ASSESSMENT OF FIRE RISK MANAGEMENT PRACTICES IN SRI LANKAN WAREHOUSES

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Abstract. Built environments such as warehouses are identified as high-risk areas due to combustible materials, diverse storage configurations, and continuous operational activities. Storage occupancies have been recognised globally as significant contributors to fire losses, resulting in economic disruption and safety challenges. In developing countries, the effectiveness of fire safety governance is often constrained by limitations in regulatory enforcement, implementation, and maintenance practices. Although fire safety regulations exist in Sri Lanka, limited empirical attention has been given to evaluating how effectively these regulations translate into fire risk management practices in warehouse operations. This study aims to assess the effectiveness of fire risk management practices in Sri Lankan warehouse operations by examining regulatory requirements, the performance of active and passive fire protection systems, and their implementation in practice. The findings indicate that while regulatory requirements provide a foundational structure for fire safety, implementation remains largely compliance driven. Inadequate maintenance regimes, weak system integration, and limited monitoring mechanisms compromise the reliability of protection systems. By reframing warehouse fire safety within facilities management, this study contributes to the discourse on safety governance and risk control, supporting systematic, performance-focused fire risk management aligned with the FMF 2026 theme on Integrated Safety and Risk Management for Total Wellbeing.

Keywords. *Active And Passive Protection; Facilities Management; Fire Risk Management; Regulatory Compliance; Warehouse Safety*

1. Introduction

Warehouses constitute a critical component of national supply chains, logistics systems, and commercial distribution networks (Nadarajah et al., 2024). In industrial economies, these facilities function as storage, consolidation, and redistribution hubs that sustain uninterrupted market operations. However, the intrinsic characteristics of warehouses with high storage densities, combustible commodities, complex racking systems, electrical installations, and expansive open floor areas create inherently high fire risk environments (Ju, 2016). International fire statistics indicate that storage occupancies experience significant fire incidents resulting in extensive property damage, operational disruption, and economic loss (*International Fire Code 2021*, 2020; Sarah Lee, 2025). More critically, warehouse fires threaten life safety, structural stability, and long-term business continuity (Kashef et al., 2009).

Fire safety in warehouse environments cannot be reduced to the installation of technical protection systems alone. Contemporary fire risk scholarship increasingly emphasizes risk-based, performance-oriented, and systems-driven mitigation strategies (Gómez Fernández et al., 2016). Effective fire risk mitigation requires a coordinated integration of active fire protection systems (such as detection and suppression), passive protection measures (such as compartmentation and fire resistance), organizational risk assessment

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procedures, inspection regimes, and maintenance governance structures. ISO 45001 and related safety management frameworks reinforce the principle that hazard mitigation must be proactive, systematic, and continuously monitored. In the context of warehouses, fire risk mitigation therefore becomes a multidimensional strategy involving regulatory compliance, engineering controls, operational discipline, and institutional accountability. Despite the existence of regulatory fire safety provisions in many developing countries, implementation challenges often limit the practical effectiveness of mitigation strategies. Studies on safety governance suggest that institutional weaknesses, limited enforcement capacity, and inadequate monitoring mechanisms frequently undermine the intended impact of fire safety regulations (Perera & Allis, 2022; Zhang et al., 2019). As a result, the presence of prescriptive fire safety codes does not necessarily guarantee that effective mitigation strategies are operationalized at the facility level.

In Sri Lanka, national building regulations specify requirements for both active fire protection systems (e.g., detection and suppression) and passive fire protection measures (e.g., structural fire resistance and compartmentation) in warehouse facilities. While these provisions provide a formal regulatory framework, limited empirical research has examined the extent to which comprehensive fire risk mitigation strategies are implemented, integrated, and maintained within warehouse operations. Existing literature tends to emphasise technical compliance and system installation, with comparatively less attention given to the strategic alignment between risk identification, mitigation planning, maintenance practices, and operational management in warehouse environments (Angammana & Jayawardena, 2022).

This reveals a critical research gap: insufficient investigation into the effectiveness and practical integration of fire risk mitigation strategies in Sri Lankan warehouses. Without such analysis, it remains uncertain whether current practices adequately reduce fire hazards, minimize ignition potential, and enhance resilience against fire incidents in high-risk storage environments.

By focusing on mitigation strategies rather than solely regulatory compliance, this study contributes to the broader discourse on performance-based fire safety management in industrial facilities. It positions warehouse fire safety as a strategic risk reduction process requiring coordination between regulatory provisions, engineering safeguards, and operational governance mechanisms. The findings are expected to inform of improvements in fire risk mitigation practices and strengthen resilience within Sri Lanka's industrial warehouse sector. The paper adds to the literature by exploring the discrepancy between regulation compliance and performance within the warehouse industry in Sri Lanka. It sheds light on the effect of governance tools and maintenance strategies on effective fire risk management, other than just installing fire protection devices.

Accordingly, this study aims to evaluate the effectiveness of fire risk management practices in Sri Lankan warehouses. The objectives are to: (1) identify predominant fire hazards and ignition sources; (2) examine the adequacy of active and passive fire protection systems; (3) assess operational practices, including inspection and maintenance;

(4) evaluate integration of regulatory and organizational controls; and (5) analyse the gap between compliance and actual performance

2. Literature Review

2.1 FIRE RISK MITIGATION MEASURES AT OPERATIONAL STAGES

Operational-stage mitigation is fire control measures applied and sustained after the stage of construction to mitigate the possibility of ignition, increase the ability to detect fire, and reduce the possibility of fire expansion and emergency preparedness. Although design requirements are minimum safety requirements, the body of research is growing to suggest that the results of fire performance are influenced by the quality of operational governance and maintenance procedures (Meacham et al., 2005). The maintenance of electrical faults is always an important part of operational mitigation because the electrical faults are repeatedly discovered to be the main points of ignition in industrial enterprises (Dungan, 2016). A set of preventive measures, including thermographic, load balancing, regular audits, and distribution systems maintenance, can help greatly avert ignition incidents when implemented in a systematic way (Iqbal & Harichandran, 2011; Karlsson & Quintiere, 1999). Likewise, active fire protection systems such as sprinkler systems, fire detection systems, and the performance of this system largely rely on inspection, testing, and maintenance (ITM) regimes. Massive fire intensification incidents in storage facilities have been attributed to system failures that have been occasioned by poor maintenance (Drysdale, 2011; Grant et al., 2000).

The operational controls have even gone to housekeeping practices and management of combustible loads. The storage density, clearance of the aisle, and the accumulation of waste affect the potential of fire growth and the availability of suppression (Grant et al., 2000). Periodic checkups on storage settings and commodity categorization are thus a very important element of performance-based mitigation (Zhou et al., 2020). Besides that, emergency preparedness, in terms of drills, evacuation schemes, and coordination response measures, reduces casualties and organizational resilience when incorporated within wider safety management frameworks, as opposed to being handled as individual compliance activities (Dungan, 2016). Together, the literature indicates that operational mitigation is not an episodic process but rather an ongoing effort that must be governed and documented and performance reviews to ensure the design intent is transformed into risk reduction.

2.2 INTERNATIONAL FIRE SAFETY CODES AND STANDARDS COMPULSORY TO WAREHOUSES

Global fire safety regulations in warehouse buildings are mainly steered by the well-organized codes and standards made by the internationally accepted regulatory and standard-setting authorities. These instruments provide minimum design, installation, inspection, and maintenance requirements of active and passive fire protection systems.

NFPA standards offer very specific technical specifications of fire protection in a warehouse. NFPA 13 encourages the design of sprinkler systems in accordance with the classification of commodities, the height of storage, the way the rack is arranged, and the clearance of the ceiling (Bueche, 2013). NFPA 25 provides the required inspection, testing, and maintenance (ITM) procedures that would be used to maintain stability in the system throughout the operating period. NFPA 72 regulates fire alarm systems and detectors, NFPA 101 regulates the rules of life safety, and the emergency plan includes the way out and means of egress. These standards work in conjunction to focus on hazard-based design of the system and ongoing verification of operations.

On the same note, the *International Fire Code 2021 (2020)* (IFC) by the International Code Council (ICC), outlines the duties of high-piled combustible storage, fire department access, smoke and heat venting, fire-resistance-rated construction, as well as operational permits. The IFC is an amalgamation of the structural (passive) and system-based (active) protection, which enhances the idea that fire safety in warehouses should be treated.

Besides regulatory codes, standards of industrial risk engineering, which are produced by international insurance organizations, offer improved performance standards. Such standards generally mandate water supply redundancy, impairment management processes, and organized emergency preparedness planning, usually beyond the statutory minimums. The presence of such frameworks upholds the significance of lifecycle-oriented fire risk management as opposed to compliance alone. Hence, the global experience shows that warehouse fire safety is controlled with the help of a complex set of design measures and operational procedures and a mandatory system of inspections, which constitute an organized system of compliance.

2.3 FIRE SAFETY GUIDELINES ON WAREHOUSES IN SRI LANKAN REGULATORY FRAMEWORK.

In Sri Lanka, warehouse safety in fire is incorporated in the national construction approval control systems and local authority regulation systems. These provisions are more or less in line with international standards, although they encounter national institution frameworks.

Active fire protection systems such as sprinkler systems, internal hydrants, hose reels, portable extinguishers, and fire alarm systems are usually installed during the regulatory approval process of regulatory approvals (Rosyidiin et al., 2024). The design stage requires passive protection procedures in the form of fire compartmentation, structural elements, protective escape measures, and emergency exit signs. Before approving occupancy, compliance forms are to be provided. Operation-level plans involve periodic inspection of the system, fire detectors and fire suppressors, housekeeping measures to avoid excessive accumulation of combustible substances, and Housekeeping of clear escape routes. Nevertheless, enforcement is based strongly on periodic inspections that are done by concerned authorities, and continuous monitoring is left to facility management to a great extent (Fauzia et al., 2022). The regulatory environment thus creates formal compliance requirements for both active and passive systems. Nevertheless, as has been determined in literature and practice, the success of such provisions is conditional upon their long-term operational monitoring, technical, and institutional enforcement capacity. The lines between regulatory compliance and functional performance are of special significance in functional warehouse settings.

2.4 CONCEPTUAL FRAMEWORK FOR OPERATIONAL FIRE RISK MITIGATION

The conceptual framework that has been developed in this study describes the fire risk mitigation as being achieved by means of four interlinked factors. The factors include hazard characteristics, protective system, operational control, and governance mechanism. Hazard characteristics refer to the intrinsic fire risks in terms of the way items are stored and any sources of ignition. Protective systems are those systems aimed at protecting from fire both actively and passively. Operational controls are concerned with maintenance and emergency planning. The governance mechanism relates to the process of inspection and monitoring.

As per recent research, the fire safety performance of buildings depends on operational and governance parameters more than design compliance (Himoto, 2021). The examples of fires in warehouses around the world show that non-compliance with respect to inspection, maintenance, and monitoring of facilities leads to the rapid spread of fires regardless of system compliance (Živanić, 2019).

While the current literature pays considerable attention to fire safety regulations and the design of fire protection systems, very little attention has been given to their operation and efficiency.

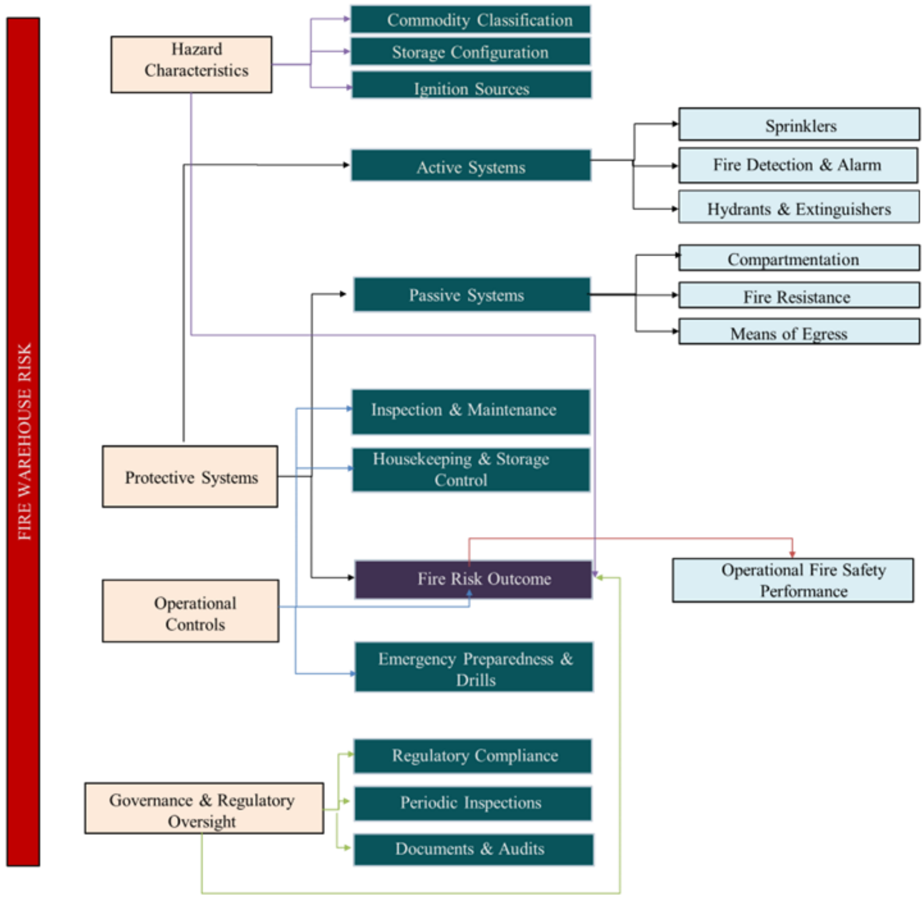

Figure 1, Operational Fire Risk Mitigation Framework

3. Methodology

3.1. RESEARCH DESIGN

The research design embraced in this study was qualitative to assess the effectiveness of fire risk management practices within the warehouse premises in Sri Lanka (Ravitch & Carl, 2019). The qualitative method was chosen to provide a comprehensive examination of the regulatory provisions, the sufficiency of the protection system, and the practices of its implementation in real situations (Hsieh & Shannon, 2005). Since the effectiveness of fire safety is determined by not only technical conformity but also by organizational practices and enforcement procedures, a qualitative design was suitable to give an insight into the views of the experts and the realities on the ground (Creswell & Creswell, 2018).

The design of the research was divided into three primary stages: (1) regulatory research, (2) field research of warehousing facilities, and (3) expert interviews. This multi-stage framework was able to triangulate regulatory demands, observed system states, and professional attitudes.

3.2. PHASE I: REGULATORY PROVISION REVIEW

To investigate the existing national fire safety provisions in relation to warehouse facilities in Sri Lanka, a desk-based regulatory review was conducted. The requirements analysed during the review were the ones associated with:

- Active fire detection and suppression
- Passive fire protection (compartmentation and structural resistance)
- Means of escape
- Provisions on maintenance and inspection

A review of internationally recognized standards of fire safety was conducted to achieve consistency in the benchmarking (Adewunmi et al., 2016). This phase was meant to decide whether current regulatory prescriptions were sufficient and comprehensive, and the need to scrutinize certain areas in the field during investigation.

3.3. PHASE II: FIELD RESEARCH OF WAREHOUSES

After the review of the regulation, a group of warehouse facilities was chosen to enter the field of investigation. The sample consisted of operational warehouse settings that reflect various ownership and operation settings to provide variation in the implementation practices. The site investigations were aimed at collecting data on:

- Availability and state of active fire safety mechanisms
- Sufficiency of passive fire protection
- Adherence to the stipulated regulation requirements
- There must be evidence of inspection, testing, and maintenance practices

To provide uniformity between the sites, the structured observation checklists were utilized. This method facilitated an organized assessment of protection systems on the regulatory expectations that were determined during Phase 1.

3.4. PHASE III: EXPERT CONSULTATIONS

The semi-structured interviews with professionals with a background in fire safety, building regulation, and industrial operations were also aimed at enhancing the analytical validity. The sample size of 10 was fire safety practitioners and regulatory officers who have direct experience in the management of warehouse safety.

The research used a purposive sampling technique in the selection of ten experts with vast knowledge on fire safety, regulation enforcement, and management of warehouses. These experts included fire officers, system installers, consultants, and risk assessment experts, who had worked in their professions for between 15 and 40 years.

Table 1, Expert Profile

Participants	Designation/field experience	Experience (Years)
R1	Retired chief fire officer and fire consultant	40
R2	Retired chief fire officer and fire consultant	30
R3	Retired chief fire officer and fire consultant	28
R4	Chief fire officer	25
R5	Chief fire officer	15
R6	Fire consultant and fire incident investigator	35
R7	Fire consultant and fire system installer	15
R8	Fire consultant and fire system installer	20
R9	Fire risk assessor	22
R10	Fire officer and fire risk assessor	20

The interviews explored,
Adequacy of existing regulations perceived

- Implementation challenges
- Maintenance culture and compliance behaviour.
- Impairments and institutional constraints.

Expert consultations were aimed at putting observed findings into perspective and pinpointing systemic obstacles to the effectiveness of fire risk management. Data analysis was done through thematic analysis. Codes obtained from the interviews were put under recurring patterns, and themes emerged from the fire risks, system performance, operation procedures, and governance areas.

3.5. DATA ANALYSIS

Thematic analysis was used in data analysis. Comparative analysis of regulatory provisions was also done with an aim of finding areas of agreement and possible gaps. Prescriptions were evaluated by field observations, and their compliance with requirements was measured to find out the level of compliance and adequacy of the system. Deductive coding of the interview data was done according to the study objectives, and inductive coding to identify new themes on issues of implementation and governance. The reliability of the findings was increased because of triangulation between regulatory review, site observations, and expert views. This analytical method facilitated the assessment of fire risk management approaches as a holistic approach and not as individual technical units.

4. Findings and Discussion

An integrated methodology is used for analysis, as the results are combined with current literature for further interpretation of the fire risk management strategies being practised. This research does not merely present descriptive data but looks at the causality among fire risks, system performance, operational procedures, and governance processes in the warehouses of Sri Lanka.

4.1 ADEQUACY OF EXISTING MITIGATION STRATEGIES IN SRI LANKAN WAREHOUSES

Empirical evidence shows that Sri Lanka has a formally organized regulatory framework on the fire safety of warehouses, although its operational effectiveness is disproportionate. Construction Industry Development Authority Fire Regulations provide installation of active fire protection devices (sprinklers, detectors, hydrants, hose reels) and passive protection measures like compartmentation and structural fire-resistance. However, according to expert interviews, compliance with regulations does not always imply the effectiveness of risk mitigation performance. All the respondents (R1 -R10) admitted that larger warehouses usually install the necessary fire protection systems at the approval level. Nonetheless, R6 also pointed out that: "It is not the problem with the installation, the weakness is that performance over the years cannot be sustained".

Equally, R9 noted that mitigation reliability is foregone as system impairment is caused by ineffective inspection and maintenance regimes. These results are in line with those of Sarah Lee (2025), who believes that fire protection systems should be managed as lifecycle assets instead of fixed compliance components. Comparatively, international standards, which are being formed by the National Fire Protection Association, stipulate that NFPA 25 stipulates continuous inspection, testing, and maintenance (ITM) documentation. On the contrary, even though CIDA requires periodic testing, systematic impairment management processes are not institutionalized. Hence, regulatory inefficiency is not the main factor that restrains the sufficiency of Sri Lankan mitigation schemes, but rather the instability of their implementation and the governance gap.

4.2 ACTIVE FIRE PROTECTION SYSTEMS: REGULATORY COMPLIANCE VS PERFORMANCE

The active systems are the key engineering control mechanism against the fire escalation in the warehouse. Empirical data show that in most large-sized warehouses (above 800 m 2) sprinklers and detection systems are installed, and this is also aligned with CIDA requirements. Nevertheless, the efficiency of such systems is very much reliant on the hazard-based adaptation in design. At the international level, the International Code Council, with the International Fire Code [IFC] (2021), and Dungan (2016), mandates that the design of sprinklers should be calibrated based on the commodity or type, height of storage, rack arrangement, and the height of the ceiling. In comparison, some Sri Lankan warehouses use generic sprinkler densities without recalculating the hydraulic demand, according to the high-piled storage conditions.

R3 reported that High rack storage with plastic commodities requires a special density of sprinkler and the reliability of the water supply. Such a degree of hazard design is not always implemented. Also, R8 pointed out the inconsistencies in the redundancy of water supply, stating that not all facilities are equipped with a second source of water or have the testing procedures for the reliability of pumps. There is also the lack of formal sprinkler impairment management, used within a broad range of NFPA systems, which poses an extra degree of vulnerability. Thus, although active systems have a structure, their reliability to perform under high-intensity fire conditions is unknown, and therefore their use is limited to mitigation.

4.3 PASSIVE PROTECTION AND COMPARTMENTATION GAPS

Passive fire protection is very important in high warehouses where vast compartments hasten fire propagation. Compartmentation is always noted as one of the main strategies to control fire in the areas of origin and avoid total engagement of the building. Despite the regulation of CIDA on the size of compartments in non- sprinkler warehouses, field experience indicates that the principle of compartmentation is often neglected for the convenience of operation. R1 noticed that undivided open spaces are found to be more convenient in warehouses regarding logistics. Compartment walls are perceived as operational blockers.

Such practice is against international standards under IFC 2021, which are more stringent in the high-piled combustible storage and engineered smoke venting systems. Smoke and heat venting provisions, though mentioned in the Sri Lankan codes, are not frequently applied with performance-based engineering evaluation. Empirical evidence also indicates that there is little maintenance of flue space upkeep in rack storage in terms of vertical structures. According to R7, storage reconfigurations tend to block the flue spaces after initial acceptance with minimal regulatory reinspection. Passive mitigation measures are therefore ordered but not always maintained during operational phases, and their purported containment role is diminished.

4.4 OPERATIONAL MITIGATION PRACTICES IDENTIFIED IN FIELD RESEARCH

On-site studies indicated that there is a great difference in operational mitigation measures in different facilities. Simple housekeeping, smoking, and maintenance of portable extinguishers were mostly monitored. Nevertheless, organized preventive measures, especially those aimed at ignition control, were sparsely taken. The most common risk to ignition was detected as electrical faults (Gómez Fernández et al., 2016). This notwithstanding, the field work suggests that thermographic inspections, load balancing audits, and predictive electrical maintenance techniques are not regular practice. According to R5, the electrical inspections are reactive. They do not occur as prevention cycles but as post-incident.

In the same way, high ignition-risk areas, which are recognized internationally based on the release of hydrogen (Kashef et al., 2009), are not necessarily separated with fire-protected separation and ventilation structures. R4 admitted that large-scale facilities occasionally isolate their operations by setting up special zones, and small-scale operations charge their operations inside storage areas. The international practice focuses on the hot-work permit systems, impairment documentation, emergency drills, and constant monitoring of the fire load. Even though there are cases where certain warehouses hold evacuation exercises, R10 has observed that the exercise is done to meet the inspection requirements and not as an extension of a risk culture observation. Thus, Sri Lankan operational mitigation is mostly compliance-focused as opposed to risk-performance-based. The distance between design-stage compliance and operational-stage governance is a limiting element to mitigation effectiveness to a considerable extent.

4.5 EVALUATING THE EFFECTIVENESS OF MITIGATION STRATEGIES IN THE SRI LANKAN CONTEXT

The analysis of empirical data alongside the global knowledge suggests the framework of warehouse fire mitigation in Sri Lanka has a structurally sufficient regulatory base but has operational and governance weaknesses that make it less effective. Provisions of the regulation stipulate active and passive protection measures extensively consistent with the international standards, but the interpretation of the provisions in the long-term performance-based risk management is uneven. The empirical data indicate that fire protection systems are typically implemented at approval stages, but the lifecycle governance, i.e., the organized inspection regime, the impairment management, the recalibration of the sprinkler systems by hazard, and the organized fire load monitoring, are also not institutionalized in the same way. International standards prepared by organizations like the National Fire Protection Association and the International Code Council underline that the success of mitigation is not only related to the installation, but also to the verification that should be conducted continuously, documented, and adjusted to the hazard.

Table 2: Comparison of Regulatory Compliance and Observed Fire Safety Performance in Warehouses

Fire Safety Component	**Regulatory Requirement (Literature/Standards)**	**Empirical Observation (This Study)**	**Performance Gap Identified**	**Supporting Literature**
Fire detection systems	Continuous operability ensured through inspection, testing, and maintenance (ITM) (NFPA 72; NFPA 25)	Systems are installed in most warehouses, but irregular testing and maintenance are observed	Reduced the reliability of early fire detection	Drysdale (2011); Grant et al. (2000)
Fire suppression systems (sprinklers, hydrants)	Designed based on hazard classification and maintained regularly (NFPA 13; NFPA 25)	Systems available but often impaired or poorly maintained	Ineffective fire suppression during the early fire stages	Bueche (2013); Zhou et al. (2020)
Electrical systems (ignition control)	Preventive maintenance and load management required	Frequent overloading and poor wiring conditions were identified	High likelihood of electrical ignition	Dungan (2016); Iqbal & Harichandran (2011)
Housekeeping and storage practices	Control of combustible load and proper storage configuration required	Inconsistent housekeeping and accumulation of combustible materials were observed	Increased fire load and rapid fire spread potential	Grant et al. (2000); Zhou et al. (2020)
Inspection and monitoring	Regular inspections and documentation required by regulatory frameworks	Inspections are periodic but lack depth and follow-up	Weak enforcement and monitoring effectiveness	Perera & Allis (2022); Fauzia et al. (2022)

Governance and safety management	Continuous monitoring and integration of safety systems (ISO 45001:2018)	Compliance-driven practices with limited proactive risk management	between compliance and actual performance	Gómez Fernández et al. (2016)

4.6 DISCUSSION

The results on electrical ignition risk are very consistent with evidence around the world that electrical malfunction is one of the major causes of industrial fire (Dungan, 2016). Systematic preventive electrical audits and load monitoring are also discussed in the literature as key mitigation measures (Welch et al., 2007). Nevertheless, although these frameworks provide systematic re-evaluation of the load expansion, the fact that Expert E03 noted that "the overloaded panels form after the growth of operations clearly indicates that there is a gap in implementation". In this way, the research will contribute to the existing literature by demonstrating in an empirical way the effect of lifecycle expansion in the absence of recalibration in enhancing ignition probability under developing warehouse conditions.

International standards have equally emphasized the need for inspection, testing, and maintenance (ITM) to ensure that active systems are reliable (Moshashaei & Alizadeh, 2017; NFPA, 2025). According to Dungan (2016), one of the reasons behind the disastrous destruction of warehouses is their failure. Although the required systems are officially implemented in Sri Lankan facilities, as Expert E02's statement confirms, systematic performance testing is not always followed, indicating non-adherence to the lifecycle-based principles of governance articulated by Liyanapeli et al. (2023). Thus, the current research supports the theoretical assumption that performance-based safety is based on the continuous integration of management and not on the availability of infrastructure.

The results of the storage reconfiguration and aisle diminution are aligned with the existing literature that correlates the storage density and combustible continuity with a rapid-fire development (Zhou et al., 2020). Nevertheless, the observation of the Expert E05 about the gaps in the assessment of zoning opens another aspect of governance: the passive erosion of protection in the form of commercialisation. This subtlety adds some contextual evidence to largely technical fire modelling literature. Lastly, fire safety models based on governance promote the use of the risk assessment cycles that are implemented in the organisational systems as a continuous process ISO, 2018). Conversely, the fact that Expert E04 states that most of the inspections are reactive indicates the enforcement constraints that have been determined in developing situations (Kumar & Chhabra, n.d.). The comparison has validated that the lack of regulation is not the issue, but an operational integration weakness that contributes to the challenge of Sri Lankan warehouse fire risks. Based on this, the research gap identified in the study is fulfilled in a rigorous manner: although the international fire requirements are considered at the design phase, the lifecycle governance discontinuity is a major factor limiting the performance of operational fire risk mitigation activities.

5. Conclusions and Recommendations

Taking into consideration the results and the Integrated Warehouse Fire Safety Framework, developed in the framework of the given research, several strategic recommendations are provided.

5.1 POLICY LEVEL RECOMMENDATIONS

The above results show that the efficacy of fire risk management is significantly hindered by inadequate regulatory enforcement and monitoring mechanisms. Hence, regulatory agencies need to improve their inspection systems by using performance-based compliance measures in addition to prescriptive inspection methods. Unannounced periodic inspections should be carried out regularly to ensure consistent compliance, and accountability measures should also be put in place for addressing non-compliance issues. Coordination between the local government bodies, fire brigades, and the regulatory agencies is critical for this purpose.

5.2 ORGANIZATIONAL LEVEL RECOMMENDATIONS

Organizations running warehouses in Sri Lanka can enhance the quality of fire risk management at their workplaces by adopting a proactive rather than compliance-based approach. The first step towards achieving this goal is to develop an efficient ITM programme within each organization to ensure the ongoing reliability of fire protection systems. Comprehensive records related to maintenance work should be kept at all times, and regular internal audits should be conducted. Training programs to educate employees about fire risks and emergencies would help as well.

5.3 TECHNICAL-LEVEL RECOMMENDATIONS

At a technical level, the key focus needs to be on enhancing the efficiency and integration of fire protection systems. There needs to be regular tests conducted on fire detection and fire suppression systems to ensure that they are in good working condition. Electrical systems have been recognized as potential ignition sources and thus need to undergo regular inspections to ensure they are not overloaded or experiencing any problems with wiring. In addition to this, there should be a proper warehouse storage arrangement, such that fire suppression will be made easy.

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