UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION-KUMASI

INDUSTRIAL SAFETY AND MANAGEMENT IN MACHINE SHOP: A CASE STUDY OF SECONDI -TAKORADI KOKOMPE INDUSTRIAL AREA

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SEPTEMBER, 2018

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7161220018

A dissertation in the Department of TECNOLOGY EDUCATION Faculty of TECHNICAL/VOCATIONAL EDUCATION, submitted to the school of Graduate studies, University of Education, Winneba in partial fulfilment of the requirement for award of the Master of Technology in Mechanical degree.

SEPTEMBER, 2018

DECLARATION

STUDENT'S DECLARATION

I, **Francis Kwabena Atise** declare that this Dissertation, with exception of quotations and references contained in the published works which have all been identified and duly acknowledged, is entirely my original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ..... DATE: .....

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with guidelines for supervision of Dissertation as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: MARTHA DANSO (ENGR. MRS.)

SIGNATURE: ..... DATE: .....

DEDICATION

This dissertation is dedicated to my parents Mr. Atise and Mother Madam Charity Badu, children; Wilhelmina Atise, Blessing Atise and Emmanuel Atise, my better half Jemima Amoah Atise. Also to my family for all the support they gave me both in prayer and motivation.

ACKNOWLEDGEMENT

I wish to express my profound gratitude to my supervisor, Engineer Martha Danso for her prompt response to my calls and reading through this work and offering suggestions and corrections. I am most grateful to the research assistants; Mr. Okyereko, Gloria, Sandra, Rose -Mary, Dzifa, the typist, the factory inspectors in Sekondi – Takoradi metropolitan office, the shop-owners and all the artisans/apprentices for their responses and support.

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ABSTRACT

This study looked at how shop owners and artisans at Kokompe, in Sekondi - Takoradi Industrial Area managed safety in machine shops. The study employed a case study as its research design. The population consisted of shop owners, factory inspectors, and artisans (auto body builders and welders). The sample size of ninety - six (96) comprised twenty - one (21) shop owners, one (1) factory inspector and seventy - four (74) artisans totalling ninety - six (96) purposively selected from the Kokompe Industrial Area of Sekondi - Takoradi. Three sets of questionnaires were prepared and used to collect data for the study. The data was analyzed using Excel and Statistical Package for Social Sciences (SPSS v16). The findings of the study revealed that 52 (54.7%) of the respondents admitted that accidents do occur at the machine shops and the frequency is very high 67 (70.5%). Among the common accidents they encountered were cuts, hammering of hands and burns recorded respectively. It was found out that generally the common accidents were as a results of inexperience, inattentiveness/carelessness and unsafe acts and unsafe conditions. The study concluded that the artisans work in poor ergonomic posture. The study also concluded that some effects of accidents in the workshop that affects the artisans are; loss of man hours, absenteeism, body pains, deformities, high cost of treatment. Based on the findings, it is recommended that training and refresher courses should be organized using simulations or scenarios at the work place for both new recruits and regular workers respectively. The master/shop-owner should enforce that all the new apprentices coming should come with their Personal Protective Equipment (PPE) before allowing them to start the work.

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Increasing business competition, rapidly advancing technology, and changing workforce characteristics are all pressing issues for the entire industrial economic sector. These changing events also present new challenges in assuring the safety and health of workers for individual companies. A pillar of every industrial workplace achievement is occupational safety performance (Bureau of Labour Statistics, 2017).

It has become clear that such exposure does not originate from just human error, technological failures, or environmental factors alone. Rather, it is the fixed organizational policies and standards, which have repeatedly been shown to predate the misfortune. Therefore, safety experts in recent years have begun to focus on the organizational values that might enhance risk and crisis management and safe performance in industries. Study by Jukka et al. (2014) estimated 2.3 million deaths occurred annually across the countries for reasons attributed to work. The biggest mortality burden came from work-related diseases, accounting for 2 million deaths whilst the remainders were due to occupational injuries.

According to the ILO report cited in Bambang (2010), for every fatal accident at work, some 500–2,000 other non-fatal injuries occur, depending on the type of work, yet these workplace tragedies rarely make the headlines. The figures differ considerably in various parts of the world. Accident rates, for instance, are very high in the Asian Tiger economies (Bambang, 2010).

In general, most small scale industries such as artisans in Ghana as well as industries do not abide by established occupational safety procedures and policies. Example was what happened at Western Steel and Forgings Limited (WSFL), Tema, on April 21, 22 and 30, 2011 at the Steel Melting Shop (SMS). When workers were performing their routine work, there was a sudden boiling and splattering of molten metal that injured thirteen (13) workers. The affected employees had burns on their bodies; one fell in an attempt to escape and sustained injuries on the knee.

The Second Incident occurred at the Oxygen plant when two (2) employees were filling oxygen cylinders when one of the cylinders burst, injuring the two (2) employees.

The Third incident occurred when a worker was poking the first charge mix when there was a sudden splash of hot air from a partly sealed object (2011, May 6, General News myjoyonline.com). However, most accidents in kokompe industrial area in the Sekondi – Takoradi metropolis are direct result of inadequate knowledge of safety, not sticking to standard safety procedures; safety culture and lack of risk management practices. Thus, the participation of all employees including managers and non-managers is vital in policy making, establishing and implementing a feedback system that drives towards a continuous safety improvement in industrial workshops to achieve a successful safety programme.

Moreover, International Labour Organisation (ILO) is currently campaigning for the provision of decent work worldwide. It is clear that those decent jobs must also be safe jobs. It must be mentioned that safety management has an important role in reducing industrial accidents in workshops and engineering. Workplace safety and hazard prevention are not solely the responsibility of the employer. Employees are on the front

lines of workplace safety and are in the best position to identify potential hazards. By doing this, they keep themselves and others working around them safe.

1.1 Statement of Problem

The issue of industrial safety is a worldwide concern to employers, workers and their families. According to Pavan and Muchiri (2010), work-related accidents and diseases continue to have serious consequences, with an estimated 2.3 million fatalities per year and economic losses of 4% of global gross domestic product (GDP).

Statistical data concerning industrial and work-related accidents form an essential base for their prevention and occupational health and safety (OH&S) promotion. This data remains fragmented and therefore, it is important to have a common data base worldwide which is accurate and reliable to avoid underreporting. This underreporting causes fewer resources to be allocated to preventive work, which in turn has a negative impact on safety and welfare of the workers.

Challenges facing industrial safety and health programmes in Ghana and the world at large include the recognition and elimination of workplace hazards, reduction of unnecessary risks, and the prevention of accidents. Safety management as a shared responsibility is of importance to employer and employee. Preventing injuries in the workplace depends on an employer's ability to identify, quantify, analyze, and address the origin of hazard root causes, and track them (U.S. Department of Human Services, 2001).

According to Ghana Statistical Report (2016), work place accidents reported in 2016 numbered 1,096 with the Manufacturing Industry recording the highest (270). In all, a total

of GH¢4,759,713.20 is the outstanding compensation for both the Public and Private Sectors to be paid as work injuries and compensations (Ghana Statistical Report, 2016).

The perception that industrial accidents and health hazards are frequent in machine workshops at Kokompe in the Sekondi - Takoradi, industrial area is not an exemption. Increased technological dependence has worsened accidents rates, involving more people, greater damage to property and the environment. This research investigates how industrial safety management in machine shops is observed to minimize industrial accidents regardless of the size and location.

1.2 Purpose of the Study

The purpose of this study is to contribute to the industrial safety, by analyzing the effect of safety auditing on performance in industrial machine shops. Safety performance is noted through the following observations on safety auditing effects on:

- the form of accidents, causes and how to curb it in the machine shops.
- not using Personal Protective Equipment and lost time case rates data.

1.2.1 Research Objectives

The following specific objectives will help accomplish the purpose of the research:

In the quest to realize the stipulated objectives and to answer the research questions, the following objectives are set;

1. To identify and examine the various forms of accidents in the machine shops

2. To explore the underlying root causes of accidents in the machine shops their effects and how to curb it

3. To determine the relationship between gender, age, educational level and length of service of artisans in compliance to safety rules at the machine shops.

1.3 Research Questions

The following research questions are articulated to answer the research aim and objectives; the study is guided by the following research questions:

1. What are the various forms of accidents that occurred in the machine shops?

2. What are the root causes of accidents in the machine shops their effects and how to curb the accidents?

3. What is the relationship between gender, age, educational level and length of service of artisans at kokompe and their compliance to safety rules and regulations at the machine shop?

1.4 Significance of the Study

Over the last two decades, national injury and illness trends as reported by the Bureau of Labour Statistics (1997) reveal a need for proactive methods of workplace surveillance activities to reduce the occurrence of accidents. Workplace occupational health surveillance provide ongoing, systematic collection and analysis of information needed for accident and injury prevention national institute of safety and health (NIOSH, 1994). Generally, however, surveillance data remain fragmented, collected for different purposes, by different organizations, using different definitions (NIOSH, 1994). The study would

also serve as a guide for instructions in the mechanical machine shops (auto body builders and welders) to educate shop owners and artisans about the appropriate safety management practices.

1.5 Delimitations and Limitations

1.5.1 Delimitations of the Study

The research is limited in scope to the machine shops at Kokompe industrial area, a suburb Sekondi - Takoradi Metropolis in Western Region of Ghana.

1.5.2 Limitations of the Study

The study was confronted with a number of constraints and challenges. Some respondents were unwilling to provide responses to the questionnaire which posed as a major challenge. They were not comfortable to give out information on their places of work. The researcher solved this problem by assuring them of the confidentiality of the information they provided. Time was another constraint of the study since a lot of time was spent retrieving the questionnaires administered to respondents. However, upon frequent visits almost all the questionnaires sent were retrieved for analysis.

1.6 Organization of the Study

The study was organized into five chapters. The first chapter which is the general introduction covers the background of the study, followed by the problem statement, aims and objectives of the study, research questions, delimitation and limitations of the study and organization of the study. Chapter two, reviewed extensive related empirical literature

on the subject matter. Chapter three covered the methodology for the study. It comprises the research population, sample size and sampling techniques, research design, sources of data and data collection instruments, data analysis method, questionnaire design and measures of variables.

The data presentations and analysis are contained in chapter four. Chapter five which is the last chapter contains the summary of major findings, conclusions, recommendations, suggestions for further research and finally the references and appendices.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this chapter, the writer tries to review the related literature using both primary and secondary data. Bernard (2002) concurs that primary data is a kind of data that is collected at first hand. Secondary data are data from published and unpublished books, internet, journals and other relevant information on the topic. The main headings discussed in this chapter are:

2.1 Issues on Industrial Health and Safety Practices in Ghana

2.2 Knowledge of Occupation Health and Training

2.3 The Factories, Offices and Shops Act, 1970 (Act 328)

2.4 Industrial Health, Safety and the Law

2.5 Responsibilities and Rights of Employees and Employers in Health and Safety Issues

2.6 Ergonomic Risk Factors

2.7 Education and Skills Training

2.8 Workplace surveillance, Accidents, Types, Causes and Effects of Accidents

2.9 Organisational Commitment and Safety Culture

2.10 Maintaining Healthy Work Environment

2.11 Inspection, Accidents Investigation and Evaluation

2.12 The Costs and Benefits of Industrial Health and Safety Programmes

2.13 Promoting Job Safety & Health

2.14 Maintenance

2.1 Issues on Industrial Health and Safety Practices in Ghana

The Ministry of Health Report (2007) identified some OH&S challenges in Ghana. These include weak OH&S infrastructures, untrained and inadequate OH&S professionals, and lack of proper monitoring and surveillances for occupational health and safety diseases and injuries.

In support, Muchiri (2003) buttressed these problem scenarios by indicating that, poor OH&S infrastructure and funding, insufficient number of qualified occupational health and safety practitioners and the general lack of adequate information are among the main drawbacks to an effective OH&S practices. Kheni (2008) conducted a survey on health and safety practices among construction SMEs and revealed serious OH&S problems. The main problems identified by Kheni included lack of skilled human resources, inadequate government support for regulatory institutions and inefficient institutional frameworks responsible for health and safety standards. Additionally, insufficient OH&S education has been one of the challenges to occupational health and safety practices (Ministry of Health Report, 2007).

According to Ghana Statistical Report (2016), there was a drastic decline in the total number of OS&H Talks/Training organised by the Regions from 178 in 2015 to 36 in 2016. All the Regions witnessed a decline in the number of OSH Talks/Training organised. The number of workplaces inspected in 2015 declined by 259, representing 13.12%, in 2016. There has been a decline in the total number of inspections of registered workplaces from 2014 to 2016 by Region Ghana Statistical Report (2016).

The Factories, Offices, and Shop Act 1970, (Act 328) establishes that there shall be an appropriate means of fighting fire in every factory, office and shop in Ghana (Alfers, 2009

cited in Puplampu & Quartey (2012). This explains why the few OH&S policies, status and regulations do not work.

According to Odhiambo (2003), a visit to factories in the country, only one small company had an OH&S policy, indicating little commitment on the part of small companies. Personal Protective Equipment (PPE) was the main measure adopted to mitigate the effect of hazards in all the Metal and Wood Processing Industries. These were safety boots, overall coat, nose masks, ear protectors, goggles and gloves. Generally, apart from the PPE's not being adequate and not properly used, there was lack of enforcement in their use. The supervisors on the factory floor did not also wear Personal Protective Equipment.

There appeared to be low administrative and engineering controls in companies because it appeared most managers perceived injured worker's replacement an easy option, and that insurance cover for injury was a sufficient protection for their workers and companies. Consequently, they perceived occupational hazards in the work place to be normal with their operations and, therefore, lacked the commitment to ensure safe healthy practices (Odhiambo, 2003).

2.2 Knowledge of Occupational Health and Safety

In the late 19th and early 20th centuries, employers ran their businesses as they saw fit to make profit. Employee safety and health were not their concern. In fact, in official terms these things were nobody's concern. In the U.S. injured employees had to litigate to obtain compensation for their injuries. The cost of doing so effectively prevented employees from going to court. Besides, employees were rarely successful since, under common law, if the

employee knew of the hazards the job entailed or if the injuries were brought about as a result of the negligence of the employee or a co-worker, the employer was not liable.

From these origins, there has emerged an approach and practice with regard to health, safety and welfare issues. The national safety council had been established in 1913 in the U.S. after safety conscious managers and engineers spearheaded its founding (major disasters led to changes in thinking). Significantly the international labour organization (1959) provided that occupational health services should be established in or near a place of employment for the employee welfare (International Labour Organisation, 1959 as cited in 1998). According to Pavan and Muchiri (2010), work-related accidents and diseases continue to have serious consequences, with an estimated 2.3 million fatalities per year and economic losses of 4% of global gross domestic product (GDP).

There are many kinds of knowledge. Advances in science and technology have had the greatest impact on the information base for manufacturing. Tools, machines, and processes have all changed dramatically since the Industrial Revolution. They continue to do so. Workers must have some knowledge of the tools of their trade and any materials and processes they use. This knowledge is gained through formal education like high schools, vocational and trade schools and colleges. They can also gain information through on-the-job training (Komacek et al., 1997).

Industrial safety should be a primary concern for all manufacturers. It is achieved by providing the safest possible environment and maintaining strict safety behaviour of employees. Both these goals take knowledge on the part of employers and employees.

The employers' job is to provide a safe working environment for employees and to encourage safe work habits. The employees' job is to work safely. Knowledge of the

hazards associated with the jobs is an essential part of any safety training. Most manufacturing companies have coordinated safety programmes.

Most successful safety programmes have the following components:

a) Educating employees to be alert to hazardous conditions. This knowledge is often specific and might not come automatically to workers

b) Co-ordinating safety and engineering principles when designing or installing new job equipment. Jobs should be designed with safety in mind.

c) Encouraging workers and management to have a positive attitude about safety through safety meetings, safety posters, safety movies and bonuses.

d) Support from all levels of management. This includes willingness to enforce safety rules (Komacek et al., 1997). Research by Nunez and Villanueva (2011) affirmed that there is direct relationship between safety knowledge as well as safety awareness and lower occurrence of occupational accidents.

From these, safety can be defined as the way of ensuring that the artisan/craftsman and his/her environment are protected from injury as well as the equipment.

2. 2.1 Safety and Warning Signs

It is important to know what Safety signs and symbols signify because they are in place to keep you and others safe. They are all around us in the world. These signs are designed to inform the reader of potential hazards or dangers usually printed on a rigid or semi-rigid material. They are typically mounted on a wall or a container in proximity to or containing a potentially dangerous object or material. These signs are typically printed on rigid or flexible materials and mounted or placed in the area of concern. Rigid safety signs and

warning signs may be printed or engraved on metal or plastic unit that are mechanically attached to a product with a fastener or adhesive, whereas flexible signs are usually adhesive-backed. Safety signs and warning signs are often printed with bright or fluorescent colours to maximize visibility.

According to Killeen et al. (1999), safety signs and warning signs are typically pasted on jobsites, worksites, municipal areas, but safety signs and warning signs may be displayed anywhere that people need to be notified or protected. They are typically classified by the manufacturer by its make, colour, size, language, adhesiveness, or non-adhesiveness and the format of the matter of the label. Safety labels and warning labels are classified according to their functionalities as well. Others recommend use of head, eye, or ear protection. Some safety signs and warning signs alert the reader to laser, burn, static, or grounding hazards; step and slipping hazards, crane hazards, forklift safety and conveyor use. These warning signs also provide notification of compliance with OSHA regulations and against hazardous materials like asbestos, pesticides, biohazards, carcinogens and flammable or explosive materials. The signs may have different uses depending on the location; they are often used in a variety of jobsites and workplaces, including laboratories, medical fields and any other area where caution of hazards may occur (Killeen et al., 1999).

Zimolong and Elke (2006) outlined the following as merits of Safety Signs:

- it gives the information required to execute a task and
- the information required to keep existing risks under control.

They emphasize the need for establishing signs, warnings, introducing personal counselling, training and qualification efforts. As Hoyos et al. (1991, as cited in Zimolong & Elke, 2006) have demonstrated, employees have little knowledge of hazards, safety rules

and proper personal protective behaviour. In some cases (16.1%) of signs and warnings support perception of hazards usually, however, people rely on knowledge, training and work experience. It is without doubt mandatory to improve the indication of hazards and risks by warning signs and labels. The use of labels and warnings to combat potential hazards, however, is a controversial procedure for managing risks. Too often, they are seen as a way for manufacturers to avoid responsibility for unreasonably risky products. Obviously, labels and warning signs will be successful only if the information they contain is read and understood by members of the intended group of people. Frantz and Rhoades (1993, as cited in Zimolong & Elke, 2006) found out that 40% of clerical personnel using a filing cabinet noticed a warning label placed on the top drawer of the cabinet; 33% read part of it and no one read the entire label. Contrary to expectation, 20% complied completely by not placing any material in the top drawer first.

2.3 The Factories, Offices and Shops Act, 1970 (Act 328)

The Factories, Offices and Shops Act (Act 328) and its related regulations including Boilers and Pressure Vessels Safety Regulations, regulate the occupational safety and health of workers in Ghana. The Department of Factories Inspectorate has the statutory responsibility for the enforcement of the Act and its regulations whose objective is to promote measures to ensure safe persons at work and safe place of work in factories, offices, shops, building operations and works of engineering constructions and docks. The Act which was promulgated by the government was, for the most part, a restatement of the requirement of the Factories Ordinance of 1952 with innovations made to bring it in line with the internationally accepted standards providing for the safety, health and welfare of

persons employed in factories, offices and shops [As amended by the Factories, Offices and Shops (Amendment) Law, 1991 (Provisional National Defense Council Law (PNDCL 275), s.1 (k)].

General Provisions

The general provisions in the Act include the following:

Notification of industrial poisoning or diseases: Cases of poisoning by lead, phosphorous, arsenic, mercury, or manganese; toxic anemia, toxic jaundice, anthrax and certain other industrial diseases occurring in any factories or shop must be reported immediately to the Chief Inspector or the inspector for the district (Section 12).

Notification of accident and dangerous occurrences: Accident, causing loss of life or disabling a worker for more than three days from earning full wages at the work which he/her was employed, must be reported forthwith to the Chief Inspector or the inspector for the district and the case entered in the General Register. Certain dangerous occurrences must also be reported whether disablement is caused or not for example, the bursting of revolving vessel wheel or grindstone moved by mechanical power, the collapse or failure of a crane, hoist or other lifting appliances, or the overturning of a crane and explosions of fires in certain circumstances (Sections 10 & 11).

Accurate records on accidents in Ghanaian industries are very difficult to obtain as many work related accidents and illnesses are not reported at all. This notwithstanding, the requirement under the labour decree that all accidents that incapacitate workers for more than five day must be notified. Moreover, the method of reporting disabling accidents, though satisfactory for purposes of workmen's compensation requirements was quite

inadequate for statistical purposes since statistical information was necessary to give proper guide to the size or nature of the problem as well as indicating directions in which remedial actions are urgently needed. The statement above underscores the fact that statistical information on work-related diseases and accidents are difficult to obtain, as those available are at best only estimates, not the actual figures.

Safe means of Access and Place of Employment: As far as it is reasonably practical, there must be provision of safe means of access to every place at which any person has at any time to work. Every such place should be kept safe for everyone working there and there should be fencing or other means to ensure the safety of any person who is to work at a place from which he would be liable to fall more than eight feet and which does not provide secure foothold or secure handhold. Sufficient clear and unobstructed space should be maintained at every machine in motion to enable work done without unnecessary risk (Section 34).

Training and Supervision of Inexperienced Worker: No person may work at any machine or in any process likely to cause him injury unless fully instructed as to the dangers likely to arise and the precautions, which he must take and has received sufficient training or is under adequate supervision (Section 36).

New machines: New power-driven machines must not be sold, let out, hired, or used unless certain specified parts are effectively guarded (Sections 41).

Protection of eyes: Suitable goggles or effective screens must be provided in certain specified processes. Where electric arc welding is carried out, the process must be screened or other provision made to prevent persons other than the actual welders from being affected by the electric arc flash (Section 25).

Duties of persons employed: A person employed must not deliberately interfere with or misuse any means, appliance, convenience or other things provided under the Act for securing the health, safety or welfare of employees. No employee must, willfully and without reasonable cause, do anything liable to endanger him or others. Where the law requires any means or appliance to provide for securing health or safety, persons employed must make use of such means and applications (Section 78).

Meals in certain dangerous places: A person must not be seen taking food or drink in any room of a factory or shop where any poisonous substances are used as to give rise to dust or fumes. Suitable arrangements should be made to enable persons employed in any such room to take their meals elsewhere in the premises (Section 24).

First aid: A first aid box or cupboard of the prescribed standard, containing requisite first aid drugs and items must be provided in every factory, office and shop. Each box must be placed in charge of a responsible person who might possibly have acquired adequate knowledge in first aid treatment and must always be readily available during working hours (Section 28).

Precautions against fire and explosion: Every factory, office and shop must have adequate and appropriate means of fighting fire, which must be kept in good condition and readily available for use. All stocks of highly inflammable substance must be kept in a fire-resisting store or in a safe place outside the building; the store in such cases must not be so placed as to endanger any exit from the factory if any fire occurs inside the store (Section 31).

Inspection

It is management's responsibility to implement a regular system of scheduled safety inspections for each workplace process and machine. For certain items of plant, the frequency of inspection and the records to be maintained are laid down in the relevant regulations or are recommended in applicable codes of practice (examples, cranes lifting tackles, steam boilers). It is essential to establish clearly who is to inspect what and at exactly what intervals and who in turn is to supervise these inspection activities. There should be a procedure for checking that corrective action is taken promptly following an adverse inspection report.

Safety representatives are entitled to inspect the workplace or any part of it if they have given the employer or the employer's representative reasonable notice in writing of their intention to do so. By agreement with the employer, inspections can be more frequent. Inspection of the workplace may be jointly carried out by the employer or employer's representatives and safety representatives and it will be often by the employer or employer's officer or specialist advisers to be available to give technical advice on health and safety matters which may arise during the course of inspection.

The safety representations will bring to the employer's notice (normally in writing) any unsafe or unhealthy conditions that come to their attention. In some cases, urgent safety and health matters are brought to the attention of the employer by direct oral approach. In the first instance, particularly where speedy remedial action is necessary or where there has been a modifiable accident, dangerous occurrence, disease and it is safe and in the interests of the employees, the safety representatives may carry out an inspection where it is reasonably practicable to do so. The employer shall provide such facilities and assistance as may reasonably be required for such an inspection. Where it is necessary for the

employer, following an accident or dangerous occurrence to take urgent steps to safeguard against further hazards, the employer should notify the safety representative of the action taken and confirm it in writing (Health and Safety Executive,1992).

Factory Inspectors

Factories Inspectors are appointed under the Factories, Offices and Shops Act 1970, (Act 328) and through them the government who takes a very lively interest in industrial accidents and health hazards prevention exerts every means in its power to keep them as low as possible. They may enter a factory, office or shop at any reasonable time by day or by night if there is good cause to believe that people are at work there. They may require the production of registers, certificates and other papers. They may also exercise such other powers as may be necessary for carrying the Act into effect, including certain powers of taking samples for analysis. It is an offence to obstruct an inspector in the execution of his duties (Sections 74 to 77). The inspectors expect the employers to provide facilities such as toilets, urinals, washing and sitting facilities as well as change rooms or places for workers' cloths.

The safety provisions seek to ensure that there is enough firefighting equipment to fight any fire outbreak or escape routes for employees. There are also provisions for fire alarms and drills. It is required that all dangerous parts of machinery are securely guarded and equipment is checked periodically. The Chief Inspector has the prerogative to prosecute any employer for failing to comply with the provisions of the Act [As amended by the Factories, Offices and Shops (Amendment) Law, 1991 (PNDCL 275), s.1 (k)].

Penalties for contraventions of the Act

Most persons who are connected to factories, offices and shops Act whether employers or employees would carry out the provisions mentioned in the Act because they are necessary for the prevention of accidents. The preservation of health and in fellow men or with desire to have an unfair advantage over their law-abiding competitors, would disregard their obligations and for those persons, penalties consisting of a fine or imprisonment or both have been included in the Act.

2.4 Industrial Health, Safety and the Law.

Ghana's Labour Act 2003, Act 651 states that an employer shall;

- Provide and maintain at workplace, plant and system of work that are safe and without risk to health.
- Ensure that safety and absence of risks of health in connection with use, handling, storage and transport of articles and substances.
- Provide the necessary information, instructions, training and supervision having regard to the age, literacy level and other circumstances of the worker to ensure, so far as if reasonably practicable, the health and safety at work of those other workers engaged on the particular work.

The Act again states that an employer who, without reasonable excuse, fails to discharge any of the obligations listed above commits an offence and is liable on summarily conviction to fine not exceeding 1000 penalty units or to imprisonment for a term not exceeding three years or to both. In all Canadian jurisdictions, occupational health and safety law provides for government inspectors to periodically carry out safety inspections

of workplaces. As in local scene, penalties consist of fines and/or jail terms. Canadian corporate executives and directors are held directly responsible for work place injuries.

2.5 Responsibilities and Rights of Employees and Employers in Health and Safety Issues.

Gany, Dessler et al. (2001) state that employers are responsible for taking every reasonable precaution to ensure the health and safety of their workers. This is called the "due diligence" requirement.

Specific duties of the employer include;

- Filing government accident reports
- Maintaining records
- Posting safety notices and legislative information
- Education and training on health and safety precautionary measures
- Employees also have responsibilities which include taking reasonable care to protect their own health and safety and, in most cases, that of their co-workers.
- These specific requirements include;
- Wearing protective clothing and equipment
- Reporting any contravention of the law of reputation.

Downey et al. (1995) identify the following as employees' basic rights under the joint responsibility model:

- The rights to know about workplace safety hazards.
- The right to participate in the occupational health and safety process.

- The right to refuse unsafe work if they have "reasonable cause" to believe that the work is dangerous.

"Reasonable cause" usually means that a complaint about a workplace hazard has not been satisfactorily resolved, or a safety problem places employees in immediate danger. If performance of a task would adversely affect health and safety, a worker cannot be disciplined for refusing to do the job.

2.6 Ergonomic Risk Factors

When using machines, there are ergonomic health risks that can lead to sprains and strains to one's back and other parts of the body (Workplace safety and health council, 2014). Ergonomics is the study and design of the work environment to address physiological and physical demands on individuals. In a work setting, ergonomic studies look at such factors as fatigue, lighting, tools, equipment layout and placement of control (Robert and John, 2004

Workplace factors associated with musculoskeletal disorders include:

Awkward postures: The human body functions best in natural postures. Prolonged awkward body postures increases the stress on muscles and ligaments, leading to muscular fatigue, discomfort and increased risk of injury. Examples of awkward postures include workers having to bend low for maintenance work or operators having to stretch uncomfortably to operate machines.

Repetitive Movements: Many machines are designed to achieve industrial efficiency by breaking down manufacturing processes into simple steps that machines can carry out. While some steps can be fully automated, the requirement for man-machine interaction

usually remains for key operating steps like loading of raw material, quality inspection and final assembly. These steps may require repetitive movement by the machine operator (Workplace safety and health council, 2014).

These repetitive movements may become detrimental to workers' health leading to chronic musculoskeletal disorders. This usually happens when the same joints and muscle groups perform the same action often, quickly and strenuously over an extended period without giving the body sufficient time to rest and recover (Workplace safety and health council, 2014).

2.7 Education and Skills Training

Efforts at all levels are in a key position to provide pre-requisite knowledge for better occupational safety and health. According to Health and Safety Executives (SHE) Guidance on Regulations L22 Power (1992, as cited in Timings & Wilkinson, 2000), Regulations 9 training deals with workforce training and states that all persons who supervise, manage or use work equipment must have received proper and adequate training for all purposes of health and safety. Such training must include the correct use of equipment, awareness of any risks entailed and the precaution taken.

One way to increase awareness is training, which should be included in all professional education, starting from elementary and primary school. Personnel injured at work often lack the information, knowledge, and skills required to protect themselves. An effective, comprehensive training programme will result in increased efficiency, reduce absenteeism and workers' compensation costs due to accidents. Helliriegel et al. (2010) states that training of employees in organisation increases higher productivity through better job

performance, more efficient use of human resources, goals and objectives more effectively met, reduced cost due to less labour turnover, reduced errors, reduced accidents and absenteeism, more capable, and mobile workforce and retention of the existing staff. In multinational companies, training can provide an important impetus to achieve shared values and facilitates network building between headquarters and subsidiaries.

According to Mukala (2009), the aim of the training is to bring expertise and skilled persons to the field of Occupational Health and Safety (OH&S) and thus build up the productivity of the country, thus reducing poverty and increasing employment

Work Experience: With the increased use of new complex robotic and automation technologies, many more jobs in manufacturing require some sort of education beyond high school (Komacek et al., 1997). Therefore, it is important for every employer and employee to train their work force to be skillful, knowledgeable and to stand the test of time. This will also improve quality of work, productivity and above all reduce the incidence of accidents and enhance risk and safety awareness.

To the extent that keen vision, hearing, balance and other physical or psychological characteristics make a critical difference between success and failure on a job. Two other factors also relate strongly to the rate of accidents among workers; age and length of service. Regardless of length of service, the newer the employee, the higher will be the accident rate. In fact, accident rate are substantially higher during the first month of employment than in all subsequent times, regardless of age. In addition, when workers of the same age are studied, accident rates decrease and the length of service increases. For instance, in mining, the disabling injury rate for miners 18 to 24 years of age is about 3

times that of miners over 45 and it holds true in industries as diverse as retail trade, transportation and public utilities and services. The lesson for managers is clear: new worker equals high risk (Cascio, 1992). The Factories, Offices and Shops Act (Act 328) section 36 also talks about how training and supervision of inexperienced worker be carried out.

2.8 Workplace Surveillance, Accident, Types, Causes and Effects

Surveillance is the cornerstone of prevention: "It helps to identify new and emerging problems, track and monitor issues over time, target and evaluate the effectiveness of intervention efforts, and anticipate future needs and concerns" (U.S. Department of Human Services, 2000). The goal of the safety-auditing program is to achieve safety incident rate reduction at the first line of defense on the shop floor, and at the observable exposure stage before hazardous incidences occur. When workplace accidents identified and categorized and trends, or specific incidents such as hand injuries, can be targeted for improvement and elimination Targeting physical hazards and unsafe behaviours early removes the foundation for greater injuries.

2.8.1 Accident

The Royal Society for the Prevention of Accidents of the United Kingdom defines an accident as any unforeseen, adverse event causing harm or having the potential to cause harm Kiwekete (2009). Workplace accident is an event that takes place without foresight or expectation and can result in some personnel injury and damage to equipment or property. Hazards and disasters or accidents occur in all aspects of life - at home, at work and elsewhere. A narrow definition of industrial accidents conceives them as resulting from

faulty equipment or the improper performance of an individual, i.e. something arising directly out of a situation. Self-inflicted injured cannot be regarded as an accident (Ghosh, 2000).

An occupational accident is an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work, which results in one or more workers incurring a personal injury, disease or death. Occupational accidents can also be considered as transport or road traffic accidents in which workers are injured and which arise out of or in the course of work, i.e. while engaged in an economic activity, or at work, or carrying on the business of the employer, International Labour Organization ILO (1998).

2.8.2 Types of Accidents

Chsafetyblogspot.com (2008) and Chapman (1979) grouped industrial accidents into: mechanical, non-mechanical and electrical accidents.

Mechanical Accidents: These are accidents caused by moving or rotating parts of machinery, which are not guarded. It is the responsibility of the management to provide safety. Safety Act states that every part of transmission machinery and every dangerous part of any other machinery must be securely fenced unless it is in such a position or of such construction as to be safe to every person.

Shafts, rotating projections such a bolts and key heads, conveyor belts, power transmission belts, pulleys, gears, spindles and any part of machines, which could catch loose, flapping clothing of passers-by or the operator and part deemed to be dangerous must be provided with some types of guard.

Non-mechanical Accidents: These are cause by situations such as fall, either from slippery floors or from heights because of the use of bad condition of ladders and working

platforms and so on are examples of non-mechanical accidents. Working bare - footed in the workshop, lifting heavy loads with hand, badly fitting spanners may slip with disastrous results to the knuckle, the user should make sure that the spanner fits very well before exerting load on to it. A loose file shaft or file may result in the spike at the end of a file being driven into the hand or piercing the palm during filling. “Safety-first” habit should be cultivated. These are not caused by any moving parts of machinery.

Electrical Accidents: Electricity is particularly a hazardous medium in that the danger involved is commonly the danger of death. Electrical hazards to human beings may result in electric shock, direct shock, direct burns, or secondary injury form non-lethal shocks. To property, it may result in fire outbreaks or explosions (either of which can cause human injury).

2.8.3 Causes of Accident

Pirani and Reynolds (1976) and Cacio (1992) indicate that accidents results from two broad causes: unsafe work condition (physical and environmental) and unsafe work behaviour. Unsafe physical conditions include defective equipment, inadequate machine guards, and lack of protective equipment. Examples of unsafe environmental conditions are noise, radiation, dust, fumes, and stress. Accidents often result from an interaction of unsafe acts. Thus if a particular operation forces a worker to lift a heavy part and twist to set it on a bench, then the operation itself forces the worker to perform the unsafe act (Pirani and Reynolds, (1976) and Cacio, (1992). Telling the worker not to lift and twist at the same time will not solve the problem. The unsafe condition itself must be corrected, either by redesigning the flow of material or by providing the worker with a mechanical devise for

lifting. Engineering controls attempt to eliminate unsafe work conditions and to neutralize unsafe worker behaviours. Management controls attempt to increase safe behaviours. Engineering controls involve some modification of the work environment; for example, installing a metal cover over the blades of a lawnmower to make it almost impossible for a member of a grounds crew to catch his or her foot in the blade.

Safety Rules: These are important stipulations which must be followed by workers in order to avoid accidents, for example, the wearing of goggles when grinding, wearing of face shield when arc welding, respirators to avoid inhalation of smoke, fumes, toxic dust and so on. Workers must obey these rules. Cascio (1992) argued that if rules are not obeyed it could mean that they are not being enforced or because of flaws in employee selection practices and inadequate training or lack of motivation.

Employee Selection: During recruitment, certain factors such as dexterity, keen vision, age, length of service (experience), physical and psychological characteristics are considered before an employee is selected for a particular work.

Feedback and Incentives: Workers must frequently be given feedback of their performances (both good and bad performances) especially safety behaviours. If the unsafe behaviours are recorded, measured and compared with accepted standards and the actual percentage of their safe behaviour posted in cache department, they would be motivated to obey behavioural safety rules more and always improve on their performances.

Employees and Supervisors Training: Ignorance or lack of information is a factor that contributes immensely to causation of accidents. Workers therefore have to undergo training to equip them with all the necessary information required to work with.

It is also estimated by Ghosh (2000) that 98% of workplace accidents are due to faulty inspection, poor discipline, and lack of concentration, unsafe practice and mental and physical unfitness for the job. Human factor has been identified as the main contributor of workplace accidents while only a minor proportion (10 percent) of workplace accidents is due to physical causes, such as faulty equipment and bad working conditions (Ghosh, 2000).

Human error was also noted by Ameweelo (2000) as the cause of many accidents. He noted that employees who worked under stress or who felt insecure about their jobs were prone to accidents more than those who did not have such mental conditions. Amedofu (2002) identified 'unsafe acts', and defined as behaviours and attitudes that significantly cause accidents. They include the failure to secure equipment and use safe attire or Personal Protective Equipment (PPE), indiscriminate littering of refuse, operating or working at dangerous speed levels, lifting improperly and assuming unsafe positioning while performing a task.

Graham and Bennett (1992) is of the view that work schedule refers to the length of time one spends on doing a particular job and the period of the day work is done. After working on a particular job for six hours, subsequent working hours could lead to accident. The rate of accident is proportional to the number of extra hours. Graham and Bennett (1992) attribute it to fatigue and partly to the fact that accidents occurs more often during night shifts.

Zimolong and Elke (2006) categorized the causes of accidents as:

- Unsafe Acts and Unsafe Condition, Overconfidence, Carelessness
- Inattentiveness

- Inexperience and Attitude.

2.8.4 Accident Prevention in Industry

Developments in behaviour management, goal setting, management systems, and quality assurance point to possibilities for accident prevention in industry. Krause, Hidley and Lareau applied their findings and added to this knowledge the results of their experience working in occupational safety (Krause, Hidley, & Lareau, 1984). They discovered, for example, that the most effective observations target those behaviours that led to incidents in a given location in the past (Krause, 1989, 1992).

Rather than using a standard list of behaviours that may or may not be problematic in a particular setting, Krause, et al. (1984) adapted quality control techniques to standard methods for identifying relevant behaviours from incident reports Krause, et al. (1984). They found that behavioural observations with immediate two-way, interactive feedback are most effective for changing behaviour in the industrial setting. Continuous improvement Krause, et al. (1984) went beyond the traditional model of training supervisors and managers, to observe behaviour and deliver feedback, or of having auditors outside the organization perform the function. They prescribed that involving employees at all levels of the organization can give the employees the authority to make observations, give feedback, and then use the behavioural-based information to target areas for safety improvement. Employee participation in the safety initiatives gives them buy-in and the tools to train new participants (Killimett, 1991).

2.9 Organisational Commitment and Safety Culture

Effective safety management requires an organizational commitment to safe working conditions. But more importantly, well designed and managed safety programmes can pay dividends for associated costs such as worker's compensation and possible fines. Furthermore, accidents and other safety concerns usually decline as a result of management efforts emphasizing safety (Salon, 2001).

Robert and John (2004) state the heart of every safety management is the organizational commitment to a comprehensive safety effort. This effort should be coordinated from the top level of management to include all members of the organization. It should also be reflected in managerial actions.

Employers can prevent some accidents by having machines, equipment and work areas so that workers who daydream periodically or who perform potentially dangerous jobs cannot injure themselves or others. Providing safety equipment and guards on machinery, installing emergency switches, installing adequate ventilation, installing emergency switches, installing safety rails, keeping aisles clear, lighting, heating and air conditioning can all help make work environment safer. Designing jobs properly requires consideration of physical setting of a job. The way the work space surrounding a job is utilized can influence the worker's performance of the job itself. Several factors that affect safety have been identified; including size of work area, kinds of materials used, sensory conditions, distance between work areas, and interference from noise and traffic flow. Designing safety policies and rules and disciplining violators are important components of safety efforts. Frequently reinforcing the need for safe behaviour and supplying feedback on positive

safety practices also are effective in improving worker safety. Such efforts must involve employees, supervisors and managers (Robert and John, 2004).

Rousseau (1988) defined culture as "the ways of thinking, behaving and believing that members of a social unit have in common". Reason (2000), identified a number of characteristics that go to make up such a safety culture. These include, an informed culture, reporting culture, flexible culture, just culture and learning culture. An informed culture he said refers to those who manage and operate the systems knowledge about the human, technical, organizational and environmental factors that determine the safety of the system as a whole, whilst a reporting culture is the willingness in which people report errors and near misses. It should be noted that behaviour in the workplace directly influences the safety climate in the workplace, which in turn exerts a positive effect on the attitude of employees in the workplace (Gyeke Salminen & Ojajarvi, 2012).

2.10 Maintaining Healthy Work Environment

David and Stephen (1999) indicate that unhealthy work environment is a concern to us all. If workers cannot function properly at their jobs because of constant headaches, watering eyes, breathing difficulties, or fear of exposure to materials that may cause long term health problems, productivity will decrease. Consequently, creating a healthy work environment not only is the proper thing to do, but it also benefits the employer. Often referred to as sick buildings, office environments that contain harmful airborne chemicals, asbestos, or indoor pollution (possibly caused by smoking) have forced employers to take drastic steps. For many, it has meant the removal of asbestos from their buildings.

Palmer (1989) makes suggestions for keeping the workplace healthy. These include

- making sure workers get enough fresh air. The cost of providing it is peanuts compared with the expense of cleaning up a problem.
- Testing new buildings for toxins before occupancy. Failure to do so may lead to potential health problems.
- Providing a smoke-free environment. If you do not want to ban smoking entirely, then establish an area for a smoker that has its own ventilation.
- Keeping air ducts clean and dry. Water in air ducts is a fertile breeding ground for fungi. Servicing the air ducts periodically can help eliminate the fungi before they cause harm.
- Paying attention to workers' complaints. Dates and particulars should be recorded by a designated employee. Because employees are often closest to the problems, they are a valuable source of information.

2.11 Inspection, Accidents Investigation and Evaluation

It is not necessary to wait to inspect the work area for safety hazards. Inspections may be done by a safety committee or by a safety coordinator. They must be done on a regular basis. According to Eva and Oswald (1981), Ridley and Channing (2004), there are basically two types of information are collected in all accident investigations. Investigation at the scene should be done as soon as possible after the accident to ensure what happened has not changed significantly. Such information as such as persons injured, date and time of accident what caused the injury, damage or other loss. The second phase of investigation covers why the accident happened, this is meant to ascertain the causes of the incident, which is more difficult to identify and thus more open to interpretation is the interview of

the injured employee, his or her supervisor and witnesses to the accident. This is followed by recommendations. Organization should monitor and evaluate their safety efforts. Just as organizational accounting records are audited, a firm's safety efforts and records should be audited periodically as well. The ideal investigation should therefore be neutral with respect to fault and should have the primary purpose of obtaining information necessary to prevent recurrence.

2.12 The Costs and Benefits of Industrial Health and Safety Programmes

Cacio (1992) states that employers frequently complain that there is no systematic method of quantifying costs and benefits when dealing with employees' safety and health conditions. Technically that is true, but there is a behaviour costing model that may provide a useful start. It is important to distinguish nondiscretionary from discretionary safety and health expenditures. Some states and local agencies require firms to comply with safety and health regulations. To comply, firms may have to purchase and install special equipment, such as machine guards, safety switch interlocks, and nonslip flooring. These costs are nondiscretionary. To do otherwise is to risk heavy fines and losses from liability and damage suits. Cacio (1992) stressed that, beyond mere compliance, however, companies have a number of options regarding the degree to which they invest in employee safety and health. A motivational poster programme (e.g. "think safety") is a token effort that requires minimal expenses. Creation of a safety committee to encourage active employee complaints is more expensive. The highest-cost option includes regular safety training for all employees. The training may involve films, lectures by safety experts or hands-on drills and demonstrations with safety and emergency apparatus.

Boyd (2003) states that for each of these levels of safety and health programmes, investment costs are measurable. They include the salaries and wages of employees participating in the programme, the costs of outside services used and the costs to implement the programmes. Unfortunately, the benefits to be derived from such programmes cannot be traced as easily to the bottom line. Certainly, the most quantifiable benefit resulting from the successful introduction of a safety and health programme is a reduction in casualty and workers' compensation insurance rates. Less measurable benefits involve the avoidance of the "indirect "cost of an accident, including;

- cost of wages paid for time lost
- cost of damage to material or equipment
- cost of overtime work required by the accident
- cost of wages paid to supervisors while time is required for activities resulting from the accident
- costs of decreased output of the injured worker after she or he returns to work
- Unsured medical costs borne by the company
- Cost of time spent by higher management and clerical workers to investigate or to process worker's compensation forms.
- Costs associated with the time it takes for a new worker to learn the job.
- Cost of labour spent on the employee engaged to replace the injured

Prediction of these costs and identification of trends in them is very difficult. It must be done on the basis of historical information (to gauge trend) and judgment by managers (to assess the seriousness of the accidents avoided). This makes economic sense for firms to

ensure that there should be no limit to efforts to eliminate accidents and health hazards. According to McCunney (2001), the primary beneficial impact of industrial health and safety on productivity is reduced absenteeism.

2.13 Promoting Job Safety & Health

Byars and Rue (2008) suggest the following as things which can be done to promote safety and health of the organization. These include;

a) Making the work interesting: Uninteresting work often leads to boredom, fatigue and stress, all of which can cause accidents. Often simple changes can be made to make the work more meaningful. Attempts to make the job interesting are usually successful if they add responsibility, challenge, and other similar factors that increase employees' satisfaction with the job.

b) Establishing a safety committee composed of operative employees and representatives of management. The safety committee provides a means of getting employees directly involved in the operation of the safety programmes.

c) Feature employees' safety contests: Give prizes to the work groups or employees having the best safety record for a given time period. Contests can also be held to test safety knowledge. Prizes can be awarded periodically to employees who submit good accident prevention ideas.

d) Publicize safety statistics: Monthly accidents reports should be posted. Ideas as to how accidents can be avoided should be solicited.

e) Use bulletins boards throughout the organization: Such as Pictures, sketches, and cartoons can be effective.

f) Encourage employees including supervisors and managers to have high expectations for safety.

g) Periodically hold safety training programmes and meetings. Have employees attend and participate in these meetings as role players or instructors.

2.13.1 Working Conditions

The following headings shall be discussed: Good housekeeping, Machine Layout, Protective Clothing, Fire prevention and maintenance.

2.13.1.1 Good housekeeping

Krar et al. (2004) opined that operators should remember that good housekeeping would never interfere with safety or efficiency; therefore, the following points should be observed at work places.

Passages and gangways must be clear of obstructions; apart from being a hazard in them, obstructions could prevent a person from escaping quickly in an emergency.

Tools, which are not in use, must be placed in proper places so that they can easily be found when needed. Materials should be stacked carefully and tidily so that they cannot fall or obtrude into the passageway where someone can walk into them.

The floor must be kept clear and clean. Scraps such as off cuts, welding rods and cable ends, should be deposited in waste containers. Oil, grease or liquid spillages are potential hazards and must be made safe and cleaned up immediately.

Oil absorbing and neutralizing compounds should be used immediately a spill occurs; sand or sawdust should not be used as they can cause more problems than they are solved. As in emergencies, people can trip over them and fall (Krar et al., 2004)

2.13.1.2 Machine Layout

The layout of workshops can also influence safe working conditions. The layout should take account of the following:

- Spacing should be adequate to facilitate access for operation, cleaning, adjustment, maintenance and supervision.
- Lighting both general lighting levels of the workplace (natural and/or artificial) and localized lighting for specific operations and machining must be better than just adequate, but without glare, machine lights (often high-intensity halogen quartz spotlights) should operate from low-voltage supplies for safety.
- Cables, pipe and conduits should be placed to allow safe access and avoid tripping. They should be positioned so that they are free from the risk of accidental damage. Wherever possible, they should be colour coded to identify their contents (Timings & Wilkinson, 2000).

2.13.1.3 Personal Protective Equipment/Clothing PPE or PPC

According to Balchin and Castner (1993), for general workshop purpose, the boiler suit is the most practical and the safest form of body protection. However, to be completely effective, certain precautions must be taken.

Sharp tools: Sharp tools protruding from the breast pocket can cause severe wounds to the wrist. Since the motor nerves of the fingers are near the surface in the wrist, these wounds can paralyze the hand and fingers.

Button missing: Since the overall cannot be fastened properly, it becomes as dangerous as any other loose clothing and is liable to be caught in moving machinery.

Loose cuffs: Not only are loose cuffs liable to be caught up like any other loose clothing, they may also prevent the wearer from snatching his or her hand away from a dangerous situation.

Hole in pocket: Tools placed in the pocket can fall through onto the feet of the wearer. This may not seem potentially dangerous, as stout shoes should protect feet, but it could cause an accident by distracting attention at a crucial moment.

Overall too long: Excessively long overalls can cause falls, particularly when negotiating stairways.

Lightweight shoes: The possible injuries associated with lightweight and unsuitable shoes are:

- Severe puncture wounds caused by treading on sharp objects.
- Crushed toes caused by falling objects.
- Damage to the Achilles tendon due to insufficient protection around the heel and ankle.

In addition to body protection, it is necessary to protect the head, eyes, hands and feet.

Eye protection: Although it is possible to walk on a wooden leg, nobody has ever seen out of a glass eye. Therefore, eye protection is possibly the most important safety precaution to take in the workshop. Eye protection is provided by wearing suitable goggles or visors. When welding, special goggles have to be worn with coloured lenses, to filter out harmful rays. Gas welding goggles are not suitable when arc welding. Eye injuries fall into two main categories: pain and inflammation due to abrasive grit and dust getting between the lid and the eye. Excessive noise can be a dangerous pollutant to the working environment.

The effect of noise can be:

- Fatigue that leads to carelessness and accidents.
- Mistaken communications that lead to accidents.
- Ear damage that leads to accidents.
- Permanent nervous disorders.
- Damage caused by exposure to ultraviolet radiation (arc welding) and to high-intensity visible radiation. Particular care is required when using laser equipment.
- Loss of sight, due to the eyeball being punctured or the optic nerve being severed by flying splinters of metal (swarf, or by the blast from a jet of compressed air).

Head Protection: Includes industrial safety helmets to protect against falling objects or impact with fixed objects; industrial scrap protectors to protect against striking fixed obstacles, scraping or entanglement and caps and hairnets to protect against scraping and entanglement.

Hand protection: An engineer's hands are in constant use and then run the risk of handling dirty, oily, greasy, rough, sharp, brittle, hot and may be toxic and corrosive materials. Gloves and palms in a variety of styles and materials are available to protect the hands, whatever the nature of the work. Gloves are sometimes inappropriate, e.g. for working precision machines, but hands still need to be protected from oil and grime, though not cuts and abrasions, by rubbing them in a barrier cream before starting to work. This is antiseptic, water-soluble cream, which fills the pores of the skin and prevents the ingress of dirt and subsequent infection. The cream is easily removed by washing, which carries away the dirt and removes sources of infection.

Foot Protection: Unsuitable footwear should always be discouraged. It is not false economy, but extremely dangerous to wear lightweight casual or sports shoes in the workplace. They offer no protection from crushing or penetration. In safety footwear, protection that is provided by a steel toecap (inside the boot or shoe) conforms to a strength specification in accordance with British Standards (BS) 1870. Safety footwear is available in a wide range of styles.

Dust respirator: If the fume from welding operations cannot be removed from the atmosphere before it reaches the welder, an alternative is to filter it from the air breathed with a dust respirator. (Balchin and Castner, 1993).

2.13.1.4 Fire Prevention

The following precautions should be followed in order to prevent fire in the machine shop:

- Always dispose of oil rags in proper metal containers.
- Be sure of the proper procedures before lightning a gas furnace.
- Know the location and the operation of every fire extinguisher in the shop.
- Know the location and the nearest fire exit from the building.
- Know the location and the nearest fire-alarm box and its operation procedure.
- When using a welding or cutting torch, be sure to direct the sparks away from any combustible material.

Factory Act 328 part 5 section 17 states that 'Effective provision shall be made to secure and maintain sufficient and suitable lighting, whether natural or artificial, in every part of any factory, office or shop in which persons are working or passing. All apparatus installed for producing artificial lighting where lighting is required by this section shall properly be maintained.

2.14 Maintenance

Maintenance, cleanliness and periodic overhaul of the equipment in the workshops are the keys to the efficiency of any department. Maintenance engineering is concerned with the day-by-day problem of keeping physical plans in good operating condition.

Maintenance ensures that machines and equipment operate at the required level of productive forms of maintenance. According to Mobley (2004), maintenance could be classified into three main categories namely; corrective, preventive and predictive maintenance. Corrective maintenance involves the repair of machine after an occurrence of a breakdown. In a sense, corrective maintenance becomes repair work. Repairs made after the equipment is out of order.

Preventive maintenance, however, is undertaken when the need arises and is aimed at minimizing the possibility of unanticipated production interruption or major breakdown. Preventive maintenance therefore consists of proper design and installation of equipment, periodic inspection of plant and equipment to prevent breakdowns before they occur, repetitive servicing, upkeep and overhaul of equipment and adequate lubrication, cleaning and painting of equipment.

Predictive maintenance is one of the newer types of maintenance scheme, which is gradually gaining increasing attention. It is a preventive type of maintenance that involves the use of sensitive instruments (e.g. vibration analyzers, amplitude meters, audio gauges, optical tooling, pressure, temperature and resistance gauges) to predict trouble. Conditions

are measured periodically or on a continuous basis to enable the maintenance people to establish the imminence of need for overhaul. This allows an extension to the service life without fear of failure.

Khanna (2009) and Mobley (2004) outlined the following objectives of maintenance:

- Greater plant availability.
- Few breakdowns occur in plant if they are maintained regularly and correctly.
- Maintenance is carried out when it is most convenient and will cause the minimum loss of production.
- Regular and simple maintenance results in less down time than in frequent expensive ad-hoc maintenance.
- Excessive length of downtime is reduced. Spaces and equipment demand are known in advance and are available when necessary.
- Regular and simple servicing is cheaper than sudden expensive stopgap repair
- Regular and planned servicing and adjustment maintains a continuously high level of plant output, quality performance and efficiency.

Demerits of Maintenance

Khanna (2009) itemized that lack of maintenance of plant and equipment in the workshop will lead to the breakdown of these components, which creates problems such as:

- Waste of time and finances
- Loss of production line
- Over use of spare parts
- High rate of accidents
- Failure to recover overheads.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter explains the research methods employed, namely; the research design, the population, sample and the sampling method used, research instrument, data collection procedure, validity, reliability, ethical issues and data Processing and data analysis.

3.2 Research Design

This research design is one of several designs for conducting a social science research. In as much as designs of a research might take the form of a case study, surveys, experiments, historical and archival analysis, this study employed case study as its research design. The case study research design was adopted to emphasize the intensive examination of the setting

Koul (2001) explains that in descriptive studies researchers, as in any study, identify and define the problem, select or construct tools for collecting data, describe, analyze and interpret the data in clear and precise terms and draw definite and meaningful conclusions. Descriptive interpret, synthesize, integrate data, and point to complicated interrelationships Thus, in spite of the advantages that descriptive design bring along, care needs to be taken to ensure that questions to be responded are clear, and not misleading, because the result of the survey can vary depending on the wording used (Hays,1994).

3.3 Population

Population consists of all the individuals whom the measurement is being taken (Cooper et al., 2001). The population for the study comprised shop owners, artisans (auto body builders and welders) and factory inspector. The respondents comprised ninety - six (96) Artisans in the study area which consists of Artisans or Technicians, that is Auto body builders and Welders, and one factory inspector. These artisans are all from Sekondi - Takoradi Metropolis in the Western region. The choice of this industrial area was made on the basis that they are well established informal industrials in the area with their offices located in the Sekondi-Takoradi Metropolis.

3.4 Sample and Sampling Method

A sample is a representative subset of a population which has all the important characteristics of the population from which it is drawn. Sample size and the technique used are influenced by the availability of resources, particularly finances and time available to select the sample (Saunders et al., 2007). Sampling techniques provide a range of methods that enable the researcher to reduce the amount of data to be collected, by considering data from a sub-group only rather than all possible cases.

The study adopted the convenience and purposive sampling procedures. Purposive sampling technique was used in this research based on the research design, purpose, and practical implication of the study.

Purposive sampling was used to obtain institutional data from the Factories Inspectorate Department (FID) and the artisans in the Sekondi – Takoradi Metropolis.

This was because the needed information could only be provided by these institutions that are knowledgeable about the subject under discussion.

Subsequently, an employee of the FID was also selected for the study. Convenience sampling was used to select respondents (Artisans) from the auto body building and welders in the informal industries from Kokompe industrial area in the Sekondi - Takoradi Metropolis.

Being a case study, a sample size of ninety – six (96) respondents was selected. A total of twenty - one (21) machine shops were visited in the course of the research. The sample frame consisted of thirty (30) shop owners, one (1) factory inspector and sixty - five (65) apprentices were selected from various workshops with at least most the respondents had 5 to10 years of experience in their work shop. Generally, most of the respondents 65(68.75%) were apprentices whiles shop owners/masters and factor inspector constituted the least 31(31.25%).

3.5 Research Instruments

The instruments used for data collection were questionnaire and observation. The questionnaire consisted of items, which were focused on Kervin (1992) writes that the Likert scale is the most widely used scaling technique since it consists of several declarative items that express a viewpoint on a topic. The researcher chose the three point Likert scale because respondents were expected to indicate the degree to which they agreed (yes) or disagreed (no) and sometimes with the opinion expressed. Also, the Likert scale is an efficient approach compared with other scale types (such as the Thurston scale), and has

an additional advantage over open-ended questionnaire. The questionnaire was designed, validated at a small work shop and delivered to the respondents at their workplaces.

3.6 Data Collection Procedure

The data collection involved the administering of questionnaire to collect information on Industrial Safety and Management in Machine Shop. The researcher administered the questionnaires to the respondents at their workshops. They were first given an orientation regarding the purpose and understanding of the items in the questionnaire. Important concerns and questions from respondents were cleared and explained before they started filling them. The respondents were given one week to respond to the questionnaires and the researcher retrieved them after the week. Those who could not read and needed assistance were assisted by the researcher and six assistants who later collected them for analysis. See appendices A - C for the questioners.

The use of the observation check list for the data collection method was also adopted. As part of the data collection process, workers were observed while doing their respective jobs in order to better understand the hazards as well as the unsafe and unhealthy working conditions they are mostly exposed to. The safe and healthy practices carried out by some workers were also observed. The instruments used in collecting data have been attached in the appendices.

3.7 Validity, Reliability and Ethical Issues

Validity and reliability of the research measurement instruments influence, first the extent that one can learn from the phenomena of the study. Second the probability that one will

obtain statistical significance in data analysis and third the extent to which one can bring meaningful conclusion from the collected data. Most ethical issues in research fall into one of the four categories: protection from harm, informal consent, right to privacy and honesty with professional colleagues (Leedy and Ormrod, 2005).

3.7.1 Validity

Validity is the ability of an instrument used to measure what it is designed to measure. They further explained two basic questions: does the study have sufficient control to ensure that the conclusions the researcher draw are truly warranted by the data and can the researcher use what she/he has observed in the research situation to make generalization to the population beyond that specific situation. The answers to these two questions address the issues of the content validity, internal validity and external validity.

3.7.2 Content validity

In order to check content validity for the descriptive studies, Leedy et al. (2005) suggests three tactics: using multiple sources of evidence, establishing chain evidence and having key informants reviewing draft of the study report. To ensure content validity the target groups included in sample represented were those who know better about the issue being investigated were contacted.

3.7.3 Internal validity

The internal validity of a research study is the extent to which its design and the data it yields allow the researcher to draw accurate conclusions about the relationships within the data. In this case, it's less likely that there will be a Hawthorne effect since the respondents have professional background and knowledge about safety management in machine shops.

They were also asked to give their consent and they were given all the right not to answer any questions if they did not wish to.

3.7.4 Ethical Issues

To anticipate ethical issues and other considerations for this study, the protection of human subjects concerning answering of questioner confidentiality and respect for respondents were adhered to. No judgmental gestures or even further probing for answers when respondents were reluctant to provide information was made.

Additionally, all respondents' identity remained confidential and they were assured of their right to withdraw from the study at any time. The researcher ensured that no respondent was under any pressure or discomfort before, during, and/or after participating in the study.

3.8 Data Processing and Analysis

The results of the data collected using the questionnaires were represented in pie-charts, bar graph and frequency tables (Koul, 2001). For clarity, easy understanding and interpretation of figures, excel and the Statistical Package for Social Sciences computer software version 16 (S.P.S.S.) were used. The data collected from the questionnaires were edited, coded, and keyed into the SPSS version 16) for processing. The data were then presented in the form of tables for easy interpretation using excel. The main descriptive statistics analysis factors like frequency tables, percentages, pie charts, bar graphs mean and standard deviation were used to explain certain findings. Percentages of the participants and their respective views on some important issues on the questionnaires found were used to discuss the data collected. Analysis is the ability to break down data

and to clarify the nature of the component parts and the relationship between them (Saunders et al., 2007).

3.9 Profile of the Study Area

Sekondi-Takoradi, a city comprising the twin cities of Sekondi and Takoradi, is the capital of Sekondi - Takoradi Metropolitan Assembly and the Western region of Ghana, with Sekondi as the administrative capital, occupies the south-eastern part of Western Region. It shares boundaries with Ahanta West, Shama and Komenda-Edina-Eguafo-Abrem Municipal. It is located on the coast, about 200km west of Accra.

Sekondi - Takoradi is the Western region's largest city and an industrial and commercial centre, with a population of 445,205 people made up of 202,605 Females, with the adult population of 121,301 (2012, census). The native occupation in the Sekondi – Takoradi is fishing.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION

4.1 Introduction

This chapter of the study analyzes the results from the data collected and discusses it with the questionnaires. Different statistical tools such as frequency tables; percentages and central tendencies; mean and standard deviation from the Statistical Package for Social Sciences (SPSS v16) was used to analyze the results in the order of the research questions.

Three (3) sets of questionnaires were administered by the researcher to the shop owners and the artisans i.e. Welders and Auto body builders (ABB), and Official of the Factories Inspectorate Department (FID). The number of questionnaires administered to the shop owners, welders and the Auto body builders were ninety-five (95) and corresponding response rates was ninety-four. The Factories Inspectorate Department was to assess the involvement of the shop owners and the artisans regarding safety issues in the industrial area.

4.2 Response Rates

A total of ninety - six (96) questionnaires were administered and ninety-four (94) were completed and retrieved by the researcher. The response rate achieved was 94 (97.9%). Constant reminders and follow ups accounted for the high response rate.

4.3 Demographic Characteristics of Respondents

Figure 4.1 and 4.2, shows gender and age of respondents, the results indicates that there were more male respondents (83.2%) compared to female (16.8%). The ages of the respondents ranged from 26 to 60 years with a mean of ($\bar{X}$ 2.99) and standard deviation of (SD$\pm$ 1.047). The ages of the respondents were 26 – 33 years 40(42.1%), followed by 34 – 41 years 28 (29.5%), 42 – 49 years 15 (15.8%) and 50-60years 12 (12.6%) were the minority group.

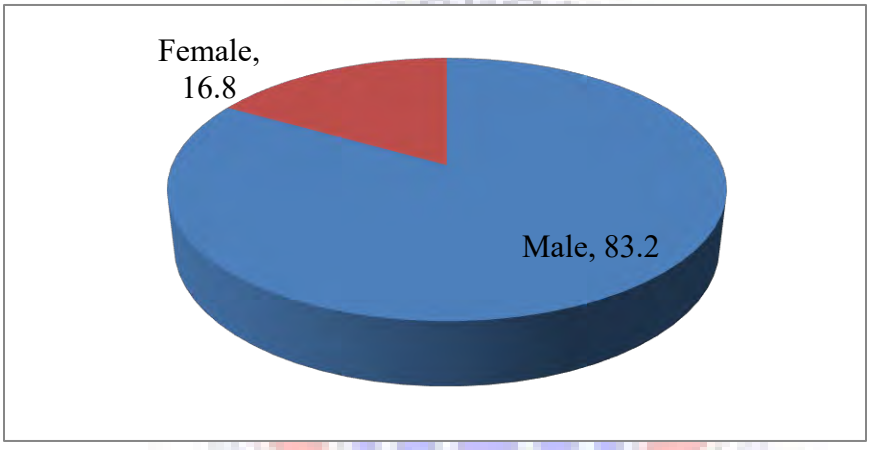

Figure 4.1 Gender. Source: Field data, 2018

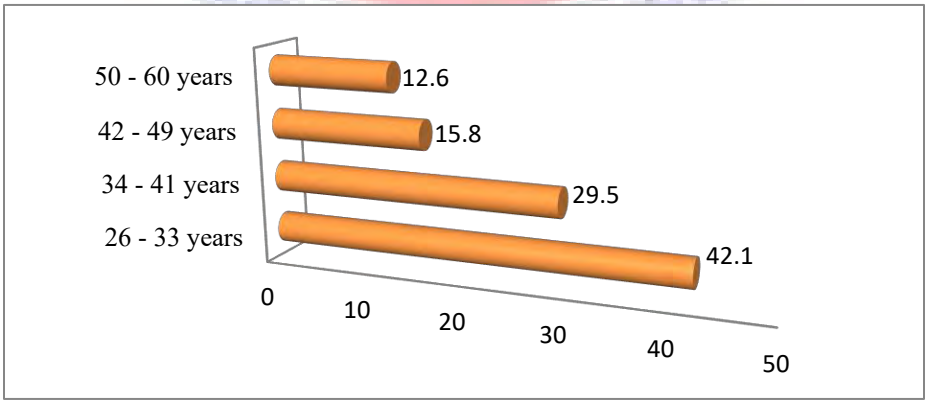

Figure 4.2 Ages of Respondents. Source: Field data, 2018

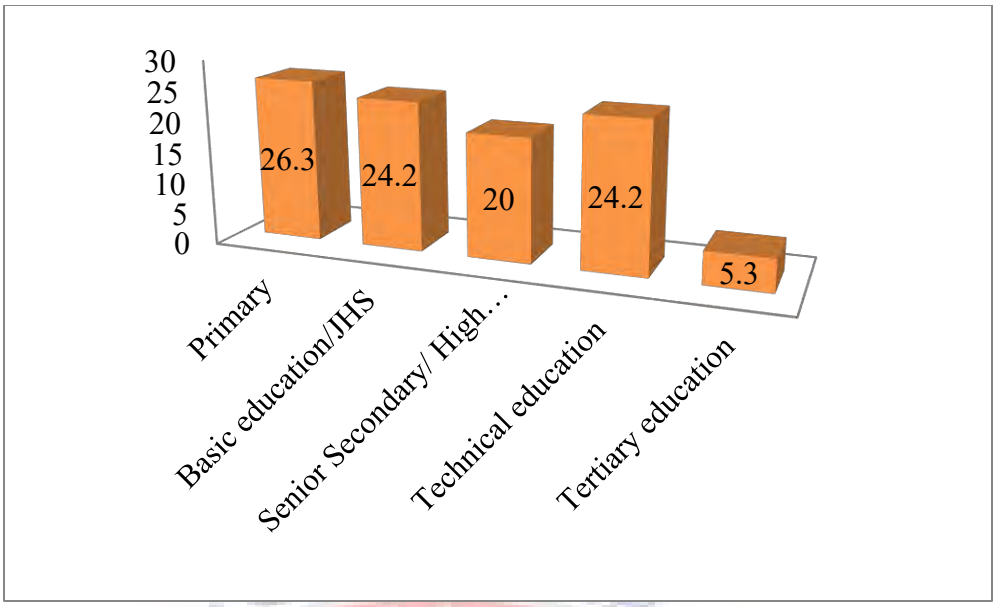

Figure 4.3 Educational Levels of Respondents. Source: Field data, 2018

Concerning educational levels, Figure 4.3 indicates that 25 (26.3%) of the respondents had only primary education, followed by 23 and 19 (24.2%, 120.0%) had JHS education and SHS as their educational qualification, 23 (24.2%) had Technical training, and 5 (5.3%) are university graduates. This result revealed that majority of the workers have a very low level of education, which can be a challenges to communication and the way they perceive industrial safety and management.

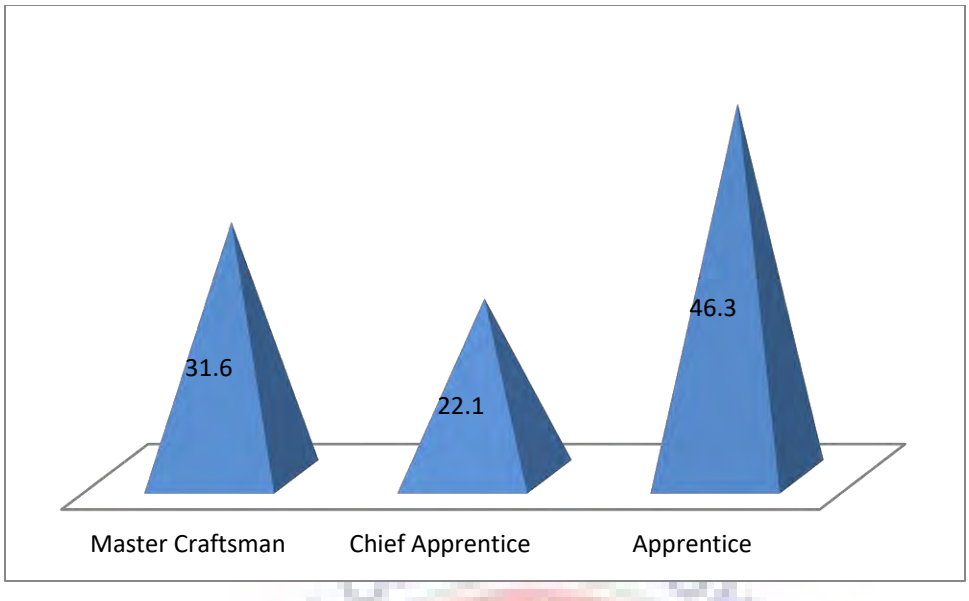

Figure 4.4 Positions of Artisans. Source: Field data, 2018

Respondents were asked to indicate their position at the various workshops, the results indicated as 44 (46.3%) were apprentice, 30 (31.6%) were master craftsmen. whiles 24 (22.1%) were chief apprentice. With regards to their experience in welding activities, the results are indicated in Figure 4.4.

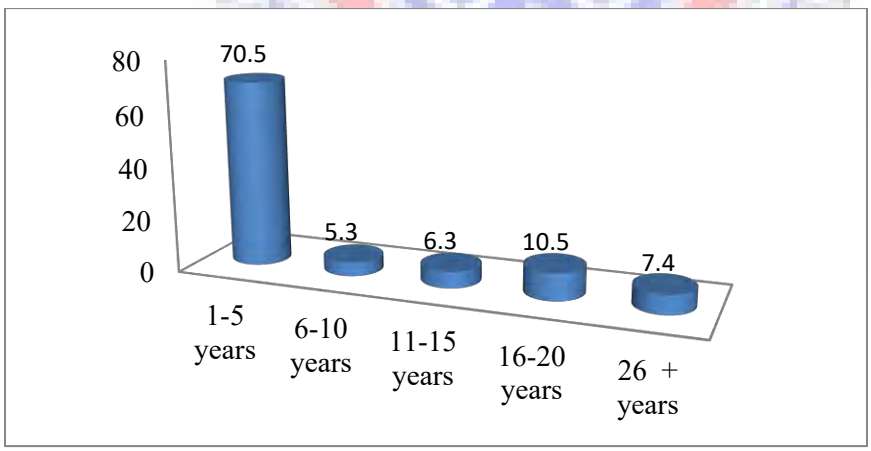

Figure 4. 5, Work experience at present job. Source: Field data, 2018

With regards to work experience at present job, majority (70.5%) had 1 – 5year, followed by (10.5%) 16 – 20 years' experience, (7.4%) had 26+ years, (6.3%) had 11 – 15 years and (5.3%) 6 – 10 years were the least. The results in Figure 4.5, shows that although the majority of workers have had little education their level of experience is varied about average of 1 – 5 years.

Research Question one (1)

4.4 Various Forms of Accidents that Occurred in the Machine Shops

Table 4.1 Do accidents occur in your workshop?

36	Variables	Frequency	Percent	Cumulative Percent
	Yes	52	54.7	54.7
	Sometimes	22	23.2	45.3
	No	21	22.1	100.0
	Total	95	100.0	

Source: Field data, 2018.

The researcher wanted to find out if accidents occur in the machine workshop, the following responses were given 52 (54.7%) yes accidents do occur, 22 (23.2%) recorded sometimes and 21 (22.1%) said no. See Table 4.1 for the illustration.

Table 4.2 How frequently do the accidents occur in your workshop?

39	Variables	Frequency	Percent	Cumulative Percent
	Very frequently	47	49.5	49.5
	Never	-	-	-
	Rarely	20	21.0	70.5
	frequently	28	29.5	100.0
	Total	95	100.0	

Source: Field data, 2018.

This study sought to find out how frequent the accidents occurrence at work shop among artisans. This was to confirm and answers they have given about the occurring of the accidents. The majority 47 (49.5%), of respondents admitted that they experience accidents at work very frequently. Another 29 (29.5%) of the respondents testified that they frequently experience accidents very often at work. Put together, one can say that the rate of accidents occurring at the workplace was very high 67 (70.5%). A few respondents 20 (21.0%) rarely suffered accidents while at work. Table 4.2 demonstrates the results.

Table 4.3 What was the nature of the injury/accident you sustained if any?

38	Variables	Frequency	Percent	Cumulative Percent
	Bruises	15	15.8	15.8
	Cut and hammering of hands	40	42.1	57.9
	Burns	29	30.5	88.4
	Electrical shock.	11	11.6	100.0
	Total	**95**	**100.0**	

Source: Field data, 2018.

With reference to Table 4.3, it was clear that the two most common accidents at the machine workshop among respondents were cuts and hammering of hands and burns recorded 40 (42.1%) and 29 (30.5%) of employees accidents sustained respectively. Cut and hammering of hands and burns were the commonest cases of accidents at the workplace because they lacked prescribed safety boots to protect their feet and not using hand gloves when working. Apart from these two common accidents, 15 (15.8%) of respondents reported having suffered from bruises and just 11 (11.6%) of respondents suffered electrical shock and eye resulting from accident. Cases of electrical shocks and eye accident were the least at the workplace this was amazing because most of the respondents were not using goggles and the return electrode holder cables are not in good condition as such it was expected that electric shocks and eyes accidents would have been among the commonest accidents. All are classified under the non-mechanical accidents as stated by Chsafetyblogspot.com (2008) and Chapman (1979). This attests to the fact that accidents occurred in the shops.

The 21 (22.1%) shop owners and the artisans who stated that accidents do not occur in their shops may be those who considered accidents only as fatal ones and not the minor cuts, slipping and falling not knowing that these incidents were classified under certain degree of accident.

Research Question Two (2)

4.5 Causes of Accident, Effects and Prevention of Accidents

Table 4.4 what are the causes of the common accidents in your workshop due to the following factors?

40	Variables	Frequency	Percent	Cum Percent
	Tiredness	15	15.8	15.8
	Inexperience, Inattentiveness / Carelessness	29	30.5	46.3
	Poor housekeeping	19	20.0	66.3
	Over confidence	11	11.6	77.9
	Unsafe acts and unsafe condition	21	22.1	100.0
	Total	**30**	**100.0**	

Source: Field data, 2018.

As indicated in Table 4.4, majority 29 (30.5%) were of the view that inexperience, inattentiveness /carelessness are the causes of some of the common accidents in their workshop. 21 (22.1%) also said unsafe acts and unsafe condition totaling 50 (52.6%), 19 (20.0%) attributed it to poor housekeeping. However, 15 (15.8%) and 11 (11.6%) on the other hand felt tiredness and over-confidence causes some of the common accidents in their workshop. This implies that, inexperience, inattentiveness /carelessness, and unsafe acts and unsafe condition are the major causes of accidents in the workshop which need to be checked.

Generally, most of the causes of accidents as expressed by both the welders and the auto body builders were identified as unsafe acts. This supports the idea of Ghosh (2000) that it is estimated 98% of workplace accidents are due to faulty inspection, poor discipline, and lack of concentration, unsafe practice and mental and physical unfitness for the job. The

research revealed that, major causes of accidents were unsafe conditions and unsafe acts, which totally corroborates to the work of Zimolong and Elke (2006).

Table 4.5 Do you try to lift heavy objects alone?

33	Variables	Frequency	Percent	Cumulative Percent
	Yes	50	52.6	52.6
	Sometimes	14	14.7	67.3
	No	31	32.6	100.0
	Total	95	100.0	

Source: Field data, 2018.

Table 4.5, revealed that 50 (52.6%) of the artisans do try to lift heavy objects they manufactured alone, 14 (14.7%) sometimes as compared to 31 (32.6) no. It was observed that the work tasks of the artisans were mainly done manually and involved heavy lifting of materials and products made which also contributes to the causes of accidents in the machine shops. This is in agreement to Pirani and Reynolds (1976) and Cacio (1992) that, if a particular operation forces a worker to lift a heavy part and twist to set it on a bench, then the operation itself forces the worker to perform the unsafe act.

Table 4.6 How many hours do you work in a day?

42	Variables	Frequency	Percent	Cumulative Percent
	3 – 5 hours	23	24.2	24.2
	6 – 8 hours	46	48.4	72.6
	9 – 11 hours	26	27.4	100.0
	Total	**95**	**100.0**	

Source: Field data, 2018

With reference to Table 4.6, regarding the number of hours the artisans work in a day, majority 46 (48.4%) of the shop owners and artisans testified they work for long hours (i.e. 6 – 8 hours a day), followed by 26 (27.4%) 9 – 11 hours a day. However, 23 (24.2%) of them spent 3 – 5 hour of their time working. To the shop owners and the artisans, overworking themselves meant producing more to obtain more money, but this is detrimental to safe working. The length of time a person uses to do a particular job and the period of the day that the work is done is termed the work schedule. According to Graham and Bennett (1992), after working on a particular job for six hours, subsequent working hours could lead to an accident. The rate of accidents is proportional to the number of extra hours. He attributed it to fatigue and partly to the fact that accidents occur more often during night working. .

Table 4.7 Posture of artisans when working

43	Variables	Frequency	Percent	Cumulative Percent
	Squatting and bending,	21	22.1	24.1
	Squatting, bending and standing	46	48.4	70.5
	Standing and bending	28	29.4	100.0
	Total	**95**	**100.0**	
44	**Is your posture comfortable**			
	Yes	23	23.2	23.2
	Sometime	-	-	-
	No	72	75.8	100.0
	Total	**95**	**100.0**	

Source; Field data, 2018

The results of artisans' posture at work are shown in Table 4.7, twenty – one 21 representing 21 (22.1%) said they were squatting and bending whiles working, majority 46(48.4%) squatting, bending and standing. whiles 28 (29.4%) said they were standing and

bending whiles working. To find out whether the artisans fill comfortable in their posture when working, 23 (23.2%), 72 (75.8%) responded yes and no respectively.

During the data collection the researcher observed that the welders and the Auto body builders were working in poor ergonomic posture/position by squatting, bending, standing and sitting on containers and the untidy work areas with scatted cables which posed a risk of slips and falls. This affirmed Amedofu (2002) stated that attitudes that significantly cause accidents include lifting improperly and assuming unsafe positioning while performing a task. The human body functions best in natural postures. Prolonged awkward body postures increases the stress on muscles and ligaments, leading to muscular fatigue, discomfort and increased risk of injury (Workplace safety and health council, 2014).

Table 4.8 What are some of the effects of accidents/ injuries in your workshop to the artisans?

41	Variables	Frequency	Percent	Cum Percent
	Loss of man hours, absenteeism, bodily pain, deformities, high cost of treatment	40	42.6	42.6
	Damages on machine tool/ equipment, high cost of repairs, reduced production	31	33.0	75.5
	Difficulty in getting experienced hands to replace in case of deformity	14	14.9	90.4
	deformity and loss of job	9	9.6	100.0
	Total	**95**	**100.0**	

Source: Field data, 2018.

Majority 40 (42.6%) rated loss of man hours, absenteeism, bodily pain, deformities, high cost of treatment as some of the effects of accidents/ injuries in the workshop to the artisans,

another 31 (33.0%) attributed the effects to damages on machine tool/ equipment, high cost of repairs, reduced production, 14 (14.9%) said difficulty in getting experienced hands to replace in case of deformity, whiles 9 (8.6%) indicated deformity and loss of job as some of the effects of accidents/ injuries in the workshop to the artisans and the shop owners, refer to Table 4.8. According to McCunney (2001), the primary beneficial impact of industrial health and safety on productivity is reduced absenteeism. Boyd (2003) also cites with this fact.

Table 4.9: Safety Law Enforcement and Supervision

	Variables	Frequency	Percent	Cum Percent
17.	**Do personnel from the factories inspectorate department visit and supervise your work periodically?**			
	No	95	100.0	100.0
	Total	**95**	**100.0**	
19	Do you have the opportunity to attend training courses or seminar on industrial safety?			
	No	95	100.0	100.0
	Total	**95**	**100.0**	
20	Have you been provided with safety guidelines to work with in order to prevent accidents?			
	Yes	95	100.0	100.0
	Total	**95**	**100.0**	

Source: Field data, 2018

All the 95 (100%) unanimously said the personnel from the factories inspectorate department do visit and supervise their work places as shown in Table 4.9. The factory

inspectors they do not go out for inspection and training these days due to lack of finance. This confirmed what Ghana Statistical Report (2016) reported, there was a drastic decline in the total number of OS&H Talks/Training organised by the Regions from 178 in 2015 to 36 in 2016. All the Regions witnessed a decline in the number of OSH Talks/Training organized.

This implies that artisans at Kokompe in the Western Region are not monitored by the appropriate institution for the proper implementation of the laws. All the 95 (100%) unanimously said they do not have such opportunity as shown in Table 4.9. This is in contrast to the view of Mukala (2009) who said the aim of the training is to bring expertise and skilled persons to the field of Occupational Health and Safety (OH&S) and thus build up the productivity of the country, thus reducing poverty and increasing employment

Table 4.9a: Safety Law Enforcement and Supervision

	Variables	Frequency	Percent	Cum Percent
21	If yes, who provided you with the safety guidelines?			

	Trade Association	25	26.3	26.3
	Shop owner/ master	70	73.7	
	Total	**30**	**100.0**	
22	Are the inspectors aware of the existence of your shop?			
	Yes	30	31.6	31.6
	No	65	68.4	100.0
	Total	**95**	**100.0**	
23	4.17 Do you report all accident cases that happen in the shop?			
	Yes	27	90.0	90.0
	No	74	77.9	100.0
	Total	**95**	**100.0**	

Source: Field data, 2018

With reference to Table 4.9a, all the artisans 95 (100.0%) confirmed that, they had been provided with safety guidelines to work with in order to prevent accidents in their machine shop. This implies artisans are well resource to avoid accidents and injuries. From Table 4.9a, majority of 70 (73.7%) confirmed that, their shop owners/ master provided them with the safety guidelines. However, 25 (26.3%) indicated that, their trade association. The implication is that personnel were getting knowledge on how to prevent accidents and be able to minimize accidents and injuries at when working.

From the Table 4.9a, majority 65 (68.4%) confirmed that, the inspectors are not aware of the existence of their shop. However, 30 31.6%) on the other hand indicated that, the inspectors are aware of the existence of your shop. As identified from Table 4.9a, majority 65 (68.4%) confirmed that, they do not report all accident cases that happen in the shop as

against 30(31.6) who do. This means that, authorities are not aware of any unpleasant situations that need attention to find lasting solutions to them.

Table 4.9b: Safety Law Enforcement and Supervision

	Variables	Frequency	Percent	Cum Percent
24.i	If yes who do you report to?			
	Trade Association	25	26.3	26.3
	Shop owner/ master	70	73.7	
	Total	**95**	**100.0**	
ii.	If yes do they investigate?			
	No	95	100.0	
	Total	**95**	**100.0**	

Source: Field data, 2018

From Table 4.9b, all the respondents 70 (73.7%) said they report to their shop owners/ master whenever such incidents happened as compared to 25 (26.3%) who report to the trade associations. They also indicated that their shop owners and the trade associations do not do anything to what they reported to them. The factory inspectors said the artisans do not report accidents that occur in their shops to them. This implies that the artisans are not motivated enough to report any incidents to their boss nor the trade associations. The FID said they inspected artisan's shops and give approved and certificates to shops in the industrial areas to operate temporally.

Research Question Three (3)

4.6 Relationship between Gender, Age, Educational Level and Length of Service of Artisans in Compliance to Safety Rules and Regulations at the Machine Shops

Table 4.10: Do you read instructions on the use of new machines before using them?

45	Variables	Frequency	Percent	Cumulative Percent
	Yes	29	30.5	30.5
	Sometimes	26	27.4	57.9
	No	40	42.1	100.0
	Total	**95**	**100.0**	
46	**If yes, do you do exactly as you are instructed?**			
	Yes	10	20.0	20.0
	Sometimes	12	24.0	44.0
	No	28	56.0	100.0
	Total	50	100.0	

Source: Field data, 2018.

The researcher sought to find out whether the respondents read instructions on the use of new machines before using them. 29 (30.5%) of the respondents supposed that they read instructions on the use of new machines before using them, as compared to 26 (27.4%) sometimes. However greater majority 40 (42.1%) admitted that they do not. Table 4.10 illustrates the results of the responses.

In the Table, respondents were to indicate if indeed, they do exactly as they were instructed, 10 (20.0%) were of the view that they do (yes) as compared to12 (24.0%) sometimes, whiles majority 28 (56.0%) said no. This implies that only few do as they are instructed. The findings in this study substantiates Frantz and Rhoades (1993, as cited in Zimolong & Elke, 2006) who found that 40% of clerical personnel filling a filing cabinet noticed a warning label placed on the top drawer of the cabinet, 33% read part of it and no one read

the entire label. Contrary to expectation, 20% complied completely by not placing any material in the top drawer first.

Table 4.11 Do you agree that refusal to use PPE poses serious danger to once industrial health and safety?

47	Variables	Frequency	Percent	Cumulative Percent
	Yes	60	63.2	63.2
	Sometimes	31	32.6	95.8
	No	4	4.2	100.0
	Total	**95**	**100.0**	

Source: Field data, 2018.

Respondents were to indicate whether they have agreed that refusal to use PPE poses serious danger to once health and safety. The results in Table 4.11, depicts that majority 60 (63.2%) of the artisans acknowledge the usefulness of PPE to one's health and safety, whiles sometimes and no recorded 31 (32.6%) and 4 (4.2%) respectively. This means that the artisans know the importance of the PPE.

Table 4.12 Do you have first Aid box with content and fire-fighting equipment?

26	Variables	Frequency	Percent	Cum Percent
	Do you have first Aid box with content			
	Yes	15	16	16
	No	80	84	100.0
	Total	**95**	**100.0**	

27	Do you have fire-fighting equipment (extinguisher) to use in case there is a fire outbreak in your shop?			
	Yes	43	45.3	45.3
	No	52	54.7	100.0
	Total	**95**	**100.0**	

Source; Field data, 2018

As illustrates in Table 4.12, out of the ninety- five (95) respondents, 15(16%) had first aid box in their shops, whiles the majority (84%) had no first aid box with content. Furthermore, 52 (54.7%) majority do not have fire extinguishers. During the observation, they were first aid and fire extinguishing equipment available in any of the places visited but they were no contents and are expired as well.

This contraventions of the factories, offices and shops Act, 1970 (Act, 328) Section (28 & 31), that states 'a first aid box or cupboard of the prescribed standard, containing requisite first aid drugs and items must be provided in every factory, office and shop'. Also every factory, office and shop must have adequate and appropriate means of fighting fire, which must be kept in good condition and readily available for use.

4.6.1 Work Conditions, Safety Precautions and Management

Table 4.13 Do you always clean the shop and arrange tools and equipment properly after the day's work?

48	**Variables**	**Frequency**	**Percent**	**Cumulative Percent**
	Yes	31	32.6	32.6
	Sometimes	35	36.8	69.5

No	29	30.5	100.0
Total	95	100.0	

Source: Field data, 2018.

Table 4.13, revealed that, 31 (32.6%), 35 (36.8%) and 29 (30.5%) are the percentages of respondents who always clean the shop and arrange tools and equipment properly after the day's work, sometimes and no respectively.

Table 4.14 Do you leave gangways in your shop?

49	Variables	Frequency	Percent	Cumulative Percent
	Yes	23	24.2	24.2
	Sometimes	15	15.8	40.0
	No	57	60.0	100.0
	Total	95	100.0	
50	**If no why and if is yes why?**			
	No and why			
	all the of the respondents said no space	57	100.0	100.0
	Total	57	100.0	
	Yes and why			
	easy movement,	20	57.1	57.1
	easy to convey finished artifacts	7	19.4	75.0
	for easy cleaning of the work area	9	25.0	100.0
	Total	36	**100.0**	

Source: Field data, 2018.

Respondents were to indicate whether they leave gangways in their shops, 23 (24.2%) responded yes to the statement, as compared to 15 (15.8%) and 57 (60.0%) who said sometimes and no respectively. From Table 4.14, all the 57 (100%) of the respondents were of the view that there is no space. Those who responded yes and sometime, were also of the opinion that gangways are meant for easy movement, easy to convey finished artifacts

and for easy cleaning of the work area and their percentages 20 (57.1%), 7 (19.4%) and 9 (25.0%) respectively. Krar et al. (2004) shared same thought.

Table 4.15 Is your shop illuminated?

28	Variables	Frequency	Percent	Cumulative Percent
	Yes	70	73.7	73.7
	Sometimes	10	10.5	84.2
	No	15	15.8	100.0
	Total	**95**	**100.0**	
29	**Do you try to lift heavy objects alone?**			
	Yes	70	73.7	73.7
	Sometimes	10	10.5	84.2
	No	15	15.8	100.0
	Total	**95**	**100.0**	

Source; Field data, 2018

Majority of the respondents 70 (73.7%) said their shops are well illuminated. This is very true because work areas visited were well lit owing to the fact that most of work was conducted in open spaces with adequate natural light. Few 15 (18.8%) had problem with lamination of their shops; refer to Table 4. 15 for the details. With regards to ventilation, 70 (73.7%) said they do not have such difficulties since their work is normally done in open work spaces which provided natural ventilation in the work areas. This was observed by the researcher during his observation that as many as fifteen (15) out of the twenty - one (21) machine shops visited do their work outside their shops but the rest were not adequately illuminated, they had a single electric bulb hanging to illuminate the whole of the shops. This goes against safety regulations stipulated in the Factory Act 328 Part 5

section 17 which states that effective provision shall be made to secure and maintain sufficient and suitable lighting, whether natural or artificial, in every part of any Factory, Office and Shop in which persons are working.

Table 4.16, Are the workers comfortable or satisfied with your work environment?

51	Variables	Frequency	Percent	Cumulative Percent
	Yes	31	32.6	32.6
	Sometimes	15	15.8	48.4
	No	49	51.6	
	Total	**95**	**100.0**	
52	**If No, please give reasons?**			
	The place is exposed to dust, heat (from the sun)	28	43.7	43.7
	The work is done in open areas and wet during the dry season	25	39.1	82.8
	The place is exposed to wind and noise from the surroundings	11	17.2	100.0
	Total	**64**	**100.0**	

Source; Field data, 2018

The artisans were to indicate whether they are satisfied with their work environment 31 (32.6%) said yes they are satisfied, as compared to 49 (51.6%) and 15 (15.8%) who responded no and sometimes respectively. Those who said no and sometimes gave the following reasons;

Twenty- eight, 28 (43.7%) of the artisans said the place is exposed to dust, heat (from the sun) the work done in open areas and wet during the dry season 25 (39.1%) and 11 (17.2%) said the place is exposed to wind and noise from the surroundings see Table 4.16. This means that the open work spaces exposed workers to physical environment elements such as heat from the sun, dust from the surrounding and rain water during the wet season. This research is in contrast to the work of Palmer (1989) makes suggestions for keeping the workplace healthy.

Table 4.17 Do you check the electrical fittings and connections regularly?

31	Variables	Frequency	Percent	Cumulative Percent
	Yes	22	23.2	23.2
	Sometimes	21	22.1	45.3
	No	52	54.7	100.0
	Total	**95**	**100.0**	

Source; Field data, 2018

Table 4.17, shows the responses of artisans view on the regularly check electrical fittings and connections before work commences, 52 (54.7%) admitted that they do not do regular check electrical fittings and connections before work commences, whiles some time and yes recorded 21 (22.1%) and 22 (23.2%) respectively.

Table 4.18, Are Pressure Gauges always checked before use?

32	Variables	Frequency	Percent	Cumulative Percent
	Yes	26	27.3	27.4
	Sometimes	10	10.5	37.8
	No	59	62.1	100.0

Total	**95**	**100.0**

Source; Field data, 2018

Greater majority 59 (62.1%) of the artisans affirmed that they do not check their pressure gauges always before use, as compared to 10 (10.5%) and 26 (27.6%) who said yes and sometimes this signified safety compliance is not their consent. During the data collection I observed that there were electrical cables exposed and one socket loaded with four electric cables supplying power to different electrical gadgets at a time in dangerous manner see Table 4.18.

Table 4.19 Do you have Maintenance schedule for your machine shop and what time is it carry out?

53 Variables	Frequency	Percent	Cumulative Percent
Yes	28	30	30
Sometimes	-	-	-
No	66	70	100.0
Total	**95**	**100.0**	

Source; Field data, 2018

Among all the respondents, majority 66 (70%) had no maintenance schedule but only undertake maintenance and repairs when their machines breaks down, whiles 28 (30%) had maintenance schedule for their plants. See Table 4.19 for details.

Maintenance and periodic overhaul of equipment and machines in the workshops is the key to the efficiency of any department. On the contrary, most workers in Konkompe were of the view that maintenance of their machines especially preventive maintenance as waste of

time and finances. This finding supports what Khanna (2009) said about the disadvantages of lack of plant maintenance. They rather accepted corrective maintenance. As could be discerned from the data analysis 66 (70%) of both welders and auto body builders opined that they had no maintenance schedules for their plants, and they only maintain when the machines/plants develop fault or break down. This is in contrast to what (Khanna, 2009; & Mobley, 2004) expressed that "maintenance, cleanliness and periodic overhaul of machine/equipment is the key to efficiency of any department. And also regular simple servicing is cheaper than sudden expensive stop gap repairs". The idea of corrective maintenance is rather expensive since repairs involve reconditioning or changing of damage parts of the machine. Khanna (2009) said lack of maintenance of plant and equipment in the workshop will lead to the breakdown of components, which creates problems such as:

- Waste of time and finances
- Loss of production line
- Over use of spare parts
- High rate of accidents
- Failure to recover overheads.

Table 4.20 Which of this safety PPE do you have/ are available?

7	Variables	Frequency	Percent	Cumulative Percent
	Nose mask, safety boat, overall	27	28.4	28.4
	Gloves, safety boat, overall	24	25.3	53.7
	Safety boat, goggles, overall	28	29.5	83.2
	Safety boat, overall	16	16.8	100.0

	Total	**95**	**100.0**

Source; Field data, 2018

Respondents were to indicate the safety apparel (PPE) are available to them with reference to Table 4.20, most 28 (29.5%) indicated safety boat, goggles and overall, 27 (28.4%) said nose mask, safety boat and overall. However, said they have gloves, safety boat, overall 24 (25.3%) and few have safety boat, overall 16 (16.8%).

Table 4.21 Provision of Personal Protective Equipment (PPE) and uses at work place among Artisans

8	**Provision of (PPE)**	**Frequency**	**Percent**	**Cumulative Percent**
	No	95	100.0	100.0
	Total	95	100.0	
9	**Uses of PPE at work place among Artisans**			
	Yes	17	17.9	17.9
	Sometimes	47	49.5	67.4
	No	31	32.6	100.0
	Total	**95**	**100.0**	

Source; Field data, 2018

When asked whether they were provided with Personal Protective Equipment for their job execution by their master/shop owners or they were asked to buy them. All the respondents 95 (100%) answered in the negative affirmation. Meaning that, they were not provided with PPE, they had to buy them, if not they had to do their work fully exposed to accidents and other forms of hazards, see Table 4.21 for details.

To find out whether they used the few PPE available to them, majority 47 (49.5%) of the respondents said they sometimes used them. In contrast to this were 31 (32.6%) of the respondents who said that they never used PPE while the remaining 17 (17.9%) admitted that they use.

Table 4.22 What can be done to ensure that workers use PPE at work?

16	Variables	Frequency	Percent	Cumulative Percent
	By creating awareness	57	60.0	60.0
	By enforcing rules and regulations	23	24.2	84.2
	Nothing can be done	15	15.8	100.0
	Total	95	100.0	

Source; Field data, 2018

As regards to what can be done to ensure that workers use PPE at work places, in Table 4.22, majority 57 (60.0%) said by creating awareness, 23 (24.2%) were of the view that by enforcing rules and regulations at work can prevent or reduce the risk of getting accidents. In all, 80 (84.25) percent of the respondents saw PPE as preventive measure to accidents at work. This is in line with Cascio (1992) that if rules are not obeyed it could mean that they are not being enforced or because of flaws in employee selection practices and inadequate training or lack of motivation. Only 15 (15.8%) said nothing can be done to prevent accidents.

Table 4.23 Industrial Safety Rules being employed by Informal Manufacturing Artisans

34	Variables	Frequency	Percent	Cumulative Percent
	Do you have rules and regulations in your shop			
	Yes	95	100.0	100.0
	Total	**95**	**100.0**	
	Is the rules and regulations written down			
	No	95	100.0	100.0
35	**Total**	**95**	**100.0**	

Source; field data, 2018

According to Table 4.23, all the respondents 95 (100%) said they have rules and regulations governing their operations. However, the all the 95 (100%) were of the view that their rules and regulations, which existed mainly in verbal form should be written and post as notices for artisans to have access to read in other to remind themselves of it.

Table 4.24, illustrates the correlation between the demographic characteristics (gender, age, and educational level) of artisans and their compliance to safety rules and regulations. From the results, there was statistically positive correlation between gender ($r = 1$; $p<0.05$) and work experience on the present job ($r = .152$, $p< 0.05$). Also the age group was ($r = .084$; $p<0.05$), and their highest level of education ($r = .315^{**}$; $p<0.01$) shows a linear of ($p<0.05$) in compliance to safety. The direction of the relationship is positive (i.e., age group and highest level of education are positively correlated), meaning that these variables tend to increase together.

With regards to gender and work experience on present job ($r = .152$, $p< 0.05$). Which of these Personal Protective Equipment's (PPE) are available ($r = -.178$; $p<0.05$)? There is

probably a correlation between highest level of education and compliance to safety by display warning notices in place where there are potential dangers($r= .230^{*;}$ $p<0.05$),

In other to find out the Personal Protective Equipment's (PPE) available and their compliance to safety use, it was revealed that there is probably a correlation between display warning notices in places where there are potential dangers and wearing of prescribed safety boots in the shop($r =.047$; $p<0.05$), and ($r = .086$; $p<0.05$) respectively.

The relationship is positive (i.e. display warning notices in place where there are potential dangers and wearing of prescribed safety boots in the shop were all positively correlated), implies that these variables tend to increase together.

With regards to gender and work experience on present job ($r = .152$, $p< 0.05$), wearing shield/goggles when grinding, chipping or welding ($r =$; $p<0.05$). Is very necessary wearing of respirators or masks when welding galvanized iron components that emit high noxious fumes and smoke ($r = .059$; $p<0.05$).

Respects to gender and wearing of prescribed safety boots in the shop ($r =.059$; $p<0.05$). There is positively correlation. Using gloves when handling components such as sheet plates with sharp edges ($r = .021$; $p<0.05$) which has a probable positive correlation, meaning that these variables tend to increase together.

There is negative correlation in availability of Personal Protective Equipment's (PPE) and wearing shield/goggles when grinding, chipping or welding ($r = -.111$; $p<0.05$). Which has a probable negative correlations, meaning that as one variable tend to increase, the other decreases. During the observation, it was observed that there were no screens or shields provided during welding to prevent exposure to other workers or the general public -

considering that work was done on road sides and open areas. This research work agrees with research by Nunez and Villanueva (2011) which affirmed that there is a direct relationship between safety knowledge as well as safety awareness and lower occurrence of occupational accidents.

Table 4.24: Correlations of Artisans demographic characteristics (gender, age, and educational level) and their compliance to Safety rules and regulations (N = 95)

	A	B	C	D	E	F	G	H	I	J
A	1	.084	-.022	.152	-.178	-.083	-.076	.059	.054	.021
B		1	-.092	-.054	.050	.155	.133	-.127	.206*	.029
C			1	-.162	.034	.230*	-.035	.315**	.032	-.097
D				1	-.047	.033	.027	-.026	-.040	.029
E					1	.047	-.111	-.007	.086	.015
F						1	.190	.198	.018	.008
G							1	-.065	-.052	.070
H								1	.031	-.290**
I									1	.052
J										1

Source; Field data, 2018

Responses = Yes, Sometimes and No

Key	Meaning	Key	Meaning
*.	Correlation is significant at the 0.05 level (2-tailed)	**.	Correlation is significant at the 0.01 level (2-tailed).

A	Gender	**F**	Do you display warning notices in place where there are potential dangers?
B	Age group	**G**	Do you wear shield/goggles when grinding, chipping or welding?
C	Highest Level of Education:	**H**	Do you wear respirators or masks when welding galvanized iron components that emit high noxious fumes and smoke?
D	Work experience on the job	**I**	Do you u wear prescribed safety boots in the shop?
E	Which of these PPE or PPC are available	**J**	Do you use gloves when handling components such as sheet plates with sharp edges?

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter of the study summarizes the findings made and draws conclusions from the findings. It also presents recommendations that would help to address some of the problems of safety management in machine shops at Kokompe in Sekondi - Takoradi Industrial Area and recommendation for future research.

5.1 Summary of Findings

It was revealed by 52 (54.7%) of the respondents that accidents do occur in the machine shops and the frequency is very high 67 (70.5%). Among the common accidents they encountered were cuts, hammering of hands and burns recorded 40 (42.1%) and 29 (30.5%) respectively.

It was observed that 29 (30.50%) and 21 (22.10%) of the accidents are as a results of inexperience, inattentiveness /carelessness and unsafe acts and unsafe condition, are some of the common accidents in their machine shops. Moreover, significant number of the respondents 50 (52.6%) attributed the causes to the artisans trying to lift heavy objects they manufactured alone, and work for long hours (i.e. 6 – 8 hours a day).

The welders and the Auto body builders were working in poor ergonomic posture/position by squatting, bending, standing and sitting on containers and the untidy work areas with scatted cables which posed a risk of slips and falls.

Moreover, the study results hold that Forty, 40 (42.6%) of the artisans said some of the effects of accidents/ injuries in the workshop to the artisans resulted to; loss of man hours, absenteeism, bodily pain, deformities, high cost of treatment.

All the 95 (100%) unanimously said the personnel from the factories inspectorate department do visit and supervise their work places. It was evident that there were no screens or shields provided during welding to prevent exposure to other workers or the general public - considering that work was done on road sides and open areas.

Significant number of the respondents (84%) had no first aid box with content. Fifty - two, 52 (54.7%) majority of the artisans do not have fire extinguishers in their shops. The study shows that 66(70%) of both welders and auto body builders opined that they had no maintenance schedules for their plants, and they only maintain when the machines/plants develop fault or break down. All the 95 (100%) artisans were of the view that rules and regulations, are in verbal form. Therefore, these rules should be written and post them for artisans to be exposed to.

The study revealed that, there is a positive correlation between age of respondents ($r = .084$; $p<0.05$), and their highest level of education ($r = .315^{**}$; $p<0.01$), this shows a linear compliance to safety rules and regulations in the workshop. The direction of the relationship is positive (i.e., age group and highest level of education are positively correlated).

There exists a negative correlation between availability of Personal Protective Equipment's (PPE) and wearing shield/goggles when grinding, chipping or welding ($r = -.111$; $p<0.05$).

5.2 Conclusions

The study has shown that accidents do occur in the machine shops and the frequency is very high. Among the common accidents they encountered were cuts, hammering of hands and burns.

It was observed that the accidents are as a results of inexperience, inattentiveness /carelessness and unsafe acts and unsafe condition, are some of the common accidents in their machine shops. Moreover, significant number of the respondents attributed some

other causes to artisans trying to lift heavy objects they manufactured alone, and work for long hours (i.e. 6 – 8 hours a day).

The artisans are working in poor ergonomic posture. The study results revealed some effects of accidents/ injuries in the workshop to the artisans as; loss of man hours, absenteeism, bodily pain, deformities, high cost of treatment. Additionally, all the 95 (100%) unanimously revealed that the personnel from the factories inspectorate department do visit and supervise their work places

It was found out that, there were no screens or shields provided during welding to prevent exposure to other workers or the general public - considering that work was done on road sides and open areas.

Furthermore, significant number of the artisans had no first aid box with content and the fire extinguishers which were available in their shops were expired.

The study shows that the artisans had no maintenance schedules for their plants, until develop faults or break down before they are maintained.

Rules and regulations exist in the shops but they are not written they are in verbal. The study revealed that, there is positive correlation between age of respondents and their highest level of education this shows a linear compliance to safety rules and regulations in the workshop. The direction of the relationship is positive (i.e., age group and highest level of education are positively correlated).

The study concludes that if the industrial safety issues are not tackled with enough seriousness with one comprehensive policy document on it, it would be disaster especially at the nonformula sector.

5.3 Recommendations

The following recommendations made were in the light of the findings and conclusions drawn from the study and when successfully implemented would help improve safety management or assurance in the machine shops at Kokompe, in Sekondi - Takoradi Industrial Area.

- The personnel from the factories inspectorate department should be visiting and supervise the activities of the artisans at their work places and also organized training programme for them.
- Shop owners should or chief apprentices should be empowered to 'discipline' immediately their subordinates whose behaviour is contrary to codes on the operations or regulations guiding behaviour at work. This is because such leaders are regularly in touch with workers and therefore, would be better placed to enforced policies than upper managerial staff.
- Training and refresher courses should also be organised using simulations or scenarios at the work place for both new recruits and regular workers respectively. These would keep them to be abreast of the dangers of their work and how to prevent them.
- The master craft men/owner should enforce that all the new apprentices coming should come with their PPE before allowing them to start the work.

- Warning signs, cartons and bulletins boards with sketches of unsafe acts should be posted at the workshops to warn and at the same time educate artisans about safety at work.

5.4 Recommendation for Future Research

This work covers only a small aspect of industrial health and safety in the metal industry. Issues of infections and diseases were not covered except the occurrence of accidents. It is therefore, recommended that future researchers expand the scope of the study to include all aspects of health and safety in the metal industry and a cross section of metal manufacturing factories be sampled.

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APPENDICES

APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA -KUMASI

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

QUESTIONNAIRE FOR ARTISANS BOTH (WELDERS & AUTO BODY BUILDERS)

This questionnaire is designed for the purpose of collection of data for a study on **Industrial Safety and Management in Machine Shop: A Case Study of Sekondi - Takoradi, Kokompe Industrial Area.** The research is being carried out by M. Tech student of the above mentioned University.
Please all information is for academic purpose only and will be treated with the utmost confidentiality.

Please, tick [√] the appropriate response and fill in where possible.

Thank you.

SECTION A

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENT

INSTRUCTION: Tick the correct answer

1. gender

a. Male [ ] b. Female [ ]

2. Age group

a.18-25 years [ ] b. 26-33 years [ ]

c. 34-41 years [ ] d. 42-49 years [ ]

e. 50-60 years

3. Highest Educational Level

a. Primary education [ ] b. Basic education/JHS [ ]

c. Senior Secondary/ High education [ ] d. Technical education [ ]

e. Tertiary education [ ]

4. Position:

[ ] Technician [ ] Master Craftsman

[ ] Chief Apprentice /Artisan [ ] Apprentice

Work Experience

5. Work experience on the job

a. 1-5 years b. 6-10 years

c. 11-15 years d. 16-20 years

e. 21- 25 years f. 26 + years

6. How long have you served as an apprentice?

[ ] 1 year [ ] 2 years [ ] 3 years [ ] 4 years

[ ] 5 years [ ] 6 years [ ] 7 years [ ] others specify please……

SECTION B

AVAILABILITY AND USES OF PERSONAL PROTECTIVE EQUIPMENT (P.P.E)

Variable items	Response		
	Yes 1	Sometimes 2	No 3
7. Which of these PPE are available to you? (Multiple Response)			
a. Nose masks	[ ]	[ ]	[ ]
b. Helmets	[ ]	[ ]	[ ]
c. Gloves	[ ]	[ ]	[ ]
d. Safety boot	[ ]	[ ]	[ ]
e. Goggles	[ ]	[ ]	[ ]
f. Safety overall	[ ]	[ ]	[ ]
8. Who provides the Personal Protective Equipment?	Master/shop owner	Self	Guardian
9. Do you use the Personal Protective Equipment?	[ ]	[ ]	[ ]
10. Are your workers trained on the use of the Personal Protective Equipment?	[ ]	[ ]	[ ]
11. Do you wear shield/goggles when grinding, chipping or welding?			

12. Do you wear respirators or masks when welding galvanized iron components that emit high noxious fumes and smoke?	[ ]	[ ]	[ ]
13. Do you wear protective clothing such as overall and leather apron when welding?	[ ]	[ ]	[ ]
14. Do you use gloves when handling materials such as sheet plates with sharp edges?	[ ]	[ ]	[ ]
15. Do you wear prescribed safety boots in the shop?	[ ]	[ ]	[ ]
16. How do you ensure the use of the protective equipment?	a. By creating awareness .b. By enforcing rules and regulations .c. Nothing can be done		

SECTION C

Supervision and Safety Law Enforcement

17. Do personnel from the department of factories inspectorate visit your shop?

[ ] Yes Sometimes [ ] [ ] No

18. If yes how often do they visit your shop?

Monthly [ ] Quarterly [ ] Bi-Annually [ ] Annually [ ] Others, **(Specify)…….**

19. Do you have the opportunity to attend training courses or seminar on industrial safety?

[ ] Yes [ ] No

20. Have you been provided with safety guidelines to work with in order to prevent accidents? [ ] Yes [ ] Sometimes [ ] No

21. If yes, who provided you with the safety guidelines?

[ ] Trade Association [ ] Factories Inspectorate Department [ ] Master/shop owner

[ ] Others, specify……

22. Are the inspectors aware of the existence of your shop?

[ ] Yes [ ] No

23. Do you report all accident cases that happen in your shop?

[ ] Yes [ ] Sometime [ ] No

24. i. If yes who do you report to?

[ ] Factories Inspectorate Department [ ] Trade Association Executives

[ ] Ghana National Association of Garages [ ] Shop owner/master

ii. If yes do they investigate? [ ] Yes No [ ]

SECTION D

Work Conditions and Safety Precautions

Variable items	**Response**		
	Yes 1	Sometimes 2	No 3
24. Do you display warning notices in place where there are potential dangers?	[ ]	[ ]	[ ]
25. Do you display warning notices on all faulty machines/ equipment so that other workers can see and not use them?	[ ]	[ ]	[ ]
26. Do you have first aid box well stock in your shop?	[ ]	[ ]	[ ]
27. Do you have fire-fighting equipment (extinguisher) to use in case there is a fire outbreak in your shop?	[ ]	[ ]	[ ]
28. Is your shop well illuminated with enough electric bulbs?	[ ]	[ ]	[ ]
29. Is your shop well ventilated?	[ ]	[ ]	[ ]
30. Is your shop thoroughly cleaned after the day's work?	[ ]	[ ]	[ ]
31. Do you check the electrical fittings and connections regularly?	[ ]	[ ]	[ ]
32. Are pressure gauges on welding cylinders always checked before use?	[ ]	[ ]	[ ]

33. Do you try to lift heavy objects alone to show strength?

34. Do you have safety rules and regulations in your shop?	[ ]	[ ]	[ ]
35. If yes, are the rules and regulations written down?	[ ]	[ ]	[ ]

KNOWLEDGE OF ACCIDENTS

36. Do accidents occur in your workshop?

[ ] Yes [ ] Sometimes [ ] No

37. How frequently does the accident occur in your workshop?

[ ] Very frequent [ ] Frequent [ ] rarely

38. What was the nature of the injury/accident you sustained if any?

a. Fracture b. Bruises c. Sprain/strain d. Cut .e. burns f. Arc eyes f.

39. Do you think the use of PPE can prevent injuries/accidents at workshop?

[ ] Yes [ ] Sometimes [ ] No

Causes of some Accidents

40. Are the causes of some of the common accidents in your workshop due to the following factors? (**You can tick more than one response please**)

[ ] Tiredness [ ] over confidence [ ] Inattentiveness,

[ ] Unsafe act (Exposure of electricity cables, lifting heavy load, use of faulty tools, machines, wrong use and handling of machine)

[ ] Inexperience [ ] Poor housekeeping [ ] Attitude [ ] Others specify, please

Effects of Accidents

41. What are some of the effects of accidents/ injuries in your workshop to the artisans?

[ ] Loss of man hours, absenteeism, illness, bodily pain, deformities, high cost of treatment,

[ ] Damages on machine tool/ equipment, high cost of repairs, reduced production,

[ ] Difficulty in getting experienced hands to replace in case of deformity

[ ] deformity and loss of job

Ergonomic Hazards

42. How many hours are you exposed to this physical hazard each week?

[ ] 3 – 5 hours [ ] 6 – 8 hours [ ] 9 – 11 hours

43. What is your usual posture at work? [ ] Standing [ ] Bending [ ] Sitting [ ] Squatting

44. Is your posture comfortable? [ ] Yes [ ] No

KNOWLEDGE OF SAFETY PRECAUTIONS

Variable items	Response		
	Yes 1	Sometimes 2	No 3
45. Do you read instructions on new machines before using them?	[ ]	[ ]	[ ]
46. If yes, do you do exactly as you are instructed?	[ ]	[ ]	[ ]
47. Do you agree that refusal to use PPE poses serious danger to one's industrial health and safety?	[ ]	[ ]	[ ]
48. Do you always clean the shop and arrange tools and equipment properly after the day's work?	[ ]	[ ]	[ ]
49. Do you leave gangways in your shop?	[ ]	[ ]	[ ]

50. If question 49 is no why an if yes why?.....

51. Are the workers comfortable or satisfied with your work environment? [ ] Yes [ ] Sometimes [ ] No

52. If No, why? ……

53. Do you have Maintenance schedule for your machine shop and what time is it carry out?

APPENDIX B

UNIVERSITY OF EDUCATION, WINNEBA -KUMASI

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

CHECKLIST FOR OBSERVING SAFETY PRACTICES AND CONDITIONS

This checklist was designed for non-participant observation by the researcher to ascertain the authenticity or reality of the responses from the respondents regarding some of the practices and conditions the various workshops in Kokompe Industrial Area in Sekondi – Takoradi Metropolis.

Please, all information is purely for academic purpose only and will be treated with the utmost confidentiality as such.

Please, tick [√] the appropriate response and fill in where possible.

Thank you.

1. (a) Do the artisans wear prescribed safety boots?
   [ ] Yes [ ] Sometimes [ ] No
2. (b) If **No** specify: ……...
   [ ] Sandals [ ] Bathroom slippers [ ] Canvas boots [ ] Old tattered shoes

3. Are the artisans wearing well-fitting overall?
   [ ] Yes [ ] Sometimes [ ]No
4. Do they put on gloves when handling components such as sheet plates with sharp edges?

   [ ] Yes [ ] Sometimes [ ] No
5. Are tools, metal scraps, materials and finished products well arranged in your workshop?
   [ ] Yes [ ] Sometimes [ ] No

6. How many electrical bulbs or lamps are there in a workshop for illumination purposes?

   [ ] One [ ] Two

   [ ] Three [ ] Four or more

7. Are the artisans using appropriate shield when welding?

   [ ] Yes [ ] Sometimes [ ] No
8. Do the artisans wear respirators during welding process?

   [ ] Yes [ ] Sometimes [ ] No

9. Are the artisans using proper return lead cable?
   [ ] Yes [ ] Sometimes [ ] No

10. Do they wear goggles when grinding or chipping?

[ ] Yes [ ] Sometimes [ ] No

11. Do they always clean the shop and arrange tools and equipment properly after the day's work?
[ ] Yes [ ] Sometimes [ ] No

12. Do they have maintenance schedule for your machines / equipment?

[ ] Yes [ ] Sometimes [ ] No

13. Do they often maintain or overhaul your machines / equipment?

[ ] Very frequently [ ] Not frequently

[ ] When the machine breakdown [ ] Not at all

SECTION B

AVAILABILITY OF SAFETY EQUIPMENT AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

14. Which of these PPE are you having / available to you? (Multiple responses)

a. Nose masks [ ] b. Helmets [ ] c. Gloves [ ] d. Safety boot [ ]

e. Goggles [ ] f. Safety overall [ ] h. Fire Extinguisher .j. [ ] First Aid Box

[ ] Others (Please specify)……

15. Who provides you the Personal Protective Equipment?

[ ] Master [ ] Self [ ] Guardian [ ] Others (Please specify) ……

16. Do the workers use the Personal Protective Equipment? [ ] Yes [ ] Sometimes [ ] No

17. How do you ensure the use of the protective equipment? a. By creating awareness .b. By enforcing rules and regulations .c. Nothing can be done

18. Are the workers comfortable using these equipment? [ ] Yes [ ] Sometimes [ ] No

19. Are your workers trained on the use of the Personal Protective Equipment?

[ ] Yes [ ] Sometimes [ ] No

20. If No, why? ……

PSYCHO SOCIAL HAZARDS

21. Are you satisfied with your work? [ ] Yes [ ] Sometimes [ ] No

22. If No, please give reasons? ……

23. What is the relationship between you (Master) and you workers?

[ ] Very Good [ ] Good [ ] Fair [ ] Poor [ ] Very Poor

24. Do you display warning notices in place where there are potential dangers?

25. Do you display warning notices on all faulty machines/ equipment so that other workers can see and not use them?

Ergonomic Hazards

26. How many hours are you exposed to this physical hazard each week?

[ ] 3 – 5 hours [ ] 6 – 8 hours [ ] 9 – 11 hours

27. What is your usual posture at work? [ ] Standing [ ] Bending [ ] Sitting [ ] Squatting

28. Is their posture comfortable? [ ] Yes [ ] No

29. Do you leave gangways in your shop?

KNOWLEDGE OF ACCIDENTS

30. Do accidents occur in your workshop?

[ ] Yes [ ] Sometimes [ ] No

31. How frequently does the accident occur in your workshop?

[ ] Very frequent [ ] Frequent [ ] rarely

32. What was the nature of the injury/accident you sustained if any?

a. Fracture b. Bruises c. Sprain/strain d. Cut .e. burns f. Hammering of hands g. Electric shock

33. Do you think the use of PPE can prevent injuries/accidents at workshop?

[ ] Yes [ ] Sometimes [ ] No

Causes of some Accidents

34. Are the causes of some of the common accidents in your workshop due to the following factors? (**You can tick more than one response please**)

[ ] Tiredness [ ] over confidence [ ] Inattentiveness,

[ ] Unsafe act (Exposure of electricity cables, lifting heavy load, use of faulty tools, machines, wrong use and handling of machine)

[ ] Inexperience [ ] Poor housekeeping [ ] Attitude [ ] others specify, please…….

35. Are electrodes left in their holders?

APPENDIX C

QUESTIONNAIRE FOR THE FACTORIES INSPECTORATE DEPARTMENT (FID)

This questionnaire is designed for the purpose of collecting data for a study **on Industrial Safety and Management in Machine Shop: A Case Study of Sekondi - Takoradi Kokompe Industrial Area.**

The researcher is a student of the Department of Design and Technology of the University of Education Winneba, Kumasi.

Please, tick [√] the appropriate response. Thank you.

1. Do you as factory inspector visit and inspect safe working conditions and safe act at Kokompe?

   [ ] Yes [ ] Sometimes [ ] No

2. If 'yes', how frequent do you visit the place?

   [ ] Once in a year [ ] Twice a year [ ] Once in two years [ ] any other, specify please……...

3. Do you periodically organize seminars or training on industrial safety to sensitize the workers at Kokompe?

   [ ] Yes [ ] Sometimes [ ] No

4. If 'yes', how often do you organize such seminars?

   [ ] Once a year [ ] Twice a year [ ] Once in two years [ ] others specify …….

5. Do you give certificates to inspected and approved shops in the industrial areas?
   [ ] Yes [ ] Sometimes [ ] No

6. How often do you go on inspection in the informal manufacturing sector?

Monthly [ ] Quarterly[ ] Bi-Annually [ ] Annually [ ] Others, Specify…….....