THE INFLUENCE OF SAFETY TRAINING ON TECHNICIANS' SAFETY CULTURE IN THE PHARMACEUTICAL MANUFACTURING INDUSTRIES IN KENYA

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The Influence of Safety Training on Technicians' Safety Culture in the Pharmaceutical Manufacturing Industries in Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

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This thesis has been submitted for examination with our approval as the University Supervisors

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DEDICATION

I dedicate this thesis to my parents Mr. & Mrs. Josiah Miring'u.

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ACRONYMS AND ABREVIATIONS

ACS	American Chemical Society
ANOVA	Analysis of variance
CCPS	Centre for Chemical Process Safety
CiP	Chemicals in Products
COMESA	Common Market for Eastern and Southern Africa
DOSHS	Directorate of Occupational Safety and Health Services
EoL	End of Life
FINIDA	Finnish International Development Agency
GLP	Good Laboratory Practices
GMP	Good Manufacturing Practices
HSE	Health Safety Education
HSE	Health Safety Executive
IFC	International Finance Corporation
ILO	International Labour Organization
INSAG	International Nuclear Safety Advisory Group
KIPPRA	Kenya Institute of Public Policy Research Analysis
LTI	Lost Time Injury
NASA	National Aeronautics and Space Administration

OJT	On the Job Training
OSH	Occupational Safety and Health
OSHA	Occupational Safety Health Act
OSHO	Occupational Safety and Health Officers
PMI	Pharmaceutical Manufacturing Industries
PPB	Pharmacy and Poisons Board
PPE	Personal Protective Equipment
SCMM	Safety Culture Maturity Model
SDG	Sustainable development Goals
SPSS	Statistical Package for the Social Science
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation

ABSTRACT

Technicians in pharmaceutical manufacturing industries work in sensitive occupational settings. They are routinely exposed to chemical hazards due to the nature of their work. In order for them to perform, safety is paramount. This research assessed the influence of safety training on safety culture of technicians in pharmaceutical manufacturing industries in Nairobi County. To achieve the objective, descriptive survey research design was employed. In selecting the study sample purposive sampling was utilized. Thirty-three (33) Pharmaceutical Manufacturing Industries were selected based on the inclusion criteria from the study area, Nairobi Metropolitan. Pharmaceutical Manufacturing Industries formed the sampling unit from where respondents were drawn. The population of the study was 4,000 employees drawn from the sampled Pharmaceutical Manufacturing Industries. The sample of the study was three hundred and seventy nine (379) respondents, who comprised of Technicians. Data was collected through self-administered structured questionnaires and observation. The collected data was subjected to quantitative and qualitative analysis by employing SPSS. The results show that the safety maturity level recorded in 85% of the pharmaceutical manufacturing industries is at continually improving safety maturity level and only 15% of the sampled industries were at the involving safety maturity level. This was based on an analysis of the safety culture key dimensions. The findings have also shown that majority of the respondents at 75.4% had their first encounter with OSH training at work environment commonly referred to as On the Job Training (OJT) and only 23.3% were trained during their academic/professional education. The findings have shown that a majority of the respondents; 89.0 % and 80.8% of the respondents had been trained on the requirements of OSH Act 2007 and Evacuation procedures respectively. Notably, the training area with the least awareness was Exposure Limits of hazardous chemicals and substances at 29.1% across all PMI's. The p values for OSH Training and Safe work documentation are $p<0.001$ and 0.421 respectively, indicating that OSH training is a statistically significant predictor of Safety Culture. Based on the results the study accepts the null hypothesis; there is a statistically significant difference in influence of safety training on safety culture of technicians among pharmaceutical manufacturing industries. The study therefore concludes that OSH training has a significant positive influence on safety culture in pharmaceutical manufacturing industries in Nairobi, Kenya. The study indicates that there is need to incorporate OSH competency in the professional training of potential employees in the pharmaceutical manufacturing industries in Kenya.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

The pharmaceutical industry is a sector in which companies, government regulators and researchers focus more on the safety of the products and their effects on end users and the environment. Although Epidemiological studies show that there are very few studies on morbidity and mortality amongst pharmaceutical workers, it is well documented in material safety data sheets (MSDS) that majority of the chemicals and pharmaceuticals have adverse health effects on human health (Heron & Pickering, 2003). Most of these chemicals used in pharmaceutical manufacturing industries contain heavy metals, persistent organic solvents and poly-chlorinated biphenyls. The unsound management of chemicals presents a predictable chemical hazard to pharmaceutical workers if they are exposed (UNEP, 2006).

Pharmaceutical workers may be exposed to uninhibited doses and durations of pharmaceutical chemicals, increasing the risk of undesirable health effects. Due to the different routes of exposure including inhalation, skin contact, or ingestion uncommon health effects, not routinely observed in treatment of patients in most hospitals, may emerge. While the production of medicines has considerably advanced human health and well-being, it has also introduced work-related hazards that may negatively affect worker health and safety (UNEP, 2006).

Among the healthy workers, any effects of drugs, whether positive or negative, should be considered serious and should be prevented. On the other hand, the manufacture of drugs has brought immense benefits to humanity, and at the same time it has had negative impacts on human health and safety (UNEP 2020).

The Pharmaceutical industry in Kenya consists of three segments namely the manufacturers, distributors and retailers. All these play a major role in supporting the country's health sector, which is estimated to have about 4,557 health facilities countrywide. Kenya is currently the largest producer of pharmaceutical products in

the Common Market for Eastern and Southern Africa (COMESA) region, supplying about 30% of the regions' market. Kenya has thirty-three (33) active pharmaceutical manufacturers (IFC, 2020).

A wide range of stakeholder groups across the globe recognize the presence of chemicals in products as an issue of concern and that they need more information regarding chemicals in products (Azimi, 2012). The underlying argument for this need is the recognition that products are vehicles through which chemicals travel through our societies. When these chemicals are exposed to consumers, they may cause harm in relation to product safety for the consumer/use as well as environmental protection with respect to impacts caused throughout the products life cycle. Similarly, occupational safety and health for people handling or using the product in their work, in production and distribution, at the point of sale and in the End of life (Eol) management of products may also be exposed (UNEP,2020).

The technician's close relationship with chemicals and their major contribution to processes of drug manufacture provide them with a profound insight into chemical problems as well as potential solutions to cope with them. Realization of this potential is, however, contingent on availability of an efficient system of encouragement, support, non-punitive and blame-free culture that allows the technicians to contribute to safety improvement without any fear of unfair punishment. Most developed countries have realized that in addition to exploiting modern technology and advanced managerial systems, high safety and reliability achievement is contingent on improving personnel safety behaviours through integrating safety attitudes to their values, beliefs and practices in establishing a "culture of safety" (Azimi *et.al.*2012).

The safety culture of an institution reflects the actions, attitudes, and behaviours of its members concerning safety. These members include the managers, supervisors, and employees in the industrial setting. The prevailing health and safety culture within an organization is a major influence on the health and safety related behaviour of people at work (American Chemical Society, 2012).

The development of a positive safety culture is important if high standards of health and safety are to be achieved and maintained. Serious chemical accidents, incidents or near miss within an organization are often thought to be the result of a weak or deficient safety culture (American Chemical Society, 2012).

It is widely accepted that if hazards are to be effectively controlled in the work environment then there is need to have effective management processes in place. Many organizations have learnt that there are limits to what can be achieved simply by using a systems-based approach to OSH such as the use of 'safe systems of work' and 'safe operating rules and procedures' are of little benefit if employers are not committed to their application. Increasingly, organizations are recognizing the significant part that human factors play in the maintenance of high standards of OSH. Safety culture is multi-faceted and includes workers' views of the importance their employer gives to OSH relative to quality or production output or how committed managers/supervisors are to OSH (Hay, 2010).

Previous studies on influence of training on safety culture have shown that staff with more knowledge and understanding of safety issues, are more cooperative in error reporting and alerting the upcoming events. Azimi *et al,(* 2012) asserts that to effectively enhance safety attitudes one of the strategies that can be employed is capacity building of workers at all organizational levels. Such training programs the aim of improving safety culture, have positive influence on occupational safety and individuals' safety perceptions. Despite the important role training plays on building staff's safety attitudes, little emphirical data exist to support this especially in developing countries such as Kenya. This study aims at contributing to the body of knowledge on the influence of training on technicians on safety culture in the pharmaceutical manufacturing industries

1.2 Statement of the Problem

Studies in developed countries have shown that training on safety culture equips workers with more knowledge and understanding of safety issues directly affecting safety culture maturity (Kariuki, 2018). Globally, many workers still face significant risks in their workplaces, and work accidents remain prevalent. From 2015 to 2022,

the global average level of national compliance with labour rights declined by 7%. (The SDG Report 2023) Annual global chemical use is projected to double between 2017 and 2030. The health impacts of these chemicals are higher in developing countries where chemicals management capacity limited. UNEP, 2023

In Kenya, training on chemical safety is a legal obligation of the employer where the Directorate of Occupational Safety and health services (DOSHS) is responsible for enforcement. (OSHA), 2007. It has not been ascertained whether pharmaceutical manufacturing companies consistently implement and evaluate the impact of such training programs on their safety culture, especially in relation to the occupational health and safety of their workers. The Kenya policy on OSH clearly shows the need to strengthen the involvement of workers and their representatives in matters relating to occupational safety and health and the need to improve the safety culture at workplaces, (Ministry of Labour, 2012). Hence the need for a positive safety culture in the pharmaceutical manufacturing Industry work-environments. This research aimed at assessing the extent to which safety training influences the safety culture in the pharmaceutical manufacturing industries in Nairobi Metropolitan, Kenya. This study establishes the relationship between OSH training, and safety culture in Pharmaceutical Manufacturing Industries in Kenya.

1.3 Justification of the Study

The growing number Kenyan population fuelled the growth of industries' capacities including the pharmaceutical industry. To stabilize the growth in pharmaceutical industry there is need for commensurate investment in the occupational safety and health of workers. The Constitution of Kenya (2010), under Chapter Four (The Bill of Rights), Article 41(2)(b), provides that every worker has the right to *reasonable working conditions*. This provision imposes a constitutional obligation on both the State and employers to ensure the provision, protection, and promotion of safe and healthy working environments (Republic of Kenya, 2010). However, in the recent past, data has shown an increase in number of accidents and incidents in pharmaceutical manufacturing industries and the situation seems to be getting out of hand despite existence of OSHA 2007. This might be attributed to the low awareness

and low knowledge on OSH. Research shows that safety culture maturity from developed countries has established a relationship between training and the number of accidents. This study intended to demonstrate the relationship between training, exposure and workplace compliance in OSH in pharmaceutical industries and the possible impact of non-compliance.

1.4 Objectives of the Study

1.4.1 Main Objective

To assess the influence of training on safety culture among technicians in pharmaceutical manufacturing industries in Nairobi county

1.4.2 Specific Objectives

1. To assess the safety culture of technicians' in pharmaceutical manufacturing industries
2. To establish the levels of technicians' safety training in pharmaceutical manufacturing industries
3. To determine the relationship between training in OSH and the technicians' safety culture in pharmaceutical manufacturing industries
4. To compare the technicians' safety culture in different pharmaceutical manufacturing industries

1.5 Research Questions

1. What are the levels of technician's safety training in pharmaceutical manufacturing industries?
2. What is safety culture maturity level of pharmaceutical manufacturing industries in Nairobi County?
3. What is the relationship between training in OSH and the technicians' safety culture in Nairobi County?
4. What are the levels of the technicians' safety culture in different pharmaceutical manufacturing industries in Nairobi County?

1.6 Scope of the Study

The research assessed the safety culture maturity level and the role of safety training amongst pharmaceutical workers in manufacturing in compliance to OSHA 2007. The study obtained data from employees, managers and other pharmaceutical technical staff.

1.7 Hypothesis of the study

In order to test the reliability of the data generated, null hypothesis was formulated. The null hypothesis developed was;

$H0_1$- There is no statistically significant influence of safety training on safety culture of technicians among pharmaceutical manufacturing industries in Kenya.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Safety culture has been defined as the product of individual and group values attitudes, perceptions competencies and patterns of behaviour that determine the commitment to and the style of proficiency of an organisation health and safety management (HSC, 1993). The prevailing health and safety culture within an organization has a major influence on the health and safety related behaviour of people at work especially in high risk industries such as the pharmaceutical manufacturing industry.

In Kenya, despite existence of relevant occupational safety and health (OSH) laws and regulations OSH problems are still prevalent across manufacturing industries in various sectors (Tait *et al*. 2018). The pharmaceutical manufacturing industry is focused on producing generic medicine whereby most raw materials utilised in the manufacture of pharmaceutical products especially the medicine, are imported in the form of active primary ingredients. (Kurunthachalam, 2012). Most of these raw materials contain chemicals such as heavy metals, persistent organic solvents and poly-chlorinated biphenyls which pose serious and irreversible impacts on the human heath (UNEP, 2006).

In an organization where a great safety culture exists, everyone prioritizes the other person's health and safety as they work. Everyone tends to share accurate perceptions of the risks with peers and adopts the same positive attitudes to health and safety as an acceptable way of doing handling safety issues. Some of the key characteristics that catalyze an effective safety culture include competent of staff in their respective skill area as well as training programs in health and safety (Vinodkumar. & Bhasi, 2010)

2.2 Theoretical Principles

2.2.1 Chemical Safety

During the United Nations Conference on Sustainable Development, (2012) sound management of chemicals was documented as a critical approach in protecting human health and the environment, reaffirmed the need to achieve Sound Management of Chemicals (SMC) throughout their life cycle by 2020 which leads to reduction of hazardous waste adverse effects on human health and the environment. However, the global goal of realizing the sound management of chemicals by 2020 was not met, even with efforts made under some global agreements and guidelines (OHCHR, 2023).

Chemicals are classified as the world's largest risk factor for disease and premature death, contributing to occupational mortality, sicknesses and disabilities annually. The sound management of chemicals is indispensable in the attainment of the 2030 Agenda for Sustainable Development goals. Poorly managed Chemicals put at risk sustainable development; the total cost of inaction is at ten per cent of the global gross domestic product (GDP). Exposure to chemicals especially at work hampers the satisfaction that comes from a safe working environment that is; the right to a safe and healthy working environment. There is a tendency of higher impacts of chemical exposure on people, informal workers and vulnerable groups such as women and children. Gender equality therefore can contribute to the sound management of chemicals (UNEP, 2023).

Globally chemical substances, and their derivatives, are extensively used across various manufacturing industries, including pharmaceutical manufacturing. Due to their toxic and hazardous nature, chemicals can pose significant risks. They may be flammable, explosive, or carcinogenic, and can enter the environment through air, water, food, or materials. These inherent risks need to be managed throughout all stages production, use, transport, storage, and disposal in an environmentally sound manner. Chemical hazards in the form of mists, vapours, gases, dusts and fumes; pose exposure risks to workers during production, storage, transportation, and disposal.

Technicians operating in these manufacturing environments may inhale or absorbed through the skin. These chemicals, which are often invisible to the naked eye posing very serious health risks that, require stringent safety measures (Goetsch, 2019).

Chemical safety is achieved by undertaking all activities involving chemicals in such a way as to ensure the safety of human health and the safeguarded environment. It covers all chemicals, natural and manufactured, and the full range of exposure situations from the natural presence of chemicals in the environment to their extraction or synthesis, industrial production, transport, use and disposal.

According to ILO (1993), it is obligatory that suppliers ensure that Material Safety Data Sheets (MSDS) for all hazardous chemicals are prepared, and are provided to employers as well as any revisions thereof. Pharmaceutical workers and their representatives should have a right to access the chemical material safety data sheets and to receive information on them in forms or languages they easily understand. Employers should not use any hazardous chemicals until they have obtained the appropriate information and have given this information to the workers in a form and language that they can easily understand. Verbal information may be appropriate in straightforward cases, but further training will often be required, supported by written instructions on methods of work, precautionary measures and action to be taken in the event of an emergency.

The challenge facing Africa is how to safely harness the benefits of chemicals. While Africa is currently neither, a major consumer nor is it a producer of chemicals in global terms, the level of risk faced by poor countries disproportionately higher than in those with sufficient resources to effectively manage and monitor chemical use. Additionally, the poor populations in countries seeking employment in industries are more vulnerable to chemical-related illnesses; their well-being may be further compromised by lack of access to information about the impact of chemicals, and their living conditions and work places may leave them exposed to these hazards of toxic chemicals (UNEP 2006). Industry predictions show that future global growth in the chemicals industry will be led by pharmaceuticals, followed by specialty chemicals, agricultural chemicals, textile fibres and industrial chemicals. Currently,

petrochemical commodities, polymers and fertilizers are the main chemical products from the African industry. (Ray, *et.al.*2014). Nonetheless, African countries have immense potential capacity in pharmaceuticals production and many are already investing in oil and gas, which are key drivers for the chemicals industries. Thus, Africans will thus face increased exposure to chemicals as a result of the growth of global trade in chemicals, changing production patterns and the predicted relocation of chemical production to developing countries, the growing market for chemical products, increasing urbanization and the lack of adequate resources for infrastructural development and maintenance particularly in the water sector, and increased industrial employment and corresponding work place exposure to chemicals (Suuronen,2011).

The pharmaceutical industry is generally regulated by the Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in order to minimize the risks that might have an impact on the safety of the patients. The purpose of the regulations is to quality assurance of the pharmaceutical products. Confirming that the intended product requirements such as identity, quality and purity characteristics. Regulations cover the whole product lifecycle right from the transport of the raw materials, the production, quality control and assurance processes, to the final product and finally the disposal of the product (Goetsch, 2019).

Although pharmaceutical industry accidents rarely reach the public media, statistics shows that serious accidents do happen and small accidents are quite common.

It is recommended, that all pharmaceutical manufacturing and production should evaluate their laboratories from the operations and maintenance perspective for ensuring personnel awareness of safe laboratory practices. A comprehensive safety program and chemical management that includes medical surveillance, hazardous material control and hazardous work detection as well as proper waste management is essential in pharmaceutical company for a good laboratory safety (Modica 2007).

In Kenya, The National Chemical Policy (2022) highlights inefficient industrial production processes and unsustainable consumption patterns as key sources that lead to excessive waste generation. This has been cited in spite of efforts that

encourage circular economy. Research and monitoring identified as a critical component that would contribute to sound management of chemicals to enhance sustainable development. The need for research is further emphasized due to the urgency to understand the toxic behaviour and mechanisms of toxicity of various chemicals for dissemination to the local and intonations communities. The policy recommends need to establish routine monitoring and reporting of the status of hazardous chemicals in water, air, and human samples which was not available.

2.3 The Concept of Safety Culture

Workplace safety has been generally ignored by organizations in order to augment profitability. Recently, safety concerns have increased due to a series of catastrophic events taking place across many different industries worldwide. On the other hand, researchers indicate that a positive safety culture can significantly contribute to the prevention of work-related injuries (Cole, *et.al* , 2013).

The term safety culture was first cited in a report by the International Nuclear Safety Advisory Group (INSAG) following the 1986 Chernobyl disaster. The concept of safety culture is derived from the concept of organisational culture, which has been studied from two principal perspectives that is a functionalistic and an interpretive perspective (Glendon & Stanton, 2000).

Following the functionalist approach, culture is viewed as a critical variable that influences certain outcomes: safety, reliability and so forth. On the other hand, the interpretive researchers' concept of culture is as a root metaphor for the organisation and they tend to approach organisations as if they were cultures (Burrell & Morgan, 1995).

According to the functionalistic approach, safety culture refers to shared attitudes, values, beliefs, and practices concerning safety and the necessity for effective control; as such, safety culture relates to the product of individual and group values, attitudes, competencies, and patterns of behaviour that determine the commitment to as well as style.

Process safety culture has been defined by the Center for Chemical Process Safety (CCPS) largely as generally how things are done in the organization, or the expectations and finally how people behave when no one is watching.

Hence it is safe to deduce that within an organization safety culture exists and is influenced on many levels. Individuals have their own set of beliefs and values based on their personal biases and experiences. Leaders within an organization have their own set of individual beliefs and values as well, but they also have a broader accountability for the organization's well-being. Leaders tend to influence others on a daily basis through their conversations, their decisions, their behaviours, and their actions. Collectively, groups within an organization shape their own cultural identity through the perceptions, interactions, and behaviours of their group members. (Choudhry,*et al* ,2014).

2.3.1 The Evolution of Safety Culture in the Pharmaceutical Manufacturing Industry

As a response to increasing public concern around pharmaceutical manufacturing industry safety, the pharmaceutical industry began in the late 1980s to focus on applying total quality management and reducing product liability risks. Safety management evolved into the product quality and safety concept (Domokos, *et.al* 2021)

A quality concept emerged expressing how to produce pharmaceutical products that are safe for human consumption. The Pharmaceutical Manufacturing Market manufacturing chain can be considered as a hybrid shop generating natural and artificial human living space in which to work. It represents risks at multiple levels, which are connected through the material basis having the effect, effect probability, and exposure, all relevant at the workplace level. The holistic approach of the PMM chain forces an organization to be open to a full spectrum of methods within the field of ergonomics, offering added value to traditional safety management aspects. (Domokas *et al* 2021)

In order to manage these regulatory, process operational safety, and distribution process risks in the different steps of its value chain, the highly internationalized pharmaceutical sector uses various risk management techniques like process risk statistics, preventive and periodic control, self and external process control, operation, and quality management. Especially for the operating party, the pharmaceutical industry generates an encapsulated human living environment.

In recent years, studies indicate that significance of a well-developed safety culture has been progressively acknowledged, as it has been found to be in the same way, if not more, fundamental than a comprehensive technological safety management system. (Sanders, 2015).

It is worth noting that the pharmaceutical manufacturing industry is a highly regulated and a safety-sensitive sector, where a strong safety culture is essential for ensuring the safety of employees, patients, and the community (Domokas *et. al* 2021).

2.3.2 Safety Culture Theories

In order to manage this safety related multi-level risks, the integrated safety culture reflective of every level of the PMM manufacturing chain was designed. This model is based on the viewpoint of, organizational culture, strategy, and output matrix. When the actual value chain is compliant or can be supplemented with the necessary additional details, this broad safety culture model serves as a foundational framework that can be customized for other process production industries. (Sanders, 2015)

Another Safety Culture model by the NASA Space Shuttle Disasters, the CCPS identified core principles necessary to maintain a positive safety culture. The first principle that was identified was maintaining a sense of vulnerability within an organisation. Another principle identified was to eliminate the regularization of any deviations however small the deviation. The third core principle was to establish a bias for safety in all activities in the organisation. The performance of valid and timely hazard and or risk assessments was identified as the fourth core principle.

Another core principle that was highlighted was open and forthright communication; last but not least it was also recommended that the culture is learnt and advanced.

The Baker Panel report (2007) organized their findings into slightly different, and perhaps more measurable, categories for evaluating process safety culture. These include: process safety leadership, employee empowerment, resources and positioning of process safety capabilities and the incorporation of process safety into management decision-making. Maturity models involve defining maturity levels which assess the completeness of organizations based on sets of conventional multi-dimensional criteria (Wendler, 2012)

Hudson (2007) defines the use of maturity models in safety culture in terms of a continuum ranging from organisations that have insecure cultures through to those who manage safety proactively and those who are at a transitional stage of improvement Organisations are perceived as progressive through the phases, by maintaining or improving the strengths and eliminating the weaknesses of the previous levels (Fleming, 2001).

A maturity model is a descriptive model in the sense that it describes essential, or key, attributes that would be expected to characterize an organization at a particular level. Regardless of the model structure that was chosen or the descriptions assigned to different categories, it was evident that process safety culture is a very real, finite, and tangible concept which can be measured, monitored, and improved over time. Proactively working toward, a more positive process safety culture will minimize process safety incidents, and this will save lives.

2.3.3 Safety Culture Maturity Model

This Safety Culture Maturity Model by Fleming is widely accepted in the high-risk industries such as Oil & Gas, Nuclear and Pharmaceutical Industries and is monitored through critical elements of safety culture. Assessment, whether qualitative or quantitative, of a safety culture requires the identification of characteristics, and further adoption of indicators that will allow the assessment of the level of safety culture, (Carrillo, 2019).

In the pharmaceutical manufacturing industry, the methodology includes a questionnaire concerning different safety culture elements based on went further in the development of the Fleming model and used in their work the following components in the assessment of safety culture: information on accidents and incidents or unusual events, the organization's ability to learn, employee engagement, communication, and commitment of leaders (Anastacio, *et al* 2018).

To begin with, Commitment of the leaders which is one of the primary drivers of a strong safety culture is the commitment and leadership demonstrated by management. Managers must visibly prioritize safety, allocate resources for safety initiatives, and actively involve themselves in safety-related activities. This sets the tone for the entire organization and influences employee perceptions of the importance of safety. Safety Culture in the pharmaceutical manufacturing industry cannot be effective without strong management buy-in and support (Sanders, 2015).

This is due to the sensitivity of safety risk associated with pharmaceutical production. Without management's active involvement in fostering a safety culture, the success and sustainability of safety programs are unlikely (Ali et al., 2017)

Another critical element is Safety communication which can be achieved through employee involvement is another key aspect of a robust safety culture. Top-down and bottom-up engagement are essential. Senior management must communicate the importance of safety, set clear expectations, and provide the necessary resources and training. At the same time, employees at all levels should be empowered to identify and address safety concerns, participate in safety-related decision making, and take ownership of safety practices. Technical employees working in the manufacturing industries play a crucial role in identifying and mitigating safety risks. According to (Acosta *et al*., 2014), employees are often the change initiators when it comes to safety culture and the organization turns to them for expertise, advice, and implementation.

The availability of safety resources is at the heart of safety culture in the pharmaceutical industry, the specific pharmaceutical manufacturing industry must also ensure the availability of appropriate safety resources, including training,

personal protective equipment, and well-designed safety management systems. Safety-related training and competency development are essential to equipping employees with the knowledge and skills necessary to identify, prevent, and respond to safety incidents. The necessary resources to facilitate training need to be planned for adequately. It is these resources that will ensure that the working environment of these meets the OSH Act requirements (Acosta *et al.*, 2014).

Finally, is the Safety competence and learning culture within the pharmaceutical industry. The culture ideally should foster a learning environment where employees are encouraged to report incidents, near-misses, and safety concerns without fear of repercussions. The industry should prioritize continuous improvement, analyzing safety data, and implementing corrective actions to prevent the recurrence of incidents. Developing a culture of competence and learning is crucial for the pharmaceutical industry, where production processes and regulatory requirements are constantly evolving. The most successful organizations include and involve senior management in facility tours and safety meetings and make accountability for safety part of performance (Azimi *et al.*, 2014).

In conclusion, the key dimensions of a strong safety culture in the pharmaceutical manufacturing industry include management commitment, safety communication, availability of safety resources, and a learning environment that prioritizes safety competence.

2.3.4 Elements of the Safety Culture Maturity Model

The elements that form the safety culture maturity model have been adapted from the safety culture components listed by the HSE in HSG487. It is unlikely that these elements will map exactly onto the factors that companies have previously measured in safety culture or climate surveys, because there is considerable variation in the proposed elements of an organization's safety culture. Some researchers argue that safety culture is composed of the safety attitudes of an organization's employees and others propose that it is much wider incorporating systems, attitudes, values, beliefs and organizational symbols. The elements used in the safety culture maturity model contain the most common components of both theoretical and measurement models.

An organization's or installation's level of maturity is determined on the basis of their maturity of these elements. It is likely that an organization will be at different levels on the ten components of the SCMM. Deciding which level is most appropriate will need to be based on the average level achieved by the organization or installation being evaluated. The safety culture maturity of an organization consists of ten elements which include: Management commitment and visibility, Training, Communication, Productivity versus safety, Learning organization, Safety resources, Participation, Shared perceptions about safety. Trust, Industrial relations and job satisfaction

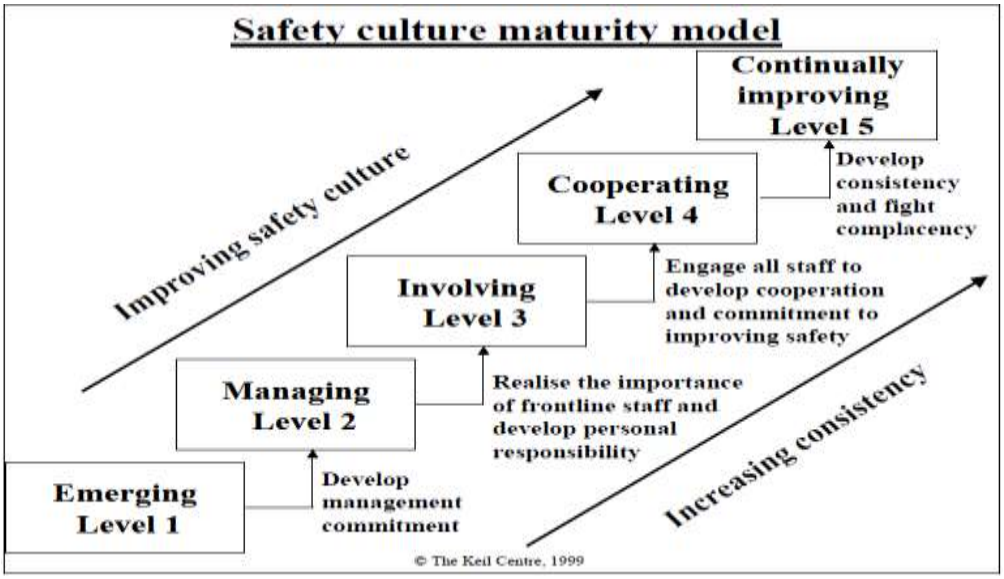

Figure 2.1: Safety Culture Maturity Model

Adapted from The Keil Centre (1999) Safety Culture Maturity Model.

2.3.5 Five Levels of Safety Culture Maturity Model

The safety culture maturity model as presented above is set out in a number of stages. It is proposed that organizations progress sequentially through the five levels, by building on the strengths and removing the weaknesses of the previous level. It is therefore not advisable for an organization to attempt to jump or skip a level. For example, it is important for organizations to go through the managing level before

the involving level as it important that managers develop their commitment to safety and understand the need to involve frontline employees (HSE, 2005).

2.3.5.1 Level One: Emerging

Safety is defined in terms of technical and procedural solutions and compliance with regulations. Safety is not considered as a key business risk and the safety department is perceived to have primary responsibility for safety. Numerous accidents are seen as unavoidable and as part of the job. Most frontline staff members are uninterested in safety and may only use safety as the basis for other arguments, such as during changes in shift systems (HSE, 2005).

2.3.5.2 Level Two: Managing

The organisation's accident rate is average for its industrial sector but they tend to have more serious accidents than average. Safety is seen as a business risk and management time and effort is put into accident prevention. Safety is solely defined in terms of adherence to rules and procedures and engineering controls. Accidents are seen as preventable. Managers perceive that the majority of accidents are solely caused by the unsafe behaviour of front-line staff. Safety performance is measured in terms of lagging indicators such as LTI and safety incentives are based on reduced LTI rates. Senior managers are reactive in their involvement in health and safety (i.e. they use punishment when accident rates increase (HSE, 2005).

2.3.5.3 Level Three: Involving

Accident rates are relatively low, but they have reached a plateau. The organisation is convinced that the involvement of the frontline employee in health and safety is critical, if future improvements are going to be achieved. Managers recognise that a wide range of factors cause accidents and the root causes often originate from management decisions. A significant proportion of frontline employees are willing to work with management to improve health and safety. The majority of staff accept personal responsibility for their own health and safety. Safety performance is actively monitored and the data is used effectively (HSE, 2005).

2.3.5.4 Level Four: Cooperating

At this stage usually, the majority of staff in the organisation are convinced that health and safety is important from both a moral and economic point of view. Managers and frontline staff recognise that a wide range of factors cause accidents and the root causes are likely to come back to management decisions. Frontline staff accept personal responsibility for their own and others health and safety. The importance of all employees feeling valued and treated fairly is recognised. The organisation puts significant effort into proactive measures to prevent accidents. Safety performance is actively monitored using all data available. Non-work accidents are also monitored and a healthy lifestyle is promoted. (HSE, 2005).

2.3.5.5 Level Five -Continuous Improvements

At this stage the prevention of all injuries or harm to employees (both at work and at home) is a core company value. The organisation has had a sustained period (years) without a recordable accident or high potential incident, but there is no feeling of complacency.

They live with the paranoia that their next accident is just around the corner. The organisation uses a range of indicators to monitor performance but it is not performance-driven, as it has confidence in its safety processes. The organisation is constantly striving to be better and find better ways of improving hazard control mechanisms. All employees share the belief that health and safety is a critical aspect of their job and accept that the prevention of non-work injuries is important. The company invests considerable effort in promoting health and safety at home.

It is important to note that while it is assumed that safety performance improves with increasing levels of maturity, based on research that compared high and low accident organizations, which revealed that lower accident organizations tended to display the features associated with higher levels of maturity (HSE, 2005).

2.4 Safety Training

2.4.1 Implementation of Safety Training in Pharmaceutical Industries

Globally, the labour force in all segments and across the world; are exposed to unsafe and unhealthy working environments every day. Many are dying due to occupational accidents and diseases; with millions more anguish from work-related injuries or chronic illnesses (World Health Organization [WHO] & International Labour Organization [ILO], 2021). As new dynamic forces affect the labour landscape, workforces must now cope with a variety of emergent hazards, over and above those that previously existed. Aside from the devastating impacts on individuals, their families and communities, the impact on enterprises' efficiency and productivity and the economic losses for societies are also of importance. (WHO, 2023)

Global reports guide that to enhance safety culture; participatory safety training programs are recommended. In addition, relevant regulatory bodies are asked to mainstream by instructing and regularizing official audits on safety training, Sound management of chemicals, Sound Management of Chemicals is well articulated in eleven out of the seventeen Sustainable development goals (SDG) amplifying the significant role towards the realization of the Sustainable Development agenda 2030.

2.4.2 Status of OSH Training in Kenya

According to OSH Policy (2012), the scenario in several Kenyan pharmaceutical manufacturing Industries, is that safety training is consistently reactionary rather than proactive; usually prompted by incidents rather than embedded in proactive risk management approach for sustainability. This affects the safety culture maturity levels of such industries. This scenario is replicated other developing economies. It is also worth noting that safety culture can be a very elusive concept to monitor, meaning that it is difficult to quantify, measure, influence, and even manage. Most would agree that it is difficult to assign an absolute, quantitative measure of good or bad Culture. However, it is possible to identify measure, analyze, and improve certain activities and characteristics that are recognized as key components of a positive process safety culture.

There exists a glaring knowledge gap in the safe and healthy working conditions; a situation that has been worsened by the ineffective human resource development. Thus, a communal need for awareness programmes amongst the working force on OSH issues is imperative. Kariuki, *et al* (2018) asserts that a lack of ample funding to propel OSH programs, the absence of a proper relationship between the promotion of OSH Act and WIBA and scanty research focusing on OSH in Kenya rescind any improvements.

Kenya has an approximate population of about 36.8 million people; out of that number, roughly two (2) million are engaged in the formal sector and 8.8 million are employed or self-employed in the informal sector across the country. (ILO, 2013)

Data from the published reports indicates that the state department DOSHS, has only about eight hundred and seventy-seven (877) trained active Occupational Safety and Health experts, which would hardly cover the numerous registered workplaces, therefore not capable of inspecting the estimated registered 140,000 workplaces, the results is that most workers are therefore exposed to OSH hazards without intervention. DOSHS coverage is currently in only in 29 counties, this means that the remaining 18 counties have no dedicated OSH officers (OSH-MIS, 2023/2024) Safety awareness levels are extremely low in the rural areas, especially in areas which are insufficiently covered by DOSHS officers, and thus workers in these areas are exposed to OSH hazards (ILO,2013)

People can cause or contribute to accidents through human error, directly causing an accident. However, people tend to not make errors deliberately. We are often conditioned by the way our brain processes information, by our training, the design of equipment among other factors. Historically health and safety and welfare are issues that have been subject of public debate in Kenya. The enactment of the factories act Cap 514 in 1951 saw the emergence of occupational safety and health. The crafting of this legislation followed the enactment of the workers' compensation act Cap 236 in 1948. In 1974, was requested during the 62nd International Labour Conference for assistance to reinforce factory inspection that is the establishment of specific inspections this led to the ILO/FINIDA project that in 1978 that established

specialised divisions in the OSH State department including; occupational hygiene, Engineering controls and occupation medicine, these were in addition to the usual field services and general inspection. (International Labour Organisation, 2013)

To support these divisions and also as part of the key outputs from the ILO/FINIDA project was the addition of the following competencies to OSH state department that is three medical officers specialised in occupation medicine, four nurses specialised in OSH, four occupational hygienists and also the institution of laboratory and work environment monitoring and assessment. This was the first time that comprehensible occupational health services and most importantly training were being offered in Kenya (International Labour Organisation, 2013)

Occupational Health and Safety Services are entrenched in the laws of Kenya, in 1990, an amendment to the Factories Act was done and the Factories and Other Places of Work Act was enacted, once again, in 2007 this Act was annulled, and was substituted by the Occupational Safety and Health Act. The Work Injury Benefits Act (WIBA) was legislated in the same year. The laws are run by the Directorate of Occupational Safety and Health Services (DOSHS). Other relevant legislations also exist such as the Public Health Act, Cap 242, The Environment and Coordination Act 1999, the Radiation Protection Act, CAP 243, and the Pest Control Products Act Cap 346. These laws are prescribed by diverse ministries and departments of the Kenyan Government (Kenya OSH Profile 2012). Other subsidiary Legislations and regulations exist through legal notices they are mainly concerned with factory rules.

The amendments in the act were to reflect developments in equipment and information but also to address additional areas of coverage other than factories and industries. The last such revision was in 1990 to include among others direct penalties for medical practitioners failing to report occupational diseases that they diagnose, list of occupational diseases, pre-employment, periodic and post-employment medical examinations and research into cases of occupational diseases among others.

Currently, the Directorate of Occupational Safety and Health Services (DOSHS) is anchored in the Government of Kenya, Ministry of Labour, Social Security and

Services. Legal Notice No. 31 that formed Safety Committees in factories and other places of work, which regularly employed more than 20 employees. From the OSH committees enacted by Safety and Health Committee Rules, 2004 which are tasked with the responsibility for overseeing OSH implementation, and performing safety audits (GOK 2010). It has been consistently reported that gaps persisted with reports that more than half of the work-related accidents and injuries went unreported or unattended. East African countries are in the process of drafting a harmonised OSH policy and legislation; this is in line with the global OSH strategy adopted in the 91st ILO Conference. The process would require collaboration with Social partners.

OSH training is a significant part towards the enhancement of positive safety culture. OSH training shapes perceptions and attitudes that promote identification of potential hazards and elimination of such hazards. Fehér, & Reich. (2020) emphasizes that training plays a key role in safety culture maturity model. For instance, new employees should be instructed in safe practices and procedures as part of the induction process to inculcate positive safety culture. According learning activity which is focussed in the direction of the acquisition of specific Knowledge and skills for a task shapes safety culture in the work environment (Cole, *et.al* 2013).

2.5 Relationship between Safety Training and Safety Culture

Technicians' safety training is critical in fostering a vibrant safety culture within the pharmaceutical manufacturing industry, the employees encounter chemical risks during the production processes. The International Labour Organization (2021) emphasizes that integrating safety training programmes as a fundamental practice reinforces safety culture meaning that promoting for safety training as a basis for proactive safety culture (ILO, 2021).

This is principally imperative in pharmaceutical manufacturing industry where a failure to recognize hazards can have serious health effects on the workers. Research also shows that planned safety training augments workers capabilities in especially chemical hazard identification and risks and their respective control and mitigation measures prioritizing positive safety culture (Karim et al., 2025).

2.5.1 Pharmaceutical Chemical Work Hazards

The attainment of sound chemical management in the pharmaceutical industry requires a coordination mechanism amongst the various sector players in chemicals management. Whereby, Chemicals hazards can be recognised through the material safety data sheets. In evaluating the safety culture within a pharmaceutical manufacturing industry, several key questions must be well-thought-out. One important area is how easily errors that could endanger a colleague are conveyed to the manager. The ease or trouble of reporting such incidents often reflects the maturity of the organizational safety culture and the level of trust between technical workers and the management. When workers feel safe to report errors without fear of retaliation, the organization is more likely to identify and avert potentially dangerous situations before they cause harm.

However, there is a real risk when employees choose not to report or correct unsafe conditions to avoid criticism or disciplinary action. Fear of negative consequences may lead to silence, allowing hazards to persist unaddressed. This hesitation undermines both individual and collective safety and points to a need for a non-punitive approach to error reporting an approach that prioritizes learning and prevention over liability.

Additionally, the ability of workers to communicate effectively is essential to maintaining a safe working environment. A shared common language enhances clarity in communication, especially when handling sensitive standard operating procedures or incidence reporting. Yet, in culturally diverse work environments, language barriers can pose significant challenges. As Modica (2007) notes, acceptable safety practices in one country may have slight variations with those in another, sometimes complicating adherence to standard procedures in a host country. This discrepancy emphasizes the need for clear, standardized communication protocols and training that take cultural differences into account to ensure all workers understand and follow safe practices consistently.

Pharmaceutical Industry workers may have difficulties in interpreting the significance of adverse events, or risk factors if they have any limitation in

comprehending the subject matter. Therefore, support and frequent collaboration and discussions between the workers and management is needed for the explanation of the risks and how to reduce it. Organization culture may have a negative or positive impact on how new practices are adopted in the organization. It is said, that the organization safety culture has its own history and it has been formed on the personnel relationships and management practices. When performing changes, one should also know organization specific culture environment and perform changes by respecting it. (Cooper. (2001) It is always better if there is sufficient time and resources to plan and do the changes jointly with the personnel. Authoritarian style should be avoided whenever possible, since by this way personnel's motivation for work is significantly lower.

Tiffany, *et al* 2019 asserts that the reason for establishing occupational health and safety practices at work place and managers must undertake accident prevention measures to minimize the pain and suffering the injured worker and their family are exposed to as a result of the accident. The happiness of the family depends upon the health and safety of the worker who normally is the bread winner. Leveson (2016) found that effective workplace health and safety practices can help to save the lives of workers by reducing hazards and their consequences. Poor working conditions can affect the environment workers live in. This means that worker, their families, other people in the community, and the physical environment around the workplace, can all be at risk from exposure to workplace hazards. All these can be eliminated by the implementation of OSH practices in the organization

2.6 Research Gaps

The objective of the study was to assess the influence of safety training on safety culture among technicians in pharmaceutical manufacturing industries in Nairobi Metropolitan, Kenya. It recommended that a similar research should be conducted with other variables or of other firms in other sectors such as the health sector. A review of literature indicated that there was limited research on the toxic behaviour and mechanisms of toxicity of various chemicals used in industrial products and

agriculture which are currently lacking. Thus, the findings of this study serve as a basis for future studies on compliance issues in the sector.

2.7 Theoretical and conceptual framework

A positive culture has several elements which determine the level or success of implementation. These elements are mainly determined by the commitment of the organization which ensures its compliance. They are elements of a positive safety culture that includes: adequate safety and Health resources which refers to budgetary allocation and competent human resource in safety and health, Independent professional training of technicians, acquired safety and Health training at the workplace, Safety standards & Management commitment and visibility as shown in figure 2.2.

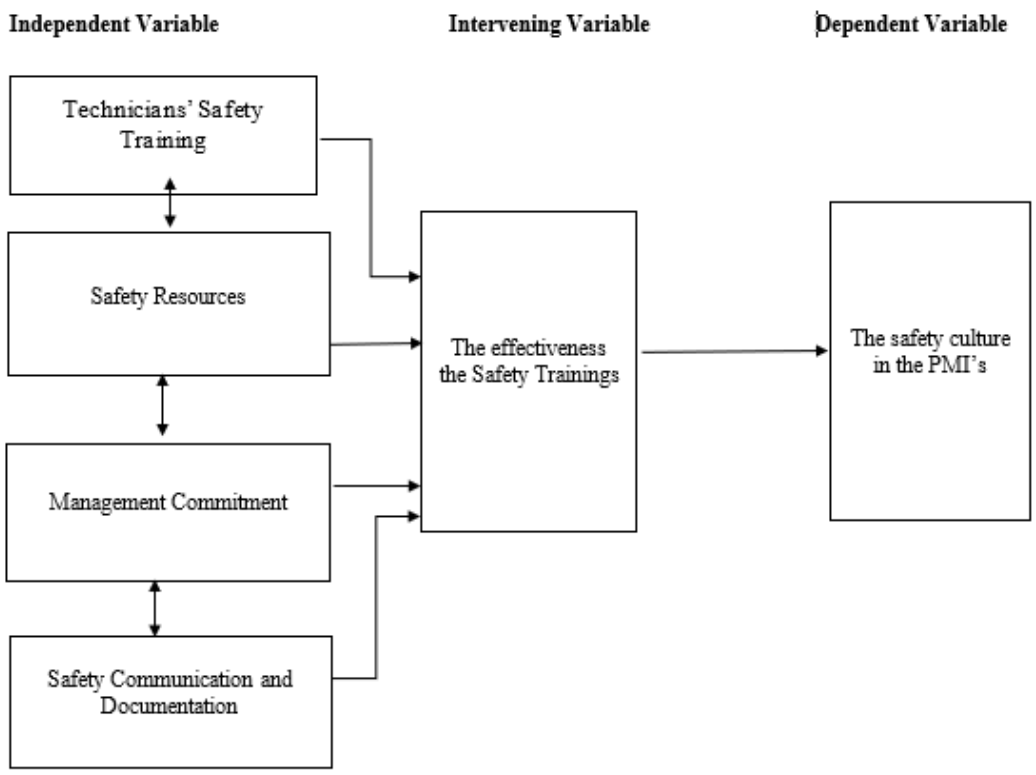

Figure 2.2. Diagrammatic Representation of the Conceptual Framework

Adapted from The Keil Centre (1999) Safety Culture Maturity Model.

CHAPTER THREE

MATERIALS AND METHODS

This chapter describes specific procedures and tools that were used in the study. It discusses the research design, study location, population of the study, sampling procedures and sample size, instrumentation, data collection and data analysis.

3.1 Study Design

The selection of a research design is largely guided by the fitness for purpose. The purpose of the research determines the methodology and design of the research. The study adopted a descriptive survey research design. The descriptive research design describes and interprets the individuals and the events that constitute their various fields of inquiry (Cohen & Manion, 2005).

3.2 Study Area and Population

The study was carried out in Nairobi Metropolitan Area. Nairobi county being the capital city of Kenya hosts eighty five percent of the pharmaceutical manufacturing industries in Kenya (Pharmacy and Poisons Board. Register). The county also houses the Directorate of Safety and Health Service (DOSHS) headquarters providing proximity to occupational safety and health regulatory services. The researcher studied a target population of approximately four thousand (4000) workers which was drawn from thirty-three (33) pharmaceutical manufacturing industries in Nairobi County which formed the sampling units. The number of Pharmaceutical Manufacturing Industries was picked from the actively registered with Pharmacy and Poisons Board register (PPB, 2019.)

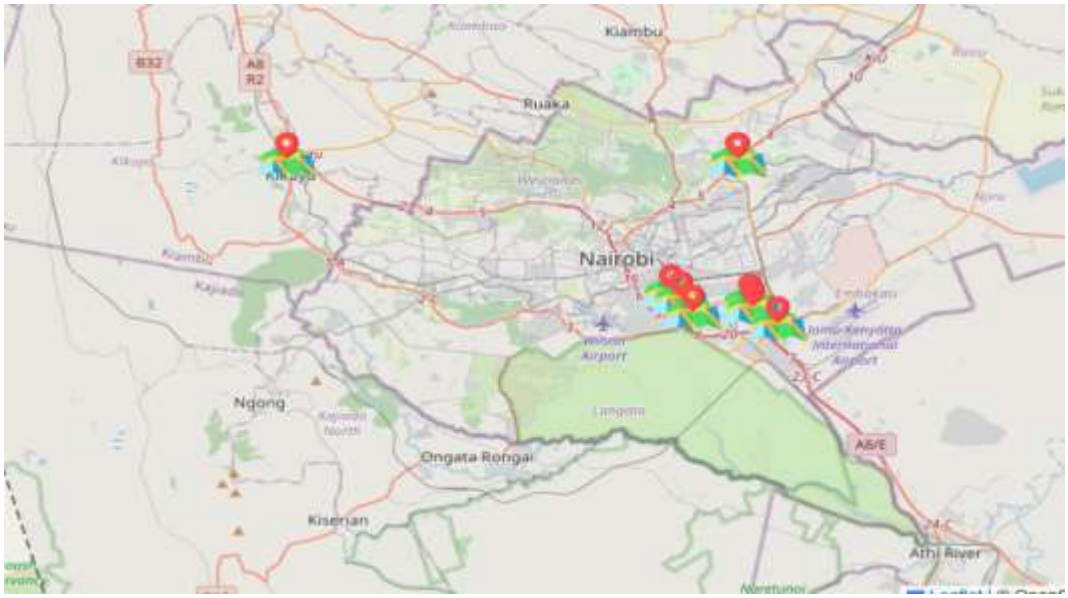

Figure 3.1: The Study Location -Nairobi Metropolitan

Adapted from Survey of Kenya (2024)

3.3 Sampling Techniques

Purposive sampling method was adopted to obtain ten (10) PMI's who met the inclusion criterion. The Inclusion criteria were pharmaceutical manufacturing industries located within the study area since over eighty-five (85%) of all the pharmaceutical manufacturing industries are located within the Nairobi Metropolitan; willingness to participate in the research and domestic pharmaceutical manufacturers. According to the Kenya Pharmaceutical Industry, Diagnostic Report 2020; the average market share of domestic manufacturers stood at 30%.

3.3.1 Sample Size Determination

To determine a representative and appropriate sample size, this research study adopted the sample size determination guiding principle by Bartlett *et.al* (2001). Their model offers recommended sample sizes for different population sizes at a 95% confidence level with a ±5% margin of error, which are standard parameters in social science research.

Given that the total population across the samples pharmaceutical manufacturing companies was estimated to be around 4000 employees**,** the recommended minimum sample size, as indicated on Table 1 below is a minimum of 351 respondents. This study targeted a sample size of 379 respondents**,** which falls well within the recommended range and exceeds the minimum requirement. This approach was adopted to improve data reliability and allow for possible non-responses, ensuring adequate representation and statistical power for meaningful analysis.

Table 3.1: Determination of the Sample Size for Continuous and Categorical Data

Population Size	**Sample size**					
	Continous data (margin of error=0.03)			**Categorical data (margin of error = 0.05**		
	Alpha=.10 t=1.65	**Alpha=.05 t=1.96**	**Alpha=.01 t=2.58**	**Alpha=.10 t=1.65**	**Alpha=.05 t=1.96**	**Alpha=.01 t=2.58**
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	77	105	170	209	270	382
1000	79	106	173	213	278	399
1500	83	110	183	230	306	461
2000	83	112	189	239	323	499
4000	83	119	198	254	**351**	570
6000	83	119	209	259	362	598
8000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

Adapted from Bartlett, *et.al* (2001)

3.3.2 Sample Selection

According to Mugenda, & Mugenda (2003**)**, when determining a sample size in descriptive studies, 10% of the accessible population is considered adequate for obtaining reliable and valid results.

In this study, proportionate random sampling was employed to ensure unbiased representation of the target population across the sampled Pharmaceutical Manufacturing Industries (PMIs). This method allowed the researcher to select respondents from each PMI in proportion to the number of eligible technicians within that industry. The method ensures generalizability of the findings as the structure of the population within the sample is maintained.

To determine the actual number of participants per industry, the total number of accessible technicians was established. A sample was then drawn from this population, and the number allocated to each PMI was calculated based on its relative share of technicians as shown in Table 2 below;

Table 3.2: Distribution of Technicians across the PMI's

PM1 Code	Population	Sample
PMI 001	144	48
PMI 002	184	62
PMI 003	189	63
PMI 004	144	48
PMI 005	114	38
PMI 006	57	19
PMI 007	84	28
PMI 008	56	19
PMI 009	82	27
PMI 010	78	26
Total	**1132**	**379**

3.4 Research Instruments

In this research study, questionnaires and observation checklists were employed as the main data collection instruments based on Occupational Safety and Health (OSH) standards and practices, Adapted from the Health and Safety Executive (HSE) the Safety Culture Maturity Model, Hudson (2001).

The questionnaire was designed for the respondents (technicians) within the Pharmaceutical Manufacturing Industries (PMIs). The questionnaire contained a mix of structured (close-ended) items using a Likert scale and a few open-ended questions. These were intended to capture both quantitative and qualitative data from

the industry. The observation checklist was used to allow the researcher to assess visible compliance with OSH practices such as the use of personal protective equipment (PPE), safety signage, cleanliness, and review of documents. The choice of these instruments was informed by their and ability to gather data from a large sample the combination of questionnaires and direct observation enhanced the validity of the data collected.

3.5 Data Processing and Analysis

An introductory letter addressed to the respondents from The Institute of Energy and Environmental Technology (IEET) at Jomo Kenyatta University of Agriculture and Technology was obtained. Later, research authorization was obtained from National Commission for Science and Technology and Innovation (NACOSTI) and the ethics committee. Emails were sent to the sampled pharmaceutical industries to inform them of their inclusion in the study and of the intended visit. For the non-responsive respondents, follow up call were made to the pharmaceutical industries. Questionnaires were delivered on a drop and pick basis to all pharmaceutical industries and were self-administered. Respondents and work place observation for safety culture performance indicators and determination of chemical exposure levels was done on the same visit. Objectives of the study were reviewed and data sorted according to the variables and objectives of the study. Data was analyzed using both descriptive and inferential statistics. Means, percentages, frequencies, standard deviations, Chi square, Analysis of variance (ANOVA) and Pearson moment correlation were used to analyze data related to all objectives. All data was analyzed using Statistical Package for Social Sciences (SPSS) Version 20

CHAPTER FOUR

RESEARCH FINDINGS, AND DISCUSSIONS

4.1 Research Findings

This chapter describes the analysis, results and discussions generated from the data. The data collected during the research was analysed, coded and tabulated for, interpretations, and discussions. The chapter applies the descriptive statistics using statistical measures such as mean, standard deviation, graphs and charts to explore the nature of results under the study. A questionnaire was used during the study to collect the data from the respondents of this research.

4.2 Response Rate

The study questionnaires were administered to the Technicians and out of 379 questionnaires administered, 344 were dully filled and returned making a response rate of 91%. This involved 296 technicians, 30 supervisors and 18 health and safety representatives which was statistically acceptable. A response rate of above 70% is excellent and representative (Mugenda & Mugenda, 2003).

4.3 Demographic Information

Demographic information provides data regarding research participants and is necessary for the determination of whether the individuals in a particular study are a representative sample of the target population and testing appropriateness of the respondent in answering the questions for generalization purposes (Mugenda and Mugenda, 2003). The demographic information for the study inquired of the respondent's bio-data which included, gender, age, marital status, academic qualification and job title and their respective department.

4.3.1 Gender Distribution of the Respondents

To determine the distribution of gender of the technicians, the data was analysed as shown in the Table 4.1. The findings indicate that majority of the respondents were

male at 56.8%. 39.4% indicated that they were female while 3.8% preferred not to say. According to ILO (2013); it is critical to integrate gender differences in the design of occupational safety and health (OSH) strategies, procedures and protocols and hazard control. The argument put forward indicates that it is critical to acknowledge that there exist differences between the two genders which if ignored could pose challenges in the implementation of effective OSH management systems in any work environment including the pharmaceutical manufacturing industries. (ILO, 2001).

Table 4.1: Distribution of Gender of the Participating Technicians

Gender of the respondents		
Gender	**Frequency**	**Percent**
Male	196	56.8
Female	137	39.8
Prefer not to say	11	3.20
Total	344	100

4.3.2 Age of the Respondents

The research findings on age of respondents showed that 87.2% of the respondents were aged between 18-35 years. 38.4% indicated 31-35 years, 5.8% indicated 18-25 years, 5.2% indicated 36-45 years while 1.7% indicated over 45 years as shown in Table 4.2. The Occupational risk to physical hazards is significantly higher among younger workers than among older workers in any organisation.

They are more likely to engage in risk affairs as opposed to the older workers who are risk that more awareness in the form of trainings on occupational safety and health for young workers to increase their knowledge and hence reduce the risk to tolerable levels. (Kines et.al, 2013).

Table 4.2: The Distribution of the Age amongst the Participating Technicians

Age Bracket of the respondents	Frequency	Percent	Valid Percent
18-25	20	5.8	5.8
26-30	168	48.8	48.8
31-35	132	38.4	38.4
36-45	18	5.2	5.2
Above 45	6	1.7	1.7

4.3.3 Marital Status of the Respondents

The study sought to establish the marital status of the respondents. The findings indicate that majority (52.7%) were married, 34.6% were single while only 12.7% were divorced or separated as shown on Table 4.3. This means that majority of the participating technicians were settled in families. These families have substantial value to the workers hence the need to safeguard the workers and breadwinners from stress and physical occupational injuries.

Table 4.3: Marital Status of the Participating Technicians

Marital Status of the Respondents	Frequency	Percent	Valid Percent
Married	176	51.2	51.2
Single	125	36.3	36.3
Divorced/separated	43	12.5	12.5
Total	344	100.0	100.0

Leslie I.B (2011) asserts that in the recent past more women have joined the manufacturing industries including the pharmaceutical manufacturing industry. In addition, more households are being headed by single employed persons. Both trends tend to substantially condense parents' open time. These two scenarios create increased pressure in the event of family health problems, including work-related injuries and illnesses. Hence the need to for safe working environments which shield workers from occupational diseases and injuries.

4.3.4 Highest Academic Qualifications of the Respondents

The researcher also sought to establish the academic qualification of the technicians. The results indicated that 53.5% of the technicians were holders of a bachelor's

degree, 34% were diploma holders, 11.7% were certificate holders and only 1.5% were masters' degree holders as shown in Table 4.4. This is a good sign which confirms that most technicians meet the minimum requirement hence are considered easy to equip with more knowledge.

Table 4.4: Highest Academic Qualification of the Respondents

Highest academic qualification of the respondents	No of respondents	Percent	Valid Percent	Cumulative Percent
Certificate	38	11.0	11.0	11.0
Diploma	117	34.0	34.0	45.1
Degree	184	53.5	53.5	98.5
Masters	5	1.5	1.5	100.0

The data was collated against the gender of the respondents which showed that most of the Degree & Diploma holders were male whereas most of the certificate level holders were female. The findings are analyzed and shown on Table 4.5.

Table 4.5: Cross-Tabulation of the Highest Qualification and Gender of the Participating Technicians

Highest academic qualification of the respondents and Gender of respondents				
Highest academic qualification of the respondents?	Gender of respondents			Total
	Male	Female	Prefer not to say	
Certificate	17	21	0	38
Diploma	64	48	5	117
Degree	112	66	6	184
Masters	3	2	0	5
Total	**196**	**137**	**11**	**344**

These findings align with the labour trends in the pharmaceutical industry report (International Finance Corporation2020).

The specific areas of training included diverse relevant fields including; biochemistry at 15.1 %, Microbiology at 9.3 %, Analytical Chemistry at 18.3% and the highest was Industrial Chemistry at 20.6 %, and other related disciplines such as Manufacturing Engineering, Laboratory Biosafety and Biotechnology. Most of the production and quality assurance managers and supervisors had specialized in

Bachelor of Pharmacy and Diploma in Pharmaceutical Technology. This was in alignment with the regulatory requirements of the Pharmacy and Poisons Board (PPB) for the Pharmaceutical manufacturing industries.

Table 4.6: Specific Academic Qualifications of the Respondents

Specific Academic Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
Analytical Chemistry	63	18.3	18.3	16.3
Applied Biology	54	15.7	15.7	34
Biochemistry	52	15.1	15.1	49.1
Biotechnology	4	1.2	1.2	50.3
Bachelor of Pharmacy	1	0.3	0.3	50.6
BSc. Food Science & technology	4	1.2	1.2	52.9
Industrial Chemistry	71	20.6	20.6	73.5
Laboratory Biosafety	1	0.3	0.3	73.8
Manufacturing Engineering	23	6.7	6.7	80.5
Microbiology	32	9.3	9.3	89.8
Pharmaceutical Technology	23	6.7	6.7	96.5
Pharmaceutical technology	2	0.6	0.6	97.1
Procurement/Supplies	10	2.9	2.9	98.9
others	4	1.1	1.1	100
Total	**344**	**100**	**100**	

4.3.5 Department and Job Titles Held by the Participating Technicians

The researcher sought to determine the job titles and departments where the participating technicians were attached. The findings show that majority of the respondents 43.2% belonged to the quality control departments, 20.3% to the in-process quality assurance function, 18.8% to the production department, 12.2% the stores and 5.5% indicated administration related roles.

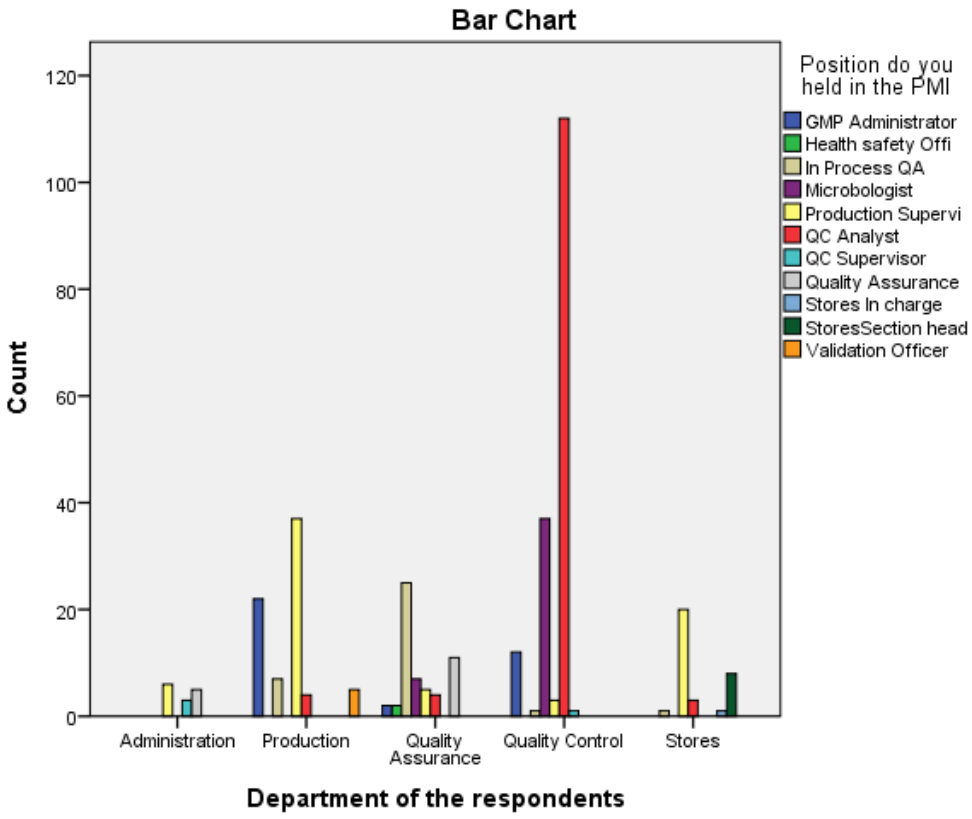

Figure 4.1: A Bar Chart Showing Distribution of the Job Titles by the Departments of the Respondents

4.4 Analysis of the Levels of Technicians' Safety Training in Pharmaceutical Manufacturing Industries

According to an ILO report assessing the OSH qualification systems at national level in the year 2024 around the world many workplaces including pharmaceutical manufacturing industries did not have access to adequate awareness of OSH to undertake proper OSH management at the workplace level. The report showed that the problem was particularly acute in developing countries. In addition, gaps were observed between the requirements in national legislation, and the status of implementation the countries.

4.4.1 Analysis of the Length of Experience in the Current Role

The researcher sought to determine the years of experience of the participating technicians. The findings show that most of the respondents (47.2%) had 2-4 years of working experience. 26.7% had 5-7 years of experience, 14.2% had 7-9 years 6.7% and 5.2% for less than 2 years, and above 10 years respectively. This indicates that the higher population (73.9%) of technicians in PMI'S had an experience of less than four years. according to the Table 4.6. According to National OSH Policy 2012, OSH had not been adequately integrated into the Kenyan education curricula. This therefore posed a challenge to new Labor market entrants in the country who lack basic knowledge and skills in occupational safety and health. This suggests that a larger proportion of the technicians could be new Labor market entrants posing a significant challenge to the OSH awareness levels in the PMI'S.

Table 4.6: Respondents Length of Experience in Their Current Role

Respondents length of experience in their current role				
	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Less than 2 years	49	14.2	14.2	14.2
2-4yrs	163	47.4	47.4	61.6
5-7 yrs	91	26.5	26.5	88.1
7-9 years	23	6.7	6.7	94.8
More than 10 years	18	5.2	5.2	100.0
Total	**344**	**100.0**	**100.0**	

4.4.2 An Analysis of the Technicians' First Encounter with Training in OSH in the Various PMI'S

To assess this, the research sought to find out the respondents' first encounter with training in safety. The findings showed that majority 75.4% indicated On Job Training (OJT) and only 23.3% indicated Professional education as shown in Figure 4.2.

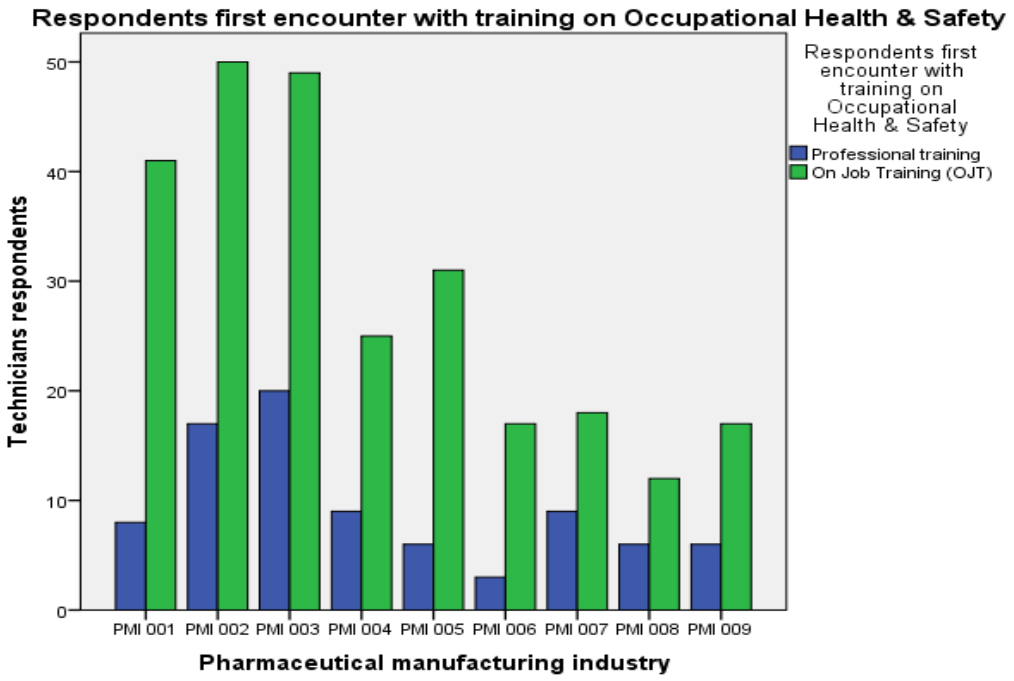

Figure 4.2: A Comparative Bar Graph Showing the Technicians' First Encounter with Training in OSH in the Various PMI'S

These findings can be deduced that majority of technicians working in the PMI'S in Nairobi County attain their first training in safety through OJT. These findings agree with Modica (2007) who established that a large proportion of employees are trained on occupational safety during employment.

However, according to Dustin, (2020), in order for students to learn safety the recommendation given was to consider preparation and continuing education programs that incorporate more production-based experiences focused on safety. Yet, there has been negligible resource allocation towards effective programs for the competency building of the occupational health and safety committees in the PMI'S.

4.4.3 A Summary of the OSH Trainings amongst Technicians.

The study sought to determine the whether all critical safety training areas were covered during the trainings according to requirements of the OSH Act 2007. The findings show the majority of the respondents; 89.0 % and 80.8% of the respondents had been trained on OSH Act 2007 and Evacuation procedures respectively. The

training area with the least numbers was exposure limits to hazardous chemicals and substances at 29.1%. Other training areas were covered as indicated in Table 4.7.

Table 4.7: Analysis of the OSH Trainings Offerings amongst Technicians in PMI'S

Safety Trainings prescribed by OSH Act 2007		Cumulative Percent	
		Yes	No
1.	Are trained on the OSHA (2007)	89.0	11.0
2.	Interpretation of MSDS-Material Safety Data Sheets	68.3	31.7
3.	The handling, transportation and disposal of chemicals and other hazardous substance materials	78.2	21.8
4.	Labelling and marking of hazardous chemicals and substances	77.9	22.1
5.	Classification of hazardous chemicals and substances	63.7	36.3
6.	Exposure limits to hazardous substances	29.1	70.9
7.	Control of air pollution, noise and vibration	79.7	20.3
8.	Evacuation procedures	80.8	19.2
9.	General safety	66.9	33.1

This suggests that due to low awareness levels of technicians on the allowable exposure limits of the chemicals, many could end up acquiring occupational chronic diseases and workplace injuries; this is despite a seemingly positive response on some areas of training. According to KIPPRA, (2021), competent OSH training personnel are still inadequate. This can be attributed to the low number of approved practicing OSH Advisors.

4.5 Safety Culture Maturity Levels

The third objective was to determine the safety culture maturity within the Pharmaceutical Manufacturing Industries. Safety culture has been defined as the product of individual and group values attitudes, perceptions competencies and patterns of behaviour that determine the commitment to and the style of proficiency of an organization health and safety management (HSE, 1993).

4.5.1 Analysis of Individual Technicians Perceptions of Safety

The study sought to determine the individual perception of safety of the respondents against other workplace related factors which included salary or compensation, Career advancement prospects, and working hours. They were asked to indicate the extent to which they considered aspects of the factors including their personal safety as they worked and the level of consideration prior to accepting a job offer. The results are shown in the Table 4.8.

Table 4.8: Comparative Analysis of Individual Perception of Safety

Aspect	Mean	Std. Deviation
Salary/Compensation	1.1213	0.3714
Working hours	1.9485	0.3802
Career advancement prospects	2.0357	0.4531
My personal safety	1.4261	0.2801
Average	1.6329	0.3712

Prior to accepting a job offer the respondents were requested to indicate the extent to which they considered aspects of the organization including their personal safety as they worked in the organisation. The findings show that they considered salary/compensation always as shown by mean of 1.1213 together with their personal safety as shown by mean of 1.4261. They considered the following sometimes: working hours as shown by mean of 1.9485, career advancement as shown by mean of 2.0357. This is an indication that the 72.4% technicians in the PMI's 'always' consider their salary/compensation as compared to personal safety at 24.4% for those who 'always' consider their personal safety as shown in the bar graph labelled (Figure 4.3).

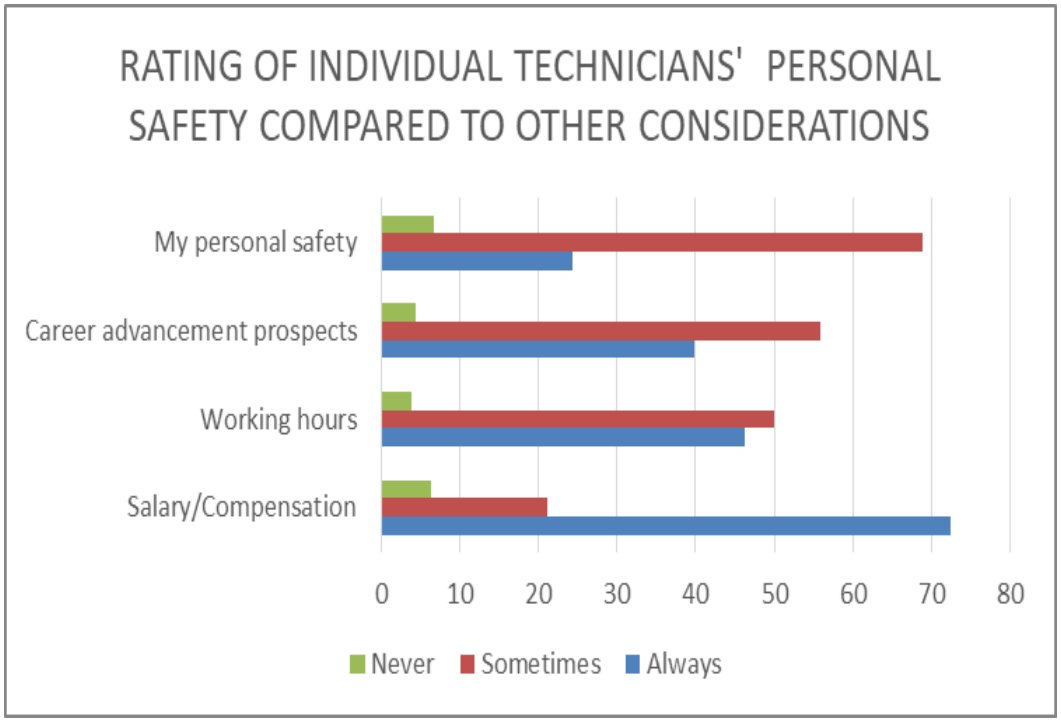

Figure 4.3: A Bar Graph Showing the Individual Technician's Perception of Safety Compared to Other Factors

The results suggest that there is a low level of awareness about the importance of workplace safety when selecting a job, particularly in the pharmaceutical industry. Sixty eight (68%) considered personal safety sometimes, five percent never considered personal safety while only twenty five percent considered personal safety always. Given the routine exposure to occupational chemicals in this field, raising awareness among job seekers about safety measures and hazards is critical. Awareness initiatives can emphasize the importance of selecting workplaces with strong safety protocols to protect workers from potential chemical exposure risks.

4.5.2 Key Dimensions that Determine the Safety Maturity Levels in the PMI's

The study selected four safety maturity indicators. These include Safety Training and Competence (KD 1), Safety Resources KD 2), Management commitment (KD 3), & Safety communication & Involvement (KD 4). According to Gonçalves Filho et al (2011) to assess this, questionnaires were prepared and the respondents were asked to indicate their level of agreement to statements. The analysis of the means and

standard deviations of key dimensions is a useful tool for evaluating safety maturity (Njeru, *et al.* 2013)

According to the current study, eight out of the nine PMIs in the study are on the borderline of the continually improving safety culture maturity level while one PMI is in the cooperating safety maturity level as shown in Table 4.9

This implies that there is need for sustained engagement of all staff to develop cooperation and commitment to improving safety Culture in the pharmaceutical manufacturing industry **(**Fleming et al., 2001).

Table 4.9: Analysis of the Safety Maturity Index in the PMI's

Pharmaceutical Manufacturing Industry		**KD1**	**KD2**	**KD3**	**KD4**	**Safety Culture Index**
PMI 001	Mean	2.8639	2.4592	3.5850	3.2109	3.02975
	Std. Deviation	0.4903	0.5288	0.6293	0.5213	0.54239
PMI 002	Mean	2.8209	2.5000	3.7114	3.3234	3.08893
	Std. Deviation	0.4618	0.4606	0.5284	0.4749	0.48138
PMI 003	Mean	2.8889	2.6014	3.6860	3.2029	3.09480
	Std. Deviation	0.3863	0.5257	0.5799	0.5308	0.50566
PMI 004	Mean	2.9314	2.6471	3.4020	3.1176	3.02453
	Std. Deviation	0.3917	0.3378	0.7049	0.6134	0.51193
PMI 005	Mean	2.9369	2.4865	3.5946	3.0991	3.02928
	Std. Deviation	0.4363	0.4929	0.6486	0.4640	0.51039
PMI 006	Mean	2.8167	2.2750	3.5500	3.3000	2.98543
	Std. Deviation	0.3820	0.4723	0.6514	0.3885	0.47351
PMI 007	Mean	2.9753	2.5556	3.6914	3.2099	3.10805
	Std. Deviation	0.4022	0.5938	0.4427	0.4543	0.47323
PMI 008	Mean	2.8333	2.5556	3.5185	3.2222	3.03240
	Std. Deviation	0.3079	0.5660	0.5742	0.4984	0.48658
PMI 009	Mean	2.8551	2.3043	3.6232	3.2464	3.00725
	Std. Deviation	0.3738	0.5981	0.4059	0.4738	0.46284
Total	**Mean**	**2.8789**	**2.5087**	**3.6182**	**3.2180**	**3.05595**
	Std. Deviation	**0.4189**	**0.5094**	**0.5846**	**0.5011**	**0.50366**

4.5.3 Descriptive Analysis of the Key Dimensions

The researcher asked questions to the technicians on the focused on the four key elements of safety culture. The analysis of these would help us determine safety maturity levels of the PMI'S. From the responses most of the technicians registering a mean of 3.99 are trained on routines product or processes safe use and handling.

However, a mean of 1.30 suggests a gap in the training on non-routine tasks by the respective supervisors the researcher had asked the technicians to mention at least one of those tasks. The findings show that 57.6 % these tasks revolved around preparation of hazardous chemicals, cultures and reagents. Other non-routine tasks included handling spills of hazardous chemicals and dispensing hazardous chemicals.

The researcher asked the respondents whether their manufacturing industry were compliant to OSHA 2007, a mean of 3.34 suggest that most of the manufacturing industries were compliant to OSHA meaning they were registered as workplaces with the directorate of safety and health services. On Management Commitment the researcher sought to find out whether most of the health and safety policies and regulations within their pharmaceutical industries made sense, the finding shows that a mean of 3.3692 was recorded suggesting that majority of them actually made sense. When there are changes to procedures or tasks, the respondents feel we are properly prepared and ready according to the findings mean (3.6366). Whether in their workplace working safely is rated as highly as getting the job done. The findings reveal a mean of 3.0699. This suggests that most of the technicians were non-committal.

Table 4.10: Descriptive Analysis of the Key Dimensions Based on the Likert Scale

Safety culture Indicator	Mean	Std. Deviation
Key Dimension 1 (Safety Training & Competence)		
I'm trained in the product's or process's safe use and handling	3.9913	0.72235
My supervisor trains me and my colleagues in the safety precautions of non-routine tasks before embarking on such tasks	1.3052	0..46118
My organization is compliant to OSHA (2007)	3.3401	.95253
Key Dimension 2 (Management Commitment)		
Most health and safety regulations are practical and make sense	3.3692	1.06099
When there are changes to procedures or tasks, I feel we are properly prepared and ready	3.6366	0.96827
In my workplace working safely is rated as highly as getting the job done	3.0669	0.97110
Key Dimension 4 (Safety communication)		
I am encouraged by my colleagues to report any safety concerns I may have	3.8488	0.82973
There is a good communication in my organization about safety issues which affect me	3.8314	0.75635
All chemical hazards present at my work place have been communicated	2.7558	0.96209
Has the organisation prepared safe operating procedures or specific safety instructions relevant to its operations	1.2064	0.40531
Key Dimension 3 (Safety Resources)		
In my work place PPE's are available as necessary	3.7035	0.89011
There are deliberate efforts by the managers to ensure a first-aider is available during every shift.	1.3140	0.46477

That more priority was directed completing the task irrespective of the safety concerns around the tasks such as availability of appropriate PPE. On safety communication, studies emphasize on the importance of clear and concise communication in creating a health safety culture in pharmaceutical manufacturing

industry. the researcher asked whether colleagues are encouraged to report any safety concerns that are in the work environment , the findings show a mean of 3.8488 , as to whether there is a good communication in the organization about safety issues which affect the technicians the finding show a mean of 3.814, this suggest that there is a fair communication on safety awareness, On whether there were any documented incident investigation procedures, the findings show a mean of 1.2034 This suggest that even if effort has been put into safety awareness ,some critical key areas may have been left out either due to lack of enforcement or inadequate competence to support such initiatives. On safety communication the respondents were also asked whether all the chemical hazards had been communicated. The findings show a mean of 2.7558. This suggests that there are chemical hazards which are not yet communicated in some pharmaceutical manufacturing industries.

4.5.4 Measurement of the Mean Scores and Standard Deviations of Safety Culture

The PMI safety culture maturity level was measured using the mean scores of the employees' level of satisfaction in the four key dimensions. Based on previous studies, the level of satisfaction of the respondents was used to compute the level of the institution's safety maturity. The PMI safety culture maturity level was measured using the mean scores of the employees' level of satisfaction in the four key dimensions. The emerging level ranges from 0.00-0.99 average mean scores on satisfaction levels, managing from 1.00 – 1.99 mean scores on satisfaction levels, involving from 2.00-2.99 scores on satisfaction levels, cooperating from 3.00-3.99 mean scores on the level satisfaction and continually improving from 4.00 mean scores on the level of satisfaction. Low satisfaction score depicts low safety culture maturity level while high satisfaction score depicts high level of safety culture maturity. The satisfaction levels were computed from the Likert scale scores in each of the key dimensions where strongly agree (SA) and Agree (A) were summed up and mean scores calculated for each key dimension for all the PMI's as indicated in Table 4.11

Table 4.11: Likert scale Key for Safety Culture Maturity Scores

Mean scores On Likert Scale	Safety culture maturity	Implications
1.00 and below	Emerging	There is need for more management commitment
1.00 – 1.99	Involving	Realize the importance of 'technical staff and develop personal responsibility
2.00-2.99	Cooperating	Engage all staff to develop cooperation and commitment to improving safety
3.00-3.99	Continually Improving	Develop consistency
4.00-and above	Mature	

4.6 The Relationship between Training in OSH and Safety Culture

In order to establish the impact of training in OSH on the safety culture of the PMI'S, the data was subjected to further analysis by use of Pearson chi square test of association. The test was used to check the association between OSH training and the safety culture each key dimension. The results as indicated in Table 4.12 suggest that there is a positive impact on the contribution of OSH Training to the safety culture of the PMI's.

Table 4.12: Results from the Pearson Chi Test of Association

Chi-Square Tests						
	Value	**Df**	**Asymp. Sig.(2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**	**Point Probability**
Pearson Chi-Square	1342.649[a]	30	0.000	0.000		
Likelihood Ratio	835.826	30	0.000	0.000		
Fisher's Exact Test	0.000			0.000		
Linear-by-Linear Association	318.030[b]	1	0.000	0.000	0.000	0.000
N of Valid Cases	**344**					

a. 26 cells (61.9%) have expected count less than 5. The minimum expected count is .02.
b. The standardized statistic is .000.

The output above shows that the Pearson Chi-Square test is statistically significant, with a p-value of 0.001. This indicates that there is a significant relationship between the variables of interest - safety training and safety culture. The high Chi-Square

value of 1342.649 and the low p-value ($p<0.001$) suggest a strong association between the two variables, the Likelihood Ratio test and Fisher's Exact Test also show statistically significant results, providing additional evidence of the strong relationship between safety training and safety culture in this context whereby the Linear-by-Linear Association test, had a value of 318.030 and a p-value of ($p<0.001$).

4.6.1 KD1-Analysis of the Influence OSH Training on Safety Culture

A chi-square test was performed and no association was found between OSH Training 1, 2, 6,7, 8 &9, (Table 4.13), and safety culture KD 1 as shown: $\chi 2(7) = 5.57$, $p = .427$, $\chi^2 (7) = 13.213$, $p = .178$, $\chi^2 (7) = 9.799$, $p = .139$, $\chi^2 (7) = 7.807$, $p = .35$, $\chi^2(7) = 11.544$, $p = .117$ & $\chi^2(7) = 8.304$, $p = .0.383$.

A significant association was found between OSH training 3, the handling, transportation and disposal of chemicals and other hazardous substance materials while training & 5, Classification of hazardous chemicals and substances and safety culture KD1 as follows $\chi^2 (7) = 29.494$, $p = .002$ and $\chi^2(7) = 23.168$, $p = .054$.

Table 4.13: Analysis of the Influence of OSH Training on Safety Culture KD 1

S/N	Test Description	Pearson Chi-Square Value	df	p-value	Likelihood Ratio	Linear-by-Linear Association	Comment
1	Training 1	5.57	7	0.591	0.421	0.427	Not significant
2	Training 2	13.213	7	0.067	0.051	0.178	Not significant
3	Training 3	29.494	7	0.001	0.001	0.002	Highly significant
4	Training 4	13.937	7	0.052	0.074	0.578	Marginally non-significant (p = .052),
5	Training 5	23.168	7	0.002	0.001	0.054	Significant
6	Training 6	9.799	7	0.2	0.201	0.139	Not Significant
7	Training 7	7.807	7	0.35	0.314	0.037	Significant
8	Training 8	11.544	7	0.117	0.025	0.022	Significant
9	Training 9	8.304	7	0.307	0.227	0.383	Not significant

A marginal association was found between OSH Training 4, Labelling and marking of hazardous chemicals and substances and safety culture KD1, $\chi^2(1) = 13.937$, $p = .052$. The findings suggest that most of the technicians are not confident of their safety when handling hazardous chemicals and substances. Hence contribute to the safety culture KD 1, Safety training and competence. There is need to focus on

effective trainings, and preparing articulate safety protocols for use by technicians when handling hazardous chemicals and substances. An improvement in the safety competence will contribute to the overall safety culture maturity levels.

4.6.2 KD2-Analysis of the Influence OSH Training on Safety Culture

A chi-square test was performed and no association was found between OSH Training, and safety culture KD 2. The results suggest that there was no direct association of the safety resources. This can be attributed to the fact that most of the resources have been provided in the pharmaceutical manufacturing industries.

Table 4.14: Analysis of the Influence of OSH Training on Safety Culture KD 2

S/NO	Test Description	Pearson Chi-Square Value	df	p-value	Likelihood Ratio	Linear-by-Linear Association	Comment
1	Training 1	4.566	5	0.471	0.455	0.453	Not significant
2	Training 2	7.84	5	0.165	0.182	0.432	Not significant
3	Training 3	3.207	7	0.668	0.529	0.391	Not significant
4	Training 4	5.335	5	0.376	0.241	0.268	Not significant
5	Training 5	5.031	5	0.412	0.365	0.368	Not significant
6	Training 6	5.006	5	0.415	0.26	0.075	Not significant
7	Training 7	2.043	5	0.843	0.834	0.672	Not significant
8	Training 8	7.26	5	0.202	0.159	0.063	Not significant
9	Training 9	5.66	5	0.341	0.356	0.501	Not significant

4.6.3 KD3-Analysis of the influence OSH Training on Safety Culture

A chi-square test was performed and high association was found between OSH Training 1(**Table 4.7),** Are trained on the OSHA (2007);2, Interpretation of MSDS-Material Safety Data Sheets3; The handling, transportation and disposal of chemicals and other hazardous substance materials ,4, Labelling and marking of hazardous chemicals and substances ,7, Control of air pollution, noise and vibration,8, Evacuation procedures & 9, General safety and safety culture KD 3 as shown: χ^2 (9) = 31.943, p χ^2=.000 , (9) = 20.843, p =.013 , χ^2(9) = 33.608, p =.000 , χ^2(9) = 20.097, p =.017, χ^2(9) = 23.196, p =.006 , χ^2(9) = 46.984, p =.000 & χ^2(9) = 25.996, p =.002,

Table 4.15: Analysis of the Influence of OSH Training on Safety Culture KD 3

S/N	Test Description	Pearson Chi-Square Value	Df	p-value	Likelihood Ratio	Linear-by-Linear Association	Comment
1	Training 1	31.943	9	0	0.001	0.403	Significant ($p < 0.05$)
2	Training 2	20.843	9	0.013	0.003	0.066	Significant ($p < 0.05$)
3	Training 3	33.608	9	0	0.001	0.134	Highly significant ($p < 0.01$)
4	Training 4	20.097	9	0.017	0.021	0.026	Significant but close to threshold ($p < 0.05$)
5	Training 5	14.083	9	0.119	0.115	0.958	Not significant
6	Training 6	13.409	9	0.145	0.076	0.662	Not significant
7	Training 7	23.196	9	0.006	0.001	0.143	Significant ($p < 0.05$)
8	Training 8	46.984	9	0	0.001	0.001	Highly significant ($p < 0.01$)
9	Training 9	25.996	9	0.002	0.002	0.001	Highly significant ($p < 0.01$)

No association was found between OSH Training 5 Classification of hazardous chemicals and substances & 6, Exposure limits to hazardous substances, and safety culture KD 3 as shown: $\chi^2(9) = 14.083$, $p = .119$ &, $\chi^2(9) = 13.409$, $p = .145$.

4.6.4 KD4-Analysis of the Influence OSH Training on Safety Culture

The analysis show that no association was found between OSH Training 1, 2,3,4,5 6,7&8 and safety culture KD 4 as shown: However, there was a significant association between OSH training 9, General safety and safety culture KD4: $\chi^2(9) = 21.409$, $p = .001$.

Table 4.16: Analysis of the Influence of OSH Training on Safety Culture KD 4

S/N	Test Description	Pearson Chi-Square Value	df	p-value	Likelihood Ratio	Linear-by-Linear Association	Comment
1	Training 1	7.583	7	0.371	0.342	0.215	Not significant
2	Training 2	8.856	7	0.263	0.166	0.717	Not significant
3	Training 3	5.707	7	0.574	0.509	0.227	Not significant
4	Training 4	11.814	7	0.107	0.062	0.029	Marginally non-significant (p = 0.107)
5	Training 5	6.957	7	0.433	0.452	0.163	Not significant
6	Training 6	4.41	7	0.732	0.683	0.191	Not significant
7	Training 7	1.613	7	0.978	0.978	0.874	Not significant
8	Training 8	8.206	7	0.315	0.220	0.638	Not significant
9	Training 9	21.409k	4	0.001	0.001	0.032	Highly significant

4.7 Multilinear Regression Model

The study sought to determine the influence of OSH training on safety culture. According to Mugenda & Mugenda (2003), Multiple regression analysis is used to determine whether a group of variables can predict a given dependent variable. For the current study the following equation was used;

$$\mathbf{Y = B_0 + B_1 X_1 + B_2 X_2 + e\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..}$$

Where

Y=the dependent variable; Safety Culture of PMI'S In Kenya

X_1= the primary independent variable; OSH Training at PMI's in Kenya

X_1= the control independent variable; OSH documentation at PMI's in Kenya

B_0= is the Constant B_1 & B_2 = the regression coefficients or change induced in Y by each X whereas e =Error.

The F-test and t-test to check whether the estimated coefficients in the model is a good fit for the data obtained from the target population from which the sample has been drawn.

Table 4.17: Model Summary

Model Summary										
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Change Statistics**					**Durbin-Watson**
					R Square Change	**F Change**	**df1**	**df2**	**Sig. F Change**	
1	0.963[a]	0.927	0.927	0.03481	0.927	2176.021	2	341	0.000	1.842

A. Predictors: (Constant), Safe-work documentation, Osh training
B. Dependent Variable: Safety culture

Model Summary on **Table 4.17** above provides the R, R2 and adjusted R2, these figures are determinants of the extent of the relationship between the independent variables and the dependent variable. R is the multiple correlation coefficient and can be considered to be a measure of the extent of the prediction of the dependent variable (Laerd Statistics, 2013).

Table 4.17 which shows the model summary also indicates the value of R which is 0.963. an indicator a decent level of prediction of the dependent variable which is the Technicians' safety culture in the pharmaceutical manufacturing industries the more the proximity to one (1.0) (Sekaran *et al,* 2019).

The other aspect of the model is the "R Square" or R2, which is referred to as the coefficient of determination. It specifies the proportion of variation that can be accounted for by the Multilinear regression model table 4.17. The R Square measures the proportion of the variation in the dependent variable that was explained by variations in the independent variables.

Table 4.17 shows that, The R^2 value was 0.927. This statistical number shows that the independent variables of safety training attributed to 92.7 % of the variability in the dependent variable; the technicians safety culture in the pharmaceutical industries in Nairobi County". Hence the other variation of 8.3 % was attributed to the other key dimensions (Laerd Statistics, 2013).

4.7.1 ANOVA and Statistical Significance Results

Table 4.18: ANOVA and Statistical Significance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5.273	2	2.636	2176.021	0.000[b]
	Residual	0.413	341	0.001		
	Total	5.686	343			

a. Dependent Variable: Safety culture
b. Predictors: (Constant), Safe work documentation, OSH training

The regression analysis shows that the model is statistically significant, $F(2, 341) = 2176.021$, $p < 0$ .001, demonstrating that both and Technicians SAFETY training and safe work documentation ,that the safety training has a significant influence on safety culture. As above These predictors describe a considerable share of the variance in technician's safety culture, accounting for roughly 93% of the whole variation. This proposes a model fit. The findings show that both safe work documentation and OSH training are predictors of technician safety culture.

4.7.2 Model Coefficients Results

Table 4.19: Model Coefficients Results

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	0.144	0.020		7.022	0.000		
	Osh training	0.867	0.013	0.963	65.967	0.000	1.000	1.000
	Safework documentation	0.006	0.008	0.012	0.805	0.421	1.000	1.000

a. Dependent Variable: Safety Culture

The results show that the Unstandardized Coefficients (B) is 0.867, safe documentation 0.006 units while the corresponding t-statistics for these coefficients are 65.967 and 0.805 respectively. The p values for OSH Training and Safe work documentation are 0.000 and 0.421 respectively, indicating that OSH training is a statistically significant predictor of safety Culture. The results show that specific training components like interpretation of MSDS, handling, transportation and disposal of chemicals and exposure limits to hazardous substances had the strongest

positive influence on safety culture. This suggests that training that focuses on hazard identification, risk assessment and control measures is critical in shaping a strong safety culture within the industry. The researcher conducted further analysis of the influence of OSH training on the Safety culture:

4.7.3. ANOVA Analysis

Table 4.20: Table Showing the ANOVA Analysis

ANOVA[a]					
Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	5.798	9	0.644	3.957	0.000[b]
	54.378	334	0.163		
	60.175	343			

a. Dependent Variable: Safety Culture

b. Predictors: (Constant), General safety, are trained on the OSHA (2007), Classification of hazardous chemicals and substances, Evacuation procedures, Exposure limits to hazardous substances, the handling, transportation and disposal of chemicals and other hazardous substance materials, Control of air pollution, noise and vibration, Labelling and marking of hazardous chemicals and substances, Interpretation of MSDS-Material Safety Data Sheets

Since the F-value is 3.957 and the p-value is 0.000, the regression model as a whole is statistically significant, suggesting that the independent variables significantly predict the dependent variable safety culture. This indicates that the set of predictors included in the model explains a meaningful portion of the variance in safety culture.

4.7.4 Estimated Model Regression Coefficients

Table 24: Model Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2.651	.231		11.459	.000	2.196	3.106
	Are trained on the OSHA (2007)	0.071	0.071	0.054	0.999	0.318	-0.069	0.212
	Interpretation of MSDS-Material Safety Data Sheets	0.147	0.050	.163	2.915	0.004	0.048	0.246
	The handling, transportation and disposal of chemicals and other hazardous substance materials	0.209	0.056	0.206	3.714	0.000	0.098	0.320
	Labelling and marking of hazardous chemicals and substances	-0.017	0.055	0.017	-0.317	0.752	-0.125	0.090
	Classification of hazardous chemicals and substances	-0.065	0.047	-.074	-1.380	0.169	-0.157	0.027
	Exposure limits to hazardous substances	0.101	0.049	0.109	2.061	0.040	0.005	0.196
	Control of air pollution, noise and vibration	-0.115	0.055	-0.110	-2.076	0.039	-0.223	-0.006
	Evacuation procedures	-0.128	0.057	-0.121	-2.258	0.025	-0.240	-0.017
	General safety	-0.053	0.047	-0.060	-1.126	0.261	-0.147	0.040

a. Dependent Variable: Safety Culture

A linear regression was conducted to assess the relationship between several training aspects and the dependent variable (Safety Culture). Significant positive predictors of Safety Culture included the interpretation of MSDS materials (B = .147, p = .004) and the handling, transportation, and disposal of hazardous chemicals (B = .209, p =

.000). Additionally, knowledge of exposure limits to hazardous substances was also positively associated with Safety Culture (B = .101, p = .040). On the other hand, control of air pollution, noise, and vibration (B = -.115, p = .039), and evacuation procedures (B = -.128, p = .025) were negatively associated with safety. Several predictors, including training on OSHA (2007) and general safety, were not statistically significant

4.8 Hypothesis Testing

A hypothesis is a statement of intent to predict whether research study conforms to expected outcome/output. This study had sought to establish if there is a relationship between OSH training and the safety culture in PMI. Chi square analysis (Table 4.7 has shown that there is a positive relationship denoting the importance of OSH training in shaping the safety culture.

From Table 4.13 the Chi-Square statistic, $\chi^2 = 28.829$, and p value (0.000). The null hypothesis is accepted, since $p < 0.05$. This means that there is a statistically significant difference in influence of training on safety culture of technicians among PMI's. Thus, the alternate hypothesis, there is a statistically significant difference in influence of training on safety culture of technicians among pharmaceutical manufacturing industries in Nairobi County, was accepted.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

This section summarizes research conclusions based on the research findings. The main objective of the study which was to assess the influence of training on safety culture among technicians in pharmaceutical companies in Nairobi County

5.1 Conclusions

With respect to objective one which was to establish the levels of technicians' safety training in pharmaceutical manufacturing industries, the study explored the demographic characteristics of the technicians, which revealed that male genders at 56.7% was higher however and the larger proposition of the technicians at 87.2% were aged between 18 and 35 years. The risk to physical hazards is significantly higher among younger workers than among older workers in any organization This also translates to younger families which were yet to stabilize. The study there for concludes that there is need put forward to address this include trainings on safety for young workers to increase their knowledge and compliance and minimize the occupational risks to the youthful workforce

In relation to the highest qualification; most of the technicians were degree Holders at 53.7% hence were easy to train because of their strong academic ability. The results show that the majority of technicians working in the PMI'S in Nairobi County acquire their first training in safety through OJT which means that a large proportion of employees are trained on occupational safety during employment. The study therefore concluded that there was a gap in safety training within the formal professional training.

In respect to objective three, the study established the safety culture levels of pharmaceutical manufacturing industries

The study on the individual perceptions of the technicians when selecting a work environment, showed that only 24.4% considered personal safety in a workplace a priority when seeking employment.

On Safety culture maturity eight out of the nine PMIs in the study are on the borderline of the continually improving safety culture maturity level; one PMI is in the cooperating safety maturity level. This implies that none of the pharmaceutical manufacturing industries had a vibrant safety culture maturity level.of continually meaning nomne had attained a level of consistency in managing safety such that The organisation is constantly striving to be better and find better ways of improving hazard control mechanisms On Objective three was to determine the relationship between training in OSH and the technicians' safety culture in pharmaceutical manufacturing industries

In determining whether there exists a significant linear trend in the data Pearson Chi Test was carried out and the results showed that, there was positive relationship between the two variables. This shows that safety training has a significant and positive influence on safety culture within the pharmaceutical manufacturing industry in Nairobi, Kenya

This study's findings suggest that safety training is a key factor in shaping the safety culture within pharmaceutical manufacturing industries in the Nairobi metropolitan area.

OSH Documentation was used as a control variable and the analysis showed it did not have a statistically significant relationship with safety culture. The results show that specific training components like interpretation of MSDS, handling, transportation and disposal of chemicals and exposure limits to hazardous substances had the strongest positive influence on safety culture.

This suggests that training that focuses on hazard identification, risk assessment and control measures is critical in shaping a strong safety culture within the industry

Objective four was to compare the safety culture of technicians across the sampled pharmaceutical manufacturing industries. The safety maturity levels of the PMI'S were compared. From the responses most of the technicians registering a mean of 3.99 are trained on routines product or processes safe use and handling. However, a mean of 1.30 indicated a gap in the training on non-routine tasks by the respective

supervisors the researcher had asked the technicians to mention at least one of those tasks. The findings show that 57.6 % these tasks revolved around preparation of hazardous chemicals, cultures and reagents. Other non-routine tasks included handling spills of hazardous chemicals and dispensing hazardous chemicals this was recorded across all the sampled pharmaceutical industries. The study concludes that there was a gap in the handling of chemical substance and the knowledge of the exposure limits

5.2 Recommendations

In the light of above research findings and the conclusions that were made the following recommendations are proposed.;

Generally, the Pharmaceutical organizations train their technicians on occupational health and safety. However, structured occupational safety and health awareness creation among current and potential workers in this industry considering the occupational chemical exposures in their routine schedules while at work.

Specific recommendations based on the study findings include

- Enforcement of the implementation of OSHA (2007) training requirements on handling of hazardous chemicals for workers in the PMI's by DOSHS in pharmaceutical manufacturing industries
- Strengthen OSH training chemical handling, classification, labelling/marking/MSDS interpretation & hazardous chemical management in Pharmaceutical Manufacturing Industries
- Improve chemical safety training by creating relevant content that covers all the aspects related to chemicals in safety manual with safe operating procedures and safety instructions
- Integrate OSH competency training into pre-employment professional programmes
- Gender differences must be considered in designing OSH procedures and hazard control strategies because of the different effects of chemicals on the genders

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APPENDICES

Appendix I: Questionnaires for Technicians

1. Name of pharmaceutical industry.....
2. What position do you hold in your organization? (optional)
3. Position title.....
4. What is your gender?

Female [ ] Male [ ] Prefer not to say Other _____

5. What is your age bracket? 18-25 [ ] 26-30 [ ] 31-35 [ ] 36-45 [ ] Above 46 [ ]
6. Marital status

Married [ ] Single [ ] Divorced/Separated [ ]

SECTION A: THE LEVELS OF TECHNICIANS SAFETY TRAINING

7. Which of the following applies to you as your highest academic qualification?

O-level [ ] Certificate [ ] Diploma [ ] Degree [ ] Masters [ ]

8. Kindly specify your highest qualification?

_____

9. What is the length of experience in your current role?

Less than 2 years [ ] 2-4yrs [ ] 5-7 yrs [ ] 7-9 years [ ] More than 10 years [ ]

10. Where was your first encounter with training in safety

Professional training [ ] On Job Training (OJT) [Other_____

11. Which of the following safety trainings have you undergone?

	YES	NO
OSHA (2007)		
Interpretation of MSDS-Material Safety Data Sheets		
The handling, transportation and disposal of chemicals and other hazardous substance materials		
Labelling and marking of hazardous chemicals and substances		
Classification of hazardous chemicals and substances		
Exposure limits to hazardous substances		
Control of air pollution, noise and vibration		
Evacuation procedures		
General safety		

12. As an employee exposed to a new chemical product or process which poses a new or increased hazard I'm trained by my supervisor in the product's or process's safe use and handling.

Strongly disagree [ ] Disagree [ ] Neutral [ ] Agree [ ] Strongly agree [ ]

13. My supervisor trains me and my colleagues in the safety precautions of non-routine tasks before embarking on such tasks

Yes [ ] No [ ]

If yes, give one such task.....

SECTION C: SAFETY CULTURE

14. Prior to accepting a job offer I always consider the following aspects (tick where applicable)

Aspect	Always	Sometimes	Never
Salary/Compensation			
Working hours			
Career advancement prospects			
My personal safety			

15. Are you aware of the Occupational Safety and Health Act enacted in the year 2007 (OSHA 2007) (if yes go to the next 2 questions in this section)?

Strongly disagree[ ] Disagree[ ] Neutral [ ] Agree [ ]Strongly agree [ ]

16. My organization is compliant to OSHA (2007)

Strongly disagree[ ] Disagree[ ] Neutral [ ] Agree [ ]Strongly agree [ ]

17. Most health and safety regulations are practical and make sense

Strongly disagree[ ] Disagree[ ] Neutral [ ] Agree [ ]Strongly agree [ ]

Section D: The Relationship between Training in OSH and The Technicians' Safety Culture

.	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
. When there are changes to procedures or tasks, I feel we are properly prepared and ready					
I am encouraged by my colleagues to report any safety concerns I may have	.	.	.	.	.
. Most health and safety rules are practical and make sense	.	.	.	.	.
. In my workplace working safely is rated as highly as getting the job done	.	.	.	.	.
. There is a good communication in my organization about safety issues which affect me	.	.	.	.	.
. All chemical hazards present at my work place have been communicated	.	.	.	.	.

Section E: Safe work practice

39. Has the organisation prepared safe operating procedures or specific safety instructions relevant to its operations?

Strongly disagree[ ] Disagree[ ] Neutral [ ] Agree [ ]Strongly agree [ ]

40. Is there a documented incident investigation procedure?

Strongly disagree[ ] Disagree[ ] Neutral [ ] Agree [ ]Strongly agree [ ]

41. Are there procedures for storing and handling hazardous substances? Strongly disagree[ ] Disagree [ ] Neutral [ ] Agree [ ]Strongly agree [ ]

39. Are technical staff represented in the health and safety committees?

Strongly disagree [ ] Disagree [ ] Neutral [ ] Agree [ ]Strongly agree [ ]

40. In my work place PPE's are available as necessary

Strongly disagree [ ] Disagree [ ] Neutral [ ] Agree [ ]

Strongly Agree [ ]

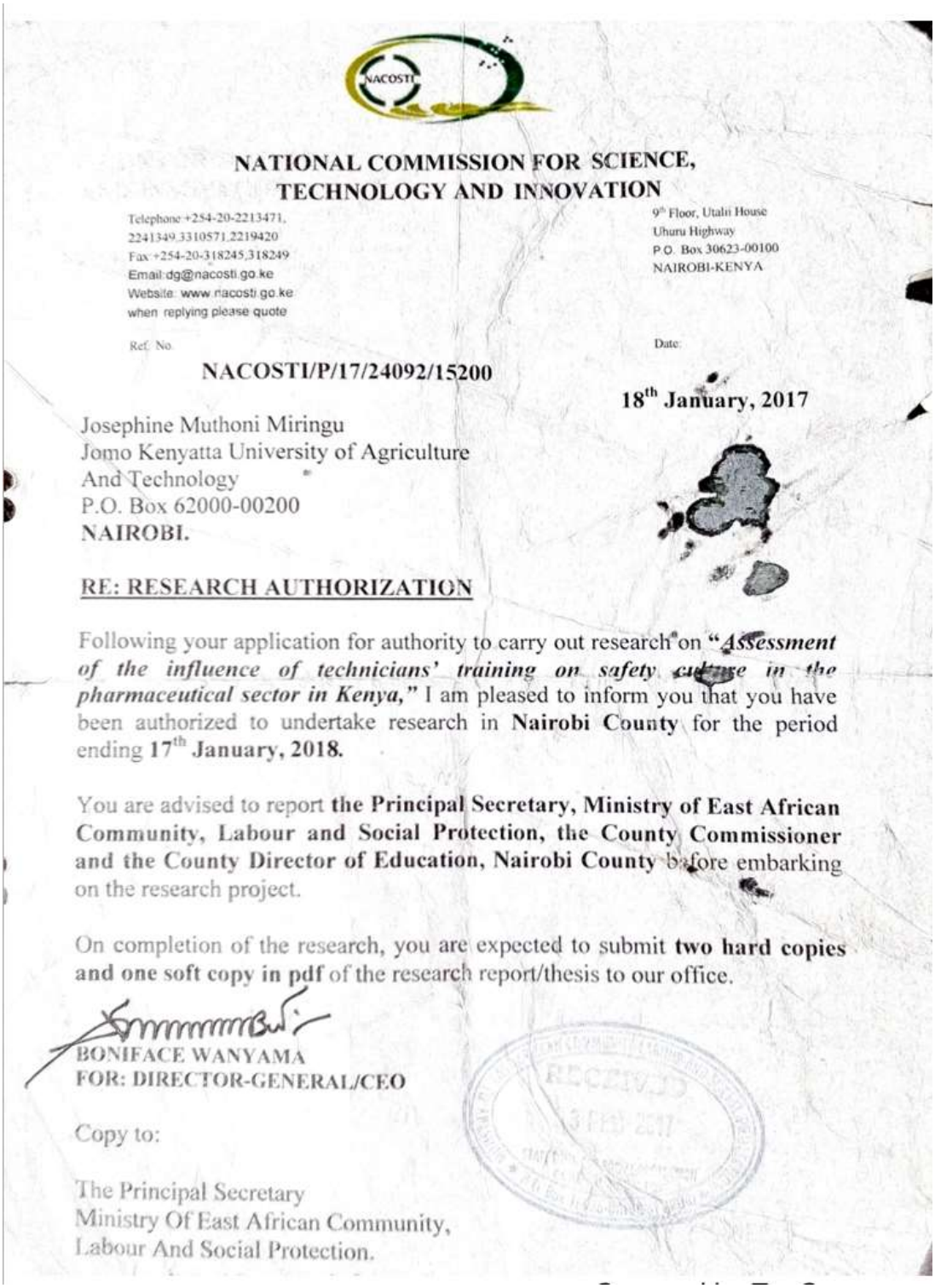
44. There are deliberate efforts by the managers to ensure a first-aider is available during every shift

Strongly disagree[ ] Disagree [ ] Neutral [ ] Agree [ ]Strongly agree [ ]

Appendix II: Observation Checklist

Section A: Safety information displayed in general and at workstations	Yes	No	Remark
1. OSH Poster is displayed			
2. Contact information for emergency is easily accessible			
3. Material Safety data Sheets are available to exposed employees			
4. Appropriate signage is available			
Section B: Hazard registers			
1. Employee updated records are available			
2. Staff training records are maintained and accessible as per OSHA requirements?			
3. Records are maintained as per OSHA and WIBA laws			
Section C: **Medical Services and First Aid**			
1. A local health facility is accessible to the workplace?			
2. A few members of staff are trained on basic first Aid			
3. Health Providers are readily available to staff concerning their health			
Section D: Condition of plant/equipment/buildings etc.			
1. First aid kits are well stocked and accessible to all employees			
2. First Aid items are genuine items			
3. Is there a shower in-case of spillage to the eyes			
4. Have fire extinguishers been installed			
5. Are the fire extinguisher adequate in number			
6. Have they been installed at easily accessible locations			
7. Have they been serviced			
Section C: PPE usage and storage			
1. Are fire safety refresher trainings frequently conducted?			
2. Has a risk assessment been carried out for potential risks to the employees (e.g. head, eye, face, hand, or foot protection) are present or are likely to be present?			
3. Are employee using PPE			

Appendix III: Research Authorization from NACOSTI



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Ref. No.

NACOSTI/P/17/24092/15200

Date:

18th January, 2017

Josephine Muthoni Miringu
Jomo Kenyatta University of Agriculture
And Technology
P.O. Box 62000-00200
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Assessment of the influence of technicians' training on safety culture in the pharmaceutical sector in Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **17th January, 2018.**

You are advised to report **the Principal Secretary, Ministry of East African Community, Labour and Social Protection, the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The Principal Secretary
Ministry Of East African Community,
Labour And Social Protection.

Appendix IV: Pharmaceutical Manufacturing Industries

Regal Pharmaceuticals	PARTICIPATED
Mac's Pharmaceutical Limited	
Regal Pharmaceutical Limited	
Universal Pharmaceutical Limited	
Cosmos Limited	
Dawa Limited	
Oschemie	
Sphinx	
Elys Chemicals Industries Limited	
Laboratory & Allied Limited	
Medivet Products Limited	DID NOT PARTICIPATE
Infusion (k) Ltd [IKL]	
Pharmaceutical Manufacturing Co (K) Limited	
Beta Healthcare	
Biodeal Laboratories Limited	
GlaxoSmithKline	