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COLLEGE OF ENGINEERING, DESIGN, ART AND TECHNOLOGY

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

FINAL YEAR PROJECT REPORT

TITLE: AN INVESTIGATION OF THE HEALTH AND SAFETY PRACTICES AT ISSA AUTO GARAGE LIMITED, NAKAWA

BY

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A REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING AT MAKERERE UNIVERSITY

DECLARATION

I, **WEWUZA PHINA**, hereby declare that this report for my final year project entitled "**An investigation of the health and safety practices at Issa Auto garage limited, Nakawa"** is my original work and has never been submitted or published before.

Signature.....

Date.....03/06/2025.....

APPROVAL

This is to certify that **WEWUZA PHINA** has gone through a systematic process to come up with a final year project report entitled "**An investigation of the health and safety practices at Issa auto garage limited, Nakawa**". Therefore, this serves to approve her Final year project report submission to the Department of Mechanical Engineering under School of Engineering, College of Engineering, Design, Art and Technology, Makerere University.

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ABSTRACT

Motor vehicle repair workshops are a key sector in Uganda's economy, yet employees are exposed to extreme occupational health and safety risks. This study aimed to assess the health and safety practices at Issa Auto Garage Limited, to determine hazards, their effects, and determining if the garage was in accordance with HSE practices. A mixed-methods approach was employed, with desk research, questionnaires completed by workshop employees, and interviews with the owner of the garage. Physical risks such as exposure to radiation and vibrations, chemical risks through solvents and fumes, and ergonomic risks through lifting and posture were identified through the research. The impact of these risks included instances of injury, illness, and reduced productivity. Further, the study examined compliance of the garage with Occupational Health and Safety national standards and enforcement of protective practices such as the provision and use of personal protective equipment. The findings of this study are critical to the development of targeted strategies aimed at mitigating occupational hazards, improving the work environment, and enhancing the health, safety, and productivity of mechanics in Issa Auto Garage Limited and, by extension, towards the ultimate goal of a healthy and safe workforce in Uganda's automobile sector.

ACKNOWLEDGEMENT

I begin by appreciating the almighty God for the gift of life granted unto me

I would like to express my sincere appreciation to the management and employees of Issa Auto Garage Limited for being willing to be included in this study, for their time, and for openly sharing their experiences and views. Their joint effort was needed in gathering the first-hand data which forms the core of this research.

I also appreciate the support and guidance provided to me by Mr. Edmond Mpagi and Dr. James Kaconco. Their expertise and constructive contributions made during and throughout the study were instrumental in shaping this report's direction and content.

Finally, I appreciate my parents and the government of Uganda for continuously supporting me throughout my education.

DEDICATION

This report is dedicated to the hardworking mechanics and technicians at Issa Auto Garage Limited and all those in Uganda's motor vehicle repair industry.

I also dedicate it to mechanical engineering students who are passionate about ensuring the health and safety of workers in motor vehicle repair workshops.

LIST OF ACRONYMS AND ABBREVIATIONS

CWs	Company Workshops
HSE	Health, Safety and Environment
ILO	International Labor Organization
LWs	Local Workshops
MVRW	Motor Vehicle Repair Workshops
NHTSA	National Highway Traffic Safety Administration
OHS	Occupational Health and Safety
PAHs	Poly Aromatic Hydrocarbons
PM	Particulate Matter
PPE	Personal Protective Equipment
RE	Resilience Engineering
SPSS	Statistics Package for Social Sciences
UV	Ultra Violet
VOCs	Volatile Organic Compounds
WHO	World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1 Background

The significant increase in the number of motor vehicles has led to the rise in motor vehicle repair workshops (MVRW) and garages due to the need for vehicle repair and maintenance (Ahmad et al., 2016). Motor vehicle repair workshops are entities where automotive mechanics and technicians come together to offer a variety of car repair and maintenance services. They are mostly owned by one master who manages the workshop. Every garage has several master mechanics specializing in different automotive systems, including electricians, automotive mechanics, welders, brake binders, interior vehicle liners, body sprayers, panel beaters, and so on (Akple et al., 2013). Mechanics are exposed to physical, chemical, and ergonomic hazards during vehicle repair, assembly, painting, and other motor-related activities (Brosseau et al., 2014). The physical hazards include exposure to ultraviolet and infrared radiations from welding operations which cause skin cancer, hand-arm vibrations from power-driven components which cause white finger syndrome, poor disposal methods of oils/grease which may lead to slipping, eye injuries from grinding and compressed air system operations like panel beating and crashing of fingers between rotating moving parts. Additionally, chemical hazards include exposure to a wide range of workshop chemicals contained in brake fluids, degreasers, detergents, lubricants, metal cleaners, paints, fuel, and solvents, resulting in skin diseases, eye irritation, increased risk of organic brain damage and cancer due to inhalation of exhaust fumes in high concentrations. Furthermore, ergonomic hazards are due to poor postures during the lifting and carrying of heavy loads that cause back pain (Datasheets & Datasheet, 2000).

A competent, active, dynamic, and healthy workforce contributes greatly to the development of the world in both the automotive and other sectors of the economy. The automotive industry has developed greatly due to high population growth rates and many emerging entrepreneurs. This sector provides bulk new employment to the majority of the poor. However, most of the people employed in the automotive industry are either ignorant about the safety measures or cannot afford the necessary personal protective equipment (PPE) needed during their day-to-day operations. Ensuring occupational health and safety is crucial for efficiency and effectiveness in MVRW (Amfo-Otu & Agyemang, 2016).

Health and safety include preventing accidents or incidents at one's workplace that may result in injuries to employees and others. Health and safety comprises programs, legislation, regulations, guidelines, processes, and procedures that protect the safety, welfare, and health of employees on the site. Occupational hazards found in MVRW activities become more severe when there is limited or no awareness, control measures, and implementation of health and safety rules and regulations (Ahmad et al., 2016). Therefore, occupational health and safety are important for the efficiency and effectiveness of workers in MVRW. Alarmingly Hamalainen, Takala and Saarela (2006) estimated that about 270 million individuals become victims of occupational accidents and 160 million are affected by occupational diseases annually (Amfo-Otu & Agyemang, 2016). To mitigate these risks, employers and employees must utilize administrative controls, work practices, engineering controls, and personal protective equipment (PPE). This proactive action ensures a safe working environment. Occupational health and safety are critical components of a productive and efficient workforce in MVRW. Employers and employees must prioritize protection measures to mitigate occupational hazards and ensure a safe working environment (Amfo-Otu & Agyemang, 2016). In Uganda, the Occupational and Safety Act of 2006 requires that employers conduct their undertakings in a way that any person who is not in their employment but may be affected by the undertaking is not exposed to risks to their health and safety (Republic, 2006).

1.2 Problem Statement

Despite the crucial role of motor vehicle repair workshops in Uganda's economy, workers at these facilities such as those at Issa auto garage limited, face considerable health and safety risks. These risks include physical, chemical and ergonomic hazards. Physical hazards such as exposure to ultraviolet and infrared radiations from welding operations which cause skin cancer and the potential for slips and falls due to spilled oils and grease. Moreover, workers are at risk of eye injuries from grinding activities and compressed air systems in addition to crushing injuries from rotating machinery. The prevalence of chemical hazards cannot be overlooked, as workers are frequently exposed to various substances including brake fluids, degreasers, detergents, lubricants, metal cleaners, paints, fuels, and solvents, which can lead to skin conditions, eye irritation, and increased risks of organic brain damage and cancer particularly from the inhalation of exhaust fumes. Furthermore, ergonomic hazards pose a significant threat, as poor lifting techniques and the manual handling of heavy loads contribute to back pain and

other musculoskeletal disorders. Unfortunately, many workers in this industry may be unaware of effective safety measures or unable to afford the necessary personal protective equipment (PPE) needed in their day-to-day operations. Some workers tend to ignore the necessary PPE needed in the repair jobs.

1.3 Objectives

1.3.1 Main objective

To assess the health and safety practices at Issa Auto Garage Limited.

1.3.2 Specific objectives

a) To identify the health and safety hazards faced by MVRW workers.
b) To assess the impacts of the identified hazards.
c) To evaluate the garage's compliance levels with the HSE practices.

1.4 Scope

This project aims to identify various occupational health and safety hazards at Issa Auto Garage Limited. It also seeks to assess the knowledge and practices regarding occupational health and safety among garage workers and workshop owners, existing safety regulations and policies in Uganda, and their effectiveness. The study also talks about the impact of occupational hazards on the health and productivity of mechanics.

1.5 Significance

This study has led to the development of strategies to mitigate occupational hazards and improve the productivity and effectiveness of MVRW mechanics, specifically those at Issa Garage Limited ultimately leading to global development.

1.6 Justification

The automotive sector employs a significant portion of the workforce in the economy yet less attention is put on health and safety in these workshops. This study aims to address the knowledge gap about health and safety at Issa auto garage limited. It will also ensure that the garage complies with Uganda’s occupational and safety act of 2006 which requires that employers conduct their undertakings in a way that any person who is not in their employment but may be affected by the undertaking is not exposed to risks to their health and safety.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Motor Vehicle repair workshops are small-scale enterprises in the automotive sector that are labor-demanding. Their workshop size, workers' number, and their job description differ significantly (Ahmad et al., 2017a).

Hazards are physical situations or conditions that cause injuries to humans, property damage, and the environment. Occupational hazards are unsafe conditions that are associated with the work performed. These hazards include physical, chemical, biological, ergonomic, and psychosocial factors that may have adverse effects on the health and well-being of workers. These conditions at the workplace are unsafe and reduce workers' safety. Unsafe conditions and acceptable individual behaviors contribute to accidents at the workplace (Amfo-Otu & Agyemang, 2016).

Figure 1: Motor vehicle repair workshop

2.2 Occupational hazards in MVRW

Occupational hazards found in MVRW activities include physical, ergonomic, psychosocial, mechanical, biological and chemical (Amfo-Otu & Agyemang, 2016). (Technology & Amongst, 2024) found out that occupational hazards are caused by physical, chemical, social, educational, biological, mechanical and physical factors that exist at the work place.

Figure 2: Hazards in motor garages

2.2.1 Chemical Hazards

Chemical hazards are caused due to exposure to industrial chemicals, heavy metals, and substances in brake fluids, degreasers, and paints, leading to chronic poisoning, skin diseases, eye irritation, dizziness, and respiratory problems. They enter the human body through inhalation, ingestion and absorption through the human skin (Akowe, 2022). Other chemicals from vehicular exhaust include different noxious oxides of Sulphur (SO2), nitrogen (NOx), carbon (CO), volatile organic compounds (VOCs) and suspended particulates which have direct or indirect health effects of the mechanics in MVRW (Ahmad et al., 2016). Most chemicals that

garage workers are exposed to have toxic effects. Studies have highlighted numerous adverse outcomes, including blood disorders and hypertension. Research on benzene exposure in South Korean industries revealed a heightened risk of hematopoietic disorders. Additionally, car mechanics in Zagazig, Egypt, showed reduced levels of erythrocytes, hemoglobin, hematocrit, and platelets. Aromatic solvents were found to decrease red blood cell and hemoglobin levels among automobile-repair workers. Furthermore, exposure to lead, benzene, and organic solvent mixtures has been associated with increased systolic and diastolic blood pressure (Ataro et al., 2018).

2.2.2 Physical Hazards

Physical hazards are due to exposure to radiations, vibrations, noise, extreme temperatures, and heat-sealing operations, causing harm such as White Finger Syndrome. There is also exposure to excessive noise during car body work (Ozomata et al., 2021).

2.2.3 Biological Hazards

Biological include risk of acute and chronic infections from bacteria, viruses, fungi, insects, reptiles, and other living organisms and adhesives particularly due to unhygienic environments that mechanics operate in (Ozomata et al., 2021).

2.2.4 Ergonomic Hazards

Musculoskeletal strain from improperly adjusted workstations, heavy lifting, poor postures, repetitive movements, strenuous activities, use of improperly designed tools and excessive force (Amfo-Otu & Agyemang, n.d.)

2.2.5 Psychosocial Hazards

These are hazards due to psychological stress from long working hours, workplace violence, verbal abuse from customers, and emotional strain (Akowe, 2022).

2.2.6 Mechanical Hazards

Risk of injury from sharp edges, shearing devices, and body parts getting caught between surfaces as a result of poorly organized workplaces (Mishra et al., 2019).

2.3 Occupational risks and health consequences.

According to WHO (World Health Organization) and ILO (International Labor Organization), the estimated work related burden of disease and injury report for 2000-2016 is tabulated below (Pega, 2022).

Table 1: Occupational risks and their respective health consequences

Risk factor	Health outcome
Occupational exposure to asbestos	Trachea, bronchus and lung cancers, Ovary cancer and Mesothelioma
Occupational exposure to arsenic	Trachea, bronchus and lung cancers
Occupational exposure to benzene	Leukemia
Occupational exposure to beryllium	Trachea, bronchus and lung cancers
Occupational exposure to cadmium	Trachea, bronchus and lung cancers
Occupational exposure to chromium	Trachea, bronchus and lung cancers
Occupational exposure to diesel engine exhaust	Trachea, bronchus and lung cancers
Occupational exposure to formaldehyde	Leukemia, Nasopharynx cancer
Occupational exposure to polycyclic aromatic hydrocarbons, silica and nickel	Trachea, bronchus and lung cancer
Occupational exposure to sulphuric acid	Larynx cancer
Occupational exposure to trichloroethylene	Kidney cancer
Occupational asthmagens	Asthma
Occupational particulate matter, gases and fumes	Chronic obstructive pulmonary disease
Occupational noise	Hearing loss
Occupational injuries	Poisoning by carbon monoxide, falls, fire, heat and hot substances, exposure to mechanical forces, pulmonary aspiration and foreign body in airway
Occupational ergonomic factors	Back and neck pain

2.4 Safety practices

Safety refers to the state of being free from harm and this involves performing work without causing damage to yourself, the work tool and the environment.(Harcourt & Harcourt, 2021). To ensure a safe and accident-free experience in mechanical workshops, mechanics must adhere to essential practices when handling machine tools, hand tools, and consumables. The essential practices are categorized into pre-operation, PPE, during operation and post operation safety measures (Harcourt & Harcourt, 2021).

2.4.1 Pre-Operation

Selecting the Right Tools for the Right Job**.** It's crucial to choose tools that are specifically designed for the task at hand. Using the correct tools minimizes the risk of accidents and ensures the job is done efficiently. For example, using a torque wrench for tightening bolts to the correct tension rather than a regular wrench.

Adopting Insulated Hand Tools for Electrical Work**.** When working with electrical components, it's important to use tools that have insulated handles to protect against electrical shocks. These tools are designed to prevent the passage of electricity, ensuring the safety of the user.

Selection of Appropriate Tooling for the Operation. Each job may require specific types of tools or equipment. Selecting the appropriate tooling involves choosing the correct size, type, and material of tools necessary for a particular operation. For instance, using a pneumatic wrench for high-torque applications instead of a manual wrench.

2.4.2 Personal Protective Equipment (PPE)

Wear Safety Gloves**.** Safety gloves protect hands from injuries when handling sharp, hot, or chemical materials. Welders, in particular, need heat-resistant gloves to protect from burns and hot metal sparks.

Wear Safety Shoes (Boots)**.** Safety boots with steel toes protect feet from falling objects and sharp items. They are essential when operating heavy or portable tools and machines, as they reduce the risk of foot injuries.

Wear Approved Eye Protectors**.** Eye protection, such as safety goggles or face shields, is necessary when operating power tools or welding to protect against flying debris, sparks, and intense light that could damage eyesight.

Welders Should Wear Flame-Resistant Clothing. Welders should wear clothing made from flame-resistant materials to protect against burns from sparks and molten metal. This clothing reduces the risk of severe burns and injuries.

Figure 3: Different PPE for different body parts

2.4.3 During Operation

Brush Chips from Machinery after Drilling**.** After drilling, it's important to clear away metal chips and debris from the machinery. This prevents the buildup of materials that can cause malfunctions or pose injury risks during subsequent use.

Test Power Tools or Machines for Functionality before Use or Adjustments. Before starting any operation or making adjustments, test the power tools and machines to ensure they are functioning correctly. This step helps identify any faults or issues that could cause accidents.

Use Proper Lifts Instead of Car Jacks When Working Under Cars**.** Using proper hydraulic lifts instead of car jacks provides more stability and reduces the risk of the vehicle falling. This precaution helps prevent back and neck injuries by ensuring a safer working environment under the vehicle.

2.4.4 Post-Operation

Turn Off All Power Machines After Use and Before Making Adjustments**.** Always ensure that power tools and machinery are turned off after use and before making any adjustments. This practice helps prevent accidental start-ups, which can lead to severe injuries.

More safety practices were recommended by (Akowe, 2022) to ensure a healthy and safe working environment.

- Sanitary Facilities. The mechanics should have access to clean toilets, washing areas, and potable drinking water.
- Medical Emergency Preparedness. First aid facilities and equipment should be available.
- Optimal Workspace Conditions**.** Adequate ventilation to prevent airborne hazards and sufficient lighting for clear visibility.
- Waste Management and Cleanliness. Proper disposal of waste to maintain a clean working environment and regular cleaning and maintenance schedules.

2.5 Health and Safety Measures for Motor Garages

According to (Health & Executive, 2020), the following health and safety measures should be implemented in motor garages.

2.5.1 Health measures

Motor garages must be well-ventilated ensuring that fresh and clean air circulates from an uncontaminated external source. This ventilation should also effectively remove warm, humid air and prevent the buildup of dust, fumes, or vapors from equipment. Mechanical ventilation systems may be necessary and should be regularly maintained.

The temperature must be well controlled. For indoor workspaces, maintaining thermal comfort is crucial. In motor garages where physical effort is involved, the temperature should ideally be at least 13°C. Both heat and cold stress should be managed through engineering measures like insulation, improved air movement, and humidity control. For cold environments, additional measures like cab heaters in forklifts and re-organizing tasks to include rest periods in a comfortable area are recommended.

Lighting: Sufficient lighting is essential for safe work and movement. Local lighting should be provided at workstations and areas of particular risk, with emergency lighting installed to ensure safety in case of power loss.

Cleanliness and Waste Management: Motor garages should maintain the cleanliness of all surfaces, including floors, walls, and ceilings. Waste materials must be regularly removed and stored in suitable receptacles to ensure a clean working environment.

Space Requirements: Workrooms in motor garages should have adequate space for workers to move comfortably. The volume of the room, divided by the number of workers, should meet the minimum requirement of 11 cubic meters per person, taking into account the room layout and the nature of the work.

Workstations and Seating: Workstations should be designed to be suitable and safe for the tasks performed. If work can be done while sitting, appropriate seating that supports the lower back

should be provided, along with footrests for those unable to place their feet flat on the floor. Emergency egress from workstations must be swift and unobstructed.

2.5.2 Safety measures

Ensuring safety measures in motor garages is crucial for protecting workers, customers, and the surrounding environment. Proper maintenance plays a key role in this effort, requiring all workplace equipment, devices, and systems to be kept in good working order. This includes mechanical ventilation systems and any machinery that, if faulty, could pose health and safety risks. Additionally, regular monitoring of building conditions helps maintain stability and address potential hazards such as vibrations, excessive floor loadings, and fire dangers.

Traffic routes within the garage should be carefully designed to facilitate safe movement for both pedestrians and vehicles. Wide pathways with adequate headroom allow for smooth circulation, and separating pedestrian walkways from vehicle routes reduces the risk of accidents. When shared routes are necessary, barriers or clear markings can help designate safe walking areas, with well-lit crossing points improving visibility.

Vehicle and pedestrian safety can be further enhanced by implementing one-way systems and drive-through loading areas to minimize the need for reversing. Speed limits should be clearly set and strictly enforced, with well-marked routes and appropriate signage guiding both drivers and pedestrians. Loading bays must also feature exit points or refuges to prevent individuals from being struck by moving vehicles.

The condition of floors and traffic routes must be maintained to prevent slips, trips, and falls. Surfaces should be strong enough to support expected loads while remaining free from obstructions, holes, or uneven areas. A system should be in place to promptly identify and repair defects such as subsidence, potholes, or cracks.

When it comes to staircases and elevated areas, safety measures should include fencing with upper and lower rails along open sides. Handrails must be installed on at least one side of every staircase—or both sides if necessary—with additional support for wider staircases. Relying on ladders or steep stairs for access between floors should be avoided.

Garages must also take precautions to prevent falls into dangerous substances. Areas containing tanks, pits, or other hazardous materials should be securely fenced or covered, with traffic routes near these zones also protected by barriers.

Lastly, doors and gates should be built with safety in mind. Those that swing both ways or are located on major traffic routes should have transparent viewing panels to improve visibility. Power-operated doors and gates must be equipped with safety features to prevent injuries and include emergency stop mechanisms for added protection.

2.6 Occupational Health and Safety in motor garages

The significance of occupational health and safety (OHS) in small industries is gaining global attention. Ensuring safe and healthy workplaces enhances physical, mental, and social well-being, while also yielding substantial financial benefits by reducing medical expenses, insurance claims, productivity loss, and damage to corporate reputation and integrity. Small industries are typically characterized by independent ownership, where the owners are the sole decision-makers and primary contributors of operational capital. These owners and supervisors often have limited awareness of OHS laws and regulations, which results in low prioritization of safety measures.

Motor vehicle repair workshops (MVRWs) are frequently small-scale enterprises that require a significant amount of labor. Their sizes, workforce, and job descriptions vary widely. Studies have identified numerous risks and hazards faced by workers in these workshops, including physical, chemical, biological, and ergonomic dangers, as well as exposure to harmful pollutants such as poly-aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), heavy metals, particulate matter, exhaust gases, and sulfur and nitrogen oxides. Common health issues among mechanics include respiratory problems, hearing loss, acute injuries, eye injuries, musculoskeletal disorders, and risks from inhaling fumes and vapors containing carcinogenic substances like PAHs.

Prolonged exposure to crude petroleum oil, dust, and associated pollutants has been linked to severe health effects such as tumors, blood disorders, reproductive complications, growth reduction, structural abnormalities, and kidney damage. Workers at MVRWs often operate in

unsanitary conditions, with inadequate awareness of chemical exposure risks and limited use of personal protective equipment (PPE), which could otherwise mitigate occupational hazards.

In Saudi Arabia, research and publications on OHS standards in MVRWs remain scarce. A study was conducted to evaluate and compare OHS practices, standards, and workplace conditions between local workshops (LWs) and multinational company workshops (CWs). Using a specialized inspection tool featuring 10 OHS components and 59 assessment criteria, data was gathered through observations, walk-through surveys, focus group discussions, and interviews. This was study conducted by (Ahmad et al., 2017b) that involved 62 local workshops and 11 multinational workshops, highlighting differences in OHS practices and offering recommendations for improvement.

2.7 Impact of HSE interventions

The HSE management system is designed to assist organizations and enterprises in tackling environmental challenges within their operations while also addressing shortcomings in health and safety. To identify workplace hazards, minimize the occurrence of accidents or incidents, and prevent exposure to dangerous situations and chemicals, it is crucial to establish systematic processes from a safety perspective. Moreover, it provides training for employees on the proper use of safety equipment, emergency response, and incident prevention (Benson et al., 2024).

The impacts of HSE interventions are grouped into short-term and long-term impacts and they include (Benson et al., 2024).

2.7.1 Short-term Effects of HSE Intervention

Enhancing Safety Measures**.** Interventions such as improved training protocols, stricter safety guidelines, and enhanced equipment maintenance can help prevent accidents and reduce injuries in motor garages. These measures create a safer working environment in the short term by ensuring that workers are well-informed and that equipment is in optimal condition.

Increasing Awareness**.** Raising awareness among workers about HSE practices and potential risks through targeted interventions can lead to a temporary increase in safety consciousness.

This heightened awareness encourages a more proactive approach to identifying and addressing hazards within the garage.

Improving Emergency Response**.** Strengthening emergency response protocols and preparedness within the garage can result in quicker and more effective responses to accidents or incidents. This minimizes the immediate impact of such events, ensuring that injuries and damages are promptly managed.

2.7.2 Long-term Effects of HSE Interventions

Cultural Shifts**.** Over time, interventions can help establish a strong safety culture within the motor garage. This involves integrating safety practices and attitudes into the organizational culture, encouraging consistent adherence to safety rules, and proactive risk identification and mitigation.

Continued Enhancement**.** Regular safety audits, incident investigations, and feedback loops can support continuous improvement in HSE practices. These ongoing procedures help uncover systemic issues and implement corrective actions, leading to long-term improvements in the garage's safety outcomes.

Technological Advancements. Introducing new technologies and innovative ideas aimed at improving HSE outcomes can lead to more efficient and safer processes over time. These advancements can reduce environmental impact and enhance overall sustainability in motor garage operations.

2.8 Resilience engineering Principles

Resilience is the ability to adapt to changing conditions, prepare for withstand and rapidly recover from disruption. A principle is a law that determines certain results. Resilience Engineering (RE) principles serve as sound design practices when they are abstract, consistent statements that improve a system's resilience (Colombi, John M.; Miller, Michael E.; Schneider, Michael; McGrogan, Jason; Long, David S.; Plaga, 2012).

According to (Pawar et al., 2021), the resilience engineering principles are flexibility, response control, proactive issue identification, failure prevention, impact mitigation and operation management systems.

Flexibility: Ensures that the garage's capacity to function safely is maintained even in disruption, such as unexpected equipment malfunction or chemical spill. For example, flexible practices to employ different equipment or location maintains safety standards, reducing hazards like chemical exposure or injury.

Response Control: Enabling instant adjustment to ensure things remain secure in the midst of dynamic incidents, e.g., halting a fire explosion by immediately activating extinguishers or evacuating the area. The concept focuses on instantaneous control to restore risky situations to balance, as opposed to adaptability addressing constant-state safety.

Proactive Issue Identification: Includes the early detection of safety risks, like a defective hydraulic lift with leaks or poor flammable materials handling, when prevention fails. Early detection prevents accidents, e.g., fire or worker injuries, which would develop into large-scale events.

Failure Prevention: Measures to prevent safety accidents, such as regular checks on electric equipment and safe storage of dangerous chemicals. Such measures lower the risks of occupational injuries, for instance, electric shock or chemical burns.

Impact Mitigation: Formulates measures to contain the effects of inevitable safety accidents, e.g., ensuring open emergency exits or keeping first-aid kits easily accessible. This minimizes damage, preventing minor accidents from becoming serious injuries or fatalities.

Operational Management Systems: Established safety-minded practices, including the provision of frequent health and safety training to workers and updated practices for handling unsafe equipment. Operational management systems address risks that may not be detectable or avoidable, thereby a robust culture of safety is encouraged.

2.9 Measures for compliance

According to (Requirements, 2018), compliance is measured based on the following instructions.

General Compliance – The garages must meet technical standards, with individual instructions ensuring structural stability and safety.

Provision of Information – Specifications for design must be furnished in clear, detailed form to responsible staff, including such information as location, foundation details, waterproofing, materials used for construction, and finishes.

Garage Foundations – Foundations must transfer loads in safety and account for dangerous ground conditions, type variations for different garage buildings, and allowances for movement.

Garage Floors – Floors must be adequately strong, moisture-resistant, and permit proper drainage, with specifications of thickness requirements and structural toppings for reinforcing.

Garage Walls – Walls must ensure stability, water penetration resistance, and proper construction to resist loads, with provision for movement joints if required.

Fire Resistance – Attached and integral garages must have fire-resisting partitions, ceilings, or walls to prevent extension of fire into homes.

Security – Systems must be secure against unauthorized entry, especially in attached garages between different owners.

Doors & Windows – Garage doors and windows must be durable and easy to operate, according to recommended installation specifications.

Garage Roofs – Roofs must be rain- and snow-resistant, support applied loads, resist uplift, and be appropriately braced for stability.

Prefabricated Garages & Carports – Prefabricated buildings must meet foundation, structural, and weatherproofing requirements.

Services – Water, electricity, and heating supplies must comply with the regulations to offer protection against freezing and fire hazards.

2.10 Risk Assessment

A risk is something inherent that is present in a process or activity. Every work place is associated with different potential risks and hazards. Risk analysis enables company management to mitigate potential harm by identifying and addressing risks. Unmanaged hazard and health risks can lead to significant consequences and losses if the safety management system is inadequate. Risk assessment involves prioritizing hazard control for accidents or occupational diseases by calculating the product of severity and probability (Izyati et al., 2023).

A safety risk is a product of severity and frequency;

$$Unit\ risk\left(\frac{severity}{work\ hour}\right) = Frequency\left(\frac{incident}{workhour}\right) * Severity\ (\frac{Severity}{Incident})$$

(López-Arquillos et al., 2015).

2.10.1 Risk Assessment matrix

The probability and severity results of potential results can be analyzed using a risk assessment matrix according to (Izyati et al., 2023).

Table 2: Risk Assessment Matrix

Probability	**Severity**			
	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)
1 (Rare)	Low	Low	Medium	Medium
2 (Unlikely)	Low	Medium	Medium	Medium
3 (Likely)	Medium	Medium	Medium	High
4 (Almost certain)	Medium	Medium	High	High

Description of severity levels and probability scores

Severity Levels

1. **Insignificant**: Minor injuries treatable with first aid or less cost treatment.
2. **Minor**: Requires specialized medical or recovery efforts for minor to moderate injuries or temporary health decline, without causing lost-time accidents.
3. **Moderate**: Moderate to severe injuries resulting in lost-time accidents, permanent disability, or partial limb loss, but re-employment is possible.
4. **Major**: Fatalities, severe limb loss preventing re-employment, or critical emergencies (e.g., fire, explosion, mass poisoning).

Probability Scores:

1. **Rare**: Almost never occurs, typically in emergency situations.
2. **Unlikely**: Infrequent, usually in abnormal or non-routine cases.
3. **Likely**: May happen, often in routine activities.
4. **Almost Certain**: Frequently occurs.

2.11 Knowledge of occupational hazards and safety practices

In Uganda, automobile mechanics belong to the automotive sector of the economy. There are no publications on knowledge of occupational hazards and health in Uganda but research in the related fields in other countries like Ghana, Nigeria and the United States of America (USA) shows that little attention is given to the automobile industry so the mechanics have limited or no knowledge regarding safety measures to protect them from hazards and diseases associated with automobile repair. According to the study carried out by (Ozomata et al., 2021) among 300 welders, only 34.2% of the welders used one or more protective devices with 60.9% using eye goggles, 50.3% using hand gloves and 34.5% using boots. The study was carried out to assess the awareness to occupational hazards and safety practices in Kaduna Metropolis in Northern Nigeria.

Another research was carried out by (Mishra et al., 2019) to assess the awareness of occupational hazards and use of personal protective equipment and the findings were; 56% were aware of at

least one or more occupational hazards. Heat (53%), electric current (52.8%), chemical (52.5%), light/radiation (52.3%), welding fumes (48.8%), sharp metals (42%), noise (41%), sparks (17.5%), internal environment (12.8%), and vibration (11.3%) were reported by the automobile workers. The findings showed that only 44.3% of the automobile workers were using at least one PPE at the work. Protective clothing (33.8%) mask (27.3%), steel toed shoes (5%), goggles (3.3%), hard hats (1.5%), gloves (1%) and welding helmet/face shield (0.5%).

CHAPTER THREE: METHODOLOGY

Introduction

This chapter outlines the methodology that was used to investigate the health and safety practices at Issa Auto Garage Limited. The aim is to identify the methods that will be used to achieve every specific objective of the study.

3.1 Data collection

A comprehensive data collection process was carried out to achieve the research objectives, including various methods to ensure robust and versatile data sources. This involved conducting field visits to yield firsthand information, conducting surveys to give quantitative feedback, and conducting in-depth interviews to give qualitative perspectives. A literature review was also carried out to position the findings in perspective within existing knowledge.

These complementary strategies gave a balanced and strict dataset for examination. The tools for data collection were questionnaires for obtaining survey responses, an interview guide, a notebook, and a pen for recording data from interviews. Secondary data was obtained from journals, articles, and publications of related studies.

a) To identify the health and safety hazards faced by MVRW workers

3.1.1 Desk research

Relevant studies on occupational hazards in MVRW and similar automotive sector settings were reviewed. This included information from key publications from organizations like the International Labor Organization and the World Health Organization regarding occupational hazards in automotive workspaces, which provided context and global insights. National OHS guidelines in Uganda, along with international standards, were analyzed to identify documented hazards specific to motor repair workshops. This facilitated comparisons between practices at Issa Garage Limited and global benchmarks.

3.1.2 Field visits

A visit was made to Issa Auto Garage to identify the health and safety risks faced by Motor Vehicle Repair Workers. The field visit included observations of work processes, handling of equipment, and physical space arrangement in the workplace. Potential hazards such

as chemical fume exposure, improper storage of flammable materials and ergonomic risks due to repetitive tasks were observed. Contacts with employees during the field visit also revealed visible threats like inadequate personal protective equipment (PPE).

3.1.3 Surveys

Questionnaires were distributed to employees to collect quantitative data on the prevalence of hazards. The surveys included questions on the frequency of exposure to harmful substances, injuries, and unsafe working conditions.

3.1.4 Interviews

Structured and semi-structured interviews were conducted with the garage owner to gather firsthand information on the specific hazards they encountered. Workers described their experiences with physical, chemical, and ergonomic risks in their daily activities

b) To determine the impacts of the identified hazards.

3.1.5 Desk research

Research papers, case studies, and government reports on workplace safety in garages were analyzed to gather data on common injuries and diseases associated with MVRW work. These sources helped compare local findings with global trends.

3.1.6 Field visits

The site visit provided an opportunity for determining the impacts of the identified hazards by observing their effects on workers and operations. By inspecting the workplace, expressions of hazard-related effects like physical injury from mishandling of equipment, or fatigue from improper ergonomic setup were noted.

3.1.7 Surveys

A structured questionnaire was used to collect data on the experienced work-related injuries or illnesses, the severity of these conditions, and their impact on productivity. Workers' perceptions of safety and the effects of hazards on their well-being were also assessed.

3.1.8 Interviews

Discussions with the garage owner were conducted to assess whether workplace safety regulations were followed. Topics included the availability and use of personal protective equipment (PPE), enforcement of safety protocols, and training programs.

c) To Evaluate the Garage's Compliance with HSE Practices

3.1.9 Literature Review

Uganda's Occupational and Safety Act (2006) and other regulatory frameworks were reviewed to provide benchmarks for assessing compliance. Research on best practices in similar industries was examined to compare the garage's safety performance against recommended standards.

3.1.10 Field visit

To assess conformity with Health, Safety, and Environment (HSE) practice, while undertaking the field visit, there was a detailed investigation of the garage's compliance with regulations and best-practice control measures. This involved inspection for the availability and quality of safety gear, such as fire extinguishers, first aid cabinets, and the provision of PPE. Observance of employee behavior, i.e., adherence to safety protocols during work was also noted.

3.1.11 Surveys

A structured questionnaire was administered to gather workers' perspectives on compliance with health and safety regulations. The questions focused on whether they received training, had access to PPE, and felt safe at work.

3.1.12 Interviews

Discussions with the garage owner were conducted to assess whether workplace safety regulations were followed. Topics included the availability and use of personal protective equipment (PPE), enforcement of safety protocols, and training programs.

3.2 Data analysis

Survey responses were analyzed using descriptive statistics to categorize and prioritize the types of hazards encountered, the safety practices implemented and the garage's HSE compliance. This was achieved by calculating the mean, median, mode, standard deviation, and range which

facilitated the identification of prevalent hazards, the extent of safety practice implementation and the degree of adherence to HSE standards. Data processing and analysis were conducted using software tools such as SPSS (Statistical Package for the Social Sciences) and Microsoft Excel. SPSS was employed for its robust statistical capabilities, enabling detailed computations and visualizations, while Excel was used for data organization, basic calculations, and generating charts to present findings clearly.

Qualitative data, primarily obtained from interviews and open-ended survey responses, was analyzed using thematic analysis to uncover common patterns and themes related to hazardous conditions, safety practices, and HSE compliance.

CHAPTER FOUR: DATA COLLECTION, ANALYSIS AND DISCUSSION

4.1 DATA COLLECTION AND ANALYSIS

The data on the health and safety practices at Issa Auto Garage Limited, Nakawa, was collected through surveys and interviews. A closed-ended questionnaire was distributed to twenty workers at the garage to gather quantitative data about the different hazards, their impacts, and the HSE compliance of the garage. An interview was held with the garage Owner, Mr. Ssembatya Isa, a senior panel beater who provided qualitative data about the health and safety practices at the garage.

The data from surveys was analyzed in Microsoft Excel and SPSS, where it was organized, interpreted, and summarized to derive actionable insights. Statistical tools were used to calculate averages and percentages.

4.1.1 Socio-demographics

The demographic profile of motor vehicle workers at Issa Auto Garage, Nakawa, shows a young and predominantly male workforce, with 80% of the workers being men and 80% aged between 18 and 35. Various roles are represented in the garage, with electricians (30%) and mechanics (25%) forming the most prominent groups, while welders, panel beaters, and body sprayers account for the rest.

Most workers have either secondary education (40%) or vocational training (40%), with no representation at the degree level. The majority possess between 2 and 10 years of work experience (65%), indicating a workforce with moderate expertise. Employment is mainly of a trainee or full-time nature (80% each) and there is a significant level of financial collaboration as 70% of the workers are members of savings groups.

Table 3: Sociodemographic characteristics of motor vehicle workers at Issa auto garage, Nakawa

Variable	**Category**	**Frequency**	**Percentage**
Age	18 – 25 years	8	40.0
	26 – 35 years	8	40.0
	> 35 years	4	20.0
Sex	Male	16	80.0
	Female	4	20.0
Position in the workshop	Mechanic	5	25.0
	Electrician	6	30.0
	Welder	4	20.0
	Body Sprayer	2	10.0
	Panel beater	3	15.0
Years of experience	≤ 1 years	4	20.0
	2 – 5 years	7	35.0
	6 – 10 years	6	300
	11 – 15 years	2	10.0
	≥ 16 years	1	5.0
Highest level of education	Primary	0	0.0
	Secondary	8	40.0
	Vocational training	8	40.0
	Diploma	4	20.0
	Degree	0	0.0
Type of employment	Trainee	8	40.0
	Full time	8	40.0
	Part-time	4	20.0
Member of savings group	Yes	14	70.0
	No	6	30.0

4.1.2 Hazards faced by MVR workers at Issa Auto Garage

The data on health and safety hazards at Issa Auto Garage, Nakawa, highlights the various risks faced by workers in their daily tasks. Physical hazards are prevalent, with 70% of workers reporting slips, trips, and falls, and more than half experiencing crushing injuries (55%) or exposure to fire (60%).

Chemical hazards also pose significant challenges, as 80% of respondents report exposure to engine exhaust, while 70% encounter welding fumes and spray paints. Additionally, 65% are exposed to dust from sanding activities. These findings show the diverse risks associated with motor vehicle repair work and emphasize the need for comprehensive safety protocols and measures to protect employees from both physical and chemical dangers.

Table 4: Health and Safety hazard faced by MVR workers at Issa auto garage, Nakawa

Type of Health Hazard	**Category**	**Response**	**Frequency n**	**Prevalence of hazards**
Physical hazard	Slips/trips/falls	Yes	14 (70.0%)	38%
		No	6 (30.0%)	
	Crushing injuries	Yes	11 (55.0%)	30%
		No	9 (45.0%)	
	Exposure to fire	Yes	12 (60.0%)	32%
		No	8 (40.0%)	
Chemical hazards	Exposure to engine exhaust	Yes	16 (80.0%)	28%
		No	4 (20.0%)	
	Exposure to welding fume	Yes	14 (70.0%)	25%
		No	6 (30.0%)	
	Exposure to spray paints	Yes	14 (70.0%)	25%
		No	6 (30.0%)	
	Exposure to dust from sanding	Yes	13 (65.0%)	23%
		No	7 (35.0%)	

4.1.3 Impacts of the identified hazards

The data on the workplace hazards at Issa Auto Garage, Nakawa, highlights significant impacts on the health and well-being of workers. A majority of respondents (60%) reported experiencing health issues such as back pain, illness like persistent cough and flue, and respiratory problems linked to workplace hazards. Additionally, 65% indicated that these hazards have led to increased injuries, and 70% noted a decline in employee morale.

Legal repercussions were also a concern for 45% of respondents, although a slightly higher proportion (55%) stated otherwise. Impacts on hearing ability were less prevalent, with 30% reporting hearing challenges caused by hazards. These findings call for a critical need for improved health and safety measures to mitigate risks and create a safer work environment.

Table 5: Impacts of workplace hazards among motor vehicle workers at Issa auto garage, Nakawa

Question Regarding the impacts of identified hazards	**Response**	**Frequency**	**Percentage**
Have you experienced any health issues (back pain and respiratory problems) that you believe are related to workplace hazards?	yes	12	60.0
	No	8	40.0
Have the identified hazards increased injuries?	Yes	13	65.0
	No	7	35.0
Have the identified hazards reduced employee morale?	Yes	14	70.0
	No	6	30.0
Have the identified hazards had any legal consequences?	Yes	9	45.0
	No	11	55.0
Have the identified hazards affected your hearing ability?	Yes	6	30.0
	No	14	70.0

4.1.4 Compliance of Issa Auto Garage with national and international HSE standards

The data reveals areas of strength, such as near-universal adoption of safety shoes and gloves, as well as full compliance in workplace cleanliness and fire extinguisher availability. However, it also points out areas needing improvement, particularly in the use of eye protectors, face shields, and masks. Awareness of HSE standards is relatively high, but the perception of compliance

levels varies, with only 20% rating them as "very well." This mixed performance emphasizes the need for targeted interventions to enhance safety practices further

Table 6: Compliance of Issa Auto garage with national and international HSE standards

Question on the HSE Practices	**Response**	**Frequency n (%)**	**PPE usage**
Do you use gloves?	Yes	18 (90.0%)	30%
	No	2 (10.0%)	
Do you wear safety shoes?	Yes	19 (95.0%)	31%
	No	1 (5.0%)	
Do you wear eye protectors?	Yes	7 (35.0%)	11%
	No	13 (65.0%)	
Do you use a face shield?	Yes	8 (40.0%)	13%
	No	12 (60.0%)	
Do you wear masks?	Yes	9 (45.0%)	15%
	No	11 (55.0%)	
Is safety training provided at Issa Auto Garage?	Yes	12 (60.0%)	
	No	8 (40.0%)	
Do you have fire extinguishers at the work place?	Yes	20 (100.0%)	
	No	0 (0.0%)	
Do you have a first aid station at the work place?	Yes	15 (75.0%)	
	No	5 (25.0%)	
Do you clean your workplace?	Yes	20 (100.0%)	
	No	0 (0.0)	
Are you aware of the local and international HSE standards applicable at your workplace?	Yes	16 (80.0%)	
	No	4 (20.0%)	
How well do you think Issa Auto Garage complies with HSE standards?	Poorly	1 (5.0%)	
	Fairly	9 (45.0%)	
	Well	6 (30.0%)	
	Very well	4 (20.0%)	

4.2 DISCUSSION OF RESULTS

4.2.1 Socio demographics

The results concerning the demographic features of the motor vehicle repair (MVR) personnel at Issa Auto Garage suggest an overwhelmingly young and male workforce. This is consistent with the generalist nature of the job, which can demand maximum physical energy available from the younger people. Electricians and mechanics constitute the larger parts of the workforce, accounting for 30% and mechanics for 25%. These groups dominate other remaining workers due to their relevance in motor vehicle maintenance. However, the relatively low proportions of other participants like welders and others (20%), panel beaters (15%), and body sprayers (10%) reveal their existence as well-defined specialized areas that require attention or assistance.

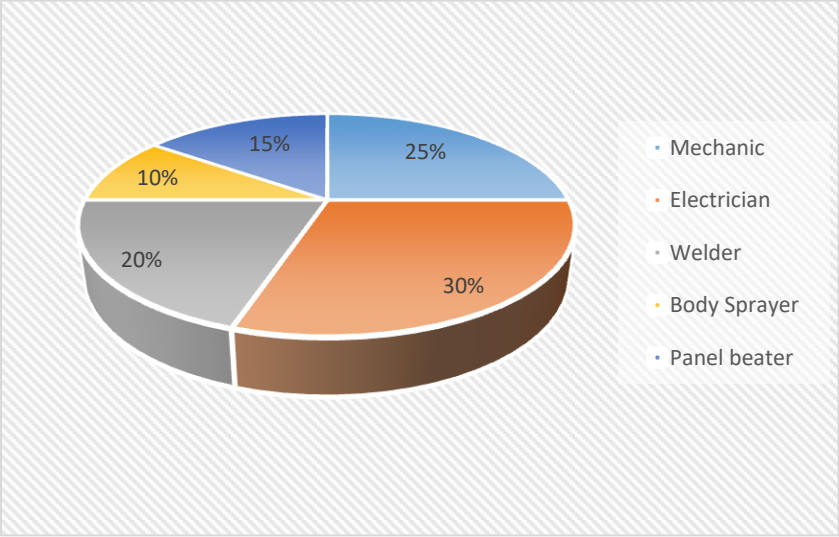

Figure 4: Positions at Issa Auto Garage

The educational qualifications, which are mainly secondary and vocational training, have the same percentage of 40. This signifies that those who employ workers in this sector concentrate more on skills than on formal academic qualifications. The lack of degree holders indicates that the industry is yet to be professionalized or there is low receptiveness in society towards higher technical education.

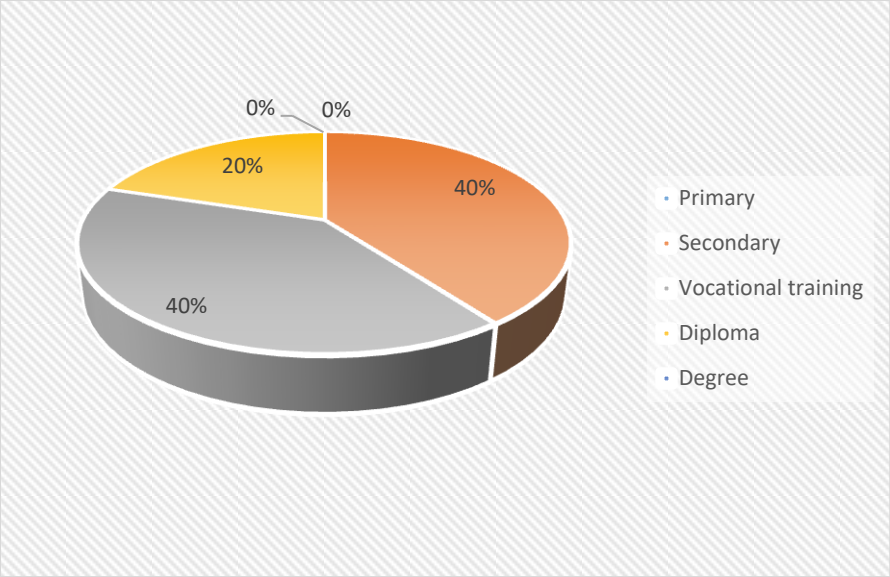

Figure 5: Level of Education of workers

Furthermore, 65% of the workers claim to have between 2–10 years of experience which implies a moderately skilled workforce who can perform jobs but require a lot of training to fully realize their potential.

4.2.2 Physical and chemical hazards

The research results from Issa Auto Garage survey correlate with existing literature concerning the hazards posed to employees in motor vehicle repair (MVR) industries in relation to their health and safety risks. Studies over time have pointed out the high levels of physical and chemical dangers within this industry, which requires adequate attention to safety regulations.

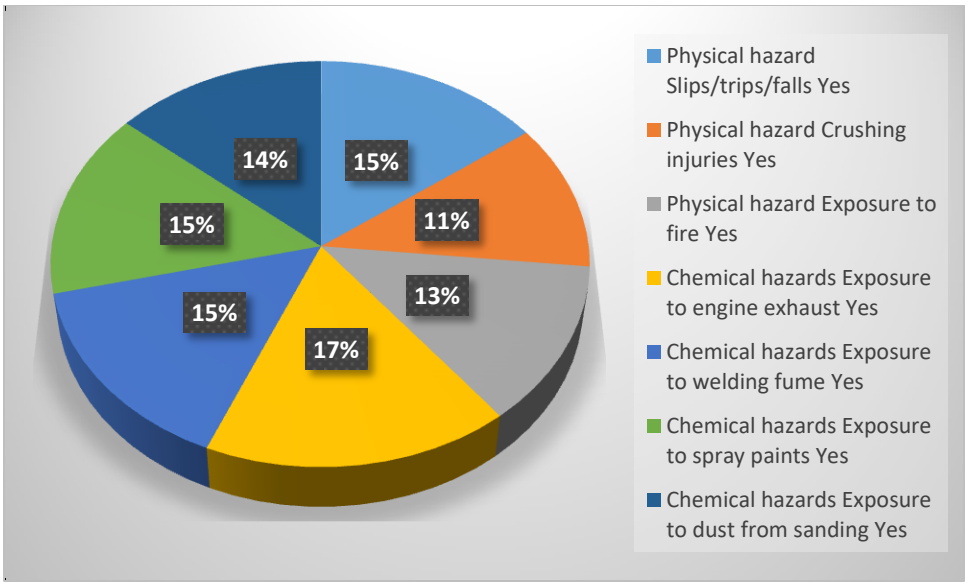

Figure 6: Physical and chemical hazards

Physical Hazards

The proportion of slips, trips, and falls (70%) incidence at Issa Auto Garage is similar to those found in other studies, where these are among the top hazards of MVRW due to oil slicks, rough surfaces, and disorganized work areas. Crushing injuries (55%) as well as fire injuries (60%) are also common in the literature due to the use of heavy machines and flammable substances. The degree of these dangers points to the need for good order in work areas, periodical equipment checks, and fire drills.

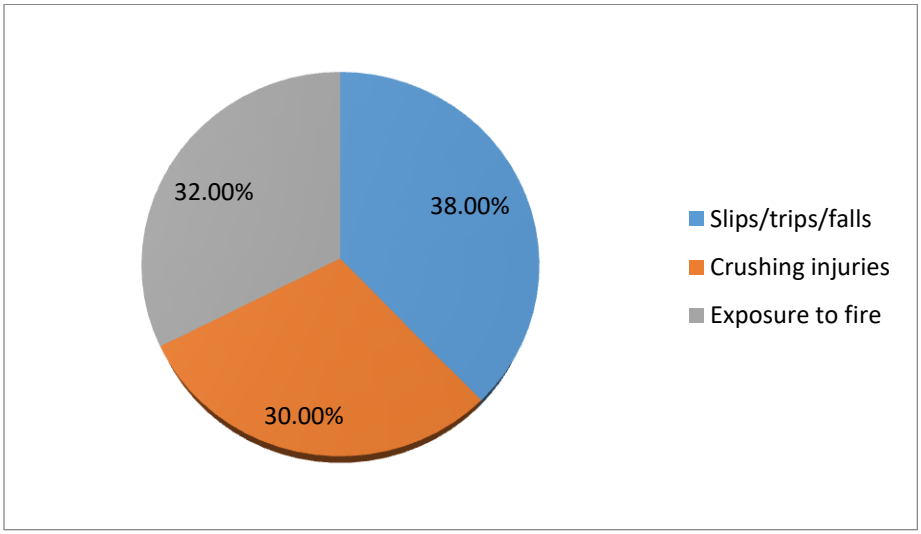

Figure 7: Physical hazards

Chemical Hazards

Typical cases in MVR industries of chemical exposure include engine exhaust (80%), welding fumes (70%), spray paints (70%), and sanding dust (65%). Being exposed to these substances for long periods is linked with respiratory conditions, skin problems, and chronic diseases like asthma or cancer. In these cases, the literature is concerned with adequate ventilation, the use of personal protective equipment (PPE), and health monitoring.

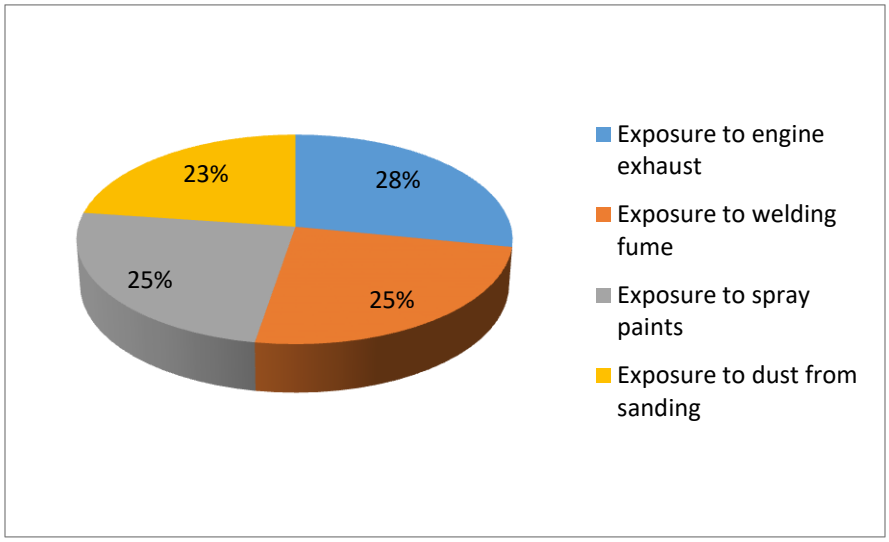

Figure 8: Chemical hazards experienced

4.2.3 Impacts of the identified hazards

The effects of workplace hazards at Issa Auto Garage correspond with the literature review regarding the health and safety of motor vehicle repair workshops. The health problems reported which include back pains and respiratory problems are in relation with many other studies that discuss the negative effects of physical workload and harmful exposure in an automotive workshop. Research suggests that manual material handling, excess standing, and fume exposure are responsible for musculoskeletal disorders and respiratory diseases. For instance, studies focusing on the repair workers of automobiles show the importance of ergonomic measures and adequate ventilation systems to lessen these problems.

The 65% of respondents who stated increased injuries is a reflection of the danger embedded within auto repair jobs. Literature highlights that poor usage of the provided personal protective

equipment (PPE) and lack of safety education are great contributing factors of injuries on the job. The 70% who reported lower morale as a result of hazardous conditions are in agreement with the research evidence, which shows that employee satisfaction and work performance suffer under insecure work conditions.

4.2.4 Compliance with HSE international standards

The compliance information of Issa Auto Garage features notable practices and gaps that need attention, which is consistent with existing literature regarding health, safety, and environmental (HSE) compliance in automobile repair workshops. The results of Issa Auto Garage point towards safety gaps that seem to be in trouble in other industry studies. For example, PPE is recommended, but its adoption is inconsistent, particularly with the use of masks and face shields. These gaps pose challenges that can only be solved through proper safety protocols, including training sessions, hazard inspections, and proper discipline for non-compliance with PPE.

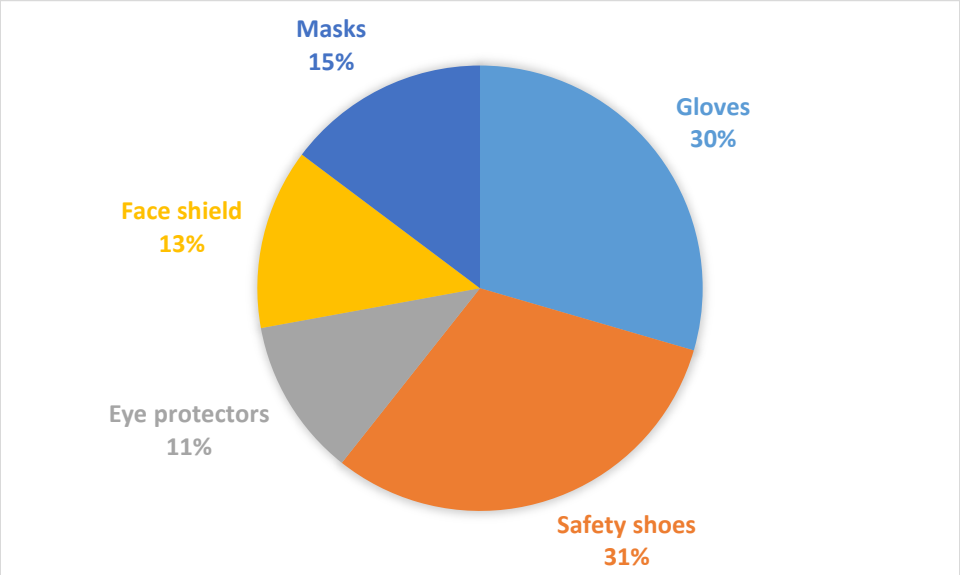

Figure 9: PPE Compliance levels

The adoption of protective measures, such as wearing safety shoes (95%) and gloves (90%), as well as total compliance with workplace hygienic conditions and fire extinguisher presence (100%), indicates a positive attitude towards basic safety measures. The literature stresses that the absence of these practices leads to increased workplace injuries, and their presence helps to

create a safe working environment. For example, the Health and Safety Executive (HSE) for motor vehicle repair is concerned about PPE and fire safety compliance due to its great importance.

It should be noted that the use rates of eye protectors (35%), face shields (40%), and masks (45%) are quite low. Deficient usage of these items raises significant concerns as they protect the users from flying objects, chemical splashes, and even inhalation of harmful substances. Studies suggest that the absence of effective PPE policies in motor vehicle repair workshops, can result in an increased occupational injury and illness rate. In addition, the lack of proper safety training is a problem in many sectors of industry (60% compliance) as training is considered one of the most important elements to creating a positive safety culture and more enhanced compliance to Health, Safety, and Environment policies.

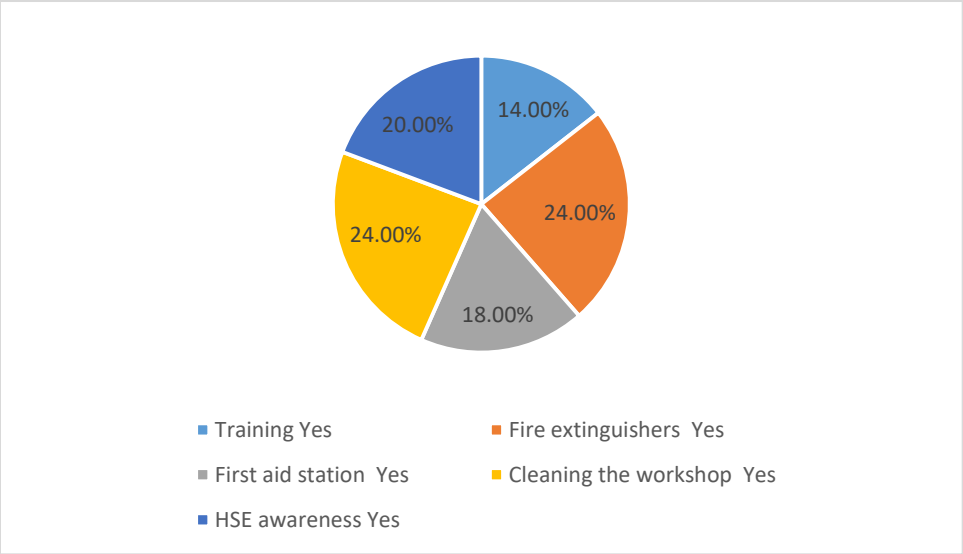

Figure 10: HSE practices

Lack of awareness of workers is troubling and the assessment shows that even with 80% of workers familiar with local and international standards pertaining to HSE, only 20% rate adherence as “very well” which shows that integration of safety measures and evaluation protocols need to be improved. Studies show that awareness is not enough as constant observation and support of safe activities is needed for a higher requirement meeting rate.

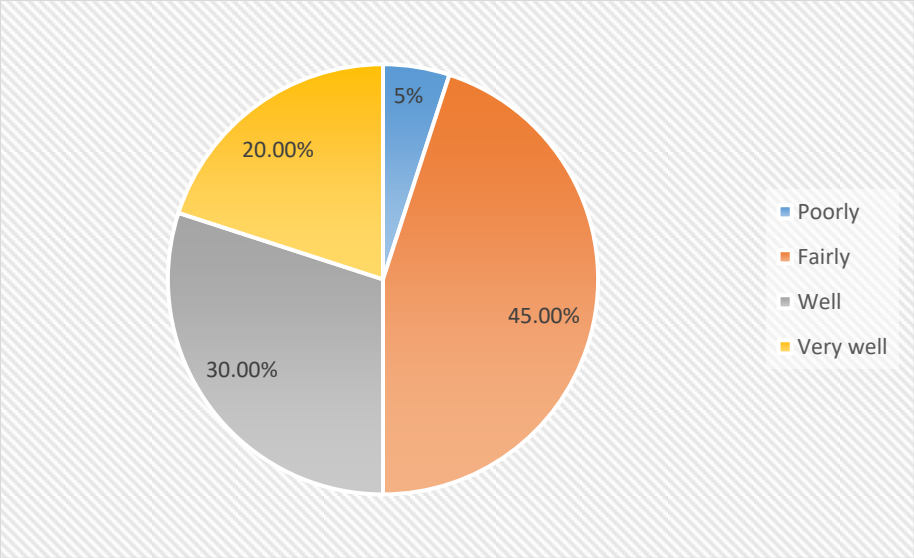

Figure 11: Compliance levels with HSE standards

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

The study of the health and safety practices at Issa Auto Garage, Nakawa, reveals a workplace with immense health and safety problems that impact the health and working efficiency of the employees. The prevalence of physical hazards, i.e., slips, trips, and falls (70%), crushing injuries (55%), and exposure to fire (60%), and chemical hazards in the form of engine exhaust (80%), welding fumes (70%), spray paints (70%), and sanding dust (65%), reflects the dangerous nature of motor vehicle repair (MVR) work. These hazards have a high impact on health, comprising 60% of workers with back injury and respiratory diseases, and 70% with low morale. Compliance with national and international Health, Safety, and Environmental (HSE) standards has strengths in the presence of near-universal use of safety shoes (95%), gloves (90%), full adherence to cleanliness in the workplace, and the presence of fire extinguishers (100%). However, it is with some of the crucial gaps identified, particularly low compliance of eye protectors (35%), face shields (40%), and masks (45%), along with uneven safety training (60%) and varying assumptions of HSE compliance, and only 20% of the participants scoring it "very well." There is an urgent need for improvement in safety, training, and monitoring to meet globally recognized HSE frameworks.

5.2 RECOMMENDATIONS

To address the problems identified and enhance workplace safety, health, and compliance at Issa Auto Garage, the following are recommended. By implementing the following suggestions at Issa Auto Garage, they can reduce occupational risks, improve the health and well-being of employees, and achieve increased HSE standard compliance, leading to a safer and more productive work environment.

Improve Training and Professional Development: Provide regular, mandatory safety training programs focusing on hazard identification, utilization of proper PPE, and safe work practices to overcome non-compliance with some PPE like face shields, masks and eye protectors. Enact a health monitoring system to evaluate workers for respiratory illness, musculoskeletal sickness, and hearing impairment and also provide access to medical check-ups.

Improve PPE Compliance: Enforce PPE policy rigorously, particularly for eye protectors, face shields, and masks, through checks and periodic trainings on the use of PPE. Provide good-quality and comfortable PPE to encourage routine use

HSE signage at different points in the garage: Develop a comprehensive HSE policy in line with international standards, with clear procedures for checking hazards, reporting incidents, and taking corrective action. HSE compliance can be improved by conducting regular workshops and employing visual reminders.

REFERENCES

Ahmad, I., Rehan, M., Balkhyour, M. A., & Ismail, I. M. (2017a). Assessment of Occupational Health and Safety in Motor Vehicle Repair Workshops in Jeddah. *Biosciences, Biotechnology Research Asia*, *14*(3), 901–913. https://doi.org/10.13005/bbra/2524

Ahmad, I., Rehan, M., Balkhyour, M. A., & Ismail, I. M. (2017b). *Assessment of Occupational Health and Safety in Motor Vehicle Repair Workshops in Jeddah*. *14*(September), 901–913.

Ahmad, I., Rehan, M., Balkhyour, M., & Abbas, M. (2016). *Review of Environmental Pollution and Health Risks at Motor Vehicle Repair Workshops : Challenges and Perspectives for Saudi Arabia REVIEW OF ENVIRONMENTAL POLLUTION AND HEALTH RISKS AT MOTOR VEHICLE REPAIR WORKSHOPS : CHALLENGES AND*. *March*.

Akowe, J. (2022). *Knowledge, Attitude and Safety Practices of Automobile Repair Artisans Towards Occupational Hazards. (a Survey of Selected Artisans in Uyo Metropolis Akwa Ibom State)*. www.orapuh.org

Akple, M. S., Turkson, R. F., Biscoff, R., & Nyamuame, G. Y. (2013). Accident and safety violation in automobile repair workshops in Ghana. In *International Journal of Business, Management and Social Sciences* (Vol. 4, Issue 1). www.ijbmss-ng.com

Amfo-Otu, R., & Agyemang, J. K. (n.d.). Occupational Health Hazards and Safety Practices Among the Informal Sector Auto Mechanics. In *Applied Research Journal* (Vol. 2016, Issue 4).

Ataro, Z., Geremew, A., & Urgessa, F. (2018). Occupational health risk of working in garages: Comparative study on blood pressure and hematological parameters between garage workers and haramaya university community, harar, Eastern Ethiopia. *Risk Management and Healthcare Policy*, *11*, 35–44. https://doi.org/10.2147/RMHP.S154611

Benson, C., Obasi, I. C., Akinwande, D. V., & Ile, C. (2024). The impact of interventions on health, safety and environment in the process industry. *Heliyon*, *10*(1), e23604. https://doi.org/10.1016/j.heliyon.2023.e23604

Brosseau, L. M., Bejan, A., Parker, D. L., Skan, M., & Xi, M. (2014). Workplace safety and health programs, practices, and conditions in auto collision repair businesses. *Journal of*

Occupational and Environmental Hygiene, *11*(6), 354–365. https://doi.org/10.1080/15459624.2013.866714

Colombi, John M.; Miller, Michael E.; Schneider, Michael; McGrogan, Jason; Long, David S.; Plaga, J. (2012). Model Based Systems Engineering with Department of Defense Architectural Framework. *Systems Engineering*, *14*(3), 305–326. https://doi.org/10.1002/sys

Datasheets, I. H., & Datasheet, H. (n.d.). *International Hazard Datasheets on Occupation Mechanic , automobile What is a Hazard Datasheet on Occupation ? Who is an automobile mechanic ? What is dangerous about this job ? Hazards related to this job*.

Harcourt, P., & Harcourt, P. (2021). *International Journal of Modern Innovations &Knowledge (IJMIK) ISSN: 2734-3294 Available on-line at: www.ijmik.com*. *2*(2), 84–95.

Health, S. and, & Executive. (2020). Workplace health , safety and welfare. A short guide for managers. *A Short Guide for Managers*, 1–8. http://www.hse.gov.uk/pubns/indg244.pdf.

Izyati, N. J., A., I. S., A., N. A., H., R. A., I., D. A., & D., A. R. (2023). Risk Management and Safety Education in Custom Garage. *Journal of Safety Education*, *1*(1), 13–18. https://doi.org/10.15294/jse.v1i1.70315

López-Arquillos, A., Rubio-Romero, J. C., Súarez-Cebador, M., & Pardo-Ferreira, M. del C. (2015). Comparative risk assessment of vehicle maintenance activities: Hybrid, battery electric, and hydrogen fuel cell cars. *International Journal of Industrial Ergonomics*, *47*, 53–60. https://doi.org/10.1016/j.ergon.2015.02.005

Mishra, S., Kannan, S., Manager, C., Statistics, A., Comments, R., & Alert, E. (2019). Get started now. *Indian Journal of Occupational and International Medicine*, *23*(1), 8–13. https://doi.org/10.4103/ijoem.IJOEM

Ozomata, E. A., Odugbemi, T. O., & Osagiede, E. F. (2021). A Study of Knowledge of Occupational Health Hazards and Safety Practices among Automobile Mechanics in an Urban Area of South-Western Nigeria. In *Nigerian medical journal : journal of the Nigeria Medical Association* (Vol. 62, Issue 3, pp. 104–112). http://www.ncbi.nlm.nih.gov/pubmed/38505198%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC10937059

Pawar, B., Park, S., Hu, P., & Wang, Q. (2021). Applications of resilience engineering principles in different fields with a focus on industrial systems: A literature review. *Journal of Loss Prevention in the Process Industries*, *69*(November 2020), 104366. https://doi.org/10.1016/j.jlp.2020.104366

Pega, F. (2022). The new WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. In *Safety and Health at Work* (Vol. 13). https://doi.org/10.1016/j.shaw.2021.12.713

Republic, T. H. E. (2006). *the Republic of Uganda the Occupational Safety and Health Act , 2006* .

Requirements, T. (n.d.). *Garages*.

Technology, I., & Amongst, S. S. (2024). *Msit 2024,*. *xx*(xx).

APPENDICES

Table 7: Budget

Particulars	**Amount (Ugx)**
Transport to visit the garage	100,000
Stationery and printing questionnaires	100,000
Miscellaneous costs	100,000
Internet access	100,000
Total amount	**400,000**

Table 8: Project timeline

	2024					**2025**				
ACTIVITY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APRIL	MAY
Proposal writing										
Literature review										
Proposal presentation										
Preparation of data collection tools										
visiting the garage										
Data collection										
Data analysis										
Documentation and report writing										
Project presentation										

Figure 12: Interviewing the manager Mr. Ssembatya Isa

Figure 13: Fire extinguisher at Isa Auto garage

Figure 14: Workers at Isa Auto garage