OCCUPATIONAL ACCIDENT PREVENTION STRATEGIES BASED ON BEHAVIOUR BASED SAFETY (BBS) IN A SELECTED MANUFACTURING INDUSTRY

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RESEARCH REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SAFETY HEALTH, AND ENVIRONMENTAL ENGINEERING

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Name of Degree: Master of Safety, Health, and Environmental Engineering

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[OCCUPATIONAL ACCIDENT PREVENTION STRATEGIES BASED ON BEHAVIOUR BASED SAFETY (BBS) IN A SELECTED MANUFACTURING INDUSTRY]

ABSTRACT

Behavior based safety is defined as an observation made on a particular employee to identify the level of safety practice concern when they perform a job. his study was conducted on the rubber manufacturing industry in Meru, Klang. This study was based on a three-month pilot test observation that took place only during working hours. A total of 152 employees were observed. The goal of this study is to discover the high-potential elements that cause workplace accidents in risky acts and conditions. Not only that, but following the pilot test, to provide a procedure on how BBS can be implemented. Each hazard factor and subfactor discussion included cost-effective ideas for preventing or reducing the number of accident instances. In this study, action plans were considered in relation to the needs of the rubber manufacturing business, and statistical output was analyzed. Due of mischievous behavior, safety behavior is acknowledged to be a main source of accident occurrence. Therefore, several strategies were provided and discussed for a long-term benefit with a slow in progress period. Highly encouraged to conduct safety trainings and frequent assemblies to highlight the importance of safety practice. As for the cost-effective solution for the data collected in this study has been proposed to set up a system which can help to record data's and to monitor improvements. Safety committees are encouraged to set up an inhouse system for non-conformance tracking and rectifications. For future studies, research study can be done on developing a BBS predictive analytical dashboard system to predict the future outcome hazards and to work on the possible solutions for the hazards.

Keywords: Behavior based safety, occupational accidents, safety behavior, pilot test, safety practice

[STRATEGI PENCEGAHAN KEMALANGAN PEKERJAAN BERDASARKAN KESELAMATAN BERASASKAN TINGKAH LAKU (BBS) DALAM INDUSTRI PEMBUATAN TERPILIH]

ABSTRAK

Keselamatan berasaskan tingkah laku ditakrifkan sebagai pemerhatian yang dibuat ke atas pekerja tertentu untuk mengenal pasti tahap kebimbangan amalan keselamatan apabila mereka melakukan sesuatu kerja. kajian beliau dijalankan terhadap industri pembuatan getah di Meru, Klang. Kajian ini berdasarkan pemerhatian ujian rintis selama tiga bulan yang hanya berlaku pada waktu bekerja. Seramai 152 pekerja telah diperhatikan. Matlamat kajian ini adalah untuk menemui elemen berpotensi tinggi yang menyebabkan kemalangan di tempat kerja dalam perbuatan dan keadaan berisiko. Bukan itu sahaja, malah mengikuti ujian rintis, untuk menyediakan prosedur bagaimana BBS boleh dilaksanakan. Setiap faktor bahaya dan perbincangan subfaktor termasuk idea kos efektif untuk mencegah atau mengurangkan bilangan kejadian kemalangan. Dalam kajian ini, pelan tindakan telah dipertimbangkan berhubung dengan keperluan perniagaan pembuatan getah, dan output statistik dianalisis. Disebabkan oleh tingkah laku nakal, tingkah laku keselamatan diakui sebagai punca utama berlakunya kemalangan. Oleh itu, beberapa strategi telah disediakan dan dibincangkan untuk faedah jangka panjang dengan tempoh kemajuan yang perlahan. Sangat digalakkan untuk menjalankan latihan keselamatan dan perhimpunan yang kerap untuk menyerlahkan kepentingan amalan keselamatan. Bagi penyelesaian kos efektif bagi data yang dikumpul dalam kajian ini telah dicadangkan untuk menyediakan satu sistem yang boleh membantu merekod data dan memantau penambahbaikan. Jawatankuasa keselamatan digalakkan untuk menyediakan sistem dalaman untuk pengesanan ketidakakuran dan pembetulan. Untuk kajian akan datang, kajian penyelidikan boleh dilakukan untuk membangunkan sistem papan pemuka analitik ramalan BBS untuk meramalkan bahaya hasil masa hadapan dan untuk mengusahakan penyelesaian yang mungkin untuk bahaya tersebut.

Kata kunci: Keselamatan berasaskan tingkah laku, kemalangan pekerjaan, tingkah laku keselamatan, ujian perintis, amalan keselamatan.

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Thurga Devi. U

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LIST OF ABBREVIATIONS

BBS	:	Behavior Based Safety
DOSH	:	Department of Occupational Safety & Health
NPD	:	Non-Permanent Disability
PD	:	Permanent Disability
DOSM	:	Department of Statistics Malaysia
SHO	:	Safety & Health Officer
OSHA	:	Occupational Safety & Health Act 1994
CF	:	Certificate of Fitness
PPE	:	Personal Protective Equipment
US	:	United States
UA	:	Unsafe Act
UC	:	Unsafe Condition
SA	:	Safe Act
UAUC	:	Unsafe Act & Unsafe Condition
IETS	:	Industrial Effluent Treatment System
M&E	:	Mechanical & Electrical
FE	:	Fire Extinguisher
LOTO	:	Log Out Tag Ou

CHAPTER 1: INTRODUCTION

1.1 Background of The Study

Safety is a no harm condition or situation that has to take place when there is an occurrence of an action. As in a daily life of an ordinary human, safety plays a vital role in avoiding dangerous event such as handling sharp edges or heat with a proper equipment's or accessories. Accidents are unpredictable event to happened when a mischievous action occurs. Besides normal condition in a daily routine, safety concerns are more pressed in 4 high risk industries such as manufacturing, construction, mining & health services. Based on Department of Occupational Safety & Health (DOSH), high number of accidents were registered and shown in statistics is from manufacturing industries. About 1,172 were recorded as non-permanent disability (NPD) and 58 were under permanent disability (PD). These recorded accidents show the highest for manufacturing industry among other industries. In that case, accident happens under two considerable concern which is due to mischievous action and unpredicted situations. Basically, these two situations are influenced by the behavior of an individual when an activity takes place.

Behavior Based Safety (BBS) is known to be a method of observation and analysis of an employee's workplace whether it is in a safe condition especially the focus on employees' behavior and attitude in their workplace(Salem et al., 2007). BBS is about observing and correcting unsafe act of an employee. There are four main elements need to be followed in order to make up a successful BBS program which is observation, checklists, feedback & goals. Observation has to be made on employee as the first step. Checklist is to help guide the individual to conduct the observation. Feedback as the third step has to be recorded before and after the observation. As the feedback record holds the good, average & poor behavior of an employee. Feedbacks that have been collected will

be sent to the respective team to proceed with action plans. And the last step is to implement the action plan and achieve the goal of the program. BBS is to highlight the mistake and implement corrective action rather than punish employee.

To identify on the effectiveness of BBS program need frequent observation and monitor on employees. Besides that, organizations contribution is much needed for a BBS implementation for Safety & Health department in terms budgeting for improvements and action plans. As in the early of 90's, BBS was the main tool to be implemented in workplaces to reduce on the accident rate and contributes to many companies and researchers has much concern on the behavioral to study (Rashid et al., 2017). About 70% to 95% of occupational injuries are occurred in workplace and this thought to be unsafe act of an individual (Rashid et al., 2017).

In this research project, rubber manufacturing industry has been chosen to do pilot study of 4 months on the unsafe act and unsafe condition that occurs at workplace. It is challenging to observe a reduction in the num of accidents in manufacturing industry. In year 2018, DOSH has reported about 5031 occupational injury cases which is compared more than year 2017 with 3635 cases (Saraih et al., 2021). Generally, this research is to identify the factors that contribute to occupational accidents and incidents which relates human behavioral in the cases. Based on DOSH statistics for year 2021 as of October, reported that manufacturing industry are the highest reported among all other sectors with 3253 cases under non-permanent disability (NPD). As for permanent disability (PD), 166 cases were reported which is the highest among other sectors. Referring to the update from Department of Statistics Malaysia (DOSM) for December 2020, natural rubber production has been increased 17.1% in December 2020 about 49,825 tonnes compared to November 2020 with 42,554 tonnes (Mahidin, 2021). During this period about RM 4.5 billion rubber gloves were exported in November 2020 and RM 4.6 billion in December 2020 which increase about 3.6%.

Table 1.1: Occupational Accident Statistics by Sector Year 2020

SECTOR	NPD	PD	DEATH	TOTAL
Hotel and Restaurant	137	1	2	140
Utilities (Electricity, Gas, Water and Sanitary Service)	214	3	3	220
Finance, Insurance, Real Estate and Business Services	312	7	8	327
Construction	137	3	66	206
Transport, Storage and Communication	294	6	11	311
Manufacturing	4202	231	73	4506
Wholesale and Retail Trade	126	1	1	128
Public Services and Statutory Authorities	73	1	3	77
Mining and Quarrying	35	1	3	39
Agriculture, Forestry and Fishery	916	20	43	979
Total	**6446**	**274**	**213**	**6933**

LEGEND:
PD - PERMANENT DISABILITY
NPD - NON-PERMANENT DISABILITY

(Source: DOSH, 2020)

Figure 1.1: Stocks of Natural Rubber

Figure 1.2: Domestic Consumption of Natural Rubber

(Source: DOSM, 2020)

Rubber gloves continues to be the main item of rubber product with 74.4% from the total consumption. This high production corelates to the pandemic season and manufacturing capacity. According to Malaysia Rubber Council, the pandemic caused a positive impact on rubber sector as for the production of medical devices such as gloves

and catheters. Rubber gloves production covers about 86% of exports. The demand for the gloves and other medical products increases to control the pandemic stretch out. Rubber manufacturing sector is contributing as part of the increase in accident case under manufacturing sector where it corelates with the production of rubber capacity. As the demand for rubber's were high the capacity of production was high due to medical equipment's orders. Due to increase in production, high potential for safety climate to change in an organization due to massive orders and planning's from the management to meet the deadline. In that case, production employee's will be in fast mode of completing job and skipping safety procedures in order to reduce time consumption and comfortability.

1.2 Objective

The objectives of the research project are listed below:

1. To introduce the procedure to the rubber manufacturing companies on the implementation of preliminary Behaviour Based Safety (BBS) test.
2. To identify on the highest potential unsafe act & unsafe condition in rubber manufacturing industry.
3. To propose a cost-effective solution for the pilot study based on the higher potential hazard source.

1.3 Scope of Study

This research study was done based on quantitative data from a rubber manufacturing industry located at Jalan Meru, Klang. This research study has completed 3 months of pilot study to investigate on the frequency of hazard source which contributes to accident. The collected data's will be analysed using statistical software to identify the impact from which category is higher. The data's will be analysed further to get the inclined ratio of the accident factors. This study will identify the factors that contributes

to the increase in accident cases. Based on the identification, effective solutions and predictive cases could lead to accidents.

1.4 Problem Statement

Based on DOSH report accident report, manufacturing accident cases have been reported as the highest. Mischievous and behaviour of an action is the major source of accidents in a manufacturing industry. These two aspects are influenced by an organizations culture and practice which implies in their daily job routine. When management concern is more on expanding empire of the growth and revenue, high potential to contribute less concern on certain division of their organization. As an example, safety & welfare of an individual where efforts needed to complete projects or jobs by timeline provided and employees tend to skip safety procedures due to time consumption and comfort at certain locations at workplace. Organization with poor safety climate will definitely lead to an increase in occupational injuries (Saraih et al., 2021). Besides that, action plans made by a Safety & Health Officer (SHO) is vital decision which should be as a long-term solution of every accident or incident cases. Every organization enforce on practicing and to strongly recommend authorized management group to approve decisions on action plans to implement. This is why because improper action plan due to lack of knowledge will mislead to implement an accurate action plan and to misjudge on the accident case where it could affect in future. Management has to be the drive of a proper action plan implementation and to hire qualified Safety & Health Officer (SHO). Communication is a very important tool to proceed an action accurately especially at workplace when a task given with a timeline. Lack of communication has domino topple effect in an organization where it leads misunderstanding in completing a task and responsibilities to carried out. Adequate knowledge transfer and trainings should be conducted by qualified competent person in order to generate importance of a training.

CHAPTER 2: LITERATURE REVIEW

2.1 Behaviour Based Safety (BBS)

Behaviour based safety (BBS) is known to be a group or one to one observation which will be made among employees on their work routine to monitor on their perception towards safety procedures and to train them accordingly (Health and Safety Authority, 2013). Basically, the intention of BBS is to check on the employee's concern on the safety behavioural in performing a task. BBS helps employees to perform their job safely as an end product of safe behaviours. BBS implies a process called ABC model were (Walker, 2003),

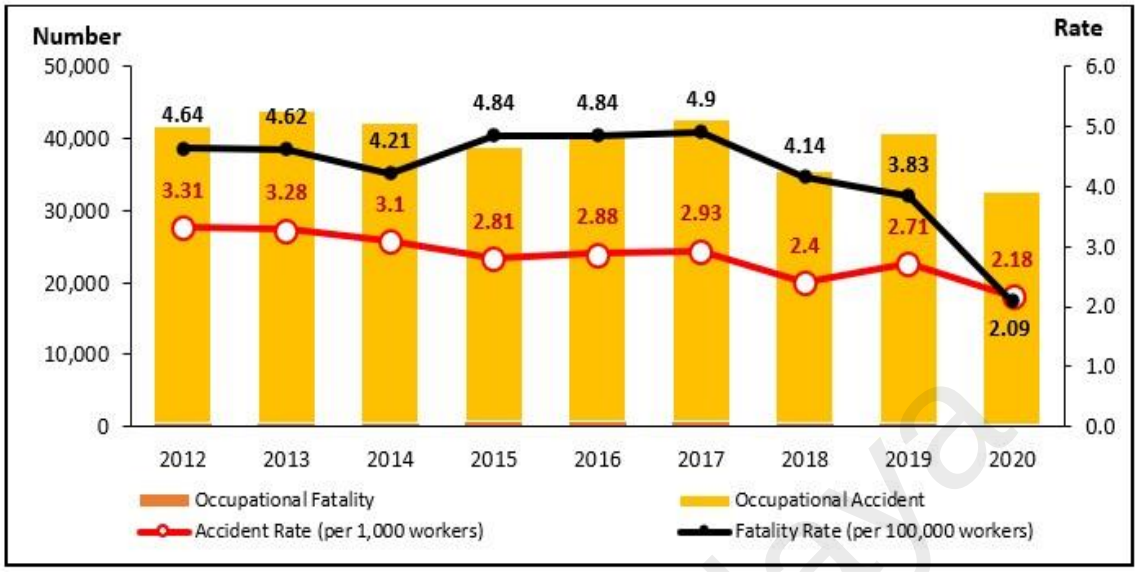
a. A stand for Antecedent
b. B stands for Behaviour
c. C stands for Consequences

ABC model is known to be a method to study about an employee's behaviour on why they choose to act or behave in certain way (Chris Kilbourne, 2010).

2.2 National Occupational Accident Statistics

In year 2020, the total number of occupational injuries was 32,674 cases which is 19.9% lesser than previous year about 40,811 cases (MAHIDIN M.U, 2021). Due to the decrease in the number of cases, the rate of accident case reduced by 0.53% per 1k employees in 2020 to 2.18 as for 2019 was 2.71. The rate fatality cases also declined from 578 cases to 312 cases in 2020 and this affected in the reduction of fatality rate per 100k employees from 3.83 to 2.09 in 2020 compared to previous year. The decrease or decline of rate is mainly due to the order and restrictions imposed for the control of COVID -19 spread. About 44.6% decrease were recorded under occupational accidents and 62.1% for occupational fatalities under second quarter of 2020 (MAHIDIN M.U, 2021).

Figure 2.1: Annual Occupational Accidents and Fatality, 2012-2020



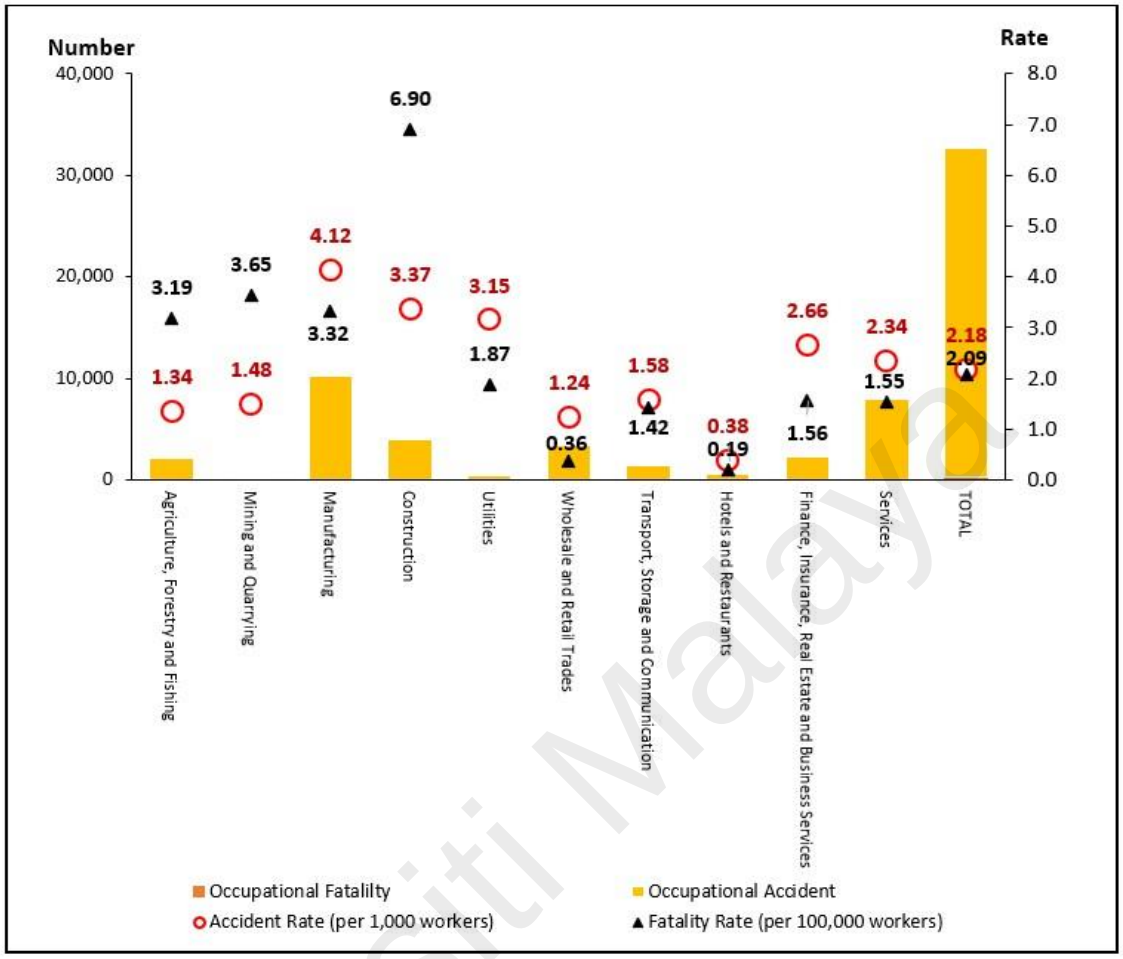
(Source: DOSM, 2021)

2.3 Occupational Safety & Health Act 1994 (OSHA)

On 25th February 1994, OSHA has been introduced to provide protections to all the activities and sectors that requires safety & health except Merchant Shipping Ordinance and military forces (Osman et al., 2015). Occupational Safety & Health Act 1994 (OSHA) objective is

a. *to secure the safety, health and welfare of persons at work against risks to safety or health arising out of the activities of persons at work;*
b. *to protect persons at a place of work other than persons at work against risks to safety or health arising out of the activities of persons at work;*
c. *to promote an occupational environment for persons at work which is adapted to their physiological and psychological needs;*
d. *to provide the means whereby the associated occupational safety and health legislations may be progressively replaced by a system of regulations and approved industry codes of practice operating in combination with the provisions of this Act designed to maintain or improve the standards of safety and health.*

Figure 2.2: Occupational Accidents and Fatality by OSHA Sector, 2020



(Source: DOSM, 2021)

In year 2020, occupational accidents under manufacturing sector were recorded about 10,303 cases. Trend of total number for occupational accident decreases for most sectors except insurance, finance, real estate and business services compared to year 2019 (MAHIDIN M.U, 2021). For manufacturing sector, the number remains the same as highest at 4.12 per 1k employees followed by other sectors such construction and utilities.

2.3.1 OSHA ACT 1994 PART V

a. General duties of manufacturers, etc. as regards plant for use at work.

Based on OSHA section 5 (20), manufacturers are responsible to ensure a plant set up before and after operating has to be in a safe condition, to conduct an experiment on the

job scope of an employee and to set up required information of a plant function which has been designed and tested to ensure for a safe and without risk circumstances. Developers such as manufacturers, suppliers, designers and planners are need to provide all the necessary information of a plants design which involves any condition that leads to safety and risk on health. Employers are responsible to provide a safe work environment for their employees in terms of technical and theoretical. This where qualified authorised employees have to hired to deliver the knowledge technically and theoretically in order to increase the awareness of safety in a particular workplace. In relate to that, manufacturers are highly encouraged to be a must to comply all the safety regulations, requirements of a safety committee and responsibility of reporting an accident or incident.

b. General duties of manufacturers, etc. as regards substances for use at work

Based on OSHA section 5 (21), it's a responsibility of a plant developer to ensure that a material in a plant to be used is in a safe condition and useable when an employee instructed to utilize. As an example, usage of machineries in a manufacturing company has to own certificate of fitness (CF) to assure the machine is safe to use. Manufacturers are highly encouraged to have concern on the machine safety by setting up adequate safety policies in companies to ensure the usage of machine is inspected by safety committee before use. Process owners such as engineers are required to have a written procedure on the machine usage instructions. Process owners are responsible to train, teach and guide on every machine usage or work procedure in the factory to the employees. This to ensure that an employee understands the process and the procedure of using a machinery without any risk and complying to workplace safety necessity to avoid accidents. To include in an organizations safety policy that suppliers are responsible for testing after commissioning a new machinery installed where this is to ensure that machines are safe to use and risk free for performing jobs.

2.3.2 OSHA ACT 1994 PART VI

a. General duties of employees at work

Based on OSHA Act 514 19954 Section 6 (24), an employee has to be responsible for their safety and others who may affected by their act at workplace. Is a must for all employees to comply basic safety regulations when they are located at a particular workplace in a factory. Employees are required to obey and work with the employer or any person in charge of a particular job by an act or regulation made and employees to wear personal protective equipment (PPE) provided by employer to perform jobs in order to prevent accident or incident risk. Every job or task in a manufacturing industry are always advised to be fully protected by PPE due to manufacturing nature where it comes with machineries and productions.

An organization with occupational safety and health policy has to be revised yearly and shared to all the employees to adhere on terms, instruction and measures. Management attention on occupational injuries reduction reflects on their concern about safety management and improvements of an organization. It's an employer's responsibility to obey, practice and set up arrangements for safety management system to establish in an organization. BBS implementation is not only an effort of an organizations safety committee responsibility, it is also involves the commitment and support from the top management to agree and adhere for the improvements (Osman et al., 2015).

2.4 Safety Behaviour among Employees in the Malaysian Manufacturing Company: What Really Matters?

Based on this study, the aim is to identify the factors that influences safety behavioural which increases in the manufacturing industry. About 237 samples were collected in this study from a manufacturing company from Klang, Selangor. Based on

the DOSH report in 2018, occupational accidents are highly reported under manufacturing sector compared to other economic sectors (Saraih et al., 2021).

Figure 2.3: Occupational Accidents Statistics by Sectors 2018

SECTORS	NPD	PD	DEATH	TOTAL
Manufacturing	2969	197	62	3228
Mining and quarrying	34	3	4	41
Construction	106	8	118	232
Agriculture forestry and fishery	709	14	26	749
Utilities (Electricity, Gas, Water and Sanitary Services)	168	-	5	173
Transport, storage and communication	124	1	12	137
Wholesale and retail trades	69	3	1	73
Hotel and restaurants	120	2	1	123
Finance insurance, real estates and business services	190	5	22	217
Public services and statutory authorities	48	1	9	58
TOTAL	**4537**	**234**	**260**	**5031**

(Source: DOSH, 2018)

A study made in United States (US) to identify several major parameters (trainings, accident alert sharing's and etc) of safety management cultures and recommended that these parameters are highly possible to reduce occupational accidents in an organization. Besides that, ana organization with lack of safety climate improvement has a great impact on the risk of occupational accidents. Management are required to focus and target by group to improve the safety behaviour and conduct appropriate trainings (Saraih et al., 2021). Besides that, safety behaviour is the main key to support and encourage optimum wellbeing among employees in a manufacturing industry. It's a responsibility for all the employers to provide all the necessary trainings in order to increase safety behaviour in their organizations.

In this study, authors discussed about the safety management practices, safety compliances, safety climate and the variables that corelates. Referring to safety management practices, authors mentioned that an organization support helps to identify crucial situation of safety issues and invest effort on implementing adequate action plans to reduce the number of accident cases. Human safety progress able to achieve by minimizing the occupational accidents cases in an organization. Safety management

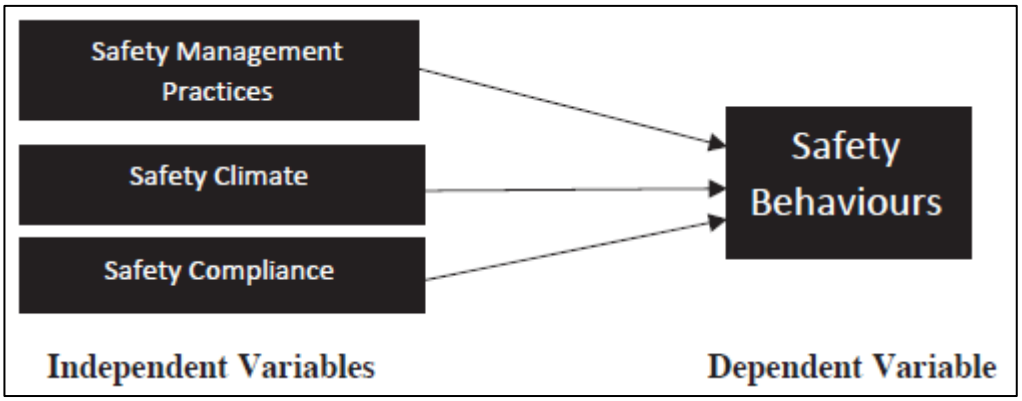
practices is not only to adhere and comply at workplace, it is highly encouraged to adapt in daily life when performing a task.

Safety climate defined as a perception about safety concern on their rules, procedures and practises in an organization (Griffin & Curcuruto, 2016). Safety climate also refers to the quality of a management, culture of an organization, practices and process, situations behaviour and values. Safety climate is widely acknowledged as an overarching determinant factor of safety behaviour in a variety of work settings and socioeconomic contexts; and, interestingly, extensive empirical underpinnings based on theory, practise, and methodology attest to a consensus that the safety climate-safety behaviour relationship is positive. For this study, there is a considerable and positive relation between organizational safety behaviour and the safety climate proposed.

Safety compliance is described as following all rules, laws, and safety procedures in order to offer excellent work performance while being safe (Saraih et al., 2021). Safety compliance refers to following safety procedures and carrying out tasks in a safe manner, whereas safety participation is defined as an individual's involvement in providing safety suggestions within the organisation, promoting safety programmes within the workplace, demonstrating initiative, and putting effort toward improving their workplace safety. In other words, safety compliance can be measured by the behaviour, attitude, safety regulations and being responsible when performing a job safely at workplace. This study proposes that there is a significant and positive relation between safety compliance and organizational safety behaviour.

This study was based on quantitative approach which used survey method by distributing questionnaires to employees those who are in manufacturing industry. SPSS software was used to run and analyse the data trend. The questionnaires were developed to identify the link between safety management practices, safety climate & safety compliance among the employees.

Figure 2.4: Dependent and Independent Variable



(Source: Saraih et al., 2021)

2.4.1 Reliability Test

Reliability test were used in this study to conduct internal consistency and degree of stability for the measures. Cronbach Alpha is defined as, as a measure of internal consistency, it is expressed as a number between 0 and 1 on a test or scale (Tavakol & Dennick, 2011). Internal consistency refers to the extent to which all of the items in a test measure the same notion or construct, and is thus linked to the test's inter-relatedness. In this test, it has been discussed that the values for safety climate and safety compliance were between the range 0.81 to 0.88. Based on the range, in this study it has been proven that Cronbach Alpha values are in a good stability and internal consistency.

Figure 2.5: Reliability Analyses

Variables	Number of Items	Cronbach Alpha Values
Safety Behaviours	5	0.83
SafetyManagement Practices	6	0.89
Safety Climate	6	0.88
Safety Compliance	6	0.82

(Source: Saraih et al., 2021)

Based on the data reported in this study, the mean for safety behaviour, safety compliance and safety managements are 3.94, 3.83 and 3.97. These variables are categorized as the highest mean (Saraih et al., 2021).

Figure 2.6: Minimum, Maximum, Mean and Standard Deviation Analyses for Variables

Variables	N	Minimum	Maximum	Means	SD
Safety Behaviours	237	2.40	5.00	3.94	0.66
SafetyManagement Practices	237	2.50	5.00	3.97	0.72
Safety Climate	237	1.83	5.00	1.98	0.70
Safety Compliance	237	2.00	5.00	3.83	0.67

(Source: Saraih et al., 2021)

2.4.2 Correlation Test

Not only reliability test, correlation test also was conducted to identify the relationship between the variables. This study was divided into three clusters, with low correlation ranging from 0.1 to 0.3, moderate correlation 0.3 to 0.5, and high correlation 0.5 to 1.0. Based on test, this study shows moderate correlation values as below.

Figure 2.7: Correlation Analysis between Variables

Variables	1	2	3	4
1. SAFETY BEHAVIOURS	-			
2. SAFETY MANAGEMENT PRACTICES	.49**	-		
3. SAFETY CLIMATE	.47**	.76**	-	
4. SAFETY COMPLIANCE	.40**	.43**	.47**	-

** Correlation is significant at the 0.01 level (2-tailed).

(Source: Saraih et al., 2021)

2.4.3 Regression Analysis

Regression analysis is defined as a test which identifies the relationship between a dependable variable or more than independent variable. Multiple regression was used in this study for safety climate, safety management practices, and safety compliance towards safety behaviour. The standardised coefficient beta value also revealed that safety management practises and compliance are positively associated to safety behaviour, with each unit increase in safety management practises resulting in an increase in safety behaviour. Result of this test, it has been discovered that safety behaviour is significantly related to safety behaviour.

Figure 2.8: Regression Analysis for Safety Management Practices, Safety Climate and Safety Compliance Towards Safety Behaviours

Variables	B	t	p	R	R^2	Adjusted R^2
				.548	.300	.291
Safety Management Practices	.2.64	5.969	.001			
Safety Climate	.142	3.409	.083			
Safety Compliance	.215	1.740	.001			

*P<0.05; **P<0.01

(Source: Saraih et al., 2021)

This study concludes that there is a strong and favourable association between safety management methods and organisational safety behaviour. In this industrial company, there was a significant link between safety management techniques and organisational safety behaviour among personnel. Management in the manufacturing industry is advised to provide the best safety management practises possible by developing a good training and supervision system and a safe working procedure and consultation. The reporting system for any incidence of safety and management commitment can also be one of the major aspects that can be followed in all firms to promote safety behaviour while also preventing accidents and injuries among personnel.

Based on the regression outcome, employees in this industrial company had no significant association between safety climate and organisational safety behaviour. Because the mean level of the safety climate in this organisation is low (mean = 1.98), this could be the reason why this factor has failed to impact the degree of safety behaviour among employees. Employees are the most valuable assets of any manufacturing company senior management must be responsible for their safety on the job. This research can be used to establish a good degree of safety management practise, which should be given by the organization's senior management. All employees in the workplace must also demonstrate an adequate degree of safety compliance. Management can take a number of steps to improve the organization's safety management practises, including providing

sufficient personal protective equipment (PPE) for all employees, providing comprehensive training to all employees on all issues relating to workplace health and safety, and treating safety as equally important to all employees.

2.5 Behaviour-Based Safety Approach for Construction Projects

In this study, BBS use has been limited for the construction industry. The aim of this project is to come out with a decision which drives a support system that can contribute on the BBS implementation. For this study, pilot test has been conducted to examine the model. The construction sector has an appalling track record when it comes to safety. In the year 2002, there were an average of 7.1 non-fatal injuries per 100 employees. It had 1121 fatalities, resulting in a fatality rate of 12.2 per 100,000 employees, second only to mining and agriculture (Salem et al., 2007). In construction production processes, workplace injuries and fatalities are indisputably inefficient and non-value-adding events. These occurrences contribute to erratic workflow, which disrupts any building job. While many organizations always have concerns about safety, there are others that have made significant improvements in their safety performance.

These companies are hiring experts to handle their safety initiatives, giving staff with training, and reporting good outcomes. However, there is a massive risk of complacency in these organizations. The way the construction sector handles safety enhancement needs to change significantly. Several ways have been used in the sector, each with its own set of pros and drawbacks. Since it focuses on the behaviour of the human at work, a behavioural perspective becomes especially crucial in addressing safety issues. According to the National Safety Council, behaviour is to blame for 94% of all illnesses and injuries (Salem et al., 2007). This has highlighted the need of emphasising employee behaviour as a vital component of improving safety standards. BBS treatments concentrate on what employees do on the job (behaviour) and the reinforcing contingencies that lead to safe behaviour. There are two primary characteristics that have

made BBS stand out from other approaches. It is said to be that human behavioural is the major source of occupational injuries and encourages management of an organization for safety enforcement as it is not only a safety committee responsibility.

2.5.1 Method of BBS Implementation

After completing a BBS intervention, eight of the thirteen studies found a statistically significant reduction in accidents/injuries. A statistically insignificant improvement was achieved in two experiments. Overall, the BBS interventions resulted in a 5% reduction in accidents/injuries, which was statistically significant (Salem et al., 2007).

a. To study an organizations, practice and historical data
b. To conduct safety meetings
c. To interact with employees on current system effectiveness
d. To keep updated safety manual of an organization
e. To create a critical behaviour statistic
f. To select site
g. Selection on the design & actual implementation for the study
h. Analysing on the outcome and conclusion of the study

2.5.2 Pilot Test of Case Study

The model was tested in a pilot study in Cincinnati with the help of a medium-sized reputable contractor. The pilot research was conducted in Laurel Homes, a mixed-income, mixed-finance complex near downtown Cincinnati that cost approximately $102 million (Salem et al., 2007).

a. To check on organization's documents past historical accident records
b. To conduct safety meetings
c. To survey and seek feedback from employee on the current practice effectiveness
d. To keep updated the safety manual to prevent misleading

e. To set up statistics for critical behaviour for improvement based on the sources of accident occurrences

f. To select site and decide on the design for the study

g. Preparation for actual study implementation

h. Analysis and interpretation based on the data collected

i. To conclude the findings and provide improvement plans

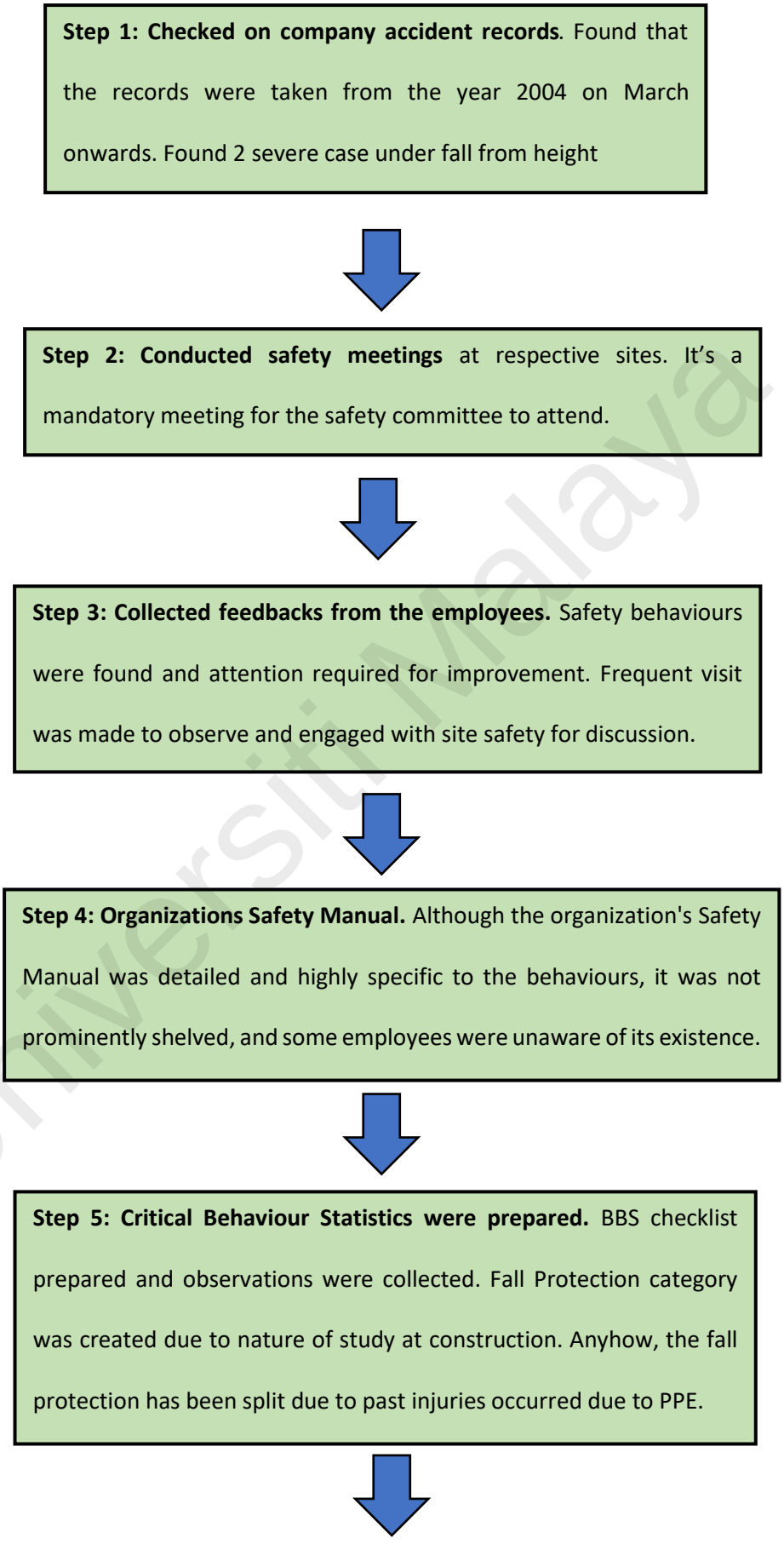
Figure 2.9: Subcontractors Working at the Site

#	PROFESSION	WORKER CHARACTERISTICS	NUMBER OF WORKERS
1	Framers-I	Caucasian	6 to 20
2	Framers-II	Hispanic	6 to 20
3	HVAC installers	Caucasian	3 to 8
4	Electricians	Caucasian	2 to 4
5	Excavation crew	Caucasian	1 to 4
6	Plumbers	Caucasian	4 to14
7	Brick Masons	African American African American Caucasian	4 to 20
8	Fire Protection Crew	Caucasian	2 to 4
9	Roofers	African American	2 to 4
10	Cladding crew	African American Hispanic Caucasian	2 to 6
11	Exterior Finishers	Caucasian	2 to 4
12	Interior Finishers	Hispanic	3 to 6

(Source: Salem et al., 2007)

In this study, the model was tested in a pilot study in Cincinnati with the help of a medium-sized reputable contractor. The pilot research was conducted in Laurel Homes, a mixed-income, mixed-finance multi-family residential project near downtown Cincinnati.

Flowchart 2.1: BBS Procedure



Step 6: Site Selection. The majority of the work was scheduled to be completed in phases, with some overlap in terms of activities, as is typical of most construction projects. This overlapping of activities was beneficial to the research since it allowed for a larger number of groups to be monitored together for a longer amount of time.

Step 7: Design of The Study. Discussion on the hazard sources such as PPE, housekeeping, tools & equipment's, environmental control and fall protection. Employees received frequent feedback, both verbal and visual, in the form of posters.

Step 8: Implementation of the Study. The observation rounds took place at random times throughout the day. The timings were set based on the work's complexity and volume. Typically, each set of employees was observed for ten minutes. All observed safe and dangerous behaviours were recorded.

Step 8: Implementation of the Study. The observation rounds took place at random times throughout the day. The timings were set based on the work's complexity and volume. Typically, each set of employees was observed for ten minutes. All observed safe and dangerous behaviours were recorded. Rating was used in this study to measure the severity of behaviour in that organization.

In this study, it has been concluded that body position and ergonomics continue to be a big issue for construction employees, according to the 6-week pilot study, and if ignored, can lead to serious problems for the industry in the future. The safety rating values in the pilot study also revealed that failing to comply with fall protection criteria is a widespread reason for worry in the construction industry. In overall, the findings of this study show that utilising a simple safety checklist and rating system, it is possible to change employee's behaviour. More importantly, research has shown that after being introduced to the programme and receiving feedback on their safety performance, the employees began to show better ratings. The initiative sparked a competitive atmosphere on the job site as well as a sense of accountability among the employees. The programme may be adopted at other sites in the industry with just minor changes, and it will serve as a guide for process improvement initiatives and efforts to improve safety performance on construction sites.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This study is based on 3 months pilot test that has been observed in the rubber manufacturing industry located at Meru, Klang. The data were observed and collected using quantitative method. In this study, total employee was observed about 152. This chapter will brief on the methods and procedures that has been used in this pilot study. These procedures will help when the real implementation BBS takes place and this will act as a reference for the implementation.

3.2 Procedures and Methods

This study is based on observation and analysis, it is very obvious that the methodology will be simple to ease on the data recording. Not only that, a BBS checklist was used in this study to collect the observations and store the data in a master data.

3.2.1 To Study on Historical Data

One of the initial tasks of the project was to monitor worker safety and gain access to the company's activities. Working as an executive for the rubber manufacturing industry it would be advantageous in terms of gaining access to specific groups within the company, as well as arranging for practical details such as planning, implementing, and overseeing the company's employee safety at work. Another early priority was to learn more about the company's overall organizational structure as well as the specifics of the operations where contractors were hired and the work they did. Rubber is manufactured and traded at the company's many industrial sites.

Not only that, accident records of past 1 year were studied especially on the frequency of accident category. Based on the historical data, the accident category was highest for machinery category as below in table 1. The accident category has further

breakdown into sub category to specify on the major hazard that causes on accidents. This is where root cause of each accident cases was recorded and it helps to refer back and use as a reference or benchmark for a new effort of implementation. BBS checklist were prepared based on the rubber manufacturing industry hazards by using historical data as reference. The checklist was corrected, verified and approved by the safety manager from HQ management.

Table 3.1: Accident Category of Historical Data

Num.	Accident Category	Total Accidents
1	Machinery	29
2	Slip, Trip & Fall	13
3	Sharp object	11
4	Chemical	10
5	Heavy object	9
6	Forklift	5
7	Sharp edge	4
8	Hot	4
9	Electrical	2
10	Others	1
11	Trip and fall	1
12	Falling object	1
13	Flying object	1
Grand Total		**91**

(Source: Rubber Manufacturing Industry, 2021)

3.2.2 Conducted Safety Meetings

Safety meeting were conducted at initial stage to brief and inform cluster leads on the pilot test. In this meeting, observation schedule was shared to the cluster leads as observation takes place every day in the morning except weekends and public holidays. Aim of this observation were discussed for a proper implementation of BBS program. Ideas were shared regarding the observation data collection and with the support of other

safety officers. BBS checklist was presented in the meeting to share on the content of hazards sources that will used. Example of BBS checklist were attached in the appendix.

3.2.3 Interaction with Employees

Communicated with employees when an unsafe act or condition observed. Verbal feedback on the situation and current practice of safety in that workplace.

3.2.4 Recording Observations

Unsafe act and unsafe condition which is observed will be immediately recorded and provide action plan. Observed result will be informed to the worker of his or her observations and provides feedback. In this positive feedback is much appreciated. Workers can become more conscious of their conduct by discussing ways in which they can execute their tasks in a safer manner. BBS programmes are built on a continuous feedback loop in which employees and observers give each other comments on how to enhance safety, and safety professionals use the data gathered during the observations to improve the BBS programme.

3.2.5 Data Analysis & Statistics

Collected data was analyzed using excel statistic term with graphing's to check on the increased trend and declined trend. Each hazard factors and subfactors were analyzed and discussed in chapter 4. Not only that, solutions were given for each factor and subfactors which effects on the BBS improvement.

3.2.6 Results and Conclusion

Once the data has been analyzed and the organization has begun to see the desired outcomes. Based on the outcome, organization may enforce safety committee to work on the category for a proper BBS implementation. To seek a good result, the period of BBS has to be longer due to the improvement and trainings provided to workers promptly.

CHAPTER 4: RESULT & DISCUSSION

4.1 Introduction

This study has been carried out mainly to achieve the objective as mentioned in chapter 1. To evaluate the achievement, the end results of the pilot test were analyzed and interpreted using SPSS software. In this chapter, findings of the output result will be discussed especially on the factors that contribute to accidents and provide solutions. Besides that, the results obtained from this study will be a reference for future BBS implementation as this will be recommended with some strategy in Chapter 5.

4.2 Behavior Based Safety (BBS) Outline

Recognizing the human factor of safety understands that human behaviors impact results even when the hierarchy of controls is strictly followed. After you've given the element a name, you can manage it (Team Safe Site, 2021). BBS not only allows you to respect the human side of safety, but it also provides you with a method for:

I. For clarity, defining safe and unsafe activities is necessary.

II. Employee participation in safety and decision-making processes

III. Education and shared understandings are used to encourage desired actions.

IV. Creating a system for formally recognizing good behaviors

These acts enable you to provide workers with consistency, which is critical for employee engagement. Few things are more frustrating for employees than not knowing what is expected of them and then receiving contradictory information. BBS enables you to work closely with employees to identify, assess, and modify unsafe behaviors, preventing them from reoccurring and escalating risk.

Detecting and rectifying risky behaviors before they generate losses is maybe the most valuable aspect for safety teams. BBS can help your company cut down on injuries by as much as 80% (Team Safety site, 2021).

The end outcome for businesses is:

I. Reduced expenditures as a result of fewer accidents (both out-of-pocket and insurance costs)

II. There are fewer operating disruptions.

III. Productivity gains

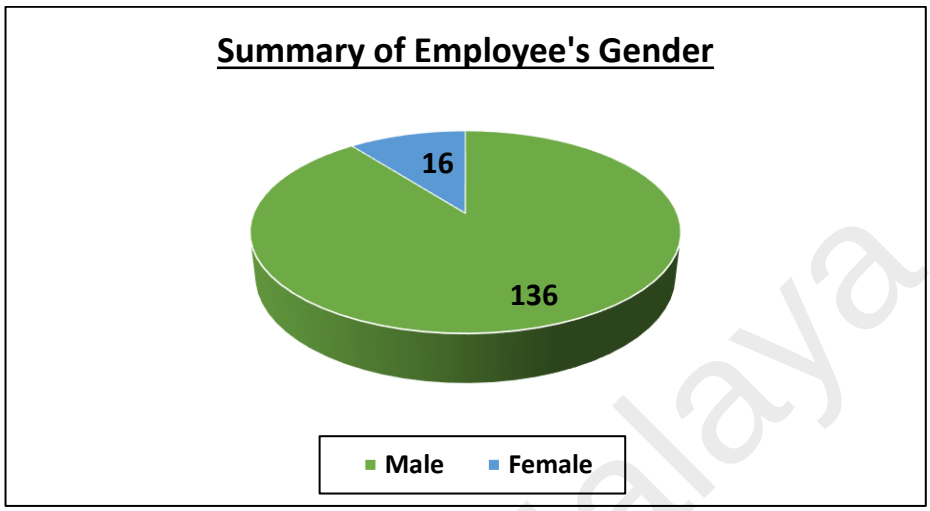
IV. Standard production is smooth and usual.

4.3 Findings on Gender Statistic

There is a strong correlation between masculinity and safety, according to research (The, 2011). Men are educated to act in ways that are counterproductive to their safety. Men are urged to do things that will make them appear powerful and indestructible, even if it means risking their lives to do so. This is how men demonstrate that they are "true men." As a result, the mining industry can improve its safety record by influencing how its male employees think about and act on gender issues. The issue for Australia's mining industry is to persuade its men that masculinity can be expressed in a variety of ways; to persuade them that it is not necessary for a guy to act or be strong. In this study male employees were found to be more in the manufacturing sector compared to ladies as the jobs are challenging and requires high capability such as welding, electrical, maintenance and etc. Based on Deloitte, women make up less than a third of manufacturing jobs (Meredith, 2021). Working in this profession provides perks such as learning about the latest advancements, having a rewarding career, and being part in complex economic processes. Salaries may begin modestly, but there is plenty of

possibility for advancement, particularly when manufacturers adopt new technologies such as robotics and automation.

Pie Chart 4.1: Number of Employee's by Gender



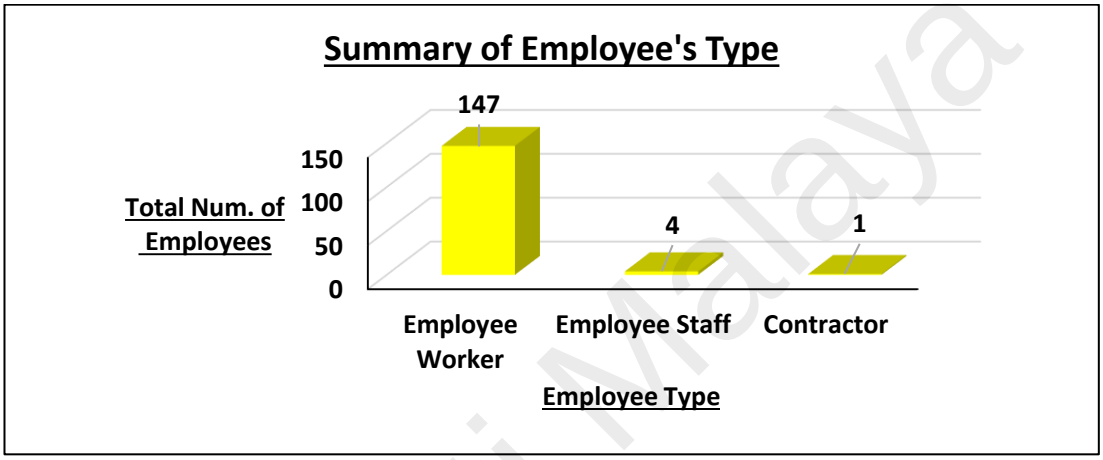
In this study, based on 3 months pilot study about 152 respondents were selected and observed continuously on their behavior and safety practice. Male respondent was the highest recorded about 136 compared to female about 16. As the nature of manufacturing industry which mostly male dominant jobs and this indicates the huge number of males in this rubber manufacturing company. In addition, women and men are exposed to distinct physical and psychological hazards at work due to the varied professions they do, their different societal positions, the expectations and duties they have, and hence require different control methods, according to a gender sensitive approach. For an example, in this rubber manufacturing industry female employees are mostly from management units and factory basis where in packing lines.

4.4 Findings of Employee Type's Statistic

In this study, the respondents are mostly workers about 147 of them, this total num of workers for this study were influenced by the location of study. As the observations were done at factories and factories are occupied by workers compare to staff and contractors. Besides that, in this company there are morning shifts and night

shifts which influences on the number of accidents. Based on OSHA Act 914, it is a must for employers to provide a safe working environment to their employees. According to that, all organization were enforced to teach and train their employees on the importance of safety practice in their working place. Not only that, without a proper safety manual or practice leads to accidents and incidents, where this could put company revenue in danger.

Graph 4.1: Number of Employee's by Type



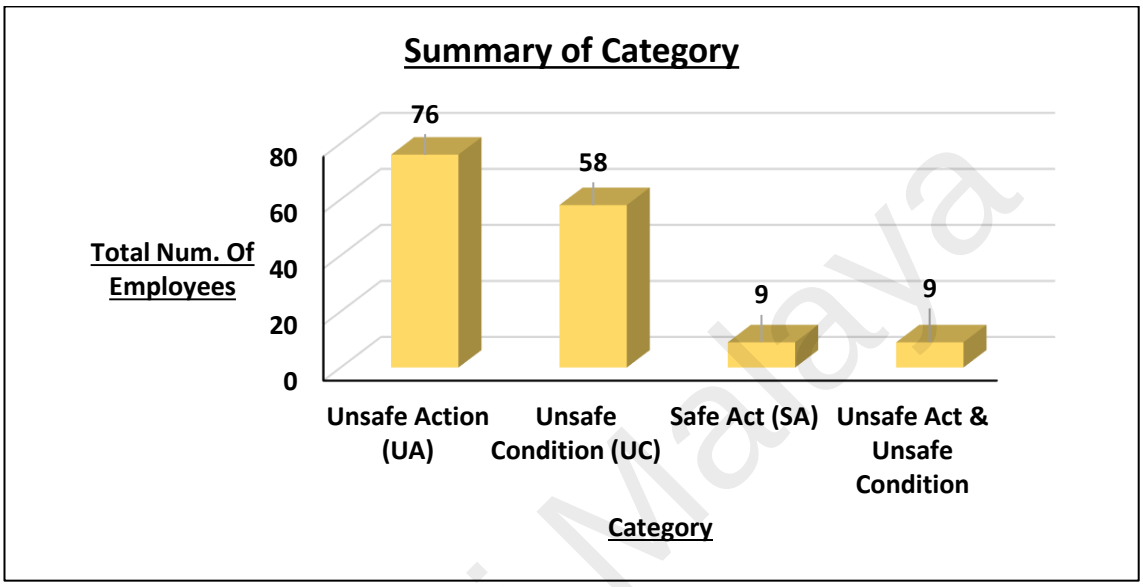
Since the data indicates the highest number under workers, management required to enforce the safety concerns for a safe work environment such as emergency procedures, chemical safety, electrical safety, work instructions, machine safety, gas safety and etc. As for the number of staffs in factory areas are always less due to their job nature at management site. Presence of staffs at factories are quite rare as even staffs are around mostly from engineering team and R&D, where they carry samples, checks, monitor and track on the productions. As for contractors their presents in factory were less too during that period of study, as there was no job related to contractors since most of the contractor jobs can be done by inhouse engineers and their team.

4.5 Findings on Category

Accidents & incidents that has been identified in an organization will be categorized the hazard risk under act and conditions. In this study, there are 4 types of

categories were used in this study to indicate the situation of each hazard risk such as unsafe act (UA), unsafe condition (UC), safe act (SA) and unsafe act & unsafe condition (UAUC).

Graph 4.2: Summary of Category



Unsafe Act (UA) is defined as an action of performing and activity or task without any safety concern which could risk hazard and accident. As for unsafe condition (UC), happens when the situation is at risk and cause accident. The way people handle their tasks is linked to risky acts. It can be avoided by providing workers with the necessary safety knowledge and skills to manage workplace hazards and risks.

Workers must be informed and updated on new safety concerns on a regular basis, and they must be involved in keeping the workplace a safe and secure environment for all. In this study, the highest category observed was on unsafe act which is about 76, second highest by unsafe condition (UC) with 58 followed by safe act (SA) and unsafe act & unsafe condition (UAUC) with 9. Since the frequency of UA is the highest, where it is related to the behavior of a worker when performing a task example performing task at production line without safety helmets and safety shoes. Lack of concern on safety practice when performing a task leads to an accident.

This is where buddy system is required to support each other and transfer knowledge from one worker to another worker. Management required to set up an arrangement for a buddy system implementation, where a job to be done by 2 workers specially to assign senior and junior workers to perform the job. Senior workers are believed to knew the culture and practice of an organizations safety policy so this aids the ease of transferring knowledge, advising and to support the workers.

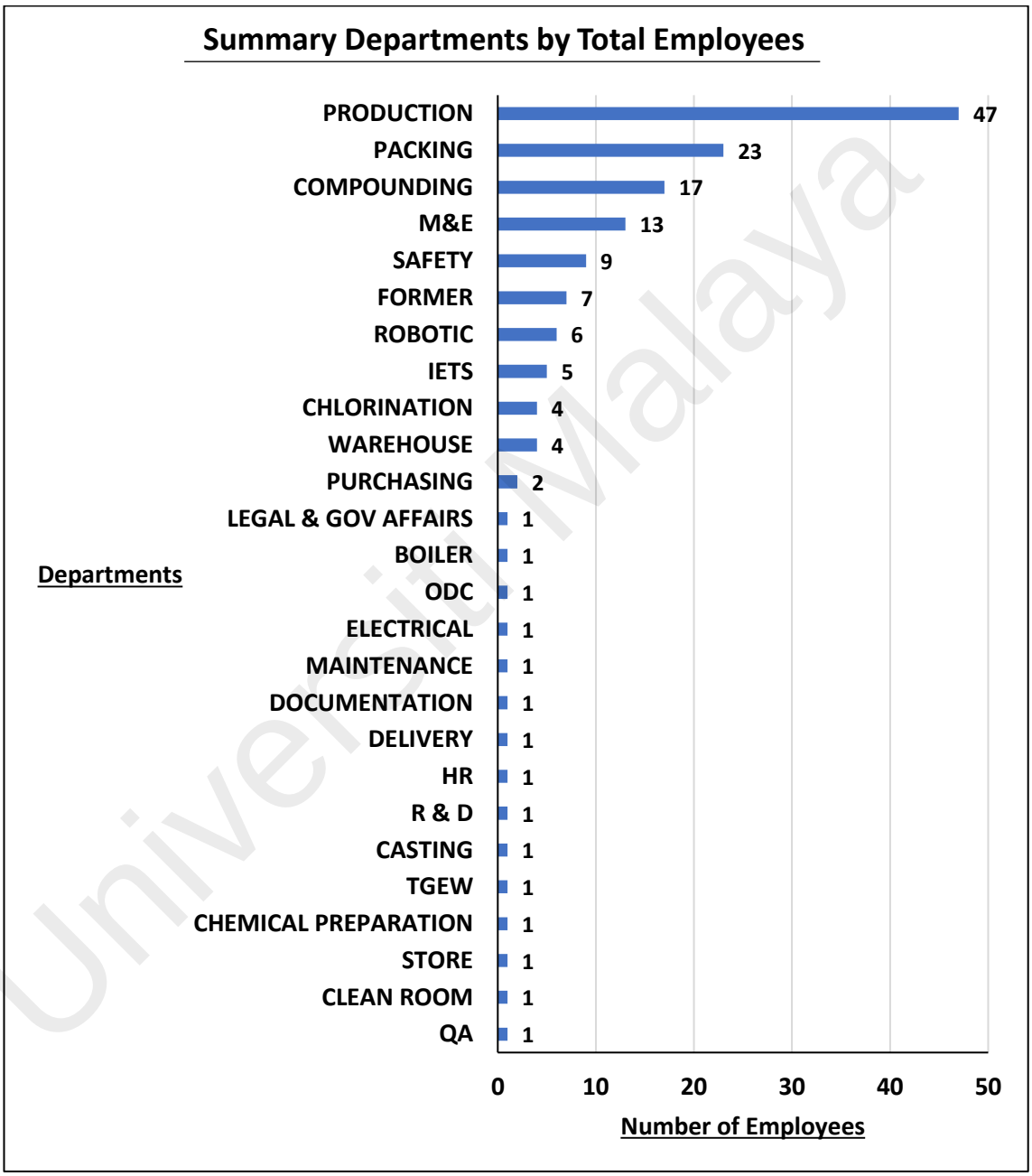
4.6 Findings on Department

In this study, about 26 departments were chosen to proceed with the pilot test as these departments are the most located in factory area. From the 26 departments, production is the highest rated number about 47 employees and followed by packing, 23 and compounding, 17. Based on the data below in graph 3, production, packing and compounding are the departments need more focus on the safety practice in their location. Production department has various high-risk jobs such as changing bearings, beading carpets, M&E jobs at production platform, electrical, panel maintenance and etc. In order to perform a job in production line, PPE is a must safety policy to follow in the factory and not only that in this study it has been identified that workers concern on PPE is very poor as they believe on their capability to perform without PPE's.

Compounding department job scope is basically on the process ingredients where there are chemicals related in this job scope. Chemical hazards are highly potential to harm directly onto the skin when improper handling and management occurs. There are two sorts of chemical dangers in the workplace which is health hazards and physicochemical hazards. The term chemical health hazard refers to a chemical's qualities that can cause acute or chronic health problems. Employees are subjected to physicochemical dangers when they are mishandled or used, but they are not caused by the chemical's biological contact with the person. Many compounds often present in the

workplace can be classified as a chemical or physicochemical hazard. As for packing department, the job nature is to be seated but the hazards are from machines that workers perform. This is highly influenced by the safety behavior which is the relevant PPE usage.

Graph 4.3: Summary of Departments by Total Employees

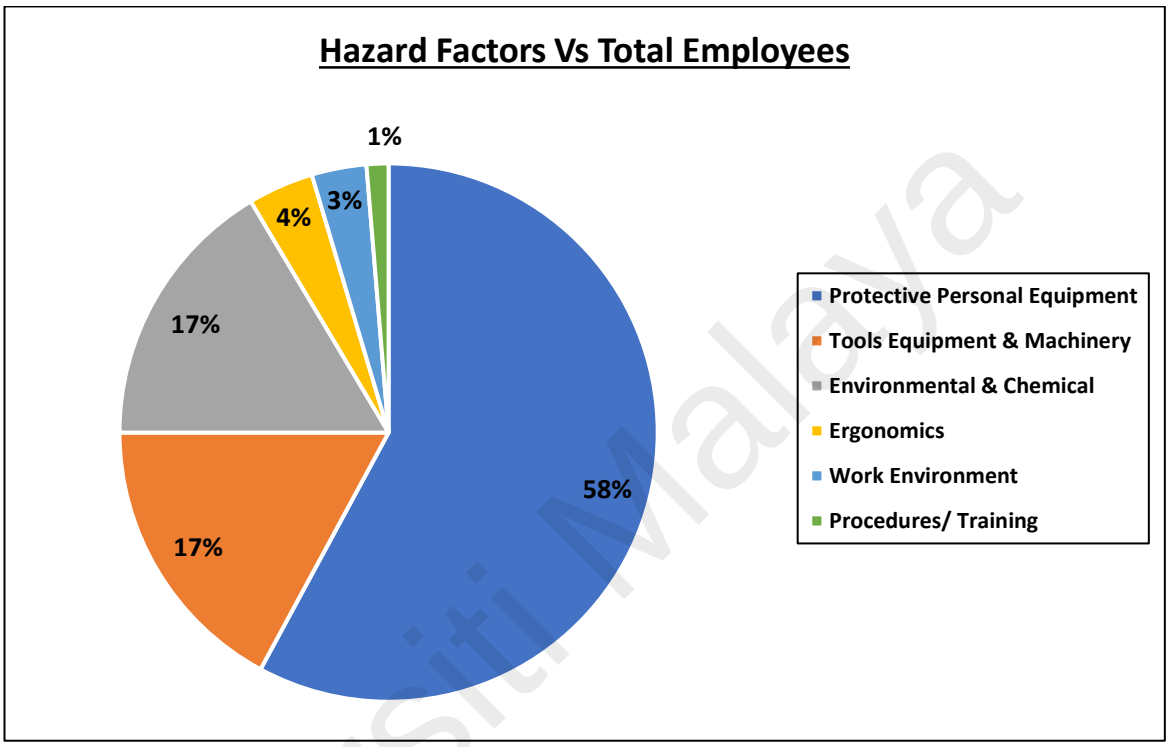


4.7 Summary of Hazard Factors

Based on the pilot test conducted, identified that protective personal equipment (PPE) is has the highest observed hazard factor about 58% among others. PPE is the main

tool of protection besides theoretical support and trainings. Tools equipment & machinery and environmental & chemical has the same percentage about 17% followed by ergonomics with 4%, work environment with 3% and procedures/training with 1%.

Pie Chart 4.2: Hazard Factors Vs Total Employees



According to the data collected, it is very obvious that the safety practice in this selected rubber manufacturing factory has poor concern on the PPE hazard and followed by others. Tools equipment & machinery is one of the hazard factors which frequently recorded in all manufacturing companies due to be job nature. This why because moving machineries and manual handling of tools equipment's are unreliable where humans have to control on the usage where it involves safety behavior. As for environmental & chemicals is deeply focus on the area to reduce hazards and risk of the danger of a particular circumstance. Referring to this study location, this environmental hazard falls under chemicals, wastes disposal and water treatment divisions. These divisions are mainly handled by compounding and Industrial Effluent Treatment System (IETS) team. To make it simple, its organizations responsibility to keep the working environment and

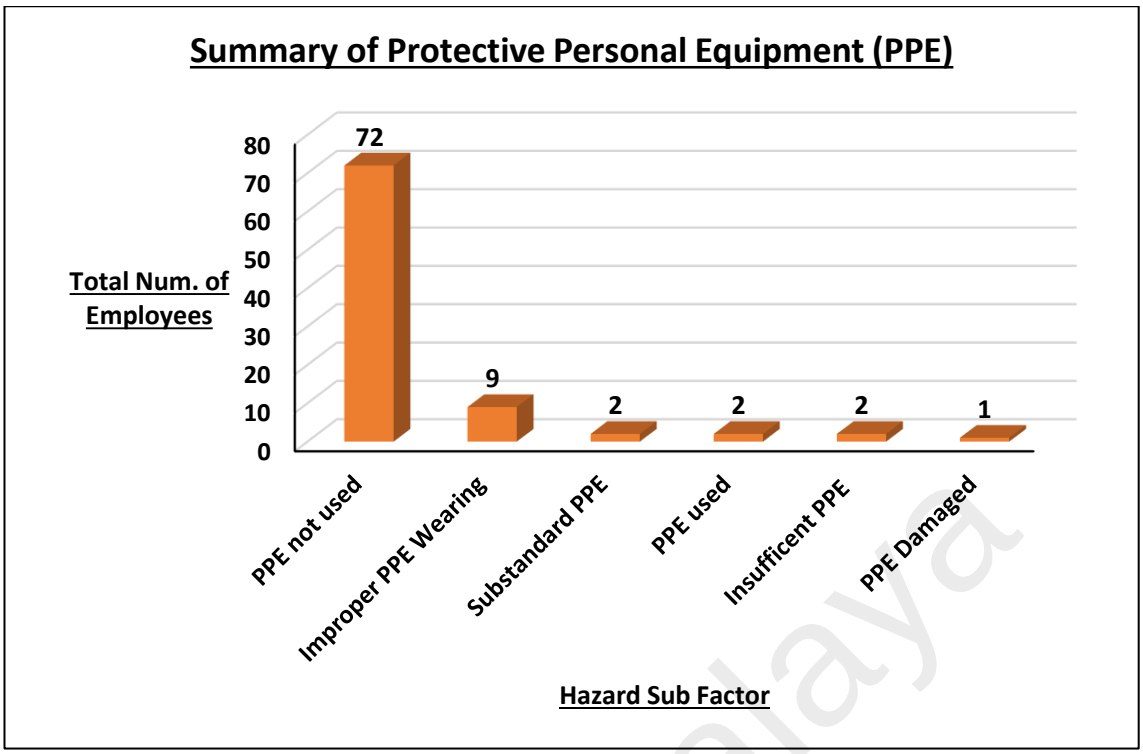
circumstances safe in terms of discharging liquids, procedures on handling chemicals and wastes disposal. In order to that, management and safety committee enforced all the employees to adhere to the OSH policy which will be reviewed yearly.

Procedures and training are a must for all the organization to follow, example every job scope should have work instructions and proper training to be given to all the new joiners. Procedures and training play a vital role in reducing or maintaining incidents from occurring. This is why because accidents or incidents happens when a particular job is not completed based on the actual procedure where high possibilities of faulty takes place.

Referring to the observation collected, PPE stands as high potential BBS factor that may cause accidents in this rubber manufacturing industry. Adding on, based on the observation made on employees found that the awareness of safety when performing jobs are very poor. Employees feedback on the PPE concern was not satisfying when verbal conversation held with them. In order to complete a job within a time frame given by their supervisors, they chose comfortability and fast work where negligence occurs create chaos for the surrounding. For an example, working at high noise area causes ear damage and to prevent those earmuffs and earplug were provided to the employees. Employee's chose to stay comfortable without wearing it as they mentioned that earmuffs are heavy headed. Earmuffs are slotted onto safety helmet where the head needs to support both PPE at once. In search of comfortability, they are making mistakes from not wearing proper PPE during a job completion. Examples of PPE unsafe acts are failure to wear safety helmet, earplugs, harness, anti-cut gloves, arm sleeves, safety shoes and etc.

4.7.1 Findings on Protective Personal Equipment (PPE)

Graph 4.4: Summary of Protective Personal Equipment's (PPE)



As discussed in 4.7, under PPE hazard factor there are 6 sub factors that influences the number of hazard risk which is 88 (58%). About 72 (88%) from the total number of PPE factor falls covers for PPE not used sub factor. This clearly shows the safety behavior of employees at this rubber manufacturing company. Based on verbal conservation during observation, workers aware of PPE importance, however majority from the few fails to show priority to the usage. As mentioned earlier, the most act that found in this observation was failure of wearing safety helmet, earmuffs and anti-cut gloves. These failures mostly take place at production line with the presence of possible hazards. In this company, all the employees are advised to equip themselves with proper PPE before entering factory. At production line, job such as changing beading carpets are required to wear anti-cut gloves as the beading holder has sharp edges. Sometimes its fair enough to accept that wearing anti-cut gloves while working will provide less grip on manual handling, at the same time without PPE for the sake of proper grip accidents might happened by losing the grip and slipped.

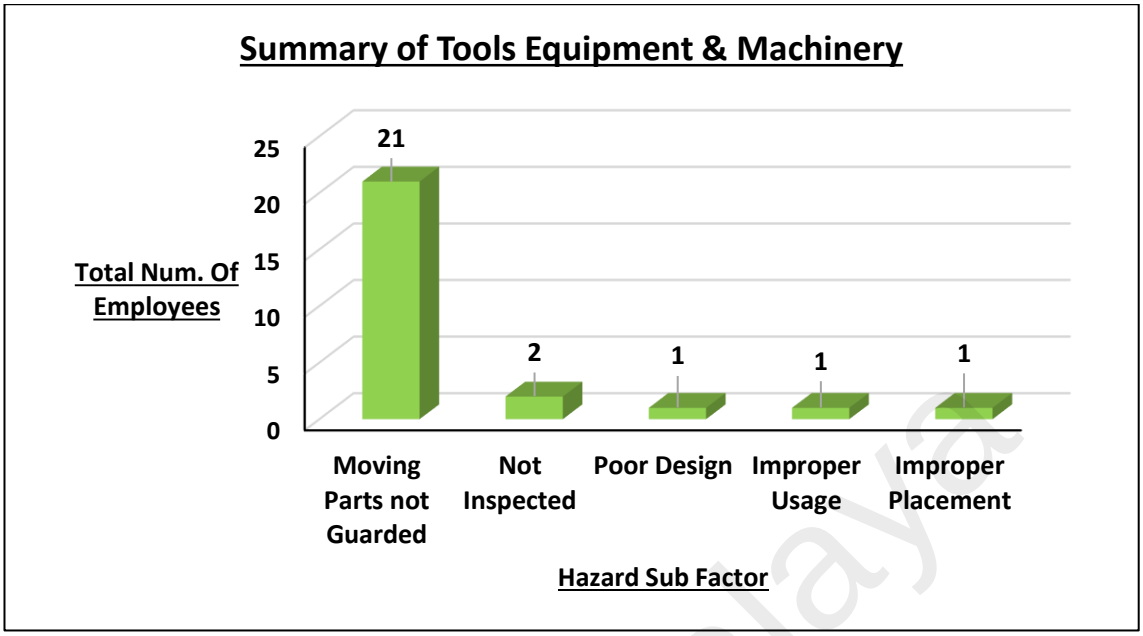
Improper PPE wearing was recorded as second highest about 9 (10%) and followed by other hazard sub factors. Based on observation, identified failure of wearing safety helmet strap, unfamiliar on wearing respirator and safety glasses. It is quite seldom workers get caught of not wearing chin strap but team leads and supervisors train their subordinates on this careless behavior. Besides that, new joiners are required to be trained on the usage of PPE's. As a new join worker, all the workers should go through all the necessary trainings. During the observation, found a worker placed safety glass on their forehead instead of placing on eye position. So, this was recorded in the observation.

Safety committees are not just responsible for driving a successful BBS, top management must also play a key role in achieving the goal and in providing relevant action plans with the support of management. Safety committees should come out with demerit point systems for the failure of meeting safety compliance in factory. For example, to set scale or matrix for the demerit guide, where safety officers demerit points based on the severity category. Besides that, safety committees to share and distribute organizations OSH policy around the factory area and to set up morning assembly every day in the morning before starting the day. Supervisors or team leads are responsible to educate their subordinates on the importance of safety procedures and practice of an organization. These recommended action plans have to be taken immediately in order to see a good progress when a proper observation implemented for a long period.

4.7.2 Findings on Tools Equipment & Machinery

Proper tool usage normally can be observed from senior workers as they knew the safety practice on the usage and OSH regulations (Salem et al., 2007). In this hazard factor about 26 (81%) findings were observed of all others. This hazard factor has 5 hazard sub factors where will be discussing on each sub factors.

Graph 4.5: Summary of Tools Equipment & Machinery



Tools equipment & machinery is one of the major uses in a manufacturing industry. As for this study the major use will be under maintenance due to repairing and installation jobs where manual handling takes place a lot. In manufacturing industries, machines are largely occupied and utilized in the sector. As for this study, more findings were recorded under rotating parts where there is no guarding when operating. Uncovered machines strike and damage people. Between rollers, belts, and pulley motors, body parts can be dragged in or trapped. This is an unsafe condition where safety officers and maintenance team are required to act immediately. To prevent uncovered rotating parts, engineering team are advised to check on machineries design and seek approval from safety committee before commissioning. Inspection on tools equipment & machinery is a must to conduct weekly or biweekly in order to keep monitor on the function and malfunction status. Based on the observation, identified that the inspection has not carried with 2 (8%) findings. Further checked on this and found the tools were belongs to Mechanical & Electrical (M&E) team workshop. Tools and machinery inspection has to be in consistent although the finding isn't much affected the total findings and the observation statistic.

As for other subfactors such as poor design, improper usage & improper placement findings were 1 for each sub factors with 4%. Unsafe condition was observed under this hazard factor where the placement of oxy cutter was wrongly placed on the ground after used. This is an unsafe condition which caused by poor safety behavior of an employee who fail to origin place of the equipment. Oxy cutter is a hot material which releases high temperature flames that can cause deep laceration by misstep while walking around the area. Careless is one of the leading behaviors that causes accidents.

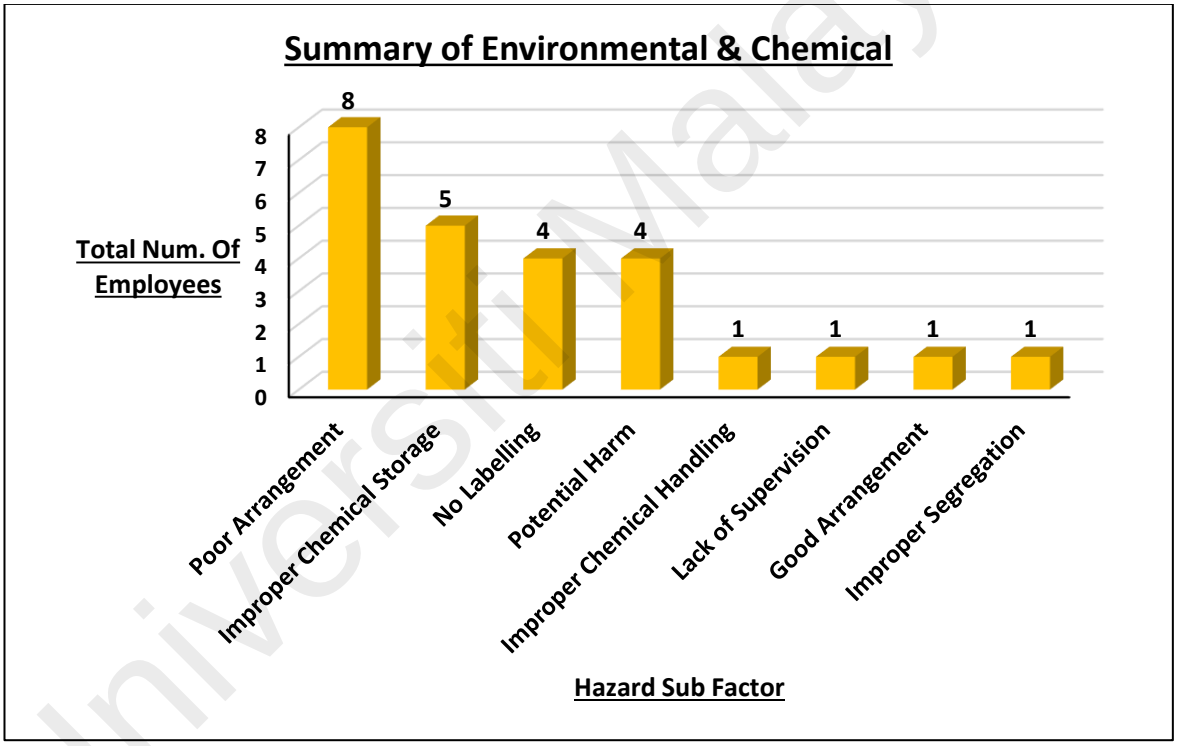
Findings from this hazard factor, has to be discussed further with safety committee of this industry due to the usage frequency under this hazard factor. Machineries and tools are items that will be utilized almost every day in a manufacturing industry. In that case, management responsible to engage with safety committee to conduct frequent spot-checks and inspections have to been done to maintain and provide a safe workplace to the employees.

4.7.3 Findings on Environmental & Chemical

This hazard factor is solely influenced by behavior of an employee who performs job in a manufacturing industry. There are 8 subfactors which will be discussed such as poor arrangement, improper chemical storage, no labelling, potential harm, improper chemical handling, lack of supervision, good arrangement and improper segregation. Poor arrangement was recorded as the highest about 8 (32%) out of 25 findings. In this finding, observed that chemical tote tank end cap was not properly closed after used where this will cause chemical spillage by chance of hitting when it has been placed on the lower level. Besides that, found chemicals were exposed to the sun light, overflow of chemicals and poor waste handling. These subfactors are caused by the irresponsible behavior of workers that leads to mishandling of job.

Improper chemical storage about 5 (20%) findings was found in the warehouse, production and compounding area where the workers store chemicals in a bottle and placed it. Not only that, chemicals were kept together with drinking water bottles at working area without labelling as some chemicals in the bottles are colorless example ethanol. These careless behaviors could lead the workers to mis consume the chemicals accidently. This is one of the sub factor findings that safety committee should take into count to prevent health risk.

Graph 4.6: Summary of Environmental & Chemical



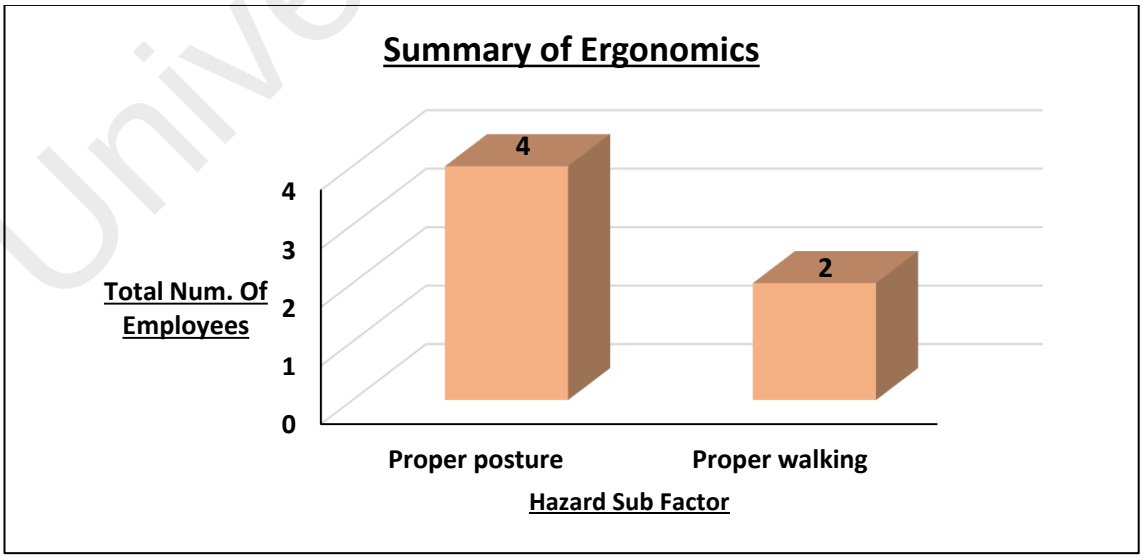
No labelling and potential harm are with same count of 4 (16%) findings at most recorded at production lines. During the observation found unsafe conditions (UC) in the sub factor where no labelling was on water tanks and chemical tanks. As checked with workers, they feedback that the previous label was detached due to poor quality and no replacement were made after detached. And this literally shows that they aren't concern on the safety practice at production line especially when handling chemicals.

As for improper chemical handling, lack of supervision, good arrangement and improper segregation are each with 1 (4%) finding. During observation, found exposed corrosive chemical which is not covered and this mishandling causes chemical hazard that my risk workers health and notified the person in charge to take immediate action to cover the exposure. Besides that, improper segregation of acid and raw material tanks was identified where this could cause high risk hazard. Whereas chemical spill kit was found not in good condition and without checklist. These hazard sources are very important to focus on the action plan and to rectify the non-conformance. In this hazard factor, found one safe act under good arrangement for chemical drum arrangement out of secondary containment.

4.7.4 Findings on Ergonomics

Ergonomics defined as an industrial designed job that fits an employee by assuring the safety & health (Fernandez, 1995). In this study, ergonomics hazard factor is the only factor that has been recorded under safe act category.

Graph 4.7: Summary of Ergonomics



About 4 (67%) out of 6 findings were recorded for proper posture and 2 (33%) findings for proper walking. These observations were collected in the office and factory.

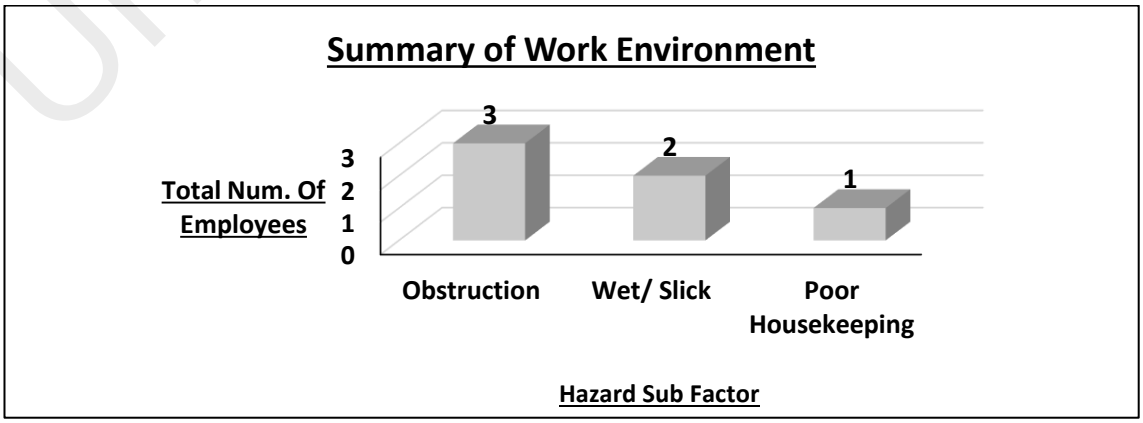
According to the observation, proper posture was recorded packing and documentation department. Documentation department by nature located in office where proper sitting posture was observed and similar to the packing department. While packing the goods, proper sitting posture was observed according to the job comfortability around the packing area.

Besides that, proper walking was observed at the walkway of staircases where staffs and workers uses the aisle of the staircase to walk. There are high possibilities for slip and trip accidents case where without the support of aisle may cause misjudge of steps and cause injuries. As observed findings from factories, workers are also walking with the support of aisle. According to the observation, ergonomics is recorded under safe act where the pilot test indicates a positive result without any negative category. For an organization, to keep maintain the positive record they are required to provide continuous training and monitoring on their daily work routine by their supervisors.

4.7.5 Findings on Work Environment

Based on the data observation, for work environment hazard factors obstruction observed to be the highest with 3 (50%) findings.

Graph 4.8: Summary of Work Environment



All the findings in this hazard factor are under unsafe condition (UC) category. During this observation found fire extinguishers (FE) blocked pedestrian walkway. As checked further, person in charge feedback that the FE were removed and placed at one point which is at pedestrian walkway in a group for service purpose. These finding were immediately rectified, advised the person in charge to remove from the walkway and place it in a proper location.

Besides that, wet/slick and poor housekeeping were recorded about 2 (33%) and 1 (17%) finding. For these findings, found wet floors dripped and leaked from water tanks at factory side area. Not only that, reclaimed rubber stains and pieces were found on the floor at production area. Housekeeping is very important in order to eliminate hazard risk such as slip and trip. It includes keeping work places clean and orderly, removing waste items and other fire dangers from work locations, and keeping halls and flooring free of slip and tripping.

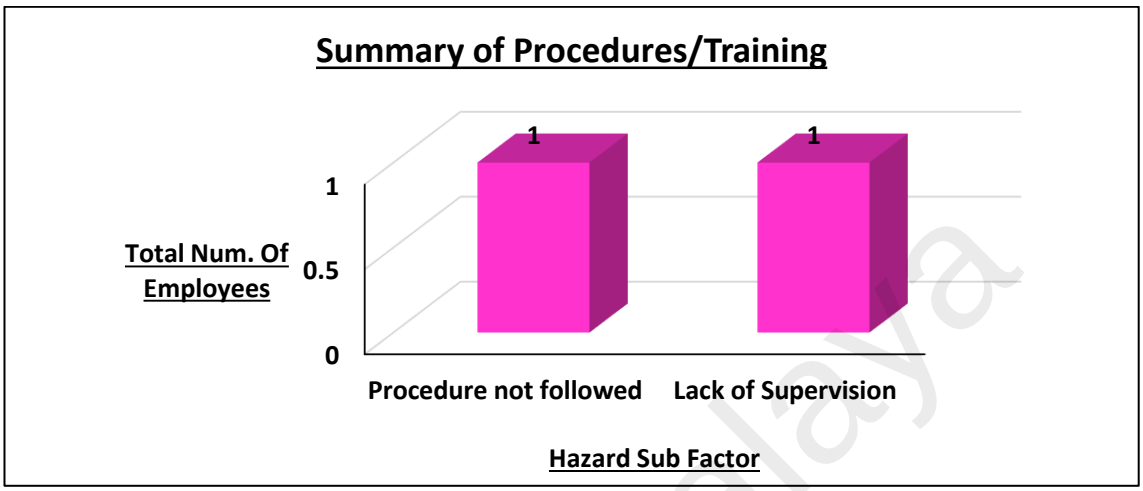
To maintain a good hygiene work environment, behaviors of an employee play a vital role to keep a safe and hazard free workplace. Unhygienic workplace could lead occupational illness as well. Safety committee required to enforce and schedule spot-checks regularly to monitor on the work environment which contributes to a hazard free workplace.

4.7.6 Findings on Procedures/Training

In this hazard factor, procedure not followed and lack of supervision was identified similar with each 1 (50%) finding. Procedures and trainings are very important in an organization to have a safe working environment for employees. Based on the findings, for procedure not followed is when front loader breakdown and the maintenance job was ongoing without signage. This unsafe condition will definitely lead to high-risk

hazard where no signages and Log Out and Tag Out (LOTO) placed during that job. This incident was immediately rectified without any further delay.

Graph 4.9: Summary of Procedures/Training



Employees are trained after they have completed their orientation. Employee training is the process of improving their skills, capabilities, and knowledge in order to do a specific job. Employees' thinking is shaped by the training process, which leads to high-quality performance. Trainings has capability of molding workers from zero knowledge to be knowledgeable when performing jobs. In that case, behaviors of an employee changes due to the responsibility of completing a job with safety compliances. Management to enforce safety trainings for new joiner as mandatory to adhere to company safety policy.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS FOR FUTURE WORK

5.1 Conclusion

This study was mainly focused on the safety behavior of an employee when performing a job. This study was based on pilot study of 3 months. Based on the observations made in a rubber manufacturing factory, it has been identified the high potential hazard that could lead to accidents and was discussed in chapter 4. Personal protective equipment (PPE) has been the most observed hazard factor that highly potential to cause accidents in the rubber manufacturing industry. As an action plan, management responsible for the implementation of an action plan. Highly encouraged to conduct safety trainings and frequent assemblies to highlight the importance of safety practice.

Based on the observations, employee's unsafe act mostly was found on the PPE and unsafe condition on tools equipment & machinery. Furthermore, the act and condition contribute to the hazard risk of mischievous behavior. To seek a good progress in behavior safety, a proper BBS implementation is needed where this study has been made to only identify factors that causes accident and this will require longer time to observe improvements. BBS is based on an observation, where it is similar to trainings but the observation and rectification will be done immediately.

As for the cost-effective solution for the data collected in this study has been proposed to set up a system which can help to record data's and to monitor improvements. Safety committees are encouraged to set up an inhouse system for non-conformance tracking and rectifications. Besides that, to implement demerit system for the workers who has been caught for not following safety policies of the organization. This will keep alert the employees to follow and adhere to the company safety policies. Not only that, buddy system is much required in manufacturing industry in order to perform jobs with

the aid of another employee. This why because manufacturing industries are mostly core jobs in terms of engineering, installations, maintenance and productions.

5.2 Recommendations for Future work

For future studies, research study can be done on developing a BBS predictive analytical dashboard system to predict the future outcome hazards and to work on the possible solutions for the hazards. Predictive analytics help to identify the opportunity in where safety practices can be implemented at the hazard risk area. Besides that, prediction able to reduce accident cases from occurring by recorded historical data's hazard category. Predictive Analytics approaches are employed. It is concerned with data that is both continuous and discontinuous, as well as its changes (Gladshiya, 2019).

This predictive analytical method will help an organization to take action before an incident occurs and this will be part of contribution for the company to increase revenue and controls the finance cost for accidents. The approach of data trend leads to a deeper investigation of a particular part to be focused and concerned.

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