AN ASSESSMENT OF THE LEVEL OF PERSONAL PROTECTIVE EQUIPMENT USAGE AMONG EMPLOYEES IN ROAD CONSTRUCTION PROJECTS.
CASE STUDIES: MBALE AND KAMPALA CAPITAL CITIES, UGANDA.

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A DISSERTATION

SUBMITTED TO THE FACULTY OF ENGINEERING, DESIGN AND TECHNOLOGY INPARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF SCIENCE ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT, INSTITUTE OF PETROLEUM STUDIES KAMPALA with AFFILIATION To UCU

MAY, 2022

DECLARATION

I, Happy Peter Murwanyi, hereby declare that this dissertation is my work and it has not been submitted before to any other institution of higher learning for fulfillment of any academic award.

Signed..... Date 17/05/2022.....

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APPROVAL

This is to certify that, this dissertation entitled “Assessment of Level of Personal Protective Equipment Usage among Employees in Road Construction Projects in Uganda” has been done under my supervision and now it is ready for submission.

Signature.....

Mr. Zzigwa Marvin

Date 17/05/2022.....

DEDICATION

This research is dedicated to all environmental, health and safety practitioners who work tirelessly to keep workplaces a safe working environment. I also dedicate this researched work to my family and my friends especially my lovely wife (Mrs. Nsimenta Sheilla Happy) who always motivated me to complete this work. To my mother Tumubweine Sadress, thank you for ever supporting me. My Children, Taremwa Quinlan Larry and Tumwesigye Joaquim Lael, this work is also dedicated to you.

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LIST OF ACRONYMS

COVID	Corona Virus Disease
ILO	International Labour Organization
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
UCU	Uganda Christian University
USMID	Uganda Support to Municipal Infrastructure Development

ABSTRACT

The use of Personal Protective Equipment (PPE) remains one of the best measures ensuring workplace safety for workers in the construction sector. This study assessed PPE usage amongst road construction projects in two cities of Uganda. It specifically established the level of employee awareness about PPE usage, determined management‟s involvement in implementation of PPE usage and the factors affecting usage of PPE on road construction sites. Both structured and semi-structured interviews with workers and management were conducted. Thematic, descriptive and inferential statistics including ANOVA tests, Binary logistic regression model and Relative Importance Index (RII) were ccarried out to analyze data. Results indicated that over 92% of the road construction workers were aware of PPE usage as a legal requirement at work. Masks (64%), goggles (16.4%) safety shoes (82.8%), earmuffs (17.6%) and gumboots (14.8%) were the commonly used PPEs by the workers. The common strategies for implementing PPE usage by management included setting policies and guidelines on PPE usage (64.29%) and ensuring availability of sufficient PPE to workers (61.9%) while penalties (95.05%) and incentives/awards (57.1%) were the least used strategies. The organizational factors that influenced PPEs usage among the workers included provision of PPEs by employer (RII = 0.6544) and availability of sufficient PPEs (RII = 0.5544). Psychological factors included discomfort from PPE usage (RII = 0.5232) and previous knowledge on PPE (RII = 0.4608). Economic/ environmental factors previous training on PPE (RII = 0.5976) and frequent supervision on PPE usage at workplaces (RII = 0.6616). There was no significant association between socio-economic factors namely; Age (p = 0.56), gender (p = 0.392), education level (p = 0.601), work type (p = 0.854) with PPE usage. There is need to promote organization processes such as policies and trainings on PPE usage among road construction workers by the employers and relevant authority the ministry of works.

CHAPTER ONE – INTRODUCTION

1.1 Background to the Study

Globally, the International Labour Organization estimates that over three hundred million people fall into work-related non-fatal accidents every year (ILO, 2015). Additionally, ILO (2015) noted that about two million workers die annually from work-related fatal accidents. It has been shown that the majority of work-related injuries and deaths are prominent amongst developing regions of the world such as Sub-Sahara Africa (Mersha & Van Laerhoven, 2016). This is attributed to the poor use of Personal Protective Equipment (PPE). Balkhyour et al. (2019) also denoted insufficient knowledge, lack of education, low awareness on occupational hazards and non-use or availability of personal protective equipment's (PPEs) as the causes of occupational accidents.

Mersha & Van Laerhoven (2016) defined PPE as a gear, device, material, or clothing worn or used by employees to safeguard themselves from work-related hazards or minimize their exposure to any harmful materials liable of causing work-related diseases, injuries or death. Some examples of personal protective equipment (PPE) include overalls, goggles, gloves, safety boots and face shields.This underpins the importance of Personal Protective Equipment (PPE) in minimizing work-related illnesses and injuries (Alemu et al., 2020). Being a sector still accounting for up to 75% of all occupational fatalities in big city like Hong Kong (Shafique & Rafiq, 2019), the use of PPE is regarding vital for the construction industry including road and building constructions (Kiconco et al., 2019; Wong et al., 2020).

However, PPE usage is still reported to be low in low income regions such as Sub-Sahara Africa Nghitanwa and Zungu (2017). This is estimated as low as 10% amongst health workers in countries like Tanzania. It is alleged that PPEs are used as the last measure for workplace hazards engineering works (Abukhashabah et al., 2020). Balkhyour et al. (2019) also reported that limited knowledge, understanding and information on proper PPE usage among workers. Additionally, (Taha, 2000) points to low education levels as the a driver to low PPE usage amongst workers in the low income countries.

In Uganda, scholars like Ninsiima and Alege (2017) have indicated that PPE usage amongst workers is equally low even when regulations such as Act of the Occupational Health and Safety (OHS) (GOU, 2006)demands employers put in place safety measures in working environments. An earlier study conducted to assess safety levels on road construction sites in Uganda by (Nyende-Byakika, 2016), it was observed that PPE usage was only among 14% of the workers.

There are enormous and many road construction projects with many work-related injuries and fatalities in Uganda (Ninsiima & Alege, 2017; and Irumba, 2014). However, there is still limited emphasis on the contextual analysis of the factors influencing the PPE usage and occupational safety as a whole among workers in the construction industry (Kiconco *et al.*, 2019). Most studies have focused on workers from other sectors of the construction industry such as mining and building construction (Lubega, Kiggundu and Tindiwensi, 2000; Ahmad, 2017; Izudi, Ninsiima and Alege, 2017). This study assessed the level ofPPE usage amongst the employees of road construction projects in Kampala Capital City and Uganda Support to Municipal Infrastructure Development (USMID) Program-Mbale City in Uganda.

1.2 Statement of the Problem

The use of personal protective equipment (PPE) is well accepted for the minimization of work related injuries and exposure to hazards in construction projects including road, power and building (Izudi, Ninsiima and Alege, 2017; Ellaban *et al.*, 2018; Gebremeskel and Yimer, 2019; Chaswa *et al.*, 2020). However, the continued low use of PPE on construction sites still keeps the rate of occupational hazards such as deaths and injurie high amongst workers (Izudi, Ninsiima and Alege, 2017; Ellaban *et al.*, 2018; Gebremeskel and Yimer, 2019; Chaswa *et al.*, 2020).

In Uganda, statistics have indicated that the construction sector is the third greatest hazardous place accounting for over 18% of all occupational injuries and 9% of all occupational deaths (Okoth & Waiswa, 2015). Consequently, fatality rates of up to 84 persons per 100,000 workers and the injury rate of 3,797 persons per 100,000 workers from mechanical and environmental related hazards have been reported in major urban centres such as Kampala (Izudi, Ninsiima and Alege, 2017; MGLSD, 2016; Okoth & Waiswa, 2015).

The observed increase in work related hazards has also been reported to be influenced by poor attitude accrued from low knowledge towards likely health risks from exposure to physical, chemical, and biological processes due to limited use of PPE (Malay, Patel and Prajapati, 2021). However, there is still limited information on the knowledge on risk perceptions and its influence on the level and choice of PPE Usage among construction workers in Uganda (Izudi, Ninsiima and Alege, 2017). There is also a knowledge dearth on how various factors such as organization process and policies, psychological factors, environmental and individual beliefs affect the use of PPEs among construction workers. Yet such kind of information is needed to inform decision making processes and proper planning for enhanced PPE usage and minimization of work-related injuries among road construction workers in the country.

The study aimed at unravelling the knowledge and awareness on PPEs amongst the employees in Road Construction Projects in the urban centers of Kampala Capital City and Mbale City.

1.3 StudyObjectives

1.3.1 Main objective

The main objective of the study was to assess personal protective equipment usage among employees in road construction projects in Uganda so as to guide proper implementation of the laws and regulation governing PPE usage among road construction workers.

1.3.2 Objectives of the Study

The objectives of the study were

(i) To establish the level of employee awareness about PPE usage and PPE equipment/material available at road construction sites.
(ii) To determine management‟s involvement in implementation of PPE usage on all construction Sites.
(iii) To determine factors affecting usage of PPE on road construction sites

1.4 Research Questions

The research questions of the study were:

1) What is the level of employee awareness about PPE usage and PPE equipment/material available at the road construction projects in Mbale city and Kampala capital city of Uganda?
2) What are the factors affecting usage of PPE in road construction projects in Mbale city and Kampala capital city of Uganda?
3) What are the different strategies used by management in implementing PPE usage on all construction Sites?

1.5 Scope of the Study

1.5.1 Content Scope

The study concentrated on the assessment of PPE usage among employees and their managers on road construction projects in Kampala Capital City and Uganda Support to Municipal Infrastructure Development (USMID) Program-Mbale City in Uganda.

1.5.2 Geographical Scope

Spatially, the study was conducted on road construction projects in Uganda, specifically those in Kampala Capital City and Mbale City. For example; Kabusu – Bunamwaya which lies between geographic coordinates of 36N (450167.20mE, 32544.83 N and 449520.75mE, 24500.53mN), Lukuli- which falls between 36N (453016.05mE, 31914.22mN and 457694.86mE, 26608.57mN) and Kulambiro 36N (456118.23mE, 40588.52mN and 457959.33mE, 42065.40mN) roads in Kampala and Uganda Support to Municipal Infrastructure Development (USMID) road in Mbale.

Road construction projects in Kampala and Mbale cities were chosen as case studies because they are big projects with a good number of workers that could have ever used PPEs while at work, and hence provided the required primary information (Nyende-Byakika, 2016). Also Kampala, the capital city of Uganda has the highest rates of deaths and injuries in the country, with statistics indicating that the construction sector is the third greatest hazardous place, which accounts for 18% of all occupational injuries and 9% of all occupational deaths (Okoth & Waiswa, 2015).

1.5.3 Time scope

This study examined PPE usage and associated reasons for failure of use of PPEs among road construction employees from April 2021 to June 2021. This time range

was found suitable for conduction of the survey on the road sites by the researcher in conjunction with the managers of the respective road construction projects in Mbale and Kampala.

1.6 Justification of the Study

The use of PPE is of paramount importance in preventing work-related injuries, ill health and its associated deadly consequences (Kaufman, 2014). In road construction projects however, Izudi, Ninsiima and Alege (2017) disclosed that 29.1% of the employees that work in warehouses do not use PPEs with unidentified levels among the other employees.

Management teams have been tirelessly ensuring the availability of PPEs and trainings the employees on how to properly use them but their usage remains unsatisfactory. This is evidenced by the study that was conducted by Ndejjo *et al*. (2015), which identified 17% of security health issues, 12% incidents, 14% injury cases and 1 accident that caused an individual to lose his foot.

Having an understanding about the usage of PPE is relevant for provisioning of information that can be used proposing new strategies safety improvement at road construction projects in Kampala and Mbale cities in Uganda. Thus, this study assessed the usage of PPE among the employees of road construction projects in the mentioned cities.

1.7 Significance of the Study

The study findings will contribute to the body of knowledge on the contributing reasons of PPE usage among road construction employees in Kampala and Mbale cities in Uganda. Thus, construction companies can use theseas a guide towards proper use of PPE, hence safeguarding employees from work-related injuries, diseases and fatalities. Future researchers on related studies will also use this study for domain knowledge enhancement. The study findings will contribute to developing measures of how to ensure 100% employee compliance and 0% workplace injuries in road construction projects in Uganda, not only in both Mbale city and Kampala capital city but also similar cities.

1.8 Conceptual Framework

In this research, the problem statement is cast within the context of a conceptual framework (Fraenkel & Wallen, 2011). A description of this framework contributes to

the dissertation in at least two ways because it identifies research variables, and clarifies relationships among the variables. The conceptual framework of this study was conceptualized in Figure 1.1.

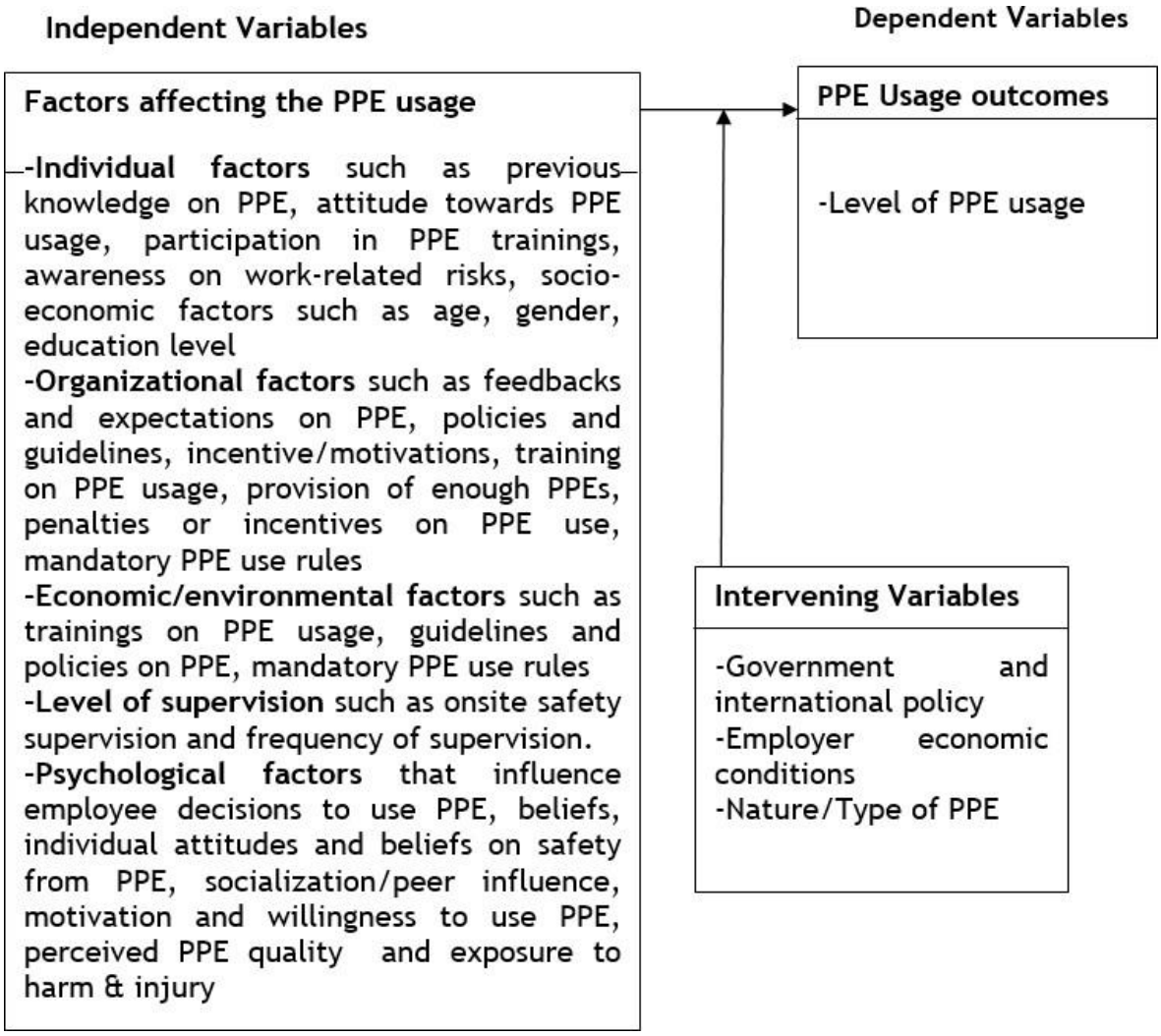

Figure 1.1: Conceptual framework of the study

Figure 1.1 illustrates the interactions between the independent, dependent and intervening variables of this study. In this study, PPE usage was considered as the dependent variable which was influenced by both the independent and intervening variables (Crossman, 2017). Factors that influence PPE usage among workers in the construction sector largely fall into five broad categories namely; organizational factors, individual factors, psychological factors, economic/environmental factors and supervisory factors (Lombardi et al., 2009; Honda and Iwata, 2016; Bakhsh et al., 2017; Dewi, Rahardjo and Murti, 2019; Sehsah, El-Gilany and Ibrahim, 2020).

Psychological factors that influence PPE usage include the perceived quality of available PPE, beliefs that PPE is effective for safety at work or reduce working

speed and income, available motivation for PPE usage, the perceived workplace exposure to injury or harm, beliefs that PPE are limited to particular workers, PPE training participation, the willingness to use PPE by workers and the peer pressure from thier fellow workers (Birhane et al., 2020; Wong, Man and Chan, 2020).

Individual factors include workers‟ beliefs, knowledge and attitudes on PPE usage such as previous knowledge on PPE use, awareness on work related risks, participate in trainings on PPE usage and willingness to use PPE provided by employers (Shen *et al.*, 2017; Wong, Man and Chan, 2020). Socio-economic factors such as workers‟ age, level of education, gender and work experience are also observed as important individual factors that influence PPE usage (Lombardi *et al.*, 2009; Dewi, Rahardjo and Murti, 2019).

Economic factors include employee training on PPE usage by employers, putting in place penalties and incentives/motivation for PPE usage and having effective guidelines and policies on PPE usage (Choudhry and Fang, 2008; Jiang et al., 2015; Leung et al., 2015). Supervision level factors include the presence of site supervisors supervising PPE usage among workers and the frequency of supervision exercise.

The dependent variable in this research was employees‟ usage of PPE in road construction projects. Intervening variables include factors such as international and national policies on PPE usage, the nature or type of PPE provided by the employers to their employees and employer economic conditions.

The intervening variables were considered as factors that influenced the use of PPE by employees without any control from them (Crossman, 2017).

CHAPTER TWO - LITERATURE REVIEW

2. 1 Introduction

This section presents the review of the literature that is related to the topic under study and was sourced from journals, text books, conference proceedings, articles and other internet sources. It contains a review of related literature guided by the objectives and research questions of the study.

2.2 Employee awareness about Personal Protective Equipment usage and their availability on road construction sites

Personal Protective Equipment (PPE) usage greatly assures the best prevention from work related injuries or deaths (Izudi et al., 2017). Employees of a given road construction project need to always be made aware and trained to wear PPE. Personal Protective Equipment include helmets, protective clothing, goggles and, overalls among others (Laisser & Ng'home, 2017).

Personal Protective Equipment can address hazards such as heat, electrical, chemicals, physical hazards and biohazards among others. Thus, this research study proposes PPE should be worn by all employees in road construction projects in Uganda for work-related health and occupational safety purposes (Laisser & Ng'home, 2017).

Research carried out in UK (Taylor, 2011) found that some construction site workers continue to have a rather cavalier attitude towards protective clothing, but even more worryingly, that little was being done in terms of training or education to rectify this situation; some health and safety managers interviewed during the study admitted to a lack of knowledge about different PPE product specifications and which clothing would be most suitable for their workplace, while they also had concerns about how to deal with unknown or unpredictable hazards. With such a lack of clarity, it should therefore come as no surprise to discover that only just over half of construction workers (56%) received any PPE training at all, with nearly a third simply selecting the protective clothing they thought was most suitable for the appropriate task; workers also acknowledged their biggest issues with PPE were to do with comfort and performance (Taylor, 2011). Three-quarters said that if work wear was more comfortable, they would be more willing to wear it than is currently the case.

Road construction workers do not wear personal protective equipment when needed because their employers do not require or enforce its use, according to a new survey of road construction safety leaders in Ohio (Sutcliffe, 2020). The survey measured road construction leaders' perceptions about awareness and use of PPE, including their viewpoints on the barriers that prevent workers from using it and the effectiveness of various safety measures, including PPE . Two hundred fifteen safety leaders took part, including 111 from the private sector (that is construction companies, unions, insurance underwriters) and 104 from the public sector (that is federal and state highway departments and other regulators, elected officials and staff).

According to Betafit (2021), knowing why PPE safety is used and being trained in how it should be used can increase an individual‟s awareness of the risks that come with working in the construction industry. A lot of injuries occur on construction projects as a result of negligence and not being aware of the risks (as well as a lack of protection). It is the duty of the employer to ensure that employees are provided with information, instruction and training as is adequate on the PPE they will need to use . Confidence in using PPE is also necessary to use it properly and this can come from training (Betafit, 2021). After all, when worn incorrectly, PPE safety is ineffective. Betafit (2021) notes that if employees know the risks, they also learn what they need to do to stop them and can see the consequences.

2.3 Perceptions on the use of PPEs among workers

Workers from the construction industry have been reported to bear numerous perceptions that shape their knowledge and attitude towards the use of PPEs (Ellaban *et al.*, 2018; Malay, Patel and Prajapati, 2021). The perceptions of workers on PPEs have been reported as both being positive and negative influencers in the adoption and non-adoption of PPE usage among workers (Ahmad, 2017; Balkhyour, Ahmad and Rehan, 2019).

According to a study by Wong, Man, & Chan (2020), the thought of possibly reducing the chances of being injured and the severity of incurring injuries was found to be the main cause of positive attitudes towards the use of PPEs among construction workers. In the aforementioned study, workers perceived that using PPE at work was useful for self-protection against work related hazards such as injuries.

Similarly, worker‟s perceptions on PPE use related to the perceived ease of use of a given PPE as well as the awareness and perceived risk of possible workplace related hazard influenced among mining workers in India (Ahmad, 2017). However, majority of workers were reported to be with low risk perception for hazards such as falling objects, contact with chemicals and sharp objects. Ellaban et al. (2018) also reported that the safety consciousness and safety knowledge shaped the use of PPE amongst construction workers. However, it has been be observed that some of the construction workers tended to think that the use of a single PPE such as goggles or a mask was sufficient enough for their protection for potential work related hazards (Balkhyour, Ahmad and Rehan, 2019).

The study by Malay, Patel and Prajapati (2021) observed that only 43.75% of workers believed that work place hazards could be prevented by use of PPE. In relation to this, Chaswa *et al.*, (2020) reported that perceptions on the risk factors of workplace related hazards tend to be influenced by expert knowledge, personal knowledge and their education level (). For instance PPEs such as masks and face shields are currently gaining more use in infrastructural development projects due to the perceived ability to minimize the spread of novel Corona virus (covid-19) (Alaloul *et al.*, 2020).

2.4 Factors affecting usage of PPE

Different factors leading to the use of PPE have been discussed by various scholars (Bakhsh et al., 2017; Hitoshi and Kentaro, 2016; & Baksh et al., 2015). According to Hitoshi and Kentaro (2016), these factors are categorized as; first, organizational factors such as policies and guidelines, feedbacks and expectations, management measures, education and training programs. Second, individual factors such as attitude towards the using PPE, knowledge, socio-demographics characteristics and perception of risks involved. Third, economic or environmental factors such as accessibility and availability.

Organizational factors are mostly a responsibility of the employer in ensuring safe working environments and stimulating positive safety behavior among the workers (Shen et al., 2017; Birhane et al., 2020a).

According to OSHA (2016), the conduction of trainings and establishment of communication channels on PPE usage between management and their workers is

important for ensuring PPE Usage among workers. As reported by Wong et al. (2020), regulations on PPE usage, putting in place penalties for PPE non-usage and motivation through awards are important factors that highly influence PPE use among construction workers. Provision of good quality PPEs and clear guidelines and policies are hailed as good tools for promoting on workplace PPE usage among workers (Shen et al., 2017; Birhane et al., 2020).

According to Wong, Man, & Chan (2020), an individual‟s accident experience, attitude towards the use of PPE, safety knowledge, perceived ease of use of the PPEs and safety consciousness act as some of the reasons that influence construction workers to avoid or use PPE. Lombardi et at., (2009) denoted that individuals‟ characteristics such as age, experience of the workers and beliefs that younger workers are often at the work place influenced the use of PPEs.

While some contractors and employers have been reported for deliberately refusing to invest in PPE usage at their workplace due to perceptions of time and money wastage on PPEs (Yankson *et al.*, 2020), construction workers have been accused of avoiding PPE usage due to perceptions that they create inconveniences and slow down their productivity at work. Existing knowledge gaps that is between different categories of workers such as professionals and casual laborers on PPEs usage have been reported, since casual laborers mostly tend not to be well equipped on the proper use and importance of PPEs (Wong, Man and Chan, 2020). The knowledge gap on PPEs is also influenced by prior training on PPE use as well as the presence of on-site specific supervisors for PPE usage at a given construction workplace (Mazlan, Osman and Saud, 2019; Malay, Patel and Prajapati, 2021). The unavailability, inadequacy and lack of orientation on how to use the PPEs is common in local owned companies in contrast to foreign owned companies which often supply their employees with PPE and attach penalties for non-compliance (Lombardi *et al.*, 2009).

The nature and extent of occupational safety and health regulation in different countries and organization, the level of supervision by safety officers, safety incentives and penalties influence the use of PPEs (Birhane et al., 2020; Mazlan et al., 2019). Bakhsh et al. (2017), Hitoshi and Kentaro (2016) and Baksh et al. (2015) asserted that it is the responsibility of management in every company or project to

lead by examples to their employees, communicate and promote training programs for the safety of all company employees.

Despite the aforementioned, there is little information about how these factors have affected employees in road construction projects in Uganda. Thus, the researcher conducted a social-survey among the employees of road construction projects in the cities of Mbale and Kampala of Uganda in order to collect primary information on how the individual and organizational factors are affecting the use of PPE.

2.5 Statutory requirements for employees' compliance to occupational safety and health rules and regulations

According to ILO (2020), for company employees to comply well with occupational health and safety act, management needs to regularly communicate their commitment to health and safety programs . Management can easily achieve this by being visible in all operations and setting an example by following the defined safety procedures that employees are expected to follow . Training programs and work meetings should be organized to review the health and safety indicators . Management should establish company goals and objectives that ought to improve health and safety at workplace. They should also train and set expectations for supervisors, managers and employees. They should properly allocate and supervise the resources required to implement the health and safety programs and address shortcomings if any. Management should ensure that the Occupational Health and Safety Act (OHSA) is followed by all compony employees at the workplace because it greatly safeguards their wellbeing at the workplace .

In Uganda, section 9 of the Occupational Health and Safety Act (OHSA) clearly indicates that it is the responsibility of an employer to ensure the safety of the employees from occupational hazards (GOU, 2006). PPE usage is clearly mentioned as one of the safest ways to safeguard workers against occupational hazards alongside other measures such as safety drills and trainings (GOU, 2006).

2.6 Management's involvement in implementation of PPE usage

An effective plan for PPE purchase, distribution and management is very vital in protecting employees by ensuring that it is correctly worn (Grant, 2020). Otherwise,

with a poor management plan for the use of PPE, employees may not use their PPE or may use them incorrectly (Grant, 2020).

When creating policies and PPE guidelines for a company, it is important that the company ownership or management be the leading examples in using PPE regularly while at work (Grant, 2020). This is because their subordinates or employees may not embrace the idea of using PPE for safety standards unless their leaders are doing the same. Grant (2020) asserted that managing a company‟s PPE does not only save lives and prevent workplace accidents, diseases, deaths or injuries, it does help the business to operate cost-effectively and efficiently. In this study, the involvement of management in implementing the use of PPE among their employees in road construction projects was investigated.

The design of a PPE program, should be such that it is comprehensive necessitating commitment and active participation at the planning, development, and implementation stages from all levels: senior management, supervisors, and workers (OSH, 2017). The organization's occupational health and safety policy should be a statement of principles and general rules which serve as guides to action (OSH, 2017).

Senior management must be committed to ensuring that the policy and procedures are carried out. PPE programs must be seen to have equal importance with all other organizational policies, procedures, and programs (OSH, 2017). The appointment of a program coordinator will help to make sure the program is successful. The coordinator has the responsibility to make sure that each of the elements of a program is in place and operational. The greater the workers' involvement in all stages of the program, the smoother the program will be to implement and operate.

Users must be educated about why the PPE is to be worn and trained on how to use it properly. The method of implementation of PPE Usage affects the acceptance and effectiveness of the whole program (OSH, 2017). Additionally, worker compliance with the PPE program is likely to be poor if a PPE device is unattractive, uncomfortable, or is imposed on the worker with little choice in the selection (OSH, 2017).

Management should also be involved in the process of PPE evaluations (OSH, 2017). It is extremely important to have the individual worker involved in the selection of specific models (OSH, 2017). This assistance in selection can be achieved by introducing approved models into the workplace for trials in which workers have the opportunity to evaluate various models. In this way, much information regarding fit, comfort, and worker acceptability will be gained. When choosing PPE, workers should select among two or three models, allowing for personal preferences. PPE should be individually assigned (OSH, 2017).

2.7 Research Gap

Various previous researchers such as Alemu et al., (2020), Ayikoru et al., (2019), and Ninsiima & Alege (2017) considered several factors that influence PPE usage. These factors included individual factors like education level, individual‟s age; organizational factors such as feedbacks and expectations, policies and guidelines, administrative/ management measures, education and training programs; Economic/ environmental factors such as safety trainings and guidelines, or availability of safety policies; and level of supervision such as onsite safety checks and the frequency of supervision. However, this study besides taking into account of other factors it also considered psychological factors which have not been investigated by previous researchers. That is, the ones that influence employee decisions to use PPE, such as the state of the mind like attitudes and beliefs as well as motivation and socialization.

CHAPTER THREE - MATERIALS AND METHODS

3.1 Introduction

This section presents the methodologies that were applied to achieve the specific objectives of the research. It focuses on the research design, study population, sample size and selection, data collection methods, data collection instruments, validity and reliability, procedure of data collection, data management and analysis, measurement of variables and ethical considerations.

3.2 Research Design

This study utilized a mixed research design approach which, includes both quantitative and qualitative approaches. The quantitative method involved the use of a survey with questions that are closed-ended and the results expressed in numbers and graphs (Maxwell, 2005).

Qualitative data from key informants that is audio recording were transcribed verbatim. For analysis, data was coded manually, classified into categories and relationships were made. The qualitative methods that were used in this research include interviews with open-ended questions, observations described in words, and literature review that explored the concepts (Maxwell, 2005). Mixed methods helped the researcher to understand the contradictions between qualitative findings and quantitative results (O'Cathain & Thomas, 2006; & O'Cathain, Murphy & Nicholl, 2007). The method increased the researcher‟s confidence in deducing findings of the study (O'Cathain & Thomas, 2006; & O'Cathain, Murphy & Nicholl, 2007).

3.2.1 Area of Study

The areas of study included sites of the road construction projects in Uganda, specifically those located in Kampala capital city and Mbale city. These included Kabusu – Bunamwaya road which lies between geographic coordinates of 36N (450167.20mE, 32544.83 N and 449520.75mE, 24500.53mN), Lukuli Road which falls between 36N (453016.05mE, 31914.22mN and 457694.86mE, 26608.57mN) and Kulambiro Road within 36N (456118.23mE, 40588.52mN and 457959.33mE, 42065.40mN) in Kampala and Uganda Support to Municipal Infrastructure Development (USMID) road in Mbale. The implementers of these roads are China State Construction Engineering Corporation Limited for Kulambiro and Bunamwaya

roads, Sterling Sobetra JV for Lukuli road while Dott Services limited for roads in Mbale city.

Road construction project sites in Kampala and Mbale cities were chosen because they had particular set of characteristics suitable for the objectives of this study. For example, a good number of workers that could have ever used PPEs while at work, and would hence provide the required primary information. Also, these projects had a reasonable number of workers from whom adequate primary unbiased data was collected. Kampala capital city of Uganda also had the highest rates of construction related deaths and injuries in the country, with statistics indicating that the construction sector is the third greatest hazardous place accounting for 18% of all occupational injuries and 9% of all occupational deaths (Okoth & Waiswa, 2015). Furthermore, the projects are World Bank funded with strict safe guard measures; hence usage of PPEs is expected to have been adopted and implemented for safety of workers from injuries and other accidents that may occur on the sites.

3.2.2 Sources of Information

The sources for primary data of this study were empirical data collected from road construction workers at the different road construction sites in both Mbale and Kampala cities in Uganda, that is; Kabusu – Bunamwaya, Lukuli and Kulambiro roads in Kampala and USMID road in Mbale. The primary data sources were both semi-structured and structured interviews with the workers and managers of the projects mentioned above using questionnaires and interview guides.

The secondary sources of data of this study were obtained through desk review of pre-existing literature materials such as published journal articles, reports, research books and literature from the internet such as government reports and statutory instruments.

3.2.3 Population and Sampling Techniques

3.2.3.1 Population

In this study, the target population was the road construction workers of Kabusu-Bunamwaya, Lukuli and Kulambiro roads in Kampala Capital City and USMID project in Mbale City. A list of these employees for each road was obtained from the Human Resource Management. Those that worked on Kabusu-Bunamwaya road

construction project was found to be 302 employees, those working on Lukuli road were 261 employees, those working on Kulambiro road were 314 and those working on Municipal Infrastructure Development (USMID) road in Mbale were 84 employees. Thus, a total of 700 employees formed the population for this study.

3.2.3.2 Sample Size

The sample size of this study was determined from the population of 700 workers found at the three roads in Kampala Capital City and Municipal Roads in Mbale City. To be able to calculate a reasonable sample size from the population of workers, the Krejcie and Morgan (1970) method of sample size determination was applied at a desired confidence level of 95% and margin error of 5 (Equation 1). The estimated sample size using this formula was 250 workers. A total of 10 key informant interviewees were also reached.

$$s = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$ ..... Equation 1

Where;
s = required sample size.

X2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be .50 that should provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (0.05)

The proportional allocation approach was used to determine the exact number of respondents to be interviewed from a particular construction site of all the three different roads in Kampala Capital City and Municipal Roads in Mbale City (Equation 2). Each road construction site formed a stratum from which simple random sampling methods were used in selection of respondents of the study using the list of workers provided by the human resources managers at a particular at site (Kothari, 2004).

$N_i = \cap . P_i$ .....Equation 2

Where,

N_i = the population of each stratum, *n*= sample size of study, P_i = proportion of elements in i^{th} stratum (Kothari, 2004).

The method is important for ensuring that the sizes of samples from the various strata are kept proportionate to the sizes of the strata (Kothari, 2004). Purposive selection of respondents was also done for informative interviews involving the managers of the different road construction works in order to obtain some in-depth information and understanding of the organization processes and policies on PPE usage.

3.2.4 Variables and Indicators

To measure different independent variables in this research, such as Individual, organizational, economic/environmental, psychological factors and level of supervision, semi-structured interviews were conducted. This was done with the help of survey questionnaire to collected information on employees‟ work characteristics, demographics, education level, previous safety knowledge and their attitude towards PPE usage. The participants in the study answered a follow-up survey undertaken a week later from the initial survey to examine the frequency and PPE usage using the identical items in the survey questionnaire. Measures on the viability characteristics of the intervention were also included at the end of the study through appropriate questions.

The dependent variable, PPE usage was measured using Likert-type questions for various PPEs such as head covers/hats, safety glasses, safety shoes, gloves, long-sleeved shirts, boots and long pants. For example, to measure the rate of using boots, a survey question asked „„How often the worker wore boots while at work?”” with possible answer options: (a) Never; (b) 1 to 2 days for every week; (c) 2 to 3 days for every week; (d) 4 to 5 days for every week and (e) Always. These were ranked from 1-5 with the level of importance in descending order being 1-5.

3.2.5 Procedure for Data Collection

Both primary and secondary data were collected for this study. Primary data was collected through both structured and semi-structured interviews using a structured

interview guide (Appendix 11) and semi-structured questionnaire (Appendix 10) respectively. Semi-structured interviews were done in order to investigate the level of employee awareness about PPE usage and PPE equipment/material available at road construction sites in Kampala and Mbale cities (Appendix 10). Structured interviews to evaluate management‟s level of adoption of PPE usage, to examine the factors affecting usage of PPE and to identify the various ways through which employees comply with usage of PPE (Appendix 11).

Secondary data was collected through documentary reviews in order to review literature related to the objectives of the study.

Objective 1: To achieve the first objective, both structured and semi-structured interviews with workers, managers and supervisors using questionnaires and interview guide were conducted to collect primary whether the workers were aware of any organizational policies and legal requirement on use of the various types of personal protective equipment at work.

The number of times they used/wore PPE while working and enforcing mechanisms that respondents were subjected to were also asked. The availability and participation in organization processes such as worker training on PPE usage and the sources of training were also asked.

Objective 2: To achieve objective two which is about management‟s involvement in implementation of PPE usage on all construction sites, structured interviews and Key informant interviews were conducted with a total of 42 supervisors and managers using an interview guide.

This research followed the approach used by Lombardi *et al.*, (2009) and assessed the existing mechanisms for enforcement and reinforcement of PPE usage among the workers. Questions asked included whether sensitization and awareness on PPE usage among workers was done, availing sufficient PPEs to workers, availing standard and quality PPEs to workers, if mandatory PPE usage policies existed at the work place and penalties for non-compliance to PPE usage among workers (Appendix 10).

Other questions asked included if awards and incentives for of exemplary workers, communication systems to workers on PPE usage and injuries from lack of PPE usage to the workers were in place (Appendix 10). Thus, face-to-face verbal discussions and interactions with respondents were done to collect data. Where the respondent was unreachable physically, electronic interviews and phone call interviews were administered.

Object 3: To achieve the third objective which was associated with the factors that influenced the use of PPE, both structured and semi-structured interviews with workers, managers and supervisors using questionnaires and interview guide consisting Likert scales were conducted.

Data about individual factors that influence employees‟ PPE usage such as, inquiring from workers if they were aware of work related risks, if workers had previous knowledge on use of PPE, if workers participate in trainings on PPE usage and workers‟ willingness to use PPE provided by employers (Appendix 10). Additionally, information on the socio-demographic characteristics of the different workers such as age group, gender, level of education and professional role in the construction works was also collected (Appendix 10).

The organizational factors including whether workers easily accessed PPEs, whether workers had ever had any training on the use and awareness of PPE, and whether the employees had ever had any training or sensitization about the company guidelines and policies on the PPE usage were asked. Other questions asked were whether sufficient PPEs were provided to the employees by employers and if there were incentives/motivation for PPE usage in place (Appendix 10).

On the same note, questions regarding the psychological factors and beliefs of the workers on PPEs were asked. These included the asking employees the possibility of reducing exposure to harmful substance through the use of PPEs, if there was any influence of PPEs on speed at work and lessening income, if workers believed that the available PPE were of standard quality, whether they believed that PPE is required by only some special worker, whether their present level of knowledge on PPE was adequate the perceived quality of available PPE and whether workers

believed that PPE is effective for safety at work PPE or reduce working speed and income (Appendix 10).

Data on economic and environmental factors for instance whether workers had training, policies, enough PPEs and if the right PPEs were procured by the organization was collected. Other data include data on supervision levels including whether there were site supervisions to ensure PPE usage on site and if frequent checkups on workers‟ PPE usage (Appendix 10).

3.2.6 Quality/Error control

In order to make sure that the quality and relevant data was collected, the research instruments were first pre-tested for validity and reliability as follows:

3.2.6.1 Validity Tests

Content validity: The questionnaire was subjected to content validity tests. To establish validity qualitatively, the instruments were given to a research expert (supervisor) to evaluate the relevance of each item in the instrument to the research questions and rated each item on the scale of Strongly Disagree (1), Disagree (2), Not Sure (3), Agree (4) and Strongly Agree (5). In cases where there were missing items or irrelevant items added in the instrument, they were be added or deleted from the instrument upon the advice of the supervisor. The tools research tools (Appendix 10) and (Appendix 11) were pre-tested prior to the field work.

Convergent and Divergent Validity Measures: Additional measures were included to assess the extent to which the individual factors score correlated with other measures of organisational factors (convergent validity), and the extent to which they were less strongly associated with the measures of hypothetically distinct constructs (divergent validity). Divergent validity measures of individual and organisational factors were selected due to their similarity in assessment, yet conceptually distinct constructs. As such, associations with these measures might be significantly weaker than with convergent validity measures

3.3 Unit of inquiry and Unit of analysis

The unit of inquiry in this research was an individual worker in the road construction projects in both Mbale and Kampala cities. Information about them was collected, for

example, the characteristics of the worker in the road construction projects such as male, female, age, marital status and the number of years spent working on the project.

3.4 Strategy for Data Processing and Analysis

Data processing consisted of editing, coding and tabulation procedures. Editing was done to detect any errors and omissions in the responses. Coding involved assigning numbers to responses so that they could be grouped into classes or categories.

Tabulation involved arrangement of responses and information collected together into meaningful and related set or list for easy interpretation. Data analysis was done using the Statistical Package for Social Sciences (SPSS) (23) to run both descriptive and inferential statistics analyses such as Relative importance index (RII), Binary logistic regression model, frequencies, means and percentage values.

3.4.1 Objective 1: Awareness levels on PPEs among the construction workers

To analyze data on the awareness levels of workers on the any organizational policies and legal requirement on use of personal protective equipment (PPEs) at work, both thematic analysis and descriptive statistics were conducted. Thematic analysis was done for qualitative data obtained from the semi-structured and key informant interviews.

Thematic analysis involved transcribing, coding, interpretation and building themes with significant broader patterns of qualitative data prior to its further analysis in SPSS (Braun, 2006; Bamberg and Bamberg, 2010). Descriptive statistics were conducted using the SPSS software to calculate frequencies and percentage of the respondents on the aspects asked (Kothari, 2004).

A One-Way Analysis of Variance (ANOVA) was conducted to analyze the variations in the awareness levels on the PPE usage among the construction workers from the different road site and the different professional positions held (type of work one) at their respective road construction sites. A post-hoc analysis was conducted to analyze the nature and extent of the differences in the awareness levels of the respondent.

3.4.2 Objective 2 : Management's involvement in implementation of PPE usage at all sites

Data acquired about management‟s involvement in implementation of PPE usage was analyzed using both thematic analysis and descriptive statistics. Thematic analysis was used to analyse qualitative data while descriptive statistics was used to calculate frequencies and percentage of the respondents on the different strategies (Kothari, 2004b; Braun, 2006).

3.4.3 Objective 3: Factors determining the use of PPEs among the construction workers

The frequencies of respondents of the rates of the Likert scale on the different factors affecting PPE usage where first analysed using descriptive statistics in the SPSS software and later transferred to Microsoft excel for the calculation of relative importance indices (RII). The (RII) of the rankings of the individual respondents from the Likert scale on other factors such as organizational, individual factors, economic/environmental, attitudes and beliefs of workers on PPE use were calculated to assess how each variable influenced the choice of the workers to use PPEs. The derived frequencies were used to examine the importance of each indicator using the (Equation 3) as described by (Azman *et al., 2019;* Holt, 2012).

Relative importance index (RII) = $5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1 \div A * N$..
Equation 3

Where:

n_5 = Number of respondents that responded strongly agree

n_4 = Number of respondents that responded agree

n_3 = Number of respondents that responded neutral

n_2 = Number of respondents that responded disagree

n_1 = Number of respondents that responded strongly disagree

A = The highest weight of the likert scale (Usually 5)

N = Total number of respondents (Sample size).

Secondly, a Binary Logistic Regression Model was conducted to assess the influence of the Socio-Economic characteristics of individual workers to utilize PPEs.

Since the use of PPEs is a dichotomous variable that includes a “Yes” on whether an individual uses PPEs or “No” when they do not, a Binary logistic regression model was ran to assess the influence of workers‟ Socio-Economic characteristics such as sex, education level, location of the road works, designated work type, duration at work and age group on their choice to use of using or not using PPES.

3.5 Ethical Considerations

The researcher sought authorization from the leaders of the road construction projects before collecting data. The researcher presented an introduction letter from the University indicating that the study was purely for academic purposes. The researcher observed ethical values during the study. For instance, he introduced and identify himself and honestly presented to respondents the aims and objectives of the study. He also ensured that respondents voluntarily agree to participate in the study by obtaining their verbal consent after explaining the aims of the study to them. The researcher ensured that items in the questionnaire and interview guide are constructed carefully so as to evoke the right responses and not to dig into the private lives of respondents outside the scope of the study. The data obtained from individuals was kept confidential. No formal form of respondent identification that was disclosed other than references to respondents in form of unique identification numbers. The researcher will contact the Research Ethics Committee (REC) to grant him a certificate that would both protect his work as well as help him publish it.

3.6 Methodological constraints faced

In this study, the researcher faced a challenge of access to restricted materials such as text books and journals among others, from which secondary data or literature on related topics could collected. Some of the anticipated respondents of the study especially key informants like the contractors of the project and managers declined to respond to the interviews arranged with them. This had implications on the in-depth information on the factors for PPE use from the managerial level.

CHAPTER FOUR - RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter comprises of information on the socio-demographic characteristics of the respondents and the key findings of this study in line with the specific objectives.

4.2 Socio-demographic Characteristics of the Respondents

The majority of the road construction workers were male (72.7%) while female accounted for 27.3%. Over 42.8% of the respondents belonged to age group of 25-30 Years, 32.0% in the age group of 18-25 years, 14.4% in age group 30-35 years, 8% in age group 35-40 years and 2.8% were above 40years. Amongst the road construction workers interviewed, 44% had at least attained primary education, 23.2% had attained secondary education, 17% were graduates at university, 7.6% at tertiary level and 7.6 without formal education (Table 4.1). The road construction workers also held different positions (work types) with 30.1% being equipment operators, 19.7% potters, 16.1% flaggers, 10.8% supervisors, 6.8% cleaners, 6% truck drivers, 3.6% foremen, 2.4% managers, 2% laboratory technicians, 1.2% carpenter and 1.2% masons respectively.

Table 4.1: Socio-demographic characteristics of the respondents

Socio-demographic factors		Frequency	Percentage %
Gender	Male	181	72.70%
	Female	68	27.30%
Age Group	18-25 Years	80	32.00%
	25-30 Years	107	42.80%
	30-35 Years	36	14.40%
	35-40 Years	20	8.00%
	Above 41 Years	7	2.80%
Education level	Primary	110	44.00%
	Secondary	58	23.20%
	University	44	17.60%
	Tertiary/Vocational	19	7.60%
	No formal education	19	7.60%
Work type	Potter	49	19.70%
	Flagger	40	16.10%
	Truck Driver	15	6.00%
	Supervisor	27	10.80%
	Foreman	9	3.60%

Socio-demographic factors		Frequency	Percentage %
	Masson	3	1.20%
	Carpenter	3	1.20%
	Laboratory	5	2.00%
	Manager	6	2.40%
	Cleaner	17	6.80%
	Equipment operator	75	30.10%

4.3 Awareness of the road construction workers on the Use of PPEs

The findings of the study showed that more than 92.4% of the construction workers interviewed during this study were found to have had a prior training on PPEs and their role in reducing workplace related hazards with only 7.6% of the respondents indicating not to be aware of what PPEs meant and their roles in health hazards prevention (Appendix 1). Findings also showed that 92.8% of the construction workers were aware of the statutory requirement for them to use PPEs while at their respective workplaces (Figure 4.1).

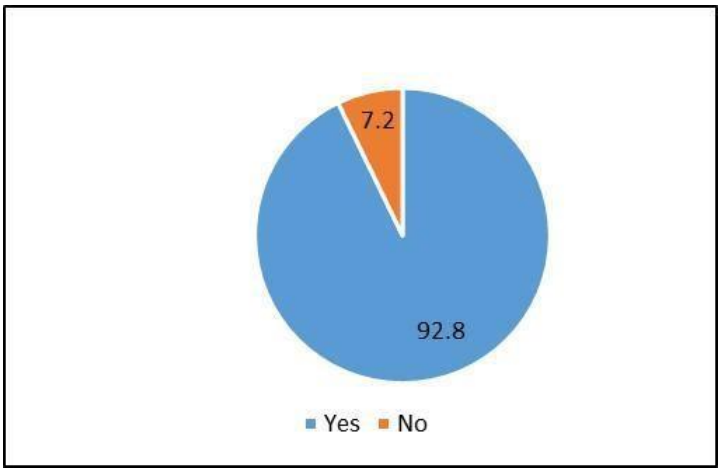

Figure 4.1: Awareness on legal requirement to use PPEs among road construction workers

Are you aware of the legal require for you to use PPE while at work? "*I am not aware of the legal requirement of us to because I have never been introduced to any by my employers".* Respondent at Mbale road construction site 13th June 2021.

Studies related to the current study have also reported the occurrence of high levels of awareness on PPEs among constructions workers at 78% (Lombardi *et al.*, 2009). Similar to these studies, the high awareness observed could be related to the growing

investment in ensuring proper occupational safety and health in working environments by infrastructural project proprietors (Balkhyour et al., 2019).

Conversely, Ahmad (2017) reported that only 16.5% of the mineworkers in India used PPE even when 87.6% of them indicated to be aware of PPE. Elsewhere, a study by Malay, Patel and Prajapati (2021) reported the use of PPEs being low at 38.6% among workers with only 45.5% of them being aware of possible occupational health hazards of not using PPEs and only 43.7% being aware that PPEs had the potential to eliminate such health hazards.The lack of awareness of PPE observed in this study can be attributed to lack of awareness creation among construction workers on the importance of PPEs in prevention of workplace related injuries and health hazards as reported in Ellaban *et al.*, (2018) and Chaswa *et al.*, (2020). Izudi, Ninsiima and Alege, (2017) denoted that limited awareness creation on the role of PPEs as a measure of promoting occupational safety and health has remained scarce. This is contributing to increasing occupational accidents. This points out to the need of increasing the use of fiscal tools such as incentives and penalties for reversed motivate workers to embrace PPE usage (Rahouti et al., 2020).

All the construction workers interviewed were found bearing some knowledge and level of awareness on the various PPE types. At least 47% of them were found aware of the hearing PPEs, 24.6% had knowledge about the eye and face PPEs, 15.8% with knowledge on foot and leg PPEs and 4.4% aware of hand and arm PPEs (Table 4.2). However, the construction workers showed no awareness of head and body PPE.

Table 4.2: Type of PPE construction workers were found aware about

Type of PPE Aware of	Eye and Face PPE	56	24.60%
	Sound/Hearing PPE	109	47.80%
	Respiratory PPE	17	7.50%
	Hand and arm PPE	10	4.40%
	Foot and leg PPE	36	15.80%
	Head PPE	0	0.00%
	Body PPE	0	0.00%
	None	0	0.00%

An analysis of the variations in PPE awareness levels among the construction workers using One-way ANOVA revealed that there was no significant difference between the awareness levels of the workers and the respective location of their road constructions sites where they operate (P= 0.097) (Appendix 1). However, there was a significant difference observed between the workers awareness levels on use of PPEs and their respective professional positions held at their respective road constructions sites such as flagger, truck driver, foreman, mason and cleaner (P=0.012) (Table 4.3).

Table 4.3: One-way ANOVA showing variation in awareness on PPE use and Work type

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.489	10	0.149	2.339	0.012
Within Groups	15.215	239	0.064		
Total	16.704	249			

The Post-Hoc test indicated that the significant difference observed between the workers awareness levels on use of PPEs and their positions at their respective road constructions sites was between the potter and truck driver (P=0.034), flagger and truck driver (P=0.011), truck driver and cleaner (P=0.011) and between truck driver and equipment operators (P=0.005) (Appendix 2).

The higher levels of awareness observed with some PPEs such as sound/hearing, foot and leg and eye and face PPE likely point to the type of health hazard risks that the construction workers are exposed to at their respective sites of work. This is in agreement to the findings by Balkhyour, Ahmad and Rehan, (2019) which indicated that the workers in Jeddah mostly reported occupational exposures to be noise, dust, vapors/fumes and direct sunlight. According to a study by Lombardi *et al.* (2009), workers operating in tasks perceived to be of high risk such as chemical laboratories and machinery seem to be more aware of the need for use of protective gears better than other works on the same site.

4.4 Management's involvement in Implementation of PPE Usage on all Road Construction Sites

The management of the road construction workers on all the sites used different strategies to implement the use of PPEs amongst their workers. Amongst the strategies, provisioning of policies and guidelines on PPE use was the commonly implemented strategy (64.29%) followed by provisioning of sufficient PPE to workers (61.9%), establishing communication channels (61.9) and trainings on PPE usage among workers (57.1%). Results showed that using penalties for workers‟ failure to use PPEs (95.05%) and incentives and awards to workers for exemplary use of PPE (57.1%) were among the least used strategies for implementation of PPE usage by the management (Table 4.4).

Table 4.4: Management's involvement in implementation of PPE usage on all road construction Sites

Strategy		Frequency	Percentage
Incentives and awards for PPE usage	No	24	57.14
	Yes	18	42.86
Availing PPEs policies and guidelines	No	15	35.71
	Yes	27	64.29
Communication on PPE usage and accidents	No	16	38.10
	Yes	26	61.90
Sensitizing and training workers on PPE usage	No	18	42.86
	Yes	24	57.14
Provision appropriate and quality PPEs to workers	No	22	52.38
	Yes	20	47.62
Provision of sufficient PPEs to workers	No	15	35.71
	Yes	27	64.29
Penalties to workers on non-usage of PPEs	No	29	69.05
	Yes	13	30.95

What are the measures used to implement PPE usage among workers at this road construction site? *"On top of providing PPE equipment such as helmets and safety shoes, we also implement their usage among workers through they report at work with them. However, some workers stubbornly put off their PPE during the course of work citing discomfort"* Key informant at road construction site Kampala th. site 16 June 2021.

Findings by Birhane et al., (2020) showed that management commitment through ensuring availability of sufficient and good quality PPE significant influences PPE

usage for improved occupation health and safety of workers. Where workers are defiant of using PPE, it is argued that strategies such as training and provision of required PPEs and guidelines to workers have the ability to entice workers to embrace PPE usage at work places (Shen *et al.*, 2017; Birhane *et al.*, 2020).
Therefore, puts the workers at expose of incurring the lack of use of motivations and incentives observed in the current study could have influence on PPE usage among less motivated workers at the different road construction sites. However, these strategies can only be initiated by site managers and supervisors.
Indeed, Mazlan et al. (2019) observed that road construction supervisors and designers possessed over 94% knowledge scores that put them in the best position to conduct safety trainings amongst all construction personnel. OSHA (2016) indicated that it is important for employers to train and establish communication channels amongst themselves and their workers in order to help them coordinate the provisioning and maintenance of a safe environment for the workers important. This is particularly important in road constructions projects where workers on the site sometimes originate from multiple employers such as the host employer and contractors.

In support of the findings of this study indicating that penalties were the least used for implementing PPE usage by management, Lombardi *et al.* (2009) reported that it was observed that management most times simply warns of punishment to workers but really never implements penalties to punish workers who do not comply with their directives. In this regard, the workers might leverage on such weak points they have found out about their management to deliberately not use the PPEs since they might not consider it a serious issue. This seems to be the situation for PPE non-compliance amongst some respondents in the current study.

4.5 Factors affecting the use of PPEs among construction workers on the visited road construction sites

Results of the relative importance index calculations on organizational factors that influenced the use of PPEs among the construction workers revealed that provision of enough PPEs by employer (RII = 0.6544), conducting trainings (RII = 0.5976) and having feedback mechanisms in place (RII = 0.572) strongly influenced PPE usage among workers. Other important organization factors in a descending order included the presence of effective PPE use policies and guidelines, the presence of incentives

and motivations for PPE usage to exemplary workers and making use of PPE mandatory for workers (Table 4.5).

However, findings from Indonesia have shown that road?? construction companies have integrated their safety management systems with new mechanisms referred to as safety-offence points on top of other mechanisms like incentives, training and safety guidelines (Chi, Chang and Ting, 2005; Man, Chan and Alabdulkarim, 2019; Wong, Man and Chan, 2020).The safety-offence points are earned by workers every time they do not use PPE and can act as a basis for dismissal for habitual safety offenders for continued non-compliance. Thus, the limited use of penalties for safety offenders in the current study might expose the limited innovativeness in ensuring PPE use among management systems of construction companies in Uganda compared to those in countries like Indonesia.

Izudi et al el., (2017) argued that although the provision of PPE is a last resort in the hierarchy of implementing worker‟s hazard prevention measures at work places, it is a crucial supplement to primary safety measures such as trainings, policies and plans. The availability of adequate and quality PPE has been linked with promoting positive PPE usage among workers (Lombardi *et al.*, 2009; Russeng *et al.*, 2019).

Table 4.5: Relative importance index results on organizational factors influencing the use of PPEs

Organizational factors	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree	Total	N	A*N	RII	Rank
Provision of enough PPEs by employer	365	180	63	198	12	818	250	1250	0.6544	1
Training on PPE usage by employer	355	108	0	264	20	747	250	1250	0.5976	2
PPE use feedback & expectations	280	76	72	272	15	715	250	1250	0.572	3
PPE policies and guidelines	205	72	39	322	17	655	250	1250	0.524	4
Incentives/Motivation on PPE usage	220	28	33	338	19	638	251	1250	0.5104	5
Mandatory rules on PPEs use	135	24	24	150	134	467	250	1250	0.3736	6

Amongst the psychological, belief and attitudinal factors, results of relative importance index calculations showed the belief that PPE are suitable for a section of workers at highest risk (RII = 0.6016) perceived exposure to injury risk or harm at work (RII=0.5256), motivation for PPE usage (RII = 0.5104) and the perceptions

that PPE use reduces speeds and lessens income (RII = 0.5056) strongly influenced their use. The other important psychological and attitudinal factors included the feeling that PPEs slow down the speed of work, the safety associated with use of PPEs, the discomfort associated with the use of PPEs, peer pressure and socialization through workmates, belief that PPE is effective for safety at work, adequate present knowledge on PPE and the quality of available PPE (Table 4.6).

Table 4.6: Relative importance index results on Psychological/ Belief factors influencing the use of PPEs

Psychological factors	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree	Total	N	A*N	RII	Rank
Believe PPE used by special worker	385	104	30	192	41	752	250	1250	0.6016	1
Exposed to injury or harm at work	195	136	66	210	50	657	250	1250	0.5256	2
Motivation for PPE usage	220	28	33	338	19	638	250	1250	0.5104	3
PPE reduce speeds and income	195	96	42	252	47	632	250	1250	0.5056	4
PPE is of standard quality	185	92	57	218	62	614	250	1250	0.4912	5
PPE is effective for safety at work	190	72	51	232	61	606	250	1250	0.4848	6
I encouraged PPE use to workmates	140	96	18	254	65	573	253	1250	0.4584	7
Workmates remind me to PPE	125	80	24	262	66	557	252	1250	0.4456	8
PPE training participation	150	48	12	284	62	556	250	1250	0.4448	9
PPE exposure to harm & injury	140	28	24	230	92	514	250	1250	0.4112	10
Willingness to use PPE	135	16	30	160	129	470	251	1250	0.376	11

The feeling that PPE use slows down the speed of work has been associated with negatively affecting the safety behavior amongst workers in the construction sector (Leung, Liang and Olomolaiye, 2015). Wong et al. (2020) indicated that workers tend to abandon the use of PPEs when work related pressure and physical stress are high due to high workloads and the need to beat deadlines. Similarly, the study by Sehsah et al., (2020) observed that perceived discomfort arising from the use of PPEs and lack of knowledge about how to use PPEs emerged as other key reasons for non-use of PPEs amongst workers.However, findings from Russeng *et al.* (2019) reported that there was no significant relationship observed with convenience relating to comfort of PPE usage unlike the statistically significant association observed between other factors like knowledge, attitude and availability of PPEs.

Dewi et al, (2019) reported that PPE usage among construction workers at New Yogyakarta International Airport in Indonesia was directly related to the knowledge of

the workers about the PPE, the perceived severity of work-related accident risks and the perceived benefit of PPE in reducing work related accidents. Possession of knowledge about PPE therefore has the potential of building positive attitude towards PPE usage among the construction works on the site as observed in the current study. Negative attitudes and beliefs of thinking that PPEs are only limited to workers working in high risk areas such as machinery and chemical laboratories has been linked with low PPE usage and increased occurrence of work related accidents and injuries among construction workers (Chaswa *et al.*, 2020; Malay, Patel and Prajapati, 2021).

Socialization factors such as workers being influenced and encouraged by their co-workers to use PPE also has the ability to influence the safety behavior. According to Chattopadhyay and Dasgupta (2015) positive PPE usage has been found among workers often reminded by their co-workers to use PPE to avoid accidents. On the other hand, negative influence from the peers who do not use PPE at work can result into negative usage of PPE among other construction through changes beliefs and attitudes (Man *et al.*, 2019). Peer influence has been reported as a significant negative influence for PPE use in circumstances where management pays less attention to safety supervision (Choudhry and Fang, 2008).

Results of relative importance index calculations showed that training on PPE usage by employer (RII = 0.5976) and available policies and guidelines on PPE (RII = 0.524) were the economic/environmental factors that strongly influenced the use of PPEs among the road construction workers among. Other important economic factors included the presence of mandatory rules on PPEs use and incentives/motivation on PPE usage (Table 4.7).

Table 4.7: Relative importance index results on economic/environmental factors influencing the use of PPEs

Environmental/ economic factors	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree	Total	N	A*N	RII	Rank
Training on PPE usage by employer	355	108	0	264	20	747	250	1250	0.5976	1
Effective guidelines and policies on PPE	205	72	39	322	17	655	250	1250	0.524	2
Incentives/Motivation on PPE usage	220	28	33	338	19	638	250	1250	0.5104	3
Mandatory rules on PPEs use	135	24	24	150	134	467	250	1250	0.3736	4

Results of relative importance index calculations showed that previous knowledge on PPE usage (0.4608), knowledge on work related risks (RII=0.4464), available policies and good attitude, participation in trainings (RII=0.4448) and attitude and willingness to use PPE provided by the employer (RII=0.376) were the individual factors that strongly influenced their use among the road construction workers. (Table 4.8).

Table 4.8: Relative importance index results on Individual factors influencing the use of PPEs

Individual factors	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree	Total	N	A*N	RII	Rank
Previous knowledge on PPE use	150	68	12	294	52	576	250	1250	0.4608	1
Aware of work-related risks	130	48	36	288	56	558	250	1250	0.4464	2
Participate in trainings on PPE usage	150	48	12	284	62	556	250	1250	0.4448	3
Willingness to use PPE by employer work	135	16	30	160	129	470	250	1250	0.376	4

Similar with the findings of this study, the study by Wong, Man and Chan (2020) also reported that the regulations on PPE usage, employee trainings, motivation through awards and penalties for non-compliance to PPE as the most prominent personal factors that highly influence PPE use among construction workers. Additionally, findings from Dewi et al, (2019) also indicated that prior knowledge about PPE among construction workers significantly influenced their PPE usage abilities. This is because the mindset on the role of workers with prior knowledge has probably changed overtime and such workers understand the role of PPE in safeguarding them from work related accidents.

Equally, Man et al., (2019) showed that risk perceptions among construction workers positively influenced their use of PPE . Thus, when individuals show perceived usefulness, high knowledge and perceive high levels of risk at their work place, they are most likely to use PPE at a high scale.

Results of relative importance index calculations showed having supervisors for PPE usage at work sites (RII=0.3736) and implementing frequent supervisions on PPE use compliance (RII=0.6616) were key supervision level factors that strongly influenced PPE usage among the road construction workers (Table 4.9). Safety supervision involving regular and thorough inspection of unsafe behaviors and working conditions has been reported as one of the most effective means of ensuring compliance to PPE usage among workers by their management (Man, Chan and Alabdulkarim, 2019; Wong, Man and Chan, 2020). This is because such increased safety supervisions by safety managers increase the emphasis of safety concerns and somehow reduce safety hazards (Jiang, Fang and Zhang, 2015; Man, Chan and Alabdulkarim, 2019). The findings of this study that showed supervisor as a significant factor influencing PPE usage is therefore in agreement with this assertion. In contrast to findings of this study, the study by Russeng et al., (2019) observed no significant association between safety supervision and the safety behavior among construction workers on a road construction site in Makassar City Indonesia. This implied that workers at these sites used PPE regardless of supervisors or not. This could be attributed to the high level of education and safety training reported amongst the construction workers by the same scholar.

Table 4.9: Relative importance index results on supervision level factors influencing the use of PPEs

Supervision levels	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree	Total	N	A*N	RII	Rank
Supervision on PPEs use	135	24	24	150	134	467	250	1250	0.3736	2
Frequent supervision	450	136	9	218	14	827	250	1250	0.6616	1

Results of the Binary logistic regression model showed a significant association between being employed as a driver and the use of PPE (p = 0.043) (Appendix 3a). The socio-Economic factors of the respondents included sex (p = 0.392), type of position held (p = 0.854), education level (p = 0.601), location of the road works (p = 0.854), designated work type (p = 0.854), duration at work (p= 0.996) and age group (p = 0.56). The confidence level had been set at (P=0.05) thus the Socio-Economic factors were found not be significant for this study.

The significance of the model as illustrated by the Omnibus Tests of Model Coefficients was significant $X^2(5, 250) = 53.206$, $P<0.001$ (Table 4.10). The values from Cox & Snell R Square and Nagelkerke R Square indicated that the variance in the Binary model ranged between 16% and 43.0% (Appendix 3b) while the Hosmer and Lemeshow Test value was not significant (p = 1.0) (Appendix 3c). The percentage accuracy in classification (PAC) of the model was 93.6% (Appendix 3d). Unlike the findings of this study, a related study conducted(Izudi et al., 2017) found out that workers‟ characteristics such gender, age and form of job done at the construction site strongly influenced the use of PPE amongst building construction workers in Uganda. This can be explained by the factor that occupational risk perception tenders to be higher amongst workers at higher exposure of unsafe environments such as those working closer to machinery (Ellaban et al., 2018; Jafari et al., 2019).

Lombardi *et al.* (2009) reported that older and more experienced workers were more likely to use PPEs. However in this study, age was not found to be a strong determinant in the use of PPEs. This can be attributed to the fact that awareness creation processes such as trainings probably do not segregate between the age and experience of workers during their implementation thus creating uniformity in awareness levels (Lombardi et al., 2009). The variation between the findings of this study and those by Lombardi *et al.*, (2009) could be attributed to the fact that the majority of the respondents in their study had a higher work experience of over 10 years unlike in the current study where the period of work ranged from 1 year and slightly above 2 years.

Table 4.10: Omnibus Tests of Model Coefficients of Binary Logistic Regression model

Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 1	Step	53.206	25	0.001
	Block	53.206	25	0.001
	Model	53.206	25	0.001

CHAPTER FIVE - CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter comprises of the conclusions and recommendations drawn by this study based on its key findings.

5.2 Conclusions

This study was conducted with the aim of assessing the use of personal protective equipment usage among employees in road construction projects in Mbale City and Kampala Capital City in in Uganda. The key findings of the study are as follows.

i. The majority of the road construction workers (>93%) were aware of what PPEs meant and the legal requirement for them to use PPEs while only6.4% had no PPE usage. Road construction workers were aware about the use of sound/hearing PPE (47.8%), foot and leg PPE (15.8%) and eye and face PPE (24.6%). Masks (64%) and goggles (16.4%) were the commonly used eye and face PPEs, earmuffs (17.6%) and single use earplugs (4.4%) as hearing PPEs. Safety shoes, (82.8%) and gumboots (14.8%) were the commonly used amongst the foot and leg PPEs. There was a significant difference observed between the workers awareness levels on use of PPEs and their respective professional role played such as flagger, truck driver, foreman, mason and cleaner at the respective constructions sites (P=0.012).

ii. The commonly used strategies for the implementation of PPE usage by management at all the construction sites included provision of policies and guidelines for PPE usage to workers (64.29%), ensuring availability of sufficient PPE to workers (61.9%), establishing communication channels (61.9) and trainings of workers on PPE usage among workers (57.1%). The least used strategies for implementation of PPE usage by the management were .Results penalties for workers‟ failure to use PPEs (95.05%) and incentives and awards to workers for exemplary use of PPE (57.1%).

iii. The factors that strongly influenced the use of PPEs among the road construction workers were under five broad categories including organizational, psychological, economic/environmental, individual factors and supervision level factors. The most influential organizational factors included provisioning of PPEs

by employer (RII = 0.6544) and conducting trainings (0.5976); psychological factors included perceived exposure to hazard at work
(0.5256) and motivations for PPE usage (RII = 0.5104). Training on PPE usage by employer (RII = 0.5976) and available policies and guidelines on PPE (RII = 0.524) were the key influential economic/environmental factors. Previous knowledge on PPE usage (0.4608) and knowledge on work related risks (RII = 0.4464) were the most influential individual factors while having supervisors at work sites (RII = 0.3736) and frequent supervisions on PPE use compliance (RII = 0.6616) were the prominent supervision level factors. Results of the Binary logistic regression model showed no significant association of socio-economic factors like age (p = 0.56), gender (p = 0.392), education level (p = 0.601), work type (p = 0.854) with the use of PPEs among workers.

5.3 Recommendations

i. There is need to promote awareness creation and trainings by employers on the benefits of using PPEs to the occupational safety and health amongst construction workers in order to enhance their knowledge on PPE use for their own safety at their respective workplaces. This is will also encourage the combined use of different PPEs such as Eye and face PPEs, hearing PPEs and foot and leg PPEs, respiratory PPEs, hand and arm PPEs, head PPEs and body PPEs among workers for adequate protection against all hazard risks at their work places.

ii. There is need for management to use holistic approaches that involve the use of both soft measures such as trainings and incentives as well some penalties for habitual non-PPE usage among some workers in order for management to achieve fully, use of PPE at their respective sites.

iii. There is need for employers to ensure provision of adequate and quality PPE for their workers in order to implement mandatory workplace policies that demand all workers to be clad in their full PPE kits in order to minimize inconsistences in the use of PPEs amongst employees.

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APPENDICES

Appendix 1: Awareness of Legal requirement and road location

ANOVA					
Awareness of Legal requirement					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.423	3	0.141	2.131	0.097

Appendix 2: POST_HOC HSD showing variation in awareness on Legal requirement and work type

POST_HOC HSD							
Multiple Comparisons							
Dependent Variable: Awareness of Legal requirement							
	(I) Work_type	(J) Work_type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Potter	Flagger	0.032	0.054	1	-0.14	0.21
		Truck Driver	-.252*	0.074	0.034	-0.49	-0.01
		Supervisor	0.008	0.06	1	-0.19	0.2
		Foreman	0.082	0.092	0.998	-0.22	0.38
		Masson	-0.252	0.15	0.846	-0.74	0.24
		Carpenter	0.082	0.15	1	-0.41	0.57
		Laboratory	0.082	0.118	1	-0.3	0.47
		Manager	0.082	0.109	1	-0.27	0.44
		Cleaner	0.082	0.071	0.987	-0.15	0.31
		Equipment operator	0.029	0.046	1	-0.12	0.18
	Flagger	Potter	-0.032	0.054	1	-0.21	0.14
		Truck Driver	-.283*	0.076	0.011	-0.53	-0.04
		Supervisor	-0.024	0.063	1	-0.23	0.18
		Foreman	0.05	0.093	1	-0.25	0.35
		Masson	-0.283	0.151	0.732	-0.77	0.21
		Carpenter	0.05	0.151	1	-0.44	0.54
		Laboratory	0.05	0.12	1	-0.34	0.44
		Manager	0.05	0.11	1	-0.31	0.41
		Cleaner	0.05	0.073	1	-0.19	0.29
		Equipment operator	-0.003	0.049	1	-0.16	0.16
	Truck Driver	Potter	.252*	0.074	0.034	0.01	0.49
		Flagger	.283*	0.076	0.011	0.04	0.53
		Supervisor	0.259	0.081	0.059	0	0.52
		Foreman	0.333	0.106	0.07	-0.01	0.68

		Masson	0	0.16	1	-0.52	0.52
		Carpenter	0.333	0.16	0.586	-0.19	0.85
		Laboratory	0.333	0.13	0.277	-0.09	0.76
		Manager	0.333	0.122	0.191	-0.06	0.73
		Cleaner	.333*	0.089	0.011	0.04	0.62
		Equipment operator	.281*	0.071	0.005	0.05	0.51
	Supervisor	Potter	-0.008	0.06	1	-0.2	0.19
		Flagger	0.024	0.063	1	-0.18	0.23
		Truck Driver	-0.259	0.081	0.059	-0.52	0
		Foreman	0.074	0.097	1	-0.24	0.39
		Masson	-0.259	0.154	0.84	-0.76	0.24
		Carpenter	0.074	0.154	1	-0.42	0.57
		Laboratory	0.074	0.123	1	-0.33	0.47
		Manager	0.074	0.114	1	-0.3	0.44
		Cleaner	0.074	0.078	0.997	-0.18	0.33
		Equipment operator	0.021	0.057	1	-0.16	0.21
	Foreman	Potter	-0.082	0.092	0.998	-0.38	0.22
		Flagger	-0.05	0.093	1	-0.35	0.25
		Truck Driver	-0.333	0.106	0.07	-0.68	0.01
		Supervisor	-0.074	0.097	1	-0.39	0.24
		Masson	-0.333	0.168	0.662	-0.88	0.21
		Carpenter	0	0.168	1	-0.55	0.55
		Laboratory	0	0.141	1	-0.46	0.46
		Manager	0	0.133	1	-0.43	0.43
		Cleaner	0	0.104	1	-0.34	0.34
		Equipment operator	-0.053	0.089	1	-0.34	0.24
	Masson	Potter	0.252	0.15	0.846	-0.24	0.74
		Flagger	0.283	0.151	0.732	-0.21	0.77
		Truck Driver	0	0.16	1	-0.52	0.52
		Supervisor	0.259	0.154	0.84	-0.24	0.76
		Foreman	0.333	0.168	0.662	-0.21	0.88
		Carpenter	0.333	0.206	0.873	-0.34	1
		Laboratory	0.333	0.184	0.774	-0.27	0.93
		Manager	0.333	0.178	0.737	-0.25	0.91
		Cleaner	0.333	0.158	0.572	-0.18	0.85
		Equipment operator	0.281	0.149	0.723	-0.2	0.76
	Carpenter	Potter	-0.082	0.15	1	-0.57	0.41
		Flagger	-0.05	0.151	1	-0.54	0.44
		Truck Driver	-0.333	0.16	0.586	-0.85	0.19
		Supervisor	-0.074	0.154	1	-0.57	0.42
		Foreman	0	0.168	1	-0.55	0.55
		Masson	-0.333	0.206	0.873	-1	0.34
		Laboratory	0	0.184	1	-0.6	0.6
		Manager	0	0.178	1	-0.58	0.58

		Cleaner	0	0.158	1	-0.51	0.51
		Equipment operator	-0.053	0.149	1	-0.54	0.43
	Laboratory	Potter	-0.082	0.118	1	-0.47	0.3
		Flagger	-0.05	0.12	1	-0.44	0.34
		Truck Driver	-0.333	0.13	0.277	-0.76	0.09
		Supervisor	-0.074	0.123	1	-0.47	0.33
		Foreman	0	0.141	1	-0.46	0.46
		Masson	-0.333	0.184	0.774	-0.93	0.27
		Carpenter	0	0.184	1	-0.6	0.6
		Manager	0	0.153	1	-0.5	0.5
		Cleaner	0	0.128	1	-0.42	0.42
		Equipment operator	-0.053	0.116	1	-0.43	0.33
	Manager	Potter	-0.082	0.109	1	-0.44	0.27
		Flagger	-0.05	0.11	1	-0.41	0.31
		Truck Driver	-0.333	0.122	0.191	-0.73	0.06
		Supervisor	-0.074	0.114	1	-0.44	0.3
		Foreman	0	0.133	1	-0.43	0.43
		Masson	-0.333	0.178	0.737	-0.91	0.25
		Carpenter	0	0.178	1	-0.58	0.58
		Laboratory	0	0.153	1	-0.5	0.5
		Cleaner	0	0.12	1	-0.39	0.39
		Equipment operator	-0.053	0.107	1	-0.4	0.3
	Cleaner	Potter	-0.082	0.071	0.987	-0.31	0.15
		Flagger	-0.05	0.073	1	-0.29	0.19
		Truck Driver	-.333*	0.089	0.011	-0.62	-0.04
		Supervisor	-0.074	0.078	0.997	-0.33	0.18
		Foreman	0	0.104	1	-0.34	0.34
		Masson	-0.333	0.158	0.572	-0.85	0.18
		Carpenter	0	0.158	1	-0.51	0.51
		Laboratory	0	0.128	1	-0.42	0.42
		Manager	0	0.12	1	-0.39	0.39
		Equipment operator	-0.053	0.068	0.999	-0.27	0.17
	Equipment operator	Potter	-0.029	0.046	1	-0.18	0.12
		Flagger	0.003	0.049	1	-0.16	0.16
		Truck Driver	-.281*	0.071	0.005	-0.51	-0.05
		Supervisor	-0.021	0.057	1	-0.21	0.16
		Foreman	0.053	0.089	1	-0.24	0.34
		Masson	-0.281	0.149	0.723	-0.76	0.2
		Carpenter	0.053	0.149	1	-0.43	0.54
		Laboratory	0.053	0.116	1	-0.33	0.43
		Manager	0.053	0.107	1	-0.3	0.4
		Cleaner	0.053	0.068	0.999	-0.17	0.27
Games-Howell	Potter	Flagger	0.032	0.053	1	-0.14	0.21

		Truck Driver	-0.252	0.132	0.706	-0.74	0.24
		Supervisor	0.008	0.065	1	-0.21	0.23
		Foreman	0.082	0.04	0.606	-0.05	0.22
		Masson	-0.252	0.336	0.994	-3.56	3.05
		Carpenter	0.082	0.04	0.606	-0.05	0.22
		Laboratory	0.082	0.04	0.606	-0.05	0.22
		Manager	0.082	0.04	0.606	-0.05	0.22
		Cleaner	0.082	0.04	0.606	-0.05	0.22
		Equipment operator	0.029	0.047	1	-0.13	0.18
	Flagger	Potter	-0.032	0.053	1	-0.21	0.14
		Truck Driver	-0.283	0.131	0.553	-0.77	0.2
		Supervisor	-0.024	0.062	1	-0.23	0.19
		Foreman	0.05	0.035	0.932	-0.07	0.17
		Masson	-0.283	0.335	0.988	-3.61	3.04
		Carpenter	0.05	0.035	0.932	-0.07	0.17
		Laboratory	0.05	0.035	0.932	-0.07	0.17
		Manager	0.05	0.035	0.932	-0.07	0.17
		Cleaner	0.05	0.035	0.932	-0.07	0.17
		Equipment operator	-0.003	0.043	1	-0.15	0.14
	Truck Driver	Potter	0.252	0.132	0.706	-0.24	0.74
		Flagger	0.283	0.131	0.553	-0.2	0.77
		Supervisor	0.259	0.136	0.707	-0.24	0.75
		Foreman	0.333	0.126	0.311	-0.14	0.81
		Masson	0	0.356	1	-2.75	2.75
		Carpenter	0.333	0.126	0.311	-0.14	0.81
		Laboratory	0.333	0.126	0.311	-0.14	0.81
		Manager	0.333	0.126	0.311	-0.14	0.81
		Cleaner	0.333	0.126	0.311	-0.14	0.81
		Equipment operator	0.281	0.129	0.545	-0.2	0.76
	Supervisor	Potter	-0.008	0.065	1	-0.23	0.21
		Flagger	0.024	0.062	1	-0.19	0.23
		Truck Driver	-0.259	0.136	0.707	-0.75	0.24
		Foreman	0.074	0.051	0.926	-0.11	0.25
		Masson	-0.259	0.337	0.993	-3.51	2.99
		Carpenter	0.074	0.051	0.926	-0.11	0.25
		Laboratory	0.074	0.051	0.926	-0.11	0.25
		Manager	0.074	0.051	0.926	-0.11	0.25
		Cleaner	0.074	0.051	0.926	-0.11	0.25
		Equipment operator	0.021	0.057	1	-0.17	0.22
	Foreman	Potter	-0.082	0.04	0.606	-0.22	0.05
		Flagger	-0.05	0.035	0.932	-0.17	0.07
		Truck Driver	-0.333	0.126	0.311	-0.81	0.14
		Supervisor	-0.074	0.051	0.926	-0.25	0.11

		Masson	-0.333	0.333	0.969	-3.72	3.06
		Carpenter	0	0	.	0	0
		Laboratory	0	0	.	0	0
		Manager	0	0	.	0	0
		Cleaner	0	0	.	0	0
		Equipment operator	-0.053	0.026	0.621	-0.14	0.03
	Masson	Potter	0.252	0.336	0.994	-3.05	3.56
		Flagger	0.283	0.335	0.988	-3.04	3.61
		Truck Driver	0	0.356	1	-2.75	2.75
		Supervisor	0.259	0.337	0.993	-2.99	3.51
		Foreman	0.333	0.333	0.969	-3.06	3.72
		Carpenter	0.333	0.333	0.969	-3.06	3.72
		Laboratory	0.333	0.333	0.969	-3.06	3.72
		Manager	0.333	0.333	0.969	-3.06	3.72
		Cleaner	0.333	0.333	0.969	-3.06	3.72
		Equipment operator	0.281	0.334	0.988	-3.07	3.63
	Carpenter	Potter	-0.082	0.04	0.606	-0.22	0.05
		Flagger	-0.05	0.035	0.932	-0.17	0.07
		Truck Driver	-0.333	0.126	0.311	-0.81	0.14
		Supervisor	-0.074	0.051	0.926	-0.25	0.11
		Foreman	0	0	.	0	0
		Masson	-0.333	0.333	0.969	-3.72	3.06
		Laboratory	0	0	.	0	0
		Manager	0	0	.	0	0
		Cleaner	0	0	.	0	0
		Equipment operator	-0.053	0.026	0.621	-0.14	0.03
	Laboratory	Potter	-0.082	0.04	0.606	-0.22	0.05
		Flagger	-0.05	0.035	0.932	-0.17	0.07
		Truck Driver	-0.333	0.126	0.311	-0.81	0.14
		Supervisor	-0.074	0.051	0.926	-0.25	0.11
		Foreman	0	0	.	0	0
		Masson	-0.333	0.333	0.969	-3.72	3.06
		Carpenter	0	0	.	0	0
		Manager	0	0	.	0	0
		Cleaner	0	0	.	0	0
		Equipment operator	-0.053	0.026	0.621	-0.14	0.03
	Manager	Potter	-0.082	0.04	0.606	-0.22	0.05
		Flagger	-0.05	0.035	0.932	-0.17	0.07
		Truck Driver	-0.333	0.126	0.311	-0.81	0.14
		Supervisor	-0.074	0.051	0.926	-0.25	0.11
		Foreman	0	0	.	0	0
		Masson	-0.333	0.333	0.969	-3.72	3.06
		Carpenter	0	0	.	0	0
		Laboratory	0	0	.	0	0

		Cleaner	0	0	.	0	0
		Equipment operator	-0.053	0.026	0.621	-0.14	0.03
	Cleaner	Potter	-0.082	0.04	0.606	-0.22	0.05
		Flagger	-0.05	0.035	0.932	-0.17	0.07
		Truck Driver	-0.333	0.126	0.311	-0.81	0.14
		Supervisor	-0.074	0.051	0.926	-0.25	0.11
		Foreman	0	0	.	0	0
		Masson	-0.333	0.333	0.969	-3.72	3.06
		Carpenter	0	0	.	0	0
		Laboratory	0	0	.	0	0
		Manager	0	0	.	0	0
		Equipment operator	-0.053	0.026	0.621	-0.14	0.03
	Equipment operator	Potter	-0.029	0.047	1	-0.18	0.13
		Flagger	0.003	0.043	1	-0.14	0.15
		Truck Driver	-0.281	0.129	0.545	-0.76	0.2
		Supervisor	-0.021	0.057	1	-0.22	0.17
		Foreman	0.053	0.026	0.621	-0.03	0.14
		Masson	-0.281	0.334	0.988	-3.63	3.07
		Carpenter	0.053	0.026	0.621	-0.03	0.14
		Laboratory	0.053	0.026	0.621	-0.03	0.14
		Manager	0.053	0.026	0.621	-0.03	0.14
		Cleaner	0.053	0.026	0.621	-0.03	0.14
* The mean difference is significant at the 0.05 level.							

Appendix 3a: Binary regression model results showing influence of socio-economic factors and PPE usage

BINARY REGRESSION									
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1a	Sex (Male)	1.031	1.205	0.732	1	0.392	2.803	0.264	29.748
Age Group									
	Age group (18-25 Years)			2.987	4	0.56			
	Age group (25-30 Years)	-0.831	0.82	1.027	1	0.311	0.436	0.087	2.173
	Age group (30-35 Years)	0.515	1.014	0.258	1	0.611	1.674	0.23	12.207
	Age group (35-40 Years)	-1.469	1.293	1.29	1	0.256	0.23	0.018	2.904
	Age group (Above 41 Years)	-18.57	13730.74	0	1	0.999	0	0	.
Education Level									
	Primary			2.747	4	0.601			
	Secondary	-0.757	13377.67	0	1	1	0.469	0	.
	University	-2.563	13377.67	0	1	1	0.077	0	.

	Vocational	-0.837	13377.67	0	1	1	0.433	0	.
	Others	-0.391	13377.67	0	1	1	0.677	0	.
Work Type									
	Potter			5.515	10	0.854			
	Flagger	-18.65	6033.589	0	1	0.998	0	0	.
	Truck Driver	1.898	0.94	4.077	1	0.043	6.671	1.057	42.094
	Supervisor	-18.344	9432.226	0	1	0.998	0	0	.
	Foreman	-19.482	12963.98	0	1	0.999	0	0	.
	Masson	-19.008	21841.81	0	1	0.999	0	0	.
	Carpenter	18.097	5664.249	0	1	0.997	72367264	0	.
	Laboratory	-18.587	16661.6	0	1	0.999	0	0	.
	Manager	-18.769	20126.93	0	1	0.999	0	0	.
	Cleaner	-18.579	9241.468	0	1	0.998	0	0	.
	Equipment operator	-0.054	0.825	0.004	1	0.947	0.947	0.188	4.77
Road Construction Site									
	Mbale USMID Roads			0.942	3	0.815			
	Kulambiro-Acacia-Stretcher Roads	0.369	1.328	0.077	1	0.781	1.446	0.107	19.517
	Lukuli-Kayemba Road	0.36	1.256	0.082	1	0.774	1.434	0.122	16.815
	Kabusu-Bunamwaya-Lweza Road	-0.462	1.29	0.128	1	0.72	0.63	0.05	7.891
Work Period									
	0-1 Year			0.008	2	0.996			
	1-2 Years	-0.068	0.745	0.008	1	0.927	0.934	0.217	4.024
	Above 2 Years)	-33.384	7949.272	0	1	0.997	0	0	.
	Constant	-1.971	13377.67	0	1	1	0.139		
a Variable(s) entered on step 1: Sex, Age Group, Education, Work Type, Road Location, Work Period.									

Appendix 3b: Binary regression Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	74.486a	0.163	0.43
a Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.			

Appendix 3c: Binary regression Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	0.397	8	1

Appendix 3d: Binary regression Classification Table

Classification Table				
	Observed		Predicted	
			Utilization of PPE among	Percentage

			workers		Correct
			Yes	No	
Step 1	Utilization of PPE among workers	Yes	231	3	98.7
		No	13	3	18.8
	Overall Percentage				93.6
a the cut value is .500					

Appendix 4: Frequencies of Organizational factors influencing PPE usage

Organizational factors	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree
Training on PPE usage by employer	71	27	0	132	20
Feedback and expectation about safety and PPE usage	56	19	24	136	15
Effective policies and guidelines on PPE available	41	18	13	161	17
Mandatory rules on PPEs use	27	6	8	75	134
Provision of enough PPEs by employer	73	45	21	99	12
Incentives/Motivation on PPE usage	44	7	11	169	19

Appendix 5: Frequencies of Psychological factors influencing PPE usage

Psychological	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree
PPE is of standard quality	37	23	19	109	62
PPE reduce speeds and lessen income	39	24	14	126	47
Motivation for PPE usage	44	7	11	169	19
Exposed to injury risk or harm at work	39	34	22	105	50
Reduce exposure injuries	28	7	8	115	92
Believe PPE for special worker	77	26	10	96	41
Believe PPE is effective for safety at work	38	18	17	116	61
Participate in trainings on PPE usage	30	12	4	142	62
Willingness to use PPE by employer work	27	4	10	80	129
Reminded by workmates to use PPE	25	20	8	131	66
Encourage PPE usage to workmates (Knowledge of use of PPE)	28	24	6	127	65

Appendix 6: Frequencies of Economic/environmental factors influencing PPE usage

Economic/environmental factors	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree
Training on PPEs	22	27	27	132	20
PPEs always available and sufficient	48	45	21	99	12
Supply of quality PPEs	44	34	28	107	15
Effective PPEs policies and guidelines	19	18	13	161	17

Appendix 7: Frequencies of Economic/environmental factors influencing PPE usage

Economic	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree
Training on PPE usage by employer	71	27	0	132	20
Effective policies and guidelines on PPE available	41	18	13	161	17
Incentives/Motivation on PPE usage	44	7	11	169	19
Mandatory rules on PPEs use	27	6	8	75	134

Appendix 8: Frequencies of Individual factors influencing PPE usage

Individual	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree
Previous knowledge on PPE usage	30	17	4	147	52
Aware of work related risks	26	12	12	144	56
Participate in trainings on PPE usage	30	12	4	142	62
Willingness to use PPE by employer work	27	4	10	80	129

Appendix 9: Frequencies of Supervision level factors influencing PPE usage

Supervision levels	Strongly disagree	Disagree	Not sure	Agree	Strongly disagree
Supervision on PPEs use	27	6	8	75	134
Frequent supervision	90	34	3	109	14

Appendix 10: QUESTIONNAIRE FOR EMPLOYEES

Dear Respondent, my name is Happy Peter Murwanyi, a student at Uganda Christian University. I am conducting research on Usage of PPE among the employees of road construction projects in Mable city and Kampala capital city of in Uganda. I kindly request you to spare some time and fill this questionnaire so that I can accomplish this task. I will keep this data confidential and use it strictly for academic purposes only. The questions require filling in short answers or ticking (□) the most appropriate options. I am grateful for your assistance.

SECTION A: PERSONAL DATA

1. Sex:

a) Male ☐ b) Female ☐

2. Age (in years):

a. 25-30 Years ☐ b) 25-30 years ☐ c) 30-35 Years ☐

d) 35-40 years ☐ e) Above 40 years ☐

3. Highest level of education attained so far:

a) None ☐ b) Primary ☐ c) Secondary ☐ d) Tertiary ☐

e) Other.....

4. What is your designation or role in this road construction project?

a) Potter ☐ b) Truck driver ☐ c) Supervisor ☐ d) Manager d) Funder ☐

5. For how long have you been working on this project?

a) 1-5 Years ☐ b) 5-10 years ☐ c) 10-15 Years ☐ d) Above 15 years ☐

6. Have you been utilizing some personal protective equipment (PPE)?

a) Yes ☐ b) No ☐

7. If yes, what type of eye and face protective equipment are you provided with among the following? (tick)

No.	**Protective Device**	
i	Safety spectacles	
ii	Impact resistant spectacles	
iii	Side shields	
iv	Goggles	
v	Welding shields	
vi	Laser safety goggles	
vii	Face shields	

viii	Others/None (specify)	

8. What type of hearing protective equipment are you provided with among the following? (tick)

No.	**Protective Device**	
i	Expandable foam plugs	
ii	Pre-molded reusable plugs	
iii	Canal caps	
iv	Earmuffs	
v	Single-use earplugs	
viii	Others/None (specify)	

9. Are you provided with any respiratory protective device?

a) Yes ☐ b) No ☐

10. Are you provided with any hand and arm protective device such as gloves?

a) Yes ☐ b) No ☐

11. What type of foot and leg protective equipment are you provided with among the following? (tick)

No.	**Protective Device**	
i	Leggings	
ii	Toe guards	
iii	Safety shoes	
viii	Others/None (specify)	

12. Are you provided with any head protective device such as head hat?

a) Yes☐ b) No ☐

13. Are you provided with any body protective equipment such as protective clothing?

a) Yes ☐ b) No ☐

14. Are you aware of any legal requirement on use of the various types of personal protective equipment as indicated the table below?

a) Yes ☐ b) No ☐

15. If yes, specify.

No.	Type	
i	Eye and Face PPE	
ii	Hearing PPE	
iii	Respiratory PPE	
iv	Hand and Arm PPE	
v	Foot and Leg PPE	
vi	Head PPE	
vii	Body PPE	
viii	Others/None (specify)	

16. How often do you use/wear the following PPE while working?

[1] Always [2] Mostly [3] Sometimes [4] Rarely [5] Never

Type of PPE	Always	Mostly	Sometimes	Rarely	Never
Eye and Face PPE (safety googles)	1	2	3	4	5
Hearing PPE	1	2	3	4	5
Respiratory PPE (dust masks/respirator)	1	2	3	4	5
Hand and Arm PPE (protection gloves)	1	2	3	4	5
Foot and Leg PPE (safety boots/shoes)	1	2	3	4	5
Head PPE	1	2	3	4	5
Body PPE (overall/dust coat)	1	2	3	4	5

17. What enforcing mechanism would you suggest to encourage usage of PPE?

a. Training on use of PPE
b. Step up inspection by Government
c. Incentives for use of PPE
d. Dismissal from work for lack of use of PPE

SECTION B: TRAINING OF WORKERS ON PPE

18. When were you last trained on PPE?

a) Less than 3 months ago
b) Three to six months ago
c) More than 6 months ago

19. What are the Sources of training?

a) Training on social media platforms Facebook, Twitter, and WhatsApp
b) In-person seminar
c) Class room lectures
d) In-person on job training
e) Online modular training

SECTION C: INDIVIDUAL FACTORS ASSOCIATED WITH USE OF PPE IN ROAD CONSTRUCTION PROJECTS

For this section, please indicate to what degree you agree with each of the following statements by ticking one of the two options below.

Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
1	2	3	4	5

#	**Questions**					
1	I have a good attitude and Knowledge to use PPE (Individual attitude)	1	2	3	4	5
2	I have previous knowledge on PPE usage	1	2	3	4	5
3	I often recommend use of PPE to all my friends (Knowledge of use of PPE)	1	2	3	4	5
4	Am well awareness of work-related risks	1	2	3	4	5
5	I often remind and encourage my workmates if they forget to use PPE (Peer influence)	1	2	3	4	5

ORGANIZATIONAL FACTORS ASSOCIATED WITH USE OF PPE IN ROAD CONSTRUCTION PROJECTS

For this section, please indicate to what degree you agree with each of the following statements by ticking one of the two options below.

Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
1	2	3	4	5

#	Questions					
1	Whether employees can easily access PPEs	1	2	3	4	5
2	Whether employees have ever had any training on the use and awareness of PPE	1	2	3	4	5
3	Whether the employees have enough PPEs	1	2	3	4	5
4	Whether the right and sufficient PPEs are procured by the organization	1	2	3	4	5
5	Whether the employees have ever had any training or sensitization about the company guidelines and policies on the PPE usage	1	2	3	4	5
6	Whether there is feedback and expectation about safety and PPE usage	1	2	3	4	5
7	Whether there are effective policies and guidelines for PPE usage	1	2	3	4	5
8	Whether there are any motivation activities for the Usage of PPE	1	2	3	4	5

SECTION E: ATTITUDES OF WORKERS TOWARDS THE USE OF PPE.

For this section, please indicate to what degree you agree with each of the following statements by ticking one of the two options below.

Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
1	2	3	4	5

#	Questions on PPE					
1	A worker is always willing to put on the highest level of PPE when the need arises	1	2	3	4	5
2	A worker is always willing to use the PPE provided by the organization during road construction work	1	2	3	4	5
3	A worker always feels following strict rules in removing PPEs such as gloves, boots face shield, and goggles is mandatory	1	2	3	4	5

SECTION F: QUESTIONS ON BELIEFS OF WORKERS ON PPE

For this section, please indicate to what degree you agree with each of the following statements by ticking one of the two options below.

Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
1	2	3	4	5

#	Questions on PPE					
1	It is possible to reduce exposure to a harmful substance or prevent injuries if I use protective devices or wear clothing to protect myself against harm or injuries while working.	1	2	3	4	5
2	I feel very uncomfortable when using devices or wearing protective clothing while working	1	2	3	4	5

3	I think using devices or wearing protective clothing will reduce speed and therefore lessen my income.	1	2	3	4	5
4	I am at risk of getting an injury or being exposed to a harmful substance that can cause an illness through my work	1	2	3	4	5
5	I am concerned	1	2	3	4	5
6	Do you believe the available PPE is of standard quality?	1	2	3	4	5
7	Do you believe that PPE is required by only some special worker?	1	2	3	4	5
8	Is your present level of knowledge of PPE adequate?	1	2	3	4	5
9	Do you believe the available PPE is effective in guaranteeing your safety at work?	1	2	3	4	5

SECTION G: MOST FREQUENT CHALLENGES FACED BY EMPLOYEES IN USING PPES

1. Other challenges faced by employees of of road construction projects in using PPEs

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2. Solutions to the challenges

a) Improve quality of the PPEs ☐

b) Establish more Suppliers ☐

c) Reduce PPE prices ☐

d) Provide more information about the PPEs ☐

e) More traing and awareness programmes

f) Others.....

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Thank you!

APPENDIX 11: Interview Guide for Management

1. How long has your firm been operating?
    - How many employees work at your firm?
2. How do you employ/ terms of workers engagement?
    - How are they paid?
3. As an employer, what arrangements have you made towards ensuring that every work activity is performed safely thereby minimizing or eliminating injuries or illnesses as a result of work?
    - Are you aware of any occupational health and safety laws?
    - What do you know about the occupational Health and Safety Act of……year…..……?
    - How are you implementing it as an employer?
4. Who do you think should be responsible for providing work protective devices or clothing (PPE) for workers?
    - Do you provide protective device or clothing for your workers meant to protect them from injuries while working?
    - Do you offer any training to your workers on the use of PPE?
    - Are there any measures you take to encourage PPE use at the workplace?
    - What measures do you take to ensure the use of PPE at the enterprise by workers?
5. How would you describe the use of personal protective equipment by road construction workers in your firm?
6. What do you think influences the use of personal protective equipment by road construction workers?
    - Knowledge of PPE and hazards exposed during work.
    - Age, gender, and work experience of worker, previous injury experience income.
    - Work environment including availability of PPE
7. What happens in the event of a worker-related injury in terms of time off to seek medical, the cost of treatment?
8. How would you describe the relationship between your firm and the government?

9. Are there specific ways you would like the government to help you to assure the occupational safety of your workers?

Thank you.