

ARTIFICIAL INTELLIGENCE (AI) IN OCCUPATIONAL HEALTH AND SAFETY: PROMOTING SAFE AND HEALTHY WORK ENVIRONMENTS AMONG FACTORY WORKERS IN NIGERIA

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Abstract

This study focused on artificial intelligence (AI) in occupational health and safety: Promoting safe and healthy work environments among factory workers in Nigeria. This study aimed at finding out the importance of artificial intelligence (AI) in occupational health and safety. This study aimed at finding out the problems of artificial intelligence (AI) in occupational health and safety among factory workers and also investigating ways of improving occupational health and safety among factory workers in Nigeria using artificial intelligence (AI). Occupational health and safety best describe a critical pillar that bothers around the management of facilities which helps in safeguarding workers from occupational hazards. Safety can be best described as the process of being free from harm and dangers that are capable of causing injuries. Artificial Intelligence (AI) simply talks about computer systems which were designated to carryout functions of tasks that solely involve human intelligence. The researcher found out the problems associated with Artificial Intelligence (AI) in occupational health and safety which include: Inadequate digital infrastructure, Resource constraint, Limited technical expertise, and Poor data quality. It was concluded that Artificial Intelligence (AI) which involves the use of internet facilities has made things easy with the current advent of technology. It was recommended that Health educators are to organize seminars, conferences and workshops in training factory workers in understanding what artificial intelligence (AI) entails and how and when to apply them.

Keywords: Artificial intelligence (AI), Occupational health, Safety, Healthy work environments.

Introduction

Artificial Intelligence (AI) which involves the use of internet facilities has made things easy with the current advent of technology has created a platform where issues pertaining occupational health and safety can be discussed. Artificial intelligence is linked closely as being part of the most essential quality of human beings because human behaviors are actually ascribed to intelligence (Reagan, 2018). Artificial intelligence has put it that human beings are the most intelligent creatures on earth and it is also seen to be pictured

in the way they exercise superiority of behavior which is quite different from animals (Kumar, 2018). It is understood that human intelligence is often expressed when the human behavior freely interacts with nature and that of the human surroundings such as random mutations for greater intelligence that usually get selected ideally (Kumar, 2018).

AI-Powered computer system that do things in an easier way which out-weighs what humans find more difficult in executing and detect vast amounts of data in a short period of time and it gives room for more prediction of insights and it aids in the automation of safety measures (Neptune, 2024). Accordingly, Internet of Things (IOT) assists in the area of artificial intelligence (AI) in coming up with devices that will be safe for all those who work in factories are referred to as wearable sensors and monitoring systems connected play a vital role in providing continuous data streams to encourage situational sensitization and the detection of hazards in the workplace (Karadag, 2024).

Innovative and technological trends such as computer vision for the physical detection of hazards, prediction of analytics for exposure control as well as real-time system alerts have been found to have chances of increasing being integrated into safe place of work by demonstrating their usefulness in avoiding illnesses and injuries (Awioroko&Ibegbulam, 2024). Occupational health and safety best describe as a critical pillar that bothers around the management of facilities which helps in safeguarding workers from occupational hazards in various places of work while it also helps in ensuring that compliance with regulatory standard is guaranteed (Iyanda and Odetayo, 2023;Ailemen, 2024). Globally, it has been estimated that 2.8 million workers die each day as a result of work-related accidents and diseases which has recorded 4% of global gross domestic product of losses due to accidents and poor working conditions (International Labour Organization, 2024). One of the most important organizational approach with the potential in reducing the injuries often recorded in the workplace is to encourage the development of an occupational health and safety management system (OHSM) is another factor that has been on ground for decades now and is a recognized standard internationally such as occupational health and safety assessment series (OHSAS) (British Standards Institution, 2023).

Machine learning and deep learning algorithms has tremendously helped in the technological advancement as it applies to occupational health and safety because it is the easiest way in which individuals who work in factories will be properly informed on the importance that is applied towards staying in good health at all times (Chizubem, Obasi, Akinwande & Ile, 2024). Artificial Intelligence (AI) can also be divided into two primary categories which involve: Internet of Things (IOT) is also meant to be optimized for special assignments and also carries out functions well in voice assistants, recommendation algorithms as well as image recognition systems (Howard, 2022). AI adoption index in this instance is solely meant to obtain data from Scopus in which it is evident in the sense that integrating AI (Artificial Intelligence) technologies within occupational health and safety is gradually becoming progressively common and valuable because AI deployment has in the last 25 years grown significantly and it has also contributed to AI in predicting maintenance, diagnostics and immersive safety training enrolments (Ferrara, Bertozzi, Di Fazio, Aquila, Maiese, Volonnino, Frati & La Russa, 2024).

Oluseye et al., (2024) was of the view that one of the greatest challenges of the application of artificial intelligence (AI) is the perception of factory workers as it is regarded as a tool for empowerment or it serves as a threat to job security and it has a significant influence on the engagement and overall job satisfaction. Moreover, it involves more of traditional methods in order to address challenges encountered in integrating artificial intelligence (AI) into occupational health and safety because it offers a lot of innovative solutions and it also provides a proper comprehensive monitoring across large and diverse workforces especially in industries that has high level of occupational risk (Hassall, 2019).

It was estimated that the workforce population data has shown that notore chemical industries had a workforce of a total figure of 441 employees as of December 31, 2023 with over 1500 personnel including that of sub-contractors and in the same vein, the Indorama fertilizers employ a diverse work-force for over 300 employees and over 3000 sub-contractors and laborers that accompany with a commitment to gender equality (Indorama Ventures, 2023). Dangote fertilizer employs an essential workforce with the population of 804 female employees and the population of 10, 608 male employees as of the year 2020 and it includes both permanent and temporary staff (Dangote Cement, 2021). The researcher observed that factory workers pay no attention to safety measures that govern the rules of workshop ethics despite the introduction of artificial intelligence (AI) which guides in the promotion of safe healthy working environments that is why things seem not to record improvements. Factory workers are in the habit of not eliminating the environment where they work of hazards that cause accidents and harm to them. The researcher aimed at focusing on the application of artificial intelligence (AI) in occupational health: Promoting safe and healthy work environments among factory workers in Nigeria. The researcher aimed at finding out the importance of artificial intelligence (AI) in occupational health and safety among factory workers in Nigeria. The researcher aimed at finding out the problems of artificial intelligence (AI) in occupational health and safety among factory workers in Nigeria and also investigating ways of improving occupational health and safety among factory workers in Nigeria using artificial intelligence (AI).

The questions that cut across the mind of researchers are: What is the importance of artificial intelligence (AI) in occupational health and safety among factory workers in Nigeria? What are the problems of artificial intelligence (AI) in occupational health and safety among factory workers in Nigeria? What are the ways of improving occupational health and safety among factory workers in Nigeria using artificial intelligence (AI)?

This study will enhance existing literature on Artificial Intelligence (AI) in occupational health: Promoting safe and healthy work environments among factory workers in Nigeria and contribute to academic debates on the study. Its findings may inform factory workers in Nigeria, Nigerian government, and help identify the challenges of occupational health and safety with the application of artificial intelligence (AI).

Concept of Occupational Health

Occupational health and safety at the workplace still remain important among factory workers which is an area where more focus is given across industries in as much as that of others who work in occupational hazard prone areas and in some instances workplaces that are more prone to occupational hazards includes constant exposures to substances that are very harmful, ergonomic risks and environments that are stress inducing (Cynthia & Friday, 2025). It was discovered that despite the advancement in safety protocols, it was on record that the dynamic state of hazards often encountered in workplaces and the limitations of the present methods of surveillance has made it more difficult to proactively address the risks involved as far as the issue of occupational health of factory workers are concerned (Azizi et al., 2022). There has been an increase in the complexity of modern workplaces coupled with the evolving health and safety requirements; it has underscored the need for innovation approaches to make sure that the health and safety of employees are always in a safe state (Nunfam et al., 2019).

Occupational health and safety within the vicinity of factories which is tailored towards management has predominantly relied on reactive methods which includes the manual risks assessment, physical inspections as well as the post-incident evaluation (Adesokan, 2024). Technological transformation has further influenced the advancements in the area of artificial intelligence, robotics and other emerging innovations as well as the changes made in the workforce of demographics, economic stability and the required number of skills set to adapt to the current changes that have taken place (Tamers et al., 2020).

It is well accepted that the application of artificial intelligence (AI) in occupational health and safety is in the area of lacking ethical and regulatory challenges as in the summations of the international association of privacy professionals (IAPP) privacy and consumer trust report amounting to 68% of global challenges of occupational health and safety and it is based on recent statistical information of factory workers recorded on a daily basis which amounted to 57% of individuals who solely believed that the increasing use of AI significantly threatens their privacy (IAPP, 2024).

It has been observed that existing regulatory frameworks such as the occupational health and safety administration standards were established in the U.S in 1970 and those by the European agency for safety and health at work was founded in 1994 were not meant to be compatible with artificial intelligence (AI) technologies in view which led to ambiguities in compliance as well as enforcement and with that AI has been recently integrated to tackle the gaps bridged and seek for measures that will aid in the improvement at workplaces (European Agency for Safety and Health at Work, 2021). The absence of standardized guidelines for AI in workplace safety increases the risk of ethical breaches in the aspect of making informed decisions for factory workers to embrace measures that will improve their overall well-being (Murikah et al., 2024).

Concept of Safety

Safety can be best described as the process of being free from harm and dangers that are capable of causing injuries to an individual as well as a group of people. Merriam Webster

(2023) defined safety as a process where a person is being free from anything that leads to danger, harm, loss or a situation when an object is not likely to cause harm. There are varieties of descriptions of AI in analyzing safety in different perspectives because the use of computer and robotics best demonstrate the importance of safety to individuals and how they can best apply it to their day to day lives and it is a lot easier due to the technological advancement that is currently on ground (Jobin et al., 2019). In addition, the IEE's Ethical Aligned Design (EAD) went on to further explain AI safety as the probability that a system will either perform its functions in the right perspective or it will stop its importance in a properly defined safe manner (Laplante, 2017).

Most importantly, safety is explained as error preventions from AI systems in a bid that system engineers critically observed that a system is able to carry out its functions in an appropriate way or reliably and still not be able to perform its specified functions as well as various kinds of accidents have more chances of occurrence from the interactions of its different reliable and components that are without faults (Leveson, 2011). With the advent of AI systems on ground, safety also goes beyond technological failures and its impacts on individuals it involves social impacts on the well-being of individuals and the welfare of the general public (Leslie, 2019).

Leslie (2019) explained that ensuring AI safety in real-world environments that are usually surrounded with various uncertainties as a challenging and unrelenting task involving AI risk management and this conforms alongside the predominant method to AI safety in the existence of trustworthy AI guidelines. AI has made use of automobiles, medical devices as well as law enforcement have been categorized at high risk, AI systems including that of high risk or life and death scenarios in areas where mistakes result in multiple deaths (NTSB) (UNESCO, 2021). Overall, AI safety and risk management mechanisms have to reflect on the factors governed by safety in a diverse real-world environment where it happens that AI systems might function including their environments that are made up of people and their different values alongside other technologies involved (Tabassi, 2023). This also helps in ensuring that AI safety in the environment that has been deployed and it simply requires critically and holistically while considering the safety implications in their potential use and it has gone far to deploy social environments and it also goes hand in hand to integrate it into the development and lifecycle (Staff, 2020).

Healthy Work Environment

Technology has become significant in the digital space in the sense that the emergence of innovation and competition in healthy working environments are brought in so as to assist those who work in factories make use of internet facilities so that there will be great improvement in their workplaces (Alena et al., 2025). The use of computer technology has to continue to assist in reshaping daily routines, communication, collaboration as well as task execution which has most importantly made positive impact on factory workers and its function in driving organizational performance in which few studies have proven that the negative impact of AI in the workplace in safety and adopting positive healthy lifestyles (Kinder et al., 2023). With the adoption of AI, it assists in adopting employees and

organizational performance and it effectively improves the efficiency in organizational processes (Loureiro et al., 2021).

AI technologies can learn and adjust overtime independently in a bid enables them to manage complex environments that are changing continuously in which they are found to have major health implications for factory workers as well as their processes in organizational settings (Ramaul et al., 2025).

Importance of Artificial Intelligence (AI) in Occupational Health and Safety

AI in healthy working environments is useful when it is applied properly. The contribution of AI is used in predicting maintenance, diagnosis and immersive safety training (Ferrara et al., 2024). AI is very essential because it assists in transforming the occupational health and safety domain and it positively enhances safety performance (Park & Kang, 2024). It is very essential in its role in obtaining data and it is evident that the integration of AI technologies within the confines of occupational health and safety settings and makes it become more progressively common and valuable (Koh & Tan, 2024). AI is seen to improve efficiency in diverse fields of study such as healthcare which is where AI is used for a variety of applications such as diagnosis of disease, treatment planning and patient monitoring (Shao et al., 2022). The following are the importance of AI in healthy working environments which include:

- i. **Mental health monitoring:** There happen to be a growing incidence of mental health challenges among individuals who make use of sickness benefits with more than 40% of these claims citing a mental or behavioral disorder of the mental health and wellbeing of factory workers (Cahill et al., 2021). In this instance, AI can be used to monitor and analyze real-time data that is in a way related to the health of the factory worker, though it is essential to list the role of the management in mental wellbeing (Chang, 2020).
- ii. **Emotional counseling and support:** AI plays an important role in the area of emotional counseling to factory workers who need assistance coping with situations that appear stressful, Chabot's and messaging applications that make use of artificial intelligence can be properly utilized to make adequate provisions for emotional support and provide counseling services to factory workers (Brougham, 2018).
- iii. **Personalized wellness programs:** AI can provide supportive measures to be used in creating personalized well-ness programs for factory workers which is done based on their individual needs in which mobile application and wearables are used to monitor and manage data pertaining to health as well as to develop health programmes that are effective at the workplace including ergonomic recommendations and the prevention of risk of work-related injuries (Rodriguez et al., 2018). Anan et al. (2021) was of the view that the use of mobile health and e-Health in health promotion activities as well as the effective measures employed to improve the health literacy and health management among factory workers in Nigeria.
- iv. **Risk factor identification:** AI has been employed to be used in checking out for workplace risk factors that may negatively impact the mental health and wellbeing of factory workers and in the same vein AI has shown significant progress in identifying

- risk factors for lung cancer, pulmonary tuberculosis, diabetic retinopathy, skin cancer and cardiovascular disease (Howard, 2019).
- v. Training and development: It is well accepted that the use of smart technologies in an organization is capable of creating an environment that not only assists factory workers in improving their skill sets but it also encourages their sense of security, acceptance and wellbeing hereby achieving long-term objectives (Molan & Molan, 2020).

Problems Associated with Artificial Intelligence (AI) in Occupational Health and Safety

Even with advent of technological advancement, there are challenges encountered along the line with the use of AI in solving occupational health problem. The following include:

- i. Inadequate digital infrastructure
- ii. Resource constraint
- iii. Limited technical expertise
- iv. Poor data quality
- v. Privacy and consent
- vi. Workforce acceptance
- vii. Lack of robust frameworks
- viii. Cybersecurity threats
- ix. Job insecurity

Improving Occupational Health and Safety using Artificial Intelligence (AI)

Technological advancement and innovation have given us a lot of clues on the steps to improve the health and safety of factory workers and it will go a long way if it is properly applied. Improving the productivity of factory workers who work in different factories have been one of the key objectives for several organizations and the introduction of artificial intelligence (AI) will aid relief in resolving all occupational health and safety challenges (Nwineewii& Adekemi, 2023). This improvement of occupational health and safety using artificial intelligence (AI) among factory workers is so that higher levels of productivity among those who work in various establishments will make adequate provisions for more opportunities and advantages (Sharma & Sharma, 2014). Another important point here is that factory workers who are also regarded as employees are more productive in what they do equally have more chances of obtaining better wages/salaries, better working conditions and favourable employment opportunities and this tends to maximize organizational competitive advantages through the reduction of costs and proper improvement in higher quality output (Baily et al., 2005).

Conclusion

Occupational health and safety best describe a critical pillar that bothers around the management of facilities which helps in safeguarding workers from occupational hazards

in various places of work while it also helps in ensuring that compliance with regulatory standards. Based on the conclusion; the following recommendations were made.

- i. Government is to make adequate provision of well-equipped factories with artificial intelligence (AI) facilities and equipment's that will aid factory workers to carry out their jobs.
- ii. All heads of factories are to place sanctions on all those who neglect the use of artificial intelligence (AI) gadgets in applying rules and regulations governing work ethics.
- iii. Health educators are to organize seminars, conferences and workshops in training factory workers in understanding what artificial intelligence (AI) that entails how and when to apply them.
- iv. All stakeholders are to make sure that they make use of artificial intelligence (AI) aids that will assist them in getting rid of anything that will cause occupational hazards to them.

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