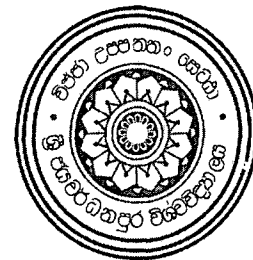


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**PROCEEDINGS OF THE ENVIRONMENTAL AND SUSTAINABILITY
MANAGEMENT ACCOUNTING NETWORK (EMAN)
GLOBAL CONFERENCE 2015**

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**Fostering Economic Bottom Line through Social Sustainability
(Industrial Safety):
The case of a mining company**

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Purpose – This paper investigates how unintentional strategies aimed at improving the negative consequences of a social parameter (industrial safety) have impacted the economic bottom line of a mining company in an emerging economy.

Design/methodology/approach – Case study approach was followed in this study as it provides in depth understanding on complex social phenomena. Data collection was mainly relied on structured and semi-structured interviews, on-site assessments and documentation review. Steps were taken appropriately to improve the trustworthiness by applying methodological triangulation. Data were analyzed thematically using domino's theory and its subsequent developments.

Findings – The study finds that the strategies to improve industrial safety have initially reduced the industrial accidents and resulted in improved productivity supporting the complementary nature of social side of sustainability and economic performance.

Research limitations/implications – Since this study was based on a single case it limits generalization to other companies.

Originality/value – Application of domino theory is limited in sustainability management literature. This paper attempts to extend the accident causation models by relating it to economic perspective in mining industries in developing countries.

Keywords: Domino Theory, Industrial safety, Mining industry, Social sustainability, Sustainable strategies.

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1. Introduction

Among the three pillars of sustainability, social perspective has so far received less attention. However, due to increasing pressures stemming from different sources, organizations pursue various actions to improve its societal impacts. Among them, the safety of its employees is crucial. This is even more important in industries that are categorized as 3D (dirty, dangerous and difficult). Serious lapses in industrial safety bring in significant social and legal repercussions. Organizations therefore pursue various actions with the primary aim of improving the safety at work by mitigating the injuries even without assessing the economic aspects. Yet, little is known on the relationship between industrial safety strategies and economic performance, whether it is conflicting or complementary, since the existing literature is not conclusive and portrays mixed results. Hence, the objective of this paper is to identify how unintentional strategies aimed at improving the negative consequences of a social parameter (industrial safety) have impacted the economic bottom line of a mining company in an emerging economy.

The paper would therefore attempt to contribute to fill the paucity of research on social sustainability businesses particularly in emerging economies. In addition it will provide insights for the practitioners to relook at the safety of employees from an economic perspective also.

2. Literature review

2.1 Social sustainability

The contemporary sustainability concept emerged in the 1960s as a response to the widespread concerns over environmental degradation during that period (McKenzie, 2004). Since then great deal of work has been done around the world. The widely used concept of sustainable development was contained in The United Nations Commission on Environment and Development (UNCED)'s report *Our common future* (1987). This report, known as the Brundtland report, defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Triple bottom line, developed by Elkington (1997), has become commonplace practice of reporting sustainability performance encompassing environmental, social as well as economic concerns. Unlike the other two perspectives social side of sustainability has received less attention (GRI, 2000, Western Australian Council of Social Services, 2002). This is mainly because what it means by social perspective of sustainability is not clearly defined or agreed (Dempsey, 2011). Torjman (2000) also has a similar view regarding social aspects of sustainability suggest that it is not easy to determine precisely which elements to include in the social sphere. Dillard, *et al.* (2009) suggest that the social aspects of sustainability has been relatively neglected and is by far the least developed. Therefore Geibler *et al.* (2006) are of the view that the work on indicators for social sustainability is still ongoing. In an attempt to define what comes under social aspect of sustainability Geibler *et al.* (2006) suggest eight aspects with significant relevance to the social impact. Among them health and safety of employees and quality of working conditions are important. Harrison and Goodwin (2001) have a similar view with respect to what aspects to be covered in social sustainability. Among many other aspects of social sustainability they include health and education. International Organization for Standardization (2010) when issuing ISO 26000 standard on social responsibility suggests health and safety at work is one of the seven core subjects of social responsibility. Moreover, GRI (2013) has stipulated the firms to report on social indicators such as type of injury and rates of injury, occupational diseases, lost days, and absenteeism, and total number of work-related fatalities, by region and by gender when preparing the sustainability or integrated reports following G4 guidelines. Hence, there is a dearth of literature on ways in which social sustainability may be implemented, and its causal relationships between its various aspects

There can be various reasons as to why organizations should follow sustainable strategies. The business case for corporate sustainability has increasingly been used to justify sustainability strategies within organizations (Salzmann *et al.*, 2005). The business case for sustainability can prove or disprove the economic rationale for corporate sustainability management. Among different typologies for the relationship between social performance and economic/financial performance Preston and O'Bannon (1997) suggest that there can be a positive synergy between social and financial performance. Dyllick and Hockerts (2002) define the socio-efficiency the relation between a firm's value added and its social impact. Unlike the negative only business

impacts on environment, social impacts can portray both positive and negative impacts. Depending on the type of impact, socio-efficiency thus implies minimizing negative social impacts (i.e. accidents per value added) or maximizing positive social impacts (i.e. donations) in relation to the value added. Thus socio-efficiency is concerned primarily with increasing economic sustainability. Weber (2008) taking CSR into perspective suggest in the long-term there is a positive relationship between the CSR involvement of a company and its financial success which suggest the business case. Although various researchers analyzed the relationship between CSR and financial performance, the research produced mixed results and does not seem to support the further development of CSR in business practice.

2.2 Occupational/industrial safety

International Electrotechnical Commission (IEC) (2014.) defines safety as, “freedom from unacceptable risk of physical injury or of damage to the health of people, either directly, or indirectly as a result of damage to property or to the environment”. Occupational accidents can be originated from a worker’s simple mistake to a professional negligence. The impacts of accidents can range from non serious hurts up to severe outcomes (Heinrich *et al.*, 1980). Unsafe acts and unsafe conditions act as the immediate or the direct causes of accidents are the central factors to cause an accident. Other physical and mental conditions of an employee as well as environmental forces and the lack of supervision on safety performance are the contributory causes of unsafe act and unsafe conditions leading to accidents (Sabet *et al.*, 2013). Earlier efforts to reduce industrial injuries had been focused primarily on technical actions and scientific safety management up to 1980s (Heinrich *et al.*, 1980; Petersen, 1988). Those injury prevention activities were basically based upon a credo of dichotomous etiology of accidents—unsafe acts and unsafe conditions. Quoted in Katsakiori (2009), Heinrich’s domino theory is the most widely quoted accident causation model so far and it has been developed many times over the past years. According to Heinrich, an "accident" is one factor in a sequence that may lead to an injury. Heinrich asserted that any injury (5th domino) is necessarily caused by an accident (4th domino) and that the accident in turn is caused by unsafe acts of a person and/or unsafe conditions (3rd domino) that are preceded by fault of person (2nd domino) and ancestry and social environment (1st domino). Heinrich suggested that removal of the 3rd domino is the easiest and most effective way to stop the sequence leading to an injury (Seo, 2005). Having a

similar view, Lutness (1987), Salminen and Tallberg (1996), and Williamson and Feyer (1990) support this idea by suggesting that at the vast majority of accidents are caused by unsafe work behavior or human errors.

Yet, being critical of the narrow interpretations of the domino theory, Petersen (1988) suggests so-called multiple causation theory that recognizes the availability of multiple factors to every accident. He is of the view that the fundamental root causes of most accidents are related to management's policies and procedures, supervision, or training. Heinrich *et al.* (1980) continued this, suggest three basic causes of accidents, namely, poor management policies and decisions, and personal factors² and environmental factors³. Proposing similar view, Cohen (1977) suggests that successful safety programs encompass (a) management commitment to safety and (b) frequent and daily contacts between supervisors and line workers.

Understanding the impact that different kinds of accidents have on the reputation for social performance of a business firm is very important as corporate reputation is major source of competitive advantage which takes a long period of time to develop and corporate reputation for social performance is an important aspect of the overall reputation of a firm. Therefore in large manufacturing industries, incident or the accident investigation and analysis are critical elements of safety management. This is mainly due because accidents produce economic and social loss, impair individual and group productivity, cause inefficiency and retard the advancement of standard of living (Ray.,S, Das., P., Bhattacharya., B.K., 2011).

Information of occupational accidents is not standardized worldwide. However, developing countries do not have reliable information on their occupational accidents due to lack of proper recording and notification systems and therefore the number of accidents in developing countries are under reported (Hämäläinen., P. , Takala. J., Saarela. K. L. 2006). Yet, US is very particular in maintaining statistics on occupational injuries. According to US Bureau of Labor (2013) In the United States in 2012, 4,383 workers died from job injuries. The mining industry has the second highest fatal work injuries per 100,000 fulltime equivalent workers after agriculture, forestry,

² Personal factors include motivation, knowledge, training, performance, and safety awareness

³ Environmental factors include physical hazards of the work environment such as temperature, humidity, dust, noise, slippery surfaces, obstructions, and hazardous objects, which are not quite different from unsafe conditions.

fishing, and hunting. This case therefore selected a mining company in a developing country in order to carry out this study.

3. Method

Understanding the industrial safety actions simply goes beyond unsafe acts and unsafe conditions and involves wider social factors. In this study we selected the case study approach as it provides in depth understanding on complex social phenomena, in this study, industrial safety (Yin, 2003). Case study method allows to retain the holistic characteristics of real-life events while investigating empirical events (Otely 1994). Further, it is appropriate for studies that ask *how* and *why*, research questions that require no control over behavioral events and that concern people who are still accessible and able to recall those events relatively accurately (Crossan and Berdrow, 2003).

The company mining company selected in this study engages in the graphite mining, processing and exporting for over 160 years in Sri Lanka and today, it is a part of a global mining giant in Germany. In 2009, this German global mining group was taken over by an US based mining group. This company is the world's only vein graphite producer and has been exporting their products to countries all over the world including. The company maintains strict environmental and quality standards during all its operational steps. It is the only graphite company in Sri Lanka to obtain and maintain the ISO 9001:2000 and ISO 14001:2004 standards in addition to those establish specifically for graphite processing by the British Standard Institute. The company's graphite products and grades include carbon 80% to +99%, lumps to micron powders and graphite parts in any geometric shapes, specifically to customer requirements. The graphite production of the company is used for many purposes and some of them include pencils, crucibles & refractory products, fire proof products, brake lining, carbon brushes, powder metallurgy, batteries, fuel, polymers and conductivity. Over the years the company has significantly contributed to the quality and productivity improvements in the mining industry especially those are resulting from the special characteristics of its graphite. In this mining company, the mining cycle essentially involves four processors. The first process is drilling full face and blasting the graphite vein, the second process is to muck the graphite and blast rock. The third process is to start mucking the rock and fixing and the final cycle involves mucking and completing the cycle.

As the main focus of this study was on a social parameter (industrial safety) which is basically company specific, relevant data about this mining were not available through public sources. Therefore the authors had to use variety of data collection methods. Accordingly, data were collected through review of archival data, on-site assessments and semi-structured interviews. The use of multiple source of evidence enabled verification through triangulation, which is the strength of case research (Noda and Bower, 1996). However, we relied heavily on the data collected mainly from the interviews with managers at mining company. Basically interviews carried out were two folds; open and semi-structured. The initial open interview with the CEO of this company provided some background of what the mining company has experienced. Then we obtained permission to visit the company and their site. To carry out the other interviews we used semi-structured interviews. Accordingly we had a discussion with the CEO of the company to get overall idea. Then we approached the safety manager for building interactions with the company with a view to further exploring the research issue in the company. We interviewed operational and top level managers including chief executive officer, safety manager, production managers, mining engineers, etc. These interviews were happened time to time to get the information for strengthening the study. On average these interviews ranged from twenty minutes to forty minutes with the exception of the interview with the safety manager. We interviewed him several times and some interviews lasted for about two hours with site visits. In addition follow up over the phone interviews were done to collect the missing information.

Data collection was commenced with a review of documentation pertaining to the company, which assisted in establishing a basic understanding of the events in the company's history and how managers of the organization talk about those events during the interviews. During the documentation review process, public data were gathered including business press coverage, analysts' reports and annual reports.

4. Analysis and Discussion

4.1 Eras of rampant industrial accidents

The workers of the mining company had been given a monthly-based target to achieve and this target was used for their performance evaluation purposes. The target was set on a work gang or team. This target was set at the beginning of each month based on three main factors, the average vein width of the face at the beginning of the month, the number of workers in the gang and the productivity figures. The performance measurement method continued to be in action for a long time till the company experienced a change of ownership of its parent to a German based group in 2009. As a result the mining company had to adhere to the parent's Safety, Health and Environment (SHE) policies maintained at high levels. When the German company acquired the mining company safety standards were way behind the standards of the parent. Thus, this created a pressure on the local management to adopt SHE policies at any cost to comply with global standards set by the parent to reduce the higher number of accidents (both minor and major) that were taking place. Explaining the pressures the local management experienced from its parent, the CEO of the company stated;

“The management of US were not that keen on our profit figures, they were more keen on our safety measures and policies, they needed lot of improvements, I was asked repeatedly to adopt the SHE policy and to reduce the number of injuries reported from the factory which were quite high by that time”

Supporting the same view of the CEO, the safety manager also stated;

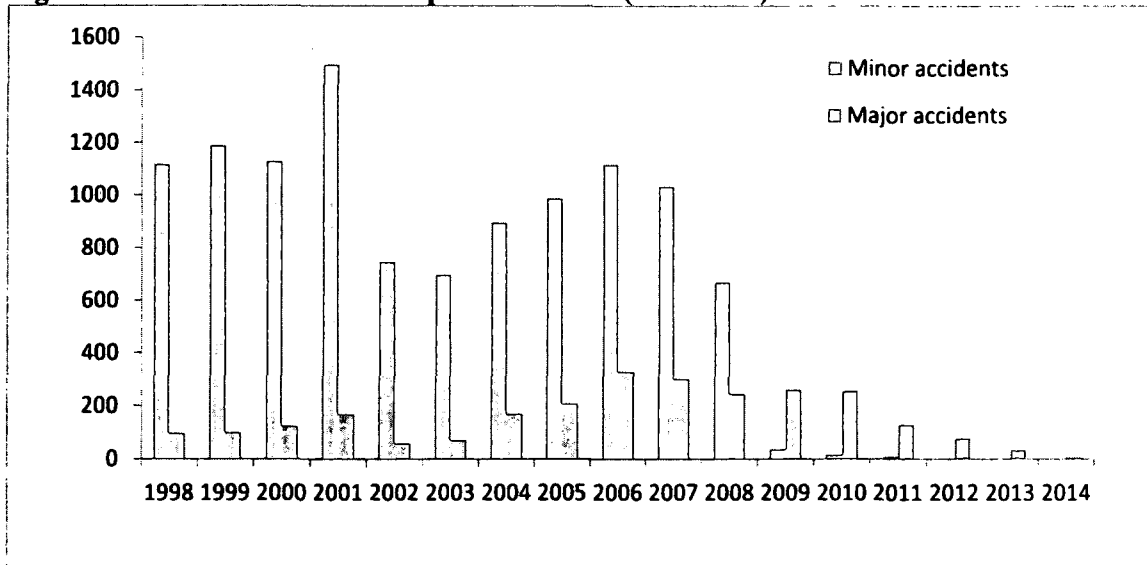
“The US parent continuously insisted us to reduce the number of injuries taken place and to adopt their SHE policy. By that time we were so behind the established standards in terms of safety and health”

Figure 1 depicts the information relevant to the high number of accidents which is classified under two categories major accidents⁴ and minor accidents⁵.

⁴ Major accident is an accident when any injury resulting in days away from work. This does not include the day on which the accident occurred and begin counting days away only on the next scheduled work day or shift after the injury occurred or the illness began.

⁵ Minor accident is an accident that causes minor injuries that can be treated with first aid.

Figure 1: Number of accidents reported at work (1998-2014)



Source: Company information

4.2 Era of taking strategies to reduce industrial accidents

Due to the high accidents rates the company was experiencing, the mining company found it difficult to adopt the safety standards of the parents. The management was ready to incur any investment/cost to overcome the safety issues to get in par with the safety policies stated by its new parent company. Around this time, the change in the internal management, with the appointment of a new CEO, compelled the mining company to consider the accidents seriously which called for several actions. A new department named “Safety Department” was set up to explore the possible causes of accidents and to take remedial actions. As Petersen (1988) suggests in multiple causation theory, there are many factors combined together in random fashion causing accidents, the Safety Department found the serious safety issues involved in the mining process are mostly related to multiple factors such as management policies and procedures, supervision, or training.

Accordingly, mining mechanism was reviewed to introduce cycle based target system instead of the traditional monthly based system that existed for many years (refer appendix 1.a for more details). Explaining the traditional monthly based system that was existed, the safety manager stated;

“With the monthly based cycle system, we gave the targets to the employees at the beginning of each month, and if the vein face at the beginning of each month become smaller than the expected at the beginning of the month, then the targets will be unrealistic to achieve. Still to have financial benefits, employees wanted to achieve even these unrealistic targets by working recklessly and unsafely. That was the major reason which caused more injuries”

The performance measurement system was also adjusted accordingly. This involved setting the target for each cycle of the work gang and at the end of the month cumulative targets were considered as the monthly target. Four factors were considered in setting up the cycle targets as average vein width of the face at the beginning of the cycle, drilling depth, face height and ore density which gave more meaningful and logical way of setting and evaluating the worker targets and their evaluation system (refer appendix 1.b for more details).

After the introduction of the new safety mechanisms the accidents reported were started to decrease and currently they have reduced to a minimum level. Consistent with the findings of Heinrich *et al.* (1980), the new mechanism introduced by the management was more systematic and gave more realistic targets considering the vein width where the employees were not given any extra stress to take more risks to achieve unrealistic targets eliminating the unsafe acts and conditions (refer appendix 1.b and 1.c for more details).

One of the key factors that contributed in achieving success in adopting SHE policy of the organization is the commitment of the management and the practice of working closely with all workers of the company. This is consistent with the findings of the Cohen (1977) who suggests the two most common factors in successful safety programs are (a) management commitment to safety and (b) frequent, informal visits by top management to work areas and daily contacts between supervisors and line workers. As of today, the management has been able to inculcate the safety standards into the DNA of the workforce so now they need only little supervision today. Supporting the Cohen (1977) argument, the safety manager explained;

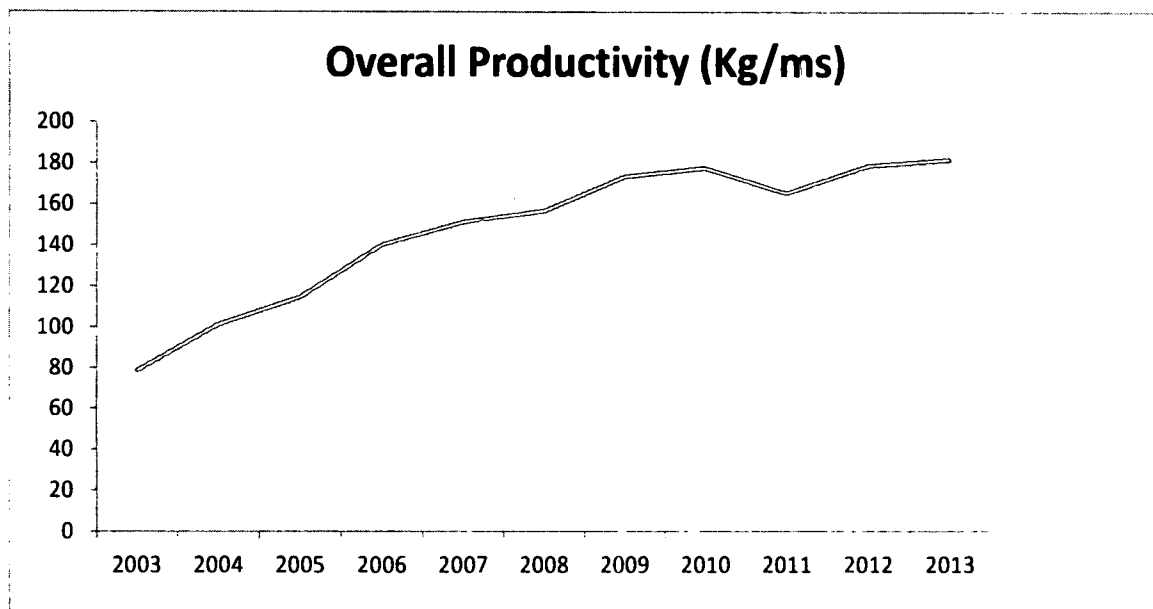
“Our first priority is safety, from us, now, it has become our passion to achieve the safety and health standards. Our managers including our CEO, we all make frequent visits to our mines and we maintain very friendly dialogue with our

workers, as the management we always emphasis the importance of maintaining the SHE policy, as a result our employees have got it in to their DNA and they almost don't need any supervision now”

4.3 Era of industrial safety measures fostering economic bottom line

Not only the new actions reduced the number of accidents and increased the safety of the company's work force, it also led to higher productivity (refer Figure 2).

Figure 2: Productivity of the mining company



Note : The drop in the productivity in year 2010-2011 period is mainly attributable to the impacts of the worldwide financial crisis.

Source: Company data

Relating to the improvements in the safety measures to the productivity achievements, the production manager stated;

“The change of performance evaluation system to cycle based, was one of the key contributors to our production achievements although we didn't expect it to be in implementing the new safety strategies. The changed evaluation system reduced the injuries and improved the working conditions and raised our employee commitment and motivation levels greatly”

As suggested by Salzmann *et al.*, (2005) and Preston and O'Bannon (1997) the overall productivity improvement highlights the positive synergy between actions to improve occupational safety and (economic) performance. It proves the business case for sustainability can prove though unintentional actions aimed at complying with safety standards of the parent company.

6. Conclusions

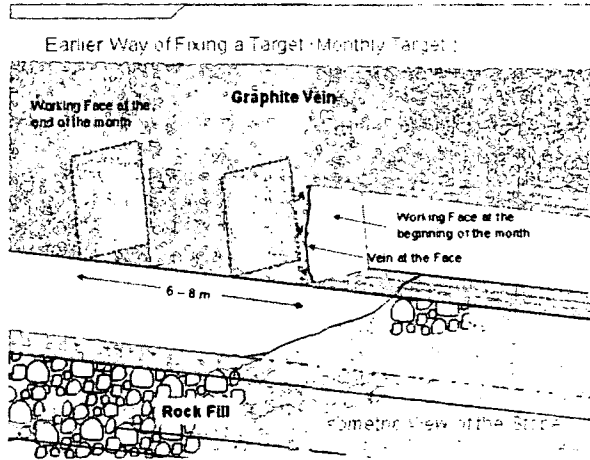
The mining company has adopted many industrial safety strategies that triggered by the industrial accidents initially. The main driver had been the pressure from the parent company. These strategies have been mainly focused on changing the performance measurement system and process improvements. However, the strategies to improve industrial safety have initially reduced the industrial accidents and resulted in improved productivity. Hence the study reveals the complementary nature of social side of sustainability and economic performance.

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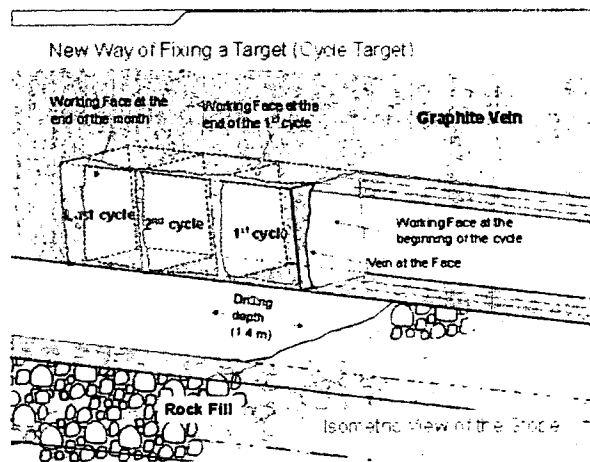
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**Appendix
Appendix 1.a**

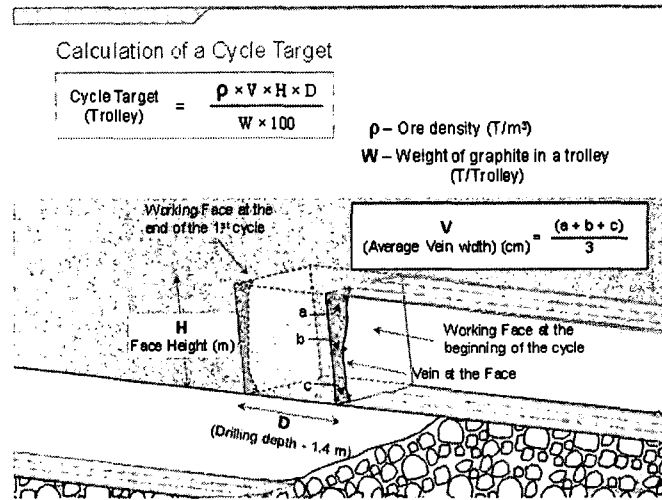


With the monthly target method, the employee targets were set at the beginning of the month based on the average vein width of the face at the beginning of the month, the drilling depth, and face height and ore density as shown in appendix 1.a. Under this method a target was set for the entire month based on the vein at the face at the top of the month. But once you drill and go in to depth of the vein during the month the vein face could be different to what it had at the beginning of the month. Due to this reason the targets that were set at the beginning of the month sometimes become more unrealistic to achieve and in some cases the targets were easily achievable. When the targets were more unrealistic, the workers were more frustrated and started work more recklessly to achieve the targets given. This created an unsafe working environment and more injuries. When the targets were easily achievable, the workers started to rest, wasting time and work slowly resulting in inefficiencies.

Appendix 1.b



Appendix 1.c



Appendix 1.b and 1.c depicts the new method introduced by the management to improve the safety and health standards of the company. The new method introduced to set the targets based on a formula which determined the target depending on the average vein width of the face at the beginning of the cycle, the drilling depth, the face height, and ore density (appendix 1.c). The new formula, introduced, let the workers to have realistic achievable targets. It reduced the extra working stress of the employees. The training provided on the health and safety reduced them working recklessly. The cycle method further introduced a new rock filling method that also aid in dipping the injuries reported. The new measures and policies encouraged employees to work safely and productively.