

OCCUPATIONAL HEALTH AND SAFETY PRACTICES AND EMPLOYEE PRODUCTIVITY AT THE KENYA NATIONAL CIVIL REGISTRATION OFFICE, NAIROBI CITY COUNTY, KENYA

Christine Auma Otieno.

Student, Masters in Public Policy and Administration, Kenyatta University, Kenya.

Weldon Kibet Ng'eno.

Lecturer, Department of Public Policy and Administration, Kenyatta University, Kenya.

©2025

International Academic Journal of Arts and Humanities (IAJAH) | ISSN 2520-4688

Received: 9th October 2025

Published: 21st October 2025

Full Length Research

Available Online at: https://iajournals.org/articles/iajah_v1_i5_455_466.pdf

Citation: Otieno, C. A., Ng'eno, W. K. (2025). Occupational health and safety practices and employee productivity at the Kenya National Civil Registration Office, Nairobi City County, Kenya. *International Academic Journal of Arts and Humanities*, 1(5), 455-466.

ABSTRACT

As the nation's economy has grown and the public and private sectors have expanded, there has been a growing interest in the connection between occupational safety and health (OSH) practices and worker productivity. Many organizations have recognized that inadequate safety standards not only endanger employees but also compromise productivity by contributing to increased absenteeism, higher medical costs, and reduced employee morale. The study assessed the effect of workplace safety practices on employee productivity at the Kenya National Civil Registration office. This study was anchored on Goal-Setting, Behavior-Based Safety (BBS) theory. A descriptive study design was adopted, targeting 200 administrative staff, 105 registrars, and 351 clerical officers. The study used disproportionate stratified sampling, to sample 100 administrative staff, 52 registrars, and 70 clerical officers. Primary data collection was done using a questionnaire and an interview guide. The analysis of the quantitative data was done

using mean and standard deviation. The findings of this study conclusively demonstrate that a positive and significant relationship exists between occupational health and safety practices and employee productivity at the Kenya National Civil Registration office. The evidence suggests that a robust and comprehensive safety program is not merely a compliance issue but is a fundamental driver of a productive workforce. The study recommended that Recommendations. The Kenya National Civil Registration office should establish a standardized and centrally managed occupational health and safety policy. The organization should invest in upgrading its ergonomic equipment to address physical discomfort among employees. A mandatory, hands-on safety training program should be implemented to ensure all employees are confident in their skills.

Keywords: Workplace Safety Practices on Employee Productivity.

INTRODUCTION

The ILO (2019) estimates that over 2.3 million people lose their lives to occupational diseases or injuries annually. Nearly two million people die from deadly sickness related to their work, and more than 350,000 people die in deadly accidents. Furthermore, more employees in the upward of 313 million get involved in fatal accidents within their places of work culminating in significant injuries loss of man hours. Additionally, 160 million ailments related to work, though non-fatal annually, are reported including 860,000 workers harmed daily in their course of their duty and at least 6,400 deaths attributed to occupational accidents and ailments (ILO, 2019).

Organizational management is greatly impacted by contemporary issues including globalization, regulatory requirements, and the technological revolution. These issues include shifting work, workplaces, and employees, safety concerns, and a corresponding rise in employee expectations. According to Keraka (2020), complexities and risks associated to work have been on the rise. The productivity of employees are increasing being affected by the dynamic nature of their occupations. Furthermore, according to Obrenovic *et al.* (2020), workplace safety procedures put in place by firms might not be enough to protect employees from modern workplace risks, which could lower their productivity.

Occupational Safety and Health (OSH) in America and Europe is achieved through effective task performance in businesses. In order to assist avoid the 15,000 work-related deaths that occur in the USA each year, the OHS Act of 1970 was passed in response to concerns about employee safety and health in the country. Effective safety and health management techniques should be focused on enhancing global organization performance, according to Mansdorf (2019). In 2013, the International Labor Organization (ILO) published statistics showing that diseases related to the workplace killed nearly 2.2 million workers per year.

In Sub-Saharan Africa, the number of employees is 21/100000, and the accident rate is 16000/100000. Each year, approximately 42 million workers and 54000 fatalities occur due to accidents, which reduces each employee's absence from work by three days (Jilcha & Kitaw, 2016). The statistics in Ethiopia, though under reported, shows that 5596 employees die annually from work related accidents, 21.5/100000 workers die each year, while the rate of accidents stands at 16.426 for every 1000,000 workers. Many organizations disregard the comfort of their employees and the working environment in favor of satisfying their external clientele with their products and services (WHO, 2019).

In Nigeria, companies should take into account a number of aspects related to employee safety, including profitability, efficiency, and productivity. According to the study, improved employee performance leads to lower costs when safety cultures are implemented. Employee performance improvements will result in fewer accidents, absenteeisms, illnesses, and occupational injuries (Medbury Medicals, 2022).

It has been demonstrated that the adoption of OHS practices in Kenya has a critical effect on worker productivity in a number of industries. Effective OHS management techniques, such as safety training, hazard control, and routine workplace safety inspections, are positively connected with increased employee productivity (Jepchirchir & Eng'airo, 2022: in Uasin Gishu County and that to 83% of the differences in employee productivity might be explained by these behaviors.

In a similar vein, studies carried out at Nyamira County plants run by the Kenya Tea Development Agency (KTDA) revealed that thorough OHS introduction and training

programs, regular workplace safety inspections, and compliance with OHS rules greatly increase worker productivity. According to the study's findings, OHS procedures must be continuously improved since they have a significant impact on worker commitment, satisfaction, and productivity (Morwabe & Atambo, 2016).

The Kenya National Civil Registration Office was formally established under the Births and Deaths Registration Act of 1928, though its history dates back to 1904 when the colonial government began recording births and deaths. Its main responsibility is to record important occurrences nationwide, including births, deaths, and adoptions. Legal documents, such birth and death certificates are essential for identity verification, service access, and legal recognition, and the office makes sure that residents receive them. Additionally, the government uses the data gathered by the Civil Registration Office to help with planning, policy formation, and the creation of important statistics. In 2018, the Kenyan National Civil Registration Office

The Kenya National Civil Registration Office complies with the OHS Act of 2007 in order to implement the Occupational Safety and Health (OSH) law and provide a safe and healthy working environment for its staff. To reduce work-related accidents and injuries, this entails maintaining ergonomic office setups, conducting routine risk assessments, and adhering to fire safety standards (UNICEF, 2019). In order to promote a culture of safety across its activities, the office also offers health programs and safety training to its staff. The Civil Registration Office reflects the national commitment to improving occupational safety and health across all sectors by upholding OSH legislation, which guarantee that clients and employees are shielded from potential hazards.

Statement of Problem

Employee productivity has a significant impact on service delivery, efficiency, and economic growth, making it a crucial predictor of organizational performance. Due to issues like poor working conditions, occupational dangers, and a lack of employee welfare programs, Kenyan public and private sector firms struggle to maintain high productivity (Omondi & Muhanji, 2021). In order to solve these issues, occupational health and safety (OHS) procedures are crucial because they establish secure workplaces that reduce health hazards, absenteeism, and workplace injuries (Mwangi & Wanjohi, 2022). Even though Kenya's manufacturing and healthcare sectors have implemented organized OHS frameworks, bureaucratic inefficiencies and resource constraints frequently make it difficult for public sector organizations to enforce safety procedures.

Although the Kenya National Civil Registration Office (KNCR) in Nairobi is essential for processing important documents like birth and death certificates, its staff members deal with heavy workloads, long hours, and limited resources, which may have an adverse effect on their productivity and general well-being. Few studies have looked at

how OHS practices affect worker productivity in this particular public institution, despite the office's significance in national administration.

The connection between OHS procedures and worker productivity in Kenya has been the subject of numerous research. After looking into safety programs in the industrial industry, Nzuve and Waithaka (2018) came to the conclusion that good OHS practices greatly lower workplace accidents and improve worker performance. In a similar vein, Nyariki and Chirchir (2019) investigated OHS compliance in healthcare facilities and discovered that safety procedures increased employee productivity by lowering occupational hazards. In their 2020 study of county government offices, Wanjiru and Kiruja found safety enforcement gaps that had a detrimental effect on workers' well-being. Although these studies offer insightful information on the importance of OHS procedures, they concentrate on sectors with operating dynamics that differ from those of the KNCR office. A new approach to workplace safety and productivity enhancement is necessary in the civil registration industry due to its high client interactions, bureaucratic demands, and data-sensitive processes.

By investigating the impact of OHS procedures on worker productivity at the KNCR office in Nairobi, this study aimed to close this information gap. It evaluated the efficiency of organizational support systems in raising productivity, the impact of working circumstances on employee performance, and the sufficiency of current safety measures. By concentrating on this public organization, the study offers evidence-based suggestions for enhancing OHS procedures, guaranteeing a more productive and healthy staff in Kenya's civil registration industry.

Objectives of the Study

To assess the effect of workplace safety practices on employee productivity at the Kenya National Civil Registration office.

LITERATURE REVIEW

This section outlines the theoretical and empirical studies on occupational health and safety practices and employee productivity from previous scholars with the aim of bringing out the gaps in research. A conceptual model illustrates the association between the independent and dependent variables are also presented. The literature review is summarized below.

Theoretical Review

The study was anchored on the theory illustrated below:

Behavior-Based Safety (BBS)

H.W. Heinrich's groundbreaking work in 1931 served as the foundation for the early development of the safety management theory known as Behavior-Based Safety (BBS), which formally emerged as an organized methodology in 1978. BBS centers on the notion that unsafe behaviors are the primary cause of the great majority of workplace

incidents and accidents. According to the theory, businesses may drastically lower accident rates and enhance overall safety performance by recognizing and changing these risky behaviors through observation, feedback, and reinforcement (Ayuni, Yusuf & Dwiyaniti, 2022). BBS is based on the idea that proactive safety training and continuous involvement may change employee behavior and create a safer workplace. According to Fazilov, Senouci, and Al-Derham (2018), behavior-based safety has come under fire for focusing too much on individual behavior while frequently ignoring larger systemic and organizational elements that affect workplace safety. Critics contend that concentrating only on behavior oversimplifies the reasons for workplace mishaps and could absolve management and insufficient safety measures of some of the blame. Additionally, there is worry that BBS may foster a blame culture in which employees are held responsible for dangerous behaviors without addressing the underlying causes, which could include subpar tools, insufficient training, or excessive demands on productivity (Harijadi, 2024). Furthermore, detractors point out that BBS might not function as well in settings where workplace dangers are more systemic in nature as opposed to behavior-driven.

By encouraging safe practices, the theory emphasizes how successful safety training programs can have a direct impact on employee behavior, lowering accidents and increasing productivity. Safety training targeted at reducing ergonomic risks, slips, trips, or data-handling incidents can help create a safer and more effective work environment in an office setting like the Kenya National Civil Registration office. According to BBS, productivity rises when workers are taught to identify and modify risky behaviors because fewer workplace accidents interrupt work. Researchers can thus investigate how safety training not only enhances safety outcomes but also creates a more productive workforce by decreasing time lost as a result of injuries and encouraging a proactive safety engagement culture by incorporating BBS into the study.

Empirical Literature

Workplace Safety Practices on Employee Productivity

Lari (2024) carried out a longitudinal study to investigate how worker productivity was affected by the occupational health and safety (OHS) practices. The results showed that OHS interventions might greatly improve the working environment and increase employee productivity. They also found a direct link between enhanced productivity and better OHS procedures, as well as a major change in how employees see OHS. According to the study's findings, OHS procedures are essential for both preserving a safe workplace and raising worker productivity. The current study, on the other hand, looks into how employee productivity at the Kenya National Civil Registration Office is affected by particular workplace safety procedures, like training, seminars, and safety drills. The current study provided a more concentrated analysis of safety procedures and their direct influence on productivity indicators like productive time, task accomplishment, and value-added within a government setting, even though both studies highlight the relevance of OHS in increasing productivity.

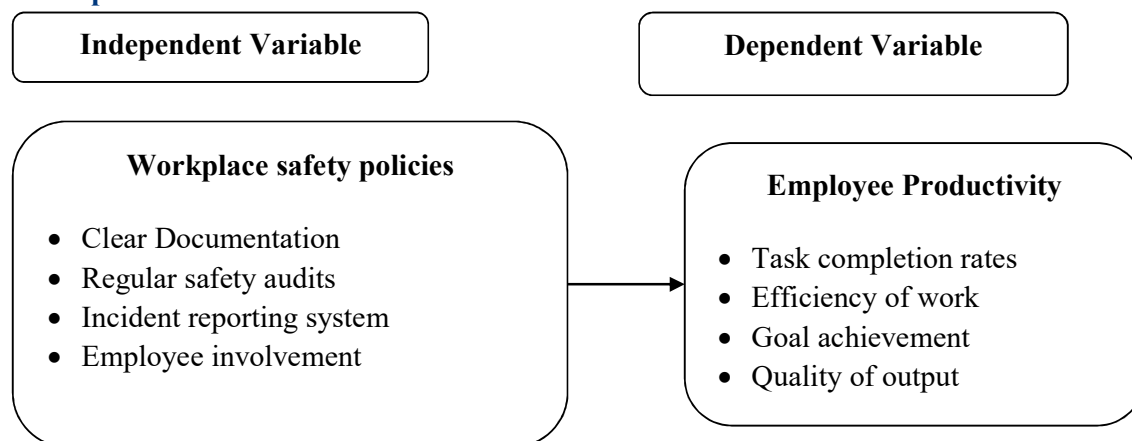
Using a descriptive research design and a quantitative methodology, Segbenya and Yeboah (2022) investigated the impact of OHS on the performance of construction workers in Ghana. OHS practices in the construction industry were determined to be in line with best international practices and to have a statistically significant impact on worker performance. The present study, in contrast, focused on how employee productivity at the Kenya National Civil Registration Office is affected by workplace safety procedures, including training, seminars, and safety drills. The current study focused on particular safety practices and their impact on productivity metrics like productive time, task completion, and value-added within a government context, establishing the role of OHS in various organizational environments, even though both studies emphasize the significance of OHS measures in improving employee outcomes. In their 2019 study, Umugwaneza, Claudine, Irechukwu, Eugenia, and Mugabe, Jean evaluated how workplace safety and health procedures affected worker dedication and output in Rwandan steel manufacturing firms. According to the study, even though the majority of employees are aware of the risks related to OHS, many continue to forego using personal protection equipment (PPE) because it causes discomfort, such heat. Notwithstanding this carelessness, the study found that employee dedication and performance are greatly impacted by workplace health and safety procedures. The current study, concentrated on how certain workplace safety procedures affected Kenya National Civil Registration Office employees' productivity. Although both studies emphasize how crucial safety measures are in affecting employee outcomes, the current study offered a more focused examination of safety practices—like training, seminars, and safety drills—in a government setting, examining their direct impacts on productivity indicators like value-added, productive time, and task completion.

Mutegi and Kinyua (2023) used a cross-sectional survey design based on positivist research philosophy and the domino theory to investigate how workplace safety affected worker productivity in Kenyan manufacturing companies. Multiple regression analysis was used in their study to show that workplace safety variables such as emergency management, ergonomics, safety training, and safety transfer substantially impacted employees' task completion, value-added, and productive time. The present study, on the other hand, examined how worker productivity at the Kenya National Civil Registration Office was impacted by workplace safety procedures. This study focused on safety practices, such as induction training, safety seminars, workshops, committees, manuals, rules, procedures, drills, and briefings, to evaluate their effects on productivity metrics like productive time, task completion, and value-added. Mutegi and Kinyua's research addressed broader safety variables. The latest study added a thorough analysis of safety procedures in a government office setting, providing insights into their particular contextual impact on employee productivity. The previous study employed regression analysis and correlation to investigate these associations.

Employee performance at Kenya Power Company (KPLC) was examined by Muriuki and Njoroge (2023) in relation to first aid training, OHS supervision, and PPE use. They sampled 290 workers from KPLC's Central Rift region using a descriptive research

approach in order to evaluate the influence of these variables on organizational performance. First aid training, OHS supervision, and PPE use were all found to be significantly linked to better organizational performance, suggesting a strong positive correlation between these safety measures and overall performance outcomes. The present study, in contrast, examined the effects of particular workplace safety procedures, including training, seminars, safety committees, and exercises, on employee productivity with a focus on the Kenya National Civil Registration Office. The current study offered a more comprehensive assessment of workplace safety procedures in a government environment, providing insights into their role in promoting productivity and task accomplishment, even though both studies emphasize the significance of safety measures in improving performance.

Conceptual Framework



RESEARCH METHODOLOGY

The study used a descriptive design. By concentrating on a subject's or phenomenon's traits and behaviors, this method helped find trends and connections while creating a benchmark for comparison. Because it allowed the researcher to examine the distribution pattern of one or more variables without assuming any causal relationships, a descriptive research strategy was used in the study. The study targeted 656 employees of the Kenya National Civil Registration Office based at the head office in Nairobi City County. This comprised people from several departments and job categories, such as clerical officers, registrars, and administrative personnel, involved in the day-to-day operations of the office. The study employed Yamane's formula in computation of a representative sample of 248 respondents. A questionnaire and key informant interviews were used to collect thorough data for this investigation. These tools were designed to record both qualitative and quantitative information about KNCRO's occupational health and safety procedures and how they affect worker productivity. In order to evaluate many facets of occupational health and safety procedures, including safety training, workplace ergonomics, emergency management, and their perceived impact on productivity, the survey was semi-structured. The quantitative information from the closed-ended questions was evaluated using descriptive statistics including the

mean and the standard deviation. Inferential statistics was accomplished using regression and correlation analysis to investigate the relationships between worker productivity and occupational health and safety protocols.

RESULTS AND FINDINGS

A total sample size of 248 employees was the goal of the study. A response rate of 81.05% was achieved by successfully completing and returning 201 questionnaires. A return rate of 60% is deemed adequate by Mugenda Mugenda (2003); nonetheless, the 80.1% return percentage in the current study is extremely noteworthy.

On gender distribution of respondents, the data indicated that 98 (48.8%) of the 201 responders were men and 103 (51.2%) were women. Given this balanced distribution, it is possible to conclude that the results are indicative of the gender composition of the entire population and are not unduly biased towards any one gender. Data on age distribution indicated that majority of the respondents (42.3%) were aged between 36 and 45 years, followed by the 26-35 years age group (39.3%). The concentration of respondents in the middle-age cohorts suggests that the study primarily captured data from a professionally active and experienced population. Data on marital status indicate dthat majority of the respondents are married (62.2%), with 37.3% being single and 0.5% widowed. This finding, showing a predominantly married sample, can be considered significant as it provides context for the study's findings, particularly since an individual's family dynamics and marital status can influence factors such as job security needs, work-life balance, and long-term commitment to an organization (Gekura, 2024). Data on education levels attained by respondents indicated that majority of the respondents (66.7%) have a Bachelors degree, which indicates a highly educated sample. This is followed by those with a Diploma (22.9%), Masters (7.5%), and High School (2.0%). A small proportion (1.0%) have other qualifications. The high proportion of educated respondents suggests that the study population is well-informed and likely possesses a strong capacity for understanding and responding to the concepts outlined in the questionnaire.

Descriptive statistics on Workplace safety practices and employee productivity

The study sought to establish whether workplace safety practices affected employee productivity at the Kenya National Registration Bureau Office in Nairobi. Table 1 provides the descriptive statistics from these results.

Table 1: Workplace safety practices and employee productivity

Statement	Mean	Standard Deviation
The current workplace safety practices are clearly communicated to all employees.	3.01	1.48
The workplace safety practices are regularly updated to address new safety concerns.	2.68	1.35
I feel that the workplace safety practices are effectively implemented at the Kenya National Civil Registration office.	2.80	1.38
The safety practices in place make me feel secure while performing my job duties.	2.96	1.38
The workplace safety practices positively affect my productivity by minimizing workplace accidents and incidents.	3.32	1.45
I believe that the safety practices reduce stress and anxiety related to potential workplace hazards.	3.48	1.79
The enforcement of workplace safety practices is consistent and fair across all departments.	2.88	1.45
I am encouraged to provide feedback on workplace safety practices and suggest improvements.	3.12	1.43

As shown in Table 1, the analysis reveals a mixed perception among employees on whether the workplace safety practices influence the productivity of employees. The highest mean score was 3.89 for the statement "The workplace safety practices positively affect my productivity by minimizing workplace accidents and incidents." This indicates a moderate level of agreement, suggesting that employees recognize the direct link between safety measures and their ability to perform without interruption from incidents. The statement "I believe that the safety practices reduce stress and anxiety related to potential workplace hazards" also had a high mean of 3.48, reinforcing the idea that safety protocols contribute to a more secure and less stressful work environment, which is a key driver of productivity. These results are in tandem with a study by Al-Kasasbeh (2021) in Jordan on the relationship between OHS management systems and worker productivity, which found that strong implementation of safety measures leads to a more efficient and productive employees.

Conversely, the lowest mean score of 2.68 was for the statement "The workplace safety practices are regularly updated to address new safety concerns." This low mean, combined with a standard deviation of 1.35, suggests a significant level of disagreement and a lack of confidence among employees that the safety protocols are dynamic and responsive to changing risks. The statement "I feel that the workplace safety practices are effectively implemented at the Kenya National Civil Registration office" also had a low mean of 2.80, indicating that while policies may exist, their on-the-ground implementation is perceived as weak. The varying standard deviations, particularly the high 1.50 for the statement on stress and anxiety, reflect a wide range of opinions among employees, highlighting a lack of consistent experience with the effectiveness of safety practices. This lack of perceived updates and effective implementation aligns with the findings of an earlier study by Tarawneh (2018), who noted that many organizations

have static safety policies that do not keep pace with technological changes and new workplace hazards, which negatively affects employee confidence and productivity.

From the interviews, employees generally believe that safety measures positively impact their productivity. One respondent shared the sentiment that "knowing that my workplace has a clear plan for minimizing accidents and hazards reduces my stress and anxiety, which allows me to be more productive. For example, knowing the fire extinguishers are maintained and accessible means I'm not worried about what-if scenarios, and I can just concentrate on my work." This aligns with a study by Al-Kasasbeh (2021) in Jordan, which found that strong implementation of safety measures leads to a more efficient and productive workforce.

However, the interviews also revealed challenges with the perceived dynamism and communication of safety practices. A key challenge highlighted was that "the biggest challenge is that the safety policies do not seem to be updated very often. We've had some changes in our office layout and equipment, but the safety protocols haven't been reviewed to reflect that." Another respondent added that the enforcement of these policies feels "inconsistent across different departments." These findings agree with the work of Al-Tarawneh (2018), who noted that many organizations have static safety policies that fail to keep pace with evolving workplace hazards, which negatively affects employee confidence and productivity.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The research output unequivocally shows that employee productivity at the Kenya National Civil Registration office is positively and significantly correlated with OHS standards. According to the data, a strong and all-encompassing safety program is a key factor in a productive workforce. By taking these steps, risks are decreased, stress levels are lowered both physically and mentally, and employees feel more confident and capable of carrying out their jobs without interference. It is indisputable that these elements work together to affect employees' productive time, task completion skills, and overall worth to the company.

Recommendations

Based on the results, the study suggests that a consistent and centrally administered occupational health and safety policy be established by the Kenya National Civil Registration office. It also recommends that the organization should invest in upgrading its ergonomic equipment to address physical discomfort among employees. The study too recommends that a mandatory, hands-on safety training program should be implemented to ensure all employees are confident in their skills. The office should conduct regular, realistic emergency drills with clear communication protocols to test and refine its emergency management procedures.

REFERENCES

- Ayuni, M., Yusuf, M., & Dwiyantri, E. (2022). Performance analysis of the behavior-based safety program in reducing occupational accident rates. *The Indonesian Journal of Occupational safety and Health*, 11(2), 275-284. <https://doi.org/10.20473/ijosh.v11i2.2022.275-284>
- Fazilov, J., Senouci, A., & Al-Derham, H. (2018). Using behavioral based safety to enhance safety performance. *Journal of Civil Engineering and Construction*, 7(4), 192-201. <https://doi.org/10.32732/jcec.2018.7.4.192>
- Harijadi, N. (2024). Efforts to minimize work accidents at pt. behavior-based safety (BBS) method. *Jurnal Impresi Indonesia*, 3(4), 337-342. <https://doi.org/10.58344/jii.v3i4.4842>
- Jilcha, Kassu and Kitaw, Daniel (2016). A literature review on global occupation safety and health practices and accidents severity, *International Journal for Quality Research* 10(2), 279-310
- Keraka, C. N. (2020). Safety Management System and Employee Performance in Textile Manufacturing Companies in Selected Counties in Kenya (Doctoral dissertation, JKUAT-COHRED).
- Lari, M. (2024). A longitudinal study on the impact of occupational health and safety practices on employee productivity. *Safety Science*, 170, 106374. <https://doi.org/10.1016/j.ssci.2023.106374>
- Medbury Medics (2022) Occupational health and safety in Nigeria: all you need to know
- Mutegi, T. M., Joshua, P. M., & Kinyua, J. M. (2023). Workplace safety and employee productivity of manufacturing firms in Kenya. *Cogent Business & Management*, 10(2). <https://doi.org/10.1080/23311975.2023.2215569>
- Neubert, M. and Dyck, B. (2016). Developing sustainable management theory: goal-setting theory based in virtue. *Management Decision*, 54(2), 304-320. <https://doi.org/10.1108/md-05-2014-0312>
- Nyariki, K. and Chirchir, K. (2019). Adoption of occupational safety and health practices among health care workers in Kenyan public referral hospitals. *American Journal of health Medicine and Nursing Practice*, 4(1), 1-17. <https://doi.org/10.47672/ajhmn.435>
- Osoro, D., & Kanyajua, D. (2019). Ergonomics and Employee Performance in State Corporations: A Case of Kenya Bureau of Standards Headquarters. *African Journal of Emerging Issues*, 1(11), 85–99.
- Ravindran, D. (2019). Ergonomic Impact on Employees' Work Performance. 6. 231-236.
- Reinhold, K. (2023). management of OSH across supply chain in construction industry., 348-354. https://doi.org/10.3850/978-981-18-8071-1_p432-cd
- Zhenjing, G., Chupradit, S., Ku, K. Y., Nassani, A. A., & Haffar, M. (2022). Impact of Employees' Workplace Environment on Employees' Performance: A Multi-Mediation Model. *Frontiers in public health*, 10, 890400. <https://doi.org/10.3389/fpubh.2022.890400>