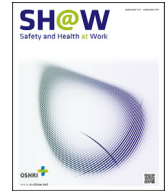Contents lists available at ScienceDirect

Safety and Health at Work

Review Article

Scoping Review of the Occupational Health and Safety Governance in Sudan: The Story So Far

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ABSTRACT

Background: The reoccurrence of occupational accidents in Sudan is evidence of a lack of effective Occupational Health and Safety (OSH) governance in Sudan.
Methods: This scope review research articles on OSH governance in Sudan from different sources, including international websites, official government websites, original research articles in journals, and various reports. The five stages of the scoping review followed in this study are: identifying the research question; identifying relevant studies; study selection; charting the data; collating, summarizing, and reporting the results.
Results: There is numerous legislation in place; however, there is no evidence of their enforcement, and no formal bodies at the national level are identified as being responsible for their enforcement.
Conclusion: Having multiple authorities with overlapping responsibilities hinders OSH governance. An integrated governance model is proposed to eliminate overlapping duties and to facilitate the participation of all stakeholders in the governance process.

1. Introduction

Over the years, the swift development of various industries in developed and developing countries has resulted in numerous accidents, injuries, and illnesses [1]. Millions of workers worldwide, including in developing countries, are at risk of various work-related diseases, including mental and musculoskeletal disorders [2]. The International Labor Organization (ILO), in a recent estimate, indicates that inadequate workplace safety and health procedures result in around 2.78 million deaths and 374 million nonfatal workplace injuries [3].

Manufacturing movement from Higher-Income Countries (HIC) to Lower and Middle-Income Countries (LMICs) is believed to have transferred hazardous exposures such as chemical compounds, unprotected machinery, and unsafe materials together with the technological transfer [4]. Literature suggests that between 50% and 100% of workers in several hazardous industries in LMICs may be exposed to dangers that exceed limitations established in high-income nations [4].

Despite significant economic and technological advancements that have helped lessen some occupational health issues, primarily in developed countries, occupational exposures in LMICs have increased over the past two decades [4]. Hence, work-related accidents and deaths continue to happen in workplaces even after the successful deployment of system re-engineering and change to organizational safety culture [5].

Occupational Safety and Health governance intend to promote and maintain the highest degree of workers' physical, psychological, and social well-being by deploying a national framework supported by national policies, laws, and regulations [6]. It is thus a complex field that requires the participation of numerous disciplines and all stakeholders. Applying the management systems approach to the functioning of national OSH systems is a logical step, given that both national OSH systems that regulate OSH needs and businesses that must implement these requirements must face this continual and rapid rate of change [7]. The concept of applying the Occupational Safety and Health Management System (OSHMS) to national OSH systems was embodied in 2006 by the ILO. The ILO

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adopted the "Promotional framework for occupational safety and health" (No. 187) convention with its recommendation (No. 197) to ensure that a higher priority is given to OSH in national agendas and to foster political commitments in a tripartite context for the improvement of OSH [7].

Developing countries must thoroughly examine their macro system, development mode, goal orientation, and economic development adaptability to ensure that they are compatible with their proposed occupational safety and health cooperation governance framework and that they support the development of sound and innovative occupational safety and health cooperation governance practices [8]. However, the literature indicates that governments in developing countries pay little attention to the governance of occupational health and safety [9].

Occupational accidents keep occurring in Sudan frequently. For example, on Sunday the 5th of June 2022, a livestock ship drowned in the Red Sea port of Suakin, with more than 15,000 sheep on board. Although all crew survived, the estimated total livestock losses were about $3.7 million. This incident is believed to cause a substantial operational, economic, and environmental impact on Suakin port. Suakin port on the western shores of the Red Sea is one of the important trading hubs in the region [10], and was at the time investigating a massive fire that broke out in the cargo area a month before the vessel incident [11]. Another tragedy happened in December 2019, when a deadly fire at Salome Ceramic Factory, in the capital Khartoum, killed around 23 people and injured more than 130 [12]. Similar accidents highlight the lack of effective national Occupational Health and Safety (OSH) systems and emergency preparedness in Sudan and the need for further investigation of its Governance.

The authors of this study believe that a thorough investigation is needed to understand how OSH is governed in Sudan to see if the existing governance model can sustain national OSH management that can protect people, improve business competitiveness and enhance economic growth. Hence, this study aims to track the development of occupational health and safety governance strategies from the 1960s to date and highlight the challenges in implementing OSH strategies in Sudan.

2. Methodology

Since the goal of this review is to gather data intending to achieve an in-depth understanding of how Occupational Safety and Health (OSH) are governed in Sudan, a scoping review was conducted. The scoping review method gathers, summarizes, describes, and contextualizes significant ideas and types of research data that are already accessible to suggest other areas for future research on a topic in discussion [13–15]. The five stages of the scoping review followed in this study are: identifying the research question; identifying relevant studies; study selection; charting the data; collating, summarizing, and reporting the results [16].

2.1. Identifying the research question

This scoping review aims to answer the four following questions:

a. What is known about OSH governance?
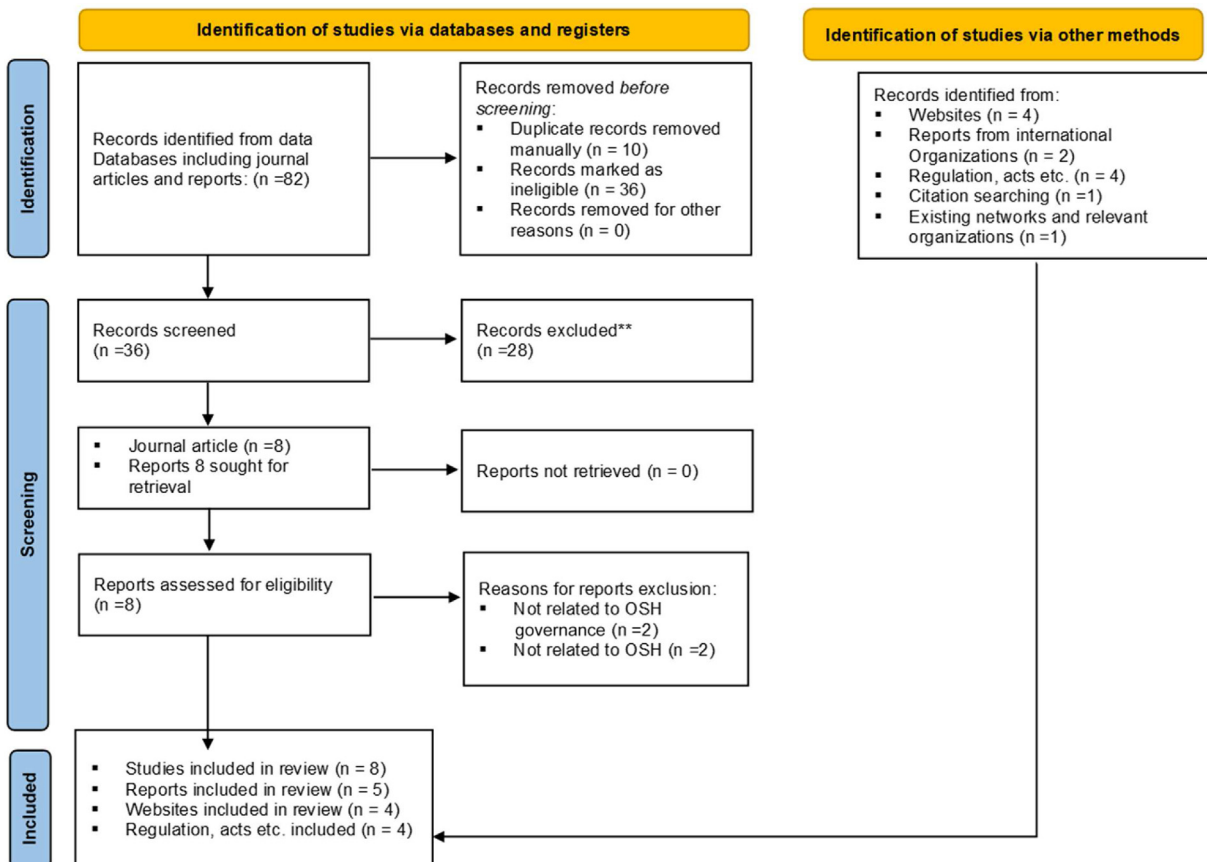b. How occupational safety and health was and is governed in Sudan?

Fig. 1. PRISMA flow diagram of the scoping literature review process [71].

Table 1
Summary of literature review findings with tally of articles based on year type of study and topic addressed

No.	Study citation	Year	Type of source of information						Topics addressed and the study scope		
			Journal articles			Report	Websites	Legislation	OSH governance legislation and services in Sudan	OSH governance legislation and services in LMIC and HIC	OSH factors and determinant
			Review	Qualitative study	Quantitative study						
1	(Khogali, 1966)	1966	X						X		
2	(OSHA, 1970)	1970						X		X	
3	(Who, 1978)	1978				X			X		
4	(Ganopol g., 1979)	1979			X						X
5	(Osman, 1979)	1979	X						X		
6	(Labor code, 1997)	1997						X	X		
7	(ILO, 2001)	2001						X		X	
8	(WHO, 2006)	2006				X				X	
9	(Radandt et al, 2009)	2009				X				X	
10	(Menéndez et al, 2009)	2009				X				X	
11	(Ncube and kanda, 2018)	2018	X							X	
12	MLAR	2018				X			X		
13	(Chen et al, 2020)	2020	X							X	
14	(Noman et al, 2021)	2021			X					X	
15	(Afolabi et al, 2021)	2021		X						X	
16	(ILO, 2021)	2021						X		X	
17	(Schulte et al, 2022)	2022	X							X	
18	(ILO, 2022)	2022					X		X		
19	(ILO, 2022)	2022					X			X	
20	(ILO, 2022)	2022					X			X	
21	(AEO, 2012)	2022					X		X		

c. What are the lessons learned from HICs' and LMICs' experiences?

d. What are the challenges to OSH governance in general and Sudan in particular?

2.2. Identifying relevant studies

To identify relevant sources of information to answer the main research questions of OSH governance in Sudan, this study adopted two of Arksey & O'Malley's (2005) strategy; which involves searching for research evidence via different sources, including electronic databases, reference lists, hand-searching of key journals and existing networks, relevant organizations and conferences [16]. The two sources utilized in this review are electronic databases, existing networks, and relevant organizations.

2.2.1. Electronic databases

A systematic database search during August 2021 and June 2022 using the three search terms "OSH governance, Sudan", "worker's safety", and "safety Sudan" was conducted to identify relevant articles. Eighty-two articles were identified from Scopus and Google Scholar, and 13 were identified from other sources like websites, international organizations, and citation searches. Fig. 1, displays the PRISMA flow diagram developed in accordance with the PRISMA statement, to promote transparency of the search [17]. After removing duplicates, 36 records remained for screening.

2.2.2. Existing networks, and relevant organizations

It was evident from the literature, see Badger et al (2000) and Prati (2021), that information concerning primary research can be generated by utilizing networks and existing knowledge [17,18]. This includes contacting relevant national or local organizations working in the field to conduct manual library searches, and/or identify unpublished work [16]. The authors of this study reached out to several pertinent OSH departments during the summer of 2021 in Sudan, including the ministry of oil and gas, the Sudanese Mineral Resources Company (SMRC), the Ministry of Labour and Administration Reforms (MLAR), and the Pension and Social Insurance Fund (PSIF).

2.3. The selection of studies

Original research, reviews, letters, editorials, case studies, regulations, and guidelines published, or unpublished were included in this study. Studies were included if they were in English or Arabic during the time frame between the 1960s and June 2022. In addition, information obtained from organizational and governmental websites such as the ILO, WHO, and Sudanese governmental websites were included in the study. The authors obtained the national context for occupational safety and health unpublished report from the Ministry of Labor and Administrative Reforms by following the existing networks and relevant organizations strategy mentioned above.

The search time frame was chosen because Sudan witnessed a greater impetus for industrialization, in the sixties of the last century, following Sudan's independence in 1956 and the enactment of the "Approved Enterprises (Concessions) Act 1956," [19].

The scoping review included 21 sources, seven articles, five reports (published and unpublished), four regulations, and information retrieved from 5 websites. Papers were included in the study if they met the inclusion criteria, namely OSH governance, OSH in developing and developed countries, or governance of OSH in Sudan. Studies were excluded if they did not fit into the conceptual framework of the study, for instance, focused on OSH practices in a certain industry in Sudan or governance but not OSH governance.

2.4. Charting the data

A data charting table is used to pull data from the 21 sources. This data extraction table was created in accordance with the objectives of our scoping review. The extracted information from each document includes the following: (1) Study citation, (2) year of publication, (3) method of the study, (4) topic addressed and the study scope, (5) and recommendations. See Table 1.

2.5. Collating, summarizing, and reporting the results

Results were collated, summarized, and reported based on the research questions. After the full text of the articles review was completed, the relevant data were extracted and subsequently categorized into different subheadings including OSH governance evolvement in developed countries, OSH governance in Middle-Income Income Countries (LMICs), and the development of the Sudanese OSH national governance. Further analysis of the challenges of implementing and enforcing OSH regulations in Low and Middle-income countries (LMICs) was included, in addition to the underlying causes of Sudan's inertia regarding OSH.

3. Results

The research in Sudan is generally humble; only a few articles were found addressing the OSH governance in Sudan. The search resulted in a total of 94 records that matched the search criteria. Of these, 10 were removed because of duplicates, and 40 were removed because they were deemed irrelevant (conference abstract, not concerning OSH or not related to OSH governance). Twenty-one articles were retained after a full-text review. Eight of these are journal articles, five reports four websites, and four regulations. Out of the eight published journal articles, two only focused on OSH governance in Sudan. These two articles were published in the sixties and seventies of the last century. Out of the eight articles, five were literature reviews, one adopted the interview method, and two used survey and secondary data analysis.

The international organization reports, websites, and standards are of an advising nature used in this study as a benchmarking tool to measure the discrepancy between what is needed in developing countries and what is required. The OSH governance in Sudan was examined in two studies published in 1966 and 1979, but more concerned with occupational health rather than occupational health and safety. Nevertheless, both studies recommended improving the existing occupational health management system. See Table 1 for the results summary.

3.1. The OSH governance in Sudan at a macro level

The negative human and economic consequences that poor OSH performance has on workers, employers, and communities are well-researched and serve as a strong call for action [20]. Especially the impact of institutions of governance on macroeconomic policies and economic growth, particularly in low-income and lower-middle-income countries (LICs and LMICs). It is thought that a good institution of governance has a crucial role in ensuring that macroeconomic policies are administered successfully to stimulate economic growth and enhance the quality of life for citizens [21]. It is evident from the literature scoped that a solid national OSH framework is necessary for developing effective OSH plans and achieving good OSH performance by reducing occupational illnesses and accidents [20]. However, Ncube and Kanda (2018)

argued that the OSH laws in Low- and Middle-Income Countries (LMIC) appear to be out-of-date, fragmented, and no deterrent [22].

3.2. Sudan's international commitment to OSH standards

The ILO has exercised global governance of work-life for more than ninety years. Its instruments for managing safety and health at work are the international conventions, recommendations, guidelines, and codes of practice [23]. Considering the national conditions and practices, ILO advises their members to provide for adopting a coherent national OSH policy and promoting OSH to improve working conditions. The Protocol calls for the establishment and periodic review of requirements and procedures for the recording and notification of occupational accidents and diseases, and the publication of related annual statistics [24]. In addition, occupational Health Services Convention, 1985 (No. 161) provides for the establishment of OSH services for all workers, including those in the public sector and members of production co-ops, in all economic sectors and enterprises. The provision should be adequate and proportionate to the health risks posed by the enterprise [25].

At the international level, Sudan has been committed to international OSH treaties since it became a member of the International Labour Organization (ILO) on 12 June 1956 [26]. Since then, it has accepted several international legal instruments related to Occupational Safety and Health within the ILO. There are eighteen ILO conventions which Sudan ratified from 1957 to 2021. Sixteen of these conventions are in force, and the remaining two will be enforced in 2022 [26].

ILO provided Sudan, among other countries, with OSH technical assistance to help build the country's capacity to address OSH issues. This help was in the form of meetings, workshops, and training courses. Similarly, the World Health Organization (WHO) maintained regular monitoring and supervision of occupational health development in Sudan and other low-income countries. For example, in the Eastern Mediterranean region survey conducted in 1978, the responsibilities of ministries and institutional bodies concerned with occupational health and its functions were cross-checked. These ministries include the ministries of labor and industry, social security services, universities, and non-governmental institutions. The occupational health functions in the WHO survey included inspection and enforcement, advisory services, sanitary supervision, and medical care. The survey results show that while the Ministry of Health is responsible for occupational health function, other ministries are involved in several occupational health functions. The report, however, didn't mention the presence or absence of coordination between institutions engaged in the same occupational health parts [31].

3.3. The development of Sudanese OSH national governance

3.3.1. From the 1940s to 1997

The OSH governance in Sudan began in the mid-20th century, focussing on large agricultural, agro-industrial, mining, and manufacturing projects as in most developing countries. Sudan progressively developed a systematic workers' health programme, appraised by the Director-General of WHO at the twenty-ninth World Health Assembly in May 1976. The main features of the OSH system were setting the division of OSH as part of the health services within Preventive Medicine (PM) at The Ministry of Health Care and Planning Supervision and Training (MHCPST) in 1967 [28].

A series of OSH regulations and acts governing employment, formation and registration of trade unions, and industrial relations rules were promulgated from 1940 to 1976 [29]. The first was the 1946 OSH regulation, followed by the I948 Employers and Employed Persons Ordinance and the List of Factories Act of 1949. Furthermore, the 1950s witnessed three more OSH regulations. These regulations include the Laboratories and Workshops bylaws in 1950, the Wages Tribunal Ordinance in I952, and the Employment Exchange Ordinance in I955. In addition, the incorporation of the labor inspectorate section to the Labor Department upon its start in I947 is thought to be a meaningful OSH governance action [29]. It is found that the development of the Industrial Relations Act of 1976 was shaped by all the phases mentioned above of OSH in Sudan.

The rapid growth of industries in developing countries, including Sudan, provoked many health problems [28]. Several amendments to the OSH laws in Sudan were made to cope with industrial development in the 1970s and early 1980s. These amendments began with the Wages and Service Conditions Committees Law in 1976, the Factories Regulations in 1977, and the
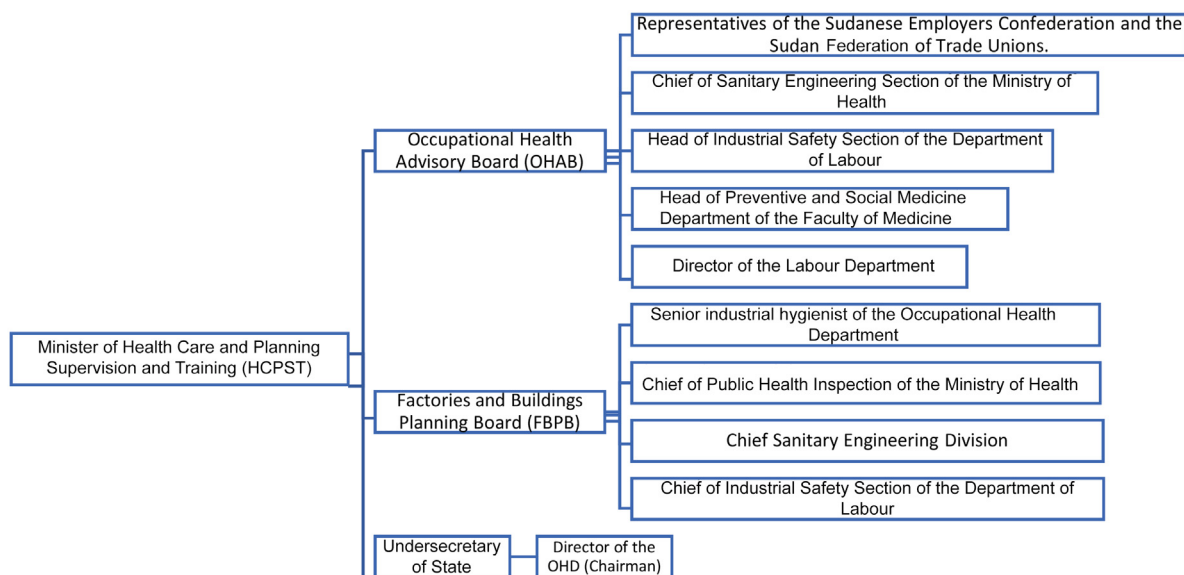

Fig. 2. A systematic workers' health programme in accordance with the OSH Act of 1976 Source [28].
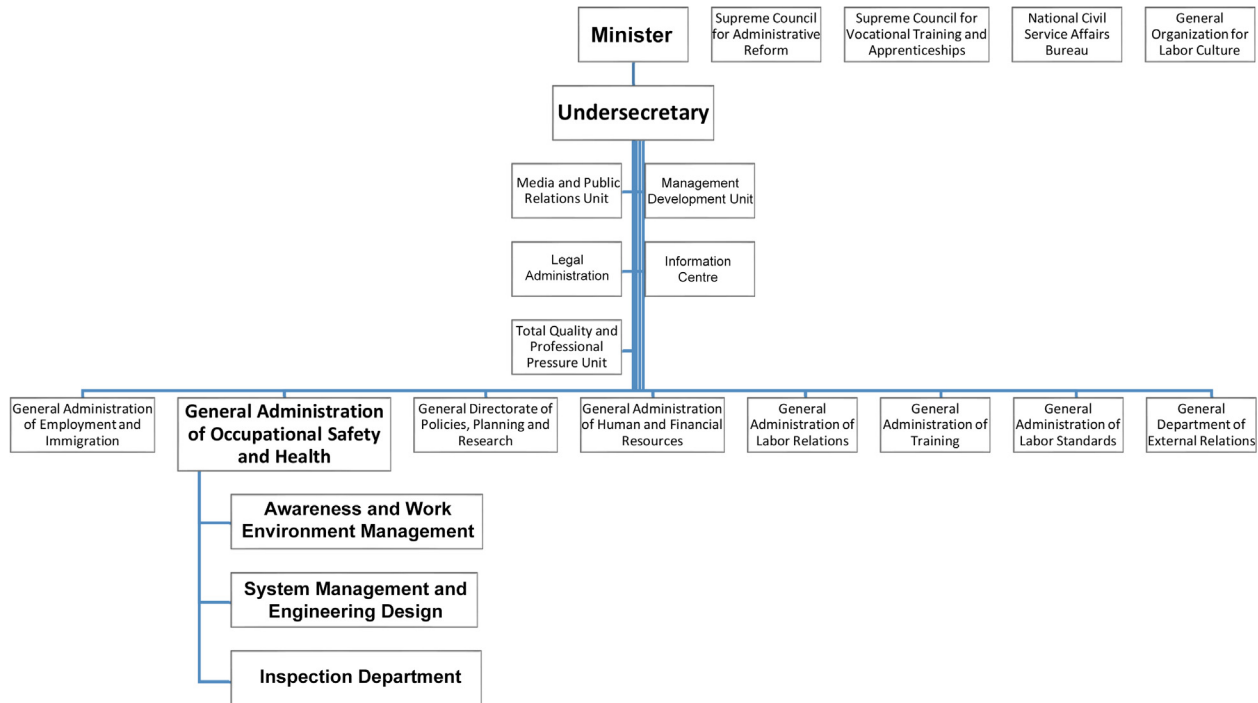
Fig. 3. The organizational dimension of the general administration of occupational safety in the organizational structure [38].

Occupational Health Regulations and the Compensation for Work Injuries Act in 1981 [29].

Each of the regulations mentioned above addresses a specific area. For instance, the Manpower Act, published and adopted in 1974, addresses the Employment policy, promotion of employment, and employment [30]. Nevertheless, sometimes two regulations share the main scope, although their main emphasis may differ. For example, the Industrial Relations Act of 1976 addresses the freedom of association, and collective bargaining, and regulates industrial relations in both the private and the public sectors. While the act of 1981 has the same scope, it focuses on eliminating child labor and protecting children and young persons. It repealed the Employment of Children Ordinance of 1929 and the Employers and Employed Persons Regulation [30].

Moreover, a significant development occurred during the 1970s when two statutory boards responsible directly to the Minister of Health Care and Planning Supervision and Training (HCPST) were formed to govern the workers' safety. These boards are the Occupational Health Advisory Board (OHAB) and the Factories and Buildings Planning Board (FBPB). Their responsibilities were to ensure full coordination among the authorities responsible for this facet of the health sector, as well as the inspection of new factories and large and complex building plans and layouts by the regulation issued by the health and safety act of 1976, respectively [28]. See Fig. 2.

More to the point is establishing the Occupational Health Department (OHD) in the same year. The OHD was under the Under-Secretary of State and the Minister of Health Care and Planning Supervision and Training (HCPST). The department's objective was to provide health care for the working population and their families. It offered the Sudanese workforce services such as guidance inspection, periodic medical examinations, industrial hygiene laboratories, medical commission divisions, workers' health centers, training, and regular monitoring programs [28].

Along the same lines, considering the growing importance of the need to introduce and promote occupational health services in

the countries undergoing industrialization, the twenty-fourth World Health Assembly in 1971 recommended that the regional committees discuss means of developing occupational health services. Before that, the WHO observed:

- Shortage in trained occupational health personnel.
- A need for guiding criteria that health authorities can use in promoting occupational health services.
- A need for coordination of all government departments concerned with occupational health at the national level and between the world health organization and other organizations within the United Nations system concerned with occupational health, including the international labor organization [31].

3.3.2. From 1997 to date
3.3.2.1. National framework. The primary and current National OSH regulatory framework includes the Labour Code of 1997, the 1981 List of Factories Decree, the 1981 Occupational Health List of Factories, and the 2005 Tobacco Control Law [30]. The new comprehensive labor code replaced the 1976 act twenty years after it was first approved and published. The code addresses how enterprises organize employment through workers' contracts and leaves, working hours and end-of-employment gratuity, etc. [32]. It also imposes manufacturing facility owners to manage their organizations' health and safety. (Articles 75-98 of the 1997 act define the terms and expressions related to the OSH, such as occupational accidents and diseases.)

The Sudanese National OSH regulatory framework also includes specific rules, regulations, codes, and standards that govern sustainable practices in different industries. For example, Sudan's Nuclear and Radiological Regulatory Control Act (NRRCA) encompasses radiation safety, nuclear security, safeguards, and liability issued in 2017 [33].

Moreover, the national OSH regulatory framework detailed the employers' responsibilities for workers' awareness of the relevant

Table 2
The distribution of inspectors across Sudan [38]

State	Inspectors
Khartoum	19
Northern	—
River Nile	6
Gezira	3
White Nile	1
Sennar	—
Blue Nile	4
Al Qadarif	3
Kassala	5
Red Sea	3
North Darfur	5
South Darfur	9
Central Darfur	3
East Darfur	4
West Darfur	4
North Kordofan	3
South Kordofan	1
West Kordofan	—
Total inspectors	73

hazards, the training required, and the necessary precautions to protect workers against industrial accidents and occupational diseases [34]. Nonetheless, the act is missing the definition of psychological health, although the definition is included in the ILO definition of the OSH. Although, it was previously believed that mental health issues among workers were confined to Europe and North America. Workers in LMICs suffer comparable or even higher levels of job-related stress than workers in HICs, with detrimental health implications [35]. One reason for the increase in mental health among workers in the LMIC is the changing economic patterns that may lead to increased layoffs of workers and unemployment and increased workload [35].

There are, however, many intersections between the executive authorities regarding powers and application mechanisms, which forces workers to bear a lot of burden and pressure [36]. Similar findings were reported elsewhere; for example, Annan et al (2015) stated that one of the challenges in implementing OSH practice in Ghana is that it has no comprehensive national OSH policy, and it is unclear how the Ghanaian government partnered with the concerned organizations in implementing the OSH activities and reported on its outcomes [36].

The 1997 code contains 14 chapters underlying the requirement to ensure norms of laborers' rights. Some orders and rules under the revoked acts remained valid and were declared under the provision of the 1997 code [37]. Moreover, all orders and regulations issued under the act of 1976 remained valid, apart from the four repealed laws listed below:

- The 1974 Labor Force,
- The 1976 Industrial Relations,
- The 1976 Industrial Safety, and
- The 1981 Individual Labor Relations Act of Sudan [37].

Moreover, the National context for occupational safety and health report (2018) [38] remarks that the Occupational Health Department, under the Ministry of Health, established by the Environmental Health and Food Control Department in 2013 consists of several specialized units as follows:

- The Medical Unit.
- Unit of Work Environment and Environmental Pollution.

- Indicative Inspection Unit.
- Work Physiology and Ergonomics Unit.
- Coordination and Partnerships Unit.
- General Administration of Occupational Safety and Health [38]. See Fig. 3.

It also indicates that no policy or strategy plan is designed for the National Occupational Safety and Health. This is despite the fact that there is a detailed National Environmental Health Strategic Plan (2015-2019) which provides a strategic framework to verify the efficiency and effectiveness of the organization, coordination, and management of the country's environmental health sector during this period [38].

3.3.2.2. Inspection and enforcement. The need for trained occupational health personnel was pointed out earlier by Khogali (1966), who called for the establishment of the Occupational Health Unit (OHU) as part of the medical school's public health, which started in 1924. He suggested that such a unit should teach undergraduate basic occupational health subjects, including field visits to factories to expose students to controlling existing risks, preventing occupational hazards, and the role of the design at the construction stage in such prevention. Such a unit is also expected to train Public Health Officers (PHO) on how to inspect factories and make recommendations on the environment, hygiene (general and personal), and waste disposal following the Factories Act references. Furthermore, the unit is expected to engage research, establish an occupational hygiene laboratory, and engage in international relations to obtain advice from experienced bodies [29].

The ILO 1981a OSH convention article 9 determines the enforcement of laws and regulations regarding OSH, and an adequate and appropriate inspection system shall secure the working environment. As for the status of Sudan, the Ministry of Labour and Administrative Reform (MLAR) supervises the OSH inspection system. The Sudanese National context for occupational safety and health report 2018 mentions that the number of OSH inspectors in the Federal Ministry of Sudan is seventy-three. Table 2 below illustrates the distribution of H&S inspectors among the Sudanese states [38]. As can be seen, there are only nineteen inspectors responsible for inspecting over five thousand industrial facilities in Wilayat Al Khartoum.

Despite the presence of Sudan OSH regulations with clear powers and functions, there are clear evidence of lack of OSH enforcement. Examples are Mursy et al (2019), Humeda (2008), and ALshebli (2015) who highlighted the lack of safety strategies, practices, and enforcement in the medical field, Khartoum airport, and in two textile plants [39–41].

3.4. The OSH governance evolvement in developed countries

With the continuing expansion of industrialization in developed countries such as the United States, the United Kingdom, Japan, and Germany, it is helpful to understand the efforts these countries made and how OSH governance evolved over the years [8]. Understanding the efforts of developed countries in this respect can serve as a reference for occupational safety and health governance in Sudan.

For example, safety in Australia since the 1970s has been conducive to overcoming the problem of bloated and inefficient administrative bureaucracy, facilitating the simplicity of OSH legislation, organizing the initiative of employers in the process of OSH governance, and achieving positive outcomes. The OSH governance model in Australia is a typical example of a cooperative and egalitarian governance model where various parties are

involved, including the government, employees, employers, associations, and safety representatives [8].

From the American experience, it was noted that the USA encourages forming a flexible, market-based, and perhaps even entrepreneurial government that emphasizes the role of the community, intermediate social groups, and non-profit organizations in OSH governance [8]. The US Congress set up the Occupational Safety and Health Administration (OSHA) in 1970 to make and enforce rules and provide workers with training, outreach, information, and assistance [42]. In addition, while labor law involves a semi-private model of collective bargaining between workers and employers, employment law has developed as a command-and-control regulatory model of worker protection. Nevertheless, as unionism is becoming increasingly rare in most American industries, the limits of a command-and-control approach to workplace policies have become more apparent in the new, post-industrial economy [43].

In the United Kingdom, the Health and Safety Executive (HSE) is Britain's national regulator for workplace health and safety. The HSE is responsible for occupational safety and health governance with eleven departments (the departments are on-site law enforcement, hazardous facilities, human resources, science and technology, planning, finance and procurement, enterprise services, policy, implementation strategy, enterprise communications, and chemical laws and regulations). However, the government has prioritized a governance mode that includes the participation of both the employer and the worker [8].

It is evident that developed countries have accumulated experience in dealing with occupational safety and health problems and have become increasingly mature in their governance methods. Adopting multivariate cooperative governance for occupational safety and health has become the governance mode in high-income countries, and this has become a valuable reference for developing countries that are evaluating their options for occupational safety and health governance [8].

3.5. The challenges of OSH governance in Low and Middle-income countries (LMICs)

Governance, particularly 'good governance,' is a significant determinant of economic growth, social progress, and overall development desired in Low- and Middle-Income Countries (LMICs) [44]. The occupational illness and injury rates are rising in LMICs, which is a typical case where economic activities grow and develop leading to concerns for the environment and human health and the need for OSH services that they are unlikely to be able to meet [35].

Managing worker safety and health is a challenge that most countries and companies encounter [5]. Ganopol (1979) discussed the factors contributing to the ineffective and insignificant Occupational Health systems in developing countries. They stated that the dependency of occupational health on the poor and challenged public health system is the main reason behind its ineffectiveness. In addition, they argued that the relationship between occupational health and general medicine is growing even though occupational health is under the Ministry of Labor while general medicine is under the Ministry of Health and each ministry has its own rules [45].

Another challenge is the informal sector which is extremely diverse and segmented by economic sector, workplace, social group, and gender. The informal sector includes part-time employment for additional cash, street trading, tiny businesses without registration, and improvised work in homes [46], with poor wages [47] and a lack of proper government regulation and surveillance [48]. According to the ILO, 2 billion people or nearly 61% of all individuals who are employed globally are in the informal sector, and 86% of them are in Africa [49]. In addition, workers in the informal economy are not covered by social security and labor laws, nor are they recognized, registered, controlled, or otherwise protected [50]. The literature noted that workers in the informal sectors lack the knowledge, skills, and resources needed to implement health and safety precautions where environmental risks and inadequate safety and health regulations are particularly pronounced [51]. Moreover, poverty and income insecurity make it often impossible for informal workers and businesses to invest in PPE and other safety devices that are relevant to their work [48]. Adding to that, with the high rates of the informal economy, the extension of social security to undocumented employees is one of the critical priorities and a considerable challenge in many countries [52].

3.5.1. OSH services

The most essential duty of an occupational health department in a developing country is to provide health care for the working population and their families [53]. However, in developing countries, occupational health services are either meager or non-existent. Even if available, they are still not properly integrated into the national health setup [53].

Lucchini et al (2015) noted that the OSH services in LMICs are challenging because they are usually limited to major enterprises and, existing laws and regulations are not comprehensive enough to cover the entire population. Workers in small enterprises, migrant workers, and recent immigrants in many countries are likely not to be included in too many OSH programs. Implementation of legislation is weak and not protective of workers and their families [35].

3.6. The underlying causes of Sudan's inertia regarding OSH

Sudan is identified as a lower middle-income country [54] that has experienced decades of drought, war, political and economic instability, corruption, and poor governance that affected nearly all sectors, including health, business, and education [55,56]. The worsening situation in Sudan is fueled by simultaneous crises, including the deteriorating economic situation, rapidly increasing inflation rate, and scarcity of essential needs like food, fuel, power supply, and lack of enough financial support for people's basic needs like healthcare and education [57].

The Sudanese budget deficit was 5.0% of GDP in 2011 due to the loss of oil revenues, intensifying military conflicts and heightened security risks, the creation of new states, and the financing of peace agreements. In addition, the US sanctions and Sudan's massive debt constrained Sudan's foreign and increased internal borrowing. As a result, the spending on social services, including health and education, declined [58].

In addition, there has been growth in the informal sector and a proliferation of smaller firms during the 1990s. An estimated 60% of the labor force is directly engaged in the informal sector, and hence, labor rules are not routinely enforced [58]. For most workers in the informal economy, the absence of social protection is not only a hindrance in their daily battles to make ends meet, but it also impedes their search for decent work, rights, and dignity. The absence of social protection affects inclusive growth, social justice, and the fulfillment of human rights in the societies in which they reside [52].

4. Discussion

To the authors' knowledge, this is the first scoping review investigating the development of the Sudanese OSH governance in
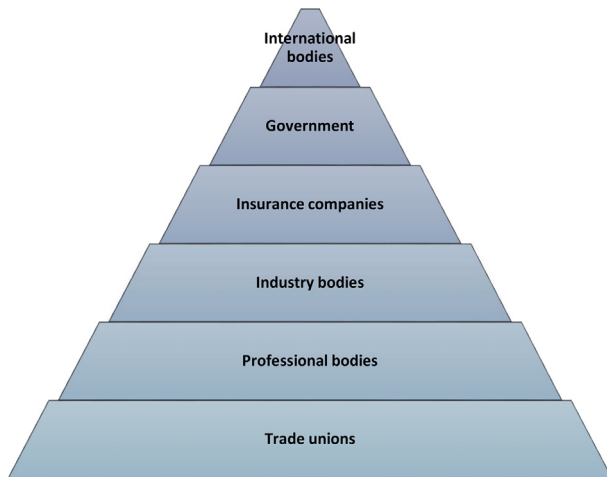
Fig. 4. The main features of the suggested Governance model.

recent years. The scoping review outlined the development of the OSH governance from the 1960s to date. It synthesized the available evidence to support decision-makers in developing and implementing an evidence-based national OSH framework. The results indicate that studies on OSH governance in Sudan are sparse throughout the study time frame (two journal articles in 56 years).

Although Sudan has committed itself to international laws and regulations since the 1940s, it has no national OSH policy to provide a strategic framework to govern work-related physical and psychological risks. Moreover, the OSH system in Sudan involves several governmental bodies with overlapping responsibilities. This study found that institutions concerned with occupational safety and health are dispersed and have limited capabilities for cooperation and coordination.

In Sudan, the OSH regulatory approach is a single governance model dominated by the government since its start in the seventies. The primary OSH act of 1997 which is a part of the labor code has undergone some developments and changes. An example is the increase in the number of laws and regulations concerning OSH, including new legislation and amendments to existing ones. Despite the increase in legislation, it was noted that the current Sudanese OSH regulations don't incorporate psychological health management, indicating that the Sudan OSH regulation does not fully incorporate the ILO conventions and recommendations.

The authors recommend separating the OSH regulations from the current labor law and updating it by defining the basic framework and authority for promoting, regulating, and enforcing workplace health, safety, and welfare in Sudan. In addition, to address the complexity of today's ever-changing work environment with its new socio-demographic characteristics and new technology, the new OSH act must consider the significance of all three forms of ethics: individual (personal), professional, and institutional [59].

Researchers discussed the importance of OSH laws and regulations enforcement and the need for an adequate and appropriate inspection system [60]. However, it was observed that the enforcement of OSH laws and regulations in Sudan has been poor over the years. This is evident in the small number of inspectors responsible for many industrial entities. It is essential to note that effective enforcement needs trained OSH personnel which was found to be one of the challenges Sudan is facing [41]. Sudan's need for more trained inspectors whose number is proportionate to the industrial facilities has been discussed in several studies in the last century: for example, Khogali (1966) [29].

Nonetheless, the shortage of inspectors seems a common problem in LMICs and HICs. For example, in the United States, Berkowitz (2020) reasoned that the decrease in inspectors since 2017 resulted from administration policies that led to an increase in the number of fatalities and injuries across the US. She reasoned that there are 862 inspectors to cover millions of workplaces; hence OSHA's ability to protect workers and spot hazards and change practices is reduced due to the overburdening inspectors [61].

Another contributor to the status of Sudan's OSH is the information scattered between various governmental departments with no coordination and formal channels for exchanging them. The driving force behind the activities of the government and other departments concerned seems to be compensated for work-related injuries and deaths.

Therefore, there is an urgent need for an integrated system of governance with specific disjoint responsibilities assigned to different departments and clear channels for the flow of information and data from bottom to top. This will unify the currently scattered, uncoordinated efforts, resulting in more comprehensive cumulative data on all OSH aspects. Sound analysis of such data will help in planning and continuous improvement of the system. The same problems occur in other countries in the region. For example, Mrema et al (2015) stated that the African region lacks systems to collect OSH data regularly and actively and relies on "passive notification," either to compensation or insurance authorities or the labor inspectorate, whenever there is a workplace accident [2].

To overcome the problems highlighted above and to improve OSH governance, the authors suggest replacing the government-controlled model with a model involving all the stakeholders, as illustrated in Fig. 4 below. The proposed figure's main features are the involvement of trade unions, professional bodies, and industry bodies in the process. In addition, all parties must operate under one independent body responsible for OSH regulation, enforcement, welfare, and research to eliminate duplication, enhance coordination, integrate information from various sources, and produce an informative national summary and analysis of the OSH status in Sudan.

The authors of this study also recommend establishing an independent national health and safety authority to prevent occupational deaths, injuries, and illnesses in Sudan. The independent authority oversees the fundamental structure, enforcement, and research of workplace health and safety in Sudan. In addition, clearly define and well-communicate the safety roles and responsibilities among different governmental bodies. Improvements in occupational safety and health require constant, multi-level communication. It is expected from those in positions of authority to make it their mission to foster an environment that welcomes and values diverse perspectives on occupational safety and health (OSH) and fosters cooperation between internal and external stakeholders in pursuing a shared OSH vision [62].

Since health and safety at work is the driving force of OSH systems, it is natural for trade unions to be at the base of the system's pyramid, to ensure workers' satisfaction with the safety systems in place, be part of incidences investigations and help their memberships in cases of work-related injuries or death. Similar recommendations appeared in previous research [63]. If the Sudanese trade unions have returned to their prominent position as one of the most significant types of civil society groups and continue to play a crucial role in Sudanese society.

It was noted that trade unions played a crucial role in making workplaces safer. For instance, the unions in the United States were fundamental to developing and passing the Occupational Safety and Health Act in 1970 [64].

Nonetheless, although the workers' trade unions establishment in Sudan goes back to 1948 with the constitution of Sudan Railway

Union (SRWU) [65], it remains ineffective. EL Agati et al (2021) discussed that the Sudanese trade unions have always been a target of totalitarian regimes seeking to deprive them of any meaning or purpose and prevent them and their leaders from participating in professional or political life and hence, preventing them from attaining their objectives, enhancing liberties and ensuring the protection of economic and social rights in the various sectors they control [66]. Contrary to the Sudanese trade union's current situation, adding the trade union to the pyramid's base is essential to overcome the OSH issues in Sudan. Since one of trade unions' major objectives is to organize labor to decrease work-related accidents in the industrialized world [67].

The remaining bodies in the pyramid follow from the base to the government and international bodies at the top. While legislation, procedures, and enforcement go from top to bottom, the awareness of their importance and abiding by them goes from bottom to top. Nonetheless, any successful intervention depends on the multi-stakeholder environment [49].

It is noted that a successful safety and health implementation requires management's leadership, vision, and resources. Involving business owners, managers, and supervisors who exercise management leadership [68]. It is evident that effective leadership improved safety performance in high-hazard and complex working environments such as aviation, energy, and manufacturing [69]. In addition, managers have a crucial role in any organization's design and improvement of working conditions, which affect employees' health [70]. Therefore, the proposed recommendation will only be effective once Sudan's leaders take the initiative to promote and maintain occupational health, safety, and well-being in Sudan.

Based on the findings of this study, there is a clear knowledge gap about the OSH governance in Sudan. Therefore, there is an urgent need for methodological research to provide information on aspects like the implementation of OSH legislation, enforcement, OSH statistics, leadership involvement, and safety culture in Sudan. In addition to a county OSH profile that provides information on labor inspection, stakeholders' participation, OSH statistics and indicators, and general demographic and economic data [27].

5. Conclusion

The reoccurrence of occupational accidents in Sudan is evidence of a lack of effective OSH governance in Sudan. There are numerous laws in place, but there is no evidence of enforcement of such legislation and no identified official bodies at the national level responsible for such enforcement. The existence of more than one authority with intersecting responsibilities is not helping the OSH governance. An integrated governance model is proposed to eliminate overlapping duties and facilitate the participation of all stakeholders in the governance process.

Conflicts of interest

The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

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