the fall of roof (goaf movement) was a predicted work conditions and uncontrolled one, but the wrong decision of mining supervisor (i.e. order to work in such hazardous conditions) could have been controlled, which ultimately led to the disasters. In other words we cannot change the way of natural occurrences but we can change the workplace within which the workers are work. In this case if that single decision was taken after risk assessment and taking advice of other including higher authority then the disaster could have been avoided. As per investigation report (DGMS Report) only the mining supervisor was held responsible for such risky decision but no one try to find the answer of “why he (mining supervisor) has taken such risky decision”. When we analyzed this question we found several factors which might be influenced the mining supervisor to take such decision that are:

- It is unfair to say that the mining supervisor was not identify the risk or hazards in that unsupported goaf area as mention in the investigation report, but it might be possible that the risk taking behavior of mining supervisor allow him to take such risky decision knowingly (collect coal under unsupported goaf area).
- Negative motivation motivating him (mining supervisor) to take such risky and hazardous decision.
- Mining supervisor does not follow the rules and norms at the time of taking decision and giving instruction.
- There is no such system in the system to interfere while violation of rules.
- Lack of decision making procedure.

- This type of thing is not a one day program. It is simply a tradition and poor culture of the system.

We can observed that this disaster was entirely because of a single decision which was taken wrongly by the mine Supervisor. When we conclude that this disaster is centered about a wrong decision/wrong judgment, then we should focus in improving the quality of decision making.

6. Decision Making Process

As per Webster dictionary a decision is defined as “a conclusion arrived at after careful consideration”. Through a decision we can transfer our internal thought process (prediction) to external action (Lapin, 1994). Decision is an event that occurs (Carlisle, 1979), a conscious choice to behave or to think in a particular way in a special situation (Duncan, 1973). Decisions are important as that directly affects the goals with its implementations (Vasilescu, 2011). Making a decision is not a difficult job; generally it is assumed that all decisions lead to some results that at least reduce the current issues. But sometimes it is more preferable not to act, instead of doing things in a wrong way, with unexpected consequences (as happened in the above case study). Effective decisions depend upon a better understanding of the problem and its consequences with the surrounding. In day-today-day life various decisions were made by us. Among that some have minor consequence, while others are having a huge consequence and with a great impact in our life.

In a complex system such as mining industry and its fast changing working environment, making decision becomes a challenge for all mine workers. They have to make decisions even if they are not willing to do so (Al-Tarawneh, 2012). Decision-making is inevitable, because to explicitly avoid making a decision is in itself to make a decision (Pearce II and Robinson, 1989). When many decisions are made in a small span of time about an unfamiliar problems then automatically it introduce a new element into management system, forcing executives already nervous in unpredictable environment to make more and more decisions and at a faster and faster pace (Toffler, 1980). Today the hardest part of managing an organization smoothly is making the appropriate decision (Mark, 1997). Decision may either programmed or non-programmed (Simon, 1977), generic or unique (Drucker, 1956), routine or non- routine (Mintzberg et al., 1976) and certain or uncertain (Milliken, 1987). Once the decision making panel (higher authority) finds out a suitable alternative for the problem and knows how to implement it, then it is easy to achieve the defined goals and objectives but at the same time getting to that point can often be a so long, complex, and challenging process. And it becomes more difficult when the most preferred alternatives are infeasible (Nutt, 1998).

In this study authors try to answer of three “How”, “*How a decision can be disasters*”? “*How decision should be made?*” and “*How we can improve our*

decision making skill?” Decisions may be long term or short term, highly unstructured, complex and risky having a great impact on the future of the organization (Al-Tarawneh, 2012). In making decision and its implementation, usually top management plays a significant role (Hofer and Schendel, 1978). These decisions influence organizational direction, administration, and structure (Christensen et al., 1982). It is more important point to consider that, a decision by an organization can affect both organization and surrounding (society) at a time (Colignon & Cray, 1980). A large number of researches have been carried out on decision-making process in past (Amason, 1996). One branch of these researches has focused on the decision-making process and the factors affecting the process (e.g. Fredrickson, 1985; Miller, 1987; Eisenhardt & Bourgeois, 1988; Fredrickson & Iaquinto, 1989; Hill & Tyler, 1991; Dean & Sharfman, 1993; Priem et al., 1995; Smith & Hayne, 1997; Van Bruggen et al., 1998; Papadakis et al., 1998; Al-Tarawneh, 2012).

6.1. Method for Decision Making

The decision making process include three phases (Drucker, 1956; Simon, 1965; Archer, 1980).

1. The intelligence phase
2. The design phase, and
3. The choice phase

But According to Newman (1971) suggested a five-step for decision-making process that is (1) Recognition of a situation that requires a decision, (2) Identification and development of alternative courses of action, (3) Evaluation of the alternatives, (4) Choice of one of the alternatives, and at the end (5) Implementation of the selected course of action. Again Mintzberg et al. (1976) upgraded decision making process by describing the process in three different phases as (1) The identification phase: opportunities, problem, and crisis are recognized and relevant information is collected and problems are more clearly identified, (2) The development phase: alternative solutions to problems are generated and modified, and (3) The selection phase: alternatives are analyzed and scanned, and an alternative is chosen

Baker et al. (2001) state that decision making starts with the identification of the problem with a specific goal, then, a general decision making process should be a combination of the following steps (Baker et al., 2001).

Step 1: Define the Problem

Step 2: Determine Requirements

Step 3: Establish Goals

Step 4: Identify Alternatives

Step 5: Define Criteria

Step 6: Select a Decision Making Tool

Step 7: Evaluate Alternatives against Criteria

Step 8: Validate Solutions against Problem Statement

6.2. A Hybrid Concept of Decision Making

After reviewing all past research on decision making process it may be concluded that the process are different having a common theme in it. Finally a hybrid concept of decision making is suggested to make a decision more accurate and effective.

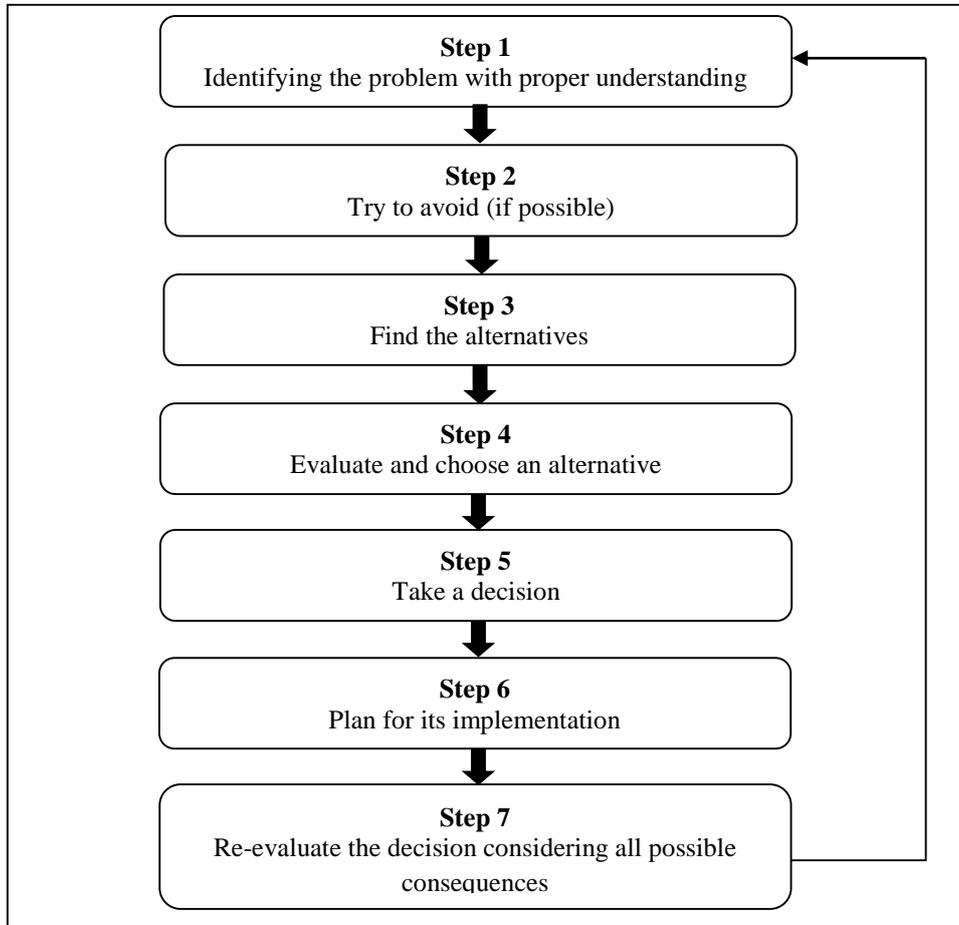


Figure 3: Step for decision making process

The figure 3 shows steps of hybrid model of decision making process. It involve of seven step as (1) Identification of the problem, (2) avoiding the problem (if possible), (3) Finding the alternatives, (4) Evaluating and choosing the best suitable and effective alternative among all, (5) Taking decision, (6) Planning for its implementation and at the end (7) Re-evaluating the decision considering all possible consequences. Each step is described in detail in the following paragraphs.

6.2.1. Identified the Problems with Proper Understanding

Every industry/organization exists to achieve certain goals within a certain period of time, such as increase production, increase safety standard etc. Within the industry/organization, each department has goals. Establishing these goals becomes the basis for identifying problem areas, deciding on courses of action, and evaluating the decision outcomes. A decision is said to be effective if it helps an industry/organization administrator to achieve a specific objective or set of goals for the industry/organization. Failure to achieve a desired goal becomes a problem, and the administrator is ultimately responsible for solving it. Identification of the problem is the first and most important step of decision making (Kepner and Tregoe, 2005). According to them, the quality of the decision has a direct relation with how deeply you investigate/understand the problem. In shortcut, their method of problem analysis includes (Kepner and Tregoe, 2005):

1. Problem identification
2. Definition of what the problem is and is not
3. Prioritizing the problem and
4. Testing for cause-effect relationships

6.2.2. Try to Avoid the Problem (if possible)

When the problem is identified then before any substitute first we should try to avoid or eliminate (if possible) with some assumption.

6.2.3. Find the Alternatives

Once the problem has been identified, the next step in the decision-making process is to generate alternatives of the identified problem. In developing/deciding the alternative solutions, decision makers must specify the goals that they hope to achieve through their decision. Are they trying to reduce the risk, improve the quality of safety standard, increase the production, or something else? Once decision makers have determined their goals, they can search the way for alternative means of achieving them. Data/Information must be collected regarding each of the alternatives and their likely consequences.

Decision makers needs to generate as many alternatives as possible and should

attempt to ensure that the alternatives are relatively diverse that is, not highly similar to one another. The extent of the search for alternatives is limited by the importance of the decision, the cost and value of additional information needed to evaluate alternatives, and the number of people affected by the decision (Zopounidis, 2011a; 2011b). The more important the decision, the more attention is directed to developing alternatives.

6.2.4. Evaluate and Chose an Alternatives

After the generation of alternatives, the next step in the decision-making process is evaluating each of the alternatives generated by the decision makers.

At the time of evaluating/choosing an alternative, we must ask the following questions:

1. "Is the alternative feasible?"
2. "Is it a satisfactory alternative?"
3. "What impact will it have on people?" (Grant, 2011)

The answer of first question tells us whether it can be done or not? Whereas the second question concerns the extent to which the alternative is satisfactory-that is, the extent to which it addresses the problem. The third question addresses the impact of an alternative. The alternative that is chosen must be acceptable to those who must live with the consequences of the decision. Failure to meet this condition is the single most likely reason for failure of the decision-making process to solve problems (Hastie, 2010).

Once all the alternatives were evaluated, then the best one is choose against the problem. At the time of evaluation most of the alternatives were rejected but in most cases two or more will remain. How does decision making panel decide which alternative is the best? In those conditions one should select the alternative which is feasible, satisfactory, and acceptable to the work group (Gilboa, 2011). Because most situations do not lend themselves to sophisticated mathematical analysis, the higher authority uses this available information in combination with judgment and intuition to make the decision (Mendel, 2011). The basis of judgment should be how close the outcomes or consequences of the alternatives come to achieving the desired goals of the organization. If all conditions permit then one can choose several alternatives at a time.

6.2.5. Take Decision

After Evaluating and choosing the best suitable and effective alternative among all its time to take strong decision confidently.

6.2.6. Plan for its Implementation

After evaluating and choosing an alternative, it's a challenge for the organisation to implement the decision. A sound decision can fail if implemented poorly. It is useful, therefore, to consider some suggestions for successful implementation (Ahmed, 2011). It needs to make sure that the alternative is understood properly. This is accomplished by communicating the decision to all involved staff. Effective communication is necessary for effectively implementing decisions.

1. It is necessary to justify the acceptance of the alternative as a course of action.
2. Organisation must provide enough resources to make the alternative succeed.
3. Organisation need to establish workable timelines.
4. Organisation need to assign responsibilities clearly.

6.2.7. Re-evaluate the Decision Considering all Possible Consequences

Finally in the decision-making process evaluating the effectiveness of the decision is done. When an implemented decision does not produce the desired results, there are probably a number of causes such as incorrect definition of the problem, poor evaluation of alternatives, and/or improper implementation. Among these possible causes, the most common and serious error is an inadequate definition of the problem. When the problem is incorrectly defined, the alternative that is selected and implemented will produce the undesired result (Lunenburg, 2010). Evaluation is important because decision making is a continuous, never-ending process. Decision making does not end when a school administrator votes yes or no. Evaluation provides school administrators with information that can precipitate a new decision cycle. The decision alternative may fail, thus generating a new analysis of the problem, evaluation of alternatives, and selection of a new alternative. Some experts suggest that many large problems are solved by attempting several alternatives in sequence, each providing a modest improvement (Hicks, 2005). Evaluation is the part of the decision-making process that assesses whether a new decision needs to be made.

6.3. Steps to Improve Decision Making Skill

Steps for making decision are described in previous sections but it cannot be achieved in one go rather it is a culture which should be developed and improved with time. Following are some points which helps in taking effective decisions and adds some more strength to the decision which are taken.

- Decisions must make by a group rather than an individual
- Making the people accountable for their decisions through training in how decisions are made? (Larrick, 2004; Lerner & Tetlock, 1999)
- Use the past data to make decision (lesson learnt from past)
- Taking an outsider's prospective: trying to remove oneself mentally from a

specific situation or taking others view/decisions to which the current problem belongs (Kahnmean and Lovallo, 1993)

- Taking advice from a genius outsider for their view regarding a particular problem to improve the judgment of decision makers.
- At the time of decision making it is more important to ensuring that, this decision is the option that is likely to be best for decision makers and/or surrounding.

7. CONCLUSION

It is observed that there is no such standard method or tool for decision making in Indian mining industry, as a result of that the decision are ineffective. Again it is hard to believe that a single decision can cause a disaster but it is caused and to support this there are several disasters due to a wrong judgement or wrong decision. Therefore it's time to adapt some tools for making effective and suitable decisions. Problem doesn't come by asking and it cannot be ignored till we learnt a lesson from that. From the past we observed a number of worst disasters due to small mistake like miscommunication, best man do a big mistake, a wrong decision, achieved the goal by hook or by crook, assumption are not always right (in the presented case study). The aim of this article is to discuss how a decision can be a disaster? And what should be the standard procedure or steps to make a suitable and effective decision and improved the decision making process. Every system or organisation has a code of practices that includes its worker's behavioural norms, that is, a set of rules governing what are acceptable and unacceptable behaviours. These rules are depending upon the skill, knowledge, experiences and competency of the workers. When people find themselves in a situation in which there is a conflict, the decision-making processes that they use to make the choices that should be the standard decision making process. It more important to focus on control rather than cause (Calton, 1996) and learnt from our own or others mistakes simultaneously (Bhattacharjee et al., 2014; Dash et al., 2016a).

This paper is a short overview of a decision causing disasters followed by a discussion on how the decision should made. History of wrong decisions leading to disasters keeps on repeating despite all procedure, guidelines, standards and recommendations. Learning lessons from past disaster / accident / incident with an active implementation of the recommendations has to be considered in the hope of preventing man-made disaster in the future. This study is based on a disasters due wrong decision. More research on process of decision making may be under taken in future for other safety critical industry including mining industry to developed standard guideline for making suitable and effective decision for prevention of all such disasters.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to Department of Mining Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad for

their help and support, and also to Directorate General of Mines Safety (DGMS) for their kind co-operation during the course of this study.

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