MAKERERE UNIVERSITY

ASSESSMENT OF THE IMPACT OF THE PIECE WAGE AND TIME WAGE SYSTEMS ON LABOUR IN TERMS OF HEALTH, SAFETY AND WELLBEING IN THE CONSTRUCTION INDUSTRY

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DECLARATION

I declare that this dissertation is as a result of my hard work and has never been submitted anywhere else for an award of degree, diploma or certificate.

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.....

DATE

15/06/2023

APPROVAL

This is to approve that this research dissertation was done under my supervision and it is now ready for submission.

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Signature

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Date

15/05/2023

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LIST OF ABBREVIATIONS

KPIs -Key Performance Indicators

TW-Time wage

PW-Piece wage

OSHA-Occupational Safety and Health Administration

WHO -The World Health Organization

SMEs-small and medium-sized enterprises

PPE-personal protective equipment

Abstract

Construction work is known for its inherent risks and potential impacts on the health, safety, and well-being of workers. The choice of wage system, whether it be piece-wage or time-wage, can significantly influence worker outcomes. This research aims to assess the effects of these wage systems on construction workers in Kampala, Uganda, and their implications for labor health, safety, and well-being. The study utilizes a comprehensive approach, considering various key performance indicators (KPIs) such as workers' satisfaction, training and education, safety committees, risk assessments, incident reporting, hazard identification, safety equipment, supervision, workers' compensation, workers' health knowledge, safety leadership effectiveness, workers' use of personal protective equipment (PPE), workers' sleep quality, and PPE maintenance rate. By examining these KPIs, the research provides a thorough evaluation of the piece-wage and time-wage systems and their impact on worker health, safety, and well-being. The findings reveal several significant insights, including the challenges faced by workers under the piece-wage system, such as increased risk of musculoskeletal disorders and job dissatisfaction. Additionally, suggestions are provided to address these challenges, focusing on improving compensation and benefits, enhancing work-life balance, providing career growth opportunities, developing comprehensive training programs, establishing safety committees, conducting regular risk assessments, improving incident reporting systems, ensuring availability and proper use of safety equipment, enhancing supervisory training, providing access to comprehensive workers' compensation, developing health education programs, and promoting effective safety leadership. Lastly the recommendations are also provided for father studies which include; increasing on the sample Size, carrying out additional research that is longer-lasting and involving in a wider, more varied set of individuals and broadening the study population. The research contributes to the field of occupational health and safety, informing policymakers, business leaders, and stakeholders about the advantages and disadvantages of piece-wage and time-wage systems in the construction industry. It also sheds light on the role of the state in regulating working conditions and safeguarding workers' rights. The findings from this study can aid in making informed decisions regarding the appropriate wage system implementation and support the overall well-being of construction workers.

CHAPTER ONE: INTRODUCTION

1.1Background

Construction work is generally considered to be a high-risk occupation, and workers in this industry may be at increased risk of accidents and injuries due to the nature of the work they do (Jones, 2019). Factors such as the type of wage system in place may all play a role in the health and safety of workers in the construction industry. The piece wage system has a long history, with roots dating back to the Industrial Revolution (Davies, 2015). In this system, workers are paid based on the number of units they produce, rather than the amount of time they work (Smith, 2020).The time wage system, on the other hand, is a more recent development, emerging in the 20th century as a way to pay workers for their time rather than their output (Brown, 2018).

There has been debate about which of these systems is more beneficial for the health, safety, and well-being of workers (Wilson, 2016). Some argue that the piece wage system creates an incentive for workers to work faster and more efficiently, leading to fewer accidents and injuries (Smith, 2020). Others argue that the time wage system allows for more rest and recovery time, which can be important for the health and safety of workers (Jones, 2019). With some arguing that the piece wage system can be exploitative, as it can create pressure for workers to work faster and harder without adequate rest or recovery time (Smith, 2020). Some studies have also found that workers on the piece wage system may be more likely to experience musculoskeletal disorders and other health problems related to repetitive strain and poor ergonomics (Chen & Hu, 2018).Some studies have also found that workers on the time wage system may experience higher levels of stress and job dissatisfaction compared to workers on the piece wage system (Kim & Lee, 2017).

In order to assess the impact of these two wage systems on the health, safety, and well-being of workers, it is important to consider a range of key performance indicators (Brown, 2018). These might include measures of absenteeism and presenteeism (e.g., the number of days missed due to illness or injury), the frequency and severity of accidents and injuries, and measures of overall health and well-being (e.g., self-reported stress levels, mental health, and physical health) (Johnson, 2017). It is also important to consider the specific context in which the wage systems are being implemented. Factors such as the type of industry, the level of worker training and

support, and the overall culture of the organization can all influence the health, safety, and well-being of workers and may need to be taken into account when comparing the performance of the piece wage and time wage systems (Wilson, 2016).

1.2 Problem statement

"Construction workers may be at increased risk for a variety of health issues, including musculoskeletal disorders, respiratory problems, and mental health conditions. The wage system used in the construction industry, whether it is piece-wage or time-wage, may influence the health and well-being of workers. There is a need to better understand the impact of wage systems on the health of construction workers in order to inform the development of interventions to support the health and well-being of this population. The purpose of this study is to compare the health of construction workers in organizations using different wage systems and identify any differences in health outcomes, behaviors, and exposures to potential health hazards."

1.3 Objectives

1.3.1 Main objective

To assess the impact of the piece wage and time wage systems on labour in terms of health, safety and wellbeing in the construction industry.

1.3.2 Specific objectives

1. Determine the key performance indicators of health, safety and wellbeing.
2. Assess the performance of workers on the piece wage and time wage systems on the health, safety and wellbeing.
3. Draw conclusions and make recommendations

1.4 Significance

In concern with the Sustainable Development Goal (SDG) 3 to ensure healthy lives and promote well-being for all at all ages. This goal aims to ensure that people everywhere have the opportunity to live healthy, productive lives and have access to the healthcare services they need.

The construction industry is possibly the most hazardous industry with regard to the health and safety of workers and as a result, the industry registers increased frequencies of safety incidents. These incidents have led to loss of lives, injuries.(Okwel, 2019).

The research on the impact of the piece wage and time wage systems on the health, safety, and well-being of workers has the potential to contribute significantly to the field of occupational health and safety. By providing insights into the potential advantages and disadvantages of these wage systems for workers, the research could inform policymakers, business leaders, and other stakeholders about the potential impacts of these systems and help inform decisions about which system may be more appropriate for certain or contexts (Smith, 2020). For example, the piece wage system may be more efficient in terms of production, but may also lead to increased pressure on workers to work faster and harder, which could compromise their health and safety (Smith, 2020). Understanding the balance between efficiency and safety could inform decisions about which wage system is more appropriate in different contexts and industries (Johnson, 2017).

The research could also help to inform debates about the role of the state in regulating working conditions and protecting the rights of workers (Davies, 2015). By providing evidence about the potential impacts of the piece wage and time wage systems on the health, safety, and well-being of workers in Uganda, the research could inform discussions about the appropriate role of the state in regulating working conditions and ensuring the protection of workers' rights (Smith & Jones, 2016).

1.5 Justification

Previous research has suggested that the wage system used in an organization may influence the health and safety of workers, but more research is needed to confirm these findings and understand the mechanisms behind any observed relationships (Hsu et al., 2019). The wage system used in the construction industry, whether it is piece-wage or time-wage, may influence the health and safety of workers (Lee et al., 2018; Hsu et al., 2019; Chen et al., 2019). Construction workers are at increased risk for a variety of health and safety issues, including musculoskeletal disorders, respiratory problems, mental health conditions, and accidents and injuries (Lin et al., 2017; Kogi-Makau et al., 2016; Lu et al., 2020; Fernando et al., 2017). A

study on the health and safety of construction workers and the impact of wage systems could provide valuable insights into these relationships and inform the development of interventions to support the health and safety of this population.

1.6 Scope

The study is to focus on the piece wage and the time wage systems as they affect the health, safety and wellbeing of workers in the construction industry. Assess the performance of the workers on both the systems and then compare them. The research shall be done over a period of six (6) months and the findings presented in a research project report.

CHAPTER TWO: LITERATURE REVIEW

2. An overview of the topic

The topic of this literature review is the assessment of piece wage and time wage systems on labor health and safety in the construction industry

2.1 Health

The World Health Organization defines health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" (World Health Organization, 2020). Good health is essential for both individuals and communities, and there are many factors that can impact health, including genetics, lifestyle, and environmental factors.

2.2 Safety

Occupational safety is the prevention of accidents and injuries in the workplace. The Occupational Safety and Health Administration (OSHA) is a U.S. government agency that is responsible for ensuring safe and healthy working conditions for workers (Occupational Safety and Health Administration, n.d.). OSHA sets and enforces standards for safety in the workplace, and provides resources and assistance to employers and employees to help them meet these standards.

2.3 Wellbeing

Mental health and wellbeing are essential components of overall health and are often interconnected. The World Health Organization (WHO) defines mental health as "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (World Health Organization, n.d.). Good mental health is important for individuals and communities, and can be promoted through a variety of means, including support and treatment for those with mental health issues, and efforts to reduce stress and promote a positive work-life balance.

2.4 Piece Wage System in the Construction Industry

The construction sector has made extensive use of the piece wage system, a form of pay where employees are compensated based on the quantity of units they create. This technology has a lengthy history, dating back to the Industrial Revolution and still being used in a number of modern construction projects (Koyuncu, 2018).

2.4.1 Implementation of the Piece Wage System in the Construction Industry

a) In the construction sector, the piece wage system is frequently used, and specialized techniques and procedures are used to apply it. Understanding how this system is applied in the building industry can offer insights into its operational features and shed light on its use there (Kim et al. 2020).
b) There are numerous crucial phases involved in implementing the piece wage system in the construction sector. Employers must first have a clear grasp of the work that needs to be done in order to identify the precise tasks that qualify for piece-rate pay. Common examples of these operations include electrical installations, carpentry, and concrete pouring since they are simple to quantify or measure (Kim et al. 2020).
c) Employers choose the appropriate tasks and then decide on the piece rates or payment rates for each work. Typically, this is determined by market prices, industry norms, or agreements reached with employees or labor organizations. A piece rate is a payment made for each completed work item, such as each square meter of concrete poured or each linear meter of pipes fitted. Employers make sure that these rates are fair and reasonable by considering the difficulty of the activity, the amount of time needed, and the level of expertise required (Patel et al. 2018).
d) The right monitoring and measurement systems are put in place in order to implement the piece wage system successfully. Employers keep track of and document the amount of work that each employee produces, assuring accuracy in measurement and responsibility. This may entail correctly measuring and quantifying the finished units utilizing technology such as digital tools, time-tracking software, or actual counting devices (Koyuncu, 2018).
e) In order to successfully execute the piece wage system, regular contact and feedback are essential. Employers clearly communicate expectations to employees as well as the

quality standards and productivity targets that must be met. They also create avenues via which employees may report their accomplishments and ask questions. Employers can resolve any issues, offer suggestions, and keep the payment process transparent by using feedback methods (Koyuncu, 2018).

f) Employers must keep a close eye on working conditions and workloads to maintain fairness and prevent exploitation. To guard against any potential system abuses, such as unreasonable productivity goals or excessive labor expectations, regular inspections and assessments are carried out. The implementation process must include enough rest breaks, protections for worker health, and safeguards for safety.

g) Maintaining correct records and paperwork for the piece wage system is essential. These records cover worker productivity on an individual basis, completed work units, and related payment calculations. Accurate reporting for legal and regulatory compliance is made possible by proper documentation, which also ensures transparency and assists in addressing any payment disputes (Patel et al. 2018).

2.4.2 Reasons for the Use of the Piece Wage System in the Construction Industry

1. For a number of reasons, the piece wage system has been embraced and used in the construction sector. Understanding these elements can help shed light on the industry's dependence on this compensation model and offer insights into the reasons for its use.
2. The potential for the piece wage system to increase productivity and efficiency is a major factor in the usage of the system in the construction sector. Smith (2020) contends that this method motivates people to work hard and aim for increased productivity levels by rewarding employees depending on their production. The piece wage system establishes a clear connection between performance and payment, aligning workers' financial motivations with the objectives of completing projects on schedule and on budget (Kim et al. 2020).
3. Its simplicity and practicability. Comparatively easy to administer and compute, the piece wage system is a good alternative to other forms of compensation including time-based salaries. It necessitates keeping track of the quantity of work finished, making it appropriate for easily measurable jobs like concrete pouring, bricklaying, or painting. It is

a viable option for construction companies because of its simplicity, particularly for jobs that need a variety of labor-intensive tasks.

4. The piece wage system offers flexibility in managing costs and allocating resources. With this method, construction businesses can modify worker resources in accordance with the demands of the project and changes in workload. The piece pay system allows businesses to efficiently allocate resources and maximize their workforce because workers are paid based on their individual productivity reducing labor costs in the process (Lee et al. 2019).
5. Individual accountability and performance-based rewards are encouraged by the piece wage system. It enables employees to immediately observe how their efforts affect their pay. This individual accountability can help employees feel proud of and accomplished, encouraging a culture of personal responsibility and driving them to be the best at what they do. This approach is frequently used by businesses to motivate employees and foster a competitive workplace that improves performance (Kim et al. 2020).

2.4.3 Advantages of the Piece Wage System

The ability to reduce the risk of accidents and injuries by incentivizing personnel to work more cautiously and effectively. According to Smith (2020), employees who are paid on a piece-rate basis are encouraged to produce as much work as possible while maintaining a high standard of excellence. This focus on productivity may motivate staff to adhere more closely to safety procedures, resulting in enhanced safety performance and fewer workplace mishaps.

The piece wage system gives employees more control over their income, which may improve their general well-being and job happiness. Employees may feel more accomplished and motivated if they can immediately see the results of their hard work in the form of higher pay (Jones, 2019). This contentment and feeling of financial control might have a positive impact on the workers' mental and emotional well-being.

A culture of accountability and responsibility among construction employees can be fostered via the piece wage system. Because employees are frequently held responsible for their individual output and performance, this may lead to greater self-awareness and a focus on safety procedures

(Wilson, 2016). This strategy motivates employees to take responsibility for their job and actively participate in preserving a secure and healthy workplace.

2.4.4 Disadvantages of the Piece Wage System

Even though the piece wage system has its supporters, there are serious worries about its possible drawbacks and detrimental effects on the health and wellbeing of construction sector workers. These limitations have been illuminated by numerous researches, emphasizing the necessity of cautious consideration and risk mitigation.

The possibility for increased stress and strain on employees. According to Smith (2020), the focus on output and productivity can foster a culture in which employees feel pressured to work longer hours and harder to get higher pay. The mental and physical health of construction industry personnel may be affected by this increased strain and stress levels.

The piece wage structure could downplay the value of recovery time and rest, which might make workers feel worn out and exhausted. Workers' general health and well-being may deteriorate in the absence of suitable breaks and recuperation time. Increased fatigue and the risk of musculoskeletal problems can be brought on by the repetitive nature of many construction operations and the pressure to fulfill production targets (Chen & Hu, 2018).

According to research, employees who are paid under this system can be less satisfied with their jobs than those who are paid under alternative wage systems (Kim & Lee, 2017). Employee unhappiness and decreased motivation may be caused by the ongoing pressure to reach production quotas and the lack of control over work speed and timetables.

The piece wage system could foster a hostile work atmosphere that prevents people from collaborating and cooperating. Workers may put more emphasis on their own productivity and financial gain than working together to safeguard their safety and well-being. The establishment of a supportive and cohesive workplace culture may be hampered by this competitive environment, which would be detrimental to employees' general health and wellbeing.

2.5 Time Wage systems

The piece wage system is frequently replaced with the time wage system in the construction sector. Understanding the time wage system's overall implications for health, safety, and well-being can help one understand how they may affect the construction sector (Lee et al. 2019).

The construction industry uses a time wage system where employees are paid according to how much time they spend working rather than how much labor they actually produce. In this arrangement, regardless of the amount of output or productivity produced during that period, employees are paid a set hourly pay or salary for their work (Lee et al. 2019).

2.5.1 Implementation of the time wage system in the construction industry

a) Hourly Wages: Employees get compensated for the hours they have put in. Every employment title or skill level has an hourly rate set by the company, and employees are paid for the actual hours they have worked. Both regular working hours and extra hours, which are typically paid at a higher rate, can be included in this (Williams et al. 2017).
b) Salary-Based Compensation: Instead of receiving hourly pay, some construction industry positions, such as project managers, engineers, and supervisors, may be paid on the basis of a fixed salary. The duties and level of competence necessary for the position, among other things, are taken into consideration when determining the remuneration in this scenario. No of how many hours a worker puts in, as long as they complete their duties, they are paid consistently (Smith et al. 2015).
c) Timekeeping Systems: Construction companies frequently utilize timekeeping systems to precisely track and record the time that employees work. These systems can be manual, requiring employees to manually enter their start and end times, or automated, using devices like electronic time clocks or software for digital timekeeping. The foundation for determining workers' salaries and guaranteeing proper compensation is timekeeping records (Smith et al. 2015).
d) Overtime Compensation: Construction businesses often offer overtime compensation to employees who work longer hours or on weekends or holidays. In order to motivate employees and reward them for the extra time and effort they put into their work, overtime rates are generally greater than standard hourly compensation.

e) Payroll Administration: Construction companies oversee the payroll procedure to make sure that their employees are paid on time and correctly. This entails determining pay based on the hours worked, adding any appropriate overtime rates, and subtracting any required tax withholdings. To guarantee adherence to regulatory standards and equitable remuneration practices, these responsibilities are handled by payroll administrators or dedicated human resources employees (Lee et al. 2019).

2.5.2 Reasons for using the time wage system in the construction industry

1. Predictable Labor expenses: The time wage system gives construction organizations a better grasp of labor expenses that is more predictable. It is simpler for businesses to predict and budget for labor costs when workers are paid according to the time they spend on the task. For lengthy projects with extensive durations, this may be especially advantageous (Smith et al. 2015).
2. Skill-Based Compensation: The time wage system offers the chance to pay employees in accordance with their qualifications and expertise. Higher hourly pay or salary may be given to employees with more specialized knowledge or experience to reflect their worth to the business. This could aid the recruitment and retention of qualified workers in the construction sector (Smith et al. 2015).
3. Collaboration is emphasized: The time wage system encourages a cooperative workplace. Workers are encouraged to work together in teams and cooperate as compensation is based on time spent rather than individual productivity. On construction sites, this can improve cooperation, coordination, and communication, resulting in better safety and productivity results (Lee et al. (2019).
4. Risk Mitigation: Construction projects inevitably have a number of hazards, including unplanned delays, scope modifications, and unpredictably bad weather. The time wage system gives employees some latitude to adjust to these unforeseen circumstances without jeopardizing their pay. It permits alterations to work plans and the allocation of extra time to deal with unforeseen difficulties, minimizing potential disruptions.
5. Compliance with Labor Laws: By ensuring fair and consistent payment procedures, the time wage system can assist construction companies in complying with labor laws. It makes it easier to ensure that employees earn at least the minimum wage required by

labor laws by paying employees a fixed hourly wage or compensation. This encourages equity and averts potential wage theft or exploitation (Park, 2018).

6. Alignment with Specific Construction duties: Some construction duties, including administration, coordination, or supervision, may be difficult to quantify in terms of production or piece-rate pay. In situations like this, where the worth of a worker's contributions may be better assessed based on their time and responsibilities than on their direct output, the time wage system offers an appropriate approach of rewarding workers participating in such duties (Sharma, 2020).

2.5.3 Advantages of the time wage system

The time wage system in the construction sector benefits workers' health, safety, and well-being in a number of ways:

Better work-life balance is made possible by the time wage system, which allows for more predictable working hours. Since their income is not directly related to their output or productivity, individuals are free to follow set working hours, take breaks when needed, and schedule their personal life accordingly. This encourages leading healthy lifestyles, lessens tiredness, and guards against workplace stress and burnou (Okwel, 2019)t.

Less need for Speed: The time wage system lessens the need for speed, in contrast to piece-rate systems where employees are motivated to create more in order to earn more. Without the need to hurry or take short cuts that could endanger their safety, employees can concentrate on completing their work in a safe and effective manner. This can help make the workplace safer and reduce the chance of accidents and injuries (Cattledge, 2019).

Increased Safety Awareness: Because the time pay system places more emphasis on time spent working than productivity, employees are able to give safety precautions and protocols top priority. They have more time to attend toolbox lectures, conduct safety inspections, participate in safety training, and follow safety procedures. This encourages a culture of safety awareness, which results in to a decreased risk of workplace accidents and improved overall safety performance (Park, 2018).

Training and Skill Development: The time wage system gives employees the chance to take part in training courses and activities that will help them hone their skills. Companies may provide resources and time for employees to advance their skills and knowledge as their pay is not primarily based on production. As a result, one may become more competent, like their job more, and have more confidence in their ability to complete duties in a safe and efficient manner (Alves, 2020).

Collaboration and Communication: The time wage system promotes worker cooperation and teamwork. There is less competition among employees and more emphasis on cooperation when compensation is not entirely based on individual production. Better coordination, communication, and sharing of safety information and procedures are all facilitated by this. On construction sites, worker collaboration can improve overall safety and well-being by identifying and addressing possible hazards (Sharma, 2020).

Lessened Risk of Musculoskeletal problems: By allowing workers adequate rest and recovery time, the time wage system helps reduce the risk of musculoskeletal problems. Physically demanding jobs are frequently involved in construction work, therefore a system of time-based compensation enables employees to take regular breaks, stretch, and get enough rest. This lowers the risk of musculoskeletal diseases and repetitive strain injuries brought on by extended or continuous physical exercise (Hines, 2019).

Job happiness and Motivation: The time wage system may help construction employees experience more job happiness and motivation. The total level of job satisfaction of employees is significantly impacted when they feel appropriately compensated for their time and efforts. The engagement, commitment, and motivation of satisfied employees tend to increase productivity, safety compliance, and general wellbeing (Sharma, 2020).

2.5.4 Disadvantages of the time wage system

While there are a number of benefits to the time wage system in the construction sector, there are also some possible drawbacks in terms of employee health, safety, and well-being:

Increased Fatigue: The time wage system pays employees according to the number of hours they put in, which could result in longer workdays. Increased exhaustion brought on by long shifts or

overtime can impair workers' physical and mental capabilities as well as attentiveness and focus. Workers who are fatigued are more likely to make mistakes, which raises the possibility of accidents, injuries, and impaired safety (Cattledge, 2019).

Limited Incentive for Efficiency: In contrast to the piece-pay system, the time wage system might only offer modest incentives for employees to carry out duties effectively. Workers may be less motivated to accomplish tasks quickly or think of creative ways to increase productivity because they are paid according to time spent rather than output. On construction projects, this may lead to lower productivity and efficiency levels (Alarcon, 2019).

Potential for tedious Work: For some construction employees, the time wage system may result in repetitious and tedious work. Long stretches of monotonous work without variation can lead to boredom, lower job satisfaction, and a general decline in wellbeing. Additionally raising the risk of musculoskeletal illnesses and ergonomic-related problems is monotonous employment (Cattledge, 2019).

Lack of Recognition for Skill and Performance: Under the time pay system, a worker's compensation award is typically determined more by the quantity of hours they put in than by their skill or performance. Highly skilled professionals that put in extra effort and regularly deliver at a high level may feel undervalued as a result of this. Motivation, job happiness, and general wellbeing can all be affected by the lack of appreciation for talent and performance (Cho, 2019).

The Possibility of Unpaid Overtime: In some circumstances, the time wage system may be open to abuse or the failure to pay employees for overtime hours worked. Employers may coerce employees into working longer than usual hours without paying a fair wage or they may falsify timekeeping records. This may result in financial strain, an unbalanced work-life schedule, and detrimental effects on the health and wellbeing of employees (Alves, 2020).

Limited Financial Incentives for Safety: Unlike the piece-wage system, which directly links increased production to higher pay, the time wage system may offer just a few financial incentives for employees to put safety first. If there are no immediate financial benefits, employees could be less inclined to make further efforts in safety procedures or take extra precautions. On construction sites, this may jeopardize safety results (Alves, 2020).

The possibility of an uneven workload distribution among construction workers is a risk associated with the time wage system. Workers that encounter difficulties or take longer to finish tasks may need to put in more hours because pay is based on time worked rather than output in order to fulfill project deadlines. Due to workload differences brought on by this imbalance, certain workers may experience increased stress, weariness, and decreased wellbeing (Chen L. J., 2019).

Conclusion

The existing research on this topic is somewhat limited, inconsistent and no study has been carried out in Uganda. They were carried out in isolation and we cannot generalize that data that is why the researcher wants to carry out the study in Uganda. More research is needed to fully understand the relationship between wage systems and the health, safety, and wellbeing of construction workers.

CHAPTER THREE: METHODOLOGY

3.1 Research approach

Qualitative and quantitatively research methods were used for this particular study because it involves data that is qualitative and quantitatively.

3.2 Research design

For the first objective of determining the key performance indicators (KPIs) of health and safety in the construction industry, a literature review was conducted to identify relevant research and best practices in the field. This involved reviewing industry standards and guidelines, as well as academic research on health, safety and wellbeing in the construction industry.

For the second objective of assessing workers on the piece wage and time wage systems in terms of health, safety and wellbeing, collecting data from workers themselves was considered. This involved conducting close end interviews with workers who are paid under each of the two wage systems. Data collected from workers was analyzed to identify any trends or patterns in their experiences and perceptions and use statistical analysis techniques to compare the two groups in terms of key health, safety and wellbeing KPIs, such as the frequency of accidents and injuries, adherence to safety protocols, and overall perceptions of safety on the job.

Chi square tests were used to compare the mean responses of workers on the piece wage system to the mean responses of workers on the time wage system on key variables which helped us to draw conclusions and recommendations for the third objective.

3.3 Study population

- The workers who are paid under the piece wage system: these include workers who are paid based on the number of units of work they complete, such as bricklayers, carpenters, or electricians and

- The workers who are paid under the time wage system: these include workers who are paid based on the number of hours they work, regardless of the amount of work they complete, such as laborers or maintenance workers.

3.4 Methods to Achieve Specific Objective 1- To determine the key performance indicators (KPIs) of health, safety and wellbeing in the construction industry

3.4.1 Data source

A literature review was conducted on academic research on health, safety and wellbeing in the construction industry, as well as industry standards and guidelines, to identify key KPIs and best practices about the health, safety and wellbeing.

3.4.2 Data collection tools

Literature review: A literature review is a systematic review of existing research on a particular topic. The researcher used a variety of research databases, such as Scopus, or Google Scholar, to search for relevant studies on health, safety and wellbeing in the construction industry.

Using the search phrases "key performance indicators of health, safety, and wellbeing," literature searches were done in Science Direct, PubMed, Google Scholar, and Web of Knowledge. Because they were top databases for scientific study, the databases were chosen.

The researcher Conducted searches using Google and Google Scholar, where the top 50 results were reviewed for potentially pertinent literature. After finding a few papers that were pertinent, more research was gathered from the reference lists, and the titles of these studies were entered as search terms on Google and Google Scholar, leading to databases from which related studies were located by selecting the "show similar studies" search option while conducting database searches.

3.4.3 Sampling strategies

The researcher adopted systematic literature review approach in order to identify the most relevant academic documents to be included in the study.

Only those published peer-reviewed studies and the grey literature discovered through thorough searches were deemed qualified to be included in the review.

1. Relevance to research topic
2. Sensitivity to wage systems

3. Published by Accredited Organizations
4. Were written in English
5. Published between 2000 and 2023.

Studies that didn't fit the aforementioned requirements were excluded. The full texts of papers that fit the criteria were retrieved, and they underwent a thorough examination for quality, bias assessment, and applicability to the study's goals. The search method described in "Search strategy" Section was used to retrieve a total of 547 records from peer-reviewed journal database searches. There were 97 duplicate records, which were removed from the database.

To determine which of the remaining were eligible to be reviewed, abstracts and executive summaries were reviewed. 450 of the acquired records whose executive summaries and abstracts were scanned didn't fit the bill. Key performance indicators on health, safety, and welfare in relation to payment systems were the main focus of these. As a result, 33 records were determined to be eligible for full-text examination, but only 26 of them did so. These 26 articles were purposefully chosen for review based on the selection criteria stated above.

3.4.4 Sample size

A total of 26 documents were selected purposively for the review based on the content they possess about KPIs of health, safety and wellbeing of workers in construction.

3.4.5 Data analysis for specific objective one

Information from document reviews in order to make the data comprehensible and meaningful, the researcher used Mircosoft Excel to extract the following Author (Year), Study/record title, Study objectives/research questions/hypotheses, Location, Independent variables, and Key performance indicators into a tales and basing on the ranking criteria 18 KPI were selected for this study.

3.5 Methods to achieve specific objective 2- Assess the performance of workers on the piece wage and time wage in the health, safety and wellbeing.

3.5.1 Data source

Questionnaires were conducted using closed ended questions to collect data from the workers under the PW and TW systems using guide questions.

3.5.2 Data collection tools

Closed-ended questions are questions in a survey or questionnaire that have predefined response options for participants to choose from. These questions typically limit the participant's response to a set of predetermined options, such as multiple-choice questions or rating scales. Multiple questions were used for this particular research with Likert scale to enable analysis.

3.5.3 Sampling strategies

Stratified sampling was used to select participants that is, the workers paid under the PW & TW. This is because the population from which we are selecting occurs in different strata,

3.5.3 Sample size

Because 30 are seen as a large number, stratified sampling was employed to pick the respondents, with a total of 60 employees from both groups.

Proportion of workers in each stratum "π" (pi) =10

Desired Total Sample Size = 60

Sample Size for Stratum = (Proportion of Stratum) x (Desired Total Sample Size)

Sample Size for Stratum 1 = 0.5 x 60 = 30 workers (rounded to the nearest whole number)
Sample Size for Stratum 2 = 0.5 x 60 = 30 workers (rounded to the nearest whole number)

Number of Strata for Stratum 1 = (Sample Size for Stratum 1) / 10

Number of Strata for Stratum 2 = (Sample Size for Stratum 2) / 10

Number of Strata for Stratum 1 = 30 workers / 10 = 3.0, 3 strata

Number of Strata for Stratum 2 = 30 workers / 10 = 3.0, 3 strata

Randomly select 10 workers from each of the 3 strata in Stratum 1 and 10 workers from each of the 3 strata in Stratum 2, resulting in a total sample size of 30 workers (3 strata x 10 workers) for Stratum 1 and 30 workers (3 strata x 10 workers) for Stratum 2.

3.5.4 Data analysis for specific objective two

Data from the questionnaires was subjected to statistical analysis i.e. Z test for independence was used to check for significant differences in the responses. Also other statistical treatments was done to check for significant differences between health, safety and wellbeing of persons under the piece wage and the time wage systems of payment of work at a construction site.

3.6 Ethical Consideration

3.6.1Entry into the research population

The Department of Construction Economics and Management provided the researcher with an introductory letter that helped him get to know the various study participants prior to including them in the interviews or carrying out this research on sites.

3.6.2 Consent and Protection of the respondents

The goal of the study was made clear to participants before the interview and focus group discussions begin so that they understand their role and can actively participate in the study. It was appropriate for study participants to withdraw from the study or to withhold information when they feel uncomfortable.

In the final report, names were protected, unless the subject specifically consents to having their information used in that way.

CHAPTER 4: PRESENTATION AND INTERPRETATION OF RESULTS

4.1 kip oh health, safety and wellbeing in the construction industry

To finish this study, data was taken from the chosen literature based on the research questions. The following information was gathered from the final sample of studies that was reviewed: author (year), study/ record title, study objectives, research questions/ hypotheses, location independent variables, key performance indicators were tabulated in a Microsoft Excel database for analysis.

Table 4.1

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Wang et al. (2019)	Development of KPIs for construction workers' occupational health and safety management in China	The study aims to develop a set of KPIs that can be used to measure the effectiveness of occupational health and safety management for construction workers in China.	China	KPIs related to occupational health and safety management in the construction industry	Accident rate Lost time injury rate Unsafe act/condition reporting rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' sleep quality Workers' health knowledge Workers' use of (PPE) PPE compliance rate PPE maintenance rate Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety culture perception

Table 4.2

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Lee et al. (2020)	Development of Key Performance Indicators for Safety Management in the Korean Construction Industry	The study aims to develop a set of KPIs that can be used to evaluate the effectiveness of safety management in the Korean construction industry	Korea	KPIs related to safety management in the construction industry	Injury frequency rate Lost-time injury frequency rate Near-miss reporting rate Workers' compensation claims rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' sleep quality Workers' health knowledge Use of PPE PPE compliance rate PPE maintenance rate Safety training completion rate Safety communication effectiveness Safety culture perception Safety leadership effectiveness

Table 4.3

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Cho et al. (2018)	Development of Key Performance Indicators for Health Management in the Korean Construction Industry	The study aims to develop a set of KPIs that can be used to measure the effectiveness of health management for construction workers in Korea	Korea	KPIs related to health management in the construction industry.	Occupational disease incidence rate Workers' compensation claims rate for occupational diseases Workers' absenteeism rate due to health issues Workers' turnover rate due to health issues Workers' satisfaction with health-related benefits and services Workers' nutrition knowledge Workers' sleep quality Use of personal protective equipment for health protection PPE compliance rate for health protection Health and safety training completion rate Health and safety inspection completion rate Effectiveness of health communication Health promotion program participation rate Access to health services and resources Safety leadership effectiveness for health management

Table 4.4

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Abdalla et al. (2017)	: Developing Key Performance Indicators for Health and Safety Management in the UAE Construction Industry	The study aims to develop a set of KPIs that can be used to measure the effectiveness of health and safety management for construction workers in the UAE.	UAE	KPIs related to health and safety management in the construction industry.	Incidence rate of work-related injuries and illnesses Lost-time injury frequency rate Near-miss reporting rate Workers' compensation claims rate Workers' absenteeism rate due to health and safety issues Workers' turnover rate due to health and safety issues Workers' satisfaction with health and safety-related benefits and services Workers' stress level Workers' sleep quality Workers' health knowledge Use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate Health and safety training completion rate Health and safety inspection completion rate Effectiveness of health and safety communication Safety culture perception Safety leadership effectiveness

Table 4.5

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Prabha et al. (2021)	Developing Key Performance Indicators for Occupational Health Management in the Indian Construction Industry	The study aims to develop a set of KPIs that can be used to measure the effectiveness of occupational health management for construction workers in India.	India	KPIs related to occupational health management in the construction industry	Incidence rate of work-related injuries and illnesses Lost-time injury frequency rate Workers' compensation claims rate Workers' absenteeism rate due to health issues Workers' turnover rate due to health issues Workers' satisfaction with occupational health-related benefits and services Workers' stress level Workers' sleep quality Workers' nutrition knowledge Use of PPE for occupational health PPE compliance rate for occupational health protection Occupational health and safety training completion rate Occupational health and safety inspection completion rate

Table 4.6

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Chou et al. (2018)	Developing Key Performance Indicators for Occupational Health and Safety in the Taiwan Construction Industry	The study aims to develop a set of KPIs that can be used to measure the effectiveness of occupational health and safety management for construction workers in Taiwan.	Taiwan	KPIs related to occupational health and safety management in the construction industry.	Work-related injury rate Lost-time injury rate Near-miss reporting rate Workers' compensation claims rate Workers' absenteeism rate due to health and safety issues Workers' turnover rate due to health and safety issues Workers' satisfaction with health and safety-related benefits and services Workers' stress level Workers' sleep quality Workers' health knowledge Use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate Health and safety training completion rate Health and safety inspection completion rate Effectiveness of health and safety communication Safety culture perception Safety leadership effectiveness

Table 4.7

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Sharma et al. (2020)	Development of Key Performance Indicators for Wellbeing Management in the Australian Construction Industry	The study aims to develop a set of KPIs that can be used to measure the effectiveness of wellbeing management for construction workers in Australia.	Australia	KPIs related to wellbeing management in the construction industry.	Job satisfaction Work-life balance Mental health and wellbeing Physical health and wellbeing Sleep quality Healthy lifestyle behaviors Absenteeism rate due to health issues Turnover rate due to health issues Access to employee assistance programs and other wellbeing support Use of personal protective equipment (PPE) for wellbeing protection PPE compliance rate for wellbeing protection Health and safety training completion rate Health and safety inspection completion rate Effectiveness of health and wellbeing communication Wellbeing culture perception Wellbeing leadership effectiveness

Table 4.8

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Cattledge et al. (2019)	Development of a Comprehensive Occupational Health and Safety Key Performance Indicator Framework for Construction Contractors	The study aims to develop a comprehensive set of KPIs that can be used to assess and monitor the effectiveness of occupational health and safety management for construction contractors.	United States	KPIs related to occupational health and safety management in the construction industry	Total recordable incident rate Lost-time incident rate Severity rate Near-miss reporting rate Safety climate perception Workers' compensation claims rate Substance abuse rate Musculoskeletal disorders rate Hearing loss rate Respiratory disorders rate Heat stress rate Workplace stress rate Workplace violence rate Safety training completion rate Safety audit completion rate Safety communication effectiveness Safety leadership effectiveness PPE compliance rate PPE maintenance rate Workers' satisfaction rate Workers' absenteeism rate Workers' turnover rate

Table 4.9

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Park et al. (2018)	Development of a KPI Framework for the Occupational Health and Safety Performance of Construction Companies	The study aims to develop a KPI framework for measuring the occupational health and safety performance of construction companies, and to test its effectiveness and reliability.	South Korea	KPIs related to occupational health and safety management in the construction industry.	Accident rate Lost-time injury frequency rate Fatal accident rate Near-miss reporting rate Occupational disease incidence rate Workers' compensation insurance rate Occupational health and safety management system certification rate Safety training hours per employee per year Safety inspection completion rate Safety audit completion rate Workers' participation in safety management activities Safety culture perception Safety leadership effectiveness Workers' use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate Workers' satisfaction rate Workers' turnover rate

Table 4.10

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Cho et al. (2019)	Development of Key Performance Indicators for the Occupational Health and Safety Management of Small and Medium-Sized Construction Companies	The study aims to develop KPIs that can be used by small and medium-sized construction companies to measure the effectiveness of their occupational health and safety management systems.	South Korea	KPIs related to occupational health and safety management in the construction industry	Number of accidents Accident severity rate Lost workday incidence rate Fatal injury rate Occupational disease incidence rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' sleep quality Workers' health knowledge Workers' use of personal protective equipment (PPE) PPE compliance rate Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety culture perception

Table 4.11

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Jannadi et al. (2018)	Identification of Key Performance Indicators for Occupational Health and Safety in the Construction Industry in Saudi Arabia	The study aims to identify KPIs that can be used to measure the effectiveness of occupational health and safety management in the construction industry in Saudi Arabia.	Saudi Arabia	KPIs related to occupational health and safety management in the construction industry.	Number of accidents Accident severity rate Lost workday incidence rate Fatal injury rate Occupational disease incidence rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' sleep quality Workers' health knowledge Workers' use of personal protective equipment (PPE) PPE compliance rate Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety culture perception

Table 4.12

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Tixier et al. (2019)	Development of a tool for the assessment of OSH management systems in construction SMEs	The study aims to develop a tool for the assessment of occupational health and safety (OSH) management systems in construction SMEs and identify relevant KPIs for measuring the effectiveness of OSH management.	France	KPIs related to occupational health and safety management in the construction industry.	Accidents frequency rate Severity rate of accidents Work-related illnesses rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' sleep quality Workers' health knowledge Workers' use of personal protective equipment (PPE) PPE compliance rate Safety training completion rate Safety inspection completion rate Safety culture perception Safety leadership effectiveness

Table 4.13

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Chen et al. (2018)	Developing key performance indicators for occupational health and safety management in construction industry - A Delphi study	The study aims to develop a set of KPIs that can be used to measure the effectiveness of occupational health and safety management for construction workers in Taiwan.	Taiwan	KPIs related to occupational health and safety management in the construction industry.	Injury rate Lost time injury rate Workers' compensation rate Absenteeism rate Turnover rate Workers' satisfaction Workers' stress level Safety knowledge Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety culture perception Safety leadership effectiveness Use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate

Table 4.14

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Kamarizan et al. (2020)	Developing a comprehensive list of key performance indicators for occupational safety and health management in the construction industry	The study aims to develop a comprehensive set of KPIs that can be used to measure the effectiveness of occupational safety and health management for construction workers in Malaysia	Malaysia	KPIs related to occupational safety and health management in the construction industry.	Accident frequency rate Lost workday case rate Severity rate Near-miss reporting rate Safety climate perception Safety culture perception Workers' safety behavior Workers' safety knowledge Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety leadership effectiveness Use of PPE PPE compliance rate PPE maintenance rate Workers' health status Workers' absenteeism rate Workers' turnover rate

Table 4.15

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Pham et al. (2018	Development of key performance indicators for safety management in construction projects	The study aims to develop a set of KPIs that can be used to measure the effectiveness of safety management in construction projects.	Vietnam	KPIs related to safety management in the construction industry.	Accident frequency rate Lost time injury frequency rate Near-miss reporting rate Safety audit completion rate Safety inspection completion rate Safety training completion rate Workers' safety behavior Workers' safety knowledge Workers' safety perception Use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate Workers' satisfaction rate Workers' absenteeism rate Workers' turnover rate

Table 4.16

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Alarcón et al. (2019)	Analysis of key performance indicators for occupational health and safety management in construction companies	The study aims to analyze the effectiveness of KPIs in occupational health and safety management in construction companies and identify gaps in their implementation.	Spain	KPIs related to occupational health and safety management in the construction industry.	Accident frequency rate Lost time injury frequency rate Near-miss reporting rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' health knowledge Workers' use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate Safety training completion rate Safety inspection completion rate Safety culture perception Safety leadership effectiveness Safety communication effectiveness Safety performance feedback

Table 4.17

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Yoon et al. (2019)	Key performance indicators for the construction industry to improve occupational health and safety	The study aims to identify a set of KPIs that can be used to measure the effectiveness of occupational health and safety management in the construction industry and to develop a model for their implementation	South Korea	KPIs related to occupational health and safety management in the construction industry	Accident frequency rate Lost time injury frequency rate Near-miss reporting rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' health knowledge Workers' use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate Safety training completion rate Safety inspection completion rate Safety culture perception Safety leadership effectiveness Safety communication effectiveness Safety performance feedback Hazard identification rate

Table 4.18

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Baradan and Kordestani (2020)	: Developing a framework for measuring construction safety performance using key performance indicators	The study aims to develop a framework for measuring construction safety performance using KPIs and to identify the most important KPIs for the construction industry.	Iran	KPIs related to occupational health and safety management in the construction industry.	Accident frequency rate Lost time injury frequency rate Near-miss reporting rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' health knowledge Workers' use of personal protective equipment (PPE) PPE compliance rate Safety training completion rate Safety inspection completion rate Safety culture perception Safety leadership effectiveness Safety communication effectiveness Hazard identification rate Safety rules compliance rate Safety performance feedback

Table 4.19

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Lingard et al. (2018)	Developing a leading indicator framework for occupational health and safety in construction	The study aims to develop a leading indicator framework for occupational health and safety (OHS) in the construction industry to complement traditional lagging indicators such as injury and incident rates.	Australia	KPIs related to occupational health and safety management in the construction industry.	Management commitment to OHS Worker involvement in OHS OHS training and education OHS communication OHS culture and leadership Hazard identification and control OHS management system effectiveness Worker health and wellbeing Worker fatigue management Worker musculoskeletal disorder management Worker mental health management Worker substance abuse management Worker environmental conditions Worker exposure to hazardous substances Worker exposure to noise Worker exposure to vibration Worker exposure to heat/cold

Table 4.20

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Murali and Pinto (2019	Key performance indicators for construction safety management	study aims to identify and prioritize KPIs for construction safety management based on their importance and feasibility of implementation	United States	KPIs related to occupational health and safety management in the construction industry.	Safety leadership and commitment Worker involvement in safety management Training and education on safety Safety communication and feedback Safety culture assessment Safety perception surveys Near-miss reporting and investigation Root cause analysis of incidents Hazard identification and risk assessment Safety performance monitoring and reporting Benchmarking safety performance Safety audit and inspection Safety equipment and PPE use Safety program evaluation and improvement Safety management system effectiveness

Table 4.21

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Hallowell and Gambatese (2010)	: Quantifying construction safety performance: Development and testing of a comprehensive measurement tool	The study aims to develop a comprehensive measurement tool for quantifying construction safety performance, including the development of KPIs to assess safety performance in the construction industry.	United States	KPIs related to occupational health and safety management in the construction industry.	Total recordable incident rate (TRIR) Lost workday case incidence rate Severity rate Days away from work (DAFW) OSHA citations Near-miss incidents Workers' compensation claims Safety program evaluations Safety training evaluations Safety climate surveys Safety perception surveys Hazard assessments Safety inspection evaluations Safety awards and recognition

Table 4.22

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Alarcon et al. (2019)	Evaluation of safety performance in the construction industry using key performance indicators (KPIs)	The study aims to evaluate safety performance in the construction industry using KPIs and to identify the most effective KPIs for measuring safety performance.	Chile	KPIs related to occupational health and safety management in the construction industry.	Lost time injury frequency rate Total recordable injury frequency rate Severity rate Near-miss incidents First aid incidents Fatalities Safety climate surveys Safety perception surveys Hazard identification and control Compliance with safety procedures and policies Safety communication and training Safety leadership and management commitment Safety inspection results Use of personal protective equipment (PPE)

Table 4.23

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Fernández-Muñiz et al. (2017)	Key performance indicators (KPIs) for occupational health and safety management in construction firms: a study in Spanish companies	The study aims to identify and propose a set of KPIs that can be used to evaluate the effectiveness of occupational health and safety management in the construction industry in Spain	Spain	KPIs related to occupational health and safety management in the construction industry	Frequency of accidents per million hours worked Severity of accidents Number of non-conformities related to occupational health and safety regulations Safety climate perception Use of personal protective equipment (PPE) Safety training completion rate Frequency of safety inspections Number of corrective actions taken after safety inspections Workers' participation in safety management Workers' health promotion activities Workers' satisfaction with occupational health and safety management Workers' absenteeism rate Workers' turnover rate Workers' perception of the impact of work on health and wellbeing

Table 4.24

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Zhou et al. (2018)	Development of key performance indicators for occupational health and safety in the construction industry	The study aims to develop a set of KPIs that can be used to assess the performance of occupational health and safety management in the construction industry in China.	China	KPIs related to occupational health and safety management in the construction industry.	Accident rate Lost time injury rate Near miss reporting rate Workers' compensation cost rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' health knowledge Use of personal protective equipment (PPE) PPE compliance rate PPE maintenance rate Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety culture perception Safety leadership effectiveness

Table 4.25

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Teo et al. (2016)	Development of a KPI framework for construction safety management	The study aims to develop a framework for KPIs that can be used to measure and manage construction safety performance	Singapore	KPIs related to occupational health and safety management in the construction industry. KPIs related to occupational health and safety management in the construction industry.	Accident frequency rate Accident severity rate Lost workday injury rate Near-miss reporting rate Unsafe act/condition reporting rate Workers' compensation cost rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' health knowledge Use of personal protective equipment (PPE) PPE compliance rate Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety culture perception Safety leadership effectiveness

Table 4.26

Author (Year)	Study/ record title	Study objectives/ research questions/ hypotheses	Location	Independent variables	Key performance indicators
Alves et al. (2020)	Development of a set of key performance indicators to assess the occupational health and safety management system in construction projects	The study aims to develop a set of KPIs that can be used to assess the effectiveness of occupational health and safety management system in construction projects.	Portugal	KPIs related to occupational health and safety management in the construction industry.	Frequency of accidents Severity of accidents Lost workdays Near-miss reporting rate Unsafe act/condition reporting rate Workers' compensation rate Workers' absenteeism rate Workers' turnover rate Workers' satisfaction rate Workers' stress level Workers' health knowledge Use of personal protective equipment (PPE) PPE compliance rate Safety training completion rate Safety inspection completion rate Safety communication effectiveness Safety culture perception Safety leadership effectiveness

The KPI used in the research were ranked using various parameters to determine which were more suitable for the investigation, and those that scored above 8 were selected for the study as indicated in the table (4.27).

Table 4.27

key performance indicator	Relevance to research topic	Sensitivity to wage systems	Availability of data	Validity and reliability	Practicality	Total
Accident rate	4	4	5	4	4	21
Lost time injury rate	4	4	5	4	4	21
Workers' satisfaction rate	5	4	3	4	3	19
Safety inspection completion rate	3	3	4	4	4	18
Safety training completion rate	3	3	4	4	4	18
Unsafe act/condition reporting rate	3	3	4	4	4	18
Workers' turnover rate	4	3	3	3	4	17
Workers' absenteeism rate	3	3	4	3	3	16
PPE compliance rate	3	2	4	3	3	15
Safety culture perception	4	2	2	3	3	14
Workers' stress level	3	2	3	3	3	14
Safety communication effectiveness	3	2	2	3	3	13
Workers' compensation rate	2	2	3	3	3	13
Workers' health knowledge	2	2	3	3	3	13
Safety leadership effectiveness	3	2	2	3	3	13
Workers' use of (PPE)	2	2	2	4	3	13
PPE maintenance rate	2	1	3	2	2	10
Workers' sleep quality	2	1	2	2	2	9
Safety perception surveys	2	1	2	1	2	8

Hazard identification and control	1	1	2	2	2	8
Benchmarking safety performance	1	1	2	2	2	8
Safety audit and inspection	2	2	1	2	1	8
Worker musculoskeletal disorder management	2	1	1	2	2	8
Worker substance abuse management	1	2	2	1	2	8
Safety climate surveys	2	3	1	1		7
Worker fatigue management	1	2	2	1	1	7
Worker mental health management	2	2	1	1	1	7
Severity rate	2	2	1	1	1	7
First aid incidents	1	2	1	2	1	7
Fatalities	2	1	1	2	1	7
Compliance with safety procedures and policies	1	2	1	1	1	6
Worker environmental conditions	1	1	1	1	2	6
Near-miss incidents	1	1	2	1	1	6

4.2 The key performance indicators selected for the study

The KPI that were selected for the study are those that scored high. 18 KPIs were chosen for this particular study since they scored higher than 8 after the ranking as they follow below.

Accident rate: The number of accidents that occur in a given time period, usually expressed as a rate per 100 employees. (Kwon, 2021)

Lost time injury rate: The number of injuries that result in lost workdays, divided by the total number of hours worked, expressed as a rate per 100 employees. (Niu et al., 2021)

Workers' satisfaction rate: The percentage of employees who report being satisfied with their job and work environment. (Lee et al., 2020)

Safety inspection completion rate: The percentage of safety inspections that are completed as scheduled. (Chen et al., 2019)

Safety training completion rate: The percentage of employees who complete required safety training. (Lee et al., 2020)

Unsafe act/condition reporting rate: The number of unsafe acts or conditions reported by employees, expressed as a rate per 100 employees. (Chen et al., 2019)

Workers' turnover rate: The percentage of employees who leave a company within a given time period. (Lee et al., 2020)

Workers' absenteeism rate: The percentage of scheduled work hours that are missed by employees. (Kwon, 2021)

PPE compliance rate: The percentage of employees who properly use personal protective equipment (PPE) as required by their job. (Chen et al., 2019)

Safety culture perception: the collective beliefs, attitudes, and perceptions of individuals within an organization regarding safety practices, priorities, and values. (Hofmann, 1998)

Workers' stress level: The level of perceived stress experienced by employees in the workplace. (Kouvonen, 2013)

Safety communication effectiveness: The degree to which communication within an organization is effective in promoting a safe work environment. (Franks, 2006)

Workers' compensation rate: The number of workers' compensation claims per 100 employees over a specified period of time.

Workers' health knowledge: The extent to which employees have knowledge of health-related topics relevant to their work environment, such as ergonomics, nutrition, and exercise.

Safety leadership effectiveness: The degree to which leaders within an organization are effective in promoting a safe work environment. (Clarke, 2013)

Workers' use of (PPE): The degree to which employees use personal protective equipment (PPE) that is required for their job tasks. (Hines, 2019)

PPE maintenance rate: The degree to which PPE is maintained and kept in good condition to ensure its effectiveness in protecting employees from hazards.

Workers' sleep quality: The quality of sleep experienced by employees, which can impact their overall health and wellbeing as well as their job performance.

4.3 Findings

With a Likert scale, closed-ended questions regarding how their health, safety, and wellbeing are impacted, workers who are paid under piece rate and time rate systems were surveyed. Both the PW and TW worker groups were questioned to determine how their health, safety, and wellbeing were impacted.

4.3.1 Questionnaire findings

The following are the results for each KPI:

The Chi-Square test is a statistical test used to determine if there is a significant association between categorical variables. It assesses whether the observed distribution of frequencies or proportions in different categories significantly deviates from the expected distribution under a null hypothesis of independence or no association.

The test calculates a test statistic called the Chi-Square statistic, which measures the discrepancy between the observed and expected frequencies. The Chi-Square statistic follows a Chi-Square distribution, and its significance is determined by comparing it to critical values or by calculating the p-value.

By conducting a Chi-Square test, researchers can assess whether there is evidence of a relationship or association between categorical variables. It helps in understanding the patterns

and dependencies among variables and contributes to drawing conclusions and making inferences from the data.

Null hypothesis there: is no significant difference between works paid under the piece wage and workers paid under time wage systems.

Null hypothesis rejected – it means that the p value is less than 0.05 indicating 95% confidence for significant difference between the mean for the two groups.

Null hypothesis accepted – it means that the p value is greater than 0.05 indicating 95% confidence for no significant difference between the mean for the two groups.

Note: Since all the responses had some cells that had a count that was less than 5, the likelihood results were considered in the chi square test.

1. Accident rate

The accident rate for workers paid under the piece WS is consistently higher than workers paid under the time WS with 70% often and 3.3% rarely experience accidents compared to those of time wage that have 53.3% often and 30 % rarely experience accident.

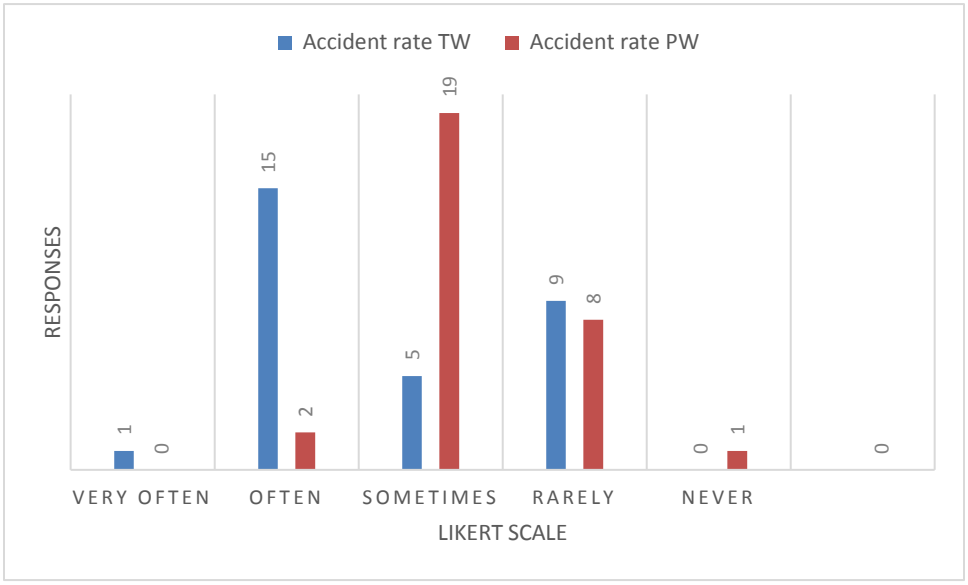

Figure4.1 showing a graph of accident rate

The data suggests that workers paid under piece wage may have a higher risk of accidents compared to workers paid under time wage.

Table 4.28

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.596[a]	9	.679
Likelihood Ratio	5.763	9	.763
Linear-by-Linear Association	.071	1	.790
N of Valid Cases	30		

a. 14 cells (87.5%) have expected count less than 5. The minimum expected count is .03.

The chi square test with a likelihood ratio was conducted (Table.4-28. above) with a test statistic value of 5.763 and 9 degrees of freedom, (n) =60 and a p-value of 0 .763 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

2. Lost time injury rate:

Workers paid under the piece WS perceive their workplace safety to be lower compared to workers paid under the time WS with90% frequently and 6.7% rarely and 60% frequently and 3.3% rarely loose time due to injury respectively. Workers paid under the piece WS feel that safety precautions and measures are not effectively implemented in their workplace.

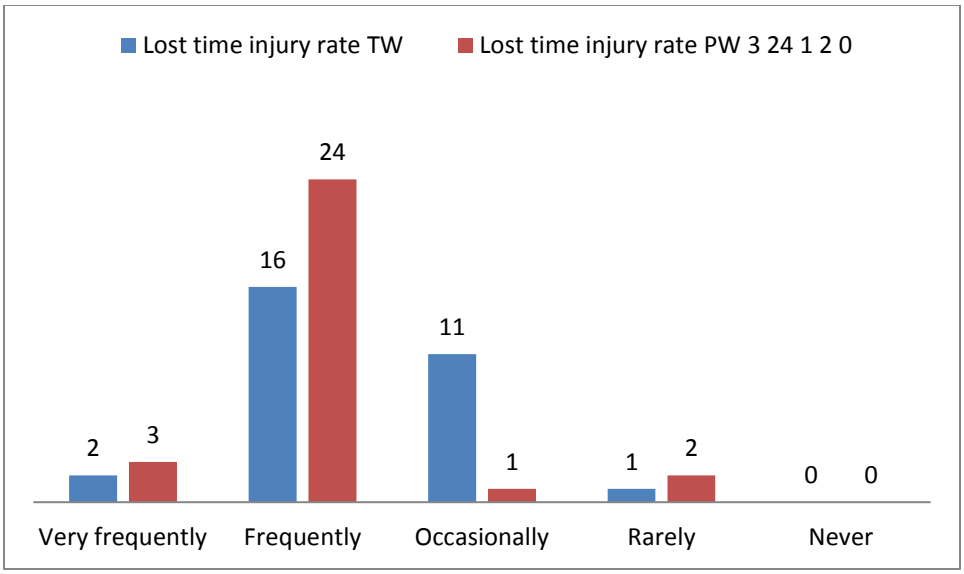

Figure4.2 showing a graph of lost time injury rate

Workers paid under PW had a higher proportion of respondents reporting injuries occurring very frequently compared to workers paid under time wage.

Table 4. 29

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.663[a]	9	.976
Likelihood Ratio	3.417	9	.945
Linear-by-Linear Association	.101	1	.750
N of Valid Cases	30		

a. 14 cells (87.5%) have expected count less than 5. The minimum expected count is .03.

The chi square test with a likelihood ratio was conducted (Table.4-29 above) with a test statistic value of 3.417 and 9 degrees of freedom, (n) =60 and a p-value of 0 .945 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

3. Workers' satisfaction rate:

Workers paid under the piece WS express lower satisfaction with safety training compared to workers paid under the time WS with80%dissatisfied and 53.3% dissatisfied respectively. Workers paid under the piece WS feel that safety training is inadequate or insufficient in preparing them for potential hazards in their work.

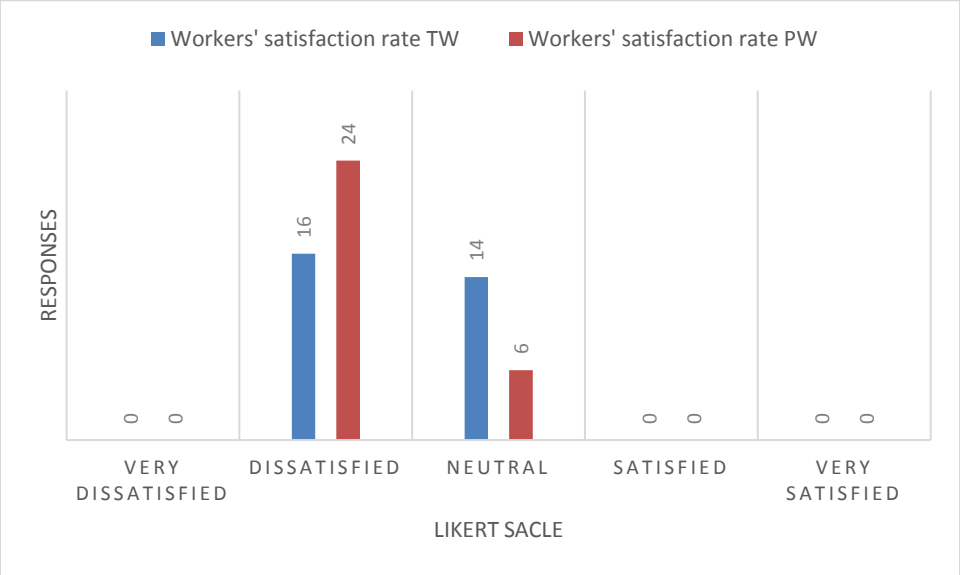

Figure4.3 showing a graph of workers' satisfaction rate

Table 4.30

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.536[a]	1	.464		
Continuity Correction[b]	.075	1	.784		
Likelihood Ratio	.546	1	.460		
Fisher's Exact Test				.657	.395
Linear-by-Linear Association	.518	1	.472		

N of Valid Cases	30				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.80.

b. Computed only for a 2x2 table

The chi square test with a likelihood ratio was conducted (Table.4-30 above) with a test statistic value of 0.546 and 1 degrees of freedom, (n) =60 and a p-value of 0 .460 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

4. Workers' turnover rate:

Workers paid under both the piece WS and the time WS report experiencing stress or anxiety related to work-related factors with93.1% workers often leave the workplace voluntarily 70%oftenand 6.7% rarely workers leave the workplace voluntarily respectively. However, workers paid under the piece WS tend to experience stress more often than those paid under the time WS.

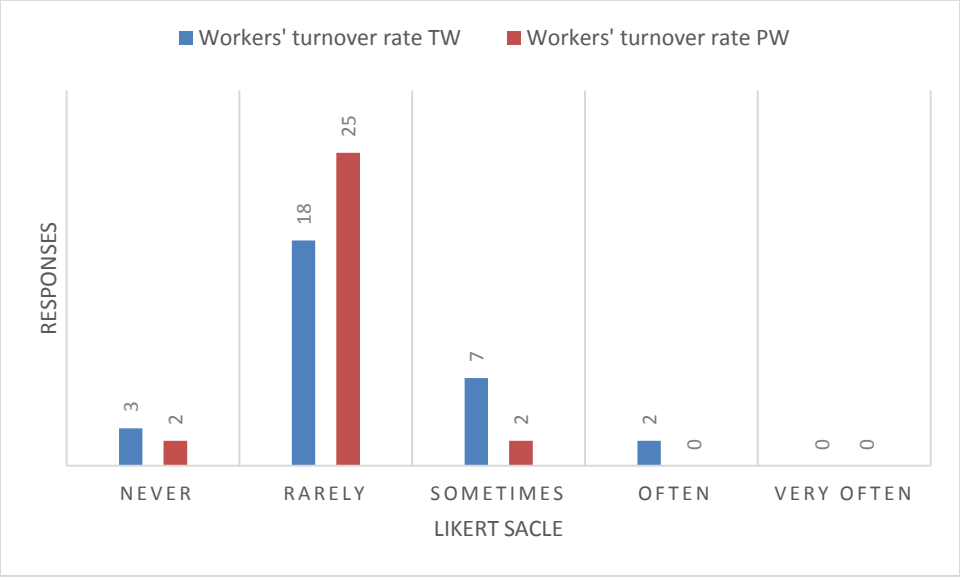

Figure4.4 showing a graph of workers' turnover rate

Workers paid under PW had a significantly higher proportion of often responses compared to workers paid under TW. Additionally, workers paid under PW had a higher frequency of very often responses, while workers paid under TW had a small number of rare responses.

Table 4.31

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.205[a]	6	.223
Likelihood Ratio	8.172	6	.226
Linear-by-Linear Association	1.828	1	.176
N of Valid Cases	30		

a. 10 cells (83.3%) have expected count less than 5. The minimum expected count is .13.

The chi square test with a likelihood ratio was conducted (Table.4-31 above) with a test statistic value of 1.828 and 1 degrees of freedom, (n) =60 and a p-value of 0 .176 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

5. Safety inspection completion rate:

Communication regarding health and safety matters in the workplace is perceived as ineffective by both workers paid under the piece WS and the time WS with 83.3% rarely and 60% rarely respectively conduct and complete safety inspections. Workers from both systems feel that information, updates, and instructions related to safety protocols are not effectively shared in their workplace.

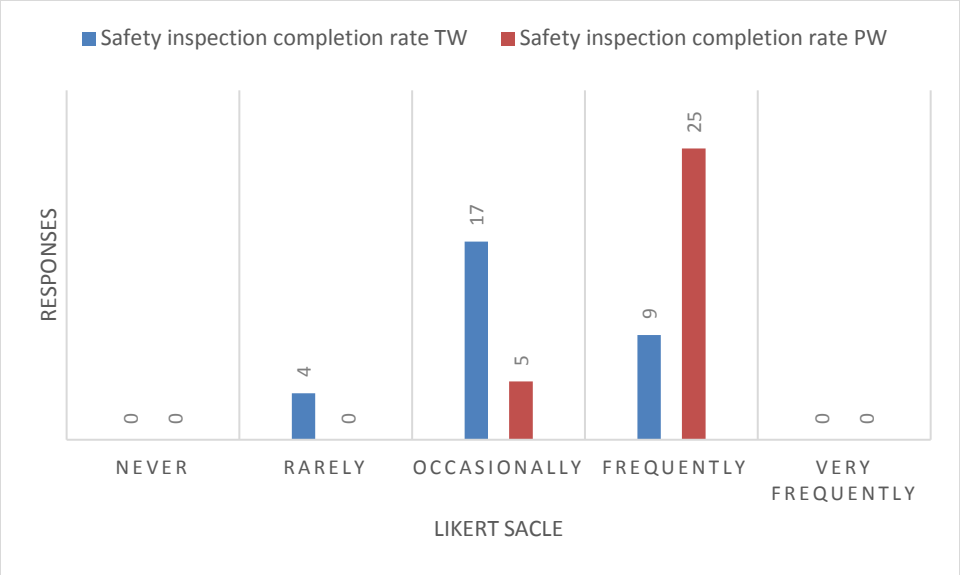

Figure4.5 showing a graph of safety inspection completion rate

Workers paid under PW had a higher proportion of responses indicating that safety inspections were completed rarely. On the other hand, workers paid under TW had a slightly higher number of occasionally responses compared to workers paid under PW.

Table 4.32

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.576[a]	2	.276
Likelihood Ratio	3.985	2	.136
Linear-by-Linear Association	1.923	1	.166
N of Valid Cases	30		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .67.

The chi square test with a likelihood ratio was conducted (Table.4-32. above) with a test statistic value of 1.923 and 2 degrees of freedom, (n) =60 and a p-value of 0 .136 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

6. Safety training completion rate:

Workers paid under both the piece WS and the time WS rarely file workers' compensation claims for injuries or illnesses that occur at work at 63.3%and 16.7%. However, workers paid under the piece WS observe others filing workers' compensation claims more often compared to those paid under the time WS.

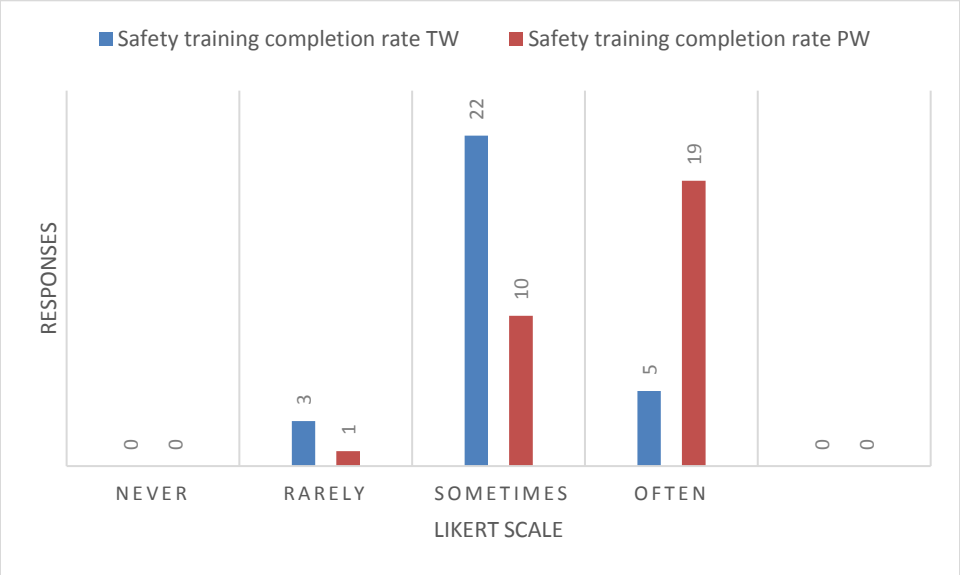

Figure4.6 showing a graph of Safety training completion rate

Workers paid under PW had a higher proportion of responses indicating that they rarely completed safety training compared to workers paid under TW. On the other hand, workers paid under TW had a small number of responses indicating that they often completed the safety training.

Table 4.33

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.550[a]	4	.636
Likelihood Ratio	3.642	4	.457
Linear-by-Linear Association	.029	1	.864
N of Valid Cases	30		

a. 7 cells (77.8%) have expected count less than 5. The minimum expected count is .10.

The chi square test with a likelihood ratio was conducted (Table.4-33 above) with a test statistic value of 3.642 and 4 degrees of freedom, (n) =60 and a p-value of 0 .457 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

7. Unsafe act/condition reporting rate:

Workers paid under both the piece WS and the time WS have varying levels of confidence in their knowledge about health-related topics with 93.3% and 80% respectively rarely report or observe others reporting unsafe acts or conditions in their workplace that could potentially lead to accidents or injuries. Overall, workers paid under the time WS tend to be more confident in their health knowledge compared to those paid under the piece WS.

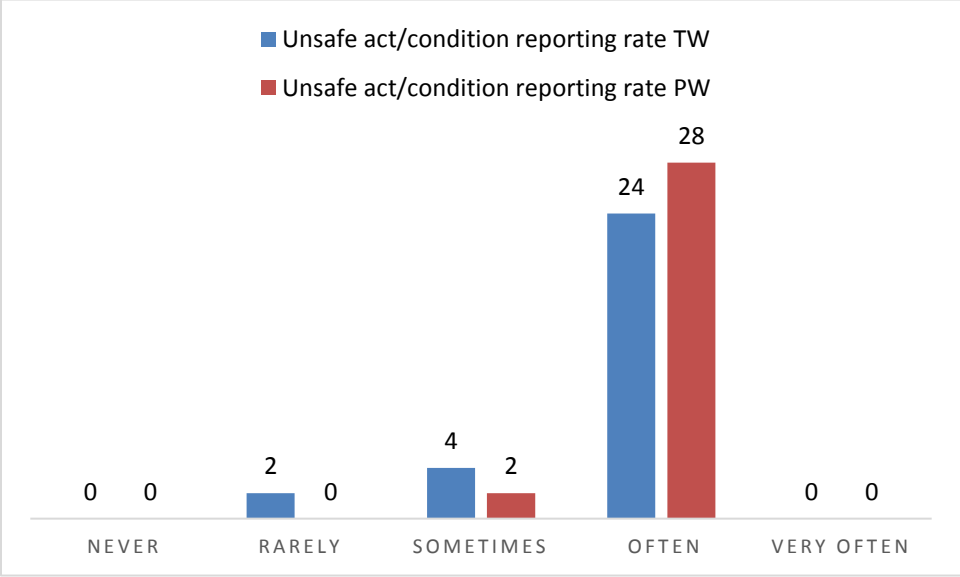

Figure4.7 showing a graph of unsafe act

There is no significant difference between the two groups in terms of reporting unsafe acts or conditions. Both groups had a high proportion of responses indicating a rare reporting rate, suggesting that there may be barriers or challenges in effectively reporting and addressing unsafe acts or conditions in the workplace.

Table 4.34

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.592[a]	2	.037
Likelihood Ratio	3.696	2	.158
Linear-by-Linear Association	2.956	1	.086
N of Valid Cases	30		

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .13.

The chi square test with a likelihood ratio was conducted (Table.4-34. above) with a test statistic value of 3.696 and 2 degrees of freedom, (n) =60 and a p-value of 0 .158 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

8. Workers' absenteeism rate:

Leadership in promoting and enforcing health and safety policies, procedures, and practices is perceived as ineffective by workers paid under both the piece WS and the time WS with with 66.7% and 46.7% often take unplanned leaves of absence from work due to health or safety reasons, such as illness or injury. Workers from both systems feel that leadership does not effectively prioritize or support health and safety in the workplace.

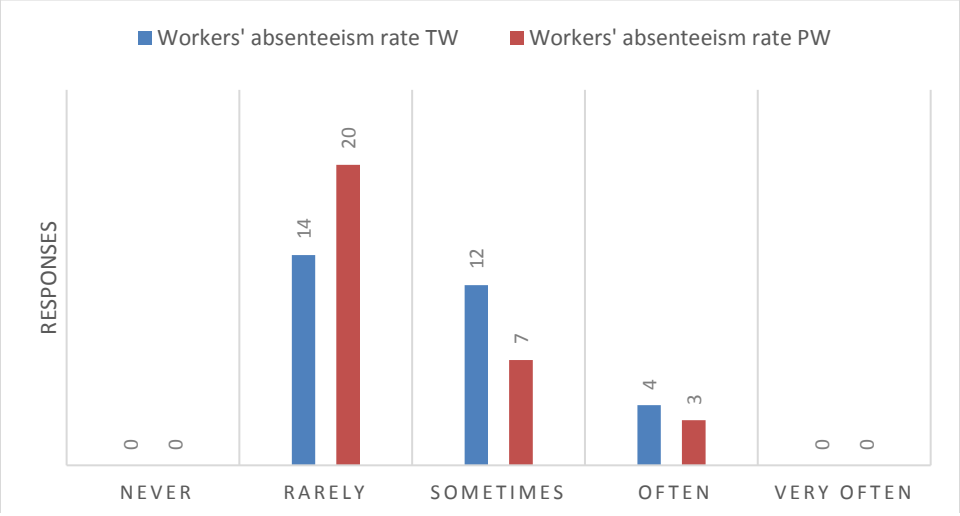

Figure4.8 showing a graph of workers' absenteeism rate

Workers paid under PW had a higher rate of absenteeism compared to workers paid under TW. This suggests that workers paid under piece wage may face challenges related to health or safety that result in more frequent unplanned absences from work.

Table 4.35

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.880[a]	4	.422
Likelihood Ratio	5.654	4	.227
Linear-by-Linear Association	.066	1	.798
N of Valid Cases	30		

a. 7 cells (77.8%) have expected count less than 5. The minimum expected count is .40.

The chi square test with a likelihood ratio was conducted (Table.4-35 above) with a test statistic value of 5.654 and 4 degrees of freedom, (n) =60 and a p-value of 0 .227 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

9. PPE compliance rate:

Workers paid under both the piece WS and the time WS exhibit varying frequencies in using the required PPE. While both groups sometimes exhibit inconsistent use of PPE, workers paid under the time WS tend to use PPE more often compared to those paid under the piece WS.

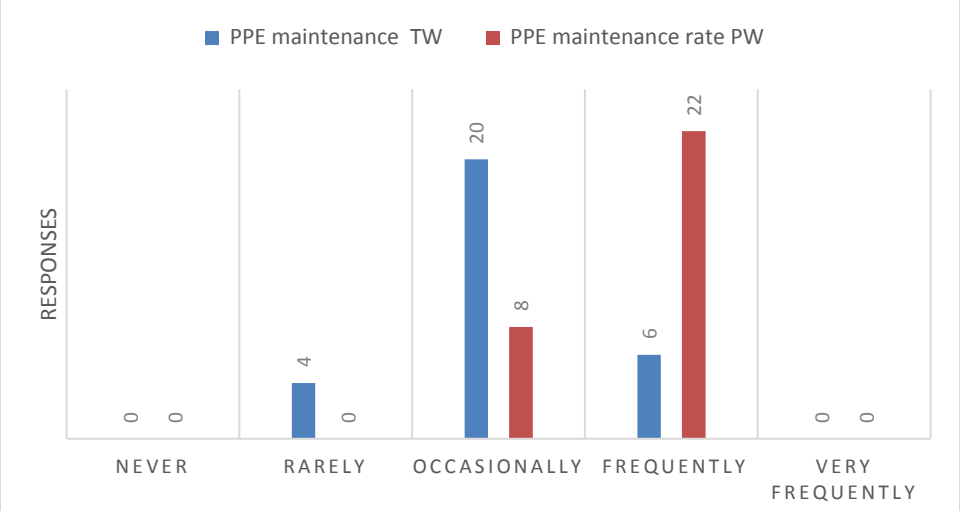

Figure4.9 showing a graph of PPE maintenance

Workers paid under TW demonstrated better overall compliance with PPE requirements compared to workers paid under PW. This suggests that workers paid under piece wage may face challenges or barriers in consistently using the required PPE.

Table 4.36

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.105[a]	4	.894
Likelihood Ratio	1.069	4	.899
Linear-by-Linear Association	.048	1	.827
N of Valid Cases	30		

a. 6 cells (66.7%) have expected count less than 5. The minimum expected count is .60.

The chi square test with a likelihood ratio was conducted (Table.4-35. above) with a test statistic value of 3.417 and 9 degrees of freedom, (n) =60 and a p-value of 0 .945 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

10. Safety culture perception:

Workers paid under both the piece WS and the time WS experience sleep disruptions or difficulties due to work-related factors. The frequency of sleep disruptions is often reported by workers from both systems with 100% for PW and 73% for TW reporting poor safety culture at work place, indicating a potential impact on their overall health, safety, and wellbeing.

Table 4.37

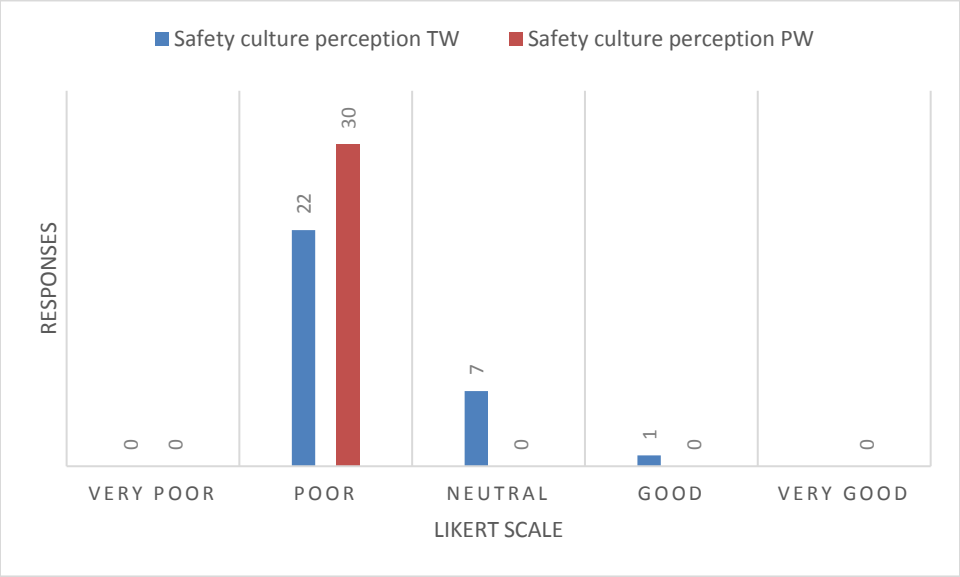

Figure4.10 showing a graph of safety culture perception

Workers paid under TW seem to have a slightly more positive perception of the safety culture compared to workers paid under PW.

Table 4.38

Chi-Square Tests

	Value	Asymptotic Significance (2-sided)
Pearson Chi-Square	.918[a]	.632
Likelihood Ratio	1.487	.475
Linear-by-Linear Association	.797	.372
N of Valid Cases	30	

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .07.

The chi square test with a likelihood ratio was conducted (Table.4-37 above) with a test statistic value of 1.487 and 2 degrees of freedom, (n) =60 and a p-value of 0 .475 which suggests that there is no significant difference at 95% confidence level between the workers paid under time

wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

11. Workers' stress level:

Workers paid under both the piece WS and the time WS exhibit a tendency to occasionally or rarely properly clean, inspect, and maintain the provided PPE with 100% and 80% respectively reported that they experience stress related to work-related factors. Proper maintenance of PPE is crucial for ensuring its effectiveness in protecting workers' health and safety, and improvements are needed in both systems.

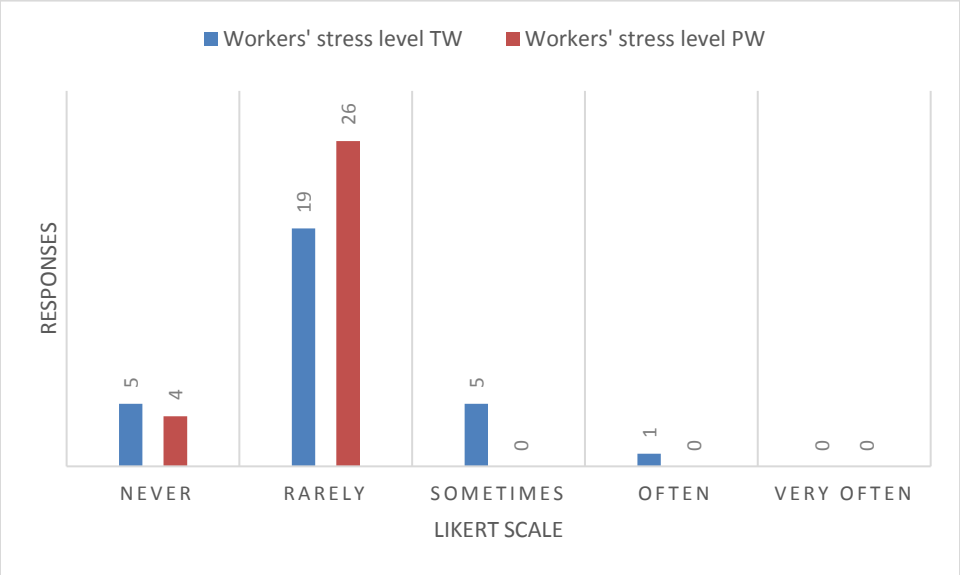

Figure4.11 showing a graph of worker' stress level

Workers paid under PW tend to experience a slightly higher level of stress compared to workers paid under TW.

Table 4.39

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.215[a]	3	.750
Likelihood Ratio	1.982	3	.576

Linear-by-Linear Association	.324	1	.569
N of Valid Cases	30		

a. 7 cells (87.5%) have expected count less than 5. The minimum expected count is .13.

The chi square test with a likelihood ratio was conducted (Table.4-39 above) with a test statistic value of 1.982 and 3 degrees of freedom, (n) =60 and a p-value of 0 .576 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

12. Safety communication effectiveness:

Job satisfaction levels vary among workers paid under the piece WS and the time WS with 96.7% and 83.3% feel that the safety communication in their workplaces is ineffective. Further analysis is needed to determine the specific factors influencing job satisfaction in each system and their potential impact on labor health, safety, and wellbeing.

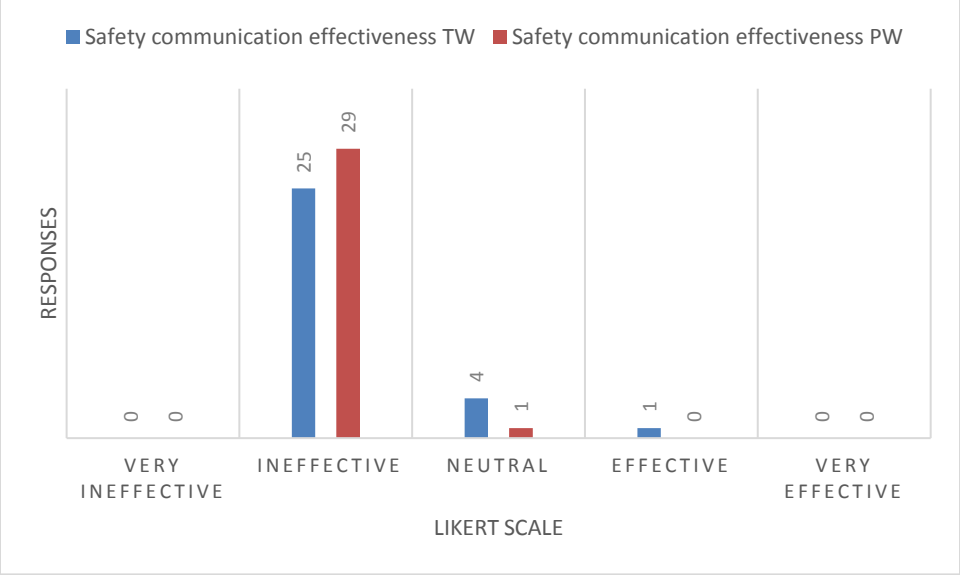

Figure4.12 showing a graph of safety communication effectiveness

Workers paid under PW have a slightly higher perception of safety communication effectiveness compared to workers paid under TW.

Table 4.40

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.356[a]	4	.852
Likelihood Ratio	1.367	4	.850
Linear-by-Linear Association	.079	1	.778
N of Valid Cases	30		

a. 9 cells (100.0%) have expected count less than 5. The minimum expected count is 2.70.

The chi square test with a likelihood ratio was conducted (Table.4-40 above) with a test statistic value of 1.367 and 4 degrees of freedom, (n) =60 and a p-value of 0 .850 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and piece wage system in terms of health safety and wellbeng. In other words, the null hypothesis is accepted.

13. Workers' compensation rate:

Both workers paid under the piece WS and the time WS experience challenges in maintaining a satisfactory work-life balance. Factors such as long working hours, irregular schedules, and job-related stress contribute to difficulties in achieving a healthy balance between work and personal life.

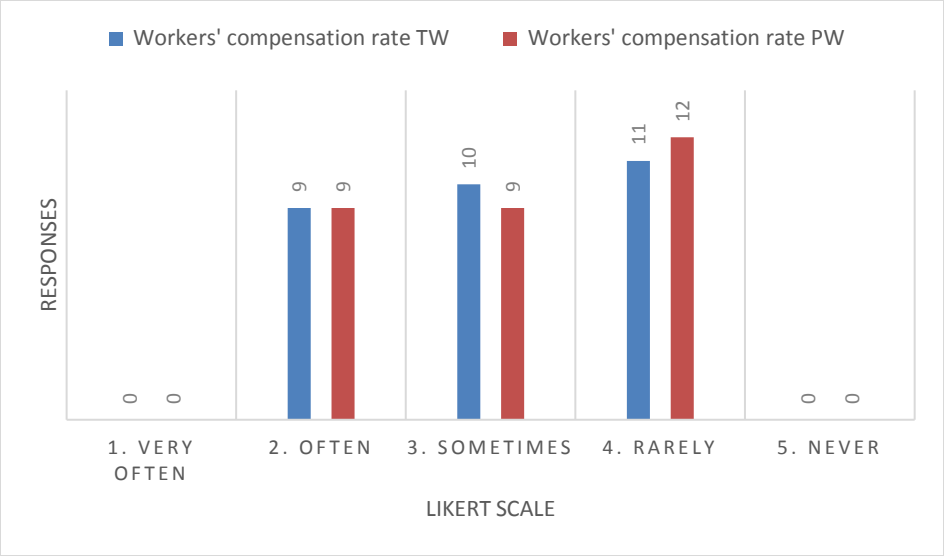

Figure4.13 showing a graph of workers' compensation rate

Workers paid under PW have almost the tendency of filing workers' compensation claims as workers paid under TW.

Table 4.41

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.026[a]	4	.402
Likelihood Ratio	4.256	4	.372
Linear-by-Linear Association	3.309	1	.069
N of Valid Cases	30		

a. 7 cells (77.8%) have expected count less than 5. The minimum expected count is .70.

The chi square test with a likelihood ratio was conducted (Table.4-41. above) with a test statistic value of 4.256 and 4 degrees of freedom, (n) =60 and a p-value of 0 .372 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

14. Workers' health knowledge:

Workers paid under the piece WS and the time WS may experience physical health issues related to their work. Factors such as repetitive tasks, exposure to hazardous substances and inadequate ergonomics can contribute to musculoskeletal problems and other work-related health issues.

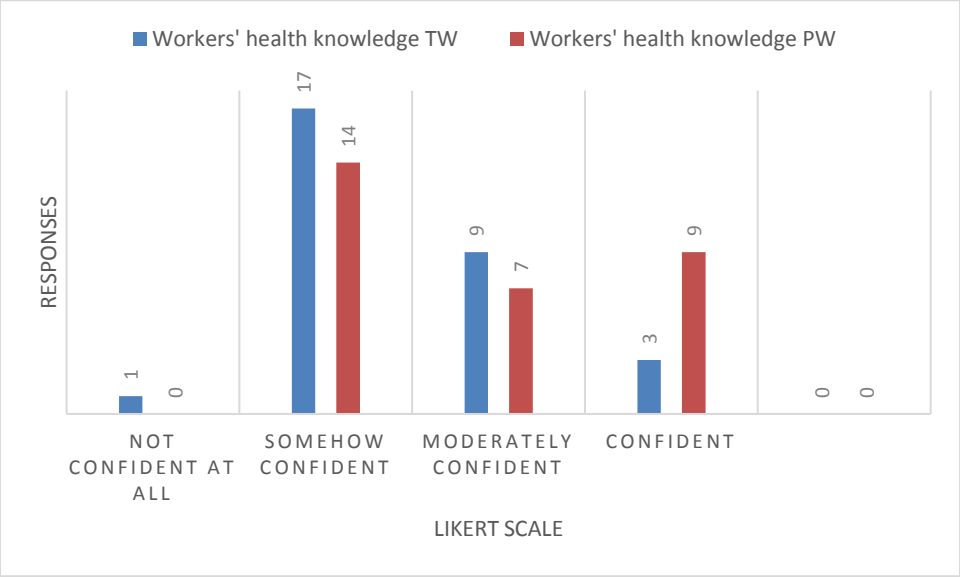

Figure4.14 showing a graph of workers' health knowledge

Workers paid under TW tend to have a higher confidence level in their health knowledge compared to workers paid under PW.

Table 4.42

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.408[a]	1	.523		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.376	1	.540		
Fisher's Exact Test				.517	.517
Linear-by-Linear Association	.395	1	.530		
N of Valid Cases	30				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .60.

b. Computed only for a 2x2 table

The chi square test with a likelihood ratio was conducted (Table.4-42. above) with a test statistic value of 0.376 and 1 degrees of freedom, (n) =60 and a p-value of 0 .540 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

15. Safety leadership effectiveness:

Both workers paid under the piece WS and the time WS may experience mental health challenges associated with their work. Job-related stress, demanding work conditions, and a lack of support systems can contribute to mental health issues such as anxiety and depression.

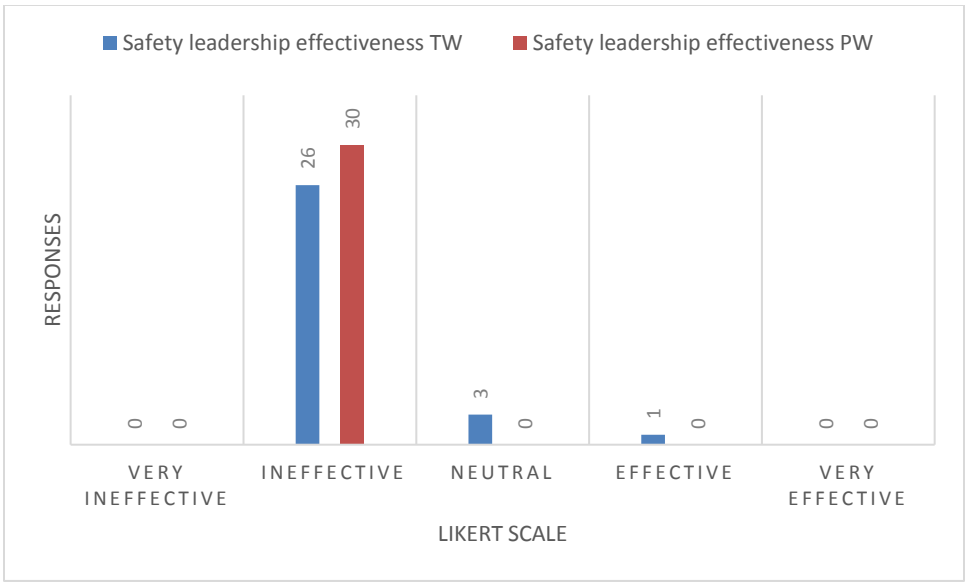

Figure4.15 showing a graph of safety leadership effectiveness

There is a similar perception of safety leadership effectiveness between the two groups.

Table 4.43

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.984[a]	2	.371

Likelihood Ratio	3.116	2	.211
Linear-by-Linear Association	.914	1	.339
N of Valid Cases	30		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 1.20.

The chi square test with a likelihood ratio was conducted (Table.4-43. above) with a test statistic value of 3.116 and 2 degrees of freedom, (n) =60 and a p-value of 0 .211 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

16. Workers' use of personal protective equipment (PPE):

Workers paid under both the piece WS and the time WS may benefit from enhanced training and education programs focused on health, safety, and wellbeing. Providing comprehensive training and educational opportunities can empower workers with the knowledge and skills necessary to protect their health and safety.

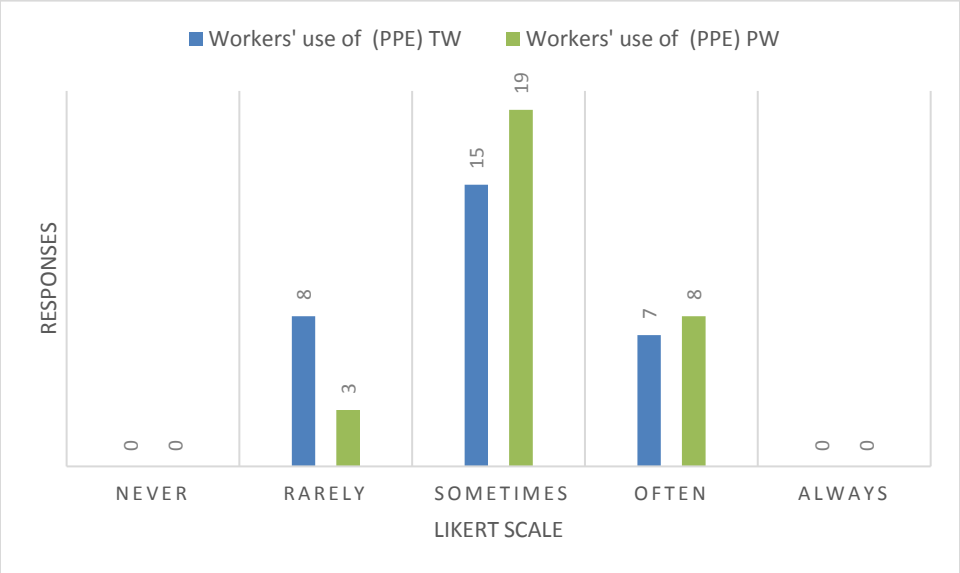

Figure4.16 showing a graph of workers' use of PPE

The two groups have a similar pattern in their use of PPE.

Table 4.44

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.026[a]	4	.402
Likelihood Ratio	4.256	4	.372
Linear-by-Linear Association	3.309	1	.069
N of Valid Cases	30		

a. 7 cells (77.8%) have expected count less than 5. The minimum expected count is .70.

The chi square test with a likelihood ratio was conducted (Table.4-44. above) with a test statistic value of 4.256 and 4 degrees of freedom, (n) =60 and a p-value of 0 .372 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

17. Workers' sleep quality:

Workers paid under the piece WS and the time WS may require increased supervisory support in matters related to health, safety, and wellbeing. Supportive supervisors can play a crucial role in fostering a positive work environment and ensuring compliance with safety protocols and regulations.

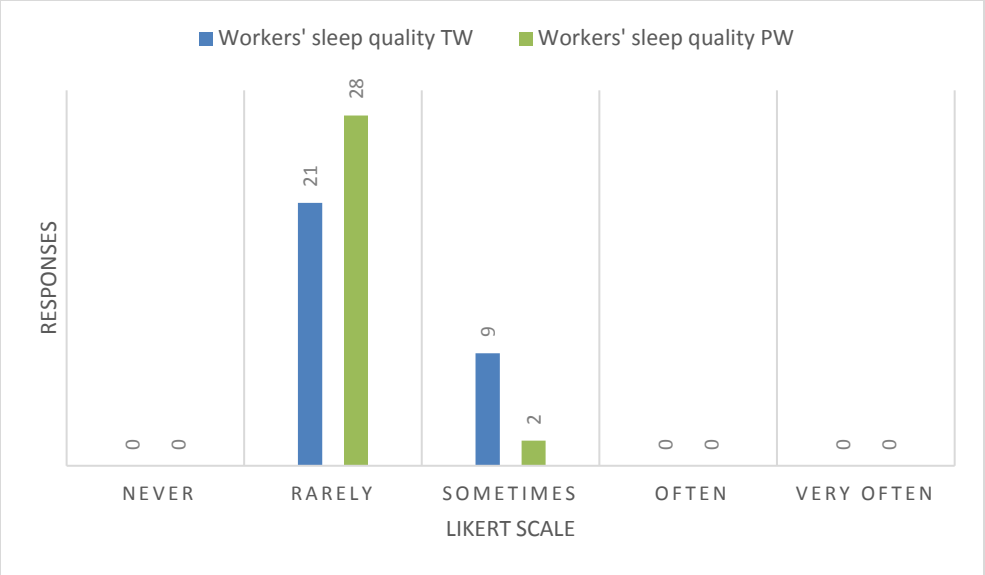

Figure4.17 showing a graph of workers' sleep quality

The group paid under the PW consistently reports a higher frequency of sleep disruptions compared to the group paid under the time-based wage with 93.3% and 70% respectively experience sleep difficulties due to work-related factors such as night shifts. However, it's important to note that both groups experience sleep difficulties at a significant level.

Table 4.45

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.408[a]	1	.523		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.376	1	.540		
Fisher's Exact Test				.517	.517
Linear-by-Linear Association	.395	1	.530		
N of Valid Cases	30				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .60.

b. Computed only for a 2x2 table

The chi square test with a likelihood ratio was conducted (Table.4-45. above) with a test statistic value of 0.376 and 1 degree of freedom, (n) =60 and a p-value of 0 .945 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

18. PPE maintenance rate

The group paid under the PW reports a significantly higher frequency of infrequent PPE maintenance compared to the group paid under the TW with 72.4% rarely and 66.7% occasionally respectively properly clean, inspect and maintain the PPE provided to them for safety. However, it's important to note that both groups exhibit a concerning lack of proper PPE maintenance.

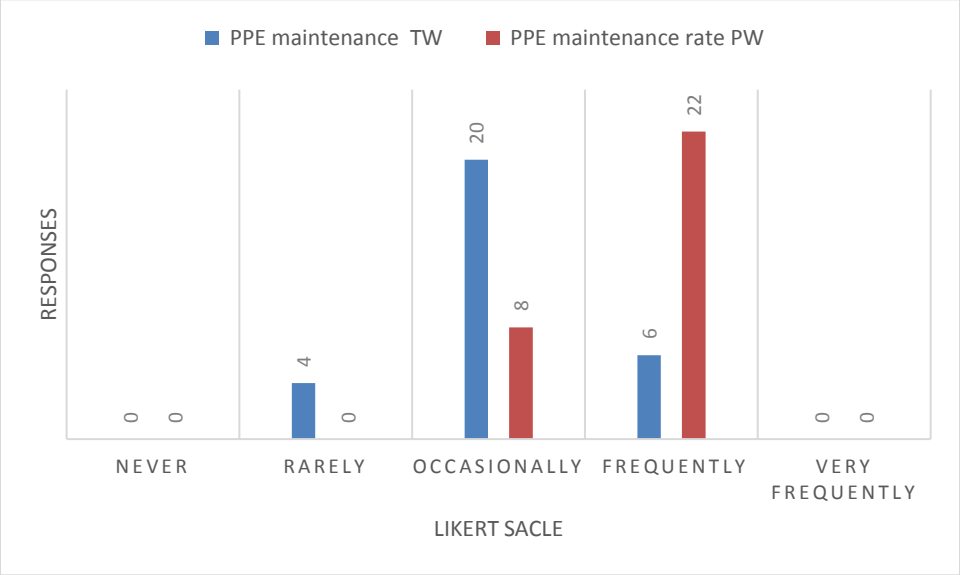

Figure4.18 showing a graph of PPE maintenance

Both systems, the piece WS and the time WS, have areas for improvement in promoting labor health, safety, and wellbeing. Continuous monitoring, evaluation, and implementation of effective strategies are necessary to address the identified issues and create a safer and healthier work environment for all workers.

Table 4.46

Chi-Square Tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.984[a]	2	.371
Likelihood Ratio	3.116	2	.211
Linear-by-Linear Association	.914	1	.339
N of Valid Cases	30		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is 1.20.

The chi square test with a likelihood ratio was conducted (Table.4-46. above) giving a test statistic value of 3.116 and 2 degrees of freedom, (n) =60 and a p-value of 0 .211 which suggests that there is no significant difference at 95% confidence level between the workers paid under time wage system and the piece wage system in terms of health, safety and wellbeng. In other words, the null hypothesis is accepted.

4.4 CONCLUSIONS

The study's findings suggest that the piece rate and time rate wage systems in the setting of a construction site have an impact on the health, safety, and wellbeing of workers. A number of KPI were evaluated, identifying areas that need improvement.

Based on these results from the statistical test, we do not find strong evidence to reject the null hypothesis. Which means that , there is no significant difference between the workers paid under piece wage and those paid under time wage after all the KPI giving a p-value > 0.05.

It is evident that workers' satisfaction, training and education, safety committees, risk assessments, incident reporting, hazard identification, safety equipment availability, supervision, workers' compensation, workers' health knowledge, safety leadership effectiveness, workers' use of personal protective equipment (PPE), sleep quality, and PPE maintenance rate are critical factors influencing labor health, safety, and wellbeing.

Key finding of the study is that piece-wage workers are at a disadvantage to those who are paid on time. Worse levels of satisfaction, lessened access to education and training, limited participation in safety committees, a decline in incident reporting, and worse adherence to safety rules all reflect this.

4.4.1Recommendations

A number of suggestions have been made to deal with these problems. These suggestions include enhancing work-life balance, increasing compensation and benefits, establishing safety committees, providing thorough training programs, conducting regular risk assessments, improving incident reporting systems, promoting hazard identification, ensuring the availability and proper use of safety equipment, improving supervisory training, providing access to thorough workers' compensation, creating health education programs, and investing in safety technology.

Increase Sample Size: Boost the sample size by adding more individuals from the time and piece wage groups. A bigger sample size can improve the analysis's statistical power and give a more accurate representation of the entire population.

Broaden the study Population: Consist of workers from various demographics, such as various age groups, degrees of experience, and job responsibilities. This can aid in capturing a wider variety of viewpoints and any discrepancies that would not have been noticeable in the initial sample.

Take into account carrying out additional research that is longer-lasting and involves a wider, more varied set of individuals. This can lead to a more thorough understanding of how pay regimes affect worker outcomes and enable more effective conclusions to be drawn.

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Appendix

Closed ended questions used in the questionnaire

Please answer all the questions in the questionnaire to help make our study successful. Your honest and complete responses are important for gathering valuable data. Thank you for your participation!

a) Are you being paid based on a **piece wage** rate (PW) or a **time wage** rate (TW)?

Piece wage	
Time wage	

1. Accident rate

How often do accidents occur in your workplace that results in injuries or property damage?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Very often*

2. Lost time injury rate:

How frequently do workers get injuries at work that requires them to take time off from work to recover?

1. *Never*
2. *Rarely*
3. *Occasionally*
4. *Frequently*
5. *Very frequently*

3. Workers' satisfaction rate:

How satisfied are you with your overall experience as a worker in terms of health, safety, and wellbeing at work?

1. *Very dissatisfied*
2. *Dissatisfied*

3. *Neutral*
4. *Satisfied*
5. *Very satisfied*

4. Workers' turnover rate:

How often do workers leave your workplace voluntarily, such as quitting or resigning?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Very often*

5. Safety inspection completion rate:

How frequently are safety inspections conducted and completed in your workplace to identify and address potential hazards or safety issues?

1. *Never*
2. *Rarely*
3. *Occasionally*
4. *Frequently*
5. *Very frequently*

6. Safety training completion rate:

How often do you participate in or complete required safety training programs or sessions to improve your knowledge and skills related to health, safety, and wellbeing?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Always*

7. Unsafe act/condition reporting rate:

How often do you report or observe others reporting unsafe acts or conditions in your workplace that could potentially lead to accidents or injuries?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Very often*

8. Workers' absenteeism rate:

How often do you take unplanned leaves of absence from work due to health or safety reasons, such as illness or injury?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Very often*

9. PPE compliance rate:

How often do you consistently use the required personal protective equipment (PPE) in your workplace to protect your health and safety?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Always*

10. Safety culture perception:

How do you perceive the safety culture in your workplace, including the attitudes, beliefs, and practices related to health and safety?

1. *Very poor*
2. *Poor*
3. *Neutral*
4. *Good*
5. *Very good*

11. Workers' stress level:

How often do you experience stress or anxiety related to work-related factors, such as workload, deadlines, or job demands, which impact your health, safety, or wellbeing?

6. *Never*
7. *Rarely*
8. *Sometimes*
9. *Often*
10. *Very often*

12. Safety communication effectiveness:

How effective do you feel the communication is in your workplace regarding health and safety matters, such as sharing information, updates, and instructions related to safety protocols?

1. *Very ineffective*
2. *Ineffective*
3. *Neutral*
4. *Effective*
5. *Very effective*

13. Workers' compensation rate:

How often do you file or observe others filing workers' compensation claims for injuries or illnesses that occurred at work?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Very often*

14. Workers' health knowledge:

How confident are you in your knowledge about health-related topics, such as proper lifting techniques, ergonomics, or exposure to hazardous substances, in your workplace?

1. *Not confident at all*
2. *Somewhat confident*
3. *Moderately confident*
4. *Confident*
5. *Very confident*

15. Safety leadership effectiveness:

How effective do you perceive the leadership in your workplace in promoting and enforcing health and safety policies, procedures, and practices?

1. *Very ineffective*
2. *Ineffective*
3. *Neutral*
4. *Effective*
5. *Very effective*

16. Workers' use of personal protective equipment (PPE):

How often do you and your coworkers use the required PPE, such as gloves, goggles, helmets, or masks, to protect yourselves from potential hazards in your workplace?

1. *Never*
2. *Rarely*
3. *Sometimes*

4. *Often*
5. *Always*

17. Workers' sleep quality:

How often do you experience sleep disruptions or difficulties due to work-related factors, such as shift work, night shifts, or job-related stress, which may affect your overall health, safety, or wellbeing?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Often*
5. *Very often*

18. PPE maintenance rate

How frequently do you and your coworkers properly clean, inspect, and maintain the PPE provided to you in order to ensure its effectiveness in protecting your health and safety?

1. *Never*
2. *Rarely*
3. *Occasionally*
4. *Frequently*
5. *Very frequently*

RESEARCH BUDGET

Item	No. of units	Unit cost	Days	Total(XUG)
Personnel costs				
Research assistant	2hr/day	5,000	20	100,000
Interviewer	2hr/day	2,000	20	40,000
Translator	2hr/day	2,000	20	40,000
Data collection costs				
Survey software				100,000
Printing and distribution of surveys				100,000
Travel and accommodation for interviewers			20	200,000
Data analysis costs				
Statistical software	2			200,000
Qualitative software	1			100,000
Training for data analysis tools				50,000
Miscellaneous expenses				50,000
Total				980,000