

Statistical Analysis of Metalworking Accidents within Small and Medium Enterprises (SMEs) in Malaysia

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Abstract. Small and Medium Enterprises (SMEs) are known to be one of the major contributors to the national economy. However, in terms of occupational safety and health (OSH) implementation and performance, these SMEs, especially in the metalworking sector have yet to meet the necessary standard. This paper discusses the statistical analysis of accidents in metalworking industry by using accident reports submitted to the Department of Safety and Health (DOSH) and Social Security Organization (SOCISO) which involved 1635 accident cases. The main objective is to identify the real causes of accidents and recommend an appropriate action plan for accidents prevention at the workplace.

Keywords: Metalworking Industry; SMEs; Accident Analysis; Accident Causes; Machine.

1. Introduction

SME refers to small and medium enterprises. In Malaysia, SMEs are one of the sectors that drive the growth of the economy. However, OSH issues in the SMEs have become a major concern due to the fact that about 80% of total accidents in Malaysia are from this sector (Surienty, 2012). Moreover, the accident rate at SMEs showed 30% to 50% higher than larger companies. Compared to multi-national companies (MNCs) in Malaysia, they are adhering well to the philosophy of self-regulation for people at work to enhance the OSH compliance.

According to DOSH Malaysia annual report (DOSH, 2014) the level of SMEs employers' compliance with the Occupational Safety and Health Act (OSHA) 1994 and its regulations is still not up to the standard and needs further improvement. According to the statistical data from Social Security Organization (SOCISO, 2014), the accident rate in metalworking industry of SMEs does show a slight reduction over the years, but it is still at an alarming level. It is been claimed that the common reasons that led to poor levels of OSH performance in SMEs are due to factors such as lack of expertise, resources or manpower (Surienty, 2012). Common problems such as lack of capital and qualified manpower have always been highlighted as excuses for the unacceptable level of occupational safety and health in SMEs.

To overcome such problems, the government, through specific agencies such as Malaysia's Small Medium Industries Development Corporation (SMIDEC), have provided

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various incentives including grants for skill training and allocations for quality and productivity improvement. However, the same problems remain and are continuously being brought up by the SMEs when issues on occupational safety and health are discussed.

In this paper, the actual causes of the problems in the SMEs are explored through a detailed study on accident reports available from DOSH and SOCSO databases. Besides, researching and discovering the factors that lead to low compliance of OSH among the SMEs, the data will be used in this study to formulate more effective approaches for accident prevention in SMEs. The ultimate goal is to recommend appropriate and practical action plan for improving and upgrading OSH in SME sector.

2. Methodology

Accident analysis is chosen as the research methodology of the paper. Accident analysis is a method that involves the collecting and analysing of accident data from selected data sources by frequency analysis. In this research, accident data involving both local and foreign workers will be used. A total of 1635 accidents data have been collected from DOSH Malaysia and SOCSO. The analysis of statistical accident data in this research involves three states of Malaysia which are Johor, Melaka and Selangor. The data extracted from the accident reports are being properly analysed and presented in the form of frequency and accident ranking. By studying these accident reports, the real causes of accidents can be identified.

3. Results And Discussion

Statistical analysis of 1635 accident cases has been carried out by using accident analysis methodology. The focus of the paper is to identify the basic and root causes of accidents as well as the most risky machineries that are commonly involved in accidents within the metalworking sector.

3.1 Basic Causes of Accident

The pie chart in Figure 1 illustrates the basic causes of accidents related to metalworking industries of SMEs. The basic causes of accidents can be divided into four major categories which are organizational failure, human failure, machine failure and work surroundings. From the above pie chart, human failure is the highest basic causes of accidents with a percentage of 40%, followed by organizational failure with a percentage of 31%. Machines failure and work surrounding are at a percentage of 18% and 4% respectively.

According to the accident report analysis, human failure is the highest causes of accident due to manual or semi-automatic operation of most machines in the SMEs. This type of operation required major human involvement. The need of humans to run these machines is necessary since majority of the metal work is routine, simple and obvious. In this case, the employees "*mine-set or perception*" on occupational hazard is low (i.e. take it easy or normal) and at the same time, majority of them "*accepted*" the hazard related to their work. The machine operator believes that the design of the "*machine is error-free*" and "*nothing*" can be done to control the machine hazard. Due to these conditions, the accidents naturally occur in accordance to Normal Accident Theory (NAT) proposed by Perrow (2001).

In the organizational aspect of OSH, the common problems are related to poor OSH commitment by the employer and OSH implementation on site. The factory owner failed to capture the spirit of self-regulation and as low as reasonably practicable (ALARP) in risk management as gazetted in OSHA 1994. Due to this limitation, their awareness and

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commitment towards OSH are seriously “*corroded or compromised*” in terms of quality and productivity of the operation.

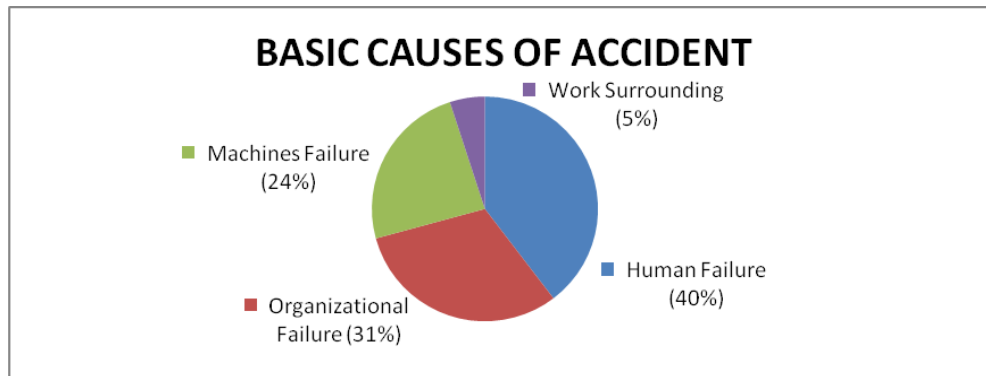


Figure 1: Basic causes of accident

In addition, machine failure caused 24% of the total 1635 cases of accidents. It is usually caused by lack of safety measures such as no machine guarding or easily open guard. Machines such as forming roll, roller and power press can cause danger to the workers and guarding is an important measure to protect the workers from possible hazards. Aging equipment also leads to the prevalence of accidents in metalworking industry. Moreover, the technology of the machines itself such as no and inadequate sensor as well as no interlock system also caused accidents in the metalworking industry.

Workstation factors for instance inadequate lighting, noise, improper plant layout, crowded space, lack of accessibility, humidity and heat contributed to 5% of the total accidents reported. However, lighting and noise are not really contributing to the accidents since the occurrence of the accidents caused by lighting and noises are really low. More over, these unsafe conditions support the other basic factors of accident, in particularly human errors.

3.2 Root Causes of Accidents

A root cause of accidents that is divided in detail from the basic causes of accidents (from Fig. 1) is presented in Figure 2. From the chart, mistakes (21%) are the highest root causes of accidents. Machine safety and lack of supervision recorded second and third with a percentage of 14% and 11% respectively, followed by aging machine (11%).

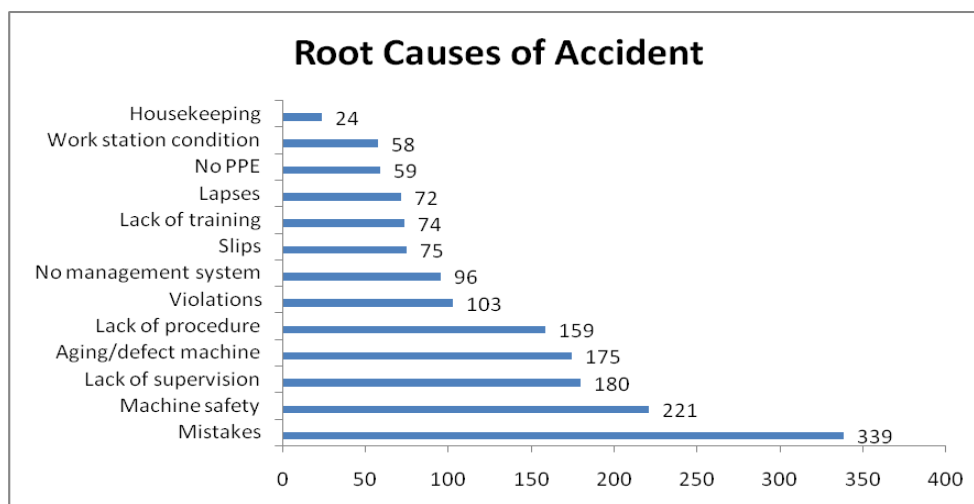


Figure 2: Root causes of accident

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Mistakes by humans while operating the machine recorded the highest because humans make errors or mistakes in their actions and judgments due to poor reasoning, carelessness and insufficient knowledge and training. Humans also tend to make mistakes when they are tired as they become exhausted due to long working period.

Machine safety is another common root cause of accidents in the metalworking industry. Substandard machinery which lacks safety measures can also lead to accidents. Aging and defect machines can cause accidents as these machines are not in good condition or are not fit and suitable to carry out its intended use. In general, machine that shakes, loose and with corroded parts may lead to structure failure and cause harm and injury to the workers. Machines should be designed, installed and provided with safety features to avoid and control the machine hazard. In practice, the hierarchy of control shall be incorporated in the design and operation of metalworking machines. Good machine design could prevent accidents through “*friendlier human-machine interface*” and “*fool-proof*” design approaches. These approaches will reduce the probability of human errors in the metal industry.

The common issues on the organizational failure are related to lack of supervision, inadequate or no OSH documentation such as Standard Operating Procedure (SOP), lack of OSH management and safety committee as well as lack of training. The findings are as expected because of the characteristics of metalworking industries within SMEs. They are usually small scale companies with lack of workers and financial resources which contributed to the lack of management supervision and accidents. However, these companies are still subjected to the employers’ responsibility as required in Section 15 (2) of OSHA 1994. Basic OSH requirement still needs to be fulfilled for safe operation.

3.3 Type of Machines

Figure 3 illustrates the types of machine that are commonly involved in accidents in SMEs related to the metalworking industries. Statistically (without other categories or 1495 cases), among the types of machines are lathes (41%), rolling mills (14%), mechanical shears (13%), power press (12%), forging machines (10%), milling machines (6%), and abrasive wheels (3%). Other metal working machines recorded the highest accidents with a total of 3337 cases include jig, drill, welding set, and other hand tools.

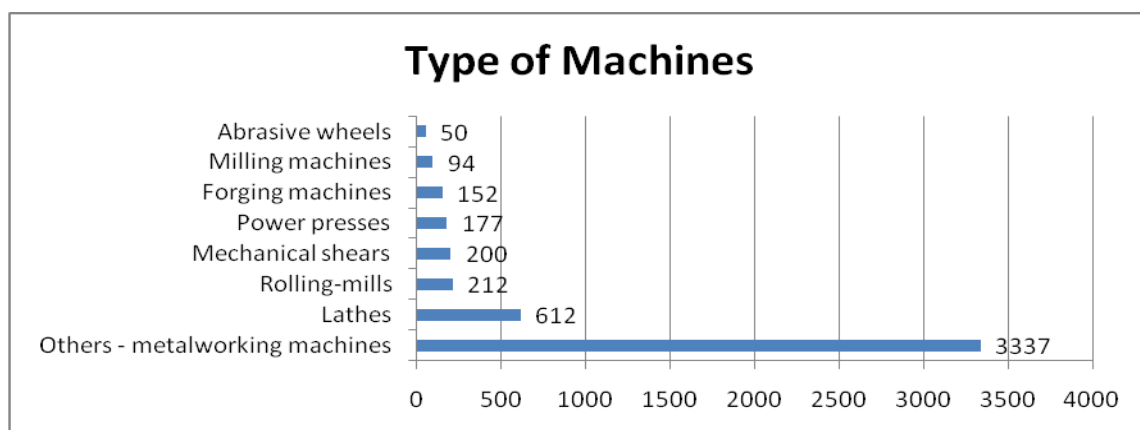


Figure 3: Types of machines

4.0 Conclusion

Based on the findings from this research, it is clear that there are many OSH related issues and problems associated to SMEs. These issues are being grouped into four distinct OSH elements as systematically illustrated in a fish-bone diagram in Figure 4.

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Statistically, the basic causes of accidents based on the data recorded can be divided into four major categories, which are organizational failure, human failure, machine failure and workstation factor. In the analysis, human and organizational failures are among dominant factors to cause accidents due to lack of supervision and low safety management system implemented in SMEs. Human mistakes also play an important role in causing accidents to happen mostly due to the lack of workers' training and knowledge.

To improve this situation, suitable action plans at different levels of OSH implementation could be done in Malaysia which includes in the area of enforcement, experience feedback system, safety management system, and safety culture. Focus will be given to prevent accidents from design, technical, organizational and human aspects by utilizing layer of protection concept such as inherently safer, passive engineered, active engineered and procedural. A balanced approach in risk management should be emphasized for effective accident prevention at the workplace. Basically, by improving the readiness of factory, machineries, work station and people on OSH aspects will lead to increasing OSH awareness and implementation within the SMEs. By acting upon these overall and balanced OSH action plans, it is believed that OSH compliance level can be significantly increased and accidents at workplace can be reduced.

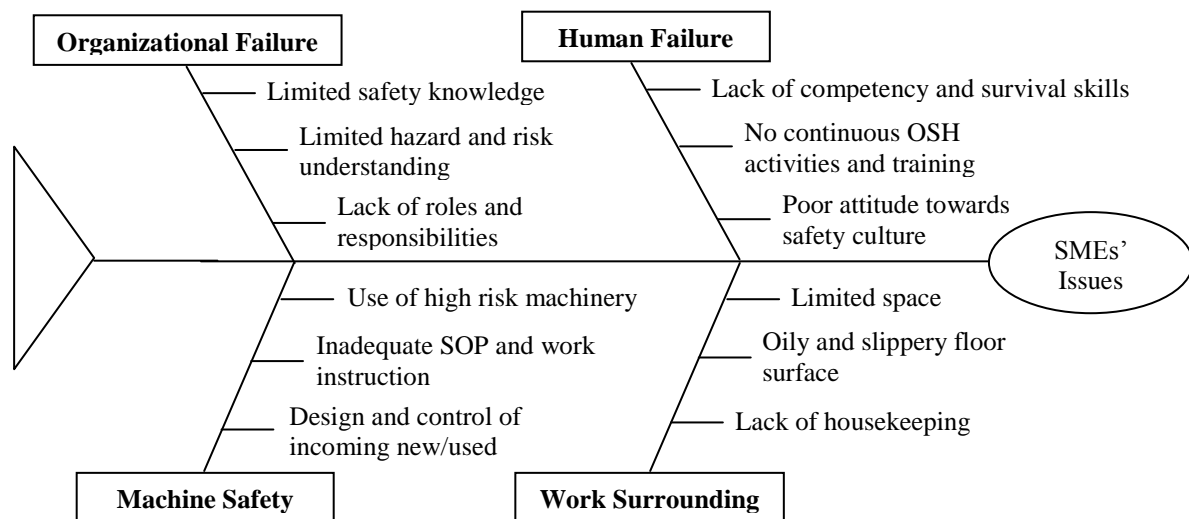


Figure 4: SMEs' Issues

References

DOSH (2013). Annual Report 2013, Department of Occupational Safety and Health, Malaysia, available for download at www.dosh.gov.my

SOCSSO (2013). Annual Report 2013, Social Security Organization, Malaysia, available for download at www.perkeso.gov.my/en/report/annual-reports.html

Surienty, L. (2012). Management practices and OSH implementation in SMEs in Malaysia. Universiti Sains Malaysia. Retrieved October 1, 2013, available for download at <http://ilera2012.wharton.upenn.edu/refereedpapers/surientylilisilera.pdf>

Perrow, C (2001). Normal Accidents: Living with High-Risk Technologies, Nasic Books, New York.

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