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Article

Workplace Safety and Employee Productivity of Manufacturing Firms in Kenya

Cogent Business & Management

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Mutegi, Tetu Mwenda; Joshua, Paul Mugambi; Kinyua, Jesse Maina (2023) : Workplace Safety and Employee Productivity of Manufacturing Firms in Kenya, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 10, Iss. 2, pp. 1-29, <https://doi.org/10.1080/23311975.2023.2215569>

This Version is available at:

<https://hdl.handle.net/10419/294460>

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To cite this article: Tetu Mwenda Mutegi, Paul Mugambi Joshua & Jesse Maina Kinyua (2023) Workplace Safety and Employee Productivity of Manufacturing Firms in Kenya, Cogent Business & Management, 10:2, 2215569, DOI: [10.1080/23311975.2023.2215569](https://doi.org/10.1080/23311975.2023.2215569)

To link to this article: <https://doi.org/10.1080/23311975.2023.2215569>



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Published online: 21 May 2023.



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MANAGEMENT | RESEARCH ARTICLE

Workplace Safety and Employee Productivity of Manufacturing Firms in Kenya

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Received: 04 January 2023
Accepted: 15 May 2023

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Reviewing editor:
Mohamed Mousa, Management,
WSB University: Akademia WSB,
Poland

Additional information is available at
the end of the article

Abstract: This study determined the effect of workplace safety on employee productivity in manufacturing firms in Kenya. Moreover, it analysed the relationship between workplace safety programmes (ergonomics, emergency management, safety training, and risk transfer) and employee productivity, measured by productive time, degree of accomplishment of tasks, and value-added. The study was grounded on the domino theory and adopted a cross-sectional survey design guided by positivist research philosophy. A sample of 124 firms distributed across the fourteen sub-sectors in the manufacturing sector was obtained and then selected using a random sampling method. Structured questionnaires were used to collect data from the target respondents, 124 heads of human resources. Multiple regression results established that each workplace safety variable, workplace safety ergonomics, emergency management, safety training, and safety transfer statistically affects employees' productive time, value-added, and degree of accomplishment of tasks. The study provides practical and epistemological insights into

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PUBLIC INTEREST STATEMENT

The manufacturing sector is considered critical to economic development. Despite this, it has been faced with safety problems and low employee productivity. The sector has been experiencing workplace safety and productivity issues despite adopting safety programmes and laws regulating workplace safety. Past studies have yet to examine the relationship between workplace safety and employee productivity in the manufacturing sector in Kenya. This study provides empirical evidence on the effect of workplace safety programmes (workplace safety ergonomics, emergency management, safety training, and safety transfer to insurance and consultants) on employees' productivity (value added, task accomplishment, and productive time) in manufacturing firms in Kenya. The study established that workplace safety significantly affects employee productivity in terms of value-added, accomplishment of tasks, and productive time. Therefore, organizations that intend to improve the productivity of their employees should ensure that their workplace safety programmes are adequate, appropriate, and effective.



designing pertinent workplace safety programmes and their effect on employees' productivity. Future research should address employees' safety attitudes that lead to varying workplace safety and productivity using alternative statistical techniques such as longitudinal research design.

Subjects: Finance; Business, Management and Accounting; Industry & Industrial Studies

Keywords: Workplace safety; employee productivity; manufacturing sector; ergonomics; safety training; safety transfer; productive time; value added; task accomplishment

Introduction

Organizations rely on employees to function and meet the set objectives. They, therefore, use resources to sustain and maintain a productive workforce. Inadequate workplace safety may inhibit employee productivity (European employee productivity institute, 2019). Current issues such as globalization, legal requirements, and technological revolution have significant implications on organizational management: changing work, workforce and workplaces, safety concerns, and consequently greater workforce expectations. Workplaces have become more complex and safety-prone (Keraka, 2020). These changes could be affecting the productivity of the employees. Moreover, as recorded by Obrenovic et al. (2020), workplace safety programmes adopted by organisations may not be adequate for protecting employees from modern workplace job hazards, which may hinder their productivity. In addition (Gupta et al., 2016) and Bayram (2022) opine that new technologies expose employees to new safety risks, while globalization has led to a diverse workforce with diverse safety attitudes. Literature by Al Mazrouei et al. (2019) and Saleem et al. (2021) notes that recent interests are shifting towards adopting safety programmes that fully protect employees enabling productivity at work. Extant literature (Ndegwa et al., 2022); Malavi et al. (2021) has further noted that adopting such programmes is low, slow, and not supported by productivity considerations, as there needs to be more empirical evidence showing their impact on employee productivity.

All firms face safety challenges, yet employees require optimal safety to be productive (Society for Human Resource Management, 2023). Therefore, organizations require appropriate programmes to cover all possible contingencies without interrupting normal work operations. Despite observations in business firms pointing out that workplace safety programmes may have influenced employee productivity, there lacks conclusive empirical evidence. For instance, Goetzel (2018) observes that when Cicna insurance company and Acco Corp in the United States offered insurance compensation packages, protective clothing, working postures training, safety consulting, and onsite medical attention, their employees became more productive; no lost workday cases, no cases of restricted work, and employees had positive risk attitudes. A study by Ravindran (2021) noted that firms without workplace safety programmes might suffer from increased absenteeism and error cases, decreased bids for more work, and workers are less motivated in their work. Extant studies have not evaluated workplace safety programmes with employee productivity measured by productive time, task accomplishment, and value-added.

There are several international guidelines for ensuring successful workplace safety for any institution: The national occupational safety association (NOSA) (2017) system, the ILCI (2015), the international safety rating system (2016), International Labour Organization's (ILO) guidelines on occupational safety (2018), ISO:31000:2009 safety risk management standard, the three Es of safety (engineering, education, enforcement) advocated by Heinrich (1998). All these international guidelines posit that effective safety management should address ergonomics, emergency management, safety training, and safety transfer. If these four areas are addressed, a safe workplace will be accomplished, and consequently, better employee productivity is expected (Heinrich, 2017). There needs to be more empirical evidence on the extent to which these safety programmes influence employee value-added, accomplishment of tasks, and productive time. This study was

intended to provide empirical insights into the effect of these safety programmes on employees' productivity in manufacturing firms in Kenya.

Workplace safety ergonomics improve workplace safety through the detection and elimination of hazards. Hulme et al. (2022) posit that workplace safety ergonomics reduce the risk factors that lead to injuries, ensuring employees' optimal productivity is not interfered. Capodaglio's (2022) study adds that workplace safety ergonomics are expected to improve work activity comfort and reduce safety injuries and fatigue, ensuring employees accomplish their work tasks fully. Inadequate workplace safety ergonomics exposes employees to injury and rapid fatigue, and this may lead to productivity losses (Ravindran, 2021). Despite previous research consistently identifying ergonomics as a strategy to boost work safety and employee productivity, they have been faulted in four areas; firstly, the studies have not evaluated the three indicators of workplace safety ergonomics (hazard detectors, protective devices, and effects analysis) against employee productivity. For instance, Leber et al. (2018) investigated the impact of protective ergonomics on work efficiency for persons with disability; Ravindran (2021) investigated the impact of hazard ergonomics on work performance while Sinno et al. (2020) and Pickson et al. (2017) focused on recognition of symptoms of overexposure and employee wellness. Second, the methodological rigor applied by previous studies did not conclusively establish the link between safety ergonomics and employee productivity; Chintada and Umasankar (2022) was a case study and used subjective measures, and Bayram (2022) did a critical literature review and therefore failed to generate original findings, while Leber et al. (2018) analyzed data using frequencies and percentages. Third, previous literature is anchored on different industries, firms, and countries; therefore, have a minimal application to manufacturing firms in a developing nation. Fourth, previous studies and extant theoretical frameworks have yet to relate workplace safety ergonomics with employee productivity measured by productive time, degree of accomplishment of tasks, and value-added.

Safety training educates employees on safe working and the identification of exposures (Mora et al., 2020). Previous studies by Alonso et al. (2018) and Malavi et al. (2021) have noted that many manufacturing firms in Kenya still need to comply with the safety training standards fully. The studies have noted that despite safety training guidelines such as safety seminars, safety manuals, safety rules and procedures, safety drills, and regular briefs, many manufacturing firms in Kenya still need to comply with the programmes. Previous literature has identified safety training as an innovative way to boost employee productivity. A study by Ravindran (2021) posits that workplace safety-trained employees become sufficiently fit to perform tasks confidently, while a safety and productivity culture can be developed through formal training programmes. A study by Huang et al. (2022) noted that safety training enables workers to identify safety risks and communicate corrective action early enough; this can prevent the onset of productivity costs. Grabowski (2019) notes that safety training ensures desirable safety behaviors among employees, such as safe working and avoiding severe errors. A study by Malavi et al. (2021) adds that workplace safety training gives employees the confidence to concentrate on their tasks without unnecessary phobias, especially in safety-prone workplaces such as manufacturing. Therefore, safety training accompanied by proper protection is expected to improve employees' productivity significantly; however, extant literature has yet to establish this.

The current study departs from extant literature on the effect of workplace safety training on employee productivity in four ways. First, empirical evidence needs to be more conclusive on the effect of workplace safety training on employee productivity; some studies have contradicting findings; for instance, Bayram (2022) and Ravindran (2021) suggested that safety training influences positive culture but does not influence employee productivity, while Obong et al. (2021) suggested that workplace safety training positively influences employee efficiency and confidence at work. Secondly, prior studies did not assess the effect of safety training on productive time, task accomplishment, and employee value added. For example, Aluoch (2015) used employee perceptions of safety; Rosa (2019) checked company loyalty by employees, and Laura (2019) used employee turnover intentions. Third, each of these studies measured employee productivity

differently. Fourth, existing literature has focused on worker safety awareness (Adim & Mezeh, 2020; Alonso et al., 2018; Aluoch, 2015; Malavi et al., 2021; Ravindran, 2021; Sawe et al., 2013) and largely ignored the existing safety training programmes put in place in organizations as posited by theoretical perspectives by Heinrich domino theory (1931). Therefore extant empirical studies measured workplace safety training in terms of ex-ante perspective instead of safety interventions put in place for safety and productivity; these measures could have led to mistaken inferences. The current study filled these research gaps.

Proactive emergency management is now a global concern since adverse risks still occur despite the level of protection in place. Workplace safety emergency management reduces the extent of workers' disabilities and work disruption and potentially can lower employee productivity losses. Prior studies by Drake et al. (2018) and Reese (2018) have provided an understanding of the nature of a manufacturing sector workplace and have observed that workplace safety incidents are disruptive and could lead to employee productivity losses. Further studies by Alariki and Al-Abed (2021) and Obrenovic et al. (2020) have pointed out that the problem of employee productivity could be due to defective management of workplace safety emergencies. A study by Leonhardsen et al. (2022) has provided a guideline for effective emergency management, including setting out rescue response and evacuation plans, emergency equipment and medical care, conspicuous display of emergency contacts, safe assembly and exit points, emergency logs, and documentation. Prior literature needs to evaluate these programs' effect on employee productivity adequately. Five aspects of extant literature have been faulted. First, the studies have not established the link between manufacturing firms' workplace emergency management and employees' productive time, degree of accomplishment of tasks, and value-added. Second, prior studies by Wilson (2010) and Keraka (2020) did not examine organizations' specific emergency management strategies. However, they focused on ex-ante perspectives and employee awareness, which could have led to mistaken inferences. As posited by the tip of the iceberg theory by McClelland (2000) that simple incidences which go unreported by employers could significantly affect employees' productivity where inadequate emergency equipment are lacking. Further, employees' awareness of their responsibility in case of loss does not guarantee effective emergency management in case programmes such as first aid kits and other emergency equipment are lacking.

Third, the studies by Obrenovic et al. (2020) and Young (2014) have employed mainly qualitative methodology; Fourth, most studies conducted in different contexts have produced contradictory findings; for instance, Adjotor (2013) found that safety emergency programmes reduce the costs associated with illness but do not affect employee productivity while Cudjoe's (2017) and Obrenovic et al. (2020) associated emergency programmes with positive employee productivity outcomes. Finally, theoretical frameworks still need to provide an understanding of how emergency management influences employee productivity. Further, unlike extant studies, the current study used Heinrich's postulates of the domino theory (1931), which emphasizes safety programmes but does not indicate organizational outcomes derived from proper safety programmes. Therefore, the current study is expected to contribute to developing the theory and existing repository of literature on workplace safety and productivity.

Workplace safety transfer to consultants and insurance companies assures the organization of its safety, improves employee morale and company pride, and reduces suffering by injured employees (Reese, 2018). Workplace safety incidents put a significant financial and psychological burden on employees, which could affect their work productivity (International Labour Organization, 2018). Previous studies by Kurdy et al. (2021) and Gubler et al. (2022) add that workplace safety transfer reduces the financial and psychological burden associated with work incidents; hence employees are expected to be optimally productive without worrying about safety incidents. Reports by International Labour Organization (2018), Osha African Report (2019), and literature by Reese (2018) have noted that the incident prone manufacturing workplace has recently been transferring their safety management to consultants and private security firms,

who design, evaluate and review their safety programmes; the manufacturing firms are also arranging health, disability, liability, and accident insurances on behalf of their employees. Gubler et al. (2022) note that the firms include external consultants in their safety committees to enhance organizations' safety and positive employee safety attitudes. The prior empirical literature has yet to systematically explore the actual effect of providing insurance and using safety consultants on employee productivity (productive time, degree of accomplishment of tasks).

The existing literature has been faulted in four areas. First, the studies could have evaluated safety transfer wholly based on its six constructs; group health insurance, private security, safety consultants, safety liability insurance, and personal accident insurance. For instance, studies by Owolabi et al. (2016), Nguyen and Zawacki (2019), and Peshawar (2014) focused only on health insurance, while Gilje and Wittry (2021) focused on safety consultants. Second, the studies did not evaluate the effect of safety transfer on employee productivity based on the three measures of employee productivity (productive time, degree of accomplishment of tasks, and value-added). For instance, Owolabi et al. (2016) only used productive time, while Gilje and Wittry (2021) conceptualized labor productivity as value added. Third, the studies by Kurdy et al. (2021), Peshawar (2014), and Gubler et al. (2022) did not generate original findings on the effect of workplace safety transfer on employee productivity. Fourth other studies had methodological limitations; for instance, a study by Otiso and Mutugi (2018) used chi-square tests to determine associations between variables and was limited to insurance safety transfer and safety. Conversely, the current study addressed these research gaps.

Contextual background

This study focused on the manufacturing sector in Kenya due to the sector's inherent safety and productivity concerns; further, the industry receives significant scrutiny by the Directorate of occupational safety over workplace safety practices and compliance with government safety regulations. Over 80 percent of the manufacturing firms in Kenya are based in Nairobi (the capital city), while the rest are located in other major towns (Kenya Association of Manufacturers (Kenya Manufacturers and Exporters Directory, 2018). Despite the Kenyan manufacturing sector being the largest among the East African countries, growth in the sector has been slow at 4.6% in 2018, 3.1% in 2019, and average growth of 3.4% in the last five years. The sector contributes an average of 10.3% to the gross domestic product (GDP) and therefore is considered critical in attaining the country's economic development goals (KNBS, 2022). Employee productivity in the Kenyan manufacturing sector is low, with an output of 2700 dollars per employee compared to the average African output of 3300 dollars per employee and the international standard of 6500 output per worker (International Labour Organization, 2018). Kenya Institute for Public Policy Research and Analysis (KIPPRA, 2023) indicated that workplace incidents in the manufacturing sector had increased by more than 65 percent in the year 2022. Further, Kenya's Directorate of occupational safety and health report (2022) ranked the manufacturing sector as leading in workplace safety issues, with 87% of occupational deaths and injuries reported. These incidents and productivity problems are still experienced even after the institutions have installed various safety management programmes (Society for Human Resource Management, 2023).

Theoretical background

The study was anchored on the Domino theory developed by Heinrich (1931). According to the Domino theory, all incidents are directly related to a lack of safety programmes such as ergonomics, emergency, transfer, and safety training. The theory posits that incidents result from a chain of sequential events, metaphorically like a line of dominoes falling over. When one of the dominoes falls, it triggers the next one. The theory posits that removing a key factor (such as an unsafe condition or an unsafe act) prevents the start of the chain reaction. The theory posits that two factors lead to unsafe workplaces: persons' faults and work-related factors. The person's fault included recklessness, nervousness, excitability, inconsiderateness, and ignorance of safe practices. Work-related factors include work overload, wear and tear, low-quality equipment, and bad design or maintenance. The theory posits that a person's faults and work-related causes

of accidents can be eliminated by effective safety ergonomics, workplace safety training, emergency management, and safety transfer to insurance and consultants. When employees are safe, they will likely produce better in the organization Sabet et al. (2021). This theory was relevant to this study because protective factors (safety ergonomics, emergency management, safety training, and transfer) reduce the effects of exposure to adversity. The more protective factors are available, the more resilient institutions are to risk, and the more the employees are likely to perform productively without worrying about safety issues. Decreased workplace incidents often lead to a transformed culture that leads to higher productivity and employee satisfaction (Aswathappa, 2015). Reese (2018) critiques the domino theory for only focusing on the causes and ways to minimize workplace incidents. It needs to indicate the employee productivity gains from a safe workplace (Bayram, 2022). Further, a study by Sabet et al. (2021) explained that the domino theory is overly detailed but needs more clarity on how safety protections influence employee and organizational outcomes. The current study's findings have provided empirical evidence of the significance of employee safety protections on employee productivity measured by the employees' degree of accomplishment of tasks, productive time, and value-added. Therefore the current study finding contributes to the development of the domino theory.

Empirical literature review and hypothesis development

Workplace safety ergonomics and employee productivity

Workplace safety ergonomics involves programmes designed to detect and eliminate workplace safety hazards. Extant literature has identified safety ergonomics as a critical and effective construct for workplace safety (Reese, 2018; Strasser, 2022). Laura (2019) posits that workplace safety ergonomics involves designing the workplace and tools for maximum safety. Extant literature by the international ergonomics association report (2019), Reese (2018), and the international safety rating system report (2016) have laid out guidelines for effective safety ergonomics for organisations. The guidelines posit that practical safety ergonomics should address hazard detection, protective devices, and effects analysis. The current study adopted these measures of safety ergonomics. Further, literature by Dessler and Varrkey (2015), Huang et al. (2022), and Dessler and Varrkey (2015) note that safety ergonomics should include safety audits, robotics, safe working tools, sanitary conveniences, and facility design for safety. When workplace safety ergonomics are adequately adopted, chances of accidents are reduced, and therefore employees are expected to be maximally productive. However, research is required to gain deeper research insights into the importance of workplace safety ergonomics on employees' productivity. The previous empirical literature has failed to investigate this effect adequately. This section reviewed related literature in the context of developed countries outside Africa, developing countries in Africa, and then studies done in the Kenyan context.

Related studies done in the context of organisations in developed countries outside Africa revealed several research gaps; Leber et al. (2018) survey investigated the impact of ergonomically designed workplaces on employee productivity. The study compared the adoption of safety ergonomics for persons with disability in three countries: Poland, the UK (United Kingdom), and Slovenia. The study suggested that ergonomics should be adopted to enhance work efficiency and employee adaptation of tasks enhancing employee productivity. The study was, however, limited to safety ergonomics for persons with disability. Further, it did not indicate which safety ergonomics were adopted for persons with disability and failed to test the empirical relationship between ergonomics and employee productivity. A study by Ravindran (2021) investigated the impact of safety ergonomics on employees' work performance in Co-operative Hospital India. The study was a critical literature review that found that a lack of safety ergonomics leads to increased absenteeism, errors, and sick leaves, which reduces employee productivity. The study was faulted for only focusing on sanitary ergonomics, was conceptualised in a different sector and country from the current study, and failed to generate original research findings. Chintada and Umasankar (2022) investigated the impact of occupational ergonomics and organizational efficiency. It was suggested that ergonomics addresses work-related mental stress and musculoskeletal disorders

and hence plays a vital role in productivity. Occupational ergonomics was conceptualized as quality equipment and maintenance, which are partial measures of safety ergonomics. The study results established that ergonomics are related to accident prevention, less fatigue, and employee morale and motivation. Unlike the current study, the study focused on one firm. It did not establish productivity gains due to safety ergonomics through objective measures such as value-added, accomplishment of tasks, and productive time.

Studies on safety ergonomics and employee productivity in African workplaces revealed various research gaps. Sinno et al. (2020) studied the impact of ergonomics on employees' productivity in two workplaces in Lebanon. The study conceptualised safety ergonomics in terms of protective devices, while the current study used three measures of safety ergonomics; hazard detection, protective devices, and effects analysis. The study found that ergonomics programmes did not significantly affect employee productivity, but a lack of ergonomics led to employee stress. The study contradicted the findings from those of Leber et al. (2018) and Ravindran (2021). The study focused on two firms and analysed data using frequencies and percentages, making it difficult to generalise the findings. Pickson et al. (2017) studied the effect of ergonomics on employee productivity at Pioneer Food Cannery in Ghana. The study focused on employee satisfaction with ergonomic challenges, unlike the current study on safety ergonomic programmes and their effect on productivity, using a broader scope of objective measures. The study established that safety ergonomics positively correlates with employee productivity. The study failed to show how employee productivity was measured but recommended empirical research to be done on the impact of ergonomic training on employee productivity.

Ergonomics awareness and employee performance were examined in a study by Olabode et al. (2017), which focused on ergonomics awareness and adoption in Nigerian organisations. This study reviewed the literature on factors that impede the adoption of comfort and safety ergonomics. Still, it did not evaluate safety ergonomics in place in organisations and their effect on employee productivity. The study findings indicated that employees could not be productive when uncomfortable or unsafe at work. The study did not generate actual results from the firms. Kingsley et al. (2012) examined the impact of office ergonomics on the performance of employees at Ghana Petroleum Corporation. The study revealed that employees were dissatisfied with the office safety designs, finishes, and furnishing. This study failed to specify what aspects of safety ergonomics the employees were dissatisfied with and failed to link this to employee productivity—further, the analysis needed to show how employee productivity was conceptualised.

Similar empirical studies in Kenya that attempted to link workplace safety ergonomics to employee productivity have been faulted for several reasons. First, a study (Corgi, 2020) focused on ergonomics and employee performance in Kemya chemical manufacturing plant. The study was a critical literature review and found that the manufacturing company had moderately adopted ergonomics, leading to fewer errors, injuries, and risks of defective products. The study found that the implementation of safety programmes was not supported by ergonomic considerations leading to workers' injuries and several errors and defects by employees. The study, however, needed to collect original findings from the firm rather than presenting the author's opinions on the topic. Second, a study by Osoro and Kanyajua (2019) investigated ergonomics and employee performance in state corporations. The study only focused on office arrangement and lighting ergonomics, which are partial measures, while the current research conceptualised safety ergonomics using a broader scope. The study found low adoption of ergonomics in state corporations and did not evaluate their effect on employee productivity. The study focused on a single firm that was non-manufacturing. Thirdly, a study by Kimwomi (2015) focused on organisational characteristics and performance in manufacturing firms in Kenya. The study revealed that safety ergonomics such as shutoff controls, industrial robots, temperature, light, and sound controls have become common in Kenyan manufacturing companies. However, the study did not investigate the effect of safety ergonomics on employee productivity in manufacturing firms in Kenya.

The study's objective was to investigate the effect of workplace safety ergonomics on employee productivity. Thus the study hypothesized that; workplace safety ergonomics has a significant positive impact on employee productivity.

Workplace safety emergency management and employee productivity

Previous literature has laid out emergency management recommendations for firms. First, the American Organization for Safety standard (2017) and Drake et al. (2018) posit that firms should have rescue response and evacuation for workplace safety emergencies. Second, the volunteer protection program (2018), Reese (2018), and International loss control institute (ILCI (2015) posit that workplace safety emergency programmes should include elaborate evacuation plans, safe assembly points, exit points, and emergency equipment such as first aid facilities. International Labour Organization (2018) opines that a lack of workplace safety emergency management often leads to work disruptions, lost work time, and fear of accidents by employees hence may hinder their productivity.

Previous empirical studies have failed to empirically evaluate workplace safety emergency management's effect on employee productivity. First, empirical studies done in workplaces outside Africa revealed several gaps; Alariki and Al-Abed (2021) focused on the impact of work safety crisis management on employee performance in the Yemeni oil industry. The study conceptualized workplace emergency management in terms of crisis planning and preparedness. Employee performance was conceptualized in terms of subjective task performance, which could have led to biased inferences due to a lack of objectivity. The study found a significant relationship between emergency workplace emergency management and employee performance. The current study used expanded and objective measures of workplace safety emergency management and employee productivity. Obrenovic et al. (2020) investigated the impact of COVID-19 pandemic emergency management and the sustainability of employee productivity. The study was a critical literature review and needed to generate original findings. The study recommended safety emergency management as an innovative approach to enhancing employee productivity during the COVID-19 pandemic. A study by Wilson (2010) investigated emergency preparedness alternatives at higher education institutions in the United States. Telephone interviews were used to collect data among employees who manage emergency programs. The study found that 30% of the organizations did not have emergency plans and equipment. The study lacked objectives and did not establish the link between emergency plans and employee productivity.

Second, the study established research gaps in related studies in African workplaces. A study by Cudjoe (2017) studied occupational health and safety practices on labor productivity at a Hospital in Ghana. Results indicated that emergency plans such as safe exits make employees feel comfortable on their job and hence be more productive. The study should have shown how labor productivity was measured. The results only focused on adopting workplace safety emergency programmes but failed to investigate the effect of the programmes on employee productivity. Further, a study by Adjotor (2013) evaluated the effects of occupational safety and health on labor productivity among selected firms in Ghana. The study evaluated employee productivity based on subjective measures of concentration and efforts of employees, while the current study measured employee productivity using the three recommended objective measures of employee productivity; value-added, degree of accomplishment of tasks, and productivity time. The study was also limited because it focused on emergency risks rather than programmes. The study found that safety emergency programmes reduce the costs associated with illness but do not affect employee productivity. This finding contradicted Cudjoe's (2017) and Obrenovic et al. (2020) results that associated safety emergency programmes with positive employee productivity outcomes.

Third, the current study identified research gaps in similar studies done in the context of the Kenyan workplace. For instance, a Keraka (2020) study investigated emergency safety management systems and employee performance in textile manufacturing companies in Kenya. The study conceptualized safety emergency management in terms of workers' knowledge, safety

promotional policies, and employee participation in implementing safety standards. Employee performance was assessed by meeting customer demands and creativity. The current study focuses on the safety emergency programmes implemented for safety and their effect on employee productivity in manufacturing firms in Kenya using broader and objective measures. Simiyu et al. (2020) investigated the effects of the occupational environment on employee performance in sugar industries in Kenya. The study conceptualized the workplace environment in terms of programmes in place and emergency preparedness. Employee performance was measured in terms of the execution of work pact obligations. The study only focused on firefighting emergency equipment.

In contrast, the current study focused on varied measures such as rescue response, emergency equipment, evacuation plans, safe assembly, exit points, and first aid facilities. The study findings revealed that the occupational safety environment contributed to employee performance, but this finding cannot be generalized because of the study's limitations. Young (2014) researched the management of safety in Kenyan institutions. The study lacked specific objectives, and its findings did not indicate which variables were being tested. The study recommended that research be done on safety emergency management and its effect on employee performance.

The objective of the study was to investigate the effect of workplace safety emergency management on employee productivity. Thus the study hypothesized that; workplace safety emergency management has a significant positive effect on employee productivity.

Workplace safety training and employee productivity

Related literature on the relationship between workplace safety training and employee productivity was reviewed in various contextual backgrounds. Firstly, a review of related studies was done in countries outside Africa. A study in the USA by Huang et al. (2022) assessed supervisors' safety training association with safety behaviour among long truck drivers in the USA. The study found that safety training improves safety communication which clarifies the exact role of employees at work and hence may enhance better performance of tasks. The study was limited by lacking objectives, the sampling method was non-probabilistic, and data were analysed using frequency and percentages. Therefore, it did not allow the testing of relationships between variables. Further, the study focused on supervisors' perception of safety training rather than on the actual safety training programmes in place in institutions.

A similar study was conducted in France by Bieder et al. (2018) on the relationship between safety training and employee skills in the transportation industry. The study reviewed 16 studies on safety training and found that organisations conduct safety training to comply with external stakeholders' expectations and not to improve workplace productivity. The study opined that safety training might boost employee productivity by addressing attitude to risk (chronic unease). This study, however, was limited because it failed to collect primary data allowing for original findings. However, it presents a research gap that the link between employee productivity and safety training is relatively unexplored by the academic world.

Similarly, a study by Bayram (2022) investigated the factors affecting employee safety and productivity in an OHSAS 18,001-certified organization in Turkey. The study used the ability to cooperate better as a measure of employee productivity and safety knowledge as a measure of workplace safety training. The study found a significant relationship between safety knowledge and productivity. The study, however, failed to address the relationship between safety programmes and employee productivity. Safety knowledge may lead to mistaken inferences since as posited by Mazorodze and Buckley (2019) most employees consider themselves inherently knowledgeable, whereas safety training helps impact new skills and clarify misconceptions and shape productivity behavior. Whereas these studies opined that workplace safety training is associated with positive employee productivity outcomes; a study conducted in the United States by (Shockley, 2022) opined that safety training does not influence productivity as employees

often forget what they learnt quickly and the hours spent in trainings reduce employee productive time. However, unlike the current study the study measure employee productivity using job satisfaction and organizational commitment. Conversely, the current study addressed these research gaps using expanded measures of workplace safety training and employee productivity.

Secondly, related studies done in the context of African countries revealed several research gaps. A study by Obong et al. (2021) sought to determine the effect of safety training on employee efficiency in manufacturing firms in Nigeria. Regression analysis revealed that workplace safety awareness had a statistically significant positive effect on employee efficiency. Safety awareness improved worker productivity skills and confidence. The study focused on one manufacturing firm; it did not show how it measured and conceptualised safety awareness and employee productivity. Further the only used primary data. Conversely, the current study used primary and secondary data and focused on safety training programmes adopted in all 14 sectors of manufacturing firms in Kenya and their effect on employee productive time, degree of accomplishment of tasks and value added.

A similar study by Adim and Mezeh (2020) focused on the impact of health and safety awareness on employee performance in oil companies in Nigeria. The study conceptualised employee performance in terms of accomplishment of tasks, while workplace safety training was conceptualised in terms of induction training. The study used correlation analysis which established a significant positive relationship between safety and health training and employee productivity. The current study conceptualised employee productivity using expanded measures (productive time, degree of accomplishment of tasks and value-added). In contrast, the current study used more measures of workplace safety training; safety induction training, safety seminars, talks and workshops, safety committee, safety manuals, safety rules, procedures and policies, safety drills and regular briefs. Further, the current study used correlation and regression analysis to determine the relationships between variables.

Thirdly related studies done in the context of Kenyan workplaces revealed several gaps. For instance, Sawe et al. (2013) assessed the effects of occupational health and safety practices on employees' productivity in Mumias Sugar Company, Kenya. The literature review identified that safety awareness might improve employees' productivity by saving work time. The study revealed that safety training was conducted well in the firm. The employees were adequately trained on selecting the right tool for the job, informed on the hazards of the tool and how to use tools correctly. Data was, however, analysed using percentages and therefore did not empirically test the relationship between variables. Further, the objectives and results of the study do not address what safety training programmes the organisation had put in place for workplace safety and their influence on employee productivity. Further, safety training and employee productivity in Kenya was evaluated by a study by Aluoch (2015). The study assessed the effect of occupational safety and health programmes on employees' performance at the Kenya Power and Lighting Company. The study revealed that safety training was done wrongly in Kenyan firms. The top management did not embrace a safety philosophy and did not inform line managers about safety problems throughout the organisation. The study, however, lacked specific objectives and only focused on one aspect of OSHA regulations (employee awareness) of safety programmes. The study fails to address what safety training programmes have been implemented in the firms.

The objective of the study was to investigate the effect of workplace safety training on employee productivity. Thus the study hypothesized that; workplace safety training has a significant positive effect on employee productivity.

Workplace safety transfer to insurance and consultants and employee productivity

Safety transfer involves shifting the burden of safety risk to more competent bodies. Workplace Safety can be transferred to insurance companies, private security, and safety consultants in manufacturing. Despite observations by previous studies, such as Berry et al. (2020) and Ruvalcaba et al. (2022), that workplace safety transfer is crucial for employee productivity, these assertions have yet to be pursued by extant studies. For instance, the effect of safety transfer on

employee productivity was studied by Owolabi et al. (2016), who investigated the impact of health insurance on employees' productivity in Kwara State, Nigeria. Data collection was done using questionnaires, while correlation analysis was used for the data analysis. The study used productive time as a measure of employee productivity. The study results showed a significant relationship between health insurance and employee productivity. The study explained that insurance ensures employees are healthy and less worried about risk hence greater productivity. The study focused only on health insurance in one organisation. In contrast, the current study focused on safety transfer through group health insurance, private security, safety consultants, safety liability insurance, and personal accident insurance. Further, the current study used more measures of employee productivity, productive time, degree of accomplishment of tasks, and value-added.

A study conducted on workplace safety and labor productivity by Gilje and Wittry (2021) in the U.S. coal industry found that failure to transfer safety issues to safety consultants adequately led to the deterioration of productive time by employees through increased safety incidents. Further, the study explained that lack of safety transfer makes the organisations fail to benefit from the vast and diverse experience of the safety consultants who can objectively identify and define the existing problems without politics and allegiance. The study was, however, faulted on several aspects; it conceptualized labor productivity using one measure- productive time. Workplace safety was conceptualized in terms of a number of work fatalities, which may have led to mistaken inferences because it is an after-loss perspective. Further, the study did not show the methodology used to analyze data; hence its results cannot be generalized.

Similarly, a study by Peshawar (2014) investigated the relationship between university employee safety transfer and productivity in England. The study literature study noted that organizations offer insurance transfer as a fringe benefit for employees and hence may boost their productivity. The study needed specific objectives and only reviewed the literature on existing studies; therefore, it did not accord an opportunity for original findings. Further, the study reviewed the literature on only insurance transfer through personal accident insurance. Nevertheless, the study has yet to pursue other safety risk transfer mechanisms. The current study filled this gap.

In addition, the assertion that safety transfer may influence employee productivity was collaborated by a study by Otiso and Mutugi (2018), which evaluated the risk prevention techniques for theft in public hospitals in Kenya. The study found that noncontributory insurance has become a trend in many modern organizations. The study opined that medical, disability and accidental costs due to workplace activity might be affecting employee productivity. An effective way to avoid constant worries by the employees and boost productivity is to ensure the safety risk. The study used chi-square tests to determine associations between variables and was limited to insurance safety transfer.

Further, the study did not evaluate the effect of insurance safety transfer on employee productivity. This assertion by Otiso and Mutugi (2018) and Peshawar (2014) that workplace safety transfer influences employee productivity has been contradicted by the findings of a review study by Perrow (2014) which investigated the link between workplace safety, firm performance, and employee productivity. The study found that organisations with higher safety risks hire safety consultants to design and inspect their programmes. The study concluded that safety consultants create an environment of safety that ensures employee productivity; however, the recent introduction of safety transfer to robotics may make employees more stressed about their job tenure, hence diminishing employee productivity. Further, the study noted that safety programmes are costly and may diminish employee value added.

Nguyen and Zawacki (2019) studied health insurance and labor productivity in the manufacturing sector. The study used value-added to measure labor productivity. The study used correlation analysis to analyze data. The study's results established that employer-sponsored health insurance

positively affects productivity. The study only focused on one aspect of safety transfer and used only one employee productivity measurement, leaving a conceptual gap on the topic.

Further, the results of the study collaborated with the findings of Owolabi et al. (2016), Otiso and Mutugi (2018), and Peshawar (2014) but contradicted the findings of a review study by Perrow (2014). Extant literature on the effect of workplace safety transfer on employee productivity had contradictory results, conceptualized variables differently, and had methodological limitations making it difficult to draw firm conclusions about the relationship between workplace safety transfer and employee productivity. Conversely, the current study addressed these research gaps.

The objective of the study was to investigate the effect of workplace safety transfer to insurance and consultants on employee productivity. Thus the study hypothesized that; workplace safety transfer to insurance and consultants has a significant positive effect on employee productivity.

Employee productivity

The productivity of employees is an essential concern to every institution worldwide. Employee productivity is employees' ability to accomplish tasks within the standard work hours as described in a work description (Samnani & Singh, 2017). While extant literature has explored measures of employee productivity and the fundamental factors that influence employee productivity, empirical evidence on how workplace safety affects employee productivity outcomes is limited. This study adopted three employee productivity measures; the first is the degree of accomplishment of tasks by employees. This measure was proposed by the European Employee Productivity Institute (2019), which posited that employee productivity could be measured by the degree to which employees produce the required output. Similarly, Laffont and Martimort (2009) and Drucker (2002) agree that the degree of accomplishment of tasks is an objective measure of employee productivity. The current study assessed the accomplishment of tasks through the total number of employees who met their set performance targets per employee dashboard/performance contracts. Extant literature has pointed out that workplace safety may be affecting employee accomplishment of tasks, but this assertion is yet to be empirically tested. For instance, a study by Karaboga et al. (2022) opined that workplace safety through protection and training leads to work efficiency and accelerated employee adaptation of tasks. Henkel et al. (2019) add that workplace programmes may lead to behavioral changes that may affect the degree to which employees perform routine tasks. Previous studies have further reported inadequate workplace safety in manufacturing firms in Kenya (Mwaruta, 2022; Mburu and Kiiyukia (2017), while other studies (Keraka, 2020; Osoro & Kanyajua, 2019; Simiyu et al., 2020) have noted that fewer employees were meeting their performance targets per the employee dashboard. Extant literature has yet to establish the relationship between workplace safety and employees' degree of accomplishment of tasks.

The second employee productivity measure adopted by the study was value added. Drucker (2002) posits that value added is computed by dividing total revenues by the number of employees in the firm. Extant literature has asserted that workplace safety may affect employees' value added; however, these assertions are yet to be empirically tested. For instance, a study by Kabir et al. (2017) posited that adverse workplace safety incidents such as lost workday cases, liability costs, and restricted duties due to injuries dwindle the employees' value added. A study by Hacamo (2022) adds that manufacturing firms have over-invested in workplace safety, ergonomics, and emergency management, negatively impacting the firm's revenues. The third employee productivity measure adopted by the study was productive time. European Employee Productivity Institute (2019) and Hacamo (2022) stated that worker productivity is measured by comparing the actual hours worked by an employee and the standard work hours during a period. This study evaluated workplace safety programmes against lost work time due to safety incidents. The problem of employee productive time in manufacturing firms has been noted by data from the Bureau of Labour Statistics report (2019) that showed that in 2018, 5.7 million injuries were reported in public and private workplaces worldwide, with manufacturing industries ranking first with 3.2 million employee injuries (Bureau of Labour Statistics report, 2019). Out of the 5.7 million injuries and illnesses reported, about 2.8 million were lost workday cases requiring recuperation, restricted work

duties, or both. The remaining 2.9 million were cases without lost workdays (Bureau of Labour Statistics report, 2019). These incidents are still experienced even after the institutions have installed various safety programmes and could reduce employee productive time (Society for Human Resource Management, 2023).

Research methodology

Research design target population and sample size

This study adopted a cross sectional survey design. The cross sectional survey design was adopted due to the fact that existing data among the manufacturing companies was collected retrospectively. The target population was the 853 manufacturing firms in Kenya that are registered with Kenya Association of Manufacturers (KAM) and that have been operation for the last three years. Data collection and analysis was done at firm level with target respondents being the heads of human resource. The firms were classified into 14 key sectors of manufacturing based of the products they manufacture. A list of the study population was obtained from (KAM Manufacturers and Exporters Directory, 2017/2018). Out of a population of 853 manufacturing firms in Kenya, a representative sample of 124 was obtained using a statistical formula suggested by Nasiuma (2010) as shown in equation 1.

$$\text{Sample size} = \frac{\text{Population of manufacturing firms} \times 17\%^2}{17\%^2 + (\text{Population of manufacturing firms} - 1)0.05^2}$$

Where: The coefficient of variation was fixed at 17% and standard error was fixed at 5%. The firms were selected randomly.

The tabulation of the sample size per sector is presented in Table 1

Therefore the target respondents were 124 heads of human resources in each sampled firm.

Operationalization of variables

Workplace safety measures were adopted from the recommendations of (NOSA) safety management system (2017), the international loss control institute (ILCI, 2015), international safety rating system

Table 1. Sample Size per Sector		
Firm Listing by Sector	N	n
Services and Consultancy	101	10
Building, Mining and Construction	29	8
Chemical and Allied Sector	79	10
Energy electrical and electronics	45	9
Foods and Beverage	187	11
Leather and Footwear	9	5
Metal and Allied Sector	83	10
Motor Vehicle and Accessories	51	10
Paper and Board	74	10
Pharmaceutical and Medical	24	8
Plastic and Rubber	77	10
Fresh Produce	11	6
Textiles and Apparels	64	10
Timber, wood and furniture	19	7
Total	853	124

(2016) and International Labour Organization’s (ILO) guidelines on occupational safety (2018). Further additional measures arose from the reviewed literature and were operationalized and measured as shown in Table 2.

Data processing and analysis

The relationship between variables was tested using Pearson’s product-moment correlation. Regression analysis was used to estimate the regression coefficients. The analytical models and their interpretation are as shown below.

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e_4$$

Table 2. Operationalization of Variables

Variable	Type of the Variable	Indicators	Measurement in the questionnaire
Workplace Safety Ergonomics	Independent	Hazard Detectors: Risk audits, Hazard & accident reporting, Intelligence, Heat, Gas and Smoke Detectors, Protective Devices: Sound, Illumination, Noise, vibration, Robotics and CCTV Cameras, Screening, Unauthorized Entry, Alarms, warnings, Safe tools, Facility planning, sanitary conveniences: changing rooms, water availability Effects Analysis: Recognition of Symptoms of over exposure	Percentage rate
Emergency Management	Independent	Rescue response and evacuation plans, Emergency equipment and medical care, Emergency contacts, safe assembly and exit Points, First aid facilities, emergency logs and documentation.	Percentage rate
Safety Training	Independent	Induction Training, Risk Seminars, talks and Workshops, Risk Committee and Safety manuals, Safety Rules, Safety Drills, Regular briefs	Percentage rate
Workplace Safety transfer	Independent	Group Health Insurance, Private Security, Safety Consultants, Safety Liability Insurance, Personal accident Insurance.	Percentage rate
Employee productivity	Dependent	• Productive time	Period in days
		• Accomplishment of tasks	Tasks accomplished out of the standard
		• Value added	Total firm revenues over the number of employees in a firm

Where:

Y_1 is Employee productivity, β_0 is regression constant, β_1 - β_4 = Coefficients
 X_1 is Safety Ergonomics, X_2 is Emergency management, X_3 is Safety training,
 X_4 is Safety transfer and e_4 is error term

Relationship exists if any of $\beta_1 \dots \beta_4$ is statistically significant.

Ethical statement

This research was approved by the board of Postgraduate studies, University of Embu, Kenya. Further research clearance was granted by national commission for science, technology & innovation. Research License Research License No. 505433 on 23 October 2020.

Research findings and discussion

Summary Statistics

The study computed the range, minimum, maximum, means and standard deviations in the data for each variable to check for any anomalies in the data. The results are presented in Table 3

Results in Table 3 showed that 108 manufacturing firms in Kenya were included in the study. Firms had slightly more than averagely adopted workplace safety programmes with deviation. According to Pandey (2017), firms that have adopted workplace safety programmes demonstrate their commitment to protecting employees from the diverse effects of workplace hazards. These results are positive because, according to the Bureau of Labour Statistics report (2019), over 50% of disabling injuries reported in workplaces are related to a lack of workplace safety programmes. Osha African Report (2019) posits that when safety programmes are present, organisations are likely to have increased employee productivity. The study results in Tables 4-7 confirmed that workplace safety programmes actually predict employee productivity.

The results further indicated that the average value added per unit of employee input was Ksh 3,090,579.975 per year, deviating by 100.07%. This employee productivity was lower than what was found in a study done in the United States (Syverson, 2020) and a similar study in the United Kingdom by (Sheehan and Garavan (2022). also, it is lower than what a study by Signé (2020) reports for Ghana manufacturing firms and the statistics by the Bureau of Labour Statistics report (2019) for Africa. This finding implied that the value added by employees in manufacturing firms in Kenya was lower than in the named countries. However, the current study used a larger sample than Signé (2020) and Sheehan and Garavan 2022, which used a purposive sample. Also, this low employee productivity could be attributed to the slightly more than moderate adoption of workplace safety programmes, as shown in Table 3.

The average unproductive time as a result of safety incidents was 24 days. This indicated that the average productive time out of the standard 260 days in the manufacturing sector in Kenya was 236 days. The 24 lost workdays translated to an average of 192 work hours yearly due to workplace safety incidents. This employee productivity is higher than the Bureau of Labour Statistics report (2019), which established that Kenyan manufacturing firm workers produce an average of 1888 work hours per year compared to the internationally accepted standards of 2080 work hours per year (Bureau of Labour Statistics report, 2019). The number of employees who failed to meet targets averaged 10.83333 per year and deviated by 94.62%. The highest number of employees who failed to meet targets was 76, while the least number who failed to meet targets was 2; therefore implying that employee accomplishment of tasks was not constant across all firms.

**Table 3. Summary Statistics
 Descriptive Statistics**

	N	Range	Min	Max	Mean	Std. Deviation
Work safety	108	3.18	1.45	4.64	3.517	.40417
Value Added	108	7259343.6	50515.46	7309859	3090579.975	1.0706
Productive Time						
• Period in Days	108	98.00	5.00	103	24.3241	.9462
Accomplishment of tasks						
• Targets Met	108	76.000	2.000	78	10.83333	.9462
Valid N (listwise)	108					

Diagnostic tests results

To ascertain whether the assumptions of the ordinary Least Squares hold normality, heteroscedasticity, multicollinearity autocorrelation, and common method variance, diagnostic tests were carried out. The normality of the data was tested using the Skewness Kurtosis test. The Skewness and Kurtosis values for all variables fell within the required threshold of ± 3 and ± 2 and p-values < 0.05 , respectively.

The Breusch-Pagan test was used to test the null hypothesis that the variance of the residuals was homoscedastic. The results showed that probability values of the chi-square statistic obtained for all models were more than 0.05, implying no heteroscedasticity in the residuals. Variance inflation factor (VIF) was used to test the presence of multicollinearity in the econometric models. The findings showed that the VIF values for all explanatory variables were found to be less than 10.00 hence indicating a moderate correlation, but not severe enough to warrant corrective action. The results of this study can therefore be relied upon. The study tested for autocorrelation using the Durbin-Watson (DW) statistic. The Durbin Watson statistic for the models ranged from 2.026 to 2.506. Since these values were between 2 and 2.5, it implied the absence of autocorrelation in the models.

Lastly, given that the data for this study was collected at one point, Harman's single factor test was carried out to determine the common method variance as recommended by Hayes and Rockwood (2017). Montgomery et al. (2021) describe the common method bias as a measurement error resulting from respondents who only provide positive answers due to the sociability of respondents. Common method bias may also result from measuring different constructs with the same method leading to observed covariation between them (Hayes & Montoya, 2017). The results show that the common method bias was absent in the study. The total variance extracted by all the factors exceeded 50%, showing no evidence of the dataset being contaminated by common method bias. Common method bias was controlled by using different methods for measuring the variables; further data was collected from one hundred and eight manufacturing, chosen strictly by chance, reducing chances of getting only positive responses. Since the data was credible, further analysis was conducted without any remedy.

Correlation of work place safety and measures of employee productivity

The study further aimed at assessing the correlation between index of workplace safety constructs and the three measures of employee productivity. The findings are presented on Table 4.

Workplace safety and value-added are strongly and positively related, further, the effect of workplace safety on value-added was significant, as indicated by the p-value in Table 4. The implication is that increased workplace safety leads to a significant increase in value added by employees. These empirical results have confirmed a statement in a report by the European Agency for Safety and Health at Work (EU-OSHA 2021) and a study by Wixted et al. (2018) that opined that eliminating workplace hazards enables employees to stay invested in their work hence are more productive and for every investment in workplace safety there is a corresponding increase in company revenue and value added by employees. The current study results filled these knowledge gaps left by the report by the European Agency for Safety and Health at Work (EU-OSHA (2021), which failed to collect original data, while the study by Wixted et al. (2018) investigated how distress and worry as a result of lack of safety mediated on the relationship between psychosocial risks and workplace safety complaints in manufacturing firms.

Secondly, Table 4 shows that workplace safety and productive time correlate positively and significantly. This suggests that workplace safety programmes increase employee productive time. These empirical results confirm the presumption of a study by Rosemberg and Li (2018) opined that lack of work safety led to decreased work performance in terms of time lost. In addition, these empirical results support the literature review study by Folkard and Tucker (2003) on the relationship between shift work, safety, and productivity. The study opined that

Table 4. Correlation of Work place Safety and Measures of Employee Productivity

Correlations		Workplace Safety	Value Added	Productive time	Accomplishment of Tasks
Workplace Safety	Pearson Correlation	1	.866**	.912**	.769**
	Sig. (2-tailed)		.000	.000	.000
	N	108	108	108	108

Note: **. Correlation is significant at the 0.01 level (2-tailed).

workplace safety reduced the number and impact of safety incidents by ensuring continuous work without work disruptions. Third, the correlation between workplace safety and the degree of accomplishment of tasks was positive and significant. This shows that improvements in workplace safety would lead to an increase in the tasks accomplished by employees. Therefore increase in workplace safety leads to a significant increase in the number of employees who accomplish tasks; hence workplace safety boosts employee productivity in terms of number of employees who accomplish tasks. Umar and Egbu (2020) found similar results; lack of safety programmes in construction firms exposes employees to safety incidents such as heat stress which affects their accomplishment of tasks by committing more mistakes and slacking in their job duties.

Regression analysis of work place safety and employee productivity

Multiple regression analysis was carried out to test the Hypotheses. Workplace safety measured by safety ergonomics, emergency management, safety training, and safety transfer was regressed against each measure of employee productivity (productive time, the accomplishment of tasks, and value-added) separately. Further, an index of the employee productivity measures was computed as recommended by Hayes and Rockwood (2017) and Montgomery et al. (2021). Workplace safety indicators were then regressed against the index to determine their effect on overall employee productivity. The results are presented in Tables 5–7.

Results in Table 5 determined a significant relationship between workplace safety and employee productivity. The probability values obtained for all measures of employee productivity were significant, with p values <0.05 . The values of the adjusted R-squared implied that variations in employee productivity (productive time, accomplishment of tasks, and value-added) could be explained by workplace safety. Precisely 79% of variations in the index of all employee productivity measures, 87.5% of the variations in productive time, 30% of the variations in the degree of accomplishment and 76.5 % of the variations in value added by the employee can be explained by workplace safety. The rest of the variations are explained by random error or other factors. Therefore increase in workplace safety in terms of safety ergonomics, emergency management, safety training, and safety transfer will increase employees' productivity in terms of increased productive time, accomplishment of tasks, and value-added.

Table 6 shows the Analysis of Variance (ANOVA) that ascertains the significance of the estimation models.

The F statistic and P values shown in Table 6 depict that workplace safety was statistically applicable in predicting employee productive time, accomplishment of tasks, and the value added since the models used were statistically significant. Further, this signified that the overall study hypothesis which stated that workplace safety affects employee productivity is accepted. A conclusion is drawn that workplace safety has a statistically significant effect on employee productivity.

Table 7 shows the coefficient estimates of the workplace safety measures and their effect on an index of employee productivity measures, productive time, accomplishment of tasks, and value-added.

Effect of workplace safety ergonomics and employee productivity

The results in Table 7 provide empirical evidence of a significant positive relationship between workplace safety ergonomics and all employee productivity measures. Precisely, the coefficient estimates shown in Table 7 implied that as workplace safety ergonomics is improved by 100%, the index of employee productivity measurements increases by 57.9 %, the productive time of employees increases by 81.9 %, the employee's degree of accomplishment of tasks increases by 79.9%,

Table 5. The Goodness of Fit of Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1(a)	.893 ^a	.798	.790	.39307	.798	101.421	4	103	.000
1(b)	.938 ^a	.880	.875	.33411	.880	188.791	4	103	.000
1(c)	.259 ^b	.670	.300	.39463	.067	1.784	4	103	.013
1(d)	.880 ^b	.774	.765	.51929	.774	87.952	4	103	.000

Note: a. Predictors: (Constant), Workplace safety transfer, Workplace safety training, Workplace safety ergonomics, Workplace safety emergency management
 Model 1(a) Dependent Variable: Index of employee productivity measures; Model 1(b) Dependent Variable: Productive time; Model 1(c) Dependent Variable: Accomplishment of tasks; Model 1(d) Dependent Variable: Value added

Table 6. The overall significance of the model

ANOVA ^a						
		Sum of Squares	df	Mean Square	F	Sig.
1 (a)	Regression	62.681	4	15.670	101.421	.000 ^b
	Residual	15.914	103	.155		
	Total	78.595	107			
1(b)	Regression	84.300	4	21.075	188.791	.000 ^b
	Residual	11.498	103	.112		
	Total	95.798	107			
1(c)	Regression	40.921	4	10.230	1.784	.013 ^b
	Residual	567.694	103	5.734		
	Total	608.615	107			
1(d)	Regression	94.871	4	23.718	87.952	.000 ^b
	Residual	27.776	103	.270		
	Total	122.647	107			

Note: a. Dependent Variable: 1(a) Index of Employee Productivity measures, 1(b) Productive time, 1(c) accomplishment of tasks, 1(d) value added

b. Predictors: (Constant), Workplace safety transfer, Workplace safety training, Workplace safety ergonomics, Workplace safety emergency management

while the value added by employees increases by 75.2 %; holding all other factors constant. These results support the hypothesis that workplace safety ergonomics affects employee productivity.

These findings contribute to the extant literature in three ways. First, the findings provide empirical evidence of the effect of workplace safety ergonomics on employee productive time, degree of accomplishment of tasks, and value-added. Previous studies have only linked workplace safety ergonomics to behavioral responses that may lead to employee productivity. The explanation for these results is that proper safety ergonomics ensure that workers are fully protected; hence they can perform productively without productivity disruptions from safety incidents. Further safety ergonomics ensure that work and workplaces are comfortable enough for the employees to accomplish tasks without safety unease. Proper safety ergonomics is an effective approach to employee productivity as it gives employees the safety mindset to optimally produce results without worrying about incidents. As noted by literature by (Chintada and Umasankar (2022), maintaining employees' productivity is hard when there is safety uncertainty because the unknown often consumes the thoughts of the employee. Therefore, a lack of safety ergonomics may lead to stress and anxiety, which may diminish the productivity of employees (Ravindran, 2021). The findings of the current study have empirically confirmed these observations.

Second, from the theoretical literature, the study used Heinrich's postulates of the Domino theory (1931). The theory explains that removing unsafe conditions in a workplace through safety programmes reduces the effects of exposure to adversity; hence the organisation can achieve the outcomes of a safe working environment. The current study adds to the development of this theory in two ways; first, by showing that safety ergonomics are a critical element for workplace safety, and second, by indicating the employee productivity gains derived from implementing safety ergonomics. When organisations invest in proper workplace safety through safety ergonomics, employees will perform productively without work disruptions or worrying about safety issues. This has been empirically proved by the findings of the current study.

Table 7. Coefficient estimates

	Index of the Employee Productivity measures						Productive time						Accomplishment of tasks						Value added								
	Bss	Std. Error	Beta	T	Sig.	B	Std. Error	Beta	T	Sig.	B	Std. Error	Beta	T	Sig.	B	Std. Error	Beta	T	Sig.	B	Std. Error	Beta	T	Sig.		
Constant	14.415	.088		163.16	.000	.954	.075		12.687	.000	15.905	.548		29.044	.000	16.421	.117		140.577	.000							
X ₁	.579	.247	.274	2.345	.021	.819	.210	.350	3.898	.000	.779	1.516	.126	.514	.038	.752	.327	.354	2.304	.023							
X ₂	.765	.254	.397	3.011	.003	.437	.216	.205	2.020	.046	.582	1.559	.281	1.015	.043	.854	.336	.147	2.542	.013							
X ₃	.204	.245	.106	.832	.007	.621	.209	.291	2.975	.004	.007	1.502	.532	2.002	.044	.356	.324	.133	1.097	.027							
X ₄	.308	.167	.158	1.836	.016	.292	.142	.135	2.050	.000	.380	1.022	.246	1.350	.018	.325	.221	.284	1.468	.004							

Note: α: Dependent Variable: Employee Productivity measured by index of Employee Productivity measures, Productive time, accomplishment of tasks and value added
 Independent variable: Workplace safety; X₁ is Workplace safety ergonomics, X₂ is Workplace emergency management, X₃ is workplace safety training and X₄ is workplace safety transfer to insurance and consultants.

Lastly, the findings further bridge the gaps identified in the previous literature reviewed; Leber et al. (2018) study associated safety ergonomics with positive employee behaviors but was limited to safety ergonomics for persons with disability and failed to test the empirical relationship between employee safety and productivity. The current study adds above the positive employee behaviors; when organisations implement ergonomics, they benefit from positive employee productivity outcomes. The results are similar to Ravindran's (2021) study on the impact of safety ergonomics on employees' work performance in Co-operative Hospitals in India. The study was a critical literature review that found that a lack of safety ergonomics leads to increased absenteeism, errors, and sick leaves, reducing employee productivity. This has been empirically tested by the current study's findings, which found that proper workplace safety ergonomics lead to increased employee productivity in terms of increased added value by employees, increased productive time, and increased accomplishment of tasks. Further, unlike any extant study, the current study determined a significant relationship between workplace safety ergonomics and employee productivity using a broader scope of objective measures, filling the conceptual gaps in extant studies by Pickson et al. (2017), which focused on ergonomic challenges and employee satisfaction; Olabode et al. (2017) and (Corgi, 2020) reviewed the literature on ergonomics awareness; Chintada and Umasankar (2022) focused on the effect of ergonomics on stress; Osoro and Kanyajua (2019) focused only on office arrangement and lighting which are partial measures. Further, the study disputed the contradictory opinion of Kimwomi (2015) and Sinno et al. (2020), which associated workplace safety ergonomics and adverse employee productivity outcomes.

Effect of workplace safety emergency management and employee productivity

Concerning the effect of workplace safety emergency management on employee productivity. The results determined that there is a significant positive relationship between workplace safety emergency management all employee productivity measurements. Precisely, the coefficient estimates and *P* values obtained implied that as organisations improve workplace safety emergency management improves by 100%, it leads to an increase in the index of all employee productivity measures by 76.5%, an increase in employee productive time by 43.7%, an increase in the employee degree of accomplishment of tasks by 58.2% and an increase in employee value added by 85.4% holding all other factors constant. These results support the hypothesis that workplace safety ergonomics affects employee productivity.

The result departs from extant literature in four ways. First, the study has provided empirical evidence that workplace emergency management programmes, including rescue response and evacuation plans, emergency equipment and medical care, emergency contacts, safe assembly, exit points, first aid facilities, emergency logs, and documentation, affect employee productivity. Second, the empirical results of the current study have shown that workplace emergency management does influence employee productive time, degree of accomplishment of tasks, and value-added. Extant literature is deficient in explaining these relationships. The explanation for these results is that workplace emergency management reduces safety distress by employees; therefore, they concentrate better on their work. Further safety emergency management enables organisations to react faster to safety incidents and therefore reduce the extent of productivity disruptions. Further, responding swiftly to incidents prevents organisations from losing an employee's productivity fulfilling a crucial role. Further, it enables organisations to recover quickly from safety incidents, saving productivity time. Third, the results add to the development of existing theoretical literature, specifically the Domino theory by Heinrich (1931). It adds that workplace safety emergency management is a critical element for workplace safety; it adds that organisations with proper emergency management will have their employees accomplish their work tasks better, increase productive time, and add more.

Lastly, the findings bridge the gaps identified in the previous literature reviewed; the study by Alariki and Al-Abad (2021) had similar findings to the current study but used one measure of emergency management and subjective measures of employee performance. The current study used employee productivity data from manufacturing firms in Kenya. Further, the results align with the recommendations of a study by Obrenovic et al. (2020) on sustaining enterprise

operations and productivity during the COVID-19 pandemic. The study recommended safety emergency management as an innovative approach to enhancing employee productivity during the COVID-19 pandemic. The findings of the current study have empirically proved this. Moreover, the current study finding brings new knowledge in using workplace safety emergency management to enhance employee productivity in terms of the value-added, degree of accomplishment of tasks, and productive time. Further, unlike other related previous studies, the current study used the existing safety emergency programmes such as rescue response and evacuation plans, safe assembly and exit points, emergency equipment, and first aid facilities in place in manufacturing firms in Kenya.

Effect of workplace safety training and employee productivity

Results in Table 7 determined a significant positive relationship between workplace safety training and employee productivity. Precisely, the coefficient estimates obtained for the effect of workplace safety training programmes on measures of employee productivity showed that as workplace safety training increases by 100%, it results in an improvement in the index of employee productivity measures by 20.4%, an improvement in employee productive time by 62.1%, an improvement in the employee degree of accomplishment of tasks by 0.7% and an improvement in value added by employees by 35.6% holding every other factor constant. These results support the hypothesis that workplace safety training affects employee productivity.

The results contribute to the extant literature in four ways. First, the study determined the effect of safety training programmes on employee productive time, value-added, and degree of accomplishment of tasks. Extant empirical studies (Aluoch, 2015; Bayram (2022); Obong et al. (2021); Mazorodze and Buckley (2019) have measured workplace safety training in terms of ex-ante perspective (employees' subjective awareness) instead of safety training interventions. These measures could have led to mistaken inferences. Second, the current study provides a fresh perspective on various measures of employee productivity. Conversely, the current study has addressed the conceptual and methodological limitations identified in previous literature by a study by Adim and Mezeh (2020). Adim and Mezeh (2020) study found a significant relationship between safety and health training and employee productivity but used one subjective measure (awareness) of employee productivity. Third, the study clarifies the contradicting findings of a study by (Shockley, 2022), who opined that safety training does not influence productivity as employees often forget what they learned quickly, and the hours spent in training reduce employee productivity time. The current study clarifies that workplace safety training influences employee productivity; however, organisations should supplement instructional safety training with safety rules, manuals, safety drills, and regular briefs since the current study found that these programmes significantly influence employee productivity. Fourth, the study findings add to the development of the existing theoretical literature by determining the employee productivity gains derived from implementing workplace safety training programmes. The explanation for this finding is that safety training ensures safety-mindedness by employees; therefore, it reduces chances of work disruptions from incidents; it also enables informed and adaptive responses to incidents enabling continuity of work operations; it clarifies their precise role in safety and productivity further enables the exchange of perspectives leading to increased productive time, an enhanced accomplishment of tasks and value added by employees.

Effect of workplace safety transfer to insurance and consultant and employee productivity

The study determined a positive and significant relationship between workplace safety transfer through insurance and consultants and employee productivity. The coefficient estimates and p-values obtained pointed out that as workplace safety transfer to insurance firms, private security, and consultants is improved by 100%, it results in a 30.8% increase in the index of employee productivity measures, a 29.2% increase in employee productivity time, a 38.0% increase in the employee degree of accomplishment of tasks, and a 35.2% increase in value added by employees holding all other factor constants. These results support the hypothesis that workplace safety transfer affects employee productivity in manufacturing firms.

Extant literature has explained the results of the current study. For instance, studies by Berry et al. (2020) and Ruvalcaba et al. (2022) have identified safety transfer through insurance as a crucial wellness programme. The studies have argued that safety transfer to health insurance ensures better healthcare for employees and assures them of protection in case of work injuries hence boosting their productivity, as the current study has determined. Therefore insurance ensures healthy and safety-assured employees who accomplish tasks better, add more value and give better productive time. Further in support of the current finding, literature by Knetsch and Watts (2023) argues that safety transfer to insurance programmes such as group life insurance, group health insurance, and personal accident insurance enhances the morale, motivation, and capability of employees. These outcomes are associated with employee productivity, and the current study findings have demonstrated that workplace safety transfer leads to better employee productivity. Further safety transfer to independent consultants and private security guarantees the employees and organisations their safety through proper design of safety programmes, compliance checks, reviews, and suggestions for corrective actions. This enhances employees' productivity, as the current study's findings determined.

These findings add to the extant literature in three ways; first, it has provided empirical evidence that workplace safety transfer to insurance and safety consultants influences employee accomplishment of tasks, their productive time, and value added. Second, the study adds to the development of existing theoretical frameworks by demonstrating that workplace safety transfer is a crucial workplace safety component and influences the most critical organizational outcome, employee productivity. Third, the current study fills the knowledge gaps left by previous studies; first, it determines the combined effect of all workplace safety transfer constructs on employee productivity, whereas past studies conceptually focused on single constructs (Owolabi et al., 2016), Peshawar (2014); Otiso and Mutugi (2018). These studies suggested that workplace safety transfer may affect employee productivity; nonetheless, unlike the current study, they barely pursued its effect on employee productive time, degree of accomplishment of tasks, and value-added. Further, the study clarifies the contradictory literature by Perrow (2014), which suggested that safety transfer programmes are costly to purchase and hence may diminish employee value added and that safety transfer to consultants and robotics are expensive and may make employees more stressed about their job tenure thus reduce employee productivity. Conversely, the current study has empirically determined that safety transfer significantly influences employee productivity in all aspects of productive time, value-added, and degree of accomplishment of tasks.

Therefore, this study concludes that the effect of workplace safety (safety ergonomics, emergency management, safety training, and safety transfer) on each employee productivity measure is positive and statistically significant at a 5% significance level. Therefore regardless of how we define employee productivity, workplace safety affects employee productivity. The multiple regression model was presented using the index of all employee productivity measures recommended by Tjostheim et al. (2021). Tjostheim et al. (2021) posit that the model should be presented using the index of all measures as this depicts all parameters simultaneously estimated and included in one model, so there is no contradiction. This is presented by equation 7.1.

$$\text{Employee Productivity}(Y) = 14.415 + 0.579x_1 + 0.765x_2 + 0.204x_3 + 0.308x_4 + \varepsilon$$

Where X_1 is Safety Ergonomics, X_2 is Emergency management, X_3 is Safety training, X_4 is safety transfer and ε_4 is error term.

Conclusion and recommendation

Based on the findings, the study concluded that an increase in workplace safety in terms of safety ergonomics, emergency management, safety training, and safety transfer leads to an increase in employee productivity in terms of productive time, the accomplishment of tasks, and value-added. Therefore, firms that intend to improve their employees' productivity should invest in effective workplace safety programmes. This will enable employees to accomplish tasks without defects, meet their performance targets, and increase their contributed value and productive time. The prior literature supports this conclusion as workplace safety is associated with a broader range of positive employee behavioral

responses, and the current study determined that it influences the productivity of employees. Future research could consider exploring historically contextualized analyses and longitudinal research design. Longitudinal studies for at least five years can examine the evolutionary effect of workplace safety on employee productivity.

Funding

The authors received no direct funding for this research.

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Disclosure statement

No potential conflict of interest was reported by the authors.

Citation information

Cite this article as: Workplace Safety and Employee Productivity of Manufacturing Firms in Kenya, Tetu Mwenda Mutegi, Paul Mugambi Joshua & Jesse Maina Kinyua, *Cogent Business & Management* (2023), 10: 2215569.

References

- Adim, C. V., & Mezeh, A. A. (2020). Health and safety training and employee performance in oil and gas companies in Rivers State, Nigeria. *British International Journal of Education and Social Sciences*, 7(8), 41–50.
- Adjotor, F. N. (2013). *The Effects of Occupational Safety and Health on Labour Productivity: A Case Study of Some Selected Firms in the Greater Accra Region of Ghana*. University of Ghana Dissertation. University of Ghana.
- Alariki, G., & Al-Abed, M. S. (2021). The impact of crisis management on employee's performance in the Yemeni Oil and Gas Industry. *Journal of Systems Impact*, 2(1), 16–27. <https://doi.org/10.48110/joi.v2i1.17>
- Al Mazrouei, M. A., Khalid, K., & Davidson, R. (2019). Modeling the impact of safety climate on process safety in a modern process industry: The case of the UAE's oil-refining industry. *Cogent Business & Management*, 6(1), 1647591. <https://doi.org/10.1080/23311975.2019.1647591>
- Alonso, S., Muunda, E., Ahlberg, S., Blackmore, E., & Grace, D. (2018). Beyond workplace safety: Socio-economic effects of safety training in dairy products manufacturers and vendors in Kenya. *Global Food Security*, 18, 86–92. <https://doi.org/10.1016/j.gfs.2018.08.006>
- Aluoch, G. (2015). Effect of occupational safety and health programmes on employees at the Kenya power. *The Milbank Quarterly*, 89(4), 728–772.
- Aswathappa, K. (2015). *Human resource management: Text and cases*. Tata McGraw-Hill Education.
- Bayram, M. (2022). Factors affecting employee safety productivity: An empirical study in an OHSAS 18001-certified organization. *International Journal of Occupational Safety and Ergonomics*, 28(1), 139–152. <https://doi.org/10.1080/10803548.2020.1739892>
- Berry, L., Mirabito, A. M., & Baun, W. B. (2020). *What's the hard return on employee wellness programs?* SSRN. <https://mays.tamu.edu/wp-content/uploads/2019/08/Whats-the-Hard-Return-on-Employee-Wellness-ProgramsHBR2010.pdf>
- Bieder, C., Gilbert, C., Journé, B., & Laroche, H. (Eds.). (2018). *Beyond safety training: Embedding safety in professional skills*. Springer International Publishing.
- Bureau of Labour Statistics report. (2019). *World Employment and Social Outlook: Trends*. 2019 ISBN 9458-92-2-132953-4 (web pdf) <https://www.ilo.org/global/research/global-reports/weso/trends2022/lang-en/index.htm>
- Capodaglio, E. M. (2022). Participatory ergonomics for the reduction of musculoskeletal exposure of maintenance workers. *International Journal of Occupational Safety and Ergonomics*, 28(1), 376–386. <https://doi.org/10.1080/10803548.2020.1761670>
- Chintada, A., & Umasankar, V. (2022). Improvement of productivity by implementing occupational ergonomics. *Journal of Industrial and Production Engineering*, 39(1), 59–72. <https://doi.org/10.1080/21681015.2021.1958936>
- Corgi. (2020) *Ergonomics and its Effects at Kenya Plant*. Retrieved from [https://studycorgi.com/ergonomics-and-its-effects-at-kenya-plant/September 8](https://studycorgi.com/ergonomics-and-its-effects-at-kenya-plant/September%208).
- Cudjoe, S. F. (2017). An assessment of occupational health and safety practices on Labour Productivity at the Tetteh Quarshie Memorial Hospital, Mampong-Akuapem. *The International Journal of Social Sciences Invention*, 3(8), 3789–3792.
- Dessler, G., & Varrkey, B. (2015). *Human Resource Management*, 15e: Pearson Education India.
- Drake, D., Drake, D. A., & Steege, L. M. (2018). Safety maintenance implement for manufacturing firms. *Western Journal of Risk and Safety Research*, 42(5), 332–339. <https://doi.org/10.1177/0193945919863409>
- Drucker, P. F. (2002). The discipline of innovation. *Harvard Business Review*, 80(SY2301), 95–104. https://d1wqtxts1xzle7.cloudfront.net/57049925/6_The_Discipline_of_Innovation-libre.pdf?1532297647=&response-content-disposition=inline%3B+filename%3DThe_Discipline_of_Innovation.pdf&Expires=1684318539&Signature=f4KxzoNpysIYwNPuTvsz9RwDAiG34JIS3AGEvXMY6uob4McHIKI-8DwCvYXqCaucVx3tXRn74Vpu2xhf68i5oOC~Lx8VB~GaeK11WG8jgKGfNvgdOs42MrRdQOLTMHyf06gk-u-VdlhCUuw1uGWVwForiFeF977rZXN52JaDZ-ac~hlyciX0JozNjr5Of67Td2pRvFWCapdn3YkqgPZ3HoGGGgPe9WYct6dVAO17e2YubygnHeebrdoieSyquQWo8t9qX0yB3kJZXkiobnm6M-y0fooGHR1Rq6JRETS4kre3GDULomq4YD3G2BIDq1QIthh5JWCGKO2OM~QleA_&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA
- EU-OSHA. (2021). The digitalization of work: psychosocial risk factors, work-related and employee productivity. Retrieved from [https://osha.europa.eu/en/publications/April 2022](https://osha.europa.eu/en/publications/April%2022).
- European Employee Productivity Institute. (2019). *Extended employee productivity crisis and national goals*. Retrieved from https://ec.europa.eu/info/sites/default/files/economy-finance/pop_2019_ang.pdf April. 2022.
- Folkard, S., & Tucker, P. (2003). Shift work, safety and productivity. *Occupational Medicine*, 53(2), 95–101. <https://doi.org/10.1093/occmed/kqg047>
- Gilje, E. P., & Wittry, M. D. (2021). Is Public Equity Deadly? *Evidence from Workplace Safety and Productivity Tradeoffs in the Coal Industry National Bureau of*

- Economic Research*, 14-2021(w28798), 113-127. <https://www.nber.org/papers/w28798>
- Goetzal, U. F. (2018). *Examining the value of integrating occupational health and safety and health promotion programs in the workplace*. US Department of Health and Human Services, Public Health Services, Centers for Disease Control, National Institute of Occupational Health and Safety, 3(1), 496-541.
- Grabowski, A. (2019, July). Innovative and comprehensive support system for training people working in dangerous conditions. In *International Conference on Human-Computer Interaction* (pp. 394-405). Springer, Cham.
- Gubler, E. A., Tai, C. W., Kondracki, L., Sommer, H., & Novák, P. (2022). Health insurance benefits as a labor market friction: Evidence from a quasi-experiment. *Strategic Management Journal*, 43(8), 1556-1574.
- Gupta, A. K., Diallo, K., Zurn, P., & Dal Poz, M. R. (2016). Assessing human resources for health: What can be learned from labour force surveys? *Human Resources for Health*, 1(1), 5. <https://doi.org/10.1186/1478-4491-1-5>
- Hacamo, I. (2022). Racial Prejudice, Safety, in the Workplace and Firm Revenue. Available at SSRN 4033827.
- Hayes, A. F., & Montoya, A. K. (2017). A tutorial on testing, visualizing, and probing an interaction involving a multicategorical variable in linear regression analysis. *Communication Methods and Measures*, 11(1), 1-30. <https://doi.org/10.1080/19312458.2016.1271116>
- Hayes, A. F., & Rockwood, N. J. (2017). Regression-based statistical mediation and moderation analysis in research: Observations, recommendations, and implementation. *Behaviour Research and Therapy*, 98, 39-57. <https://doi.org/10.1016/j.brat.2016.11.001>
- Heinrich, K. (1998). Heinrich Domino theory. *International Journal of Advances in Engineering & Technology*, 4(2), 53.
- Henkel, T. G., Marion, J. W., Jr., & Bourdeau, D. T. (2019). Project manager leadership behavior: Task-oriented versus relationship-oriented. *Journal of Leadership Education*, 18(2), 1. <https://doi.org/10.12806/V18/I2/R8>
- Huang, Y. H., Robertson, M. M., Lee, J., Rineer, J., Murphy, L. A., Garabet, A., & Dainoff, M. J. (2022). Supervisory interpretation of safety climate versus employee safety climate perception: Association with safety behavior and outcomes for lone workers. *Transportation research part F: Traffic psychology and behaviour. Transportation Research Part F Traffic Psychology and Behaviour*, 26, 348-360. <https://doi.org/10.1016/j.trf.2014.04.006>
- Hulme, A., Stanton, N. A., Walker, G. H., Waterson, P., & Salmon, P. M. (2022). Testing the reliability and validity of risk assessment methods in Human Factors and Ergonomics. *Taylor & Francis International Journal of Ergonomics*, 65(3), 407-428. <https://doi.org/10.1080/00140139.2021.1962969>
- International Labour Organization. (2018). *ILO Declaration on Fundamental Principles and Rights at Work and Its Follow-Up*.
- International Loss Control Institute-ILCI. (2015). *Cause, effect, and control of accidental loss guidelines for manufacturing companies*. CRC Press.
- Kabir, Q. S., Watson, K., & Somaratna, T. (2017). Workplace safety events and firm performance. *Journal of Manufacturing Technology Management*, 29(1), 104-120. <https://doi.org/10.1108/JMTM-07-2017-0133>
- Karaboga, T., Erdal, N., Karaboga, H. A., & Tatoglu, E. (2022). Creativity as a mediator between personal accomplishment and task performance: A multigroup analysis based on gender during the COVID-19 pandemic. *Current Workplace Psychology*, 1-13. <https://doi.org/10.1007/s12144-021-02510-z>
- Kenya Manufacturers and Exporters Directory. (2018). Association of Manufacturers (KAM) Directory 2018. Retrieved from <https://kam.co.ke> December 13, 2020.
- Keraka, C. N. (2020). *Safety Management System and Employee Performance in Textile Manufacturing Companies in Selected Counties in Kenya* (Doctoral dissertation, JKUAT-COHRED).
- Kimwomi, K. (2015). Knowledge Strategy, Organizational Characteristics. *Innovation and Performance of Manufacturing Firms in Kenya University of Nairobi, School of Business*, 24385(2015).
- Kingsley, A., Robinson, T. P., Roche, C., Pugh, T., Richards, S. P., Kingsley, A. J., Lowe, J. P., & Johnson, A. L. (2012). The impact of office ergonomics on employee performance; a case study of the Ghana National Petroleum Corporation (GNPC). *Inorganic Chemistry*, 51(1), 246-257. <https://doi.org/10.1021/ic201602m>
- KIPPRA. (2023). An overview of workplace safety and health in Kenya. *Nairobi KIPPRA An Overview of Workplace Safety and Health in Kenya*, 2023(3). <https://kippra.or.ke/an-overview-of-workplace-safety-and-health-in-kenya/>
- KNBS. (2022). *Kenya Demographic and Health Survey 2018*. Kenya National Bureau of Statistics.
- Knetsch, J., & Watts, K. (2023). What is the potential of compensation funds for addressing COVID-related personal injury? *The Geneva Papers on Risk and Insurance-Issues and Practice*, 1-22. <https://doi.org/10.1057/s41288-023-00292-y>
- Kurdy, A., Rzechuła, A., Pawłowska, J., & Soliwoda, M. (2021). Workplace insurances, work productivity and the environment: A way forward to a better understanding. *Business & Management Journal*, 11(11), 1108. <https://doi.org/10.3390/agriculture11111108>
- Laffont, J. J., & Martimort, D. (2009). *The theory of incentives: The principal-agent model*. Princeton university press.
- Laura, D. C. (2019). Mediation effects of safety climate and safety motivation on the relation between organizational climate and safety performance in the workplace. *Testing, Psychometrics, Methodology in Applied Psychology*, 15(2), 77-90.
- Leber, M., Bastič, M., Moody, L., & Krajnc, M. S. (2018). A study of the impact of ergonomically designed workplaces on employee productivity. *Advances in Production Engineering & Management*, 13(1), 107-117. <https://doi.org/10.14743/apem2018.1.277>
- Leonhardsen, M., Nilsen, A. S., & Olsen, O. E. (2022). The process of integrating risk management: Usefulness, standardisation and adaptation. *International Journal of Emergency Management*, 17(3/4), 255-273. <https://doi.org/10.1504/IJEM.2022.125157>
- Malavi, D. N., Abong, G. O., & Muzhingi, T. (2021). Effect of safety training on behavior change of food handlers: A case of orange-fleshed sweetpotato purée processing in Kenya. *Food Control*, 119, 107500. <https://doi.org/10.1016/j.foodcont.2020.107500>
- Mazorodze, A. H., & Buckley, S. (2019). Knowledge management in knowledge-intensive organisations: Understanding its benefits, processes, infrastructure and barriers. *South African Journal of Information Management*, 21(1), 1-6. <https://doi.org/10.4102/sajim.v21i1.990>
- Mburu, R. O., & Kiiyukia, C. (2017). Assessment of occupational safety and health status of sawmilling industries in Nakuru County, Kenya. *International Journal of Health Sciences*, 5(4), 75-102.
- McClelland, G. M. (2000). The tip of the iceberg safety theory. *Quality Progress*, 34(5), 29-37.

- Montgomery, D. C., Peck, E. A., & Vining, G. G. (2021). *Introduction to linear regression analysis*. John Wiley & Sons.
- Mora, Z., Suharyanto, A., & Yahya, M. (2020). Effect of work safety and work healthy towards employee's productivity in PT. Sisirau Aceh Tamiang. *Burns*, 3(2), 753–760. <https://doi.org/10.33258/birci.v3i2.887>
- Mwaruta, S. S. (2022). *Occupational Safety and Health Training and Performance of Cement Manufacturing Firms in Kenya* (Doctoral dissertation, JKUAT-COHRED).
- Ndegwa, P. W., Guyo, W., Orwa, G., & Murigi, E. M. (2022). Legal Framework as a Determinant of Implementation of Occupational Health and Safety Programmes in the Manufacturing Sector in Kenya. *International Journal of Human Resource Studies*, 4(4), 21. <https://doi.org/10.5296/ijhrs.v4i4.6500>
- Nguyen, S. V., & Zawacki, A. M. (2019). Health insurance and productivity: Evidence from Evidence from the manufacturing sector. *US Census Bureau Center for Economic Studies Paper No. CES-WP-09-27*.
- Obong, M., Amadi, C., Ekpenyong, O., Emu, W., & Edodi, H. (2021). Influence of Health and Safety Training, Safety Monitoring and Enforcement of Compliance on Employee Efficiency in Manufacturing Firms. *Research in World Economy*, 12(2), 86. <https://doi.org/10.5430/rwe.v12n2p86>
- Obrenovic, B., Du, J., Godinic, D., Tsoy, D., Khan, M. A. S., & Jakhongirov, I. (2020). Sustaining enterprise operations and productivity during the COVID-19 pandemic: "Enterprise Effectiveness and Sustainability Model". *Sustainability*, 12(15), 5981. <https://doi.org/10.3390/su12155981>
- Olabode, S. O., Adesanya, A. R., & Bakare, A. A. (2017). Ergonomics Awareness and Employee Performance: An Exploratory Study. *Economic and Environmental Studies*, 18(44), 813–829. <https://doi.org/10.25167/ees.2017.44.11>
- Osha African Report. (2019) Occupational safety and health in Africa: Country profiles, Improving and maintaining a safe and healthy working environment for all. OSHAfrica 2019 conference.
- 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.
- Otiso, H. N., & Mutugi, J. (2018). Effect of risk prevention techniques on theft in Public Hospitals in Embu County, Kenya. *International Journal in Management & Social Science*, 6(4), 1–31.
- Owolabi, M. O., Thrift, A. G., Mahal, A., Ishida, M., Martins, S., Johnson, W. D., & Shobhana, A. (2016). Workplace safety incidents prevention worldwide: Translating evidence into action. *The Lancet Public Health*, 7(1), e74–85.
- Perrow, C. (2014). Link between workplace health & safety & firm performance & productivity. In Martin, P. (Ed.), *Normal accidents: Living with high risk technologies-Updated edition* (pp. 114–121). Princeton university press.
- Peshawar, F. (2014). Employee safety transfer in universities and employee productivity. *Environmental Monitoring and Assessment*, 187(3), 126.
- Pickson, R. B., Bannerman, S., & Ahwireng, P. O. (2017). Investigating the effect of ergonomics on employee productivity: A case study of the butchering and trimming line of pioneer food cannery in Ghana. *Modern Economy*, 8(12), 1561. <https://doi.org/10.4236/me.2017.812103>
- Ravindran, D. (2021). Ergonomic impact on employees' work performance in A.K.G Memorial Co-Operative Hospital, Kannur. *Advance and Innovative Research*, 6(1), 231–237.
- Reese, C. D. (2018). *Occupational health and safety management: A practical approach*. CRC press.
- Rosemberg, M. A. S., & Li, Y. (2018). Effort-reward imbalance and work productivity among hotel house-keeping employees: A pilot study. *Workplace Health & Safety*, 66(11), 516–521.
- Ruvalcaba, C., Akdevelioglu, D., & Schroeder, J. (2022). Stakeholders as value creators: The role of multi-level networks in employee wellness programs. *Journal of Macromarketing*, 42(3), 414–432. <https://doi.org/10.1177/02761467221084626>
- Sabet, P. G. P., Lahiji, H. A., Aadal, H., & Rad, K. G. (2021). Description of Organization Failure Process and the Way of Prevention by a Simulated Model Originated from Accident Domino Theory. *Journal of Basic and Applied Scientific Research*.
- Saleem, F., Malik, M. I., & Malik, M. K. (2021). Toxic Leadership and safety performance: Does Organizational Commitment act as Stress Moderator? *Cogent Business & Management*, 8(1), 1960246. <https://doi.org/10.1080/23311975.2021.1960246>
- Samnani, A. K., & Singh, P. (2017). Workplace Safety: Considering the interaction between individual and work environment. *Journal of Business Ethics*, 139(3), 537–549. <https://doi.org/10.1007/s10551-015-2653-x>
- Sawe, N. G., Onyango, C. M., & Njage, P. M. K. (2013). Current safety management systems are associated with lower performance due to context riskiness. *Risk Control*, 40, 335–343. <https://doi.org/10.1016/j.foodcont.2013.12.019>
- Sheehan, M., & Garavan, T. (2022). High-performance work practices and labour productivity: A six wave longitudinal study of UK manufacturing and service SMEs. *The International Journal of Human Resource Management*, 33(16), 3353–3386.
- Shockley, M. D. (2022). *Getting Ready to Work: Using Initial Job Training at Sun East to Impact Perception of Role Preparedness & Intention to Remain on the Frontline* (Doctoral dissertation, Wilmington University (Delaware)).
- Signé, L. (2020). The potential of manufacturing and industrialization in Africa: Trends, policy, safety, opportunities, and strategies for growth. Retrieved from <https://com/africaportal.org> on 13th December 13, 2022.
- Simiyu, G., Kariuki, V., Ombaba, M., & Otuya, R. (2020). Effects of the occupational environment on employee performance in sugar industries in Kenya: An Indirect Effect Model. *SEISENSE Journal of Management*, 5(1), 1–16. <https://doi.org/10.33215/sjom.v5i1.724>
- Sinno, N., Ammoun, M., & Alam, A. S. A. (2020). The Impact of Ergonomics on employees' productivity in the architectural workplaces. *International Journal of Psychosocial Rehabilitation*, 24(2). <https://doi.org/10.37200/IJPR/V24I2/PR200556>
- Society for Human Resource Management. (2023). The voice of all things work. *Academy of Management Journal*, 38(11–2023), 635–672.
- Strasser, H. (2022). Compatibility as guiding principle for ergonomics work design and preventive occupational health and safety. *Zeitschrift Für Arbeitswissenschaft*, 76(3), 243–277. <https://doi.org/10.1007/s41449-021-00243-0>

- Syverson, C. (2020). Challenges to mismeasurement explanations for the US productivity slowdown. *Journal of Economic Perspectives*, 31(2), 165–186.
- Tjostheim, D., Otneim, H., & Stove, B. (2021). *Statistical Modeling Using Local Gaussian Approximation*. Academic Press.
- Umar, T., & Egbu, C. (2020). Heat stress, a hidden cause of accidents in construction. *Proceedings of the ICE*, 173(1), 49–60. <https://doi.org/10.1680/jmuen.18.00004>
- Wilson, L. L. (2010). Before the emergency: A framework for evaluating emergency preparedness alternatives at higher education Institutions naval postgraduate school montereycal. ADA531738 1738 <https://apps.dtic.mil/sti/citations/ADA531738> . naval postgraduate school montereycal.
- Wixted, F., Shevlin, M., & O'Sullivan, L. W. (2018). Distress and worry as mediators in the relationship between psychosocial risks and upper body musculoskeletal complaints in highly automated manufacturing. *Ergonomics*, 61(8), 1079–1093. <https://doi.org/10.1080/00140139.2018.1449253>
- Young, H. J. (2014). Management of safety of employees in Kenyan companies. *Organisational. Management Journal*, 5(2), 249–255.