

SIGNIFICANT WORKPLACE INJURIES AND DISEASES IN SRI LANKA

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Department of Building Economics

University of Moratuwa
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Thesis submitted in partial fulfillment of the requirements for the degree of
Master of Science in Occupational Safety and Health Management

Department of Building Economics

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Sri Lanka

August 2016

Declaration

I hereby declare that this is my own work and that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or institute of higher learning and that to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where acknowledgement has been made in the text.

.....
A.W.M.B. Wijekoon

.....
Date

Certification

The above candidate has carried out research for the Masters Dissertation under my supervision.



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.....
Ch.QS. H.S. Jayasena

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Date

Abstract

Significant Workplace Injuries and Diseases in Sri Lanka

Abstract: The growth of the industrial sector has been a valuable element of the economic development strategies of many countries worldwide. However in industrial operations, there is a risk of accidents and diseases that can cause extensive harm to people, and incur huge costs. The victims need to be compensated in accordance with the Workmen's Compensation Act. This thesis presents the results of a study conducted to analyze the most significant accidents and diseases that occur in workplaces by considering the insurance claims made under the Workmen's Compensation Act.

The study classifies different types of accidents, and compares and correlates their severity and frequency. During the analysis, different types of accidents that had taken place in workplaces were identified along with the most significant accidents among them. The correlation between the severity and the frequency of workplace accidents was also established. The frequency and time have a "positive linear relationship" with each other whereas severity has a "negative linear relationship" with time. The cost per accident (severity/ frequency) has a "negative linear relationship with time. With the rapid industrialization of the country, this subject has become an area that needs to be addressed early to keep up with the phase of development. Efforts made towards reducing the rate of severity/ frequency could be a good indication that the need to gradually improve workplace safety has been acknowledged. Therefore, this study is one of the important parameters that could be used to monitor the level of safety in a workplace. The ratio (cost/ accident) also could be used to benchmark a workplace against other workplaces. This study has also revealed that no compensation has been paid for occupational diseases, which raises a concern on the effectiveness of our national policy on workplace safety.

Keywords: Accidents, Diseases, Workmen's Compensation Act, Insurance, Cost, Workplace, Safety

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Table of Contents

Declaration	i
Abstract	ii
Acknowledgement	iii
Table of Contents	iv
List of Figures	vi
List of Tables	vii
List of Abbreviations	viii
CHAPTER 01	1
1.0 Introduction to the research.....	1
1.1 Background	1
1.2 Research problem.....	3
1.3 Aim of the study.....	3
1.4 Objectives of the study.....	3
1.5 Methodology.....	4
1.6 Scope & Limitations.....	4
1.7 Structure of the thesis (Chapter breakdown).....	5
1.8 Summary	6
CHAPTER 02	7
2.0 Literature Review.....	7
2.1 Workplace accidents and diseases in different industries.....	7
2.2 Prevention of workplace accidents and diseases.....	8
2.3 Severity of accidents and diseases	9
2.4 Drawbacks in accident reporting.....	12
2.5 Some contributors of workplace accidents	12
2.6 Personal Protective Equipment (PPE) as a last resort against accidents and diseases	13
2.7 Liability under the Workmen’s Compensation Ordinance	14
2.8 Gaps in the existing reporting procedure	16
2.9 Industrial Safety and Health in Sri Lanka.....	17
2.10 Conceptual framework.....	22

CHAPTER 03	25
3.0 Research methodology	25
3.1 Introduction	25
3.2 Study Setting	25
3.3 Study Population	25
3.4 Study Design	26
3.5 Study Tools	26
3.6 Research Process	27
3.7 Data Collection	27
3.8 Data Analysis	31
3.9 Summary	33
CHAPTER 04	34
4.0 Data analysis and results	34
4.1 Introduction	34
4.2 Composition of the sample	34
CHAPTER 05	58
5.0 Conclusions and Recommendations	58
5.1 Summary of Study	58
5.2 Key Findings	58
5.3 Conclusions	59
5.4 Recommendations	60
5.5 Other Recommendations	62
5.6 Limitations of Study	63
5.6.1 Period	63
5.6.2 Data Source Characteristics	63
5.7 Further Research	64
List of References	65



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List of Figures

Figure 4. 1: Monthly frequency of accidents	35
Figure 4. 2 : Quarterly frequency of accidents and trend.....	36
Figure 4. 3 : Quarterly severity of accidents and trend.....	37
Figure 4. 4 : Cost per accident on quarterly frequency basis and trend.....	38
Figure 4. 5 : Main types of accidents-based on frequency.....	39
Figure 4. 6 : Other types of accidents –based on frequency	40
Figure 4. 7 : Quarterly accident frequency in each year	42
Figure 4. 8 : Quarterly accident severity in each year	43
Figure 4. 9 : Main types of accidents-based on severity	44
Figure 4. 10 : Fatal and non-fatal accidents-based on severity.....	45
Figure 4. 11 : Fatal and non-fatal accidents-based on frequency.....	46
Figure 4. 12 : Main groups of accidents-based on frequency	47
Figure 4. 13 : Other groups of accidents-based on frequency	48
Figure 4. 14 : The type of accidents under industrial group-based on frequency.....	49
Figure 4. 15 : The type of accidents under commuting group-based on frequency....	50
Figure 4. 16 : The type of accidents under man-made group-based on frequency	51
Figure 4. 17 : The types of accidents under natural group-based on frequency	52
Figure 4. 18 : Main groups of accidents –based on severity.....	53
Figure 4. 19 : The cost incurred in each type of accident under commuting group ...	54
Figure 4. 20 : The cost incurred in each type of accident under industrial group.....	55
Figure 4. 21 : The cost incurred in each type of accident under man-made group.....	56
Figure 4. 22 : The cost incurred in each type of accident under natural group.....	57

List of Tables

Table 2. 1 : Estimated cost components of occupational injuries and diseases (M.Lebeau et al/Journal of Safety Research 50(2014) 89-98)	11
Table 2. 2 : Accidents classified by industries in year 2008.....	19
Table 2. 3 : Accidents classified by type of accident.....	20
Table 2. 4 : Fatal Accidents in year 2008(Classified by Major Groups)	20
Table 2. 5 : Accidents in 2008 by age.....	20
Table 2. 6 : Accidents in 2008 by agency	21
Table 2. 7 : Percentage of workers in each industry	21
Table 2. 8 : Accidents by sex from 2004 to 2008	21
Table 3. 1: Sample of Secondary Data (Raw data)	29
Table 3. 2: Sample of Secondary Data (Arranged data)	29
Table 3. 3: Accidents severity	30
Table 3. 4: Accidents frequency	31
Table 4. 1 : The types of accidents which were in the initial data base (Not taken into this study)	41
Table 4. 2 : The main groups and respective accident types (From January 2010 to September 2013).....	47



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List of Abbreviations

FIE	–	Factory Inspecting Engineer
CFIE	–	Chief Factory Inspecting Engineer
CPFs	–	Construction Project – Features
H & S	–	Health and Safety
ILO	–	International Labor Organization
LU	–	Labor Union
OSH	–	Occupational Safety and Health
OSHC	–	Occupational Safety and Health Committee
OIR	–	Occupational Injury and Illness Rate
OSHAS	–	Occupational Safety and Health Auditing System
PPE	–	Personal Protective Equipment
RTA	–	Road Traffic Accident
SLS	–	Sri Lanka Standards
UK	–	United Kingdom
WCI		Workmen's Compensation Insurance
WCO		Workmen's Compensation Ordinance



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1.0 Introduction to the Research

With the rapid phase of development taking place in the industry, there have been concerns on the employees' safety and health. In this context, the identification of most significant accidents and diseases in relation to industrial operations, would pave the way to mitigate those and enhance the quality of the employees. It will promote productivity, and industrial peace and harmony. This thesis is on a research conducted to identify the most significant workplace accidents and diseases. The findings of the study will be useful to mitigate accidents and diseases proactively.

1.1 Background

The growth of the industrial sector has been a valuable element of economic development strategies of many countries worldwide. However, industrial operations come with a risk of injuries and diseases that can cause extensive harm to people, thereby incurring a huge cost. The victims need to be compensated, in accordance with the Workmen's Compensation Act. The Workmen's Compensation Insurance (WCI) is one of the common avenues available to compensate the victims of workplace related injuries/accidents and diseases.

Almost all the countries pay compensation for occupational injuries and diseases. However, countries vary greatly from one another in the way they organize workers' compensation systems. An employee affected by occupational injuries and diseases is compensated either through a Workmen's Compensation Insurance Scheme or through an employers' funding mechanism. Private insurance schemes encourage their clients to mitigate occupational accidents and thereby the associated insurance costs. A higher coverage is associated with a low rate of occupational injuries and diseases. This indicates that the 'worker comfort effect' is greater than the 'moral hazard effect'. This shows that the insurance scheme plays an important role in

determining the occurrence of occupational injuries and diseases. The policy makers should consider the effect of insurance schemes in order to reduce the occurrence of occupational accidents (Shin, young, & Hyung, 2011).

Occupational accidents directly affect the employees as well as the property of the employers, and also increase the social cost of a country. In 1998, the number of fatal injuries in the world was 350,000, i.e., 970 deaths per day. The estimated number of non-fatal occupational injuries was 264 million, which amounts to more than 700,000 injured workers per day (Hamalainen, Takala, & Saarela, 2007).

According to statistics pertaining to construction accidents, the number of fatal accidents in Sri Lanka has shown an increase between 2009 and 2012 whereas during the same period, non-fatal accidents have shown a decrease in their number. The highest number of accidents have been caused by construction activities (construction industry) amounting to 30% of the total number. (De Silva & Nawarathna, 2014). Results indicate that these accidents were mainly due to unsafe behaviour/acts (80% to 88%). The balance 12% to 20% of the accidents can be avoided through the implementation of effective engineering controls and administrative strategies (Al-Hemound & Al-Asfoor, 2006). The reporting procedure of construction accidents has so many drawbacks, most important among them being the inaccessibility to loss history. This hinders taking control measures or rather mitigating the risks through lessons learnt from past accidents. Labour Unions (LU) and Occupational Safety and Health Committees (OSHCs) engaged in accident prevention activities can effect changes to Occupational Injury and Illness Rate (OIIR) (Hyung, Hak Cho, & Kim, 2011).

The International Labour Organization (ILO) has estimated the total cost of occupational accidents and work related diseases to be 4% of the gross national product of a country. Workmen compensation is a liability for the employer and is a legal requirement under the Factory Ordinance.

The parties who are responsible for occupational accidents and occupational diseases are mainly the employers, employees, relevant authorities, and the society as a whole. Although all parties do understand the necessity for mitigating accidents and diseases, so far these have not been adequately addressed. The decision makers need facts and figures to understand the gravity of the problem, so that they can take appropriate action based on those facts and figures. In general, policy makers will be encouraged to take actions to mitigate significant accidents and diseases if they know the significance of these workplace accidents and diseases.

1.2 Research Problem

According to the available information, no proper study has so far been conducted in Sri Lanka to identify the most significant of workplace accidents and diseases. This knowledge is necessary to mitigate accidents and diseases proactively. Since Sri Lanka is being developed in many sectors, more attention needs to be drawn on workplace accidents and diseases to ensure a safer workforce, and to achieve sustainable development. The gap in the knowledge on the most significant workplace accidents and diseases hinders the development of appropriate mitigation strategies and policies. This emphasises the requirement to identify the most significant workplace accidents and diseases, and to determine the frequency and the severity of these accidents and diseases.

1.3 Aim of the Study

The aim of this study is to identify the most significant workplace accidents and diseases in Sri Lanka.

1.4 Objectives of the Study

To achieve the aim of the study, the following specific objectives were formulated:

1. Identification of different types of workplace accidents and diseases in Sri Lanka

1. Determination of the frequency and the severity of workplace accidents and diseases, and their trends
2. Identification of the most significant workplace accidents and diseases in Sri Lanka based on their frequency and severity

1.5 Methodology

Research methodology refers to the principles and procedures of a logical thinking process that are applied to a scientific investigation (Fellows & Liu, 2003). Quantitative data analysis was used as the methodology in this study. Insurance claim data that was based on the Workmen's Compensation Insurance (WCI) was used for the analysis. The data consisted of claims that were paid in accordance with the Workmen's Compensation Act, and this has been the first time that this type of data has been used in a study to analyse workplace accidents and diseases.

1.6 Scope & Limitations

According to the Workmen's Compensation Ordinance, an occupational disease can also be treated as an accident that happens to a person while he is employed. The disease must be directly or reasonably attributable to the work the person was engaged in. Although accidents that occur while "Travelling to and from work" are not strictly covered under the Act, the insurer selected has included this in his insurance policy.

One particular insurance company was selected for this study. Secondary data over a four year period (from 2010 to 2013) was collected for the study. Conclusions were made after a statistical analysis by using the date of the injury/accident, type of injury/accident, and the frequency and severity of accidents/diseases. Data related to insurance claims made by the Insurer under the Workmen's Compensation Insurance (WCI) was used for the analysis. Employer's liability for workplace accidents under the Workmen's Compensation Act is transferred via WCI.

1.7 Structure of the Thesis (Chapter Breakdown)

This thesis will comprise of five chapters.

Chapter 1: Introduction

This chapter provides the basic background information about the thesis, constraints to the study, research problem, aim of the study, objectives of the study, scope and limitations, and the preparation of the thesis.

Chapter 2: Literature Review

This chapter presents a general overview of workplace injuries and diseases and their causes, significant workplace accidents and diseases, methods used to mitigate risks and costs incurred in specific situations of different industries including high risk industries and their hazard levels, and the compensation mechanisms in place. Furthermore, this chapter presents how workmen compensation insurance is involved in claim settlement connected with workplace accidents or diseases. In order to understand the causes of injuries and diseases in workplaces, and the costs of compensation, references were made in the areas, namely wages and compensation cost, workmen compensation insurance, occupational injuries and illnesses and associated costs in different industries, activities of labour unions and health committees' which can effect changes to the occupational injury and illness rate, training and management systems.

Chapter 3: Methodology

The methodology framework adopted in carrying out this research is discussed in this chapter outlining under several sub topics, study setting, study population, study design, study tools and data analysis.

Chapter 4: Data Analysis and Results

The focus of this chapter is on the research findings and on the summary of the study. The chapter starts with an introduction, analyses a data set of 3367 and

presents the analysis in the form of graphs, pie charts, bar charts, tables, trends and relationships. A brief explanation is given for each of the analysis.

Chapter 5: Conclusions and Recommendations

Conclusions were made based on the analysis. Through the analysis and a general discussion about the thesis, recommendations to be made and the type of additional research that could be done were identified.

1.8 Summary

Occupational accidents and diseases have a huge impact on the society as a whole. Thus, it is important to identify the most significant occupational accidents and diseases. Workmen's Compensation Insurance under the Workmen's Compensation Act is one of the common mechanisms available to provide compensation to affected employees. Victims of occupational accidents and diseases are covered under the Workmen's Compensation Act. Policy makers need facts and figures to understand the gravity of the problem, and to make decisions. According to the information currently available, no proper study has so far been conducted in Sri Lanka to understand the most significant occupational accidents and diseases in the country.



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2.0 Literature Review

This chapter presents a general overview of workplace injuries and diseases, their costs in relation to different industries including high risk industries and their hazard levels along with the compensation mechanisms in place. Furthermore, the chapter presents how the workmen's compensation insurance schemes get involved in claim settlement when there has been a workplace accident or a disease. In order to understand the causes of significant injuries and diseases that occur in workplaces, and also their compensation costs (severity), references have been made to wages and compensation costs, workmen compensation insurance, occupational injuries and illnesses and associated costs in various industries, activities of labour unions and health committees' in changing occupational injury and illness rate, Workmen's Compensation Act, training and management systems.



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2.1 Workplace Accidents and Diseases in the Industry

The construction sector in Sri Lanka has the highest percentage of accidents (ranging from minor accidents to fatal accidents) when compared to other sectors (De Silva & Nawarathna, 2014). Although it was difficult to get the exact figures, more than 30% of the reported accidents in Sri Lanka which is about 60% of the total number of accidents that have occurred were in the construction sector (Rameezdeen, Pathirage, & Weerasooriya, 2003). This sector has reported the highest accident rate globally as well. The construction industry is found to have 13 times more accidents than the other industries (Amarasinghe, 2009; Rameezdeen, et al., 2003). Thus the construction industry with the highest accident rate is a high risk industry compared to other industries. In Hong Kong, 25.2% of industrial accidents in 2012 have been in the construction sector according to its Department of Labour with a recorded 1.5% increase of the values in 2011 (Published in 2013). In UK too, the construction industry has been identified as the most hazardous industry and with about two

million construction workers, a huge cost has been incurred in respect of accidents (Office of Government Commerce, 2004). Hence, the authorities are highly concerned about the Health and Safety (H&S) issues in the construction sector. There had been another study focussing on Construction Project Features (CPFs) and their influence on the health and safety of workers and accident occurrence (Suraji, Duff, & Peckitt, 2001; Haslam, et al., 2005). In Korea, the accident rate in 2002 had been 0.77 per 100 workers, a figure almost same as that of the previous year. The number of workers who suffered industrial accidents in Korea stood at 81,911 in 2003, an increase by 477 over that of the previous year (Korea Occupational Safety and Health Agency, Republic of Korea, 2003).

2.2 Prevention of Workplace Accidents and Diseases

Awareness on these hazards is the key to minimizing their impact. Paint industry results show that 72.5% of the employees in that industry were aware about the hazards they face, 30% have had formal training, 40% did not wear Personal Protective Equipment (PPE) and that 90% had developed symptoms. Blood tests are indicative of recent exposures to carcinogens while urine tests are indicative of long term exposures (Awodele et al., 2014). Labour Unions (LUs) and Occupational Safety and Health Committees (OSHCs) who engage in accident prevention activities can contribute to changes in the Occupational Injury and Illness Rate (OIIR). According to a study done in Korea on manufacturing industries having more than 5 employees, those which had either LUs or OSHCs, showed a relatively low OIIR. The parties who are involved in the occupational safety and health system of a country are its government, workers, workplace owners and the OSH experts. The government, workers and workplace owners are responsible for legal and institutional strategies (Hyung YI, Hak Cho, & Kim, 2011). Therefore, establishing an integrated model for measuring site safety performance of construction projects is a good construction safety management practice for accident prevention and mitigation. For improving site safety performance and minimizing accidents, it is important to identify core factors and associated sub factors that cause accidents in worksites. The complexity of the project, degree of safety supervision, rate of labour

turnover, frequency of safety inspections, degree of control exercised on sub-contractors by the main contractor, frequency of legal convictions in safety, experience of construction workers, efforts on safety promotion, frequency of safety audits or reviews, frequency of reported accidents, contributions of top management to safety, extent of safety training and personal protection, frequency of safety meetings, and the implementation of preventive and corrective safety measures are found to be the core factors(Chan & Choi, 2014)

2.3 Severity of Accidents and Diseases

It is important to know first the classification of costs. Costs of occupational injuries are usually divided into three categories as direct costs, indirect costs, and pain and suffering costs. Pain and suffering costs are also called human costs (Corso, Finkelstein, Miller, Fiebelkorn, & Zaloshnja, 2006). The cost of occupational injuries and diseases can be further sub-divided into six categories, i.e., medical costs, funeral costs, salary costs, productivity costs, administrative costs, and human costs. Medical costs refer to all expenditure incurred in treating and rehabilitating injured or sick workers. They include the expenses of medical equipment, medications and transport along with expenses related to hospital administrative work. Medical costs of employers incurred in treating and rehabilitating workers with an accepted injury/disease through employers' contributions also come under this category of costs. Some injuries and diseases end up in death, and a death will entail funeral costs. Funeral costs borne by an employer relate to that part of the funeral costs reimbursed by the employer subject to a maximum, through death benefits awarded to workers. These funeral costs affect not only the workers but also the community. They have been estimated at \$ 1,349,457 in Quebec during one year (Hamdad, 2003). Salary costs too need to be considered, as employers have to pay for un-worked or non-productive hours in the form of wages and fringe benefits (Health and Safety Executive, 2013). Productivity loss relates to paid or unpaid work that is no longer performed by the victim. A decrease in productivity means a decrease in income. In estimating productivity losses, injuries and diseases can be separated into two categories as non-fatal and fatal. To calculate lost wages of non-

fatal accidents, the worker's daily gross pay is multiplied by the number of compensated days. The human capital method is used in case of fatal accidents. This method discounts future gross earnings from the year of death to the expected year of retirement. According to Rice, Mackenzie, and Associates (1989) the overall model will be as follows:

$$PV = \sum_{n=y}^{60} p_{s,y,n} S_n (1 + g / 1 + r)^{n-y}$$

where

- PV is the present value of future earnings
- $p_{s,y,n}$ is the probability that a person of sex s and age y will survive up to age n
- S_n is the worker's annual pay at age n (includes wage growth adjustment)
- g is the rate of increase of labor productivity
- r is the real discount rate

The termination age used was 60 years (Institute de la statistique du Quebec, 2009).



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Human costs (called pain and suffering costs) are easily challengeable, and are difficult to measure. An affected worker has to undergo changes in his quality of life, family, friends, co-workers, and the community around him. The duration of such changes also is important. The situation will be worse in case of a death or in the potential loss of years of life (Rice, D. P., Mackenzie, E. I., & Associates, 1989).

Table 2. 1: Estimated cost components of occupational injuries and diseases
(M.Lebeau et al/Journal of Safety Research 50(2014) 89-98)

Costs	Employers	Workers	Community
Medical Costs	Medical aid costs Rehabilitation costs	-	-
Funeral Costs	Compensated funeral costs	Funeral costs(net of compensation)	Death benefits
Salary Costs	Waste pay of the injured worker on the day of the accident	-	-
Productivity Losses	Lost wages Income replacement Indemnities Death benefits Fringe benefits Fringe benefits assumed by the employer for non-productive employees Household work Compensated household work	Lost wages (net of compensation) Lost fringe benefits Inability to work Inability to work (net of compensation)	Uncollected income tax Fringe benefits assumed by the community
Administrative Costs	Recruitment and training	-	-
Pain and Suffering Costs	Body injury indemnities	Pain, anxiety, stress, and loss of enjoyment of life affecting the victim, family members, and friends (net of compensation)	

In a study carried out in 2008 in Bangkok, two types of costs related to workplace injuries and illnesses, i.e., direct costs and indirect costs have been identified. Workmen compensation data from workmen compensation claims had been collected from the Thai Workmen Compensation Fund. The study had focused on direct costs, which had been collected from the payments made on workmen

compensation claims. A total of 52,074 non-fatal occupational injuries with an overall incident rate of 16.9 per 1,000 had been considered. The total direct cost had been estimated as \$ 13.87 million, out of which \$9.88 million had been for medical services and related expenses and \$ 3.98 million for compensable reimbursements. The no compensated lost earning was estimated to be an additional \$2.66 million (International Labour Organization Asian-Pacific Regional Network on Occupational Safety and Health Information [internet].2009[cited 2014 Sep. 3]).

2.4 Drawbacks in Accident Reporting

The reporting procedure of construction accidents has got so many drawbacks, the most important of them being the inaccessibility to loss history. This hinders the enforcement of control measures or rather mitigation of the risks by making use of lessons learnt from past accidents (International Labour Organization (ILO), 1996). This situation is also the case in most of the other industries as well.

2.5 Contributors to Workplace Accidents

Accidents are mainly due to workers' behaviour (unsafe acts and unsafe behaviour) form 90% of the accidents (Ahamed, Nafeel, Rishath & Dissanayake, 2011). There is other research which indicates slightly different figures (80%, 88% etc.). However, it is quite clear that unsafe acts and behaviour are the main factors that need to be considered in mitigating construction accidents (Al-Hemound & Al-Asfoor, 2006). Occupational hazards vary depending on the workplace, the process, the type of raw material used, and on the items produced. In the paint industry, medical hazards are caused by heavy metals such as lead, cadmium, and chromium pigments, and fungicides such as mercuric oxide (Piper, 1965). Hazards are of two types, some of which can be easily recognized whereas others can remain undetected for many years (Molyneux, 1981; Courtney, 1996; Cox, 1998). Lead and mercury have serious irreversible impacts on the mental development of children (Manda, 2004). Adults may also experience symptoms such as high blood pressure, fatigue, kidney and brain disturbances (Hifsa, 2009) when exposed to these metals. There can

be carcinogenic effects when a person is exposed to these metals for a long period (Shad, 2008). There are 18 factors that influence the safety behaviour of construction workers. They come under 2 main categories as personal factors and as organizational factors. Personal factors are age (Hinze,1997; Swacha et al.,1999; Carpenter,2002; Parker,2007; Seixas,2008; Choudhry et al., 2008), marital status (Fang et al.,2006; Choudhry & Fang, 2008), number of dependents (Fang et al., 2006; Choudhry & Fang, 2008), education level (Hinze,1997; Carpenter, 2002; Parker,2007; Seixas, 2008; Masood & Choudhry, 2012), knowledge on safety (Fang et al., 2006; Idirimanna & Jayawardena, 2011; Masood & Choudhry, 2012), experience (Siu et al., 2004), gender (Hinze,1997; Carpenter,2002; Parker,2007; Seixas,2008; Masood & Choudhry, 2012), drinking habits (Fang et al, 2006; Masood and Choudhry, 2012), work related pressure (Choudhry & Fang, 2008) and work-mate safety behaviour (Swacha et al., 1999). Organizational factors are the commitment of the management, provision of a Peptide site, safety training and awareness, site layout, OSH monitoring and feedback systems, incentives and employment types. These findings of the in-depth literature review were further verified from industrial experts working in the construction industry in Sri Lanka. Based on their responses, 'gender' and 'employment type' were removed from the list applicable to Sri Lanka, and 'previous exposure to OSH accidents' was added (Manjula, & De Silva, 2014). It is important to understand the proximate factor of Construction Project Features (CPF) that has an influence on the accident occurrence. For example, manual handling, mechanical handling and housekeeping problems (proximate factors) will have little influence on accident occurrence in pre-assembly construction whereas they will have considerable influence on conventional on site construction (Manu, Ankrah, Proverbs & Suresh, 2010).

2.6 Personal Protective Equipment (PPE) as a last resort against Accidents and Diseases

The “Human Element” plays an important role in accident prevention in a workplace. Studies have shown that approximately 80% of the accidents in workplaces can be attributed to unsafe behaviour or rather a deficiency in their management systems,

and that the balance 20% can be addressed by enforcing effective engineering controls and implementing appropriate administrative strategies. Personal Protective Equipment (PPE) is used as a last resort in the prevention of accidents and diseases.

2.7 Liability under the Workmen's Compensation Ordinance

This law was enacted in 1934. It provides legal provision for the payment of compensation for injuries and deaths that occur during the course of employment of a workman. The original act was amended subsequently several times, the most recent being the Act No. 10 of 2005. According to this act, an employer is liable to pay compensation to a workman who meets with an accident that causes him injury or death. There is liability to pay compensation to a worker under this ordinance, if there has been an accident to him which has arisen out of his employment, and in the course of his employment. An occupational disease of a worker is also treated as an accident to him that has arisen in the course of his employment. The disease must be directly or reasonably attributable to the work in which the worker was engaged. There are however exceptions applicable under this ordinance (subsection 3 of the Workmen's Compensation Act). The employer is not liable to pay compensation if the injury is negligible (i.e., if the injury results in total or partial disablement for not more than 3 days). Any injury which does not result in death and which is directly attributable to facts such as being under the influence of liquor, wilful disobedience by not accepting orders given expressly to ensure safety and wilful removal of or disregard to any safety device given to ensure safety. A workman is defined in this ordinance as any person who has entered into or works under a contract with an employer in any capacity for the purposes of his trade or business irrespective of whether the contract is expressed or implied, oral or in writing, and whether it is a contract of service or of apprenticeship or a personal contract to execute work and whether the remuneration payable therein is calculated by time, or by the amount of work done or otherwise, and whether such contract was made before or after the coming in to force of this definition. Persons who are contracted only for a certain period of time or persons under apprentice are also included under this definition. The members of armed forces (except persons who are working in civil capacity) and

the members of police are excluded. The maximum amount of compensation payable in the case of death is Rs. 550,000/=, as given in Schedule IV of the Ordinance., The amount of compensation payable subject to the provisions of the Workmen's Compensation Ordinance will be as given below.

- a. Where death results from the injury and the deceased was a workman in receipt of monthly wages falling within limits shown in the first column of Schedule IV (see page 34), the amount shown against such limits in the second column thereof.
- b. Where permanent total disablement has resulted from the injury, and the disabled workman was in receipt of monthly wages falling within limits shown in the first column of Schedule IV, the amount shown against such limits in the third column thereof.
- c. Where permanent partial disablement has resulted from the injury,
 - I. In the case of an injury specified in Schedule I, such percentage of the compensation which would have been payable in the case of permanent and total disablement is as specified therein being the percentage of the loss of earning capacity caused by that injury, and
 - II. In the case of an injury not specified in Schedule I, such percentage of the compensation payable in the case of permanent and total disablement is proportionate to the loss of earning capacity permanently caused by the injury.

Provided that in a case where more than one injury have been caused by the same accident, the amount of compensation payable under this head shall be aggregated but not so in any case as to exceed the amount which would have been payable if permanent and total disablement had resulted from injuries.

- d. Where temporary disablement, whether total or partial, has resulted from the injury, a half monthly payment payable on the sixteenth day after the expiry of a waiting period of three days from the date of the disablement, and thereafter half monthly, during the disablement or during a period of five years , whichever period is shorter, in the case of a workman in receipt of

monthly wages falling within limits shown in the first column of Schedule IV, of the sum shown against such limits in the fourth column thereof.

If the accident has caused injury, the compensation will be paid to the injured. If the accident has caused death, the compensation will be paid to the dependents. There is a procedure for claiming compensation. In case of an injury, the injured can make an application to the Commissioner (Form A) together with a medical certificate (Form S). In case of death, the dependents can make an application (Form B) along with the death certificate. Insurance of workmen is not compulsory but is advisable. Insurance companies must obtain a license to offer workmen's compensation insurance schemes. If anyone claims compensation under the Workmen's Compensation Ordinance, he/she will not be able to claim compensation from a civil court (Workmen's Compensation Ordinance, 1934).

2.8 Gaps in the existing Reporting Procedure

It is important to identify the gaps in the existing reporting procedure. Eight gaps have been identified, namely (1) failure to report and record systems at organizational level, (2) failure to report to the Department of Labour, (3) failure to report minor accidents (in less than 3 working days), (4) unavailability of a centralized recording system, (5) poor relationship between the Department of Workmen Compensation and the Department of Labour, (6) poor relationship between insurance companies and the Department of Labour, (7) poor relationship between hospitals and the Department of Labour, and (8) poor relationship between the police and the Department of Labour. Seven strategies can be proposed to lessen the identified gaps such as the establishment of an independent division, employment of qualified safety representatives, introduction of prescribed information sheets, conduct of awareness programmes, implementation of the SLS OSHAS 18001 standard, continuous monitoring of notification of accidents and encouragement given to construction organizations to apply for the OSH excellence award (De Silva & Nawarathna, 2014).

2.9 Industrial Safety and Health in Sri Lanka

Sri Lanka is an island in the Indian Ocean with 64, 000 sq.km in land extent. It has become an important country in South Asia because of its unrivalled geo-strategic location in the Indian Ocean. It has a population of nearly 20 million (as of now) of whom nearly 6.0 million represents the working population. This figure can vary due to the rapid pace of development taking place in the island. The growth of such activities has obviously posed problems on occupational health & safety in the industries of the country.

Improving industrial health & safety at national level is vital, particularly in the context of the rapid expansion of the industrial and constructional sectors which result in the establishment of new industries and development projects with foreign aid and collaboration.

The Industrial Safety Division of the Department of Labour is engaged in carrying out routing inspections of industries to ensure that the provisions relating to safety are complied with. Special inspections are carried out for investigating accidents. Investigations are also carried out on a priority basis when complaints with regard to health & safety are received. Action under Section 44 of Factories Ordinance is initiated whenever it is noted at an inspection that the conditions and processes at the workplace concerned are hazardous or dangerous. It is only after eliminating these hazards or dangers, that permission will be granted to the industry and construction sites concerned to commence their operations.

The factory inspectorate is also engaged in carrying out routing inspections of the industries to ensure that provisions relating to safety, health & welfare of workers are provided and maintained in an efficient manner. Special inspections are also carried out for investigating accidents.

The additional duties of the Factory Inspecting Engineers include the prosecution of errant factory occupiers and in the case of fatal accidents, attending courts and Workmen's Compensation Tribunals as and when required.

Under the amended Law, any new factories to be constructed have to be initially approved by the Factory Inspectorate. The industrialists have to be aware of the building plans, the layout of machinery, processes, safety measures, fire prevention, health requirements in order to create a safe working environment for their workers from the beginning itself.

Definition of Labour Accidents

An industrial accident is an unplanned and uncontrolled event in which the action or reaction of an object, substance or person may result in personnel injury to a worker or damage to property. Accidents will not just happen but will happen only due to some cause. Hence, care is required to prevent accidents because it is said that all accidents have a cause. The causes are either

- a. the result of an unsafe act or,
 - b. the result of an unsafe condition.
- 

Labour Accidents Reporting System (Death and Injury)

The Factories Amendment of Law No. 12 of 1976 relates to reporting of accidents. According to this amendment, all accidents which

- a. cause death to any person employed in a factory,
- b. disables any such person for more than three days from earning full wages at work at which he was employed, or
- c. make any such persons unconscious as a result of heat exhaustion, electric shock, poisonous fumes or gases.

have to be reported to the District Factory Inspecting Engineer using Form 10. Immediately after the injured persons resume work after accidents in the categories (b) & (c), a Follow - up Report on Form CFIE – 1 has to be submitted to the District Factory Inspecting Engineer.

The above mentioned law is applicable to all manufacturing enterprises, construction sites and service industries.

Statistics

The number of fatal accidents that occurred in the years 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007 and 2008 are 43, 32, 44, 51, 42, 52, 84, 77 and 45 respectively. The number of non-fatal accidents that occurred in the years 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007 and 2008 are 2253, 2122, 1907, 1742, 1522, 1688, 1740, 1755 and 1454 respectively.

Table 2. 2: Accidents in the year 2008 classified according to industries

Industry	No. of accidents in the year 2008
Tea	70
Rubber	172
Rice & grinding mill	9
Food & Beverage	155
Textile & con	90
Timber	24
Textile	394
Leather	13
Metal	86
Building & construction	34
Ports & Docks	54
Electricity & water	22
Petroleum & chemicals	37
Ceramic & Tiles	72
Paper based Industries	84
Hotel & Restaurant	6
Transport & storage	24
Others	150

Table 2. 3: Accidents in the year 2008 classified by the type of accident

Type of Accident	No of Accidents in the year 2008
Fall of persons	238
Stuck by falling objects	179
Struck by objects	384
Caught in or between objects	366
Strenuous movement	20
Contact with electric current	16
Exposure to harmful substances	46
Explosions or fire	17
Other	194

Table 2. 4: Fatal accidents in the year 2008 classified by the type of major groups

Major Groups of Fatal Accidents	Percentage in year 2008 (%)
Falls	36
Machinery	11
Electrocution	1
Explosions and Burns	1
Others	24

Table 2. 5: Accidents in the year 2008 classified by age

Age	Accidents Percentage (%)
Below 20	7
20-25	21
25-30	19
30-35	12
35-40	10
40-45	10
45-50	8
50-55	5
55-60	1
Above 60	7

Table 2. 6: Accidents in the year 2008 classified by agency

Agency	Accidents in Percentage (%)
Prime Movers	0
Transmission Machinery	1
Other Machines	50
Transport & Lifting Equipment	2
Pressure Vessels	1
Kilns & Furnaces	1
Materials	11
Working Environment	32
Electrical Installations & Tools	1
Ladders & Scaffolding	1

Table 2. 7: Percentage of workers in each industry

Industry	Percentage of Workers
Agriculture	38.2
Mining & quarrying	1.2
Manufacturing	15.7
Electricity, Gas & Water	0.8
Construction	5.1
Commerce & Hotels	12.6
Transport, Storage & Communication	4.2
Insurance & Real Estates	1.6
Personal services	17.6
Not defined	3.2

Table 2. 8: Accidents classified by sex during the period from 2004 to 2008

Year	Male	Female
2004	1817	347
2005	1894	312
2006	1938	303
2007	1817	389
2008	1195	312


Electrocution & falls have been the major causes of fatal accidents for many years. The majority of these fatal accidents have occurred in the construction industry and their numbers have remained relatively constant over the years (Labour Gessate, Department of Labour).

2.10. Conceptual Framework

The following are the conclusions made from the literature survey:

- a. According to statistics, the number of fatal accidents that occurred in Sri Lanka has increased during the period from 2009 to 2012 whereas the number of non-fatal accidents that occurred during the same period has decreased (De Silva & Nawarathna, 2014). Worker population has also increased during this period. Therefore, it is difficult to analyse these changes and comment on them. However, there can be many reasons for the increase in figures such as increase in worker population and awareness about and motivation to report accidents. According to statistics, it appears that there was more interest in reporting fatal accidents than in reporting minor accidents. Generally, non-fatal injuries are less attention and the causes of most of them are known. However, fatal accidents are of low frequency and in most cases their causes are identified only after the accidents have occurred. Therefore, a proactive approach is essential in managing these accidents.
- b. Since more than 80% of accidents are caused by employee behaviour, it is critical to ensure safety behaviour in industries. Personal factors affecting the safety behaviour are the age, marital status, number of dependents, education level, knowledge on safety, experience, gender, drinking habits, work related pressure and work mates' safety behaviour (Al-Hemound & Al-Asfoor, 2006).
- c. In a manufacturing organization, getting Labour Unions or Occupational Safety and Health Committees to get involved in accident and illness prevention activities will reduce the illness and accident rate, and will also

enhance labour productivity (Hyung, Hak Cho, & Kim, 2011). The main parties involved in implementing legal and institutional strategies are the government, the labourers and the workplace owners. A safety expert's involvement is important to enhance the overall safety performance in an organization. Furthermore, an expert's opinion can also be used for an independent and fair judgment.

- d. According to the Department of Labour of Hong Kong, accidents in construction projects in that country have shown a 1.5% increase in their number in 2012 compared to their figure in the year 2011 (published in 2013). There can be many reasons for this increase. One of the reasons could be the weaknesses of the existing system. It is important to carry out research to find out the other reasons. By addressing appropriately the proposed 14 typical core factors such as the complexity of the project, degree of safety supervision, rate of labour turnover, frequency of safety inspection etc., the risks could be mitigated and the accident rate reduced.
- e.  In most of the countries, the construction sector is identified as the most hazardous sector (Office of Government Commerce, 2004). Hence it is necessary to carry out extensive research to identify hazards which have so far not been addressed. Since this is a global issue, knowledge sharing and implementation of improved practices through legal enforcements are essential.
- f. There was a time when to receive compensation under the Workmen's Compensation Ordinance, the victim had to prove that the accident was caused by a fault or negligence on the part of the employer. This situation has now changed in that the employer now has to pay for any workplace accident, and negligence is no longer a concern in deciding compensation. Any person (casual, temporary, short-term) or any person who works as a hired person even for one hour is entitled for compensation. There is no limitation on the duration of the period of work. The employer could be the

contractor, a labour contractor or an outside agent. Thus, there is now a wider cover. However, the fact that the accident has occurred and that it is out of and in the course of the employment of the worker are the basic factors that need to be fulfilled to receive compensation (Workmen's Compensation Ordinance, 1934).

- g. Unsafe acts and unsafe behaviour cause approximately 80% of the accidents. The remaining 20% of accidents can be mitigated using administrative controls and engineering controls, and as a last resort using Personal Protective Equipment (PPE). It is important to note that under the Workmen's Compensation Ordinance, the use of PPE is a requirement. This is referred to in the Ordinance as "Wilful removal of or disregard to any safety device given to the workmen in order to secure safety". If this is proved, the claimant would not be able to proceed with the claim (Workmen's Compensation Ordinance, 1934).



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3.0 Research Methodology

3.1 Introduction

A literature survey and the identification of the research problem were carried out in Chapters 01 and 02. The purpose of this chapter is to outline the way the aim and objectives of the research are achieved. Therefore, this chapter describes the methodology of the research.

3.2 Study Setting

The study was focused on workplace accidents and diseases in Sri Lanka based on Workmen's Compensation Insurance (WCI) Schemes. This segment represents a reasonable amount of reported occupational accidents and diseases. The data of a four year period from 2010 to 2013 obtained from the selected insurance company was used for this study.



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3.3 Study Population

Those who were insured under Workmen Compensation Insurance Policy and numbering 3367 were taken as the target population in this study. Since accessibility to data was limited, convenience sampling was done by obtaining data from one selected insurance company.

Inclusion Criteria: It is a known fact that in most of the industries and large establishments, there are individuals who can afford to have insurance policies to cover accidents and diseases. This category of employees will be present in a majority of industries and individuals. There has been no evidence, or logic to assume a relationship between the nature of accidents and the insurance company selected. Therefore, the sample was considered unbiased and representative.

Exclusion Criteria: The accidents and diseases which did not come under the purview of the insurance company were excluded. It was because that it was not feasible to gather the relevant information because of the non-availability of records.

3.4 Study Design

This study was designed to gather accurate secondary data on accidents and diseases that have occurred over a period of five years. The basic information included was the date of injury/accident, type of injury/accident, and the respective compensation cost. It is the first time that this type of data has been used in a study like this.

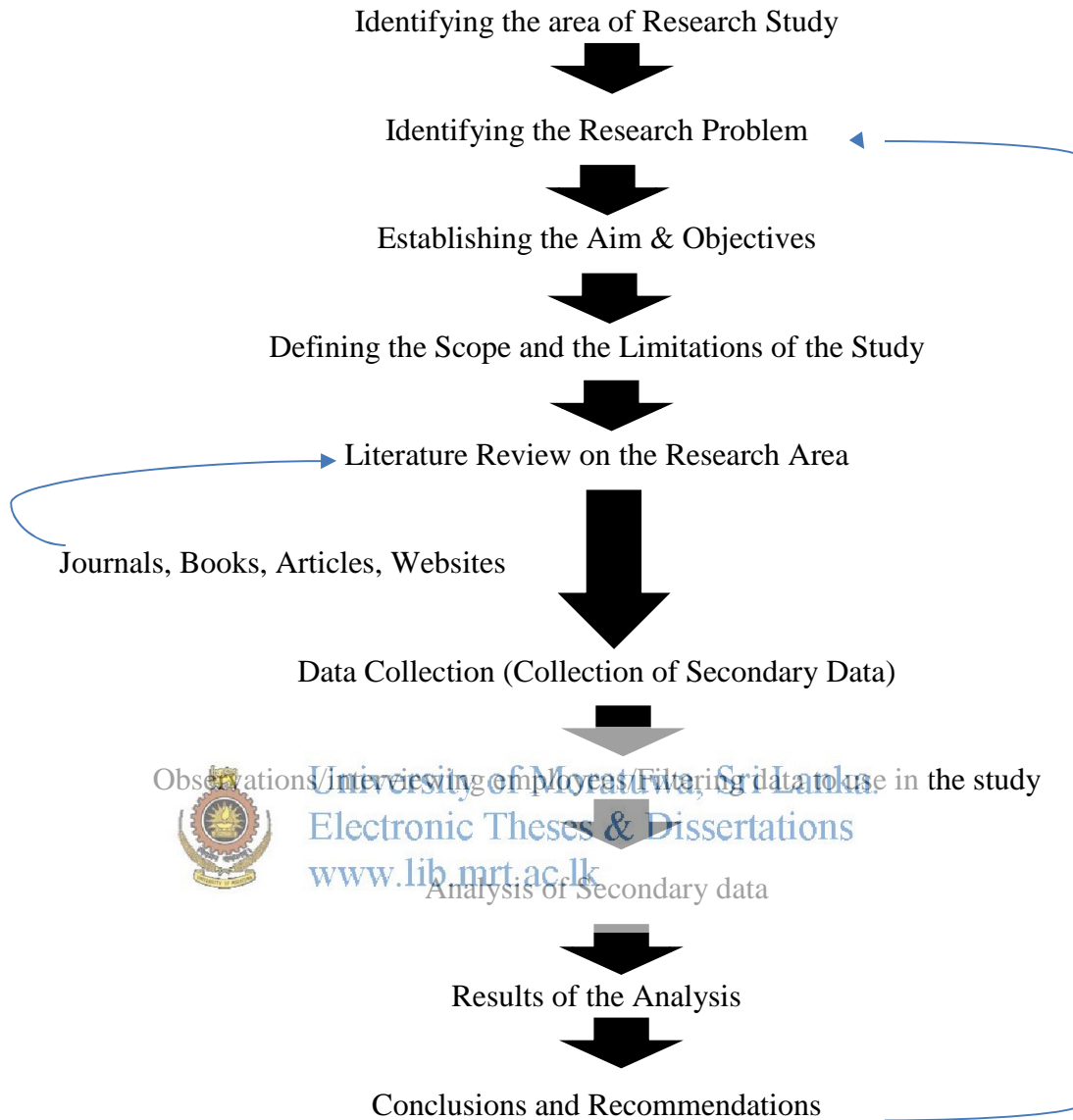
3.5 Study Tools

- References of past accidents under WCI cover
- Statistical analysis
- Interviews with two employees of the insurance company (as described in 3.6) to obtain clarifications about the meaning of different types of accidents mentioned in the data set.



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3.6 Research Process



3.7 Data Collection

According to Tan (2002), commonly used data collection techniques are the interviews, questionnaires, document surveys, observations and participation. In this research document surveys were used to gather data.

Currently, work related accident data is not available with the authorities who investigate accidents in Sri Lanka. One of the most reliable sources as at present is

the insurers offering Workmen's Compensation Insurance Policies. The insurers collect and record data and tailor-make them to suit their purposes. The data is not expected to be exposed to third parties. Therefore, the data set could be obtained only after a significant effort, indicating that it will be used only for this study. The main challenge was in interpreting data for use in the study. The initial data set had many drawbacks, i.e., at times their true meaning was not clear, there were spelling mistakes and different words have been used with a single item of data. The two employees (A and B) who had entered data into the computer had to be interviewed to obtain clarifications with regard to the meaning of some data. For example, it was not clear as to what category "accidental deaths" recorded in the data would fall into. The interview questions and answers were as follows:

Interviews with Employees A and B

A- What do you mean by accidental death in data entry?

They refer to death by road accidents.

B- How are road accidents recorded?

Some are recorded as road traffic accidents while sometimes they are recorded as motor cycle accidents or even simply as accidents.

The above two statements confirm the fact that data recorded as accidental deaths are also due to road traffic accidents.

Both qualitative and quantitative secondary data was used. The required data and information was collected by the Insurer through a structured questionnaire. With the aid of proper records and inspections, the Insurer had prepared a report and done loss adjustments. In loss adjustments, the policy holder has had to state the amounts claimed, and the Insurer has decided on the amounts to be allowed and paid as losses. In addition, the date of loss, type of accident/disease, and losses that were paid were also recorded.

Accidents occur in workplaces. Our main concern is the occupational health and safety in workplaces and the accidents that had occurred due to occupational health and safety issues. Therefore, this particular sample of insurance data pertaining to claims made under Workmen's Compensation Insurance Policy of the Insurer will not have any influence on this study just because of the fact that it has been collected from one particular insurer.

The basic tables prepared for the analysis by using raw data (Table 3.1, 3.2, 3.3 and 3.4) are given below.

Table 3.1: Sample of secondary data (raw data)

Date of loss	Type of Accident/ Disease	Compensation cost (paid loss) in Rupees
2010.02.24	Accidental	350,000
2010.03.12	Accidental Injury	41,169
2011.10.26	While on Duty	5,000
2011.07.25	While coming to Duty	5,000
2012.06.07	Accidental Death	280,968
2012.12.21	While on duty	2,500
2012.12.06	While on duty	11,116
2012.10.03	Death	58,641
2013.10.08	On Duty	6,123
2013.11.04	Due to RTA	1,038

Table 3.2: Sample of secondary data (arranged by data)

Date of Loss	Type of Accident/ Disease	Compensation Cost (paid loss) in Rupees
2010.02.24	Accidental Injury	350,000
2010.03.12	Accidental Injury	41,169
2011.10.26	Accidental Injury	5,000
2011.07.25	Travelling to and from Work	5,000
2012.06.07	Death due to RTAs	280,968
2012.12.21	Accidental Injury	2,500

Date of Loss	Type of Accident/ Disease	Compensation Cost (paid loss) in Rupees
2012.12.06	Accidental Injury	11,116
2012.10.03	Death while on Duty	58,641
2013.10.08	Accidental Injuries	6,123
2013.11.04	Due to RTA	1,038

Table 3.3: Accident severity

Year	Month	Type of accident (cost in Rupees)				
		Accidental injuries	Travelling to and from work	Death due to RTA	Death while on duty	Due to RTA
2010	1	0	0	0	0	0
	2	350,000	0	0	0	0
	3	41,169	0	0	0	0
2011	...	0	0	0	0	0
	6	0	0	0	0	0
	7	0	5,000	0	0	0
2012	...	0	0	0	0	0
	6	0	0	280,968	0	0
	...	0	0	0	0	0
2013	10	0	0	0	58,641	0
	11	0	0	0	0	0
	12	13,616	0	0	0	0
	1	0	0	0	0	0
	...	0	0	0	0	0
	10	6,123	0	0	0	0
	11	0	0	0	0	1,038
12	0	0	0	0	0	

Table 3.4: Accidents frequency

Year	Month	Type of accident (Number of accidents)				
		Accidental injuries	Travelling to and from work	Death due to RTA	Death while on duty	Due to RTA
2010	1	0	0	0	0	0
	2	1	0	0	0	0
	3	1	0	0	0	0
2011	...	0	0	0	0	0
	6	0	0	0	0	0
	7	0	1	0	0	0
	...	0	0	0	0	0
	10	1	0	0	0	0
2012	...	0	0	0	0	0
	6	0	0	1	0	0
	...	0	0	0	0	0
	10	0	0	0	1	0
	11	0	0	0	0	0
2013	12	0	0	0	0	0
	...	0	0	0	0	0
	...	0	0	0	0	0
	10	1	0	0	0	0
	11	0	0	0	0	1
	12	0	0	0	0	0

3.8 Data Analysis


- The analysis was done using statistical tools provided in spreadsheet software (MS Excel-2013).
- Pie charts, bar charts, descriptive statistics and tables were created by making use of the data collected.
- Trends over a 4 year period from 2010 to 2013 were analysed and possible explanations given.

- Based on the analysis done and the critical observations made recommendations and conclusions, and the basis on which future work could be carried out were made.
- The data was divided into three main categories as follows:

Category No 1

Accidents that have occurred out of employment and in the course of employment as indicated below.

Amputation of left finger, amputation of left hand index finger, amputation of second and third fingers, amputation of second and fifth fingers, amputation of the leg above the knee, amputation of three fingers, crush injuries to the right hand second and third fingers, injuries to the toes of the left leg, accidental injuries, cut injuries, chest & abdominal injuries, injuries to leg due to a falls, electrocution due to lightning, fire accidents, death due to head injuries and death while on duty.

 The above can be directly interpreted by the data. All the above accidents had been due to technical, operational, or construction activities in the premises.

Category No 2

Accidents that are not straight forward and which therefore required clarifications to ascertain whether they had arisen out of the worker's employment and during the course of his employment. For this purpose, two employees (A and B) who had entered the data on to the system were interviewed. Their answers' to the questions posed to them had to be cross-checked. The road accidents (outside the physical boundaries of the premises) identified after this test are as follows:

Those caused by RTAs, death due to RTAs, accidental death due to RTAs, accidental death, death due to motor cycle accidents, death due to train accidents, accidents that occur while travelling to and from work.

The above mentioned accidents are due to vehicular activities outside the premises of the workplace. Although “Travelling to and from work” is not expressly covered in the Act, the Insurer has included it in his policy.

Category 3

The following accidents are not straight forward and thus are not expressly covered in the Act. It is assumed that they had occurred out of employment and in the cause of employment.

Death due to heart trouble, due to a heart attack, dengue fever, snake bites, attacks by police, assaults by unknown people, kidnapping by a gang and murder.

3.9 Summary

Accidents listed in the Workmen’s Compensation Act were used for the study. The data for the four year period from 2010 to 2013 obtained from the insurance company was used as the population for this study. There is no evidence or logic to assume that there is a relationship between the nature of accidents and the insurance company. Therefore, the sample was considered unbiased and representative.

Accidents occur in workplaces since risks cannot be eliminated altogether. The main concern is the occupational health and safety in workplaces and the accidents caused by occupational health and safety issues. Therefore, this particular sample of insurance data pertaining to claims made under Workmen’s Compensation Insurance Scheme can have no influence on this study just because it had been collected from one particular insurer.

4.0 Data Analysis and Results

4.1 Introduction

Chapter 03 discussed the research methodology used in this study. This chapter will present the data that had been used in the study. The composition of the sample, descriptive statistics of the sample and its analysis are the topics that will be covered in this chapter.

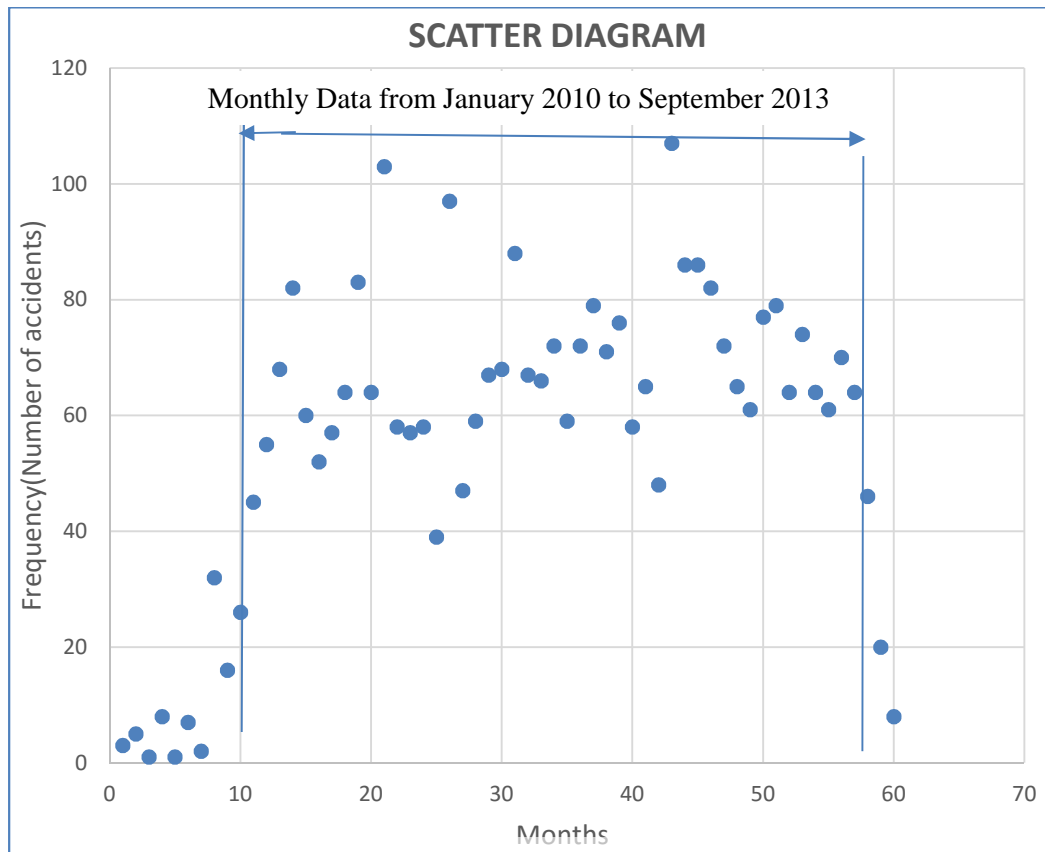
4.2 Composition of the Sample

The sample selected consisted of a secondary data set that has been used for the first time in a study like this. There are more than 3000 such data sets collected from 2009 up to 2013. After observing the scatter diagram given below (Figure 4.1), it was decided to use the data from January 2010 to September 2013. The composition of each data set is as given below.



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- Date of accident/loss
- Type of accidents
- Amount paid under the Workmen's Compensation Ordinance by the insurer through its Workmen's Compensation Insurance Scheme (WCI)



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Figure 4. 1: Monthly frequency of accidents

The above scatter diagram indicates the monthly frequency of accidents that have been considered by the insurer under its Workmen’s Compensation Insurance (WCI) Scheme for the period from January 2009 to December 2013. The decision for selecting data from January 2010 to September 2013 was mainly due to lack of accident related data during the periods from January 2009 to December 2009 and from September 2013 to December 2013.

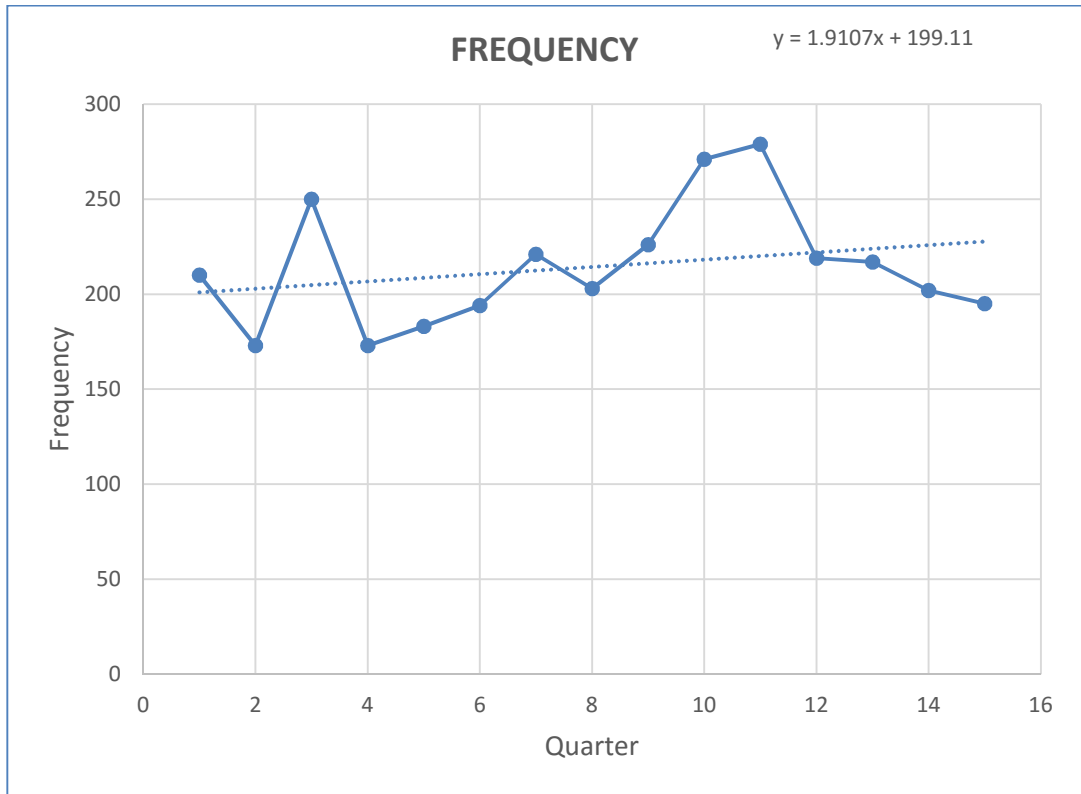


Figure 4.2: Quality of Morality of accidents trend
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The above diagram shows that the frequency and time have a “positive linear relationship” meaning that there has been a positive trend in the number of accidents considered under the Workmen’s Compensation Insurance (WCI) Scheme during the period from January 2010 to September 2013.

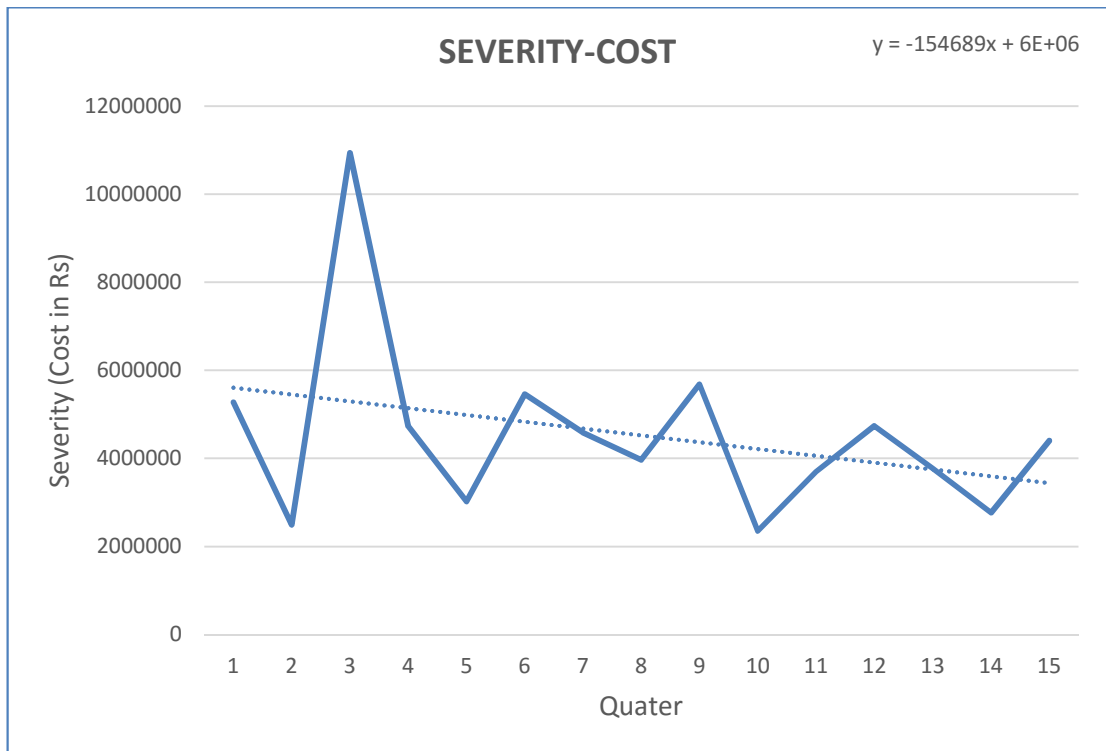


Figure 4. 3: Quarterly severity of accidents and its trend



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Figure 4.3 shows that severity and time have a “negative linear relationship” meaning that there has been a negative trend in the cost of compensation claimed under the Workmen’s Compensation Insurance (WCI) Scheme during the period from January 2010 to September 2013

The fact that there is a positive trend in the frequency of accidents with the severity expressed by means of overall cost having a negative trend led to the analysis of the cost per accident.

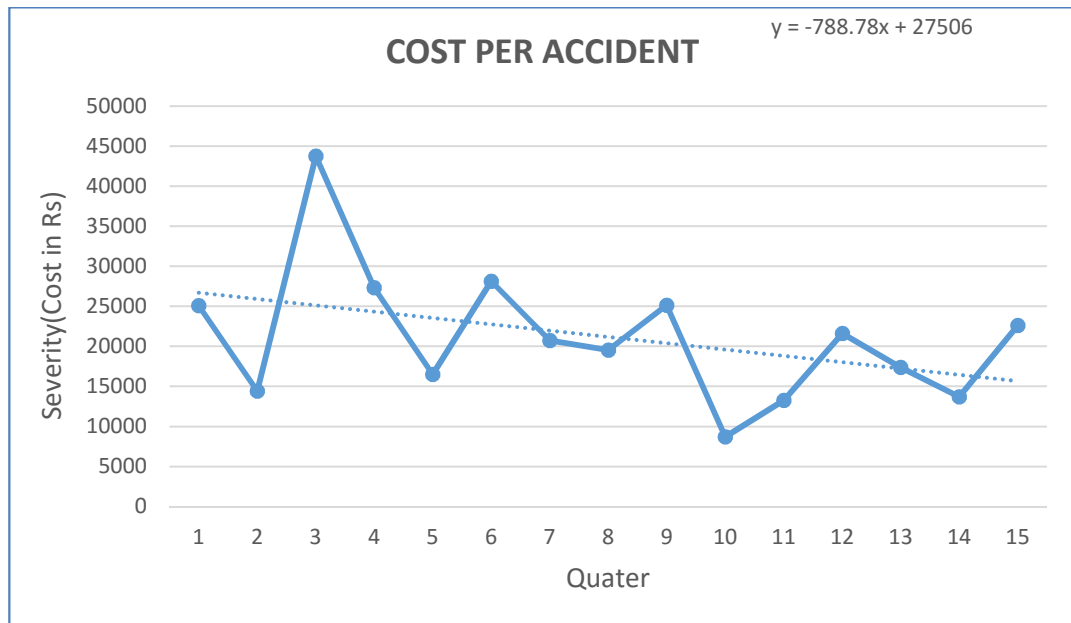
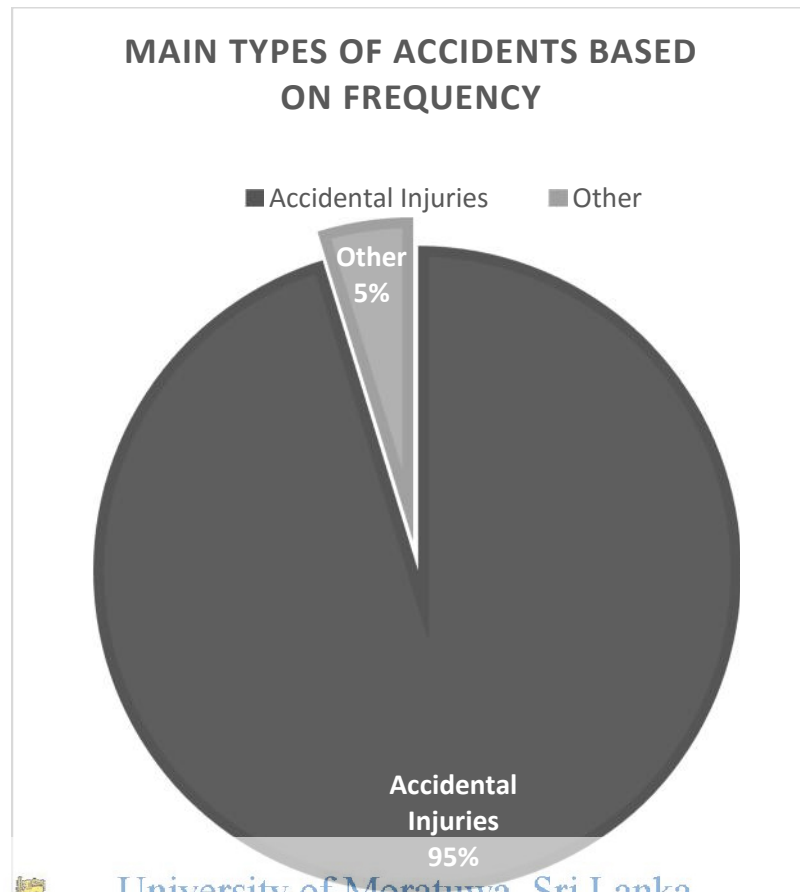


Figure 4. 4: Cost per accident on a quarterly basis and its trend

Figure 4.4 show that the cost per-accident (severity/frequency) and time have a “negative linear relationship”. Thus there is a negative trend in the cost per accident of accidents considered for compensation under the Workmen’s Compensation Insurance (WCI) Scheme during the period from January 2010 to September 2013

This indicates that while the frequency of accidents showed a positive trend during the period concerned, the cost per accident has had a negative trend during the same period. The reason for this could be the fact that workplace safety had been improved during the period by reducing unsafe acts and unsafe conditions at the workplaces.



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Figure 4.5: Main types of accidents based on their frequency

The pie chart in Figure 4.5 which is based on insurance claims shows the percentage of the main types of accidents that occurred in workplaces on average during a period of 4 years (from January 2010 – September 2013).

The different types of accidents that occurred in workplaces can be categorised broadly into two groups, viz., accidental injuries and other types. This broad categorisation has become necessary since accidental injuries represent 95% of the accidents in a workplace. Therefore, accidental injuries are the most significant type of accidents. They include all accidents in a workplace except the other types of accidents which are described below in Figure 4.6.

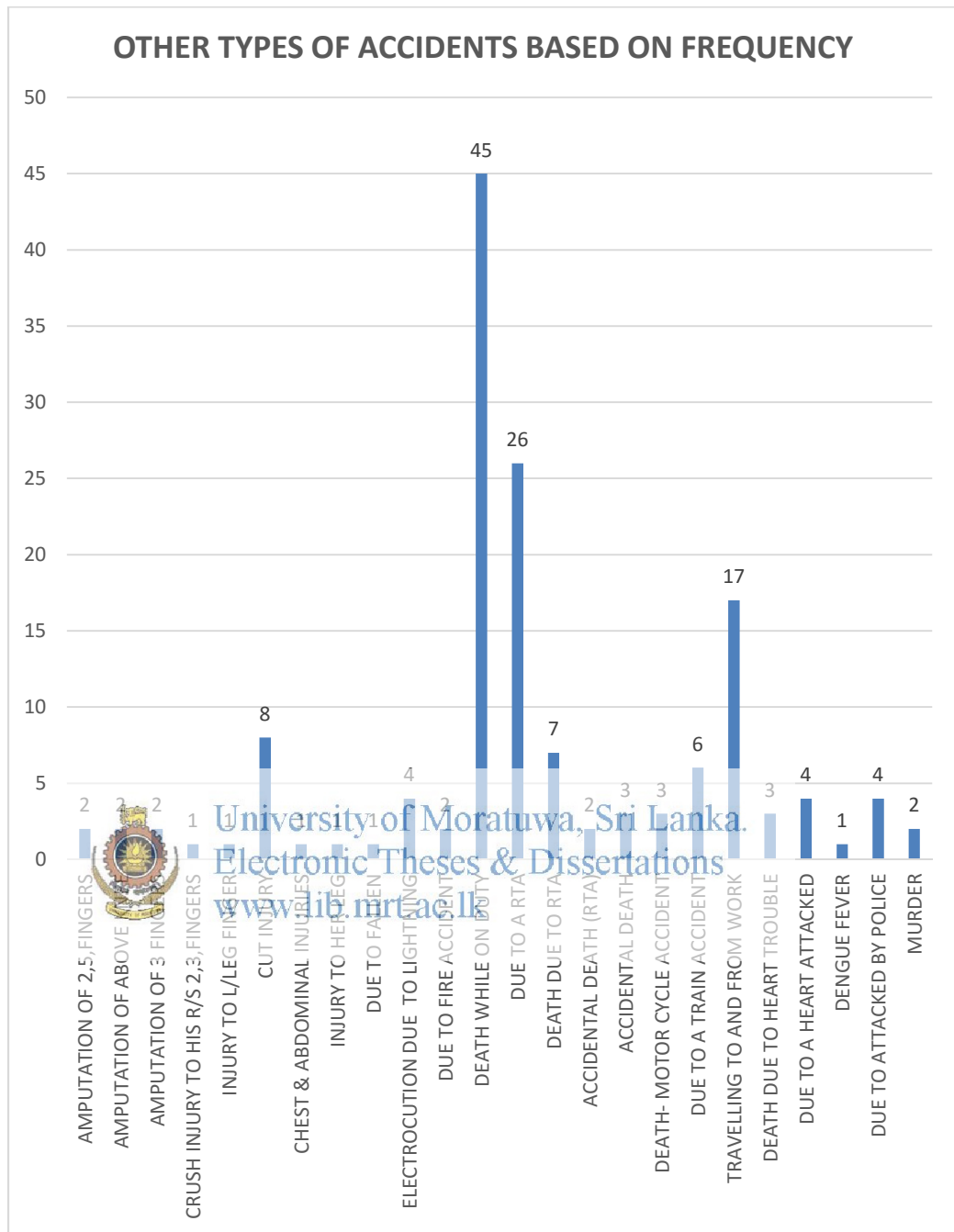


Figure 4. 6: Other types of accidents based on frequency

The bar chart in Figure 4.6 which is based on insurance claims shows the frequency of the other types of accidents that occurred in workplaces on average over a period of 4 years (from January 2010 – September 2013).

Figure 4.6 indicates the distribution of the other types of accidents. These other types of accidents which constituted only 5% of the total accidents reported, included 24 types of injuries as indicated below.

Amputation of the second and fifth fingers, amputation of the leg above the knee, amputation of three fingers, crush injuries to the second and third fingers of the right hand, Injury to a finger in the left leg, cut injuries, chest & abdominal injuries, leg injuries due to falls, electrocution due to lightning, fire accidents, death while on duty due to a RTA, death due to RTAs, accidental death due to a RTA, accidental death, death due to a motor cycle accident, death due to a train accident, death while travelling to and from work, death due to heart trouble, heart attacks, dengue fever, Police attacks and Murder.

Table 4. 1: Types of accidents which were in the initial data base

(not considered in this study)

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Type of Accident	
1	Amputation of left finger
2	Amputation of left hand index finger
3	Amputation of 2 nd and 3 rd fingers
4	High Voltage
5	Death due to head injuries
6	Snake Bite
7	Assaults by unknown people
8	Kidnapping by gangs

The types of accidents listed above do not appear in Figure 4.6 but were in the initial data base (relating to year 2009 and the fourth quarter of 2013).

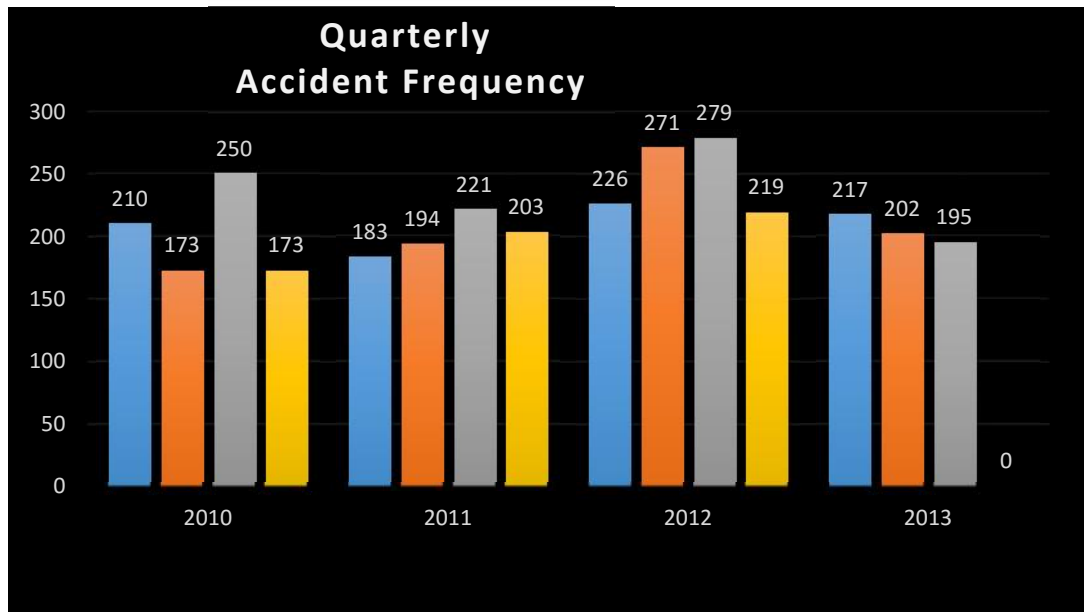


Figure 4. 7: Quarterly accident frequency

The bar chart in Figure 4.7 which is based on insurance claims shows the average frequency of accidents that occurred in workplaces in each quarter of a 4 year period (from January 2010 – September 2013).



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It can be seen that the highest number of accidents has been reported in the third quarter (Q3) of every year except 2013. It can be because of the fact that the third quarter has a relatively low number of holidays compared to the other quarters of the year. The Sinhala New Year holidays and Christmas holidays fall in March/April and December respectively.

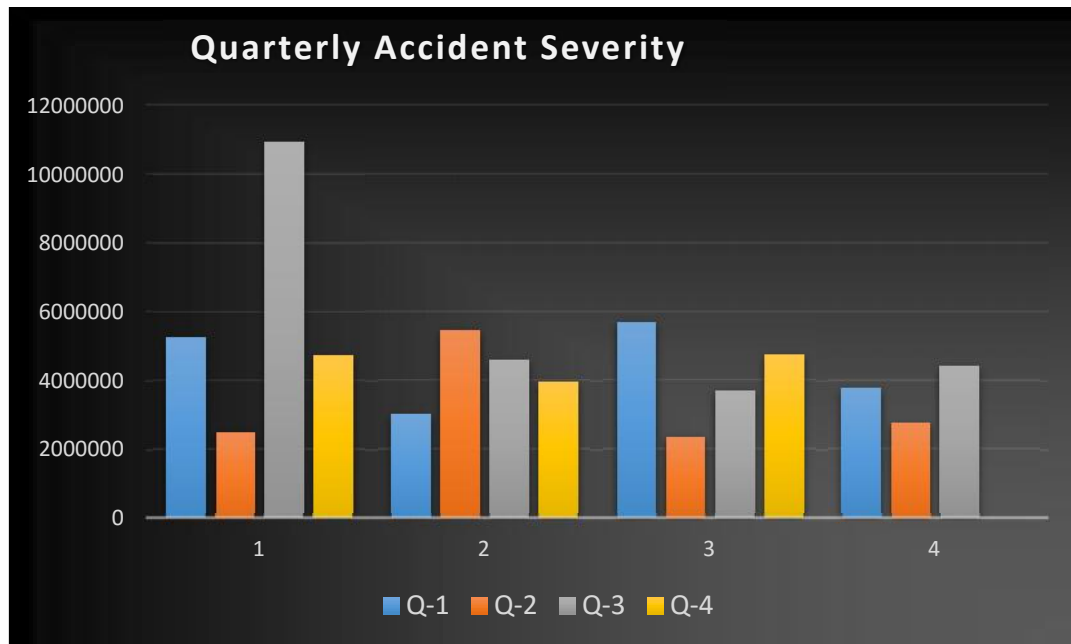
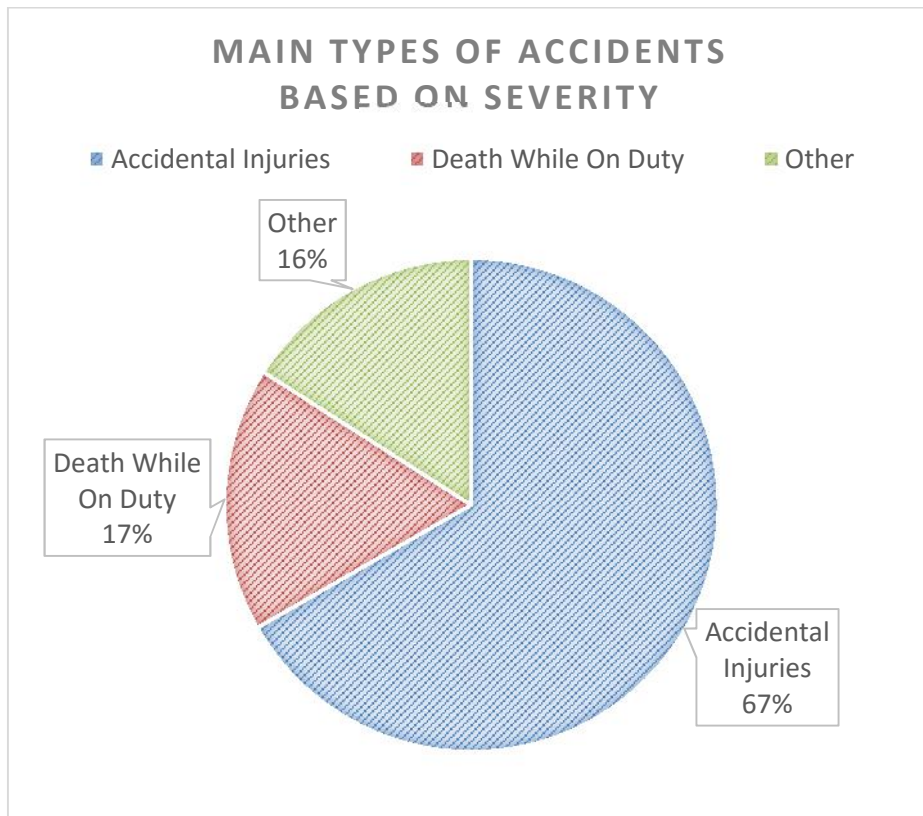


Figure 4. 8: Quarterly accident severity

The bar chart in Figure 4.8 which is based on insurance claims shows the average severity of accidents that occurred in workplaces in each quarter of a 4 year period (from January 2010 – September 2013).

Figure 4.8 shows that the second quarter (Q2) of every year except 2011 has recorded the lowest amount of compensation paid during a year. The probable reason for this could be that in the second quarter of any year, workers in most of the industries including garment factories which belongs to an important sector in terms of the number of workers employed, enjoy long holidays. The Sinhala New Year falls in April. It is a known fact that every year during the festive season the number of accidents reported is more. However it has to be noted that WCI covers only accidents related to work.



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The pie chart in Figure 4.9 which is based on insurance claims shows the average severity of accidents as a percentage of the main three types of accidents that have occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The main type of accidents is the accidental injuries that recorded 67 % (Figure 4.9) of losses whereas their frequency for the same period was 95% (Figure 4.5). Therefore, the accident severity is found to be independent of accident frequency. The second highest loss paid was for death while on duty which was 16%. All other types of accidents represent only 17% which is a relatively low figure when it is considered that this segment includes 23 types of accidents.

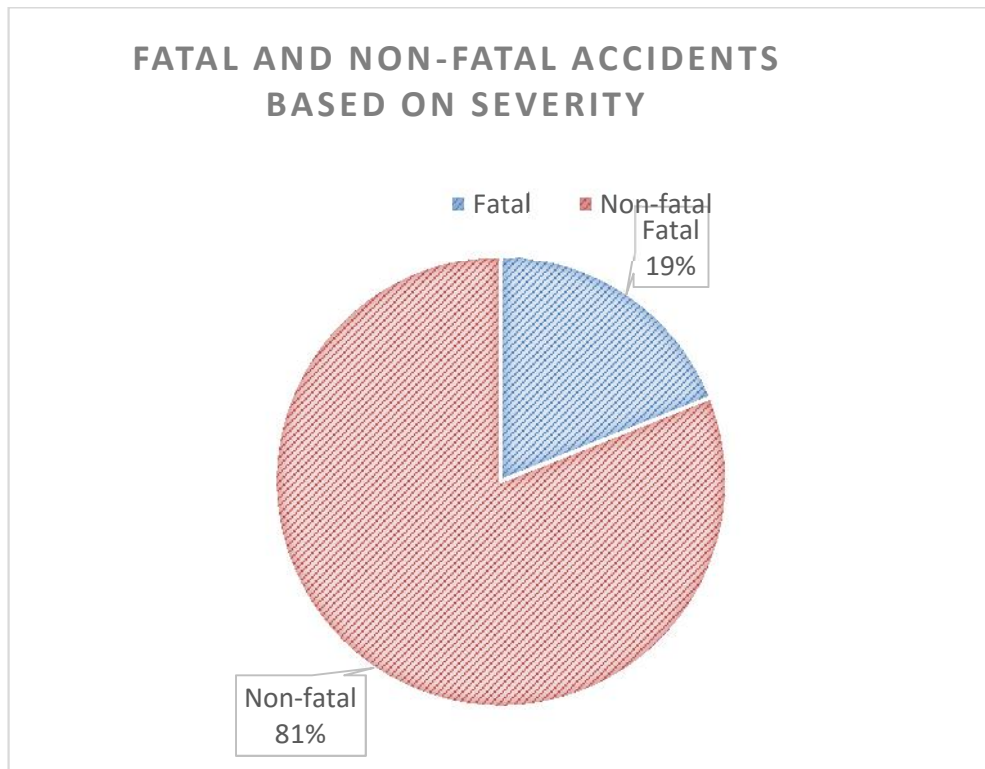


Figure 4. 10: Fatal and non-fatal accidents based on their severity



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The pie chart in Figure 4.10 which is based on insurance claims shows the average percentage severity of fatal and non-fatal accidents that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

According to this figure, the loss was mainly due to non-fatal accidents (81%). The loss caused by fatal accidents was only 19%. Seven of the twenty five types of accidents include fatal accidents. Death while on duty, death due to RTAs, accidental death (RTA), accidental death, death due to motor cycle accidents, death due to heart trouble and murder are the seven types of these fatal accidents. The different types of accidents that have not been stated in the Act need attention since workplace environments have been constantly changing with time due to new hazards that develop in workplaces.

FATAL AND NON-FATAL ACCIDENTS BASED ON FREQUENCY

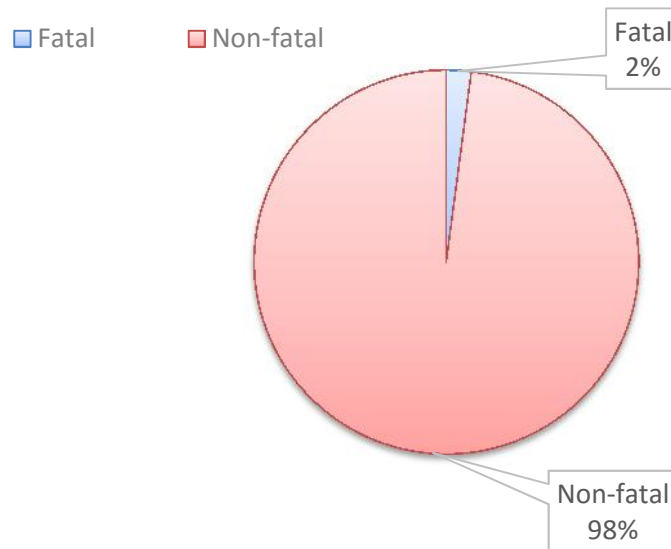


Figure 4. 11: Frequency of fatal accidents based on their frequency



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The pie chart in Figure 4.11, which is based on insurance claims shows the average percentage of the frequency of fatal and non-fatal accidents that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

According to Figure 4.11, the frequency of non-fatal accidents was a significant 98%. The frequency of fatal accidents was low being only 2%. As indicated in Figure 4.10, seven out of the twenty five types of accidents include fatal accidents. It is interesting to note that 2% of the fatal accidents (frequency) represent 19% of the total loss (severity).

Accidents can be categorised into four main groups. They are

- a. industrial,
- b. commuting,
- c. natural, and
- d. man-made.

Table 4. 2: Main groups and their respective accident types (from January 2010 to September 2013)

	Main Group	Accident Types
a	Industrial	Accidental injuries, amputation of second and fifth fingers, amputation of three fingers, amputation of the leg above the knee, chest & abdominal injuries, crush injuries to second and third fingers of the right hand, cut injuries, death due to heart trouble, death while on duty, dengue fever, heart attacks, falls, injuries to legs, injuries to fingers of the left leg
b	Commuting	Accidental death(RTA),death due to a RTA, death due to motor cycle accidents, due to a RTA, due to a train accident, while travelling to and from work ,accidental death
c	Natural	fire accidents, electrocution due to lightning
d	Man-made	attacks by police, murder

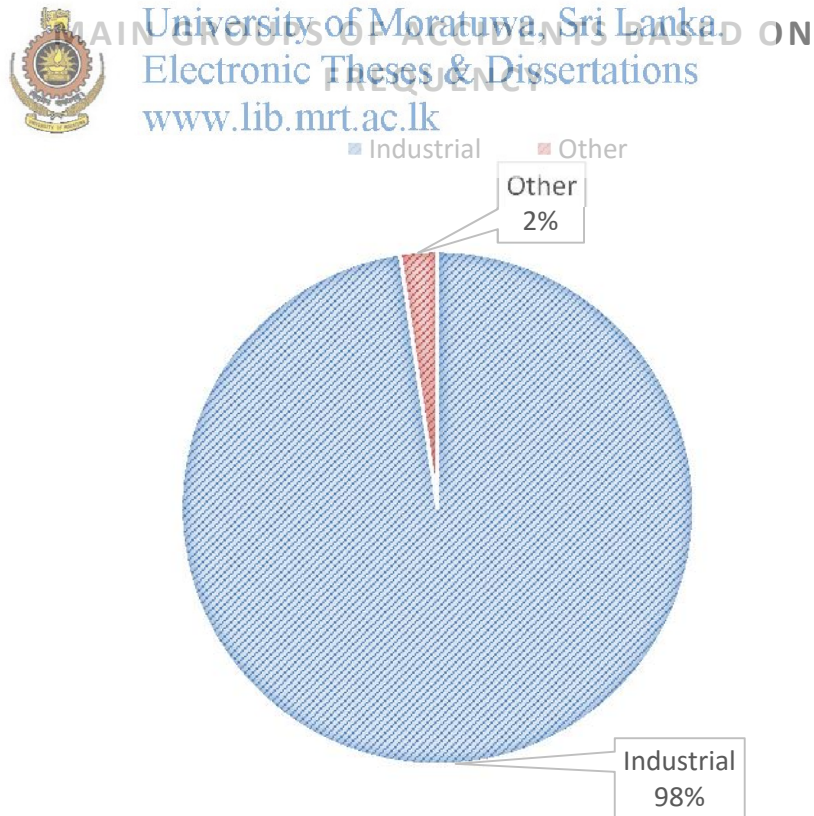


Figure 4. 12: Main groups of accidents based on their frequency

The pie chart in Figure 4.12 which is based on insurance claims shows the average percentage of main groups of accidents that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

This categorisation was based on the nature of damage caused. The previous analysis was based on the type of the accident. In this analysis, similar types of accidents were grouped together forming four groups. They are industrial, commuting, natural and man-made. According to the analysis, 98% of the accidents came from the industrial group with only 2% coming from the other groups.

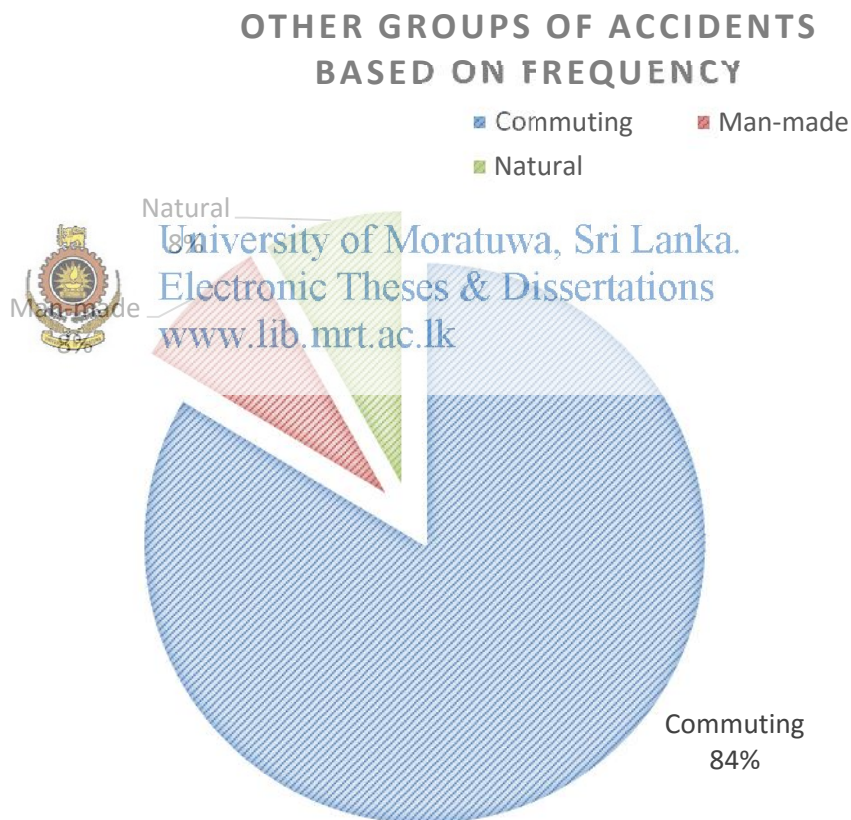


Figure 4. 13: Other groups of accidents based on their frequency

The pie chart in Figure 4.13 which is based on insurance claims shows the average percentage of other groups of accidents that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The other groups such as commuting; man-made and natural was only 2 % of the total number of accidents reported (Figure 4.12). Commuting recorded 84% out of these three groups. Figure 4.13 indicates that the frequency of the commuting group was relatively high compared to that of natural and man-made groups.

THE TYPE OF ACCIDENTS OF THE INDUSTRIAL GROUP BASED ON THE FREQUENCY

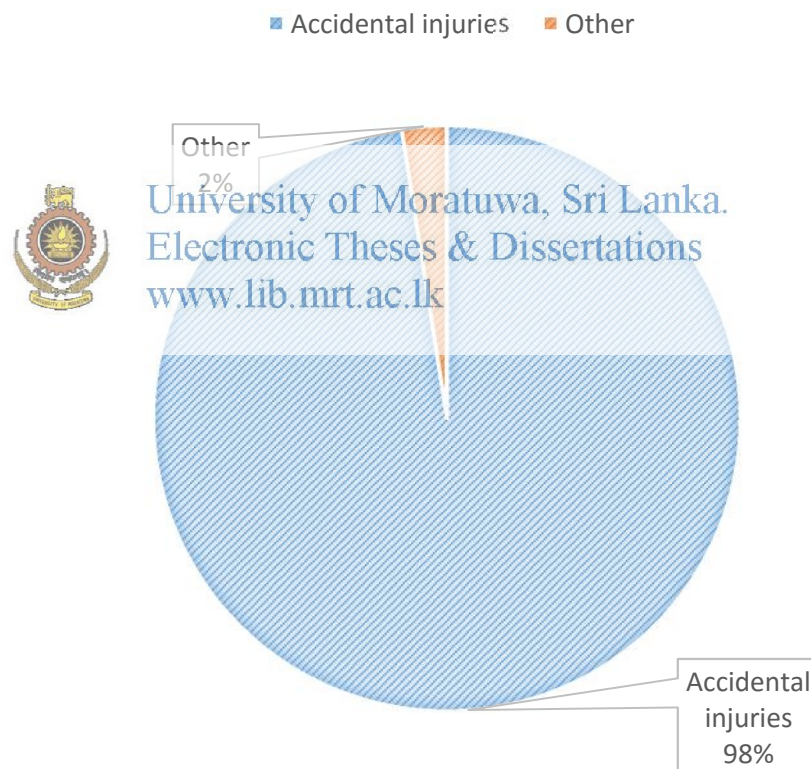


Figure 4. 14: Type of accidents of the industrial group based on their frequency

The pie chart in Fig 4.14 which is based on insurance claims shows the average percentage of type of accidents of the main group (industrial) that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The industrial group consists of accidental injuries (98%), and other types (2%) such as the amputation of the second and fifth fingers, amputation of the leg above the knee, amputation of three fingers, crush injuries to second and third fingers of the right hand, injuries to fingers of the left leg, cut injuries, chest & abdominal injuries, injuries to legs, falls, death while on duty, death due to heart trouble, heart attacks and dengue fever.

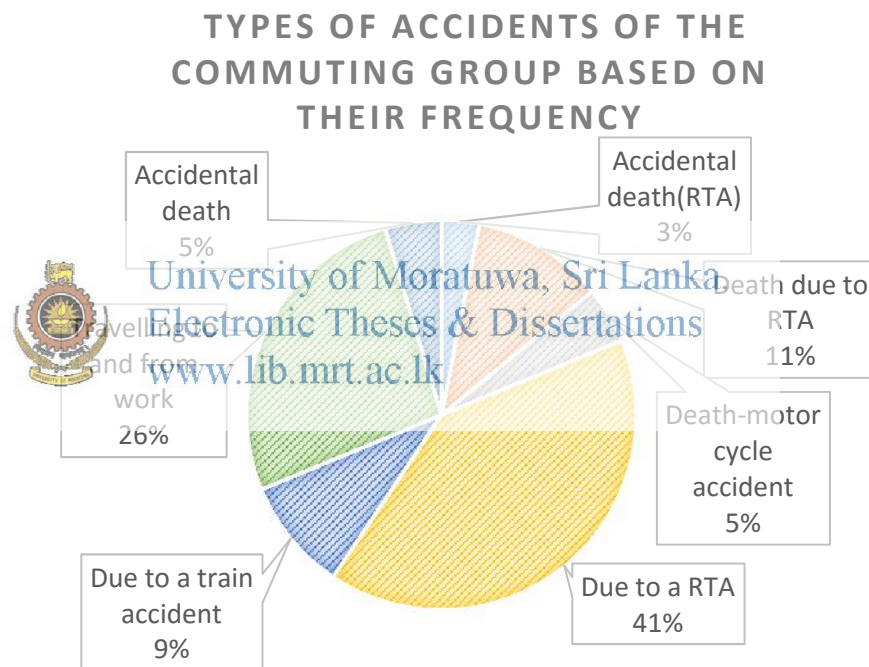


Figure 4. 15: Type of accidents of the commuting group based on their frequency

The pie chart in Figure 4.15 which is based on insurance claims shows the average percentage of accidents of the commuting group that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The commuting group consists of seven types of accidents such as accidental death (RTA), due to a RTA, death due to a RTA, death due to a motor cycle accident, death due to a train accident, while travelling to and from work, and accidental death which were 3%, 41%,11%,5%,9%, 26% and 5% respectively. Death due to commuting sums up to a percentage of 24% with the rest of the accidents having a percentage of 76% included under the other types of accidents.

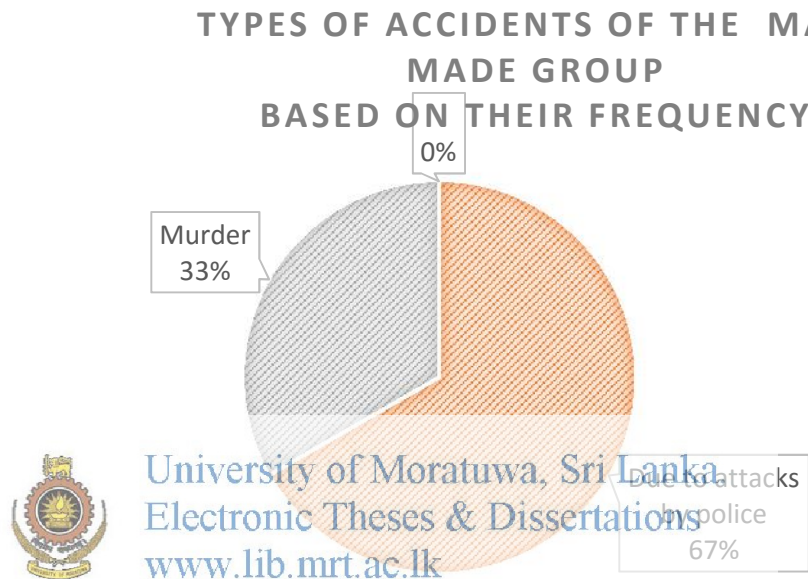


Figure 4. 16: Types of accidents of the man-made group based on their frequency

The pie chart in Figure 4.16 which is based on insurance claims shows the average percentage of accidents of the man-made group that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The man-made group consists of murder and attacks by police. Figure 4.16 shows the distribution of this type of accidents. There can be different types of uncommon and unexpected accidents that can occur in a workplace. Employers/relevant authorities need to focus their attention on them to minimise such accidents.

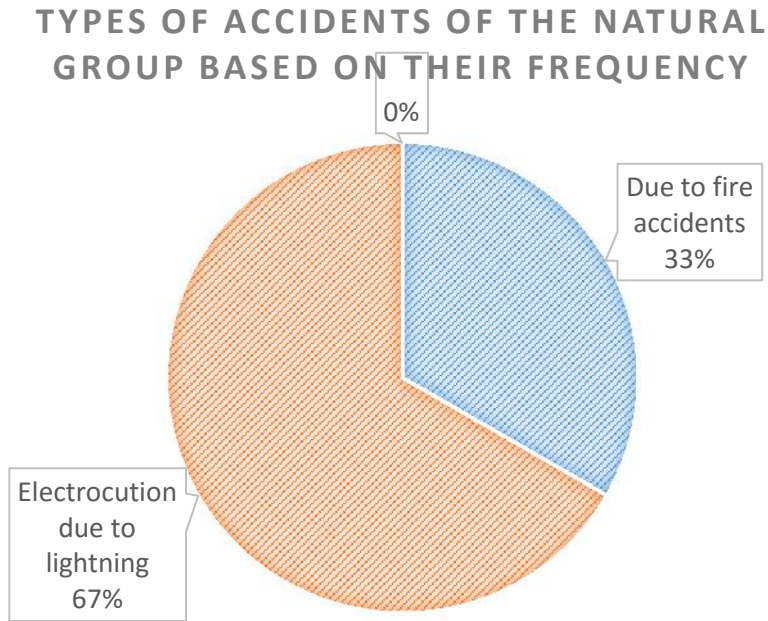


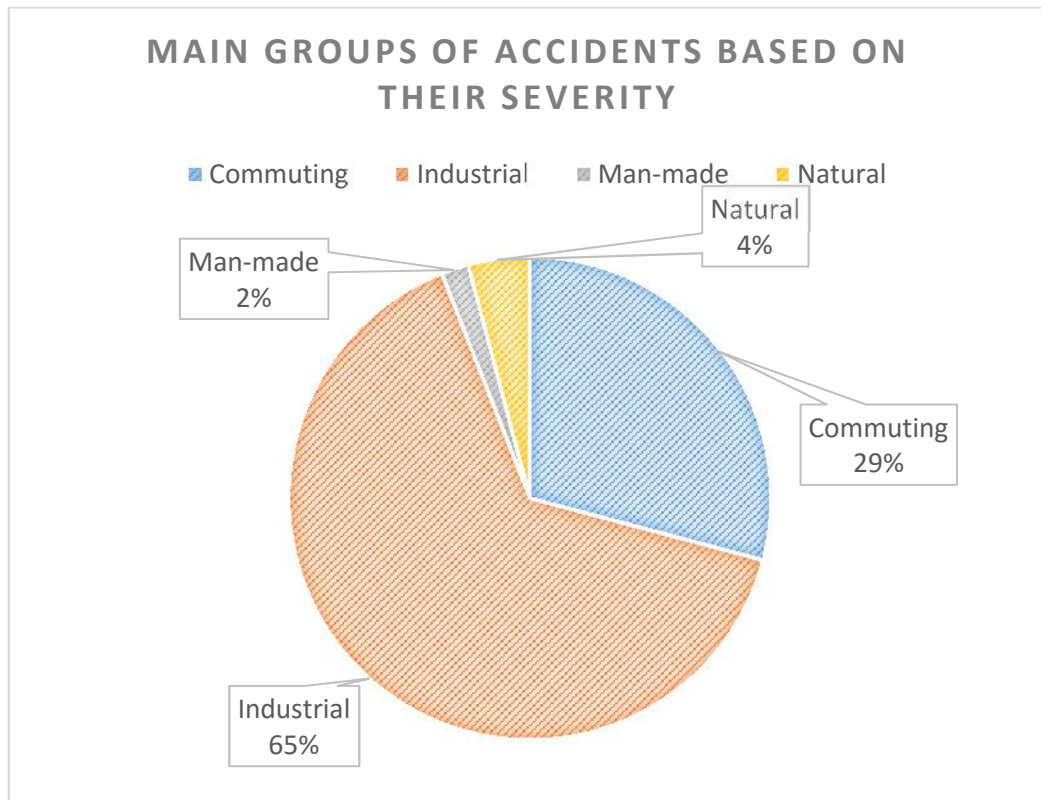
Figure 4. 17: Types of accidents of the natural group based on their frequency



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The above pie chart which is based on insurance claims shows the average percentage of accidents of the natural group that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The natural group consists of electrocution due to lightning and fire accidents. Figure 4.17 shows the distribution of this types of accidents. It indicates the need for awareness of the type of accidents that are unforeseen until the time of the loss. Both unsafe acts and unsafe conditions contribute to this type of accidents. This type of accidents can be minimised by deploying trained and skilled staff.



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Figure 4.18: Main groups of accidents based on their severity

The pie chart in Figure 4.18 which is based on insurance claims shows the average percentage of cost of each group of accidents that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

According to the analysis, 65% of accident compensation costs have come from the industrial group and 29% from the commuting group. Costs related to man-made and natural groups were relatively lower totalling to a percentage of only 6%. The costs incurred in the commuting group (29%) were significant compared to their frequency during the same period which was only 2% (Figure 4.12).

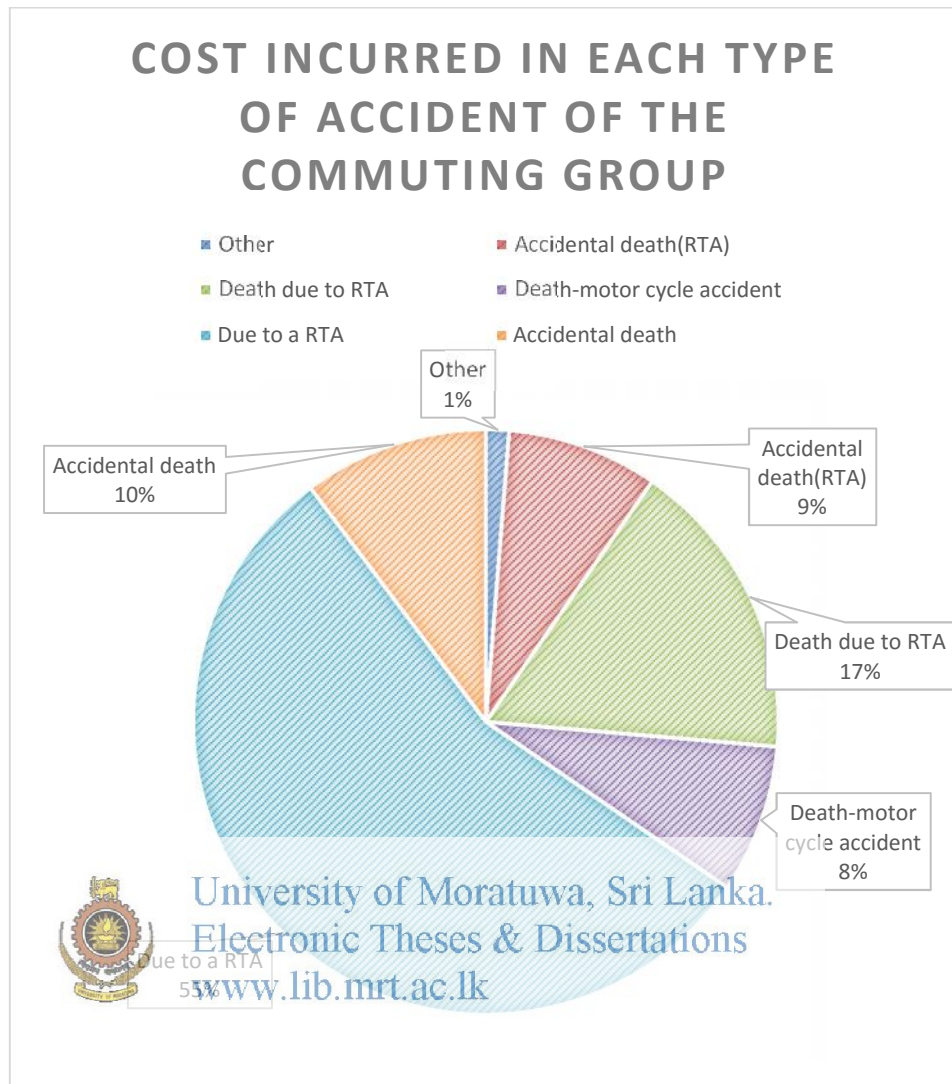


Figure 4.19: Cost incurred in each type of accident of the commuting group

The above pie chart which is based on insurance claims shows the average percentage of cost incurred in each type of accident that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The commuting group consists of accidental death due to a RTA, death due to a RTA, death due to a motor cycle accident, accidental death and others (due to a train accident, and while travelling to and from work). Figure 4.18 shows that accidents of the commuting type were relatively high (29%) compared to those of either the man-made or the natural types. The percentage of deaths was relatively high compared to

other groups , i.e., accidental death (RTA) (9%), death due to a RTA (17%), death due to a motor cycle accident (8%) and accidental death (10%) which summed up to a percentage of 44%, while the rest due to a RTA and other types of accidents was 56%. Some of the accidents were outside the physical boundaries of the workplace, and therefore accident prevention has to be treated as a national issue (e.g., road traffic accidents that occur outside the premises while on duty).

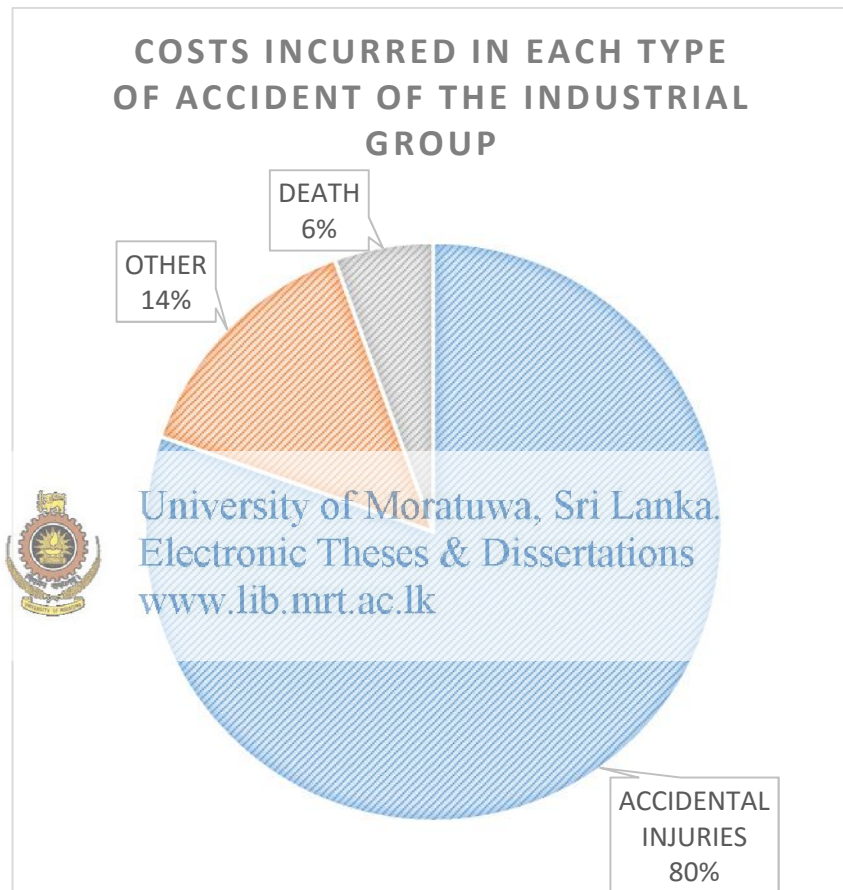


Figure 4. 20: Costs incurred in each type of accident of the industrial group

The pie chart in Figure 4.20 which is based on insurance claims shows the average percentage of the cost incurred in each type of accident of the industrial group that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The industrial group consists of fifteen types of workplace accidents. It consists of three major types of accidents, namely accidental injuries, death (includes death while on duty and death due to heart trouble) and other accidents (amputation of second and fifth fingers, amputation of the leg above the knee, amputation of three fingers, crush injuries to second and third fingers of the right hand, injuries to fingers of the left leg, cut injuries, chest & abdominal injuries, injuries to legs, falls, heart attacks and dengue fever). The percentage of accidents of the total number of accidents caused by accidental injuries, death, and others are 80%, 6% and 14% respectively. Thus it is obvious that the majority of accidents were due to accidental injuries. Therefore, more attention need to be paid to minimizing accidental injuries and eliminating factors that influence them.

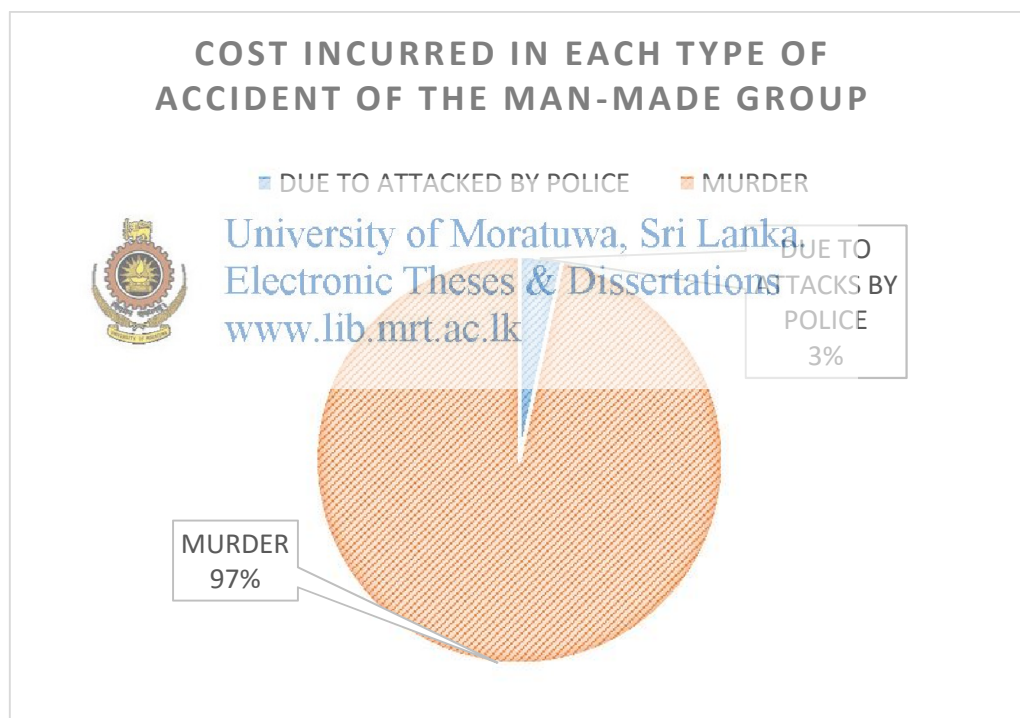
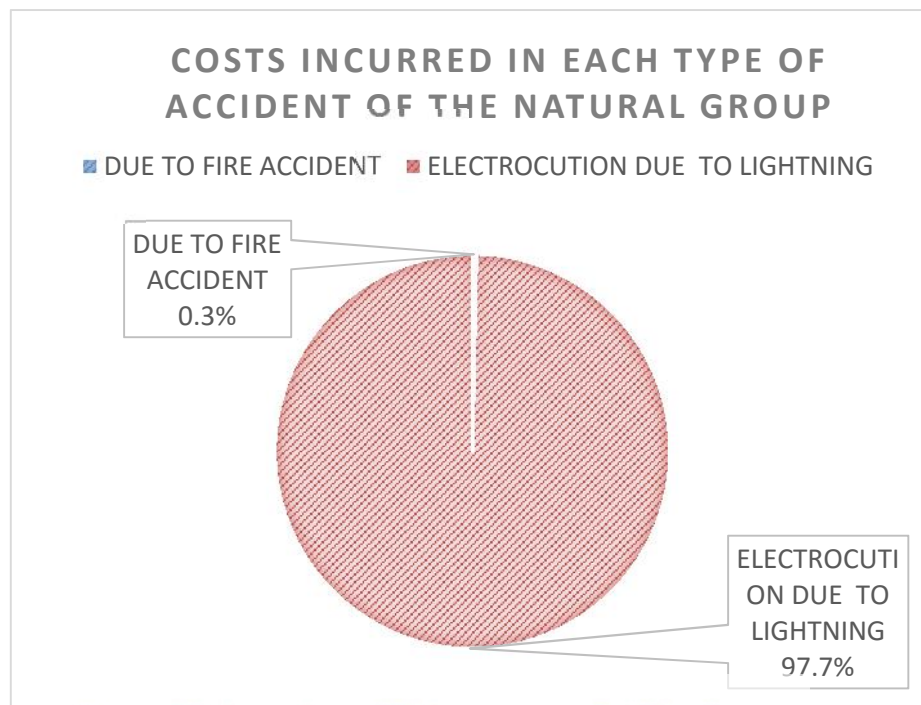


Figure 4. 21: Cost incurred in each type of accident of the man-made group

The pie chart in Figure 4.21 which is based on insurance claims shows the average percentage of cost incurred in each type of accident of the man-made group that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

Murder (97%) was high and the rest was due to attacks by police (3%). A reasons for these figures could be the limited data that was available.



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Figure 4.22: Costs incurred in each type of accident of the natural group

The pie chart in Figure 4.22 which is based on insurance claims shows the average percentage of cost incurred in each type of accident of the natural group that occurred in workplaces during a period of 4 years (from January 2010 – September 2013).

The figure shows the distribution of costs between electrocution due to lightning (97.7%) and fire accidents (0.3%) indicating that the latter is negligible. The number of accidents due to fire accidents (frequency) in the natural group was 33% (Figure 4.17) which is significant compared to its cost (0.3%). The reason for this could be that the damage to humans (employees) from fire accidents was lower than the damage to property by fire accidents whereas electrocution due to lightning can severely affect the employees of a workplace.

5.0 Conclusions and Recommendations

5.1 Summary of Study

Employees' safety has become one of the major concerns with the rapid phase of development now taking place in the industry. In this context, the identification of the most significant accidents and diseases in terms of their severity and frequency helps to mitigate these accidents and ensure that a workplace is safer for carrying out industrial operations. However in industrial operations, the risks of injuries and diseases are unavoidable. Mitigating these accidents and diseases has become a challenge. The victims need to be compensated by satisfying the minimum conditions stated in the Workmen's Compensation Act. Workmen's Compensation Insurance (WCI) is one of the common methods that are available to cover workplace related injuries/accidents and diseases. This study was formulated to gather accurate secondary data from an insurer on accidents and diseases that occurred during a period of four years and which were covered under its WCI Scheme. The data has been used for the first time in a study like this. The basic information included was the date of injury/accident, type of injury/accident, and the respective compensation cost. A quantitative method was used for the data analysis.

5.2 Key Findings

Both the frequency and the severity of accidents need to be considered in the decision making process. Accidental injury was found to be the most significant type of accident among the 25 accident types. The ratio severity/ frequency (cost per accident) could be used to benchmark workplaces, and monitor their progress over time. There was no evidence of any employee being compensated for suffering from an occupational disease. Statistical analysis shows the trends, severity and frequency of different types of accidents, and groups of accidents.

5.3 Conclusions

The following conclusions can be made based on the analysis of Workmen's Compensation Insurance (WCI) data that were extracted from the claims received by an insurance company made under the Workmen's Compensation Act, during a period of four years (from 2010 – 2013).

5.3.1 Frequency and time have shown a “positive linear relationship” with each other whereas severity has shown a “negative linear relationship” with time during the same period (Figure 4.2 & Figure 4.3). Cost per accident (severity/ frequency) has a “negative linear relationship”(Figure 4.4) with time. This indicates that although the number of accidents have a positive trend, the cost of accidents have a negative trend. With the rapid industrialization of the country, this is an area that needs to be addressed early to keep up with the phase of development. In order to make the workplace safer this rate need to be reduced. Therefore this rate is one of the important parameters that could be used to monitor the level of safety in a workplace.

The ratio (cost/accident) also could be used to benchmark workplaces.



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Other Findings

5.3.2 It is significant to note that severity (cost) of non-fatal accidents was 81% of the total cost whereas that of fatal accidents was only 19%. The frequency (number of accidents) of non-fatal accidents during the period was 98% and that of fatal accidents was only 2%. This shows that even though the frequency of accidents is low, their severity was significantly high. Therefore, both severity and frequency of accidents need to be considered in decision making.

5.3.3 The accidents that were significant were those that recorded 67% (severity) of losses whereas their frequency for the same period was 95%. The second highest loss was paid for death while on duty which was 17% of the total losses. All other types of accidents represent only 16% (severity) of losses which is a relatively low figure.

5.3.4 This study found no evidence of any employee suffering from an occupational diseases being compensated.

5.3.5 As far as workplace accidents are concerned, the second major group of accidents came from the commuting group (this includes all accidents that occurred due to travelling and while travelling to and from work). This recorded 29% (severity) of losses whereas frequency for the same period was only 2%. This emphasises the importance of identifying accidents which do not directly arise from the core operations of a workplace but from workplace supportive operations which however are covered under the Workmen's Compensation Act.

5.3.6 The commuting group (this includes all accidents due to travelling and occurring while travelling to and from work) recorded 44 % (severity) of losses due to deaths whereas its frequency for the same period was 24%. The severity and frequency of losses due to death, thus the risk of death, were high in the commuting group when compared with any of the other groups. This is an important area that relevant authorities have to make a note of.



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5.4 Recommendations

The following recommendations are made based on the conclusions:

5.4.1 There should be a way of benchmarking the number of accidents occurring in a country (from a regional perspective in Asian countries first. Hence there should be accurate databases to compare the figures of different countries in a region. This is one of the areas that need to be addressed in order to promote, motivate, and achieve our goals, i.e., minimizing the number of accidents which should be possible to achieve through a strong legal framework. As far as regional perspectives are concerned, there should be a common understanding and a legal framework among the countries of the region to address these matters. This can be achieved by having a common legal framework through the ILO.

5.4.2 The cost of accidents per annum can be taken as a measure to plan safety activities (accident prevention strategies). Therefore, the assessment of economic loss due to an accident is important to understand the gravity of the problem and to take adequate precautions. Practically, no organization will allocate funds for safety improvements above its breakeven point. Therefore, the assessment of economic loss will motivate them to make necessary steps as it will be easier for the top management/decision makers of the organizations concerned to understand figures. Accidents in a workplace can occur due to unsafe acts and unsafe machinery. One of the causes of unsafe acts is negligence. Wilful negligence could be controlled by taking disciplinary action against the persons concerned within a given legal framework whereas negligence can be minimized by getting them to follow awareness/training programmes.

5.4.3 In certain industries, for example, in the paint industry, hazardous vapour/fumes exist and the prolong exposure of workmen to such a hazardous environment can cause many diseases in them. Fatal accidents and minor accidents are relatively low while diseases due to long exposure are high. This is however difficult to prove once an employee gets affected by a disease like cancer. Therefore, it is recommended that a screening test be done for possible diseases before people are recruited and to monitor their health thereafter by carrying out periodical tests while being in employment. The enforcement of legal provisions in this regard is important.

5.4.4 The compensation cannot be paid for the first three days of a disablement. Therefore, it is very clear that some of the minor accidents and near misses have not been recorded in most of the instances. In accident prevention, near misses is one of the critical areas that need to be incorporated.

5.4.5 The amount of compensation paid under the Workmen's Compensation Act needs to be reviewed as the minimum salary (monthly wages of the workmen) can exceed the maximum possible compensation in most instances. An increase in the

maximum amount of compensation payable is necessary to mitigate disparities and ensure respect to different categories of workmen.

5.4.6 There is a list of occupational diseases mentioned in the Workmen's Compensation Act (covered by the WCI). Not a single employee was found during the study to have been compensated for an occupational disease listed in the Act. This fact needs to be addressed. Furthermore, it was revealed that there had been many patients suffering from occupational diseases but who were unable to prove that their diseases have been caused by working in hazardous environments. The relevant authorities should critically analyse this situation and incorporate necessary amendments to the Workmen's Compensation Act.

5.5 Other Recommendations

5.5.1 In the case of fatal accidents and permanent disablement, no legal action was possible (e.g. falls, electrocution) due to lack of necessary regulations in the country. In order to overcome this situation, regulations pertaining to a variety of industries such as the construction industry have to be introduced. This situation will be rectified considerably when electrical regulations and construction regulations come into force.

5.5.2 Individual factors such as age, marital status, number of dependents etc., need to be considered appropriately in mitigating risks of accidents caused by unsafe acts and unsafe behaviour. For example, most of these factors can be considered at the time of recruitment of an employee, and they need to be provided with training on stress management / attitude and behaviour since positive attitudes will have a definite impact on reducing accidents. The accidents caused by other factors can be effectively addressed by making use of effective engineering controls and administrative strategies.

5.5.3 The essential factors to be considered at national level in minimising accidents in workplaces will be the experts' involvement and training, and physical

infrastructure such as equipment and other facilities. Once these are in place, it would be much easier and practical to think of legal provisions.

5.5.4 Workplace environments are constantly changing due to the rapid phase of development taking place in the country. New hazards are coming into workplaces due to this rapid industrialisation. Therefore, it is important to make necessary amendments to the current Act in order to make it more effective.

5.6 Limitations of Study

5.6.1 Period

This study was designed to gather from one insurance company, the accurate secondary data that was available with the company on accidents and diseases that occurred during a period of four years from January 2010 to September 2013.

5.6.2 Data Source Characteristics

Those who were insured with the insurance company concerned under the Workmen's Compensation Insurance Scheme were considered in this study. According to Workmen's Compensation Ordinance, an occupational disease also has to be treated as an accident that has occurred in the course of the employment of a worker. The disease must be directly or reasonably attributable to the work in which the worker was engaged. Although "Travelling to and from work" is not expressly covered under the Act, the insurer has included it in his policy.

Only one insurance company was selected for this study. Conclusions were made after a statistical analysis of data available with that company by using information such as the date of injury/accident, type of injury/accident, and the frequency and severity of accidents/diseases. Insurance claim data that was available with the insurer in respect of its Workmen's Compensation Insurance (WCI) Scheme was used for this analysis.

This study was expected to gather accurate secondary data on accidents and diseases that had occurred during a period of four years. The basic information included were the date of injury/accident, type of injury/accident, and the respective compensation cost. It is for the first time that this data has been used in a study like this.

The accidents and diseases which did not come under the purview of the insurance company concerned were excluded as it was not feasible to gather information about them due to the non-availability of relevant records.

5.7 Further Research

5.7.1 A study could be carried out by using data of at least fifteen years so that the trends could be analysed comprehensively.

5.7.2 The secondary data set which was used contained redundant data. This data has to be removed. The data set can consist only of details such as the cause of loss, amount claimed, amount allowed, location, type of industry, date of accident and a brief description of the accident.



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5.7.3 The consequences that can arise from industrial accidents and which will have an effect on the employee's family and society have not been considered in this study. This can be one of the areas on which research can be focused in the future to make people think of and understand the gravity of the issue, and enhance the safety culture.

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