Assessment of Fire Safety Preparedness in Elementary Schools: Evidence from Banjarmasin, Indonesia

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Abstract

School fire incidents present critical risks to vulnerable demographics, particularly in developing urban areas. This study evaluates the structural fire preparedness of primary education facilities. Employing a descriptive qualitative research design, this study selected thirty-two elementary schools in Banjarmasin City through purposive sampling, prioritizing institutions near high-density residential zones with predominantly wooden structures. The assessment framework was established based on the Banjarmasin City Regional Regulation Number 13 of 2008, supplemented by the Indonesian Ministry of Public Works Regulation Number 26/PRT/M/2008. The evaluation criteria strictly measured four core dimensions of fire preparedness: active fire protection facilities, passive fire truck access, life-saving evacuation facilities, and Building Fire Safety Management (MKKG). Primary data were gathered through direct on-site observations, standardized checklists, and interviews with school principals. The findings revealed severe gaps across the evaluation criteria: only 22% of schools possessed functional fire extinguishers, none had fire hydrants, and life-saving assets such as emergency lights and exit signs were completely absent. While 94% of the sites demonstrated sufficient fire truck accessibility, the implementation of formal MKKG scored 0% across all sampled institutions due to the total absence of emergency response organizations or written evacuation plans. It is concluded that fire safety readiness remains critically suboptimal. These systematic deficiencies highlight an urgent need for policy interventions, integrating school operational budgets with standardized emergency response governance.

Keywords: Banjarmasin, Building Fire Safety Management, Elementary Schools, Emergency Preparedness, Fire Protection Facilities

I. INTRODUCTION

Fire incidents are among the common problems faced in Indonesia and other parts of the world [1]. The advancement of modernization in urban cities increases the risk of fire. Various fire incidents occur across multiple sectors such as high-rise buildings, hospitals, schools, educational centers, shopping malls, and other public facilities [1]. Fire is classified as a disaster or calamity caused by unwanted or uncontrolled flames [2]. Fires can be caused by two factors: natural factors and human factors. Fires caused by natural factors include volcanic eruptions, earthquakes, lightning, and drought. Meanwhile, fires caused by human factors are usually due to negligence, such as the use of cooking equipment, human behavior like lighting fires in flammable areas, improper or non-standard electrical installations, and the use of electrical equipment with excessive loads [3].

The understanding and awareness of fire safety among the Indonesian population can be categorized as low. This is evident from fire incidents caused by a lack of knowledge and awareness of fire hazards, unsafe behavior, improper use of electricity leading to short circuits, negligence in using LPG cylinders, and gas leaks [4]. In addition, there is a lack of community preparedness to face and respond to fire hazards, an underdeveloped fire management system, and inadequate fire protection infrastructure and facilities in buildings [5]. Fires occur not only in residential areas but also in schools. According to data from the National Fire Incident Reporting System (NFIRS), the national losses caused by school fires are estimated to reach 85 million dollars [6].

In addition, there were fifty-six school fire incidents in Iran. These incidents resulted in deaths, serious injuries, and disabilities for dozens of students and teachers. Moreover, 65.6% of these incidents occurred in elementary schools [7]. Globally, more than 300,000 people die each year from fire-related injuries, and over 95% of burn-related deaths occur in developing countries[8]. Children are a high-risk group for burn injuries and fatalities [9]. Children under the age of fourteen are also more vulnerable to the effects of hazardous exposure because they have less knowledge about dangerous situations and lack the ability to react quickly and appropriately [10]. Children also tend to panic easily and become difficult to manage in emergency situations [11]. Furthermore, global statistical data shows that a number of fire-related incidents occur in schools. This is due to the use of flammable materials and paper-based documents, wooden furniture, and classroom decorations [12] Fire is one of the disasters that frequently occur in the city of Banjarmasin. In 2017, a fire incident occurred at a school in Banjarmasin, causing damage to school property [13]. To access fire safety, a qualitative study was conducted at elementary school in Banjarmasin City.

Numerous studies have extensively investigated Building Fire Safety Management (BFSM) across various contexts. However, the majority of these prior researches have predominantly focused on high-risk urban infrastructures, such as high-rise commercial buildings, modern shopping malls, and large-scale healthcare facilities. While these studies provide valuable frameworks for emergency evacuations and active fire protection systems, they frequently overlook institutional structures in sub-urban or specific regional settings. Consequently, systematic assessments of fire preparedness in educational environments particularly public elementary schools remain significantly underrepresented in the current literature.

This omission represents a critical scholarly gap, as elementary school buildings possess unique risk profiles, including highly vulnerable occupants (young children) and often constrained safety budgets. Furthermore, within the Indonesian context, existing school safety literatures are heavily biased toward geological disasters like earthquakes and floods, leaving fire hazards largely ignored. Specifically, no empirical study has yet assessed the fire safety readiness of elementary schools in Banjarmasin, a city with distinct tidal swamp topography and densely populated wooden urban areas that pose unique logistical challenges for fire mitigation. Therefore, this study explicitly addresses this gap by evaluating the current state of fire safety preparedness and infrastructure in Banjarmasin's elementary schools, offering localized empirical evidence to enhance regional school safety policies.

One of the schools that experienced a fire was Teluk Dalam 3 Public Elementary School. The fire destroyed three classrooms and one laboratory. As a result, the learning process had to be carried out in shifts. To prevent such incidents from happening again, an analysis is needed so that the school can develop a fire prevention system. In addition, several schools in the city of Banjarmasin are vulnerable to fire due to their proximity to residential areas [14]. While urban fires occur frequently in Banjarmasin City, a systematic assessment of fire safety preparedness in elementary schools has not yet been conducted. This study addresses this critical gap by anchoring its analysis within a robust theoretical lens, utilizing the Comprehensive School Safety Framework (CSSF) and the Sendai Framework for Disaster Risk Reduction. These theoretical baseline provide a structured approach to conceptualizing institutional preparedness by mapping out multi-hazard risks and evaluating school level infrastructure resilience.

Driven by this conceptual foundation, this study formulates two pivotal research questions. The research questions are to what extent do public elementary schools in Banjarmasin meet the physical and structural requirements for active and passive fire protection system and how effectively is Building Fire Safety Management (BFSM) implemented at the institutional level to protect vulnerable young occupants. Consequently, the primary objective of this research is to evaluate the existing fire protection facilities, emergency egress infrastructure, vehicle access routes, and management protocols across thirty-two public elementary schools in Banjarmasin City. Ultimately, this analysis aims to identify immediate areas for structural improvement and offer localized empirical evidence to foster disaster resilient educational environment.

II. METHOD

This study conducts a fire safety analysis of elementary schools in the city of Banjarmasin. The fire safety analysis is carried out using the main assessment instrument, namely Banjarmasin City Regional Regulation Number 13 of 2008, and a supplementary instrument, namely the Regulation of the Minister of Public Works Number 26/PRT/M/2008 concerning Technical Requirements for Fire Protection Systems in Buildings and the Environment. This study employs a descriptive cross sectional assessment design to evaluate fire safety readiness in elementary schools. This approach was selected because the research focuses on objectively measuring and classifying real world conditions at a specific point in time. The data collection instruments include observation checklists, structured assessments, and a categorical scoring system [15].

Data collection was carried out through interviews with school representatives, particularly with the principals. A total of thirty-two elementary schools located across five districts of Banjarmasin City will be selected as samples. Thirty two samples can be considered a sufficient number if they are representative, as the characteristics of the samples related to the research objectives are the same as or very similar to those of the population [16].

A purposive sampling method was used to select thirty-two elementary schools from a total population of approximately 200 schools across Banjarmasin, representing roughly 16% of the city's total elementary education institutions. This sample is considered representative of the city's specific fire risk profiles based on two main criteria: their location near residential areas and a share structural characteristic, where many buildings are still constructed of wood.

The sample distribution spans all districts, comprising twenty schools in South Banjarmasin (Basirih 1, Basirih 8, Kelayan Barat 2, Kelayan Barat 3, Kelayan Dalam 5, Kelayan Selatan 3, Kelayan Timur 2, Kelayan Timur 3, Kelayan Timur 6, Kelayan Timur 8, Mantuil 2, Murung Raya 1, Pekauman 1, Pemurus Dalam 3, Pemurus Dalam 5, Pemurus Dalam 6, Pemurus Dalam 7, Pemurus Dalam 8, Pemurus Baru 2, dan Tanjung Pagar 3), four schools in East Banjarmasin (Karang Mekar 1, Karang Mekar 5, Kuripan 2, Pengambangan 5), four in Central Banjarmasin (Antasan Besar 7, Mawar 7, Pasar Lama 1, Teluk Dalam 3), two in North Banjarmasin (Sungai Andau 4 and Sungai Miai 7), and two schools in West Banjarmasin (Kuin Cerucuk 1 and Telaga Biru 1). While this distribution does not strictly adhere to a probability based model, the deliberate concentration of twenty schools in South Banjarmasin is methodologically justified. As the most densely populated district with the highest number of schools and a historically higher frequency of residential fire incidents, this disproportionate sampling ensures the assessment captures the most critical areas facing elevated risks, making the findings highly relevant for targeted fire safety interventions.

The data sources used in this study are primary data obtained directly from the research sites. The data were collected from school informants, namely the principals or designated school staff. Data collection methods included checklists, interviews, and direct observations. The observed fire safety components were based on Banjarmasin City Regional Regulation Number 13 of 2008 and also referred to the Regulation of the Minister of Public Works Number 26/PRT/M/2008. The observed fire safety components include four main elements: fire protection facilities, fire truck access, life-saving facilities, and building fire safety management.

III. RESULTS AND DISCUSSION

This study evaluated the fire safety preparedness of thirty-two public elementary schools across five districts in Banjarmasin City. The assessment focused on four core legal dimensions: fire protection facilities, fire truck accessibility, lifesaving facilities, and Building Fire Safety Management. To provide a comprehensive to overview of the current preparedness levels and facilitate a localized analytical comparison, the quantitative compliance rates across different districts are summarized in the following Table 1:

Table 1. Compliance Rate of Fire Safety Readiness Index (FSRI) Across Districts

District	Number of Schools	Fire Protection (D1)	Truck Access (D2)	Life Saving	Management (D4)	Overall FSRI	Readiness Category
South Banjarmasin	20	0%	100%	0%	0%	25%	Low Readiness
North Banjarmasin	2	25%	100%	0%	0%	31,2%	Low Readiness
East Banjarmasin	4	25%	100%	12,5%	0%	34,4%	Low Readiness
Central Banjarmasin	4	37,5%	75%	25%	25%	40,6%	Low Readiness
West Banjarmasin	2	75%	50%	0%	0%	31,2%	Low Readiness
Total / Average	32	12,5%	93,7%	4,7%	3,1%	28,5%	Low Readiness

To delve deeper into the specific findings and contextualize these compliance rates, the subsequent section discusses each fire safety dimension in detail:

A. Analysis of Fire Protection Facilities

To evaluate the structural readiness of primary education facilities against fire hazards, an assessment of active fire protection systems was conducted using the criteria outlined in Banjarmasin City Regional Regulation Number 13 of 2008 and the Regulation of the Minister of Public Works Number 26/PRT/M/2008. This baseline assessment focused in critical first aid suppression tools specifically fire extinguishers and hydrants alongside emergency early warning devices. The empirical field data gathered across the thirty-two surveyed public elementary schools reveal severe infrastructural deficits. As summarized in Table 1, the vast majority of institutions completely lack standard active firefighting equipment, with only a small fraction maintaining basic fire extinguishers, and almost all schools relying on alternative, non-standardized water sources such as nearby rivers or swamp water.

Table 2. Data on the Availability of Active Protection Facilities and Warning Systems

Active Fire Protection Component	Availability Count (Schools)	Compliance Percentage	Actual Field Condition
Portable Fire Extinguisher	7 out of 32	21.8%	The majority use ABC Powder types with varying capacities (2.5 kg – 9 kg).
Building / Environmental Hydrant Systems	0 out of 32	0%	No hydrant infrastructure, heavily reliant on nearby swamp/river water.
Fire Alarm / Early Detection Systems	1 out of 32	3.1%	Only available at Mawar 7 Elementary School, the majority rely on manual announcements.
Manual Supporting Equipment (buckets/hoses)	32 out of 32	100%	Buckets (averaging 5 – 30 units) and water hoses are available as substitutes for standard protection.

A fire extinguisher is a first-aid tool used to handle small-scale fires before they spread. The availability of fire extinguishers allows trained school personnel to respond quickly, thereby minimizing potential damage and loss of life. According to a review in the Journal of Education and Health

Promotion, children are considered a highly at-risk group during fire incidents. The presence of fire extinguishers is a crucial element in safety efforts to prevent injuries or fatalities caused by fires within school areas [17]. A study published in the International Journal of Occupational Safety and Health revealed that fire education programs accompanied by hands-on fire extinguisher simulation significantly improve students understanding and ability to respond to fire emergencies. This improvement was statistically significant ($p < 0.001$) based on assessment results related to the use of fire extinguishers [18].

In addition to fire extinguishers, hydrants are a vital component of active fire protection systems. The installation of hydrants in school environments, which are considered public areas with high population density, plays an important role in reducing the risk of serious injuries and property loss in the event of a fire [17]. A research study published in PMC on educational institutions (though not limited to elementary schools) highlights the importance of fire evacuation training and drills. Protective equipment such as hydrants also serves as a practical learning tool for students and staff to respond to emergencies quickly and accurately [17].

For the fire early warning system, only one school is equipped with such a system, which is in the form of a fire alarm. The fire alarm is only available at Mawar 7 Public Elementary School. Schools are environments filled with many individuals, especially children who have limited experience and are not yet trained to respond to emergency situations. Therefore, an early warning system is essential to provide sufficient lead time for evacuation before the fire spreads further. According to the Regulation of the Minister of Public Works and Public Housing, the installation of fire protection systems in public facilities, particularly in schools, is crucial given the limited mobility and response capabilities of students in emergency situations [19]. In addition, early detection systems such as fire alarms, smoke detectors, heat sensors, or gas detectors operate continuously for twenty four hours and are capable of recognizing the early signs of a fire, such as the presence of smoke, a sudden rise in temperature, or sparks. This allows preventive measures to be taken promptly before the situation worsens. Early warning systems are a critical component of fire risk management, as they enable action to be taken before the fire spreads [20].

B. Access and Positioning of Fire Fighting Facilities

Beyond on site suppression facilities, the physical accessibility of school environments for external emergency services represents a decisive factor in mitigating structural fire losses and ensuring occupant safety. In accordance with regional safety standards, public infrastructure must provide adequate right of way and dedicated staging space to facilitate rapid tactical deployment by municipal fire brigades. Direct site observations and institutional interviews were carried out to evaluate the clearance widths and structural load bearing capacity of the schools' primary entryways. Regarding the results of fire safety interviews concerning access and the positioning of firefighting units at several public elementary schools in Banjarmasin City:

1. Fire Truck Access and Placement

a) Availability of access roads: overall and almost all listed schools have adequate access roads (+) for fire trucks.
b) Placement location within school area: the majority of schools (+) allow fire trucks to enter the school premises and be parked or positioned in the school yard (e.g., at Sungai Andai 4, Pekauman 1, Basirih 1 with limited space, Kelayan Selatan 3, Kelayan Barat 2 & 3, Kelayan Timur 8, Telaga Biru 1, Mawar 7, Kelayan Dalam 5, Kuin Cerucuk 1, Teluk Dalam 1, Pasar Lama 1, and Pengambangan 5 Elementary Schools).
c) Placement exception: there is an exception for the last school on the list (Pemurus Dalam 6 Elementary School), marked with (-), where the fire truck is reported to only be able to access the front area of the school.

2. Red Button as a Fire Alarm

a) Absence of alarms: almost all listed schools do not have a red button as a fire alarm (-).
b) The only school with an alarm: Only Mawar 7 Elementary School has this alarm facility (+). However, records indicate that the alarm was last activated in 2023, and its current working condition is unknown.

Based on interviews and surveys conducted at thirty-two public elementary schools, it was found that some schools still only allow fire trucks to access as far as the front of the school. This is due to narrow roads and densely populated surroundings. The presence of dedicated access routes for fire trucks ensures that emergency vehicles can reach the site quickly and be positioned close to spray points, risers, or evacuation areas. In fire emergencies, response speed is a critical factor. Access barriers that prevent fire trucks from approaching the fire source can cause critical delays, increasing the risk to student safety and damage to infrastructure. Adequate access allows for the efficient deployment of equipment and water spraying. Various international literatures recommend that access routes for firefighting vehicles are a crucial element in the planning of school fire protection systems. A study titled Fire Prevention and Protection in the School Environment: A Literature Review emphasizes the importance of providing adequate access so that fire trucks can easily reach buildings and carry out firefighting operations effectively [21].

When evaluating these findings from a broader comparative perspective, the low level of preparedness observed in Banjarmasin reflects a pervasive national challenge but present unique local vulnerabilities. For instance, a similar baseline of inadequate fire safety infrastructure was documented by Lestari across five elementary schools in DKI Jakarta demonstrating that even the capital city struggles with institutional prioritization of fire risks [4]. However, the crisis in Banjarmasin is significantly compounded by acute localized infrastructure limitations. Unlike, newer urban development's many elementary schools in Banjarmasin are situated in dense residential areas and structurally feature highly flammable wooden components. This high material vulnerability combined with narrow access roads that limit fire truck maneuverability to the mere front gates that can creates a catastrophic safety gap.

Meanwhile, only one school is equipped with a fire alarm system. Fire alarms serve as a crucial early warning system, allowing students, teachers, and staff to evacuate immediately before the fire spreads widely. Their function becomes especially vital in densely populated school environments with numerous enclosed spaces [17]. Building safety regulations such as NFPA 72 in the United States and BS 5839 in the United Kingdom mandate the installation of fire detection and alarm systems in school environments [22].

3. Evaluation of Life Saving Facilities

Safe egress architecture and robust emergency communication networks constitute the core components of life saving infrastructure required to manage highly anxiety evacuations among vulnerable young occupants. Under critical emergency thresholds, when the available safe egress time is drastically restricted by toxic smoke and rising thermal gradients, schools must rely on rapid communication and unobstructed exit routes to prevent causalities. And engineering and operational review was conducted across the sample size to evaluate the availability of emergency contact procedures, audio warning systems, and building exit dimensions. Table 3 details the specific configurations of these lifesaving facilities, highlighting a widespread absence of direct emergency hotlines and dedicated escape stairwells, living schools to depend almost exclusively on standard daily use corridors and main perimeter gates for emergency exit.

Table 3. Data Results in Terms of Life-Saving Facilities

Rescue Facilities Aspect	Availability / Compliance Status	Geometric & Operational Technical Notes
Agency Emergency Contact Number	Very Limited (Only a few schools)	Some schools have contacts for local Fire Department personnel

Rescue Facilities Aspect	Availability / Compliance Status	Geometric & Operational Technical Notes
Audio Warning System (Loudspeaker)	Available in 32 schools (100%)	Uses the school's daily loudspeakers; placed in corridors or the teacher's room.
Dedicated Emergency Stairs	Not Available (0%)	Multi-story schools use general daily circulation stairs without smoke protection.
Main Exit Gate / Door	Available in 32 schools (100%)	The opening width ranges from 1.5 m to 6 m; some schools have back/side doors.
Exit Signs & Assembly Point (Labels)	-	Only few schools have exit sign and assembly point

For life-saving facilities, evaluation can be conducted by examining aspects such as the emergency communication system, emergency stairs, and school exit routes. The availability of emergency phone numbers in schools is inadequate. Only a few schools provide emergency contact numbers, and these are often limited to private contact with the local Fire Department. According to regulations, emergency phone numbers must be known by school personnel and visibly posted in the teachers' lounge and security post. The availability of emergency contact information is crucial, as having internal emergency phone facilities allows schools to quickly reach the fire department or security authorities during a fire incident. The absence of a direct communication line carries the risk of delayed response and could lead to greater escalation of the situation. Literature reviews emphasize the importance of multi-channel communication systems, including telephones, in managing panic and supporting effective coordination during emergencies [23].

In addition to the limited availability of emergency phone numbers, schools also lack non-electric communication systems. During major fire incidents, power outages frequently occur, affecting cell towers, data transmitters, and wired networks. As a result, mobile phones, internet, and call services become unreliable for emergency coordination. Systems such as two-way radios or intercoms do not rely on public networks or building electricity, and therefore can continue to function during a power outage [24].

Emergency stairwells constitute a critical component of evacuation infrastructure, particularly in fire scenarios where the prompt and safe evacuation of students is required. Research indicates that stairways serve as the sole reliable means of egress during such emergencies, as the use of elevators is strictly prohibited in the event of fire or seismic activity [25]. Evacuation simulations conducted in elementary schools indicate that the required safe egress time (RSET) is approximately 386 seconds, whereas the available safe egress time (ASET) is limited to only 180 seconds before hazardous conditions such as dense smoke and high temperatures set in [26]

In emergency situations, high levels of anxiety can cause people to move in a disorganized manner. A designated assembly point that is regularly practiced through drills can help establish order, reduce panic, and facilitate a calmer and more organized roll-call process. The presence of an assembly point helps minimize confusion and enables school personnel to quickly identify anyone who is unaccounted for after an evacuation. Additionally, the assembly point helps prevent further casualties, as it must be located in an open area, away from fire, smoke, heat, and the potential collapse of buildings due to the fire [27].

This severe of localized infrastructure and safety management stands in direct violation of international school fire safety standards, such as The National Fire Protection Association (NFPA) 72 guidelines in the United States and BS 5839 in the United Kingdom which strictly mandate comprehensive early detection and continuous automated alarm networks in high occupancy educational facilities. By failing to establish active fire protection systems or formal emergency respond organizations, these school drastically compress the Available safe Egress Time (ASET) to a window far below the international standard required for safe evacuation. This compounding administrative

deficit leaves an exceptionally vulnerable, panic prone demographic of young children exposed to highly elevated risk of preventable casualties.

4. Building Fire Safety Management Implementation

While physical infrastructure forms the passive defense against fire hazards, institutional resilience is ultimately governed by active administrative frameworks and human preparedness through Building Fire Safety Management. Effective risk management demands the establishment of dedicated emergency response organizations and routine behavioral training for school personal. Qualitative interviews were conducted with institutional leaders to gauge the formalization of safety committees and the frequency of disaster simulation drills. The administrative findings compiled in Table 4 demonstrate a near total absence of formal fire safety management structures across the surveyed institutions, with only exceptional cases reporting isolated, non-routine awareness sessions organized by external disaster mitigation agencies.

Table 4. Data Results Based on Building Fire Safety Management

Fire Safety Management Aspects	Availability / Implementation Status Across Schools	Information
Emergency Response Organization		
Organizational Structure for Building Fire Safety Management	Not Available (0%)	None of the registered schools have a dedicated organizational structure for fire safety management.
The availability of personnel for responding to fire emergencies	0.03%	Only 1 school have the coordinator
Fire Safety Training		
Fire prevention education and training for teachers and school personnel	0%	The school has never organized or facilitated fire prevention education or training programs for teachers and staff.
Teachers and school personnel who took part in the training	0%	Not a single teacher or school staff member is recorded as having undergone fire safety training.
Fire awareness and training conducted at the school	-	a) The event was held in 2021 and was attended by teachers in Kuin Cerucuk Elementary School b) The training was held at the school by Baznas and was attended by teachers (Teluk Dalam Elementary School) c) There was a fire safety training in 2015 organized by Indonesian National Board for Disaster Management (BNPB). It was only a general (Pemurus Dalam Elementary School)

Fire Safety Management Aspects	Availability / Implementation Status Across Schools	Information
		d) In 2024, a fire safety training was held at the school and was attended by teachers (Sungai Miai 7 Elementary School) e) General material dissemination from the Fire Department (Antasan Besar Elementary School) f) In 2024, a fire safety training was held at the school and was attended by teachers (Karang Mekar Elementary School)

The organizational structure for emergency situations establishes clear roles and responsibilities, such as evacuation, communication, and logistics teams. This creates a structured chain of command (unity of command), thereby minimizing confusion during emergencies. This approach aligns with the principles of the Incident Command System, which has proven effective in disaster response. Findings from the qualitative study also indicate that coordination, both internal and external to the institution, as well as proper delegation of responsibilities, are crucial for enabling schools to respond more effectively to disasters [28]. Through the implementation of a well-planned emergency organizational structure, schools can regularly conduct evacuation drills, provide education to teachers and students, and prepare fire response equipment such as extinguishers, alarms, and evacuation routes. These measures contribute to reducing the risk of injury and enhancing students' preparedness in the event of a fire [17], [28]. Furthermore, such as fire preparedness programs implemented in school settings have been proven to enhance students' understanding and ability to respond to fire emergencies as demonstrate by studies showing significant improvements in knowledge about types of fires, the use of fire extinguishers, and evacuation skills through interactive educational approaches like simulations and hands on drills. Moreover, a meta-review revealed that interactive educational approaches such as simulations and hands-on drills are more effective than passive methods like video presentations [18],[29].

The organizational structure reflects an emergency management system that includes the establishment of a safety committee, the development of an emergency response plan, the provision of evacuation maps, and coordination with external parties such as fire departments, healthcare services, and parents. These elements play a crucial role in maintaining the continuity of school operations after an incident, as part of a broader strategy to build disaster-resilient schools [30-33].

The stark contrast between the stringent mandates of Banjarmasin City Regional Regulation Number 13 of 2008 and the dismal reality on the ground where building safety management is completely nonexistent points toward deep rooted structural and administrative shortcomings rather than mere institutional negligence. This systemic noncompliance is primary driven by severe budget. In Indonesia, public elementary schools operate under highly constrained budgets, where available funding through programs like the School Operate Assistance (BOS) is heavily prioritized for core academic needs and basic infrastructure repairs. Consequently, allocating funds for dedicated fire safety equipment, such as standard fire extinguishers, hydrants, and centralized alarm systems is frequently sidelined.

IV. CONCLUSION

According to the overall findings of the study, fire safety in elementary schools remains suboptimal. Based on the evaluation of active fire protection systems, only 7 schools (22%) were equipped with light fire extinguishers (APAR), and none of them had fire hydrants. Regarding passive protection systems, 30 schools (94%) had adequate fire truck access, but only one school was equipped with an alarm system. For life-saving facilities, 21 schools (66%) possessed evacuation routes, but none had emergency exit signs, assembly point labels, or emergency lights. Furthermore, from the perspective of Building Fire Safety Management (MKKG), all 32 schools scored 0%, as none had a structural fire organization or a written emergency response plan.

Beyond summarizing the current state of infrastructure, this study offers critical scientific implications for disaster management theory, particularly in conceptualizing school resilience within urban environments characterized by high material vulnerability and socioeconomic constraints. It extends the traditional safety framework by demonstrating that in developing regions, disaster preparedness is not merely a technical configuration of hardware but an institutional challenge rooted in governance and resource prioritization. Practically, these findings serve as a policy roadmap for local education authorities and school administrations to transition from a reactive approach to a proactive safety culture. Immediate interventions must include the strategic restructuring of school operational funds (BOS) to institutionalize basic life-saving facilities, alongside the mandatory formation of school-based emergency organizations in collaboration with local fire departments.

To build upon the baseline assessment established in this research, future studies should advance toward empirical and spatial modeling. First, running computer-based evacuation simulations (such as Pathfinder) is highly recommended to precisely predict student movement patterns and optimize Required Safe Egress Time (RSET) in wooden school structures. Second, future research should implement GIS-based fire risk mapping across Banjarmasin City to identify spatial vulnerability clusters, enabling authorities to allocate firefighting resources more efficiently. Finally, conducting a cost benefit analysis of various fire safety interventions would provide actionable financial strategies for low-budget public schools, ensuring that limited resources are invested in high-impact protective infrastructure.

V. ACKNOWLEDGMENT

The author would like to express sincere gratitude to the Ministry of Higher Education, Science, and Technology for funding this research under the 2025 fiscal year. Appreciation is also extended to LLDIKTI XI for its support, the Banjarmasin City Education Office for granting permission, the Fire Department as a source of information, and the elementary schools in Banjarmasin (including principals, vice principals, and designated school representatives) that served as research samples.

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