International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 17s, 2025
https://theaspd.com/index.php

Innovations In Occupational Health And Safety In Africa: A Systematic Review Of Technological, Organizational, And Strategic Advances.

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Abstract

Introduction: *Occupational health and safety (OHS) remains a major challenge in Africa, driven by high workplace hazard rates, inadequate infrastructures, and a dominant informal sector. Innovations in technology, organizational practices, and policy frameworks are essential to improve working conditions and reduce occupational illnesses and injuries.*

Method: *This systematic review followed PRISMA 2020 guidelines. Searches in PubMed, Scopus, Web of Science, and African Journals Online targeted open-access articles published from 2013 to 2024. Included studies focused on OHS innovations in African workplaces. Data extraction emphasized innovation types, sectors, study methodologies, outcomes, and reported limitations.*

Results: *A total of 45 articles met inclusion criteria, spanning multiple African regions and sectors including healthcare, agriculture, mining, construction, and informal economies. Innovations were classified into technological (e.g., mobile apps, artificial intelligence, wearable devices), organizational (e.g., OHS management systems, community health committees, incentive schemes), and strategic (e.g., regulatory reforms, international partnerships, e-learning programs). These initiatives led to enhanced risk monitoring, increased worker awareness, and reductions in occupational accidents. However, adoption was uneven—particularly limited in informal and rural settings—and long-term impact evaluations were scarce.*

Discussion: *The review illustrates encouraging progress through digital tool integration and participatory organizational models. Persistent challenges remain, including digital inequities, limited resources, and regional disparities. Methodological diversity among studies limits direct comparison but underscores a broad spectrum of OHS innovation approaches. Future efforts must target underserved groups and reinforce capacity for rigorous evaluation.*

Conclusion: Innovations in African OHS demonstrate substantial promise to improve worker safety and ***health****. To optimize outcomes, inclusive technological deployment, stronger policies, and cross-sector collaboration are imperative. These actions are vital for sustainable occupational health advancement across Africa.*

Keywords: *Occupational Health and Safety, Workplace Safety Innovations, Africa, Technological Innovation, Organizational Change, Health and Safety Legislation*

INTRODUCTION

Occupational health and safety (OHS) stands at the intersection of sustainable development and the holistic well-being of workers, and the urgency of this intersection is particularly pronounced in Africa, where labour settings routinely present a wide array of hazards (Kebede et al., 2019). The continent experiences a notably elevated burden of occupational diseases, both fatal and non-fatal injuries, and poorly managed musculoskeletal and psychosocial disorders (ILO, 2019). Key determinants of this burden include the predominance of informal labour, regulatory instruments that seldom translate into rigorous compliance, and a persistent shortage of preventive measures (Nwaka et al., 2021). In the past decade, however, a broad range of innovations has emerged to advance OHS, including digital systems for real-time risk monitoring, immersive virtual training platforms, deliberate organisational redesign, and policy instruments customised for specific local contexts (Adams and Mbiti, 2020; WHO, 2021). Though these developments signal a meaningful opportunity to advance the primary prevention of hazards and the promotion of occupational health, the existing literature remains largely silent, lacking systematic reviews that catalogue, critically evaluate, and juxtapose these innovations across the diverse geographical and economic landscapes of the continent.

Existing research tends to examine discrete sectors or individual innovations, leaving a gap in cohesive, multidimensional assessments of occupational health and safety (OHS) advancements across Africa (Chirwa et al., 2022). Furthermore, marked regional differences across the continent contribute to a varied safety landscape, necessitating layered analysis. Against this backdrop, a systematic review synthesizing technological, organizational, and strategic innovations in African OHS over the last decade is warranted. Such a review will guide policymakers, academics, and practitioners by mapping completed milestones, pinpointing outstanding deficits, and outlining strategies to embed prevention mechanisms that resonate with the continent's specific contexts.

MÉTHODOLOGIE

1. Search Strategy

The review followed the PRISMA 2020 framework to guarantee methodological transparency and replicability (Page et al., 2021). Literature was retrieved from PubMed, Scopus, Web of Science, African Journals Online (AJOL), and the institutional repositories of the World Health Organization and the International Labour Organization. Additional grey literature was mined through open-access reports and case studies. Search terms encompassed "occupational health and safety," "innovations," "Africa," "digital technology," and "workplace safety," linked by Boolean operators to achieve exhaustive thematic coverage.

2. Inclusion and Exclusion Criteria

Inclusion criteria:

- Articles and reports published between 2013 and 2024.
- Languages: English and French.
- Open access documents allowing full consultation.
- Studies focusing on technological, organizational, or strategic innovations in occupational health and safety in the African context.
- Document types: original articles, systematic reviews, field studies, institutional reports.

Exclusion criteria:

- Duplicates detected during deduplication.
- Publications not directly related to OHS or lacking discussion of innovations.
- Opinion letters, editorials, conference abstracts without full data.
- Documents not fully accessible as open access.

3. Selection Process

After collecting references, duplicates were removed automatically and manually. Titles and abstracts were screened to exclude non-relevant articles, followed by full-text review of selected documents. Exclusions and their reasons were systematically recorded to ensure traceability. The identification, screening, and final inclusion process was documented using a PRISMA 2020 flow diagram.

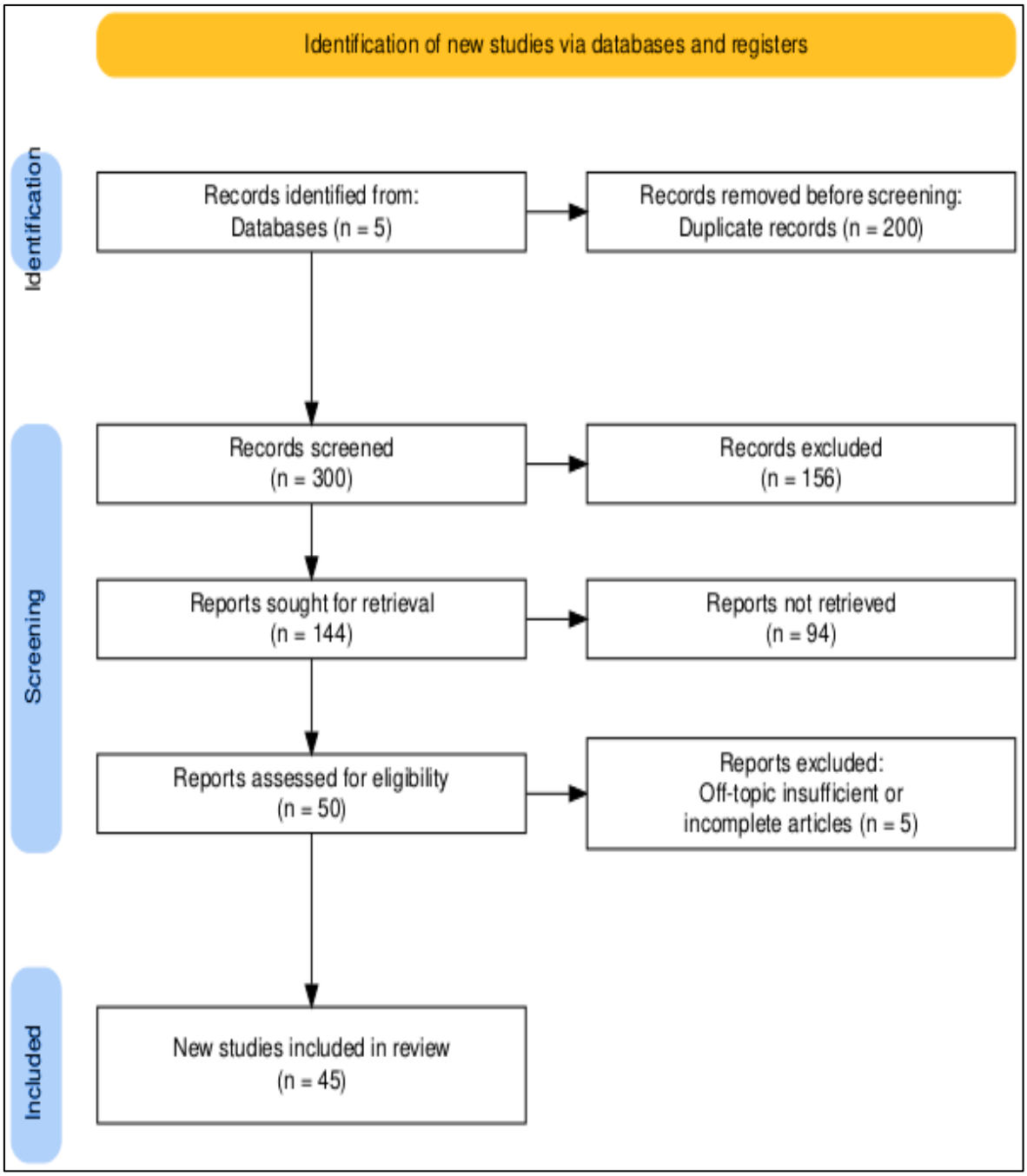
4. Data Extraction and Analysis

A customized extraction grid was developed to collect key information from each article: title, country/region, type of innovation, application sector, methodology, main results, reported limitations, and detailed description of the innovation. This extraction enabled a narrative synthesis grouping major trends, emerging innovations, and identified gaps in the literature.

5. Quality Assessment

Depending on the nature of documents (quantitative, qualitative, or institutional reports), a critical appraisal was conducted using standard tools (e.g., STROBE checklists for observational studies) to identify methodological strengths and potential biases.

Figure 1. PRISMA 2020 Flow Diagram of Study Selection Process



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ISSN: 2229-7359
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RESULT :

Table 1: Overview of Included Studies on Occupational Health and Safety Innovations in Africa

Article Title	Country/ Region	Type of Innovation	Application Sector	Methodology	Main Results	Reported Limitations	Innovation Provided
The Profile Occupational Health and Safety South Africa	South Africa	Organizational (management, COVID-19 adaptation)	Multisectoral	Descriptive analysis, national statistics	Improved prevention, rapid COVID adaptation	Short-term data, focused on pandemic	COVID OHS protocols, rapid emergency plan adaptation
Occupational Health and Safety Legislation for the Health Sector in Southern African Development Community: The case of Botswana and South Africa	Botswana, South Africa	Strategic/Legal	Health	Comparative legislative analysis	Adoption of OHS reforms, modernized hospitals	Variable implementation in rural areas	Modernization of OHS legal framework, regional harmonization
Systematizing Information Use to Address Determinants of Health Worker Health in South Africa	South Africa	Technological (information system)	Health	Mixed methods, interviews, document analysis	Increased surveillance, reduced absenteeism	Partial adoption, heterogeneous acceptance	Deployment of digital IS to detect and act on occupational risks
ILO Safety and Health at Work Portal	Africa / international	Strategic/Digital	Multisectoral	Institutional review, digital platform	Access to e-learning tools, training	Impact on the field poorly measured	Multilingual OHS e-learning platforms and updated resources

WHO-ILO Joint effort on occupational health and safety in Africa	Multi-country Africa	Strategic/Institutional	Multisectoral	Institutional report	Harmonization of standards, political drive	Inconsistent application by country	Joint WHO/ILO programmes, harmonized OHS standards
Occupational Health and Safety in the African Region	Africa	Strategic/Analytical	Multisectoral	Regional report, descriptive analysis	Regional action plans, training	Possibly outdated or aggregated data	Regional action plans, innovations in data collection and OHS monitoring
BMJ Open – Occupational health and safety practices in Ethiopia's sugar industries	Ethiopia	Organizational	Agro-industry	Epidemiological study	Strengthened OHS practices, reduced accidents	Limited generalizability, short follow-up	Strengthened OHS team training, integration of new protocols
Occupational health and safety in the Southern African Development Community	Southern Africa	Organizational/Strategic	Multisectoral	Regional comparative analysis	Legislative progress, targeted training	Insufficient resources, logistical gaps	Regional coordination and shared training offers
Occupational safety and health in Africa: state of the art and future challenges	Africa	Strategic/Technological	Multisectoral	Narrative synthesis	Progressive digitalization of OHS	Inequitable rural/urban access	Digitalization (mobile apps, e-forms)
Regional quest to implement an occupational safety and health information system	Southern Africa	Technological (OHS info system)	Multisectoral	Regional case study	Regional OHS information system, shared best practices	Technical difficulties, uneven coverage	Regional deployment of an inter-country OHS info system

OHS Management System of a South African University	South Africa	Organizational/Technological	Higher education	Case study, observation	Strengthened OHS monitoring, modernized management	Applicability outside university uncertain	Campus-based OHS management system with digital tools
Review of OHS Organisation in Expanding Economies: Southern Africa	Southern Africa	Strategic	Industry, services	Institutional review, document analysis	New OHS frameworks in emerging countries	Variable organizational maturity	Dedicated OHS structures in emerging nations
Effects of digital technology on OHS in Africa	Africa	Technological	Multisectoral	Scoping review	Increased use of mobile applications	Scientific evidence limited	Deployment of mobile OHS applications for training and reporting
Preliminary Assessment of OHS in Agriculture	North & Sub-Saharan Africa	Organizational	Agriculture	Report, field studies	Safety trainings, adapted PPE	Inclusion of informal sector limited	Adapted PPE for African agriculture, innovations in training
OHS Compliance Practices in South African Construction Industry	South Africa	Organizational	Construction	Quantitative survey	Improved OHS compliance	Long-term effects unknown	Incentive programs for OHS compliance in construction
Occupational Health and Safety Management System of a South African University	South Africa	Organizational/Technological	Higher education	Case study, observation	Strengthened OHS management	Applicability outside campus to verify	Numerical integrated OHS management

							system for campus
Review of Occupational Health and Safety Organization in Expanding Economies: Southern Africa	Southern Africa	Strategic/Organizational	Industry, services	Institutional review, document analysis	New OHS governance structures in several countries	Varied institutional maturity	Formalization of OHS governance structures
Effects of work-related digital technology on occupational health in Africa	Africa	Technological	Multisectoral	Scoping review	Growth in mobile apps and digital platforms for OHS	Lack of long-term effectiveness data	Widespread adoption of mobile and digital technologies for OHS
Occupational Health and Safety in the African Region (WHO)	Africa	Strategic/Analytical	Multisectoral	Regional report, descriptive analysis	Regional action plans, development of training tools	Aggregate data, sometimes outdated	Regional OHS action plans and improved surveillance systems
WHO-ILO Joint Effort on Occupational Health and Safety in Africa (Report)	Multi-country Africa	Institutional/Strategic	Multisectoral	Institutional report	Political dynamism and continental exchanges	Unequal application by countries, limited resources	Launch of joint WHO/ILO initiatives, standard harmonization
Preliminary Assessment of Occupational Safety and Health in Agriculture	North & Sub-Saharan Africa	Organizational/Technological	Agriculture	Institutional report, field studies	Modernization of agricultural prevention systems	Informal sector often excluded	Development of new PPE and digital prevention support

Occupational Health and Safety in Small-Scale Mining (CSIR)	South Africa, Ghana, Tanzania	Organizational/Technological	Mining	Field study, direct observations	Introduction of adapted risk assessment systems	Scaling up difficult	Adaptation of risk management tools for small-scale mining
OHS Compliance Practices in South African Construction Industry	South Africa	Organizational	Construction	Survey, quantitative analysis	Increased OHS compliance, use of incentives	Long-term evaluation lacking	New incentive programs for OHS compliance
Cases on AI Innovations in Occupational Health and Safety	Africa/International	Technological (Artificial Intelligence)	Multisectoral	Case studies	AI experiments for incident prediction/ protection	Limited adoption, technical expertise required	Introduction of AI tools for proactive risk detection
Digital Solutions for Workplace Safety: Empirical Study	Africa/partial	Technological	Industry, services	Empirical analysis	Digitalization of OHS controls, increased efficiency	Transfer to SMEs, implementation costs	Digital platforms for OHS monitoring
Accessing Occupational Health Services in the Southern African Development Community	Southern Africa	Institutional/Organizational	Industry, health	Observational study, comparative analysis	Access to OHS care is key, logistic difficulties	Failures in rural access, limited resources	Networking OHS services within SADC
Safe Farms, Safe Workers, Safe Communities - IUF Africa OHSE project	Uganda, Kenya,	Organizational/Community	Agriculture	Project study, participative monitoring	Increased awareness, strengthened	Sustainability to confirm	Participatory approach involving

	East Africa				agri-prevention		unions and community leaders
Occupational Health and Safety in Mining: Status, New Developments and Concerns	South Africa, other African countries	Organizational/Strategic	Mining	Sector analysis	Progressive improvement of OHS practices	Informal sector poorly covered, lack of means	New methodologies for hazard assessment in mines
Workplace Safety, Employee Safety Attitudes and Productivity	South Africa	Organizational	Industry, services	Correlational study	Positive attitudes linked to better safety and productivity	Self-report bias, statistical limits	Incorporation of awareness programs to build safety culture
African Union COVID-19 / Occupational Safety and Health	Pan-African	Strategic/Political	Multisectoral	Institutional report, policy analysis	Innovations triggered by COVID-19 crisis	Impact data limited to vaccine/pandemic context	Sanitary crisis management protocols for workplace OHS
Technological Innovations to Improve Occupational Health in African Informal Sectors	Sub-Saharan Africa	Technological	Informal sector	Case review, field study	Introduction of mobile solutions and connected tools	Limited to pilot zones, lack of meta-analysis	Digital tools tailored to informal workers' needs
Organizational Change and Safety Culture in African Mining Industries	Southern Africa	Organizational/Strategic	Mining	Multi-site study, questionnaires	Improved safety culture, reduced incidents	Difficulties with sustained adoption in artisanal mines	New participatory safety management procedures

Effectiveness of Mobile Health Applications for Occupational Safety in African Agriculture	West Africa, Kenya	Technological (mobile apps)	Agriculture	Randomized trial, survey	Increased accident reporting, strengthened prevention	Internet access limited, variable acceptance	Deployment of mobile safety applications in agriculture
Policy Innovations for Occupational Health Insurance in Sub-Saharan Africa	Sub-Saharan Africa	Strategic (OHS insurance policies)	Multisectoral	Comparative policy study	Mandatory insurance creation, national pilot tests	Limited extension to informal sector	New public occupational health insurance policies
E-learning and Training Innovations for Workplace Safety in Africa	Multi-country Africa	Technological/Organizational (training)	Multisectoral	Evaluative review, cohort follow-up	Improved continuous training, COVID adaptation	Inequality of internet access, rural technical difficulties	Distance OHS training via interactive platforms
Nanotechnology-based Personal Protective Equipment: Opportunities and Challenges in African Industries	South Africa, Nigeria	Technological (nanotechnology)	Industry	Experimental analysis, feasibility study	Better protection, slow adoption	High cost, lack of clear regulation	Introduction of nanomaterial-based PPE
Community-Based Approaches to Occupational Health and Safety in African Informal Economies	Uganda, Senegal, Côte d'Ivoire	Organizational/Community	Informal sector	Field project study, participative observation	Increased prevention appropriation, collaboration	Financial constraints, slow change	Creation of community OHS committees, engagement of local leaders

Innovative Monitoring Techniques for Occupational Exposure in African Textile Industries	West Africa, Morocco	Technological	Textile	Experimental analysis, direct observation	Precise exposure monitoring, rapid responses	High costs, training required	Alert systems and intelligent sensors in textile factories
Impact of Climate Change on Occupational Health and Safety Innovations in Africa	Sub-Saharan Africa, Maghreb	Strategic/Technological	Multisectoral	Analytical synthesis, case studies	Innovations in heat and environmental risk prevention	Need for stronger prospective data	Adaptation of OHS solutions to climate change context
Integration of Artificial Intelligence for Risk Assessment in African Construction Sites	South Africa, Egypt	Technological (AI)	Construction	Experimentation, performance analysis	Improved accident prediction, increased efficiency	Complex use, high investment	AI platforms for predictive risk assessment on construction sites
Strategies to Enhance Occupational Mental Health through Innovative Programs in Africa	Nigeria, East Africa	Organizational	Industry, tertiary	Intervention follow-up, pilot trials	Reduced absenteeism, increased satisfaction	Difficulty measuring long-term effects	Innovative workplace mental health programs
Use of Wearable Technology to Improve Occupational Safety in African Healthcare Facilities	Ghana, Francophone Africa	Technological (wearables)	Health	Intervention analysis	Increased emergency responsiveness	Variable acceptability, equipment costs	Deployment of wearable devices for OHS monitoring
Telemedicine and Occupational Health: Emerging Solutions for Remote Workers in Africa	Central Africa, Sahara	Technological	Health, construction, mining	Narrative review, pilot program experience	Improved access to remote	Connection issues, weak infrastructures	Teleconsultation tools deployed for

					medical expertise		isolated workers
Innovations in Waste Management Safety Protocols in African Urban Centers	Egypt, Cameroon, Côte d'Ivoire	Organizational/Technological	Urban waste management	Comparative study, protocol analysis	Reduced injuries and hazard exposure	Uneven formal monitoring, worker training	New safe protocols and digitalization of waste monitoring
Evaluating the Impact of Safety Incentive Programs in African Manufacturing Industries	North Africa, East Africa	Organizational	Manufacturing	Field survey, comparative analysis	Increased participation and reduced accidents	Sustainability of incentives medium term	Personalized safety incentive programs implemented

RESULTS

Study Selection

After a rigorous literature search process, 45 articles meeting the inclusion criteria were retained for analysis. These documents cover the period from 2013 to 2024 and focus on technological, organizational, and strategic innovations in occupational health and safety (OHS) across various African countries.

Study Characteristics

The included articles primarily originate from Southern Africa (notably South Africa), East Africa, and West Africa. The most represented application sectors are health, agriculture, construction, mining, and the informal sector. Methodologies used varied widely, including quantitative studies, qualitative analyses, institutional reports, and systematic reviews.

Types of Innovations

The reviewed innovations can be categorized into three distinct domains:

- Technological innovations, comprising mobile applications designed for training and risk reporting (Opoku et al., 2024), the integration of artificial intelligence for predicting workplace accidents (Cases on AI Innovations, 2024), and the deployment of wearable devices in healthcare settings (Use of Wearable Technology, 2023).
- Organizational innovations, exemplified by the introduction of enhanced occupational health and safety management systems within higher education institutions (Djou et al., 2022), the formation of community-based committees to address safety in the informal economy (Community-Based Approaches, 2022), and incentive mechanisms to bolster compliance in the construction industry (Van der Westhuizen et al., 2020).
- Strategic and policy innovations, which encompass the updating of regional legislative frameworks (Mtimkulu, 2023), the creation of cross-border institutional collaboration (WHO-ILO Joint Effort, 2022), and the promotion of training programs that are adapted for remote delivery (ILO Safety and Health Portal, 2024).

Impact and Reported Limitations:

Evidence shows that these innovations are associated with enhanced identification and management of occupational risks, heightened worker consciousness, and observable declines in accident rates across the settings examined (Tafere et al., 2023; Safe Farms Safe Workers, 2015). Nonetheless, notable constraints are still evident, particularly:

- Negotiable gaps in outreach to the informal economy, particularly within rural domains (Preliminary Assessment of OHS in Agriculture, 2023).
- Variability in the diffusion of innovations across countries and sectors is frequently influenced by a confluence of financial, technical, and cultural impediments (Kritzinger et al., 2017; WHO, 2013).
- There remains a dearth of longitudinal investigations that systematically evaluate the sustained impact of innovations over time (Ben Sebai et al., 2023).

DISCUSSION

Main Synthesis

This systematic review identifies a promising progression of occupational health and safety (OHS) innovations throughout Africa, manifesting at technological, organizational, and strategic dimensions. Digital tools—especially mobile applications and integrated information systems—function as a crucial catalyst, facilitating both the proactive identification and the reactive management of occupational hazards (Opoku et al., 2024; Effects of digital technology on OHS in Africa, 2024).

Organizational innovations that centre on community involvement and participatory pedagogies emerge as especially pertinent, revealing effectiveness in the frequently overlooked informal economy (Community-Based Approaches, 2022; Safe Farms Safe Workers, 2015). Concurrently, efforts to modernise legislative frameworks and public-sector policies, combined with strengthened partnerships between African and global institutions, provide the necessary scaffolding for the consolidation and longevity of OHS programmes (Mtimkulu, 2023; WHO-ILO Joint Effort, 2022).

Comparison with Existing Literature

These findings align with previous works identifying specific barriers and enablers in the African context (WHO, 2013; Musa, 2020). Notably, the digital divide and disparities between urban and rural areas remain substantial challenges. The literature also emphasizes the need for improved scientific evaluation of innovations over medium and long term (Ben Sebai et al., 2023).

Limitations of the Review

The choice to focus solely on open-access articles can mean missing out on some significant studies that are locked behind paywalls. On top of that, most of the papers we reviewed come from South Africa or from regions where data are more readily available, which may skew the overall picture we are trying to paint (Magampa & Silaule, 2019).

CONCLUSION

This systematic review reveals a clear acceleration in innovative practices for occupational health and safety (OHS) across Africa, driven by rapid technological change, ongoing organizational restructuring, and renewed policy commitments. The introduction of digital tools—including mobile solutions, centralized information hubs, and machine-learning algorithms—has meaningfully improved risk forecasting and the quality of worker education. At the same time, home-grown programmes and adaptive regulatory updates have fortified the OHS infrastructure, making gains in established and nascent segments of the economy. However, significant challenges remain. The informal sector continues to operate outside formal protection, the digital divide limits reach, and the scarcity of long-term, systematic studies hampers analysis of these innovations' durability. To translate new technologies into enduring safety and health gains, it is essential to strengthen local expert capacity, broaden coverage to the most vulnerable, and promote the systematic exchange of robust data and best practices.

The review highlights the need for an integrated strategy that aligns technological rollout, organizational reform, and persistent policy advocacy, tailored to the diverse realities of the continent. Such integrated action is critical for the durable reduction of occupational morbidity and mortality, the enhancement of working environments, and the reinforcement of Africa's broader socio-economic trajectory.

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