WORKER'S INVOLVEMENT, SAFETY COMMUNICATION AND SAFETY TRAINING TOWARDS SAFETY COMPLIANCE AMONG EMPLOYEES IN MANUFACTURING INDUSTRY

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Abstract

The research investigates how worker participation alongside safety messaging and training affects adherence to safety protocols in Malaysia's manufacturing industry. Although the safety guidelines of OSHA 1994 exist, workplace accidents continue to occur widely especially in Penang. The research findings focus on enhancing safety practices within manufacturing establishments and reducing injury rates while promoting both safety and productivity. This study have incorporated a cross-sectional approach, gathering data from 290 workers in Pulau Pinang through structured questionnaires and a simple random sampling technique. Data analysis using SPSS included descriptive statistics, correlation, and multiple regression analysis, aiming to identify factors influencing safety compliance and improve safety practices in manufacturing. The study results assessing workplace safety compliance including the descriptive statistics show moderate safety training levels alongside strong correlations between safety communication and worker involvement with safety compliance. According to regression analysis results safety communication ($\beta = 0.495$) and worker involvement ($\beta = 0.322$) positively influence safety compliance while safety training ($\beta = 0.086$) shows a weaker and insignificantly affects compliance. The study results show that good safety communication and worker involvement are crucial for improving workplace safety.

Keywords: Workers Involvement, Safety Communication, Safety Training, Safety Compliance, Employees, Manufacturing Industry

Abstrak

Kajian ini menyiasat bagaimana penyertaan pekerja di samping komunikasi dan latihan keselamatan mempengaruhi pematuhan kepada protokol keselamatan dalam industri pembuatan Malaysia. Walaupun garis panduan keselamatan OSHA 1994 telah wujud, kemalangan di tempat kerja terus berlaku secara meluas terutamanya di Pulau Pinang. Penemuan penyelidikan memberi tumpuan kepada meningkatkan amalan keselamatan dalam industri pembuatan dan mengurangkan kadar kecederaan sambil menggalakkan kedua-dua keselamatan dan produktiviti. Kajian ini telah menggabungkan pendekatan keratan rentas, mengumpul data daripada 290 pekerja di Pulau Pinang melalui soal selidik berstruktur dan teknik persampelan rawak yang mudah. Analisis data menggunakan SPSS termasuk statistik deskriptif, korelasi dan analisis regresi berbilang, bertujuan untuk mengenal pasti faktor yang mempengaruhi pematuhan keselamatan dan meningkatkan amalan keselamatan dalam industri pembuatan. Hasil kajian yang menilai pematuhan keselamatan tempat kerja termasuk statistik deskriptif menunjukkan tahap latihan keselamatan sederhana di samping korelasi yang kuat antara komunikasi keselamatan dan penglibatan pekerja dengan pematuhan keselamatan. Menurut keputusan analisis regresi, komunikasi keselamatan ($\beta = 0.495$) dan penglibatan pekerja ($\beta = 0.322$) mempengaruhi pematuhan keselamatan secara positif manakala latihan keselamatan ($\beta = 0.086$) memberi kesan negatif kepada pematuhan. Hasil kajian menunjukkan bahawa komunikasi keselamatan yang baik dan penglibatan pekerja adalah penting untuk meningkatkan keselamatan tempat kerja.

Kata kunci: Penglibatan Pekerja, Komunikasi Keselamatan, Latihan Keselamatan, Pematuhan Keselamatan, Pekerja, Industri Pembuatan

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List of Abbreviations

WHO	World Health Organization
ILO	International Labour Organization
OSHA	Occupational Safety and Health Administration
DOSH	Department of Occupational Safety and Health
NPD	Non Permanent Disability
PD	Permanent Disability
SME	Small and Medium Sized Enterprise
PPE	Personal Protection Equipment
SCT	Social Cognitive Theory
SMT	Surface Mount Technology
SPSS	Statistical Package for Social Science
ANOVA	Analysis of Variance
SOP	Standard Operating Procedures

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Safety compliance plays a major role in the organisational performance of every organisation especially in the manufacturing industry. It is important to follow safety regulations to avoid accidents, maintain employee health and keep employees productive. Mujtaba and Kaifi (2023) study shows that failure to adhere to the safety guidelines can be fatal, resulting in workplace injuries, deaths and production stoppages. Millions of work-related injuries occur each year, the World Health Organization (WHO) reports, and manufacturing industries are among the most accident-prone. In 2021, for example, the International Labour Organization (ILO) estimates more than 2.3 million deaths at work in the world, most of them from unhealthy work environments or violation of Occupational Safety and Health Administration, OSHA (International Labour Organization, 2021).

As stated by Birhan and Endawoke (2023), OSH compliance directly affects the performance of the company through accidents and downtime, and ultimately increases productivity and profit. Compliance with safety protocols is legal, but it is also a business's responsibility to employees. In fact, studies by Salguero-Caparrós et al. (2020) demonstrate that organisations that follow proper safety compliance have more employees and work more efficiently.

It has been identified that several factors are contributing to safety compliance which is an important indicator of compliance with work-related safety measures such as worker involvement, safety communication, and safety training. Study done by Dyreborg et al. (2022) have demonstrated that implementing safety compliance

decreases accidents at the workplace, increases productivity, and protects employees' health. However Hemon-Hildgen et al. (2020) also have mentioned that maintaining a steady compliance is difficult to achieve in dynamic work cultures such as manufacturing, where hazards of operations abound.

Workplace safety is becoming a hot topic in Malaysia, especially the manufacturing industry, which causes most of the workplace injuries. In 2022, there were more than 30,000 workplace accidents reported in Malaysia by the Department of Occupational Safety and Health (DOSH), most of them in manufacturing facilities (Departmental of Occupational Safety and Health, 2022). Report shows manufacturing accidents having the most, which caused nearly 4,181 total cases from January 2023 to October 2023 in Malaysia (Zermane et al. 2023).

Malaysia has taken steps to meet these problems by enforcing safety laws such as the Occupational Safety and Health Act (OSHA) 1994 which requires employers to train workers, distribute proper safety information and engage employees in safety programs. Yet despite these efforts, compliance is uneven from industry to industry especially in Small and Medium Sized Enterprises, SMEs. The need for a holistic approach, in terms of safety training, communication and worker involvement to ensure a safer work environment, should be more focused in Malaysia's manufacturing industry.

There are various factors that could influence the employees' safety compliance such as worker's involvement, safety communication and safety training. Aderamo et al. (2024) have stated that workers involvement refers to employees being actively engaged in safety functions, such as reporting hazards and deciding on safety procedures. Workers involvement builds a safety culture in which people take

ownership of both their own and others' safety. Brauer (2022) also opined that when it comes to the manufacturing industry that might mean having safety meetings, knowing the hazards, or attending safety training. Worker involvement helps management and employees to communicate better so safety issues are addressed efficiently and promptly. The beneficial effects of worker engagement on safety behaviour are confirmed by research conducted in recent years. Zakaria et al. (2020) emphasising the direct relationship between worker participation and safety results in Malaysia's manufacturing sector.

Apart from that, safety communication also can influence safety compliance. Safety communication means sharing safety information transparently, regularly, and effectively between employer and worker (Haas & Yorio, 2022). Safety communication involves how effectively and frequently safety information is communicated between workers, supervisors, and managers (Naji et al. 2022). Naevestad et al. (2020) also have mentioned that by communicating well, it can help employees know the safety procedure, what is risky, and the significance of following safety rules. It has been determined that safety compliance needs a good communication mechanism. When manufacturing firms had effective safety communication channels, their compliance with safety standards increased by 30 percent (Zara et al. 2023). This allows workers to be the ones responsible for their own and their fellow's safety, making accidents less likely. Zara et al. (2023) mentioned that companies that communicate openly and honestly about safety performance tend to have high levels of safety compliance and low accidents.

Moreover, safety training is one important aspect relating to safety compliance. Safety training is systematic activities that are intended to provide workers with the knowledge and abilities to operate safely. Safety training of workplace safety where employees know and have the skills to work safely. In manufacturing, when people are running machines, handling dangerous products and doing physically demanding work, they need training to avoid injuries and comply with safety rules (Duarte et al. 2021). Safety courses often teach about hazard identification, emergency response, and use of safety equipment. Research has repeatedly confirmed that safety training helps to promote safety compliance. Research by Madsen et al. (2022) found manufacturing companies with formal safety training were 40 percent less likely to be involved in an accident than those that did not.

In summary, this research seeks to investigate the significant influence between worker's involvement, safety communication, safety training and safety compliance among employees in the manufacturing industry.

1.2 Problem Statement

Accident rates in manufacturing have always been an issue, especially in Penang, an industrial and manufacturing hub in Malaysia. The Office of Occupational Safety and Health (DOSH) report has highlighted that Penang recorded 723 occupational injuries, with 695 non-permanent disability (NPD), 15 permanent disability (PD), and 13 fatalities (Departmental of Occupational Safety and Health, 2022). All these numbers demonstrate the critical importance of workplace safety in Penang's manufacturing sector. The high accident rate is closely tied to the concentration of manufacturing factories in Penang. Penang is one of the most industrialised in Malaysia, with several manufacturing units playing an important role in the economy

of the country. Manufacturing in Penang consists of a large variety of businesses such as electronics, machinery, and food processing which employ thousands of workers.

Up to date, there are more than 3000 manufacturing companies and SMEs based in Penang (SEMI, n.d). These figures speak to the importance of safety management in Penang's manufacturing industry. High accident rates and high density of manufacturing activities result in a compelling need to explore how worker involvement, safety communication, and safety training can be tailored to minimize exposures and improve overall workplace safety outcomes. This following research is necessary because it is seeking to examine these variables to improve safety compliance in Penang's manufacturing sector.

Subsequently, there is evidence that a gap exists in the relationship between safety training and safety compliance. Safety compliance in the workplace is a top priority for manufacturers, but studies that investigate the effect of safety training are a mixed bag, suggesting a lack of evidence that needs to be examined. While some, including Dyreborg et al. (2022), claim that safety training effectively prevents workplace injuries through increased compliance with safety rules, others such as Dugolli (2021) argue that training is insufficient to make compliance work in some industrial environments. This discrepancy indicates an understanding deficiency as to whether safety training is sufficient on its own or whether worker involvement or safety communication is more important. It is also important to note the lack of studies focused on the Malaysian manufacturing sector, given its varying organisational size and structure, to find out the impact of safety training on safety compliance in this context.

Methodological gap is another issue in investigating safety communication and safety compliance. Teske and Adjekum (2022), for example, used an online convenience sampling technique with large numbers of sample size and found a strong correlation between safety communication and compliance. In contrast, Mohamed et al. (2021), via anonymous postal surveys, found no such connection between the variables. Such differences give pause for doubts regarding the validity of findings from disparate sampling, sample sizes and data collection procedures. This would require future studies to be more rigorous and use different sampling technique such as stratified random sampling to provide results with strong statistical inferences to highlight these methodological gaps.

Moreover, worker involvement and safety compliance are not uniform across different industry scenarios. Tompa et al. (2021) showed that high employee engagement reduced workplace injuries by 80 percent in European factories. Yet Zulkifly (2020) reported a moderate relationship between worker participation and safety compliance in Malaysian manufacturing. All of these results call for more research on the Malaysian manufacturing context that drives this correlation. The question of how to improve worker engagement in this very context might hold important lessons and bridge this contextual divide. This study fills these voids by exploring the effect of worker's involvement, safety communication, and safety training on worker safety compliance in Malaysian manufacturing industries. With a robust sampling strategy and the local focus, this research provided an overall picture of what motivates safety compliance and helps improve safety practices in the industry.

1.3 Research Questions

1. Does worker's involvement significantly influence safety compliance?
2. Does safety communication significantly influence safety compliance?
3. Does safety training significantly influence safety compliance?

1.4 Research Objectives

1. To investigate whether worker involvement can significantly influence safety compliance.
2. To investigate whether safety communication can significantly influence safety compliance.
3. To investigate whether safety training can significantly influence safety compliance.

1.5 Significance of the Study

1.5.1 Practical Contribution

This research's direct application is that it could contribute to better safety implementation within the manufacturing sector in Malaysia. By studying how worker engagement, safety messaging, and safety training impacts employee compliance, the study gives organisations concrete tips on how to improve their safety operations. Businesses can use the data to create better safety plans, improve communications, and get more employees to be more involved in safety-related decisions. It means that there will be fewer workplace injuries, fewer operations interruptions, and eventually more productivity and profit.

1.5.2 Empirical Contribution

Empirically, this paper addresses a literature gap by offering newly collected information on the association between safety compliance and the major factors like worker participation and communication within the Malaysian manufacturing sector. While previous research has considered these considerations individually, this study adds to the literature by summarising and refining them, and provides a more detailed picture of how multiple variables combine to influence safety compliance in the real world.

1.5.3 Theoretical Contribution

This research also adds to the theory of safety compliance by building on and refining previous safety management models like Social Cognitive Theory. This theory is with the ideas of worker involvement, safety training, and safety communication gives us a new window into how these factors can be combined to create a safer workplace and makes them more relevant to our workday practice in safety management today.

1.6 Scope of the Study

The purpose of this research is to explore the connection between the following aspects like worker involvement, safety communication, safety training and safety compliance with OSH standards in the manufacturing sector. The key goal is to examine how each of these variables plays a role in compliance with safety standards that directly influences accidents at work and operating costs. Workers involvement, safety communication, and safety training are selected as independent variables since they have studied the effects of these variables in other studies to find evidence that it plays a significant role in compliance but have less investigated in previous research to

identify its impact in the Malaysian manufacturing industry. Safety compliance was the dependent variable of this study since it is the crucial factor to keep the workplace safe and make the workplace safe

The researchers have applied a simple random sampling process to ensure representativeness across the selected manufacturing company in Penang. The data collection process included the provision of formal questionnaires to assess worker involvement, safety communication, safety training and safety compliance. The research results are slated to be widely used in practice, and provide information to manufacturing firms to enhance their safety procedures. It has also strengthened the scholarly literature on industrial safety compliance and provided recommendations to policymakers and companies on how to better ensure safety.

1.7 Definition of Key Terms

Safety Compliance: Safety compliance refers to safety standards, regulations, protocols and rules that have been developed by organisations and regulators to create a safe workplace (Umeokafor et al. 2022). Employees follow safety measures and rules to avoid injuries and accidents at work.

Worker's Involvement: Worker's involvement refers to worker's involvement in the organisation with regard to safety-related decision-making, procedures, and duties (Olokede & Ukpere, 2023).

Safety communication*:* Safety communication refers to the processes through which organizations ensure the exchange of information related to safety, including reporting hazards, sharing safety-related knowledge, providing feedback, and ensuring open

channels of communication between employees and management to improve workplace safety. (Vinodkumar & Bassi, 2010).

Safety Training: Safety training refers to the organized efforts by an organization to enhance employees' knowledge, skills, and awareness of workplace safety. It includes formal and informal training programs aimed at equipping workers to identify, manage, and respond effectively to workplace hazards, thereby reducing accidents and improving safety behavior (Vinodkumar & Bassi, 2010).

1.8 The Organisation of the Study

The study consists of five chapters. Chapter 1 provides the background, purpose, importance and scope of the study. It creates the primary key words and the independent and dependent variables. Chapter 2 is an extensive literature review of studies on safety compliance, employee engagement, safety communication and safety training to identify discrepancies and theoretical frameworks. Chapter 3 discusses the research design, data collection, sampling, and analysis. The fourth chapter has provided the quantitative data and also illustrated the findings along with the brief discussion. Furthermore the chapter 5 has concluded the research while provide a brief recommendations and future options for this study to continue.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter 2 reviews the literature on manufacturing safety compliance, considering three independent factors which are worker's involvement, safety communication and safety training. It provides definitions, relevance, and research findings of these variables and their correlation with safety compliance. The chapter also reviews the main theory which is Social Cognitive Theory as a theoretical framework for the study. By integrating recent research (2019-2024), the chapter outlines what is not yet being studied and opens the way to future exploration of the drivers of safety compliance.

2.2 Safety Compliance

Safety compliance is defined as employees and organisations following occupational health and safety Occupational Safety and Health (OSH) rules, practices and protocols designed to reduce the risks of accidents, injuries, and health risks on the jobsite (Cheng et al. 2022). As per the study by Andersen et al. (2019) further emphasises that, it is the sum of both individual steps, like safety measures and wearable protection, and collective steps, like training and risk assessments. Safe practices ensure workplace accidents and better worker health for a safer, more productive workplace.

Global studies highlight safety compliance as the key to workplace prevention injuries. A paper by Ajmal et al. (2022) reported that safety compliance is positively associated with reduced injury when the construction workers do their best to obey safety rules. While, Nævestad et al. (2021) noted that companies that have high safe

compliance had fewer accident incidents and more safety culture. As these studies suggest, safety compliance is an integral aspect of workplace safety in all business sectors and requires a robust safety program and leadership.

Safety compliance is another major concern in manufacturing companies in Malaysia, even though OSH regulations have always been enforced by the government. Study by Tang (2020) found safety compliance in Malaysian factories was uneven, and employees did not strictly follow safety policies. This report listed poor safety training and communications as a major reason for this non-compliance. In another paper by Ibrahim et al. (2022) noted that safety compliance could be improved by more worker participation and safety communication and the solution must be a multi-disciplinary one.

In line with international research that shows safety compliance to be an important driver of workplace safety, the findings from Malaysia reveals that poor compliance due to factors such as lack of safety training, poor communication, and worker participation. All these data points show that Malaysian manufacturing could benefit from a holistic safety compliance management program including the training, communication, and employee participation in safety decision-making.

2.3 Worker's Involvement

The study by Aderamo et al. (2024) shows that worker's involvement can be in the form of participation in safety procedures, attendance on safety committees, or active involvement in hazard identification and risk assessments. Ajmal et al. (2022) study said more employee involvement creates more responsibility and ownership, which can promote safety compliance.

Workers are repeatedly shown to have beneficial effects on safety practiced at the workplace. An article by Govaerts et al. (2021) in the European manufacturing industry revealed that companies where workers were involved in safety decisions had fewer workplace injuries. This was especially true in workplaces where workers actively participated in risk identification and management. In a study byNewman-Toker et al. (2024) in the United State, participants in safety committees reported unsafe conditions increased and injury rates decreased. From these researches it appears that workers will more often abide by safety regulations and take preventative measures to minimise risks if they see themselves as participating in the process.

Worker's participation in safety management has been an increasing concern in Malaysia especially in manufacturing industries. Zulkifly et al. (2021) discovered that Malaysian manufacturing enterprises who had employees present at safety meetings and decisions made more safe workers. However, there is still plenty of businesses who are not fully getting their people involved in safety initiatives. Research by Saleem et al. (2022) reported that worker engagement positively influenced safety compliance but the absence of formal safety programmes and management involvement in some companies limited the impact of such engagement.

The international and national research reveals one constant notion where worker participation is key to safety compliance. The findings from Europe and the US are obvious but in Malaysia worker engagement is positive. What this means is that for Malaysia's manufacturing industry to have a greater safety compliance it needs to work on increased engagement through formal safety programmes and leadership.

2.3.1 The relationship between Worker's Involvement and Safety Compliance

The connection between worker involvement and safety compliance has been studied extensively and the finding is that higher levels of worker involvement in safety-related tasks increase safety compliance (Yang et al. 2021). Recent report by Ajmal et al. (2022) reported that workers had a much better likelihood of complying with safety policies if they participated more heavily in safety committees and decision-making processes. Workers who were involved in hazard detection, risk assessment and training learned more safety practices and fewer accidents occurred. This result is in line with participatory safety management where employees play a central role in safety activities.

In a similar way, research by Osei-Asibey (2021) conducted in the construction sector reported that worker participation in safety planning and decision-making promoted safety behaviour and compliance. They showed that when employees were invited to participate in safety meetings, they were more informed about risks and more likely to abide by safety protocols. This result confirms the hypothesis that participation in safety management practices increases employees' safety responsibilities.

However, a more recent Malaysian paper by Saleem (2022) retested the value of worker participation. They found that when workplaces were engaged in safety measures, compliance was improved substantially by firms that clearly communicated and were supported by management. So, developing a co-opting model where worker participation is combined with employer commitment is essential to improving workplace safety compliance.

The connection between worker involvement and safety compliance has been studied extensively and the finding is that higher levels of worker involvement in safety-related tasks increase safety compliance (Yang et al. 2021). Recent report by Ajmal et al. (2022) reported that workers had a much better likelihood of complying with safety policies if they participated more heavily in safety committees and decision-making processes. Workers who were involved in hazard detection, risk assessment and training learned more safety practices and fewer accidents occurred. This result is in line with participatory safety management where employees play a central role in safety activities.

Strid et al. (2021) study shows participation of employees in recognising and implementing safety practices can reduce the chances of workplace incidents. involvement of workers plays a crucial role in fostering safety compliance particularly in the manufacturing sector. employees can develop a sense of ownership while they are engaged in a safety related decision making procedure. However, it has been recognised that lack of involvement of workers often leads to poor safety regulations, since employees feel disconnected with the workplace.

Besides that, there is no perfect positive correlation between worker participation and safety behaviour specifically on the compliance toward the safety rule and procedur. Zulkifly (2021) reported that in Malaysia's manufacturing industry found less connection between worker engagement and safety compliance. The employees participated in safety programmes and meetings, but did not fully comply, mainly due to poor communication, lack of management support and safety training. That is because besides employee engagement, there are other factors that contribute to safety compliance in the workplace.

2.4 Safety Communication

Safety communication is the communication of workplace safety information between employees and managers, as well as the communication of safety performance and safety practices to workers (Djaelani et al. 2021). Safety communications must be straightforward, consistent, and unambiguous about safety processes, hazards, and risks. Orikpete and Ewim (2024) says that safety communication give employees direction and feedback on how they can be safer, which promotes a culture of employees who are themselves responsible for being safe.

Dyreborg et al. (2022) reported that companies with more extensive safety communication had fewer workplace injuries. The workers were more likely to be alert of safety hazards and had any unsafe practices reported to the management as soon as possible. Hence, it can be summarized that communicaton on safety is not always one-way, workers should be encourage to join and participate to continue improving safety at the workplace.

Safety communication has been recognised equally in Malaysia. In a paper by Mashi et al. (2020) that was done with the Malaysian manufacturing industry and found that safety communication was associated with better safety performance especially on the workers' compliance with the safety rule and regulation. Bello et al. (2024) have explained that the majority of manufacturing companies in Malaysia lacked clear safety communication avenues leading to misperceptions or unresolved safety issues early on. Employees in these companies also said they did not feel involved in safety processes because of the lack of feedback.

Moreover, Yap et al. (2024) concluded that safety communication in Malaysia can be better implemented using the advanced communication tools and platforms for

real-time feedback. They hypothesised that both increasing the quality and frequency of safety communication could help increase employee participation in safety initiatives and workplace accidents. The research from both the global and regional perspective all focus on safety communications to promote safety standards. It can be said that timely communication are the main drivers of safety behaviour through the OSH compliance.

2.4.1 The relationship between Safety Communication and Safety Compliance

Safety communication has been consistently found to be well-correlated with safety compliance in the global studies. Research by Cowley et al. (2021) in the oil and gas industry discovered that, when paired with timely safety communication, it helped workers adhere to safety measures much more consistently. The study concluded that if workers got regular and explicit safety messages, they were more likely to work safely. As replicated by Renn (2020), in manufacturing industry safety communication increases awareness of hazards and risks and in turn increases safety compliance.

Research around the world shows that effective safety communication drives safety compliance. Another paper by Quaigrain et al. (2024) discovered that safety messaging was the main factor behind better compliance involving employees working in the oil and gas industry. It also found that employees who received frequent, clear and positive reinforcement for their safety actions were more likely to adhere to safety policies (Hu et al. 2021). They also found that frequent safety communications resulted in the immediate prevention of accidents.

Furthermore, Shaikh et al. (2021) study shows that the correct input received on safety communication is directly helping the workers adhere to safety rules. The workers who received corrective feedback for unsafe behaviours and positive

reinforcement for safe behaviours, the researchers reported, tended to modify their behaviour to conform to safety protocols. These results indicate that safety communication does not just inform workers, but also recommits workers to safety rules through feedback loops. On the other hand, Hamim et al. (2021) reported on a case study in transportation where safety communication was vital. When they analysed the worksite, they found that workers received no timely or explicit assurances of safety communication through the safety compliance even when they had high levels of safety communication. Safety compliance was lower than anticipated as a result, particularly in those companies where the communication was too technical for workers to understand.

Research by Mercader et al. (2021) indicates that communication and compliance are beneficial factors. However, other studies have found a lack of effective communication, suggesting that improved communication tools could help address these shortcomings. These results suggest that even though safety communication and compliance are in common understanding, communications strategies can be difficult to fully leverage, particularly for industries with complexities in safety.

Both international and Malaysian studies show that safety communication are excellent indicators of safety compliance. However, whether these are effective or not hinges both on how frequently and clearly communication happens and how promptly, precisely and effectively feedback is provided. All this research points to safety communication as being essential for safety compliance.

2.5 Safety Training

Safety training includes the courses offered that train workers in the knowledge and skills to identify, analyse and prevent hazards on the job (Casey et al. 2021). It includes safety training, proper use of PPE, emergency response and regulation compliance. Safety education must ensure that workers are aware of the dangers of their job and can act to avoid accidents and harm. It is an essential part of safety culture in an organisation and an antidote to workplace injuries. In Malaysia, for instance, there is a requirement for worker safety training in highly hazardous fields (Musarat et al. 2022). However, such programs are in different degrees effective and it has to be constantly improved so training stays up-to-date, current and interesting. The evidence now appears to show that hands-on, interactive modules combined with frequent refresher courses make for more long-term compliance in safety training programmes (Casey et al. 2021).

Safety training is the formal way of training employees on hazards, safety protocols, and controls for the purpose of reducing risks and improving workplace safety. Gajek et al. (2022) states that teaching workers knowledge and skills so that they know what risks are, how to operate equipment safely, and how to comply with safety standards. According to Md Yusop et al. (2024), safety training consists of initial training for new hires as well as periodic refresher training for staff that are in a current position of safety awareness. Safety training plays an important role in reducing accidents, injuries, and deaths in the workplace. Tappura et al. (2022) also have mentioned that effective training initiatives raise employee morale, productivity, and create a strong safety culture within the organization. Furthermore, qualified staff can more quickly respond to emergencies, and so everybody is safer at work. The long-term

rewards for companies that invest in safety training include reduced operating expenses through fewer claims, improved morale, and legal compliance.

Safety training is compulsory in Malaysia under the Occupational Safety and Health Act (OSHA) 1994. Section 15 of OSHA 1994 makes it the employer's obligation to ensure the safety, health and welfare of workers through training, education, and management (Reid, 2022). Companies in high-risk fields, like manufacturing, invest heavily in the creation of comprehensive safety training. These include in-house training, workshops, and mock emergency drills that reflect management's ongoing effort to meet OSHA and worker safety standards. It is a proactive way of ensuring the rules are followed and a culture of safety.

Training is fundamental to promoting safety as safety training can improve safety outcomes overseas while the Malaysian studies confirm the same in domestic industry. However, lack of resources and inconsistency around how training is delivered are major hindrances to achieving the highest levels of safety compliance. These results indicate that, although safety training is an important component to achieving better safety compliance, it is only effective if it is delivered consistently, with enough resources and continued contact with workers.

2.5.1 The relationship between Safety Training and Safety Compliance

The importance of safety training in workplace safety has long been known. Many researches over the past five years have explored this connection, most of which have found that safety training does indeed have a substantial positive outcome on safety compliance.

A study on manufacturing in which they found a strong association between safety training and safety performance (Zulkifly et al. 2021). They found that employees who had frequent, formal safety training sessions were more likely to be safe at work and adhere to safety rules. Their finding was that safety training taught workers to be able to spot and prevent dangers, which in turn led directly to improved safety performance. While Osei-Asibey et al. (2021) in the construction industry confirmed this result, and showed that workers who received thorough safety training tended to comply with safety laws. These studies concluded that safety training not only increased employees' knowledge of safety processes, it also encouraged workers to be proactive about creating a safe work environment and thus significantly reduced accidents and injuries.

Research has consistently indicated that safety training increases safety compliance. Berhan (2020) conducted a study in the manufacturing industry were comprehensive safety training programmes dramatically increased employees' safety behaviours and safety compliance. They found that when employees were given consistent safety training, they were more likely to recognise potential hazards and make corrective decisions. Further, safety training helped employees to learn about organisational safety norms, resulting in increased safety compliance.

In Malaysia, safety training and safety compliance have also been found to be positively correlated, especially in manufacturing and construction. A study by Zulkifly (2020) on factory workers in Malaysia confirmed that safety training often significantly increased worker compliance with OSH. Yet the research found that not every organisation was able to provide sufficient safety training, especially small and medium enterprises (SMEs) with minimal resources. Nevertheless, employees in workplaces

where there was a structured and regular safety training programme showed greater concern for safety.

Further, a report by Umeokafor et al. (2022) on the construction industry in Malaysia emphasised the importance of safety training to promote worker safety. They concluded that safety training that was interactive and interactive resulted in better compliance. They also found that employees who were empowered by the training were more likely to follow safety procedures and report hazards. The study did not observe a negative effect of safety training in the overall sense that training was ineffective in certain ways, as well as by varying delivery styles or lack of follow-up sessions.

However not all studies have produced the same strong correlation. Safety training did improve safety compliance, but not as strongly in companies where training was suboptimal or incomplete (Zhang et al. 2024). In such settings, employees did not adhere to safety policies, and thus continued and intensive safety education is needed to ensure long-term compliance. Overall, these studies show that safety training and safety compliance are generally positive and consistent, although success of the training depends on variables such as habit, engagement, and persistence

2.6 Underpining Theories

The Social Cognitive Theory of Albert Bandura consists of behaviour, personal and environmental factors. It offers an appropriate theoretical framework to examine how worker involvement, safety communication and safety training impacts safety compliance. SCT examines the dynamic interaction between personal traits and environmental conditions which together with behavioral elements determine human behavior. The behavioral factors identified in SCT show a strong connection with worker involvement through skills development, practical experience, and enhanced

self-efficacy. Workers who engage in safety-related tasks such as hazard identification and safety meetings acquire essential skills and practical knowledge which enhances safety measures (Koutroubas & Galanakis, 2022). Through their active involvement, workers develop self-efficacy because they become more confident in their ability to recognize and tackle safety problems. It can be said that through a consistent participation in safety practices workers establish a compliance-focused culture which grows from their demonstrated behavior and reciprocal determinism.

On the other hand, safety communication corresponds with social norms and community access while influencing others according to SCT environmental factors. When safety protocols are communicated clearly and consistently this results in a safety-focused environment through established social norms (Islam et al, 2023). The availability of communication channels like meetings and memos gives workers essential information to comprehend safety requirements. Through their role modeling behavior, supervisors and colleagues teach others to follow safety rules by means of observation. Furthermore, the personal factors within SCT consist of knowledge along with expectations and attitudes which safety training programs target. Through training programs workers learn about safety protocols and risks which establishes explicit expectations for maintaining safe behaviors. Training programs instill safety values in workers to shift their attitudes toward viewing compliance as a fundamental responsibility. Hence, this framework shows how safety compliance in the manufacturing industry improves through the interaction of personal, environmental, and behavioral factors by matching independent variables to SCT elements.

2.7 Summary of the Chapter

This chapter outlines the literature on safety compliance in the manufacturing industry and identifies correlations between the following variables like worker involvement, safety communication, and safety training. It defines safety compliance and the independent variables and describes past research that studies how they have impacted safety behaviour. However, concepts like Social Cognitive Theory is incorporated into the research paradigm to provide explanations of how this affects safety compliance. It finishes with a review of the literature in support of the suggested research goals and hypotheses.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The purpose of discussing research methodology is to provide a detailed and comprehensive explanation of the process. Critical examination of the relationship between safety communication, worker involvement and safety training towards safety compliance in the manufacturing industry has been discussed in the following chapter. Moreover, a significant research framework related to research variables has been included in this chapter. The most suitable research design has been justified in this chapter as well. Furthermore, the research hypothesis has been developed so that a significant relationship between research variables can be justified. Apart from that, the operational definition, measurement of variables, and the process of data collection and analysis have been highlighted in the research methodology chapter. In this following chapter, the processes of choosing population and sample have been mentioned as well.

3.2 Research Framework

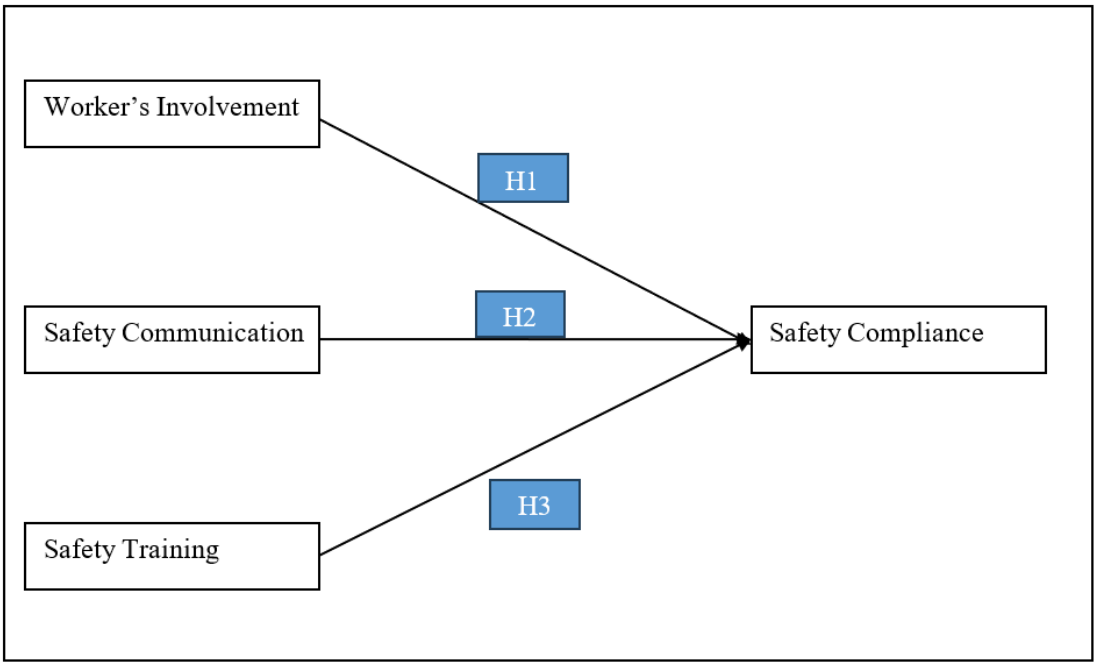

Figure 3.1
Research Framework

In the above research framework the significant relationship between the research variables has been depicted. The considered independent research variables are workers' involvement, safety communication and safety training. On the other hand, safety compliance is the dependent variable. The presence or absence of workers' involvement, safety communication and safety training across the manufacturing industry affects the existence or significance of safety compliances. It can be mentioned from this framework that if employees of the manufacturing industry actively participate in workplace safety processes, then safety compliance can be ensured. In addition, clear and consistent communication among manufacturing industry employees ensures that employees are aware of the safety protocols.

3.3 Hypotheses Development

H_1: *Worker's involvement significantly influences safety compliance.*

H_2: *Safety training significantly influence safety compliance.*

H_3: *Safety communication significantly influence safety compliance.*

3.4 Research Design

Research design is the overall approach and strategy used by researchers to achieve research objectives. In this research, a cross-sectional study design has been considered to critically examine the relationship between safety communication, worker's involvement and safety training towards safety compliance in the manufacturing industry. This research design is a significant research method for the collection of data from chosen research samples at a specific point of time (Wang & Cheng, 2020). On the other hand, Hamaker et al. (2020) stated that cross-sectional study design aims to critically analyse the relationship between different research variables at one particular moment without any type of manipulation. In the context of this research, the main purpose of choosing a cross-sectional study is to ensure how high safety compliance in manufacturing organisations can be maintained with safety communication, worker involvement and safety training.

This paper further uses a quantitative research methodology to investigate how worker's involvement, safety communication and safety training influence safety compliance in manufacturing company. Guzik and Wieckowska (2023) study shows that quantitative research involves gathering and analysing quantitative information to discern patterns, correlations, and trends. The Five Point Agreeableness Likert-scale questionnaires was used to create structured surveys to collect measurable data from

the participants, for statistical analyses such as correlation and regression. The quantitative nature of this study is also helpful to test hypotheses and to measure the effects of independent variables on safety compliance efficiently. Therefore, from the above critical discussion, it can be inferred that cross-sectional study design and quantitative studies have been the most suitable in terms of achieving the research objectives.

3.5 Operational Definition

Worker's Involvement: The term "worker's involvement" mainly determines the participation of workers in a safety-related work activity. Workers involvement might include activities like safety meetings, decision making on safety procedures, and safety risks reporting. Workers involvement can be used to assess their understanding and knowledge on safety compliance at manufacturing sites.

Safety Communication: It is the communication of safety procedures, risks and practices between employees, managers, and supervisors. It includes formal communications and informal communications between workers and management.

Safety training: The comprehensiveness and effectiveness of programs designed to educate employees on workplace safety, including training on safety procedures, emergency responses, and hazard assessments, as well as incentives for participation in these programs.

Safety compliance: The adherence of workers to established safety practices, including using necessary safety equipment, following safety procedures, and encouraging others to uphold safety standards to ensure a safe working environment.

3.6 Measurement of Variables/Instrumentation

Questionnaires for survey have been developed to measure the primary study variables associated with safety compliance in manufacturing. Worker's Involvement has been assessed through indicators that measure employee participation in safety activities, such as involvement in safety meetings, decision-making processes, and hazard reporting. A Five Point Agreeableness Likert Scale has been used to assess the overall questionnaires including worker's involvment, safety communication, safety training and safety compliance ranging from strongly disagree to strongly agree. Worker's involvement is measued by collecting data such as the relationship of workers and the top management, intensity of workers decision making and safety issue discussion. Other than that, safety communication has been measured by evaluating the platform used (Afzal & Shafiq, 2021).

Moreover safety training has been measured by collecting data such as the extensive of training programs, special incentives and hazard assesment. Lastly, safety compliance questionnaires included items such as carrying out work in safetly manner, usage of safety procedures and obeying safety in all conditions. Additionally, employee self-reporting on adherence to safety rules has been collected.

Table 3.1:
Item Measurement

Variable	Author	Original Questionnaire Items	Adopted/ Adapted Questionnaire Items
Safety Compliance	Ajmal et al. (2022)	I carry out work in a safe manner	I carry out work in a safe manner

		I use all necessary safety equipment to do my job	I use all necessary safety equipment to do my job
		I use the correct safety procedures for carrying out my job	I use the correct safety procedures for carrying out my job
		I ensure the highest level of safety when carrying out my job	I ensure the highest level of safety when carrying out my job
		I encourage coworkers to use safety equipment to perform their jobs	I encourage coworkers to use safety equipment to perform their jobs
		Sometimes because of work conditions, I ignore health and safety principles	Sometimes because of work conditions, I ignore health and safety principles

Variable	Author	Original Questionnaire Items	Adopted/ Adapted Questionnaire Items
Worker's Involvement	Ajmal et al. (2022)	In decision making related to safety matters, top management appreciates suggestions from workers in the organization	In decision making related to safety matters, top management appreciates suggestions from workers in the organization
		In the safety committee, safety experts and representatives provide	In the safety committee, safety experts and

		mutual suggestions to improve workplace safety	representatives provide mutual suggestions to improve workplace safety
		Top management welcomes suggestions from workers to promote workplace safety	Top management welcomes suggestions from workers to promote workplace safety
		In workplace matters related to safety, issues are also discussed with workers	In workplace matters related to safety, issues are also discussed with workers
		Workers actively participate in safety-promotion programs to improve workplace safety	Workers actively participate in safety-promotion programs to improve workplace safety

Variable	Author	Original Questionnaire Items	Adopted/ Adapted Questionnaire Items
Safety Communication	Ajmal et al. (2022)	Workers have opportunity in their department to report hazards before they occur	Workers have opportunity in their department to report hazards before they occur
		In our organization, top management encourages workers to share ideas	In our organization, top management encourages workers to share ideas about

		about improvements in workplace safety	improvements in workplace safety
		My company has an open-door communication policy, and in the meeting, employees can give suggestions for improvement	My company has an open-door communication policy, and in the meeting, employees can give suggestions for improvement
		The goals for safety performance in my organization are clear to the workers	The goals for safety performance in my organization are clear to the workers
		There is open communication about safety issues in this workplace	There is open communication about safety issues in this workplace
		I often discuss with my supervisor about safety-related matters	I often discuss with my supervisor about safety-related matters
		My organization uses social media to create awareness about safety issues in the workplace	My organization uses social media to create awareness about safety issues in the workplace

Variable	Author	Original Questionnaire Items	Adopted/ Adapted Questionnaire Items
Safety Training	Ajmal et al. (2022)	Our company arranges extensive training programs to train	Our company arranges extensive training programs to train

employees related to workplace safety issues and challenges	employees related to workplace safety issues and challenges
Moreover, in the organization, “newly joined employees are trained adequately to maintain workplace safety on a formal and informal basis	Newly joined employees are trained adequately to maintain workplace safety on a formal and informal basis
In the organization’s safety-training programs, priority of safety is highlighted to lower the rate of occupational accidents and injuries	In the organization’s safety-training programs, priority of safety is highlighted to lower the rate of occupational accidents and injuries
In safety-training programs employees are also trained to respond in emergency situations	In safety-training programs employees are also trained to respond in emergency situations
Special incentives are offered for workers to attend training sessions on workplace safety awareness	Special incentives are offered for workers to attend training sessions on workplace safety awareness
Comprehensive hazard assessment training helps to develop and improve knowledge and safety skills	Comprehensive hazard assessment training helps to develop and improve knowledge and safety skills

3.7 Data Collection

Data Collection means gathering data for research or analysis. There are mainly two types of data collection methods such as primary and secondary data collection. Ribeiro-Navarrete et al. (2021) have suggested that data collection mainly helps in gathering information about the important data that can be helpful in discussing the research variables. Data collection for this has been done from collecting data from workers in the manufacturing sector about their involvement in safety activities, safety communication and safety training.

As mentioned by Taherdoost (2021), quantitative data collection uses data in numbers and is typically done through structured surveys or questionnaires which can then be statistically processed. Whereas, qualitative data collection is qualitative data-based data (interviews or open-ended questions), which is revealing to more deeply reflect experiences and beliefs.

This following research has chosen quantitative data collection as it allows to measure associations between factors like worker's involvement, safety communication, safety training and safety compliance. The data has collected with the structured questionnaires and Likert scales and then compared statistically to detect patterns and trends to the safety compliances. This allows the researchers to perform unbiased data analysis of large amounts of data and get generalisable results that can be scaled to larger groups of employees in the manufacturing space. Furthermore, quantitative data gathering makes sure to make sure that the quantification of relevant factors is clear, consistent, and reliable.

3.8 Sampling

3.8.1 Population

A research population is the entire group of individuals who share some common attributes or characteristics and it is the main focus of the undertaken research (Barker et al. 2021). The total research population in this undertaken study is 650. In this research, the population is the employees working in the Surface Mount Technology, SMT production department department. The employees working in this department has been chosen because the production process runs continuously, 24/7, and the workers are consistently engaged with the machinery and required to use the personal protective equipment (PPE) to perform their work. Not only that, these employees are chosen is to understand the effectiveness of safety training programmes and the extent of safety compliance within the company.

3.8.2 Sampling Frame

A sampling frame comprises the entire target population. According to Mweshi and Sakyi (2020), the sampling frame is the original list of individuals from which a sample is considered. The sampling frame involving the employees working in the Surface Mount Technology, SMT production department has been retrieved from the Human Resource Department. The sampling frame includes operators, technicians, supervisors, team leader, engineers and managers.

3.8.3 Unit of Analysis

The unit of analysis is highly interconnected with the level of analysis, research phenomenon, and the context of the study. The study by Martinsuo and Huemann (2021), states that a unit of analysis refers to the entity being investigated in the study.

In the scenario of the undertaken research, it can be mentioned that the unit of analysis is the interconnection between involvement of workers in safety communication and training programmes and its impact on safety compliance in the manufacturing industry. The unit of analysis in this study is individual employees working in manufacturing company in Penang. The perceptions, and experiences of these employees related to involvement in safety communication and training within the workforce have been critically analysed by using five point likert scale.

3.8.4 Sample Size

A sample size is the subset of the entire population from which research conclusions can be drawn. As expressed by Casteel and Bridier (2021), the sample size of the selected number of individuals from the larger population who participate in a study.

In this research, out of 650 populations, a sample size of 242 manufacturing company employees from Penang. As per sample size calculation, the sample size of 242 is appropriate for the representatives in the research procedure. The formula for the sample size calculation is which z is the z score, N is the population size and P stands for population portion.

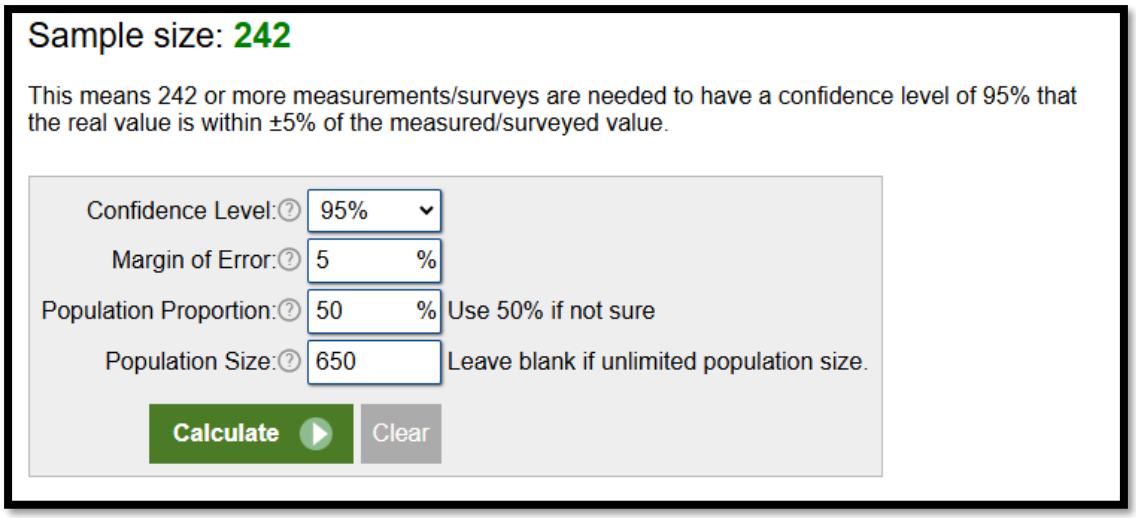

Figure 3.2
Sample size calculator
Source: Calculator.net

The research participants have been selected from the Surface Mount Technology, SMT production department which consists of managers, supervisors, engineers, technicians and operators. The different responsibilities and roles of each designation in the production department would help to study regarding impact of worker's involvement, safety communication and safety training on safety compliance in manufacturing company. The study by Galea and Tracy (2007), shows the need to increase the minimum sample size by 10 to 20 percent to mitigate the impact of non-responses, participants dropouts and other unforseen issues that could lead to incomplete data. Hence in this research, the minimum sample size of 242 is increased by 20 percent to become 290.

3.8.5 Sampling Procedure

In this research, a simple random sampling procedure has been considered. As mentioned by Hiebl (2023), the sampling procedure is a systematic process of selecting a subset of the population. A simple random sampling procedure helped to create a complete list of 650 workers who have the experience of working in one of the selected

manufacturing company in Penang. Each worker has been assigned a unique number in order to facilitate random selection. Random sampling applet software such as research randomiser has been used in order to generate 290 unique random numbers which are related to workers' IDs. All the selected samples have been cross-checked to ensure the representation of the worker's who are part of the production workers. The selected workers are informed and their consent has been collected and then the survey was conducted among 290 research participants.

3.9 Data Collection Procedures

The data collection has been methodically conducted so that the data is accurate, reliable, and consistent with the research goal for worker's involvement, safety communication, safety training, and safety compliance in manufacturing.

For the preparation process at the very first the questionnaire has been drafted with concise and easy to understand questions that match the study's goals. In order to keep the questions clear and easy to read, a pilot study with a limited number of respondents from the same population needs to be done (Gani et al. 2020). This is to make sure that the questions are clear and understandable.

Recruitment of participants had been conducted where all the participants for this study has been recruited from across the manufacturing companies to get representative input on employee involvement, safety communications, and safety training. They have been a combination of production line workers, supervisors, and safety managers.

Data processing for the Surveys has been carried out through online as per participants' convenience to provide convenient responses. At the same time the participants have been send proper instructions for filling out the surveys so that they could not make any mistakes. Next would be minitoring stage where at the data

gathering phase, the priority has been on response time and quality. A strict submission deadline has been set to encourage early submission and increase response rate.

Lastly data verification is done where the completed questionnaires have been verified for validity and completeness. Missing or indefinite responses has been retried for clarification. This data has been stored in a database and processed for data integrity.

3.10 Pilot Test

Table 3.2
Pilot Test Results

Variable	No of Item	Responses	Cornbach's alpha
Safety Compliance	6	30	0.828
Worker's Involvement	5	30	0.845
Safety Communication	7	30	0.977
Safety Training	6	30	0.963

This pilot study evaluated the internal consistency of the measurement device, called Cronbach's alpha. These results, reported in Table 3.2, indicate robust reliability for all constructs. Each questionnaire items was tested with 30 respondents across different departments in a manufacturing company. The pilot test sample size of 30 respondents meets the minimum standard accepted for reliability testing methods including Cronbach's alpha. Bujang et al. (2024) study state that a minimum sample size of 30 enables researchers to detect design issues with questionnaires and evaluate both internal consistency and the preliminary reliability of measurement tools. This following study has selected 30 respondents to obtain a valid and reliable assessment. Six-item for safety compliance had a Cronbach's alpha of 0.828 and exhibited high

consistency. Workers involvement, as determined by five items, was high-reliability, with a Cronbach's alpha of 0.845. Safety communication with seven items had a perfect Cronbach's alpha of 0.977, which indicates high internal consistency. Safety training with six items, also showed high reliability, with a Cronbach's alpha of 0.963. The findings confirm that the survey tool does indeed capture the constructs, so that items are stable and consistent. These robust reliability scores above 0.8 for all variables confirm that the instrument was appropriate for the primary experiment. This lends trust to the tools for measuring safety compliance and other related parameters.

One of the item from safety compliance "sometimes because of health conditions, I ignore health and safety principles" is known as a negative item and had been reverse coded before the test is done. By reverse coding negative items, all responses are aligned in same direction, making it easier to interpret the scale. If negative items are not reverse coded will lead to incorrect test results.

3.11 Techniques of Data Analysis

The research has been done using the Statistical Package for the Social Sciences (SPSS), a common quantitative data-analysis program. As opined by Rahman et al. (2021), SPSS has some strong tools for processing massive amounts of data, with accurate results.

3.11.1 Descriptive Analysis

Descriptive analysis was performed in order to present the study demographic and relevant variables in a structured form. The demographic information, including age, gender, years of working experience in manufacturing industry, job role and work shift gives an idea of what the sample population was like. For continuous variables

this research included means, medians, and standard deviations. This analysis allowed to get a full picture of the workforce composition and how they feel about worker's involvement, safety communication and safety training.

3.11.2 Normality Analysis

A normality test has been illustrated to see if the data had a normal distribution, which is an important assumption for parametric statistical tests. Standard deviation was evaluated using Q-Q plots. Skewness and kurtosis were also evaluated for large samples to make sure they were within normal ranges (+1-1). These findings verified whether subsequent analyses like regression could proceed with parametric methods or non-parametric approaches.

3.11.3 Reliability Analysis

In order to make the measurement tools credible, Cronbach's alpha was calculated for each construct which are worker's involvement, safety communication and safety training. The internal consistency standard was set at 0.7 (Bujang et al. 2024). A construction with an alpha value over this limit was considered reliable which means that the survey instrument did indeed count the desired variables consistently.

3.11.4 Correlation Analysis

This study also includes correlation analysis to look for correlation between the independent variables which are worker's involvement, safety communication, and safety training and the dependent variable which is safety compliance. The strength and direction of these relationships were determined by Pearson's correlation coefficient. The findings revealed robust relationships among the variables, and demonstrated whether greater worker's involvement, safety communication and safety training

helped increase compliance. The process of correlation analysis determines how variables relate to each other through a coefficient that spans from -1 to +1, where positive values show direct relationships and negative values show inverse relationships. Sabatini et al. (2021) have mentioned a standard guidelines to evaluate correlation strengths as coefficients between ±0.10 to ±0.29 indicate weak relationships, values from ±0.30 to ±0.49 signify moderate relationships and coefficients from ±0.50 to ±1.00 denote strong relationships. The correlation value of 0 demonstrates that there is no relationship between the two variables. A correlation coefficient value of +0.65 demonstrates a strong positive relationship between variables while -0.25 represents a weak negative relationship (D'Agostino et al. 2023). The knowledge of these ranges allows researchers to evaluate how factors like worker involvement, safety communication and safety training impact safety compliance as the dependent variable while allowing to draw meaningful insights into how study relate to one another.

3.11.5 Multiple Regression Analysis

Multiple regression analysis was used to evaluate the cumulative impact of independent variables on safety compliance. This analysis accounted for how much each factor contributed to compliance differences, controlling for the effects of other variables. The adjusted R-squared was used to calculate the model's explanatory power and standardized beta coefficients were used to quantify the relative significance of each predictor. Significance of different predictors has been assessed with the help of P value whereas $p < 0.05$ showcases significant effect and $P < 0.001$ showcases very high effect (Wasserstein & Lazar, 2016).

3.12 Summary of the Chapter

In this methodology chapter, the research approach was explained to study the interaction between worker's involvement, safety communication, safety training, and safety compliance in the manufacturing industry. This research uses a cross-sectional research design and gathers data at a time point from 290 Pulau Pinang manufacturing company workers. This chapter gives operational definitions of major factors like worker involvement, safety communication, safety training, and safety compliance all of which are all tracked with questionnaires and Five Point Likert scales. The chapter goes on to discuss how the data was gathered, including quantitative surveys and structured questionnaires for gathering information about safety practices. It uses a simple random sampling strategy to recruit them from the population of 650 workers. This chosen sampling method is helpful in order to select each worker in the population with the same likelihood of selection which supports fairness and minimizes selection bias. Furthermore, this chosen method improves sample representativeness which helps the research accurately depict the full group of 650 workers' viewpoints and experiences.

At the same time the primary data collected in this study has also been analysed in SPSS with descriptive statistics, correlation analysis, normality analysis, reliability analysis and multiple regression analysis. Its aim is to measure how safety training, safety communication and workers' involvement impact safety compliance. Examining these, the research hopes to shed light on how manufacturing company can achieve better safety compliance. This chapter provides the context of the data collection and analysis that has been used for valid and stable results to satisfy the research goals.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This Chapter 4 findings will display the study's results and examine factors that affect workplace safety compliance. The chapter has provided detailed demographic information about participants including age range, gender distribution, educational levels, work experience duration, job functions, and work shifts. The chapter displayed descriptive statistics for primary survey questions which evaluate worker involvement in safety procedures as well as safety communication effectiveness, safety training methods, and compliance behaviors. The chapter incorporates normality tests for dataset analysis and reliability statistics for measurement consistency assessment. This chapter also included the correlation analysis to demonstrate key variable relationships and continues with regression analysis model results to evaluate how worker involvement, safety communication and safety training affect safety compliance. The detailed results presented in this section build a basis for additional analysis and discussions throughout the later chapters.

4.2 Findings

4.2.1 Response Rate

Table 4.1
Return Rate

Questionnaire	Number	Percentage
Distributed Questionnaires	290	100
Returned Questionnaires	285	98.3
Usable Questionnaire	285	98.3
Unusable Questionnaire	0	0

Table 4.1 presents the response rate for the study. A total of 290 questionnaires were distributed, of which 285 were returned, resulting in a high response rate of 98.3%. All returned questionnaires were found to be usable, maintaining a usability rate of 98.3%. The absence of unusable questionnaires (0%) indicates a well-executed data collection process, ensuring that all responses were complete and valid for analysis. The high response and usability rates reflect strong participant engagement and enhance the credibility of the study findings by providing a robust and representative dataset for further analysis.

4.2.2 Demographic Findings

Table 4.2
Demographic Findings

Personal characteristics	Frequency	Percentage
Age		
18-25 years	34	11.9
26-36 years	128	44.9
37-47 years	94	33.0
48-58 years	26	9.1
Above 58 years	3	1.1
Gender		
Male	167	58.6
Female	118	41.4
Educational background		
High school certificate or equivalent	60	21.1
Diploma	118	41.4
Bachelor's degree	82	28.8
Master's degree or higher	25	8.8
Working Experience		
Less than 1 year	45	15.8
1-5 years	108	37.9

6-10 years	82	28.8
11-15 years	36	12.6
More than 15 years	14	4.9
Job Role		
Operator/Technician	95	33.3
Supervisor/Team leader	102	35.8
Engineer	63	22.1
Manager	25	8.8
Work Shift		
Day shift	147	51.6
Night shift	64	22.5
Normal shift	74	26.0

The demographic distribution of the respondents based on age, gender, educational background, work experience, job role and shift is given in Table 4.2. These characteristics highlight the characteristics of the study subjects to ensure that the findings are based on a panel of subjects with different set characteristics. In terms of age, the majority of respondents (44.9%) were between 26-36 years old (128 respondents), followed by 37-47 years (94 respondents, 33.0%). A smaller percentage were aged 18-25 years (34 respondents, 11.9%), 48-58 years (26 respondents, 9.1%), and above 58 years (3 respondents, 1.1%). This distribution indicates that the workforce in the manufacturing industry is predominantly within the young to middle-aged category.

Regarding gender, 167 respondents (58.6%) were male, while 118 respondents (41.4%) were female. This suggests a male-dominated workforce, which is common in many manufacturing settings. For educational background, the largest group of respondents held a diploma (118 respondents, 41.4%), followed by those with a bachelor's degree (82 respondents, 28.8%). Those with a high school certificate or

equivalent accounted for 21.1% (60 respondents), while the smallest group, 25 respondents (8.8%), held a master's degree or higher. This indicates that most employees possess formal education relevant to their roles.

The working experience data shows that 37.9% (108 respondents) had 1-5 years of experience, followed by 28.8% (82 respondents) with 6-10 years of experience. Employees with less than 1 year accounted for 15.8% (45 respondents), while 12.6% (36 respondents) had 11-15 years of experience. Only 4.9% (14 respondents) had been working for more than 15 years, suggesting a workforce with a mix of both experienced and relatively new employees.

Regarding job roles, the largest group was supervisors/team leaders (102 respondents, 35.8%), followed by operators/technicians (95 respondents, 33.3%). Engineers constituted 22.1% (63 respondents), while managers made up 8.8% (25 respondents). This distribution highlights the varying levels of responsibility within the organization.

Finally, for work shifts, 51.6% (147 respondents) worked the day shift, while 26.0% (74 respondents) worked a normal shift, and 22.5% (64 respondents) worked the night shift. This suggests that the workforce is distributed across different working hours to maintain operational efficiency. Overall, the demographic findings provide valuable insights into the workforce composition, ensuring that the study's results reflect the diversity within the manufacturing industry.

4.2.3 Descriptive Statistics

Table 4.3
Descriptive Statistics

	N	Mean	Std. Deviation
Safety Compliance			
I carry out work in a safe manner	285	3.9474	.90812
I use all necessary safety equipment to do my job	285	3.8947	.88182
I use the correct safety procedures for carrying out my job.	285	3.9895	.98397
I ensure the highest level of safety when carrying out my job.	285	3.9930	.85988
I encourage coworkers to use safety equipment to perform their jobs	285	4.0456	.88891
Sometimes because of work conditions, I ignore health and safety principles.	285	3.9965	.91351
Worker's Involvement			
In decision making related to safety matters, top management appreciates suggestions from workers in the organization	285	3.9509	.86666
In the safety committee, safety experts and representatives provide mutual suggestions to improve workplace safety	285	4.0000	.89992
Top management welcomes suggestions from workers to promote workplace safety	285	4.1719	.86516
In workplace matters related to safety, issues are also discussed with workers	285	4.0035	.97684
Workers actively participate in safety-promotion programs to improve workplace safety	285	4.1474	.87976
Safety Communication			

Workers have opportunity in their department to report hazards before they occur	285	4.0772	.86460
In our organization, top management encourages workers to share ideas about improvements in workplace safety	285	4.1649	.92548
My company has an open-door communication policy, and in the meeting, employees can give suggestions for improvement	285	4.3018	.89610
The goals for safety performance in my organization are clear to the workers	285	3.9544	.89286
There is open communication about safety issues in this workplace	285	3.9719	.85121
I often discuss with my supervisor about safety-related matters	285	3.9579	.87108
My organization uses social media to create awareness about safety issues in the workplace	285	3.9298	.90887
Safety Training			
Our company arranges extensive training programs to train employees related to workplace safety issues and challenges	285	4.1368	.81289
Newly joined employees are trained adequately to maintain workplace safety on a formal and informal basis	285	4.0702	.88532
In the organization's safety-training programs, priority of safety is highlighted to lower the rate of occupational accidents and injuries	285	4.0561	.95884
In safety-training programs employees are also trained to respond in emergency situations	285	4.1474	.95278
Special incentives are offered for workers to attend training sessions on workplace safety awareness	285	4.0386	.87326

Comprehensive hazard assessment training helps to develop and improve knowledge and safety skills	285	4.1614	.91654

Table 4.3 presents the descriptive statistics for the key variables in this study, including Safety Compliance, Worker's Involvement, Safety Communication, and Safety Training. The table provides insights into the mean values and standard deviations for each item, reflecting respondents' perceptions of workplace safety and compliance practices.

For Safety Compliance, respondents demonstrated a high level of agreement with most statements. The highest mean value (4.0456) was recorded for the item "I encourage coworkers to use safety equipment to perform their jobs", suggesting that employees actively promote a safety-conscious environment. Additionally, "I ensure the highest level of safety when carrying out my job" had a mean of 3.9930, highlighting employees' commitment to safe practices. However, the item "Sometimes because of work conditions, I ignore health and safety principles" had a mean of 3.9965, indicating that external factors may sometimes influence compliance. The standard deviations ranged from 0.85988 to 0.98397, showing some variability in responses.

In terms of Worker's Involvement, respondents acknowledged that safety decision-making involves employee input. The highest mean (4.1719) was for "Top management welcomes suggestions from workers to promote workplace safety", indicating that leadership is open to worker feedback. Similarly, "Workers actively participate in safety-promotion programs" had a mean of 4.1474, suggesting high engagement in safety initiatives. The lowest mean (3.9509) was recorded for "In decision-making related to safety matters, top management appreciates suggestions

from workers", implying some variation in perceptions of managerial responsiveness. Standard deviations ranged from 0.86516 to 0.97684, reflecting moderate variation among responses.

For Safety Communication, the responses highlighted an effective communication framework within the organization. The item "My company has an open-door communication policy, and in the meeting, employees can give suggestions for improvement" had the highest mean (4.3018), indicating a strong culture of open communication. The statement "Workers have the opportunity in their department to report hazards before they occur" had a mean of 4.0772, suggesting that proactive safety reporting mechanisms are in place. However, "My organization uses social media to create awareness about safety issues in the workplace" had a relatively lower mean (3.9298), indicating that digital communication for safety promotion may not be fully utilized. Standard deviations for safety communication items ranged from 0.85121 to 0.92548, signifying consistent responses.

Regarding Safety Training, the findings suggest that employees receive structured training on safety measures. The item "Our company arranges extensive training programs to train employees related to workplace safety issues and challenges" had a mean of 4.1368, showing that training is a priority. Similarly, "Comprehensive hazard assessment training helps to develop and improve knowledge and safety skills" had a mean of 4.1614, reflecting strong training initiatives. However, the lowest mean (4.0386) was recorded for "Special incentives are offered for workers to attend training sessions on workplace safety awareness", suggesting that additional incentives may be needed to boost training participation. Standard deviations for safety training items

ranged from 0.81289 to 0.95884, indicating a relatively uniform perception of training effectiveness.

Overall, the descriptive statistics indicate that respondents have positive perceptions of safety compliance, involvement, communication, and training in their workplace. The high mean values across all variables suggest strong safety practices, while the standard deviations reflect a moderate level of variability in responses. These findings provide a robust foundation for further analysis of safety compliance in the manufacturing industry.

4.2.4 Test of Normality

Figures 4.1 to 4.4 illustrate the Normal Q-Q Plots for each variable, which visually assess the distribution of the data. In Figure 4.1, the Q-Q plot for Worker's Involvement shows some variation from the expected normal line, particularly at the extremes. This pattern is similarly observed in Figure 4.2 for Safety Communication, where data points display a slight divergence from the diagonal reference line.In Figure 4.3, the Q-Q plot for Safety Training follows a comparable trend, with some deviations appearing along the diagonal. Likewise, Figure 4.4, which represents Safety Compliance, exhibits a distribution pattern that aligns with the observations in the other variables.

Despite the observed patterns in skewness, kurtosis, and Q-Q plots, the results indicate that the dataset remains appropriate for further analysis. Many statistical techniques are robust to variations in distribution, and the sample size of 285 respondents supports the reliability of inferential statistical procedures (Norman, 2010). Therefore, the findings in this section provide sufficient justification to proceed with

subsequent analyses, ensuring meaningful insights into the relationships among the study variables.

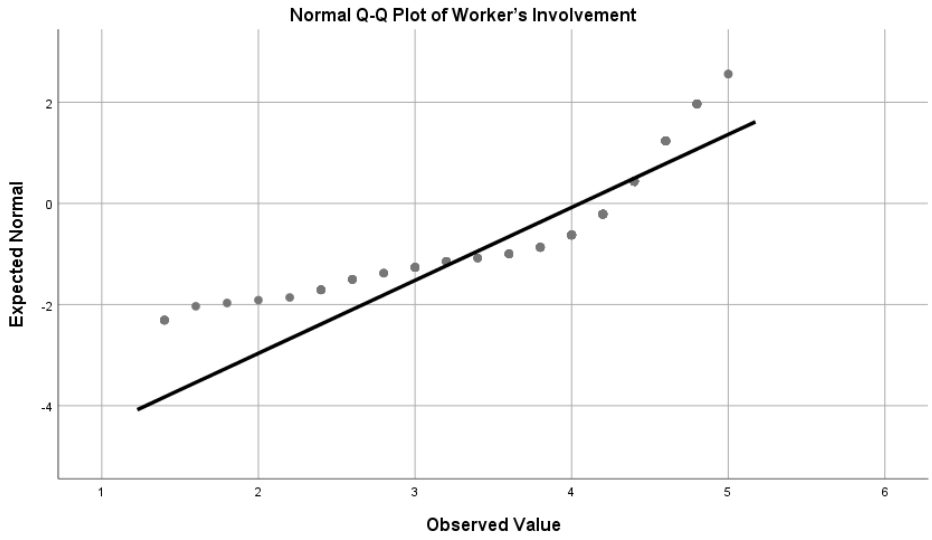

Figure 4.1
Normal QQ Plot of Worker's Involvement

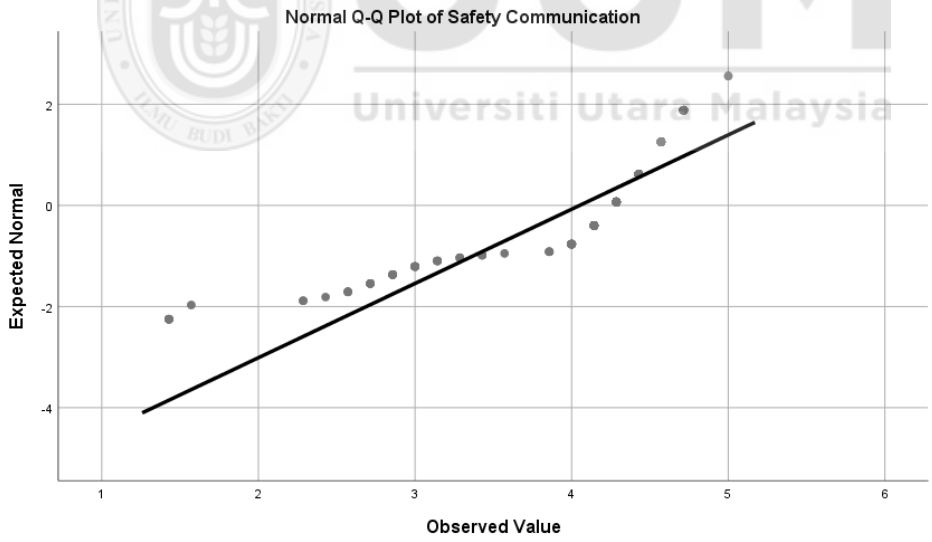

Figure 4.2
Normal QQ Plot on Safety Communication

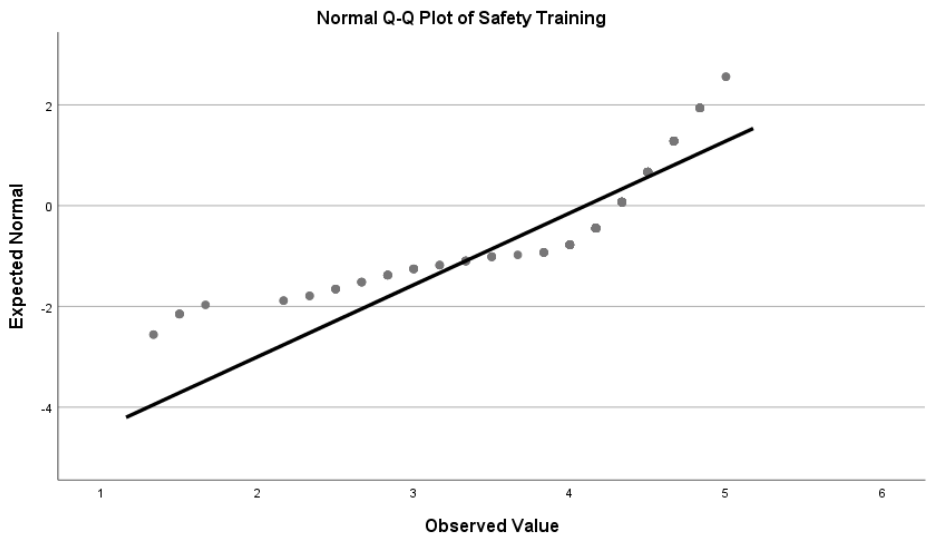

Figure 4.3
Normal QQ Plot of Safety Training

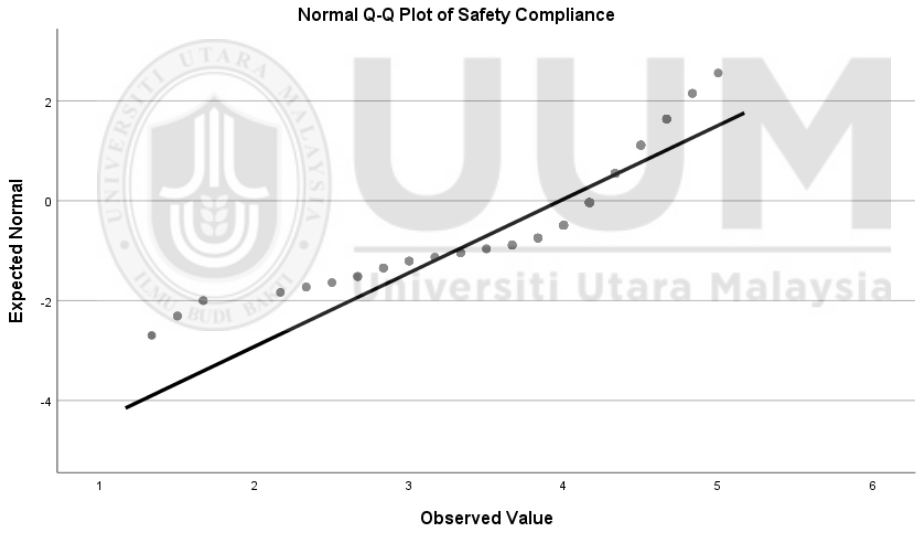

Figure 4.4
Normal QQ Plot of Safety Compliance

4.2.5 Correlation Analysis

Table 4.4
Pearson Correlation Analysis

Correlations

		SC	WI	ISC	ST
Safety Compliance (SC)	Pearson Correlation	1	.834**	.860**	.804**
	Sig. (2-tailed)		.000	.000	.000
	N	285	285	285	285
Worker's Involvement (WI)	Pearson Correlation	.834**	1	.866**	.845**
	Sig. (2-tailed)	.000		.000	.000
	N	285	285	285	285
Safety Communication (ICS)	Pearson Correlation	.860**	.866**	1	.879**
	Sig. (2-tailed)	.000	.000		.000
	N	285	285	285	285
Safety Training (ST)	Pearson Correlation	.804**	.845**	.879**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	285	285	285	285

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

Table 4.4 presents the Pearson correlation analysis for the key variables in this study: Safety Compliance (SC), Worker's Involvement (WI), Safety Communication (ISC), and Safety Training (ST). The correlation analysis examines the strength and direction of relationships between these variables, providing insight into how they influence one another. The correlation coefficients range between -1 and +1, where values closer to +1 indicate a strong positive relationship, and values closer to 0 suggest a weaker association.

The results show that Safety Communication (ISC) and Safety Compliance (SC) exhibit a strong positive correlation (r = 0.860, p = 0.000), indicating that improved communication in the workplace enhances safety compliance. Organizations that promote open and effective communication channels enable employees to report hazards, discuss safety concerns, and receive timely updates on safety measures. This fosters a culture of compliance and reduces the likelihood of workplace accidents. The

strong correlation suggests that clear and structured communication strategies, such as regular safety meetings, hazard reporting systems, and feedback mechanisms, play a crucial role in ensuring compliance.

Similarly, Worker's Involvement (WI) and Safety Compliance (SC) are strongly correlated, with a Pearson correlation coefficient of 0.834 ($p = 0.000$). This suggests that when worker involvement in safety matters increases, safety compliance is also likely to improve. Employees who are actively engaged in safety initiatives, decision-making, and hazard reporting are more likely to adhere to safety regulations and workplace protocols. This finding aligns with previous research that highlights the importance of involving employees in safety discussions to enhance compliance.

Safety Training (ST) also demonstrates a strong positive correlation with Safety Compliance ($r = 0.804$, $p = 0.000$), confirming that training programs are critical in ensuring compliance with safety regulations. Employees who receive adequate safety training are more knowledgeable about workplace hazards, emergency response procedures, and proper use of protective equipment. This finding supports the notion that continuous safety education and refresher training sessions contribute to improved compliance with safety protocols. Organizations that invest in comprehensive safety training programs can significantly reduce workplace risks and enhance overall safety performance.

The results also show strong interrelationships among Worker's Involvement, Safety Communication, and Safety Training. Worker's Involvement (WI) and Safety Communication (ISC) are positively correlated ($r = 0.866$, $p = 0.000$), indicating that when employees are more involved in safety-related matters, communication within the organization improves. Employees who actively participate in safety programs,

discussions, and decision-making are more likely to share safety concerns, contribute suggestions, and engage in meaningful discussions with supervisors and management.

Additionally, Worker's Involvement (WI) and Safety Training (ST) exhibit a strong correlation ($r = 0.845$, $p = 0.000$), suggesting that organizations that emphasize employee participation in safety matters are also likely to prioritize training programs. This reflects the interconnected nature of workplace safety initiatives, where an organization's commitment to engaging workers in safety discussions is often accompanied by structured training efforts.

Furthermore, Safety Communication (ISC) and Safety Training (ST) show the highest correlation among the variables ($r = 0.879$, $p = 0.000$). This implies that safety communication and safety training efforts go hand in hand where effective communication enhances the impact of safety training, ensuring that employees understand and retain critical safety information. Organizations that use multiple communication channels, such as meetings, posters, digital platforms, and social media, can reinforce training content and improve knowledge retention among employees.

This study reports significant correlation that highlights how the four variables are strongly associated and need to be viewed as a whole. Both worker involvement and open communication are necessary in a combination with regular training and a strong compliance mechanism to have effective safety management. Overall, the impact on safety performance is enhanced when the above mentioned three factors are worked on simultaneously by organizations instead of individual factors. Overall there is clear indication that Safety Compliance is dependent on Worker's Involvement, Safety Communication, and Safety training. Organizations that provide the environment enabling employees to be informed, well engaged, and well trained, have

higher government compliance levels. These findings reiterate the need for an all encompassing holistic safety management strategy taking involvement, training and communication into consideration to create a safer place to work.

4.2.6 Model Summary

Table 4.5
Model Summary

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.879[a]	.773	.771	.32446

a. Predictors: (Constant), Safety Training, Worker's Involvement, Safety Communication

Table 4.5 presents the model summary for the regression analysis conducted to examine the relationship between Safety Compliance (SC) and its predictors: Safety Training (ST), Worker's Involvement (WI), and Safety Communication (ISC). The R-value of 0.879 indicates a strong positive correlation between the independent variables and Safety Compliance. This suggests that these three factors collectively contribute significantly to variations in safety compliance among employees in the manufacturing industry.

The R Square value of 0.773 implies that 77.3% of the variation in Safety Compliance is explained by Safety Training, Worker's Involvement, and Safety Communication. This high percentage demonstrates that these factors are strong determinants of compliance behavior in the workplace. The remaining 22.7% of the variance may be influenced by other external factors not included in this model, such as organizational policies, management style, or individual attitudes toward safety.

The Adjusted R Square of 0.771 further confirms the robustness of the model. Since this value is very close to the R Square value, it suggests that the model would perform well even if applied to a different sample population. The standard error of the estimate (0.32446) indicates a relatively small margin of error, supporting the model's accuracy in predicting safety compliance based on the three independent variables.

Overall, the model summary demonstrates that Safety Training, Worker's Involvement, and Safety Communication play a critical role in influencing Safety Compliance. This finding highlights the need for organizations to focus on these areas to enhance compliance with workplace safety regulations.

4.2.7 ANOVA

Table 4.6
ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	100.888	3	33.629	319.447	.000[b]
	Residual	29.582	281	.105		
	Total	130.470	284			

a. Dependent Variable: Safety Compliance
b. Predictors: (Constant), Safety Training, Worker's Involvement, Safety Communication

Table 4.6 presents the Analysis of Variance (ANOVA) results, which evaluate the overall significance of the regression model predicting Safety Compliance (SC) based on Safety Training (ST), Worker's Involvement (WI), and Safety Communication (ISC). The ANOVA test determines whether the independent variables significantly contribute to explaining variations in safety compliance.

The F-statistic of 319.447 and the corresponding p-value of 0.000 indicate that the overall model is statistically significant. This means that Safety Training, Worker's Involvement, and Safety Communication collectively have a significant impact on Safety Compliance. Since the p-value is less than 0.05, the null hypothesis, which suggests that these predictors have no effect on Safety Compliance, is rejected.

The regression sum of squares (100.888) represents the portion of the total variance explained by the independent variables, while the residual sum of squares (29.582) accounts for unexplained variance. The total sum of squares (130.470) reflects the overall variation in Safety Compliance among respondents. The model explains a substantial proportion of this variation, further confirming its effectiveness in predicting compliance behavior.

The results of the ANOVA confirm that the regression model is valid. Safety Training, Worker's Involvement and Safety Communication are contributory factors to Safety Compliance individually. This finding point to these factors as instrumental in improving adherence with any office safety rule and as such, organizations must boost on security training and worker involvement, communicate security messages better.

4.2.8 Coefficients

Table 4.7
Coefficients Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.316	.120		2.628	.009
	Worker's Involvement	.322	.059	.329	5.418	.000
	Safety Communication	.495	.068	.497	7.315	.000
	Safety Training	.086	.062	.089	1.396	.164

a. Dependent Variable: Safety Compliance

Table 4.7 presents the regression coefficients for the model predicting Safety Compliance (SC) based on Worker's Involvement (WI), Safety Communication (ISC), and Safety Training (ST). The coefficients provide insight into the contribution of each predictor variable, indicating their relative impact on Safety Compliance. The constant (B = 0.316, p = 0.009) represents the baseline level of Safety Compliance when all independent variables are set to zero. This suggests that even in the absence of Worker's Involvement, Safety Communication, and Safety Training, some level of Safety Compliance exists due to other influencing factors not included in this model.

Safety Communication (B = 0.495, p = 0.000) has the highest impact on Safety Compliance, as indicated by its standardized Beta value of 0.497. This means that Safety Communication contributes more to Safety Compliance than Worker's Involvement and Safety Training. The positive coefficient suggests that clear and open communication about safety issues enhances compliance among employees. The t-value of 7.315 reinforces the strength of this relationship, emphasizing the importance of effective communication strategies such as regular safety meetings, hazard reporting mechanisms, and clear dissemination of safety procedures.

Worker's Involvement (B = 0.322, p = 0.000) demonstrates a positive and statistically significant relationship with Safety Compliance. The standardized coefficient (Beta = 0.329) indicates that Worker's Involvement is a strong predictor of compliance. This suggests that when employees are actively engaged in safety-related decision-making, discussions, and initiatives, they are more likely to comply with workplace safety regulations. The t-value of 5.418 further confirms the significance of this relationship, highlighting the critical role of worker participation in fostering a safe working environment.

Safety Training (B = 0.086, p = 0.164) shows a weaker and statistically insignificant relationship with Safety Compliance. The p-value (0.164) is greater than 0.05, meaning that Safety Training does not significantly predict Safety Compliance in this model. The standardized Beta value of 0.089 also indicates a relatively low contribution compared to the other two variables. The t-value of 1.396 suggests that while training is beneficial, its direct influence on compliance is less pronounced than that of Worker's Involvement and Safety Communication. This finding suggests that training alone may not be sufficient to ensure compliance unless it is reinforced with worker participation and effective communication strategies.

In general, the regression coefficients suggest that Safety Compliance is driven mainly by these factors, Worker's Involvement and Safety Communication. Safety Training is still a necessity for workplace safety but its complicity may be through an indirect influence as training content must be communicated effectively and implemented within the daily workplace activities. These findings underline the importance of implementing an integrated approach to safety management, namely,

training should be bolstered with strong communication channels and full employee involvement for maximum compliance.

4.3 Summary of the results

Table 4.8
Summary of the results

Hypotheses	Results
H_1: Worker's involvement significantly influences safety compliance.	Accepted
H_2: Safety training significantly influence safety compliance.	Rejected
H_3: Safety communication significantly influence safety compliance.	Accepted

Table 4.8 summarizes the hypothesis testing results. H1, which posited that Worker's Involvement significantly influences Safety Compliance, is accepted. This indicates that employees who actively participate in safety-related decisions and programs are more likely to adhere to safety regulations.

H2, which proposed that Safety Training significantly influences Safety Compliance, is rejected. While training is essential for equipping employees with safety knowledge, the results suggest that training alone does not directly predict compliance. Other factors, such as communication and engagement, may play a more significant role in ensuring adherence to safety practices.

H3, which hypothesized that Safety Communication significantly influences Safety Compliance, is accepted. The findings confirm that clear communication of safety policies, hazard reporting systems, and open discussions about safety concerns enhance compliance.

Overall, the results highlight the importance of Worker's Involvement and Safety Communication in promoting Safety Compliance, while Safety Training requires additional reinforcement to be effective.

4.4 Summary of the Chapter

This chapter discussed the study results including key influencing factors of the safety compliance among the manufacturing employees. It presented a detailed overview of the demographic makeup of the participants, such as age, gender, any education, work experience, work roles and work shifts. The descriptive statistics illustrated respondents' perception of safety compliance, worker involvement, safety communication as well as safety training. Where it was confirmed by the normality test that such data were adequate for further statistical analysis, and finally where reliability analysis showed high internal consistency for all measurement scales. The associations between safety compliance and worker involvement, safety communication and safety training, were consistently strong positive. Safety compliance was influenced by worker involvement, safety communication and not by safety training, using regression analysis.

The robustness and statistical significance of the regression model was confirmed by the model summary and ANOVA. The findings of hypothesis testing provided support to the importance of worker involvement and communication in enhancing compliance and helped support the need to integrate these elements into workplace safety strategy. Overall, this chapter lays a strong base for the analysis and understanding of the findings of the following chapter, paying specific focus to the important connection between employee engagement and effective communication to enhance safety compliance.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter summarizes the key findings of the study, emphasizing the impact of worker involvement, safety communication, and safety training on safety compliance. The findings indicate that worker involvement and safety communication significantly impact safety compliance, whereas safety training does not have a direct effect. Based on these results, this chapter outlines theoretical, practical, and policy implications, along with its limitations and directions for future research. Finally, key insights are presented, reinforcing the importance of fostering a safety-oriented work culture through active participation and effective communication.

5.2 Worker's Involvement can significantly influence safety compliance

The purpose of this study proves that worker involvement has a significant effect on safety compliance and the findings from the correlation analysis and regression result support that worker involvement has a strong positive relationship with safety compliance. This means taking the active part of workers in the decision making, discussions, in the process of performing safety related initiatives leads to the increase of compliance with these safety protocols. Such a high level of engagement in decision making promotes a sense of ownership in responsibilities that in turn helps strengthening the adherence to safety measures.

Results from a study by Ajmal et al. (2022) are that workers who participated in safety committees and hazard detection were more compliant than those not involved in any of these. The same has been reported by Osei-Asibey (2021) who reported that the level of worker participation in safety planning increases adherence in safety rules due to the employee being more aware and dedicated to workplace safety. Additionally, Strid et al. (2021) also showed that workers should be involved in identifying and implementing safety practices and that there is a great reduction on the number of incidents in the workplace, which proves that employees that actively take part in the safety programs are more obedient with the standards safety.

On the other hand, some research suggests that worker involvement might not be enough to satisfaction of compliance. Saleem et al. (2022) concluded that although worker engagement has a positive relationship with safety compliance; this relationship is subjected to effective management support and explicit communication. Zulkifly (2021) found that worker participation did not always lead to high safety compliance in Malaysia's manufacturing firms due to poor communication and inadequate safety training.

This study compares its findings with those on worker involvement in the manufacturing industry and confirms that worker involvement plays a significant role in improving safety compliance. Furthermore, the effectiveness of this intervention can be strengthened when combined with good management support and good communication. The findings further supported the claim that worker involvement in safety discussion and decision making helps embed safety consciousness intoworkplace culture. In conclusion, the worker involvement was demonstrated to have a big and positive impact on safety compliance.

5.3 Safety Communication can significantly influence safety compliance

The findings indicate that safety communication has a strong influence on safety compliance and is the most significant predictor in this study. Effective communication plays a crucial role in ensuring that employees understand safety policies, hazard reporting mechanisms, and emergency procedures, ultimately leading to greater adherence to safety regulations.

This is further supported by Cowley et al. (2021), who discovered that clear and timely safety communication significantly improves compliance, as workers regularly exposed to safety messages are more likely to use safety rules. For instance, Quaigrain et al. (2024) found that safety communication among employees in the oil and gas industry was more effective when it was reinforced and employees were constantly reminded of the safety expectations and procedures. Shaikh et al. (2021) also discovered that corrective feedback and safety communication reinforcement are instrumental in making workers' behavior in line with safety requirements.

Furthermore, this research in the Malaysian manufacturing industry found that safety communication enhances both safety performance and compliance consistent with the findings of Mashi et al. (2020). Nevertheless, as reported by Bello et al. (2024), many Malaysian manufacturing companies do not have a clear communication channel making it prone to confusion and misunderstanding about safety policies. Even in industries with a high focus on safety communication, the communication could be too technical for people to understand and comply as reported by Hamim et al. (2021).

The findings of the current study are also compared with previous findings which indicated that safety communication is a critical factor to ensure safety compliance. The results emphasise the importance of clear, frequent and easily understandable communication strategies to increase adherence to safety regulations. This research concludes that safety communication was found to be a strong and positive safety compliance predictor.

5.4 Safety Training insignificantly influence safety compliance

Although safety training exhibited a statistically significant moderate correlation with compliance, its effect in the regression model was not significant.. This implies that although safety training helps to build knowledge and awareness, it does not directly lead to compliance unless other factors that are not part of the training are present, such as worker involvement and effective communication.

In contrast to various previous studies that reported a strong positive relation between safety training and compliance, this study demonstrated a stronger efficacy of safety training in promoting compliance. As reported by Zulkifly et al. (2021), higher adherence of employees to safety protocols is shown by those who had frequently attended safety training. Similarly, Osei-Asibey et al., (2021) also highlighted that workers in the construction industry that received prolonged training on safety were more likely to adhere to the safety laws and workplace regulations. Structured safety training programs were also shown to enhance the employee compliance by promoting awareness and proactive safety behavior (Berhan, 2020).

However, some studies align with the findings of this research. Zhang et al. (2024) highlighted that while safety training improves compliance, it is ineffective when training frequency is low or lacks practicality. Umeokafor et al. (2022) also confirmed that safety training alone is not enough to ensure worker compliance unless it is complemented byclear communication and active employee engagement. Similarly, Dugolli (2021) emphasized that safety behavior modification through training should be continuous and interactive.

The findings of this study suggest that while safety training is valuable, it may not be the most critical factor in achieving compliance. It is suggested that safety training has to be reinforced through good communication and active worker participation. Although employees may receive training, its effectiveness is limited without a workplace culture that encourages and supports compliance. Although this study did not establish a significant relationship between safety training and safety compliance, this does not suggest that safety training is unimportant. Instead, its effectiveness depends on proper implementation and reinforcement in which worker involvement and effective safety communication play a crucial role. This aligns with recent studies that highlighted the value of engagement in fostering compliance. These findings underscore the need for organizations to integrate safety training with other initiatives rather than relying solely on training programs."The study supports the findings of Ajmal et al. (2022) and Cowley et al. (2021)’s on the significant role of the worker involvement and communication in enhancing safety compliance. However, it contrasts with the findings of Osei-Asibey et al. (2021) and Zulkifly et al. (2021) which which reported a positive association between safety training and compliance. The

dissimilarity may be due to the implementation and reinforcement of training programs which vary among different industries and organization contexts.

Taken together these findings imply that organizations should concentrate on forming a safety culture based on participation and communication rather than training. Future research may examine ways to increase the effectiveness of both safety training and integration between safety training and other safety measures. In conclusion, two of the three research objectives were achieved. The findings indicate that worker involvement and safety communication have significant effect on safety compliance, while safety training has no direct impact.

5.5 Contribution of the study

This study makes valuable contributions to workplace safety research in the manufacturing industry by offering theoretical, practical, and policy-level insights. It highlights the significant role of worker involvement, safety communication, and safety training in promoting safety compliance among employees. The contributions are relevant for academia, industry practitioners, and regulatory bodies because the study shows for an integrated approach to workplace safety management.

This study contributes to the safety compliance literature by empirically examining the relationship between safety communication, safety training, and worker involvement in the manufacturing sector. While previous research has examined these variables independently, this study integrates them into a single framework to better understand their combined effects on safety compliance. First, this is study was able to confirmed that worker involvement and safety communication are very important in influencing safety compliance, while safety training itself has minimal direct impact.

This does not support the existing models which assume that training is the largest driver of compliance to safety requirements. According to the findings, training has to be driven by energetic worker participation and strong communication channels to yield any real benefit. Through this, it gives new insights to the safety management theories, particularly in the high-risk industry manufacturing.

Secondly, the study addresses and corroborates with relation to behavioural safety theories, including the Theory of Planned Behaviour (TPB) and Safety Climate Theory. This reinforces the idea that employees are more likely to adhere to safety measures when they perceive their role as significant and when safety communication is clear and readily accessible. The study contributes to the literature on participatory safety management, reinforcing the growing emphasis on worker engagement roles.

From a practical perspective, this study serves a valuable information to manufacturing industry leaders, safety officers and human resource managers to increase workplace safety compliance. The results indicates that organizations should not only focus on training programs but also prioritize improving workers participation and enhancing the delivery of safety communication. The key takeaways is that management should actively involved in safety decision making process. Top down safety policies can be implemented by many organizations without consulting workers, but may resulted to lower compliance. Yet, this study highlighted that the likelihood of employees following safety protocols is higher if employees participating in safety discussion committees, and in decision making. For this reason, organizations should establish structured work involvement programs, urge workers to report safety issues and give suggestions for the workplace safety improvement.

The study also shows the significance of safety communication on compliance. If making safety communication clear and consistent among all levels of the organization is not possible, manufactuirng company should use multiple channels of communication like meetings, digital platforms, and visual signage to broadcast their safety messages effectively. Manufacturing company should encourage a two way communication channel since employees will be able to express their concerns, ask questions, and join in safety discussions. Although safety training had no direct link with compliance, this variable continues to be an important element of workplace safety. Organizations ought to consider altering their training programs to be interactive, practical and applicable to actual scenarios. Continuous reminders and reinforcement through communication and worker involvement initiatives should be combined with training.

This study has policy implications for regulatory bodies, government agencies and workplace safety organizations. Training is generally required by current occupational safety regulations, although the involvement of workers and communication are not considered as critical compliance factors. This study suggest that policies should be adjusted to adopt a holistic framework that integrates these elements with existing regulations to enhance workplace safety. Regulatory agencies and policy makers should consider mandating worker's involvement in safety planning and decision-making, ensuring that employees have a voice in workplace safety policies. This can be done by encouraging the implementation of structured safety communication strategies, requiring organizations to establish open communication channels for reporting safety concerns, and enhancing workplace safety inspections by

assessing not just training compliance but also the effectiveness of communication and worker engagement initiatives.

Moreover, this study further contributes to the debates on the international safety standards, for instance the standards examined by Occupational Safety and Health Administration (OSHA) and International Labour Organization (ILO). The study demonstrates the critical role of worker involvement and communication in supporting improvement of global safety frameworks.

In conclusion, this study makes a significant contribution to both the theory as well as practice of workplace safety. It challenges conventional notions on the use of safety training and reinforces the importance of integrating worker involvement and safety communication into compliance strategies.. The study has practical impacts on organizations to increase safety compliance through structured involvement programs and clear communication strategies. The study offers measures, policy wise, of occupational safety regulation by accentuating participatory safety management. This, finally, offers an opportunity to further research the effectiveness of safety training in integrating the training lesson with communication and engagement strategies.

5.6 Limitation of the study

While this study presents valuable information about the factors impacting on safety compliance within the manufacturing sector, limitations of this study need to be acknowledged. All of these limitations are due to the aspects of sampling, methodology, data collection and generalizability of findings. This is important because it offers directions for future research and helps to interpret the study's results in context.

Despite its limitation of a single industry and geography, this study is one of very few studies providing evidence of interactions and the effects on compliance. As this research was conducted in the manufacturing sector, the results may not be universally applicable to industries such as construction, healthcare, and transportation, where safety compliance dynamics may differ. Furthermore, the study was carried out in a particular geographic area where uniquel regulations, culture factors, and organization practise may influence workplace safety. Other countries or other industries may also experience different results due to different regulatory environments and cultures in the workplace.

Another limitation is that the data were obtained through self-reported surveys.. Although surveys are useful for understanding employees' safety compliance perceptions, they are prone to social desirability bias and self-reporting errors. The respondents may have over or under estimated their level of compliance with safety practices because of fears of job security. Future research was suggested either to use direct observational methods or safety incident reports to supplement survey responses and ensure objective assessment of compliance.

Our study is also limited by being cross-sectional. As it was collected at a single point in time, it was difficult to establish a causal relationship between worker involvement, safety communications, safety training, and safety compliance. While the study establishes strong correlations and significant regressions, it does not account for potential changes in these relationships over time.. A longitudinal study would be better able to determine whether improvements in compliance are a result of producing a change in worker involvement, communication and training that sustains a higher level of compliance.

As reported, safety training was found to be insignificant in relation to compliance, contrasting with findings from some previous studies.. Another possible explanation might be due to the study not distinguishing between different type of training such as incumbent vs. outsider, mandatory vs. voluntary, or frequent vs. sporadic training. Future research will focus on studying the impact of various forms of training and its frequencies on compliance to shed light on its role in the workplace safety.

In addition, sample size and demographic distribution also contributes to the limitation of the study. Statistical analysis was feasible with the existing sample size. However, a larger and more diverse sample across multiple industries and regions would enhance the generalizability of the results. Moreover, factors such as age, job roles, and experience level, which may influence safety compliance, were not analyzed in depth. Despite these limitations, the study provides important contributions to workplace safety research. While acknowledging these constraints, future research can build upon these findings by addressing industry-specific variations, incorporating multiple data sources, and using longitudinal designs to enhance the understanding of safety compliance factors.

5.7 Recommendation for the future research

The findings of this study provide useful information regarding the interrelationship of worker involvement, safety communication, safety training, and safety compliance in the manufacturing sector. Nevertheless, several areas remain underexplored and warrant further research to expand on these findings and address the study's limitations. Future research should explore broader context in which the study

can be conducted, utilizing alternative research methods, and generated causal relationships, and industry specific variations to enhance the understanding of workplace safety compliance.

The next step for research is to widen the study across several industries and across different locations. The application of this study's results might not be applicable to other industries, for example, construction, healthcare, logistics, oil and gas, due to the differences in the safety challenges and regulatory requirements. Comparative studies across various sectors would provide a broader perspective on whether worker involvement, communication, verification, and training make any difference in how much effort is expended to comply in different environments. Also, cross-country studies could shed light on how varying cultural and regulatory influences affect safety compliance as well as communication of safety measures to make them more universally applicable.

Future research should also include longitudinal studies to determine whether safety compliance changes over time. Due to the cross sectional nature of this study, observation on safety compliance was only able to be attained one point in time. The longitudinal approach would allow the researchers to track evolution of safety compliance with changes in policies, training programs, or the communication strategies. Such an effort would enable us to tell whether worker involvement and communication have any longterm effects on compliance and determinining effecctive strategies in securing sustained improvement.

Further research on the types of safety training could be a valuable area of focus. However, in contrast to previous studies, this study did not find a significant direct impact of safety training on adherence. Future studies should distinguish between different formats of training such as hands-on training, interactive simulation, digital learning, or classroom instruction which maybe more effective in improving compliance. It is also suggested that research should concentrate on how training frequency, an engagement level and the practical application affects workers' behavior, as not all training programs have the same influence on all individuals.

Other factors that would mediate and moderate the safety compliance should be explored further. Since this study was focused on worker involvement and types of communication and training in regards to safety, other factors such as organizational culture, leadership style, remuneratory programs of safety, and workplace hazards may influence on compliance. Future studies could investigate how these factors influence safety behavior in interaction with worker involvement and communication. Investigation on the use of strong safety leadership to improve worker involvement communication would provide additional insight on safety management.

Another important recommendation is to employ mixed-method research to enhance the depth of understanding as the current study relied on self-reported survey data, which may be influenced by social desirability bias. In addition to quantitative data, future research should include the use of qualitative approaches, such as depth interviews, focus groups and workplace observations to enrich the available information on factors influencing compliance.

Numerous studies, including this research, have identified factors that influencing compliance. However, further research is needed to test and evaluate work place interventions that will increase employee engagement, improve communication and increase training effectiveness. Empirical evidence on the best approaches to instilling a strong safety culture in a workplace can be obtained through field experiments or through study on intervention. Ultimately, addressing these research gaps will allow future studies to build upon the findings and further enhance the understanding of workplace safety compliance.

5.8 Conclusion

The objective of this study was to investigate the effect of worker involvement, safety communication and safety training on safety compliance practices for employees in the manufacturing industry. Worker involvement and safety communication have significant impact on safety compliance, whereas safety training have minimal impact. The results of these tests demonstrate that training programs alone are not sufficient to ensure safety compliance, rather these results highlight the importance of effective engagement and communication in leading to safety compliance.

The findings supported that when workers are involved in safety related decisions, discussions and initiatives, they tend to comply with workplace safety requisites. Employees who participate and provide feedback in decision-making process will feel important and acknowledged in the company which ensure compliance. Likewise, it helps to communicate safety policies, hazards and emergency procedures in such a manner that the workers fully understand and avoid violation of

the rules. An open communication channel and hazard reporting mechanism creates safety culture within the organization to ensure that they comply to the regulations.

The finding that safety training would not significantly affect compliance is unexpected and emphasized that training alone is not enough unless communication and active participation reinforce it. Training is given to employees, but without continuous engagement and clear communication on compliance expectation, the impact remains minimal. The findings challenge traditional safety management approaches that favor training over communication and worker involvement, highlighting the limitations of relying solely on isolated safety management solutions..

By integrating these three safety factors into a single framework, this study contributes both theoretically and practically to explaining behavioural safety theories, such as the Theory of Planned Behavior (TPB) and Safety Climate Theory. From a practical standpoint, the findings offer recommendations to organizations on ways to encourage workers to contribute to safety compliance programs, by improving communication strategies, establishing formatives worker involvement programs, and changing the formatives training programs to relatively engaging and participative.

However, this study has limitations, in which only one industry that been studied and its heavy reliance on self reported survey data. These findings require further research through industry- wide comparison, longitudinal studies, and mixedmethod approaches to ensure validation. Additionally, analyzing the effectiveness of various training formats and their relationship to communication and worker involvement can contribute to improving workplace safety.

Overall, the study highlights that the worker participation and communication have a greater influence on safety compliance than the training alone. Organizations seeking to reduce workplace accidents rates should prioritize open dialogue, transparency, and actively engaged to foster a culture of compliance.

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Appendix A: Survey Questionnaire

Age

1. 18-25 years
2. 26-36 years
3. 37-47 years
4. 48-58 years
5. Above 58 years

Gender

1. Male
2. Female

Educational background

1. High school certificate or equivalent
2. Diploma
3. Bachelor's degree
4. Master's degree or higher

Years of working experience in manufacturing industry

1. Less than 1 year
2. 1-5 years
3. 6-10 years
4. 11-15 years

5. More than 15 years

Job Role

1. Operator/Technician
2. Supervisor/Team leader
3. Engineer
4. Manager

Work shift

1. Day shift
2. Night shift
3. Normal shift

Descriptive scales

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

No	*Questions*	*Responses*				
Demographic						
1	Age	1	2	3	4	5
2	Gender	1	2			
3	Educational background	1	2	3	4	
4	Years of working experience in manufacturing industry	1	2	3	4	5
5	Job role	1	2	3	4	
6	Work shift	1	2	3		
DV: Safety Compliance						
1	I carry out work in a safe manner	1	2	3	4	5
2	I use all necessary safety equipment to do my job	1	2	3	4	5
3	I use the correct safety procedures for carrying out my job	1	2	3	4	5
4	I ensure the highest level of safety when carrying out my job	1	2	3	4	5
5	I encourage coworkers to use safety equipment to perform their jobs	1	2	3	4	5
6	Sometimes because of work conditions, I ignore health and safety principles	1	2	3	4	5
IV: Worker's Involvement						

1	In decision making related to safety matters, top management appreciates suggestions from workers in the organization	1	2	3	4	5
2	In the safety committee, safety experts and representatives provide mutual suggestions to improve workplace safety	1	2	3	4	5
3	Top management welcomes suggestions from workers to promote workplace safety	1	2	3	4	5
4	In workplace matters related to safety, issues are also discussed with workers	1	2	3	4	5
5	Workers actively participate in safety-promotion programs to improve workplace safety	1	2	3	4	5
IV: Safety Communication						
1	Workers have opportunity in their department to report hazards before they occur	1	2	3	4	5
2	In our organization, top management encourages workers to share ideas about improvements in workplace safety	1	2	3	4	5
3	My company has an open-door communication policy, and in the meeting, employees can give suggestions for improvement	1	2	3	4	5
4	The goals for safety performance in my organization are clear to the workers	1	2	3	4	5

5	There is open communication about safety issues in this workplace	1	2	3	4	5
6	I often discuss with my supervisor about safety-related matters	1	2	3	4	5
7	My organization uses social media to create awareness about safety issues in the workplace	1	2	3	4	5
IV: Safety Training						
1	Our company arranges extensive training programs to train employees related to workplace safety issues and challenges	1	2	3	4	5
2	Newly joined employees are trained adequately to maintain workplace safety on a formal and informal basis	1	2	3	4	5
3	In the organization's safety-training programs, priority of safety is highlighted to lower the rate of occupational accidents and injuries	1	2	3	4	5