BENEFITS OF EMERGING TECHNOLOGIES ADOPTION FOR HEALTH AND SAFETY (HSE) BY SMALL AND MEDIUM-SIZED ENTERPRISES (SMEs)

Abstract

Construction safety and health culture in small and medium-sized construction enterprises in South Africa has gotten little attention regarding research or support for preventative safety measures initiatives, especially from the emerging technology perspective. A quantitative research method was used to gather data through a questionnaire administered to construction industry professionals. 78 responses were retrieved and analysed accordingly. The analysed data indicated that adopting emerging technologies will enhance SMEs' ability to achieve safety. It is recommended that more emerging technologies and adequate training be granted to employees on-site and that skills development be promoted to make safety and health training more effective.

Keywords: adoption, construction industry, emerging technologies, safety and health, small medium-sized enterprises, South Africa

Introduction

Small and Medium-sized enterprises play an essential role in the South African Construction industry, especially in alleviating unemployment. However, safety is a significant concern in the construction industry globally Zhou, 2012). Globally, the construction industry is perceived to have one of the poorest occupational health and safety records (Donaghy, 2016). Construction work is known to be executed in hazardous, clumsy environments and under poor and unhealthy working conditions (Welch, Russel, Weinstock and Betit, 2015). Despite stringent health and safety regulations, no significant decline in construction accidents has been recorded (Azmy and Zain, 2016). Defective equipment, dangerous work areas and unsafe working conditions are cited as common causes of construction site injuries and fatalities (Hinze and Teizer, 2018). In the South African construction industry, achieving safety has been a major concern over the years (Adekunle, Aigbavboa and Ikuabe, 2023).

Considering these, various technologies and interventions have been developed to prevent worker injuries and accidents and enhance construction job site safety (Welch et al., 2015; Dodge Data and Analytics, 2017; Zhou, Whyte and Sacks, 2021). With the emergence of novel technologies, numerous studies have identified that adopting these technologies could provide

a lasting solution to the problem of construction health and safety (Zhou et al., 2013; Zhang, Cao and Zhao, 2017; Adekunle et al 2023).

Several studies have concentrated on the application of emerging technologies such as Virtual Reality (VR), online databases, Geographic Information Systems (GIS), Building Information Modelling (BIM), Unmanned Aerial Vehicle (UAV), 4D Computer-Aided Design (4D CAD), wearable robotics, laser scanning, photogrammetry and sensor-based technologies for accident prevention and onsite safety (Dodge Data and Analytics, 2017); (Zhou et al., 2021). Li and Ng (2017) considered the application of wearable robotics and industrial robots, such as exoskeletons, robotic arms and the Assist Suit AWN-03, as a practical approach to improve site worker's health issues and safety conditions. Zhang et al. (2017) argued that sensor-based technologies, including sensor-based location, vision-based sensing and wireless sensor networks, provide innovative methods for advancing real-time construction safety. As a viable technique, the application of wireless sensor networks, which are widely used for forecasting and environmental monitoring, could assist in the avoidance of accidents and improve construction site safety performance (Wang, Luo and Zhang, 2018). Teizer (2015), Kim and Cho (2020), Teizer and Caldas (2017), and Navon and Sacks (2016) argued that automation is a significant alternative that can enhance up-to-date gathering of safety data and improve the construction environment to ensure better safety performance. This study explores the benefits of adopting emerging technology for health and safety in SMEs from the South African construction industry perspective. SMEs, despite playing a critical role in the construction industry.

Emerging Technologies and its Trends in Construction Safety and Health Management.

Technologies in construction have existed since hard hats and protective glasses. In recent times, the combination of big data, tech genius and construction has improved the safety of workers on construction sites (Azmy and Zain, 2016). With the development of new technologies, the use of technology continues to attention (Zhou, et al., 2013). Various tools have been developed to assist contractors in achieving safety on their construction projects. Numerous studies have identified digital technologies such as BIM, VR and AR, drones, GIS, automation and robotics, unmanned machinery, sensing and warning technologies as effective for accident prevention and safe project delivery (Zhou et al., 2021).

RESEARCH METHOD

To achieve its objectives, the study adopted a quantitative approach. The questionnaire was distributed to respondents in the South African construction industry. The respondents were mainly site foremen, health and safety officers, construction/site managers, site engineers, site agents, project managers, structural engineers, civil engineers, quantity surveyors, land surveyors and architects working for small and medium-sized enterprises contractors. The study randomly administered the questionnaire to the respondents. Section A focused on the respondents' general information. Section B is on the benefits of emerging technology adoption in small and medium-sized enterprises (SMEs) on construction sites in South Africa. The data collected is to get different perceptions of the respondents. The questionnaire was distributed through a Google form for convenience and to achieve a wide reach. The instrument's reliability was tested and statistically found to be 0.987, which is above the 0.6 threshold.

Result

Respondent demography

The respondents for the study are of diverse backgrounds and educational qualifications they also 5.1% of the respondents were site Architects, 28.21% are Quantity Surveyors, 8.97 are Civil Engineers, 7.69% are Project Managers, 12.82% Construction Managers, 2.56% are Structural Engineers, 2.6% are Land Surveyors, 2.56% are Site Surveyors, 11.54% are Health and Safety Officers, 2.56% are Site Agents, 7.69% are Site Forman, 6.4% are Site Engineers and 1.28% other. the qualifications each respondent has, which discovered that 5.1% have Matric Certificate (grade 12), 12.82% of the respondents have a National Diploma, 56.41% have Bachelor’s Degree, 12.82% have Honours Degree, 11.9% have Masters Degree and 1.26% have doctorate.

Benefits of Adopting Emerging Technologies For Health And Safety (HSE) By Small And Medium-Sized Enterprises (SMEs)

The mean item score, standard deviation and rankings of the benefits of adopting emerging technologies for health and safety by small and medium-sized enterprises were found to be the following: The following were ranked to be top benefit in adoption of emerging technologies, efficient safety evaluation (MIS=3,88 and SD=1,229), helps with safety inspections (MIS=3,86 and SD=1,256), emerging technologies helps to check procedure of data acquisition (MIS=3,85 and SD=1,310), safer workplace (MIS=3,83 and SD=of 1,323).

Table 1 Benefits of adopting emerging technologies for health and safety by small and medium-sized enterprises in the South African construction industry

Benefits	Mean	Std. Deviation	Ranking
Efficient safety evaluation	3,88	1,256	1
Helps with safety inspections	3,86	1,299	2
Helps to check procedure of data acquisition.	3,85	1,310	3
Safer workplace	3,83	1,323	4
Assist in accident investigation	3,82	1,317	5
Decrease in site injuries and accidents	3,81	1,310	6
Helps in health and safety decision making	3,81	1,300	7
Efficient safety planning	3,78	1,306	8
Implementing construction safety through real-time monitoring of buildings.	3,78	1,345	9
Identifying risks at an early stage.	3,78	1,392	10
Increased organizational performance.	3,74	1,304	11
Visualisation of high-risk areas during the project's life cycle.	3,74	1,362	12
Reduce insurance payments.	3,71	1,369	13
Improved health and safety training.	3,71	1,572	14
Enhanced company productivity	3,67	1,420	15
Improves work performance.	3,63	1,478	16
Improved health and safety education.	3,60	1,565	17
Reduce injuries and absence from work.	3,58	1,305	18
Enhances company reputation.	3,58	1,567	19
Increase staff morale.	3,54	1,402	20

According to Chileshe (2016), construction professionals need to adopt emerging technologies to help with safety inspection on-site to avoid accidents happening on construction sites. The emerging technology also helps with safety evaluation, which also helps identify risks on construction sites; evaluating safety helps avoid risks and accidents since the safety team knows

what is likely to cause problems after safety evaluation. Adopting emerging technologies for health and safety by small and medium-sized enterprises helps to check the procedure of data acquisition and prevent faulty data acquisition; this works to the benefit of small and medium-sized enterprises.

From the study findings, it can be deduced that emerging technologies help with safety inspections and evaluation; emerging technologies help to check the procedures of data acquisition, and a safer workplace needs to be seen on site, having workers working in a safe environment(Adekunle *et al.*, 2023).

Conclusion

Achieving safety is a daunting task in the construction industry. However, stakeholders are striving to achieve safety. Two areas were before now not given adequate attention, - SMEs and technology adoption for safety. This study fills the gap by identifying the benefits of SMEs adopting emerging technologies for health and safety in South Africa. The findings provide a motivation for stakeholders to achieve safety in SMEs. The study underscores an important aspect which is the adoption of technology for safety on construction sites. Also, stakeholders must pay more attention to the construction SMEs.

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