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ASSESSMENT ON FIRE RISK MANAGEMENT IN YANGON

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ASSESSMENT ON FIRE RISK MANAGEMENT IN YANGON

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ABSTRACT

This study explores assessment on fire risk management in Yangon. It aims to examine the fire cases and fire risk management system in Yangon and to evaluate the perception of Fire Services Department's (MFSD) staffs on fire risk management in Yangon. A descriptive quantitative method was used, collecting survey data from 171 respondents, including MFSD's staffs, Auxiliary Fire Brigade and trained volunteers. The study examined six key factors: fire prevention, preparedness, response, capacity building effort, equipment systems, and fire risk management. Secondary data were sourced institutional reports published by the MFSD, Department of Social Welfare, and Yangon City Development Committee (YCDC), as well as from the relevant academic literature and official policy documents. Descriptive and inferential statistical analyses were conducted using SPSS. The findings show that Yangon's fire risk management has made good progress, especially in fire prevention, public awareness, and community involvement. Trainings and the availability of fire safety tools have contributed an important role in improving overall safety and preparedness in Yangon. Suggestion include emergency plans should be simplified and practiced more often. Strengthening resource availability, communication systems, and equipment maintenance will make emergency response efforts even more effective.

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LIST OF ABBREVIATIONS

| | |
|-------|---|
| ANOVA | Analysis of Variance |
| KMSS | Karuna Mission Social Solidarity |
| NGO | Non-Governmental Organizations |
| SPSS | Statistical Package for the Social Science |
| UNDRR | United Nations Office for Disaster Risk Reduction |
| JICA | Japan International Cooperation Association |
| MFSD | Myanmar Fire Service Department |
| MRCS | Myanmar Red Cross Society |
| YCDC | Yangon City Development council |
| FSM | Fire Safety Management |
| FAO | Food and Agriculture Organization |
| NFPA | National Fire Protection Association |

CHAPTER (I)

INTRODUCTION

1.1 Rationale of the Study

Fire risk management is a comprehensive, multidisciplinary strategy aimed at systematically identifying, assessing, and mitigating fire hazards to prevent outbreaks and minimize their devastating impacts on human life, property, infrastructure, and the environment (Chen et al., 2011). This approach integrates a wide array of measures, including proactive prevention, preparedness planning, rapid emergency response, and effective post-incident recovery, all designed to reduce the likelihood and severity of fire-related disasters.

Fire hazards remain a critical global challenge, threatening human lives, infrastructure, and ecosystems as urbanization, climate change, and industrial activities intensify the frequency and severity of fire incidents (Fiorentini & Dattilo, 2023). Effective fire risk management requires coordinated efforts in prevention, mitigation, response, and recovery, supported by skilled personnel, robust regulatory frameworks, and advanced technological infrastructure (Della-Giustina, 2014). Developed nations, such as the United States and Japan, have implemented comprehensive fire safety systems, including automated fire suppression, real-time monitoring, and strict building codes, which significantly reduce fire-related losses.

As global trends such as rapid urbanization, industrial expansion, and climate change continue to escalate, the frequency and intensity of fire incidents have surged, making fire risk management a critical component of disaster risk reduction frameworks worldwide (Fiorentini & Dattilo, 2023). The United Nations Office for Disaster Risk Reduction (UNDRR) emphasizes that robust fire risk management not only safeguards human lives and assets but also strengthens community resilience, supports sustainable development, and mitigates the socio-economic and environmental consequences of fires (UNDRR, 2022). By fostering collaboration among governments, private sectors, civil society organizations, and local communities, fire risk management ensures a holistic approach to safety, addressing both immediate threats and long-term vulnerabilities. This is particularly relevant in the context of

global urbanization, where densely populated cities and industrial hubs face heightened risks due to complex infrastructure, flammable materials, and environmental factors.

In regions like Southeast Asia, where rapid urbanization and climate change increase fire risks, the adoption of integrated fire safety systems is critical. These systems must include early detection mechanisms, public education campaigns, resilient infrastructure, and coordinated emergency response protocols to address the unique challenges of each region. By drawing on global best practices and tailoring them to local contexts, fire risk management can significantly reduce the frequency and impact of fire disasters, fostering safer and more resilient communities worldwide. Community-based fire safety programs in Southeast Asia have proven effective in resource-constrained settings, offering cost-effective solutions to enhance preparedness.

In Myanmar, a developing nation grappling with rapid urbanization and socio-economic challenges, fire risks are a significant concern due to factors such as poorly regulated urban development, limited public awareness, and inadequate infrastructure. As developing countries, like Myanmar face systemic barriers, such as limited funding, inadequate equipment, and poor inter-agency coordination, which exacerbate their vulnerability to fire disasters (Y. Wang et al., 2024).

In Myanmar, recurring fire incidents, particularly in urban and industrial areas, underscore the urgent need for improved fire risk management. The Myanmar Fire Services Department (MFSD) is tasked with implementing preventive and responsive measures, yet it faces challenges such as limited equipment, insufficient training, and constrained budgets (MFSD, 2024). Programs like Light Search and Rescue (LSAR) training have been introduced to enhance the skills of firefighters and volunteers, but their implementation remains inconsistent across regions. The lack of standardized policies and coordination among agencies further complicates efforts to reduce fire risks effectively.

For instance, rural fire stations often lack basic equipment, while urban stations struggle with access to fire-prone areas due to congested roads. This study seeks to evaluate Myanmar's fire risk management system, identifying key gaps in infrastructure, training, and policy enforcement, and proposing actionable solutions to strengthen institutional capacity and community preparedness. By addressing these issues, the research aims to contribute to national efforts to mitigate fire-related disasters, protect vulnerable populations, and build a more resilient fire safety framework that aligns with Myanmar's development goals.

As Myanmar's commercial capital and largest urban center, Yangon faces heightened fire risks due to its dense population, aging infrastructure, and congested traffic networks.

Despite the presence of trained firefighters and community volunteers, response efficiency is hampered by logistical challenges and inconsistent enforcement of safety regulations. For example, many buildings in Yangon lack fire exits or sprinklers, increasing the risk of fatalities during fire incidents.

Fire risk management in Yangon is especially important because the city faces significant fire hazards caused by its high population density, aging infrastructure, and heavy traffic congestion. These factors increase the likelihood and severity of fire incidents, putting lives, property, and critical infrastructure at risk. Although Yangon has trained firefighters and community volunteers working to prevent and respond to fires, challenges such as limited firefighting equipment, insufficient training, and inconsistent enforcement of fire safety regulations continue to weaken overall effectiveness. Many buildings lack basic fire safety features like fire exits and sprinklers, which further heighten risks during emergencies (Wang et al., 2024; UNDRR, 2022). Studying fire risk management in Yangon helps identify gaps and improve strategies to protect lives, property, support community safety as well as to contribute practical solutions that strengthen fire prevention, preparedness, and response in Yangon's unique urban environment. This study focuses to examine the fire cases and fire risk management system in Yangon and to evaluate the perception of Fire Service Department's staff on fire risk management in Yangon.

1.2 Objective of the Study

The objectives of the study are

- (1) To examine the fire cases and fire risk management system in Yangon
- (2) To evaluate the perception of Fire Services Department's (MFSD) staffs on fire risk management in Yangon.

1.3 Method of Study

This study adopts a descriptive quantitative research methodology to analyze Yangon's fire risk management system. Primary data collected through structured questionnaires administered to 171 respondents, including personnel from the Myanmar Fire Services Department (MFSD), Auxiliary Fire Brigade and trained volunteers in Yangon.

To support and contextualize the survey findings, secondary data collected from institutional reports published by the MFSD, Department of Social Welfare, and Yangon City Development Committee (YCDC), as well as from the relevant academic literature and official

policy documents. Although the study focuses solely on quantitative data, the integration of secondary sources strengthens the interpretation of results and ensures a broader understanding of systemic trends and challenges in fire risk management.

1.4 Scope and Limitations of the Study

The scope of this research is focused to examine the fire cases and fire risk management system in Yangon and to evaluate the perception of Fire Services Department's (MFSD) staffs on fire risk management in Yangon in selected fire-prone districts. A total of 171 respondents, including Myanmar Fire Service Department staff, Auxiliary Fire Brigade and trained volunteers operating in urban fire-affected zones. Additionally, access to certain high-risk areas and sensitive data may be limited, potentially affecting the depth of some findings. The data collection was carried out from March 2025 to May 2025.

1.5 Organization of the Study

This study is organized into five chapters. Chapter (I) provides an introduction, including the rationale, objectives, method, scope and limitations, and organization of the study. Chapter (II) presents literature reviews Chapter (III) fire risk management system in Yangon, Chapter (IV) examines survey analysis, and Chapter (V) is the conclusion.

CHAPTER (II)

LITERATURE REVIEW

2.1 Concept of Fire Risk Management

Fire risk management is a multidisciplinary field that seeks to minimize the occurrence and impact of fire-related disasters through a systematic process of identifying, assessing, and mitigating fire hazards (Della-Giustina, 2014). Rooted in risk management theory and disaster resilience frameworks, this concept emphasizes proactive planning to reduce vulnerabilities and enhance preparedness, response, and recovery capabilities. At its core, fire risk management integrates scientific, technical, and social approaches to address the complex interplay of factors contributing to fire incidents, such as human behavior, environmental conditions, and infrastructural deficiencies.

Globally, fire risk management is embedded in urban planning, occupational health and safety, and environmental protection strategies, reflecting its critical role in safeguarding lives, property, and ecosystems (Fiorentini & Dattilo, 2023). In developed nations like Japan, Singapore, and the United States, fire risk management is characterized by advanced technologies, including satellite-based fire detection, real-time monitoring systems, and automated fire suppression mechanisms (Ramachandran, 1999). For instance, Tokyo's fire department employs drone surveillance and AI-driven predictive models to identify high-risk areas, enabling rapid response and resource allocation during emergencies. These systems are supported by stringent building codes, regular inspections, and public education campaigns, which collectively reduce fire incidence and severity.

Effectiveness of fire risk management relies not only on technology and infrastructure but also on institutional coordination and behavioral compliance (Yung, 2009). Fire safety is increasingly understood as a shared responsibility between governments, industries, and the public. In cities with rapid urbanization, the integration of risk assessments into building design and land-use planning has proven to be a proactive step toward minimizing fire exposure (He, Xie, & Huang, 2021). This includes the application of Geographic Information Systems (GIS) to map fire-prone zones, optimize the location of fire stations, and improve emergency evacuation routes. Moreover, successful fire risk reduction frameworks prioritize public

education and awareness-building strategies that promote safe behavior in households, workplaces, and public facilities (Guldenmund, 2010). Studies have shown that communities with higher levels of fire safety knowledge and preparedness respond more effectively during emergencies, resulting in lower casualties and economic losses (Boeteng & Adjei, 2022). Effective fire safety management and maintenance are critical for establishing a robust fire safety framework within buildings, integrating proactive planning, regular inspections, staff training, incentive mechanisms, and advanced fire detection systems. The PLAN-DO-CHECK-ACT cycle, advocated by the Muckett and Furness (2007), emphasizes continuous improvement and accountability, ensuring that fire safety measures are consistently updated and enforced (Manglik, 2024). Competent staff and facility managers, trained through regular drills and simulations, are essential for effective decision-making during emergencies (Thomson, 2001).

Institutional frameworks also play a pivotal role in standardizing fire codes, conducting audits, and enforcing regulations, particularly in commercial and high-occupancy structures. Governments that establish clear accountability lines and invest in training fire service personnel are better equipped to sustain long-term fire resilience (Chow, 2004). In recent years, international collaboration through knowledge-sharing platforms and technical assistance programs has helped bridge capacity gaps in low-resource regions. Research by Malhotra and Sharma (2018) suggests that embedding fire risk management into national disaster risk reduction (DRR) policies creates synergies that improve coordination across sectors. Overall, the evolving concept of fire risk management reflects a dynamic blend of science, governance, and community empowerment one that adapts to the diverse threats posed by urbanization, climate change, and socio-economic inequality.

The integration of fire safety into urban development plans, coupled with public-private partnerships, can enhance the effectiveness of fire management systems. For example, collaborations with international organizations like the Japan International Cooperation Agency (JICA) have supported the development of fire safety infrastructure in Myanmar, demonstrating the potential for global partnerships to bridge capacity gaps (Wang et al., 2025). By combining scientific advancements, community engagement, and policy reforms, fire risk management can create resilient urban systems capable of mitigating the growing threat of fire disasters in developing nations.

2.2 Factors Assessing Effectiveness of Fire Risk Management

Fire risk management is a vital component of disaster risk reduction, aimed at minimizing the occurrence, impact, and consequences of fire incidents on people, property, and the environment. The literature highlights several critical factors that collectively contribute to an effective fire risk management system. These include fire prevention, preparedness, emergency response, capacity building, equipment systems, and overarching fire risk management frameworks. Understanding these elements and their interconnections allows policymakers and practitioners to design comprehensive strategies to reduce fire hazards and improve community resilience. For example, in commercial buildings, well-trained staff can reduce evacuation times by guiding occupants to safety. Incentive systems that reward compliance with safety standards can foster a culture of vigilance, while smart sensors and automated alert systems enhance real-time response capabilities (Nazar & E, 2019). Global examples, such as the United Kingdom's fire safety management protocols, which require annual inspections and staff certification, offer valuable lessons.

2.2.1 Fire Prevention

Fire prevention involves proactive measures designed to eliminate or reduce the possibility of fire outbreaks. This includes enforcement of building codes, public education on fire hazards, control of flammable materials, and routine inspections. According to Karter (2018), effective fire prevention is the foundation of fire safety, reducing both the frequency and severity of fires before they start. Public awareness campaigns and community involvement are essential to ensure compliance and encourage safe behaviors (Smith & Petrescu, 2020). Preventive efforts significantly lower the risk of fire-related damage and fatalities, as demonstrated in urban centers where strict fire prevention policies are implemented (Jones et al., 2019).

Many countries have developed strong fire prevention systems that help reduce fire risks and protect people and property. In the United States, for example, the National Fire Protection Association (NFPA) provides fire codes and safety standards that are used across the country. Local governments follow these rules to make sure buildings are safe, and fire departments often visit homes and schools to teach fire safety. According to Karter (2018), regular inspections and public education help prevent fires before they start. In Japan, fire prevention is closely linked with community involvement. Fire drills are common, and people receive training on how to react during a fire. Buildings are designed with fire-resistant materials, and fire exits are clearly marked and checked regularly. The Japanese government

also uses early warning systems and technology to monitor fire risks (Yamamoto & Suzuki, 2017).

In Singapore, strict building codes and fire safety rules are enforced by the Singapore Civil Defence Force (SCDF). Developers must include fire alarms, sprinklers, and emergency exits in all buildings. The SCDF also runs fire safety campaigns and school programs to teach students about fire risks. A study by Tan and Goh (2019) found that these efforts have helped Singapore reduce fire cases in high-rise buildings. In Sweden, fire prevention is part of everyday life. Families are given fire safety checklists, and people are encouraged to install smoke alarms and fire blankets in their homes. Firefighters visit homes to do safety checks and explain how to prevent common fire causes like electrical faults or unattended cooking (Andersson & Hallberg, 2020). Fire prevention works best when rules are clear, people are well-informed, and governments take active steps to check and support safety. Countries that combine laws, education, and community action are more successful in reducing fire risks.

2.2.2 Preparedness

Preparedness refers to the planning, training, and exercises conducted to ensure individuals and organizations are ready to respond effectively when a fire occurs. FEMA (2021) emphasizes that preparedness involves developing emergency plans, conducting regular fire drills, and educating the public on evacuation procedures. Preparedness measures increase response speed and reduce panic during incidents. Studies by Lee and Chan (2017) show that communities with well-established preparedness programs experience lower casualty rates and faster recovery. Technology also plays a role in preparedness, with early warning systems and fire alarms enhancing situational awareness (Deng et al., 2019).

However, preparedness remains underfunded and inconsistently implemented. Many urban slums and informal settlements lack regular fire drills or inspections due to resource constraints, leaving residents vulnerable (Fiorentini & Dattilo, 2023). Budget limitations restrict the stockpiling of essential equipment, such as fire extinguishers, first aid kits, and communication devices, while non-functional fire hydrants in some areas hinder response efforts. Coordination between national disaster authorities, municipal fire services, and health services is limited, leading to gaps in medical support during emergencies (Bruegman, 2021).

2.2.3 Emergency Response

Internationally, emergency fire response has evolved through the adoption of advanced coordination systems, investment in real-time technologies, and integrated service models.

Countries like Japan, the United States, and the United Kingdom have developed robust frameworks to ensure rapid deployment and efficient on-scene management. In Japan, the Fire and Disaster Management Agency (FDMA) operates a national emergency communication network that connects local fire departments, emergency medical services (EMS), and disaster response units. This system ensures that information is relayed instantly and decisions can be made within seconds, improving the speed and effectiveness of response (FDMA, 2022).

In the United States, the Incident Command System (ICS), part of the National Incident Management System (NIMS), provides a standardized hierarchy for managing emergencies. ICS assigns roles clearly such as incident commander, safety officer, and logistics coordinator to avoid confusion during large-scale fire incidents. This system was notably effective during California's wildfires, where multiple agencies worked under one command structure to coordinate evacuation, suppression, and recovery efforts (FEMA, 2020). Similarly, in the United Kingdom, the National Coordination Centre (NCC) helps manage fire and rescue service resources by analyzing nationwide needs and reallocating assets as needed during major incidents (Home Office, 2021).

Advanced technologies also support emergency response. For instance, Singapore's Civil Defence Force (SCDF) uses an integrated Fire Command and Control System (FCCS) that combines CCTV surveillance, GPS tracking of fire trucks, and building fire alarm linkages to provide firefighters with situational awareness before they even arrive on site (Tan et al., 2019). This enhances both the speed and precision of firefighting actions. In addition, European nations like Germany and the Netherlands regularly conduct joint emergency drills between fire services, police, and hospitals to test and refine inter-agency coordination under simulated conditions (Van der Vegt & Essens, 2005).

Moreover, capacity building through international partnerships and training exchanges has strengthened emergency preparedness in many developing nations. Programs led by the Japan International Cooperation Agency (JICA) and the United Nations Office for Disaster Risk Reduction (UNDRR) support fire service training, equipment provision, and policy development in Southeast Asia and Africa, building stronger response capacities at the local level (UNDRR, 2023).

Overall, global best practices in emergency response highlight the value of structured coordination, clear communication, use of technology, and regular joint exercises. These strategies have proven essential in reducing response time, saving lives, and minimizing property damage during fire emergencies.

2.2.4 Capacity Building Efforts

Capacity building refers to the development of skills, knowledge, and institutional capabilities needed to support fire risk management. Training programs for firefighters and community volunteers are vital components, as highlighted by the International Fire Chiefs Association (IFCA, 2022). Capacity building also involves strengthening organizational frameworks, leadership, and resource management. Research by Patel and Kumar (2019) indicates that continuous training and education improve operational readiness and foster community participation in fire safety initiatives. Furthermore, partnerships between government agencies, NGOs, and private sectors enhance resource sharing and knowledge exchange (Baker & White, 2020). Despite these efforts, several capacity gaps persist. Training programs are not standardized nationwide, leading to variations in quality and content depending on location and facilitator expertise. Budget constraints limit the frequency and scale of training, particularly in low-income neighborhoods, where access to resources is minimal (Lord, 2023). Many volunteers lack personal protective equipment (PPE), such as fire-resistant suits and breathing apparatus, increasing their vulnerability during operations.

Capacity building is a critical process for enhancing the skills, knowledge, and resources of individuals, organizations, and communities to manage fire risks effectively and sustainably. Australia's standardized firefighter training programs, which combine technical skills with leadership development. International partnerships with organizations like the Asian Disaster Preparedness Center can provide technical support and funding for capacity-building initiatives.

2.2.5 Fire Safety Equipment System

The availability, accessibility, and functionality of fire safety equipment, such as portable extinguishers, hydrants, sprinklers, and emergency lighting, are pivotal in determining fire safety outcomes. These tools enable immediate response, prevent escalation, and facilitate safe evacuation during fire incidents (Manglik, 2024). Regular maintenance and functionality testing are critical, as malfunctioning systems due to inadequate inspections contribute to high fatality rates, as seen in student housing fires globally (Lord, 2023). Compliance with international standards, such as the International Building Code (2018), mandates the installation of fire hydrants, smoke detectors, and illuminated exits, supported by regular audits. Innovations like IoT-enabled monitoring and automated extinguishing systems can enhance detection accuracy and reduce human error (Vaughn & Ai, 2025).

The availability and maintenance of firefighting equipment significantly affect the effectiveness of fire risk management. Essential tools include fire engines, hoses, personal

protective equipment, and fire detection systems. According to Zhang et al. (2021), modern equipment such as automated sprinkler systems and drones for aerial firefighting enhance fire suppression capabilities. However, the functionality of these systems depends on regular maintenance and adequate funding (Harrison & Davies, 2017). The integration of technology with equipment systems also supports real-time monitoring and rapid response (Garcia et al., 2019).

2.2.6 Fire Risk Management

Fire risk management frameworks provide the overarching structure to coordinate prevention, preparedness, response, and recovery activities. These frameworks encompass policies, regulations, risk assessments, and inter-agency collaboration mechanisms. The United Nations Office for Disaster Risk Reduction (UNDRR, 2022) stresses that comprehensive risk management frameworks are essential for aligning resources and actions across different levels of government and sectors. Effective frameworks also incorporate community-based approaches to ensure local needs and vulnerabilities are addressed (Nguyen et al., 2020). The adaptability of these frameworks to emerging risks, such as climate change and urbanization, is increasingly important for sustained fire safety (Santos & Ribeiro, 2021). The physical characteristics of buildings, including the number and width of emergency exits, stairway design, travel distance to exits, and the use of fire-resistant materials, are foundational to fire safety planning. Buildings with long egress distances or narrow staircases pose significant risks, particularly to vulnerable populations (Chen et al., 2011). Retrofitting older structures with fire-rated doors, flame-retardant insulation, and steel-framed staircases can enhance safety, especially in historic buildings (Council, 2021).

Effective fire safety management performance reflects the successful integration of management, equipment, and building characteristics to achieve reduced fire incidents, improved preparedness, minimal response times, and lower casualty rates (Manglik, 2024). Key performance indicators include fire drill participation, response efficiency, audit compliance, and occupant feedback on perceived safety (Muckett & Furness, 2007). Balancing preventive measures, such as hazard identification, with reactive strategies, like fire suppression, is critical for optimal outcomes. Global models, like Canada's fire safety performance metrics, which track response times and drill participation, offer insights for Yangon. By synchronizing management, equipment, and building design through regular audits, community engagement, and infrastructure upgrades, Yangon can create a resilient fire safety framework that minimizes risks and ensures safer outcomes for all stakeholders.

2.3 Policy Frameworks for Fire Risk Management

Fire risk management policies play a crucial role in reducing the risk and impact of fire incidents around the world. These frameworks are usually shaped by national laws, building codes, environmental regulations, and international safety standards. Effective fire risk policies guide governments and organizations on how to prevent, prepare for, respond to, and recover from fire emergencies. In many countries, these policies are continuously updated based on lessons learned from past disasters and new technologies, aiming to protect lives, property, and the environment. This section explores how different countries implement such policies and what lessons can be drawn from them.

In the United Kingdom, the Regulatory Reform (Fire Safety) Order 2005 mandates that building owners and employers are legally responsible for assessing fire risks and implementing safety measures. It promotes a risk-based approach where regular inspections, clear evacuation plans, and staff training are prioritized (UK Government, 2005). Japan integrates fire risk management into urban planning through the Fire Service Act, which emphasizes community-based disaster reduction and high-tech solutions like real-time fire alarms and earthquake-resistant buildings. Japan also promotes volunteer fire corps, strengthening local capacity (Yamori, 2012). In the United States, the National Fire Protection Association (NFPA) develops widely used codes such as NFPA 1 Fire Code and NFPA 101 Life Safety Code, which are adopted by state and local governments. These codes include detailed guidance on fire prevention, emergency exits, and fire protection systems (NFPA, 2020). Singapore enforces strict policies through the Fire Code managed by the Singapore Civil Defence Force (SCDF). All new buildings must comply with fire safety designs, and regular audits are conducted. The country also focuses on public education and drills, helping to build a fire-aware society (SCDF, 2023).

Globally, frameworks such as the Sendai Framework for Disaster Risk Reduction (2015–2030), adopted by the United Nations, encourage countries to integrate fire risk into national disaster risk strategies and ensure that fire-related data is used to guide policies and investments (UNDRR, 2015). Strong fire risk management policies are essential for creating safer communities. Countries like Japan, the UK, the US, and Singapore provide practical examples of how legal frameworks, public awareness, and technical standards come together to reduce fire hazards. International agreements like the Sendai Framework support a global push for better risk-informed policies. These examples show that effective fire management depends not only on rules but also on active enforcement, technology use, and public cooperation.

2.4 Global Use of Technology in Fire Risk Management

The use of technology has greatly improved fire risk management across the world. Advanced tools help detect fires early, send alerts quickly, and support efficient firefighting responses. Many countries now rely on smart systems, data analysis, and automation to reduce fire hazards and save lives. One key technology is early warning systems. For example, in Australia, authorities use satellite imaging and heat-sensing tools to monitor wildfires in remote areas. The Sentinel Hotspots System, operated by Geoscience Australia, provides near real-time fire location updates, helping emergency services respond faster (Geoscience Australia, 2022). Another innovation is smart fire alarms and sensors. In Singapore, new buildings must install interconnected alarm systems that send automatic alerts to the fire department. These systems can detect smoke, heat, and gas leaks, which helps prevent fires before they spread (Singapore Civil Defence Force, 2023).

Drones are also increasingly used for fire surveillance and damage assessment. In the United States, the Los Angeles Fire Department (LAFD) uses drones to map fire-affected zones and guide firefighters during operations, especially in large wildfires or in places where access is difficult (LAFD, 2020). Artificial Intelligence (AI) and data analytics are being adopted to predict fire risks. For instance, Japan's fire departments use AI-based models to identify high-risk areas in urban zones based on past incident data, weather, and building density (Yamori, 2019). This allows fire services to pre-position resources and reduce response times.

Internet of Things (IoT) technology is also used to link fire equipment, alarms, and building systems. In South Korea, smart buildings connect fire suppression systems to central control rooms. When a fire is detected, sprinklers, alarms, and emergency lights are automatically activated while alerts are sent to emergency teams (Kim & Park, 2021).

2.4.1 Integration of Technology in Fire Risk Management in Southeast Asia

In Southeast Asia, countries are applying practical technologies to manage fire risks more effectively. Though not always high-tech, these approaches are affordable, community-friendly, and useful in both urban and rural settings. The integration of these tools reflects a growing understanding that even basic technologies can make a big difference in saving lives and reducing fire damage.

(a) Fire Alert and Communication Systems

Many Southeast Asian countries now use basic mobile phone technology to spread early warnings during fire emergencies. In the Philippines, local governments have implemented

SMS-based warning systems that send alerts directly to residents when a fire breaks out. These messages provide real-time updates about fire location, evacuation instructions, and emergency contact numbers. In Indonesia, the “PetaBencana” (Disaster Map) platform lets citizens report fire incidents via messaging apps like Telegram and WhatsApp, which are then displayed on a public map to inform nearby communities and authorities. These systems are cost-effective and work well in areas with high mobile usage but limited internet access (Lagmay et al., 2015).

(b) GIS and Fire Mapping

Southeast Asian countries with large forested areas, such as Indonesia, Thailand, and Malaysia, face seasonal wildfire threats. To monitor these, governments and NGOs use Geographic Information Systems (GIS) and satellite imagery to identify fire-prone zones. Indonesia’s Peatland Restoration Agency uses satellite-based maps to track hot spots, helping fire services to focus their patrols. The World Resources Institute (WRI) supports this effort through real-time fire alert platforms, which also warn plantation companies about fire risks on their land (WRI Indonesia, 2018). These tools help allocate resources efficiently before a disaster occurs.

(c) Firefighting Equipment Tracking and Station Readiness

In Vietnam and Cambodia, urban fire stations have begun adopting simple digital tracking systems to monitor their equipment. These include spreadsheet-based or mobile inventory tools to check whether fire engines, water tanks, hoses, and protective gear are in working condition. This helps prevent delays during emergencies caused by missing or damaged equipment. Some cities in Malaysia are also testing QR-code-based equipment checks, which allow quick scanning and reporting of problems. This system supports faster maintenance and better accountability among staff (Tran & Nguyen, 2020).

(d) Community-Based Radio and Warning Systems

For remote areas where mobile signals are weak, community radio systems remain a reliable way to communicate during fire events. In northern Thailand, villages vulnerable to dry-season wildfires rely on two-way radio networks set up between forest patrol teams and community leaders. The Food and Agriculture Organization (FAO) has supported these systems, which connect early fire detectors with fire volunteers and local authorities. When a fire is spotted, messages are passed along quickly, allowing for faster action and better coordination in hard-to-reach areas (FAO, 2016).

(e) Awareness Tools and Mobile Education Campaigns

Raising awareness about fire prevention is a key part of fire risk management. In countries like Malaysia and Indonesia, mobile apps and public campaigns are used to teach people about fire safety. The “Safe Steps” campaign, supported by the Prudence Foundation and IFRC, shares short, simple fire prevention videos through social media and mobile platforms (IFRC, 2019). These videos use easy-to-understand language and local examples to show how to avoid fire risks at home or in markets. Schools and community centers also use printed materials and mobile slideshows to support these lessons, especially in areas with limited internet. Southeast Asia demonstrates that fire risk management does not always require expensive or highly advanced technology. Instead, the region is using smart, locally adapted solutions to meet the needs of different communities. By combining mobile alerts, satellite fire mapping, equipment tracking, radio communication, and mobile education, these countries are making real progress in protecting lives and reducing fire hazards.

These technological innovations are essential parts of modern fire risk management because they help reduce the time between fire detection and emergency response. Early warnings save lives and property, while data-driven planning helps fire departments allocate resources more effectively. Smart systems also allow automatic coordination between alarms, suppression equipment, and emergency services, reducing human error and increasing safety. Moreover, these technologies show that effective fire risk management is not only about having advanced tools but also about regular system maintenance, staff training, and public cooperation. Together, these components create a more resilient system capable of preventing, controlling, and recovering from fire disasters.

2.5 Review on Previous Studies

Previous research provides critical frameworks and global best practices for assessing fire safety management. These studies offer validated methodologies for evaluating system effectiveness and user perceptions, guiding this study’s survey design and analysis. They also highlight integrated strategies for planning and training, informing recommendations to strengthen Yangon’s fire risk management.

Zhang (2013) developed a comprehensive urban fire risk assessment system using Haikou City, China, as a case study. The study analyzed fire risk through three key dimensions: fire accident risk, urban vulnerability, and anti-fire capability, based on the UN ISDR’s risk framework. A hierarchical model was created with 3 first-level, 13 second-level, and 48 third-

level indicators, covering data such as fire history, weather, infrastructure, manpower, training, equipment, and response systems. The Analytic Hierarchy Process (AHP) was used to assign indicator weights, and Grey Correlation Degree was applied to assess risk, vulnerability, and capacity. Results showed that anti-fire capability had the strongest impact on overall fire safety. Applying the model to 17 sub-districts and one town in Haikou revealed varying risk levels, which closely matched observed fire incident patterns. The study concluded that this method effectively supports urban fire risk management and recommended enhancing fire service capacity, monitoring systems, and targeted prevention in high-risk areas.

Wong and Xie (2014) studied a study focused on developing and implementing an integrated fire safety management strategy for complex developments such as high-rise buildings, mixed-use properties, and transportation hubs. The study presented a conceptual framework that connected fire management planning, emergency response procedures, and maintenance operations under a unified structure. Central to this system is a fire safety management team comprising directors, managers, wardens, and frontline staff who collaboratively ensure that safety plans are practical and continuously updated. This model includes three core components: a fire management team plan, fire emergency procedures, and a maintenance plan. These are supported by a comprehensive fire safety policy, ongoing training programs, and strong collaboration with local fire authorities. The study highlighted that clear role assignments, regular drills, and proper maintenance are vital to managing fire risks and ensuring safe evacuations. Furthermore, consistent coordination with fire services and police was identified as essential to effective emergency response. Wong and Xie emphasized that successful fire safety is not solely reliant on advanced technical systems but also on well-trained personnel and strong leadership. The study concluded that proactive planning, communication, and continuous staff development significantly improve fire safety in large-scale buildings. Property developers and owners are urged to invest in structured policies and long-term coordination with regulatory bodies to reduce fire risks and enhance overall resilience.

Ferreira et al. (2016) studied urban fire risk evaluation and emergency planning in historic city centres, using Seixal, Portugal as a case study. Published in the *Journal of Cultural Heritage*, their research focused on managing fire and seismic hazards during urban rehabilitation. They developed the ARICA method (Assessment, Reduction, Intervention, Control, Awareness), a GIS-based framework to assess fire risk, prioritize vulnerable areas, and support emergency planning in heritage districts. The study showed that integrating spatial data and stakeholder collaboration among planners, fire services, and heritage managers

effectively improves fire risk management and emergency preparedness. Ferreira et al. recommend embedding ARICA protocols into both design and operational stages of heritage rehabilitation to enhance preservation and public safety.

Myo Min Tun's (2017) studied "Case Study on Three Townships in Yangon Region," provides a focused examination of disaster preparedness particularly for fire emergencies within three low-income townships in Yangon. Using a mixed-methods approach, including household surveys and interviews with local officials, the study evaluates how socioeconomic status, infrastructure limitations, and institutional preparedness affect fire risk response. Findings indicate significant disparities in preparedness levels, with poor urban settlements lacking basic fire prevention tools, clear evacuation plans, and awareness training. Emergency responses were further hindered by narrow roads, poor vehicle access, and insufficient coordination with township fire services. The research emphasizes the need for localized community education, improved infrastructure, and clearer emergency communication systems. By highlighting the lived experiences of vulnerable communities, the study advocates for participatory risk reduction strategies and targeted policy interventions that account for urban poverty and structural constraints within Yangon's expanding urban landscape.

Ibrahim Yakubu Ebenehi et al. (2018) evaluated the effectiveness of fire safety management (FSM) in Malaysian higher education institutions by examining six key factors: management, fire safety equipment and systems, building safety design, user awareness, user attitude, and perceived FSM effectiveness. Using a pilot survey with 77 valid responses, their framework showed high reliability (Cronbach's Alpha between 0.885 and 0.948) and strong validity. The authors concluded that their survey tool is suitable for larger studies and recommended conducting longitudinal research to track changes in user perceptions and the real impact of fire safety policies. They also emphasized the importance of integrating fire safety education into staff and student training, updating policies, conducting regular safety audits, and involving users actively. These efforts aim to build a strong fire safety culture and improve institutional resilience against fire hazards.

Nyein Chan Aung (2021) studied "Analysis of Fire Incidents in Industrial Zones: A Case Study of Patheingyi, Ayeyarwady Region," conducted a comprehensive investigation into fire risks plaguing the region's critical rice milling and storage facilities. The study revealed that electrical system failures, particularly overloaded circuits and outdated wiring in aging infrastructure, constituted the most frequent ignition source, compounded by hazardous storage practices where rice sacks were often stacked near heat sources without proper ventilation. These technical vulnerabilities were further exacerbated by systemic issues including lax

enforcement of Myanmar's National Fire Safety Code, inadequate worker training on fire prevention protocols, and under-resourced local fire brigades struggling with slow response times due to poor rural road conditions. The research emphasized that these intersecting factors regularly escalated small incidents into catastrophic losses, threatening both livelihoods and food security in Myanmar's rice basket region. Among its key recommendations, the study advocated for mandatory facility safety audits paired with stricter compliance monitoring, targeted fire safety training programs for agricultural workers, and public-private partnerships to modernize fire suppression infrastructure in high-risk zones.

Wang, Zhou, and Liu (2024) developed a dynamic fire risk assessment framework tailored to rapidly urbanizing and climate-sensitive cities, especially in developing countries. Their model integrates spatial data, socio-economic vulnerability, and environmental risk factors using GIS and statistical tools to generate real-time fire risk maps. The framework emphasizes continuous updates through hazard identification, vulnerability analysis, and dynamic monitoring via satellite and reporting systems. Findings highlight the benefits of a data-driven, adaptive approach for resource allocation, community resilience, and proactive risk communication. The study stresses the importance of including social vulnerability metrics and enhancing inter-agency coordination. It concludes that traditional static fire strategies are inadequate in today's urban contexts, calling for institutional investment in spatial technologies, stakeholder training, and flexible policy frameworks. Ultimately, the research advocates for incorporating risk-based planning and collaboration into all stages of urban development to improve fire resilience in vulnerable urban zones.

The study by Aye Thandar Phyto Wai, Alan March, and Anna Hurlimann (2024), titled "Towards Enhanced Urban Fire Risk Reduction through More Effective Urban Policy: A Case Study of Mandalay City, Myanmar", investigates the intersection of urban planning and fire risk management in Mandalay. Using a qualitative approach involving key stakeholder interviews and policy reviews, the research identifies critical gaps in fire risk preparedness embedded in urban form, such as the lack of accessible road networks, poor land-use planning, and inadequate integration of fire safety measures in municipal development policies. The study reveals that while fire risk is high in densely populated and informally settled zones, municipal planning rarely reflects these vulnerabilities. It recommends a policy shift toward spatially inclusive planning and calls for greater coordination between fire services and urban planners. This study underscores the urgent need to embed fire risk management within city development frameworks for long-term resilience.

CHAPTER (III)

Fire Risk Management System in Yangon

3.1 Causes and Impacts of Fire Cases in Myanmar

Fire disasters in Myanmar are driven by a complex interplay of structural vulnerabilities, socio-economic behaviors, and environmental conditions. The most common causes include electrical faults, open flames, negligence, and, in some cases, intentional arson. According to the Myanmar Fire Services Department (MFSD), electrical short circuits remain the leading cause, often resulting from outdated wiring systems, unregulated appliance usage, and overburdened circuits in both residential and commercial areas. In rapidly urbanizing cities such as Yangon and Mandalay, informal settlements and crowded markets are particularly susceptible due to the lack of building codes and reliance on makeshift power sources. Human behavior also contributes significantly improper handling of cooking fires, careless smoking, and inadequate fire safety awareness frequently lead to accidental ignitions. The impact of these fires is severe and multidimensional. Loss of life, injury, and psychological trauma are immediate human consequences, while the destruction of homes, public infrastructure, and small businesses has long-term socio-economic implications. Markets, which are vital to local economies, are frequently affected, causing financial hardship for vendors and communities. Fires also place a considerable burden on emergency services and disrupt public utilities. In rural and forested regions, fire disasters can lead to environmental degradation, deforestation, and loss of biodiversity, compounding the challenges posed by climate change. Furthermore, displacement resulting from large-scale urban fires can strain social services and increase vulnerability among marginalized groups, particularly the elderly, women, and children. Overall, the recurring nature of fire disasters in Myanmar reveals systemic weaknesses in risk mitigation, emergency preparedness, and public education, underscoring the urgent need for integrated, long-term strategies that address both the root causes and far-reaching impacts of fires across the country.

Table 3.1 Major Fire Cases in Myanmar with loss and damage data (2005-2025)

| Year | Location | Descriptions | Impact |
|------|----------|---|--|
| 2005 | Yangon | Warehouse fire in downtown Yangon | Property damage estimated at \$2 million |
| 2008 | Mandalay | Market fire in Zegyo Market | Estimated \$5 million in damages |
| 2012 | Yangon | Residential fire in North Okkalapa Township | Several houses destroyed |
| 2015 | Yangon | Fire at a garment factory | Factory destroyed, heavy economic loss |
| 2017 | Yangon | Shwepyitha township residential fire | Dozens of houses burned |
| 2019 | Yangon | Fire at a chemical warehouse | Toxic fumes caused evacuation, damage to environment |
| 2021 | Yangon | Fire in Mingaladon Industrial Zone | Multiple factories damaged |
| 2023 | Yangon | Major fire at a crowded market | Hundreds of stalls destroyed |
| 2024 | Yangon | Beily Bridge, South Dagon | Vehicle damage, 33 houses destroyed |

Source: Myanmar Fire Services Department (MFSD, 2024); Global New Light of Myanmar (2021, 2022, 2023)

Fire risk management in Myanmar is a multifaceted challenge shaped by the country's socio-economic conditions, rapid urbanization, and evolving institutional frameworks. The Myanmar Fire Services Department (MFSD), under the Ministry of Home Affairs, serves as the primary authority responsible for fire prevention, suppression, rescue operations, and community education, overseeing more than 1,100 fire stations and 10,000 personnel nationwide (MFSD, 2024). The Fire Services Law of 2015 established a legal framework for fire safety, empowering MFSD to inspect buildings, issue safety certificates, and conduct public awareness campaigns.

However, enforcement remains inconsistent, particularly in informal settlements and rural areas, due to weak municipal coordination and limited resources (Buchanan & Abu, 2017). For example, the lack of a centralized fire incident database limits real-time monitoring and trend analysis. Budget constraints, uneven resource distribution, and a shortage of trained professionals further challenge MFSD's ability to address Myanmar's growing fire risks. Despite these challenges, MFSD has made commendable efforts in public education, training

programs, and regional collaboration, particularly in urban areas like Yangon, where innovative fire safety initiatives are being piloted to enhance national resilience.

Additionally, partnerships with private companies and international donors could support the procurement of modern firefighting equipment and the construction of new fire stations in underserved areas. By addressing these challenges through targeted investments in human resources, infrastructure, and policy development, Myanmar can build a more robust fire risk management system. This would involve standardizing training curricula, improving inter-agency coordination, and integrating fire safety into national development plans to ensure long-term sustainability. Such efforts would not only reduce the frequency and severity of fire incidents but also enhance Myanmar's overall resilience to disasters, protecting lives, livelihoods, and the environment.

3.2 Causes and Impact of Fire Cases in Yangon

Fire disasters in Yangon stem from a combination of electrical, human, and environmental factors, with significant socio-economic and environmental consequences. According to MFSD, electrical short circuits account for 60% of fires, driven by faulty wiring, overloaded circuits, and aging infrastructure, while negligence (20%), smoking/open flames (10%), and arson/accidental fires (10%) are also significant contributors (MFSD, 2024). These incidents result in loss of life, burn injuries, and strain on public health services, alongside economic losses from damaged markets, businesses, and homes. Psychosocial trauma affects vulnerable populations, particularly children and the elderly, while environmental damage from fires, including air pollution and habitat destruction, exacerbates urban challenges (Wang et al., 2025).

The impacts of these fires are extensive and multifaceted. Fire incidents in Yangon frequently result in loss of life, physical injuries, and displacement, especially in densely populated areas. The strain placed on emergency services and healthcare systems during and after major fires significantly hampers response capacity. Economically, fires cause irreparable damage to markets, homes, and businesses, directly affecting livelihoods and urban commerce. These events demonstrate how fire disasters can disrupt both formal and informal economic sectors.

Beyond the physical and economic toll, fire disasters impose long-term psychosocial impacts. Vulnerable groups such as children, the elderly, and low-income families suffer from trauma, instability, and loss of security. Environmental degradation is another consequence,

particularly in cases like the 2018 Hlaing Tharyar dump site fire, which released harmful pollutants into the air, affecting public health and urban ecosystems. Fires not only damage property but also contribute to air pollution, destroy urban greenery, and threaten biodiversity.

To effectively reduce both the frequency and severity of fire disasters, Yangon must adopt a comprehensive and coordinated strategy. This should include upgrading urban infrastructure, enforcing electrical and building safety regulations, expanding community-based fire prevention programs, and strengthening early warning and emergency response systems. A proactive and collaborative approach—linking government agencies, local communities, and civil society—will be essential not only for minimizing immediate damage but also for enhancing long-term urban resilience. By addressing systemic weaknesses and investing in sustainable fire risk reduction measures, the city can better protect its people, economy, and environment from the recurring threat of fire disasters.

Table 3.2 Major Fire Cases in Myanmar with loss and damage data (2010-2025)

| Year | Location | Descriptions | Impact |
|---------------|---------------------------------|--|--|
| 2010 May | Mingalar Zay Market | Fire broke out in a 5-story complex; over 870 shops destroyed. | Estimated loss over \$21M; lasted 12 hours. |
| 2010 February | Thingangyun Market | Cause linked to faulty electrical wiring. | Over 650 market stalls burned. |
| 2011 December | Mingala Taung Nyunt (Warehouse) | Massive fire in national warehouse; | Residential and business buildings destroyed. |
| 2013 April | Mosque-based Orphanage, Yangon | Fire resulted in death of 13 boys. | Several injuries among young children. |
| 2017 October | Kandawgyi Palace Hotel | Fire engulfed heritage hotel | Significant cultural loss and property damage. |
| 2018 April | Hlaing Tharyar Dump Site | Large-scale fire due to chemical reactions in trash. | Over 60 people sickened, wide air pollution impact. |
| 2021 March | Hledan Market, Yangon | A large fire broke out at Hledan Market | It destroyed hundreds of market stalls, caused millions of kyat in losses, and displaced numerous vendors. |
| 2023 | South Dagon Industrial Blaze | Suspected fuel-related incident | the blaze devastated several industrial buildings, destroyed at least nine structures, and disrupted operations at nearby facilities |

| | | | |
|---------------------------|-----------------------------|----------------|--|
| 2025 June (up to 15th) | Various Townships in Yangon | 610 fire cases | Estimated loss over \$270,000 across affected areas. |
|---------------------------|-----------------------------|----------------|--|

Source: Myanmar Fire Services Department (MFSD, 2024); Global New Light of Myanmar

3.3 Functions of Fire Service Department

Fire risk management in Yangon is governed primarily by the Myanmar Fire Services Department (MFSD), which operates under the Ministry of Home Affairs. The MFSD serves as the leading institution responsible for fire prevention, firefighting, rescue operations, and public education related to fire safety. In Yangon, the department operates dozens of fire stations strategically distributed across major townships, with varying levels of staffing, equipment, and operational readiness. Each township typically maintains its own sub-department, tasked with conducting building inspections, community outreach, and emergency response coordination. However, disparities in institutional capacity between townships often result in uneven service delivery. The MFSD collaborates with other agencies such as the Yangon City Development Committee (YCDC), the Department of Disaster Management, and the police, but the lack of an integrated disaster response framework hampers coordination during emergencies. The Fire Services Law of 2015 provides the legal foundation for the department’s operations, authorizing it to conduct safety audits, enforce compliance, and lead educational campaigns.

Yangon, Myanmar’s largest metropolitan area and commercial hub, faces unique fire risks due to its population of over 5.5 million, diverse building stock, and complex urban landscape. The Yangon Region Fire Services Department, operating under MFSD, coordinates with the Yangon City Development Committee (YCDC) and township offices to manage over 50 fire stations strategically located in high-density areas. These stations are staffed by professional firefighters and volunteers, equipped with basic fire trucks and rescue tools. YCDC enforces fire safety regulations in commercial and residential buildings, but compliance is inconsistent, particularly in informal settlements where safety codes are often ignored (Wang et al., 2025).

As of 2025, there are approximately 88 fire stations across Yangon Region, including both main and auxiliary (sub-) fire stations, as operated under the Myanmar Fire Services Department (MFSD). These stations are distributed throughout major urban townships, suburban zones, and industrial areas. There are 88 fire stations in the Yangon Region, and Fire stations are divided into three grades: A, B, and C with 21, 10, and eight firefighters,

respectively (FSD,2018). FSD is one of the agencies directly responsible for and participating in Disaster Risk Reduction such as search and rescue efforts.

3.3.1 Roles and Responsibilities of the Myanmar Fire Service Department

Fire risk management is an essential part of protecting communities, property, and the environment from fire hazards and related disasters. In Myanmar, the growing population and expanding urban areas have increased the likelihood of fire incidents, making a strong fire safety system necessary. The Myanmar Fire Brigade Law (2015) establishes a legal framework for fire prevention, firefighting, rescue, and public education. This law assigns clear responsibilities to the Fire Service Department and includes provisions for Auxiliary Fire Brigades and trained community volunteers. Together, these groups create a coordinated network that helps to prevent fires, respond quickly to emergencies, and educate the public on fire safety. This section discusses the roles and duties of the Fire Service Department, the Auxiliary Fire Brigade, and the importance of trained community volunteers in Myanmar's fire risk management efforts (Myanmar Fire Brigade Law, (The Pyidaungsu Hluttaw Law No. 11, 2015).

The Fire Service Department is the central government agency charged with managing fire safety and emergency response throughout Myanmar. Its functions include preventing fires by enforcing fire safety laws, inspecting buildings and businesses, and issuing safety guidelines to reduce fire risks. The department also leads firefighting and rescue operations when fires or other disasters occur, deploying trained personnel and specialized equipment to contain and extinguish fires effectively. Public education is another key duty, where the department organizes awareness campaigns to teach people about fire hazards and how to respond safely in emergencies.

Additionally, the Fire Service Department conducts training for its staff and auxiliary volunteers to maintain high professional standards and preparedness. It works closely with other government departments to integrate fire safety into urban development plans and industrial projects. The department also manages donations and technical assistance from local and foreign sources to support fire prevention and rescue work. Through these comprehensive duties, the Fire Service Department plays a vital role in safeguarding lives and property in Myanmar (Myanmar Fire Brigade Law, 2015, Chapters II, V, X).

3.3.2 Role and Responsibilities of the Auxiliary Fire Brigade

The Auxiliary Fire Brigade is made up of trained volunteers from the community who support the Fire Service Department in carrying out fire safety activities. Organized and trained by the department, these volunteers assist professional firefighters during emergencies, especially in areas where full-time fire services are limited. Their role includes responding quickly to small fires, helping with rescue operations, and participating in public education programs to promote fire safety awareness. Auxiliary members also assist in maintaining and inspecting fire safety equipment within their communities.

Volunteers must be at least eighteen years old to join and receive training from the Fire Service Department. The formation, reorganization, or dissolution of an Auxiliary Fire Brigade requires official approval from the department, ensuring proper management and coordination. By involving local volunteers, the Auxiliary Fire Brigade extends the reach of fire safety efforts, provides faster emergency response, and fosters a culture of shared responsibility for fire prevention and protection (Myanmar Fire Brigade Law, 2015, Chapter VI).

3.3.3 Roles and Responsibilities of Trained Community Volunteers

Beyond the Auxiliary Fire Brigade, trained community volunteers contribute significantly to fire risk management at the local level. These volunteers receive education on basic firefighting techniques, early fire detection, emergency procedures, and fire safety awareness. They play a critical role in encouraging neighbors to adopt safe practices, report fires promptly, and assist with evacuations when necessary.

Their participation enhances the community's ability to respond quickly to fire incidents and minimizes the potential damage caused by fires. Working closely with the Fire Service Department and Auxiliary Fire Brigades, trained community volunteers help build resilience and empower citizens to actively participate in safeguarding their communities from fire hazards. This approach promotes a sense of shared responsibility and improves overall fire preparedness throughout Myanmar (Myanmar Fire Brigade Law, 2015, Chapters VI and VIII).

Thus, Myanmar Fire Brigade Law (2015) creates a comprehensive fire risk management system based on the cooperation between the Fire Service Department, Auxiliary Fire Brigades, and trained community volunteers. The Fire Service Department holds the central role in enforcing fire safety regulations, conducting firefighting and rescue operations, training personnel, and educating the public. The Auxiliary Fire Brigade supplements these efforts by mobilizing trained volunteers to assist with emergency response and fire prevention at the local level. Trained community volunteers further strengthen fire preparedness by

fostering awareness and providing early response support within their neighborhoods. This integrated network is crucial to Myanmar's efforts to reduce fire risks, protect lives and property, and enhance public safety across the country.

3.4 Trainings and Public Awareness

Training and Public Awareness are fundamental to building a fire-resilient society in Yangon. Recognizing that effective fire risk management extends beyond institutional response, the Myanmar Fire Services Department has increasingly focused on empowering the public through education and training. Awareness campaigns are conducted via multiple channels, including television, radio, posters, school outreach, and public demonstrations. These campaigns aim to familiarize citizens with basic fire safety practices such as using fire extinguishers, safe handling of electrical appliances, and evacuation procedures. In addition, fire drills are regularly organized in schools, markets, and government offices to ensure that people are prepared to act swiftly in emergencies. Despite these efforts, participation levels remain inconsistent, particularly in low-income and peripheral communities where access to information is limited. Furthermore, most training programs are short-term and do not include follow-up mechanisms to assess knowledge retention or behavior change. There is also limited collaboration with civil society organizations and local leaders who could help tailor messages to specific community needs. Enhancing the effectiveness of public awareness initiatives requires a more participatory approach that involves local stakeholders in the design and delivery of training. Long-term strategies should include integrating fire safety education into school curricula, developing mobile training units for underserved areas, and creating volunteer fire response teams. These community-based models have proven effective in other countries and can be adapted to Yangon's context. Ultimately, a well-informed and engaged public is one of the most powerful assets in reducing fire risks and ensuring timely and effective responses when disasters occur.

3.4.1 Fire safety training

Fire safety training is a foundational element in fire risk management strategies. These training programs are designed to equip individuals, especially community members and employees, with the necessary knowledge and practical skills to prevent, respond to, and recover from fire incidents. Topics typically include the identification of fire hazards, safe use of electrical and flammable materials, emergency evacuation procedures, and the use of fire extinguishers. By improving people's understanding and preparedness, fire safety training helps

reduce human error, encourages a culture of safety, and ultimately minimizes the potential for fire-related losses.

Table 3.3 Fire Safety Trainings for Firefighters and Volunteers (2015-2025)

| Year | Training Name | Place | Target Group |
|------|---|------------------------------------|-------------------------------------|
| 2015 | Fire Safety Refresher Training | Yangon Central Fire Station | Firefighters |
| 2017 | Urban Disaster Risk Reduction – Fire Module | Yangon Region | MRCS Volunteers |
| 2019 | Firefighter Technical & Vehicle Operations Training | Yangon Fire Services Department HQ | Firefighters |
| 2021 | Aircraft Rescue & Fire Fighting Course | Yangon International Airport | Firefighters |
| 2023 | First Aid & Fire Safety for Volunteers | MRCS Yangon Branch | MRCS Volunteers |
| 2024 | Light Search and Rescue (LSAR) Training | MRCS Yangon | MRCS Volunteers & Community Leaders |
| 2025 | Fire-fighting & SAR Operations Course 1/2025 | Yangon Region Training Center | Fire Brigade & MRCS Volunteers |

Source: MFSD, MRCS Yangon Training Reports, Global New Light of Myanmar (2024).

3.4.2 Awareness Raising Activities

Awareness Raising Activities fire risks plays a critical role in prevention. Awareness campaigns are implemented through community seminars, public service announcements, posters, social media outreach, and school programs. These initiatives aim to change attitudes and behaviors by educating the public about common fire causes (e.g., careless cooking, faulty wiring, unattended candles), the impact of fire disasters, and simple fire prevention steps. Widespread awareness contributes to community-wide resilience, reduces risky behavior, and promotes proactive fire safety practices.

Table 3.4 Awareness Raising Activities in Yangon (2015-2025)

| Year | Awareness Activity Name | Target Group | Organizer |
|------|--|------------------------------------|-----------------------------------|
| 2015 | Fire Prevention Week Campaign | Public schools and households | Yangon Fire Services Department |
| 2017 | Community Fire Awareness Talks | Wards and Township communities | Yangon FSD & Local Authorities |
| 2019 | School-based Fire Safety Education | Primary and middle school students | Yangon Education Dept + FSD |
| 2020 | Fire Hazard Posters and Broadcasts | Urban residents and shop owners | Yangon City Development Committee |
| 2022 | Fire Safety in Industrial Zones Workshop | Factory workers and managers | FSD + Ministry of Labour |
| 2023 | Community-based Disaster Awareness Program | Volunteers & Local Leaders | MRCS + Township DRR Committees |
| 2025 | Digital Fire Risk Communication Campaign | Online users & youth | Yangon FSD + DDM |

Source: (MFSD, 2024)

3.4.3 Fire Drill Exercise

Fire Drill Exercise, fire drills and emergency simulation exercises are essential for testing the real-time readiness of individuals and organizations. These drills allow people to practice evacuation routes, identify bottlenecks, and coordinate roles and responsibilities in a safe, controlled environment. Regular drills help ensure that in the event of an actual fire, panic is reduced, people know exactly what to do, and emergency response time is minimized. For public buildings, offices, factories, and schools, drill exercises are often mandated as part of fire safety regulations and compliance.

Table 3.5 Drill Exercise Activities in Yangon (2015 – 2025)

| Year | Training Name | Place | Target Group |
|------|---|------------------------------------|------------------------------------|
| 2015 | Fire Safety Refresher Training | Yangon Central Fire Station | Firefighters |
| 2017 | Urban Disaster Risk Reduction – Fire Module | Yangon Region | MRCS Volunteers |
| 2019 | Firefighter Technical & Vehicle Operations Training | Yangon Fire Services Department HQ | Firefighters |
| 2021 | Aircraft Rescue & Fire Fighting Course | Yangon International Airport | Firefighters |
| 2023 | First Aid & Fire Safety for Volunteers | MRCS Yangon Branch | MRCS Volunteers |
| 2024 | Light Search and Rescue Training | MRCS Yangon | MRCS Volunteers, Community Leaders |
| 2025 | Fire-fighting & SAR Operations Course 1/2025 | Yangon Region Training Center | Fire Brigade & MRCS Volunteers |

Source: (MFSD, 2024)

3.5 Volunteering Fire Services in Myanmar

Firefighters have long been an integral part of Myanmar’s fire risk management system. Nationwide, the Myanmar Fire Services Department (MFSD) estimates over 249,000 volunteers contribute to fire prevention and emergency response efforts (Scribd, 2019). These volunteers, often recruited locally, assist professional firefighters in both urban and rural areas. In many townships, particularly remote or resource-limited ones, volunteers form the frontline response force, conducting fire suppression, rescue, and public education activities. The government has sought to strengthen this network by providing basic training, issuing official identity cards, and encouraging community participation (Ministry of Home Affairs, 2024). However, challenges such as inadequate protective equipment, inconsistent training schedules, and lack of formal welfare support continue to hinder volunteer capacity.

Despite these challenges, volunteers remain vital in Myanmar’s fire management framework by enhancing manpower and local knowledge. For example, during the devastating fire in Mandalay’s Aungmyethazan Township in 2018, local volunteer brigades were mobilized rapidly alongside professional teams, helping to contain the fire and assist displaced residents

(The Irrawaddy, 2018). Such community involvement reflects a hybrid model that combines state-led services with grassroots action to manage fire risks in diverse contexts across Myanmar.

In Yangon, Myanmar's largest and most populous city, volunteer firefighters are embedded within the broader fire safety ecosystem. While Yangon has a relatively robust network of professional fire stations, the scale and density of urban life require additional human resources during large-scale emergencies. Volunteer units are active across many townships, often coordinated through local ward offices or community organizations. A notable example is the volunteer response during the massive fire at the Shwepyitha Industrial Zone in 2019. Volunteers joined the Myanmar Fire Services Department and other emergency agencies in containing the blaze, providing manpower for evacuation and first aid support (Myanmar Times, 2019). Additionally, volunteers regularly participate in public awareness campaigns, fire drills in schools, and neighborhood fire safety trainings, helping raise knowledge on prevention and preparedness.

The Yangon Regional Government and MFSD have worked to formalize volunteer participation by offering basic firefighting training and limited equipment support. However, volunteers still face challenges such as insufficient protective gear and funding constraints. Despite this, their role remains crucial in supplementing professional services and extending fire safety efforts into communities throughout Yangon.

In fire risk management, large, medium, and small-scale fire disasters are typically categorized based on a combination of interrelated factors that determine the severity, required response capacity, and overall impact of the incident. These factors include the total **burnt** area, the number and type of affected structures, the scale of firefighting resources mobilized (such as number of fire engines and personnel), the duration required to control the fire, the extent of evacuation needed, and the level of human and economic impact. Classification by scale helps fire authorities prioritize response efforts, allocate resources more efficiently, and plan appropriate mitigation or recovery strategies. While international organizations such as the UNDRR (2021) and National Fire Protection Association (NFPA) (2020) provide general guidelines, contextual adaptations—such as those used by the Myanmar Fire Services Department (MFSD) also consider local infrastructure, urban density, and emergency response capability.

Table 3.6 Classification of Fire Disasters by Scale

| Criteria | Small-Scale Fire | Medium-Scale Fire | Large-Scale Fire |
|----------------------|----------------------------------|---|--|
| Burnt Area | Less than 100 m ² | 100–1,000 m ² | Over 1,000 m ² |
| Number of Structures | 1 building or room | Multiple structures or a large facility | Multiple buildings or complex facilities |
| Response Resources | 1–2 fire engines, 5–10 personnel | 3–5 fire engines, 15–30 personnel | 5+ fire engines, 30+ personnel from multiple units |
| Duration to Control | Within 1 hour | Several hours | Half a day to multiple days |
| Evacuation Need | Usually not required | May involve temporary displacement | Often includes mass evacuation |
| Casualties/Damage | Minimal injuries or loss | Possible injuries and property damage | High risk of casualties, major infrastructure/ economic loss |

Sources: UNDRR (2021) Urban Fire Risk Reduction Guidebook, NFPA (2020) Fire Incident Size Classifications

(a) Small-Scale Fire Disaster

Small-scale fires typically involve limited property damage and affect only a few structures or localized areas. In such cases, initial response is usually managed by the nearest fire station or local volunteer firefighters. The primary tasks include rapid fire suppression, evacuating affected persons if necessary, and protecting adjacent properties to prevent fire spread. Local community awareness and early detection are critical for minimizing damage. After extinguishing the fire, firefighters conduct basic investigations and provide fire safety advice to prevent recurrence.

(b) Medium-Scale Fire Disasters

Medium-scale fires involve larger areas or multiple structures and often require coordination beyond a single fire station’s capacity. These incidents may occur in densely populated townships or commercial zones. Fire services activate additional resources such as regional command units, specialized equipment, and more volunteer teams. Incident command systems are established to coordinate multiple units, ensure safety, and manage logistics.

Evacuation and medical assistance become priorities, alongside efforts to limit fire spread. Public communication is intensified to keep communities informed and calm.

(c) Large-Scale Fire Disasters

Large-scale fires are major incidents causing extensive damage, often spanning multiple townships or industrial areas. Managing these requires mobilization of the entire regional fire service, mutual aid from neighboring regions, and sometimes national-level emergency response teams. Command centers coordinate complex operations involving fire suppression, search and rescue, medical aid, and public safety. Strategic planning includes resource allocation, rotation of personnel to prevent fatigue, and cooperation with other emergency agencies such as police and medical services. Long-term recovery planning, including damage assessment and rehabilitation support, begins as soon as the immediate threat is controlled.

Effective fire risk management depends on scaling response and resources appropriately to the incident size. Small fires need swift local actions, medium fires require inter-unit coordination, and large fires demand multi-agency, high-level command and recovery efforts. Training, equipment, and communication systems must be adaptable to support these varying scales of disaster.

3.6 Legal Aspects of Fire Safety in Myanmar

In Myanmar, the Myanmar Fire Brigade Law (Pyidaungsu Hluttaw Law No. 11, 2015) serves as the key legal framework governing fire risk management activities, including fire prevention, preparedness, and response. This law outlines clear duties and responsibilities for both government departments and the public to follow in the event of fire and other related emergencies.

As fire prevention, the law mandates that fire safety inspections must be carried out before permission is granted for high-risk infrastructure projects such as the construction of high-rise buildings, factories, and facilities handling flammable or explosive materials (Section 17). This includes obtaining fire safety recommendations from the Department of Fire Services before opening hotels, markets, storage facilities, or any business exposed to fire hazards. These measures are intended to reduce potential fire risks before they occur (Myanmar Fire Brigade Law, 2015, Chapter VIII).

In terms of preparedness, the law emphasizes public education and community involvement. According to Section 15, fire safety bodies at different administrative levels are

required to organize awareness campaigns and fire safety education to encourage public cooperation. The formation of Auxiliary and Reserve Fire Brigades is also legally required to support readiness efforts. Auxiliary Fire Brigades consist of trained civilian volunteers (Section 8), while Reserve Fire Brigades must be formed by owners or managers of fire-risk facilities such as factories or hotels (Section 13). These provisions ensure there is a trained, community-based workforce ready to assist professional fire personnel during emergencies.

Regarding response, the law provides specific powers to fire service personnel and authorized volunteers during active fire incidents. Authorizes them to take immediate action such as cutting off electricity, accessing buildings, demolishing structures to prevent fire spread, and using any available water sources or vehicles to control the fire (Section 20). These legal powers ensure that fire response teams can act decisively and effectively to contain fires and minimize damage.

In addition to operational duties, (Section 21) mandates the head of the Township Fire Services Department to investigate the cause of the fire and assess the losses. This ensures accountability and supports future prevention strategies. These legal provisions form a comprehensive legal structure that not only supports the technical side of fire risk management but also integrates public participation, accountability, and coordination between sectors.

The Myanmar Fire Brigade Law (2015) also includes specific legal penalties for individuals and organizations who fail to comply with fire safety regulations. These penalties serve as a legal mechanism to enforce responsibility and ensure proper adherence to fire risk management procedures across all sectors.

Section 24 to Section 33 of the law outlines various prohibited actions, such as failure to follow fire safety directives, obstructing firefighting efforts, or failing to form Reserve Fire Brigades in high-risk businesses. For instance, owners or managers of fire-risk businesses (such as factories, hotels, or ports) who do not establish Reserve Fire Brigades or fail to provide necessary fire safety equipment can be punished with up to three years imprisonment, fines, or both (Section 35).

Similarly, anyone who deliberately obstructs or misleads firefighting personnel during an emergency, or who reports a fire without cause, can face imprisonment ranging from one to five years depending on the severity of the offense (Sections 26–29, 36–37). More serious violations, such as bribery or fraud committed by fire brigade members, may result in up to seven years of imprisonment (Section 38).

These legal penalties highlight the seriousness with which fire safety is treated in Myanmar. By holding individuals and institutions legally accountable, the law helps ensure a more disciplined and effective fire risk management system throughout the country.

3.7 Human Resource Management of Fire Services Department in Yangon

Human resources in Myanmar's Fire Services Department (FSD) operate within a structured yet under-resourced setting. The Department, under the Ministry of Social Welfare, Relief and Resettlement, maintains a hierarchical staffing system from Director-General down through Station Officers, Sergeants, and Privates, as outlined in its organizational structure (Ministry of Home Affairs, 2024) (moha.gov.mm). Across the country, FSD has around 4,778 paid fire personnel supported by over 249,000 auxiliary and reserved volunteer firefighters, reflecting a two-tiered workforce that mixes professional and unpaid volunteers ("Myanmar Fire and Disaster", till 2019). Operationally, Myanmar is divided into states and divisions, and within them township fire stations graded A, B or C with Grade A stations staffed by roughly 21 personnel, Grade B by ten, and Grade C by eight firefighters totaling approximately 550 stations nationwide (Scribd).

Staffing levels remain well below national requirements. Today's professional personnel number about 11,000, and annual recruitment stands at roughly 2,000 firefighters; yet experts estimate Myanmar needs over 26,000 fire personnel to meet public safety needs (Frontier Myanmar, reporter Theint Mon Soe aka J). Volunteers are essential to filling the gap; FSD draws upon a pool of around 300,000 auxiliary volunteers ready to assist in emergencies (Frontier Myanmar).

Training and capacity building occur at two primary centers are the Central Fire Services Training School in Pyin Oo Lwin, established in 1999, and the Training Section in Yangon. Pyin Oo Lwin offers 12 types of courses, including basic and advanced firefighting, rescue techniques, paramedic training, computer skills, driving, and leadership courses (Scribd). Yangon's section provides complementary training such as staff-work, English language, and advanced search and rescue training. International collaborations, including Urban Search & Rescue programs with Singapore in 2011–2012 and rescue and firefighting courses with French and other instructors in subsequent years, have added technical skill enhancement for select officers (Ministry of Home Affairs, 2024) (moha.gov.mm). Nevertheless, many recruits complete only three months of basic training mostly theoretical and weak practical readiness upon deployment, forcing them to acquire crucial skills "on the job," according to veteran fire officers (Frontier Myanmar).

The FSD's declared duties focus on four key functions fire safety, natural disaster prevention, search and rescue, and public welfare and are operationalized through "seven performance" goals that include enhancing administrative and firefighting ability, maintaining equipment readiness, organizing volunteers, and conducting public fire safety awareness (Ministry of Home Affairs, 2024) (moha.gov.mm).

Recent developments offer some optimism. In January 2025, Thaton Township in Mon State launched a refresher training course for 50 auxiliary firefighters combining practical and theoretical elements to improve search, rescue, and fire safety capabilities (Myanmar Digital News, 2025) (MDN - Myanmar Digital News). In Yangon, over 50 trainees from social welfare organizations across five townships participated in a two-week firefighting and search & rescue training organized by FSD, focusing on standardized international practices and hands-on equipment use (Global New Light of Myanmar, 2025). These efforts point to an evolving emphasis on volunteer capacity building and institutional strengthening even amid resource constraints.

Ultimately, fully addressing the human resource needs of Myanmar's fire service will require a strategic, multi-pronged approach: increasing permanent recruitment to meet staffing targets; improving the practical quality of both professional and volunteer training. By aligning recruitment, training and motivation with the Department's four core duties and seven performance goals, Myanmar's Fire Services can evolve into a more effective, resilient institution capable of safeguarding communities nationwide.

3.7.1 Overview of Fire Stations in Yangon Region

Fire stations in Yangon Region are deliberately situated to maximize response capacity in the city's most vulnerable zones typically areas with dense populations, intensive land use, and heightened disaster risk. In a comprehensive 2018 GIS-based urban study, Bhattacharya et al. (2018) conducted a spatial analysis of fire-risk across Yangon's 34 townships, mapping existing station locations against risk levels. Their results showed that central and downtown wards characterized by dense daytime populations and mixed-use architecture emerged as fire "hotspots," justifying a higher concentration of fire stations. Thus, fire stations are densely placed within the Central Business District (CBD) and nearby downtown areas to facilitate rapid dispatch for Level 1 incidents, with "first dispatch" zones predesignated around these high-risk neighborhoods. Indeed, Bhattacharya et al. (2018) found that, due to existing station density, inner-city wards are adequately covered whereas the western and northern outskirts lack sufficient infrastructure and should be prioritized for future expansion. In summary,

Yangon’s fire station network clearly follows a risk-informed deployment strategy: resources are focused where population density, structural complexity, and ignition likelihood coincide, while emerging suburban zones are earmarked for growth to bolster resilience.

Table 3.7 Fire Stations in Yangon Region

| Sr | District | Township | Fire Station Location | Number of Fire Station | Building Completion Year |
|----|---------------|----------------------|-----------------------|------------------------|--------------------------|
| 1 | Yangon (East) | - | South Okkalapa | 1 | 2021 |
| 2 | Yangon (East) | South Okkalapa | South Okkalapa | 1 | 2010 |
| 3 | Yangon (East) | - | Ward (6) | 1 | 2019 |
| 4 | Yangon (East) | - | Ward (10) | 1 | 2019 |
| 5 | Yangon (East) | Yankin | Yankin | 1 | 2019 |
| 6 | Yangon (East) | Thinkangyun | Thinkangyun | 1 | 2017 |
| 7 | Yangon (East) | - | Thuwana | 1 | 2022 |
| 8 | Yangon (East) | South Dagon | Yankin | 1 | 2011 |
| 9 | Yangon (East) | - | Thinkangyun | 1 | 2019 |
| 10 | Yangon (East) | - | Laydaungkan | 1 | 2019 |
| 11 | Yangon (East) | North Dagon | North Dagon | 1 | 2009 |
| 12 | Yangon (East) | - | Ward (31) | 1 | 2022 |
| 13 | Yangon (East) | East Dagon | East Dagon | 1 | 2015 |
| 14 | Yangon (East) | - | Ward (156) | 1 | 2022 |
| 15 | Yangon (East) | Tarmwe | Tarmwe | 1 | 2010 |
| 16 | Yangon (East) | - | Tarmwe | 1 | 2011 |
| 17 | Yangon (East) | Pazundaung | Pazundaung | 1 | 2020 |
| 18 | Yangon (East) | Mingalar Taung Nyunt | Mingalar Taung Nyunt | 1 | 2014 |
| 19 | Yangon (East) | Thaketa | Thaketa | 1 | 2009 |
| 20 | Yangon (East) | Dagon Seik Kan | Dagon Seik Kan | 1 | 2008 |
| 21 | Yangon (East) | - | Nyaung Pin | 1 | 2021 |
| 22 | Yangon (East) | Dawpone | Dawpone | 1 | 2022 |
| 23 | Yangon (East) | North Okkalapa | North Okkalapa | 1 | 2009 |
| 24 | Yangon (East) | - | | 1 | 2010 |
| 25 | Yangon (East) | - | Waibargi | 1 | 2020 |
| 26 | Yangon (East) | - | Shwepaukkan | 1 | 2020 |

| | | | | | |
|----|----------------|---------------|---------------------|---|------|
| 27 | Yangon (West) | - | - | 1 | 1997 |
| 28 | Yangon (West) | San Chaung | San Chaung | 1 | 1926 |
| 29 | Yangon (West) | Kyauktada | Kyauktada | 1 | 1912 |
| 30 | Yangon (West) | Hlaing | Hlaing | 1 | 2018 |
| 31 | Yangon (West) | Kyeemyindaing | San Chaung | 1 | 2010 |
| 32 | Yangon (West) | - | Satsan | 1 | 2018 |
| 33 | Yangon (West) | Kamaryut | Kamaryut | 1 | 2017 |
| 34 | Yangon (West) | Mayankone | Mayankone | 1 | 2017 |
| 35 | Yangon (West) | - | Thamine | 1 | 2017 |
| 36 | Yangon (West) | Ahlong | Ahlong | 1 | 2022 |
| 37 | Yangon (South) | - | - | 1 | 2019 |
| 38 | Yangon (South) | Thanlynn | Thanlynn | 1 | 2023 |
| 39 | Yangon (South) | Kyaun Tan | Kyaun Tan | 1 | 1981 |
| 40 | Yangon (South) | Kyauk Tan | Tadar | 1 | 2016 |
| 41 | Yangon (South) | Thone kwa | Thongwa | 1 | 2018 |
| 42 | Yangon (South) | Kayan | Khayan | 1 | 2020 |
| 43 | Yangon (South) | - | Paukpinshwehla | 1 | 2018 |
| 44 | Yangon (South) | Cocokyun | Cocokyun | 1 | 2004 |
| 45 | Yangon (South) | Dala | Dala | 1 | 2021 |
| 46 | Yangon (South) | Twantay | Twantay | 1 | 2014 |
| 47 | Yangon (South) | - | Phayargyi | 1 | 2019 |
| 48 | Yangon (South) | Seikgyi | Seikgyi | 1 | 2015 |
| 49 | Yangon (South) | Kawhmu | Kawhmu | 1 | 2009 |
| 50 | Yangon (South) | - | Kyaik Htaw | 1 | 2019 |
| 51 | Yangon (South) | Kungyangon | Kungyangon | 1 | 2009 |
| 52 | Yangon (South) | - | Kawt Dun | 1 | 2018 |
| 53 | Yangon (North) | - | - | 1 | 2020 |
| 54 | Yangon (North) | Inn Sein | Inn Sein | 1 | 2011 |
| 55 | Yangon (North) | Insein | Da Nyin Kone | 1 | 2019 |
| 56 | Yangon (North) | Hlaingthayar | Hlaingthayar (East) | 1 | 2018 |
| 57 | Yangon (North) | - | Hlaingthayar (East) | 1 | 2009 |
| 58 | Yangon (North) | - | Hlaingthayar (West) | 1 | 2019 |
| 59 | Yangon (North) | Shwe Pyi Thar | - | 1 | 2019 |
| 60 | Yangon (North) | - | Shwe Pyi Thar | 1 | 2009 |
| 61 | Yangon (North) | | Sathmuezone | 1 | 2016 |

| | | | | | |
|----|----------------|-----------|-----------------|---|------|
| 62 | Yangon (North) | - | Hlaw Ga | 1 | 2019 |
| 63 | Yangon (North) | Hmawbi | Hmawbi | 1 | 2021 |
| 64 | Yangon (North) | - | Nyaung Hnit Pin | 1 | 2007 |
| 65 | Yangon (North) | Htantabin | Htantabin | 1 | 2015 |
| 66 | Yangon (North) | Hlegu | Hlegu | 1 | 2019 |
| 67 | Yangon (North) | - | 11 miles | 1 | 2016 |
| 68 | Yangon (North) | - | Dar Pein | 1 | 2019 |
| 69 | Yangon (North) | - | Hpaung Gyi | 1 | 2021 |
| 70 | Yangon (North) | | Mingaladon | 1 | 2012 |
| 71 | Yangon (North) | Taikkyi | Taikkyi | 1 | 2013 |
| 72 | Yangon (North) | - | Oakkan | 1 | 2014 |
| 73 | Yangon (North) | - | Ah Pyauk | 1 | 2017 |

Source: Yangon Region Fire Service Department (2025)

Myanmar Fire Brigade is endeavoring to protect the lives and property of the people in the State and perform fire prevention, safety and rescue and service for environmental hazards with 24-hour service and mitigation measures and accomplish its duties and functions. Firefighters are committed to their duties. Myanmar Fire Brigade is responsible for fire safety and disaster response in Myanmar, including Yangon. They provide training, equipment, and personnel to handle fires and other emergencies. Myanmar Fire Brigade also works with government departments and organizations to form auxiliary fire brigades. Fire Brigade Headcount in Yangon Region, the number of male and female professional firefighters across Yangon's four administrative districts East, West, South, and North is presented.

Table 3.8 Fire Brigade Headcount in Yangon Region

| Sr | District | Fire Brigade | | |
|----|----------------|--------------|--------|-------|
| | | Male | Female | Total |
| 1 | Yangon (East) | 245 | 63 | 308 |
| 2 | Yangon (West) | 293 | 45 | 338 |
| 3 | Yangon (South) | 260 | 19 | 279 |
| 4 | Yangon (North) | 294 | 32 | 326 |

Source: Yangon Region Fire Service Department (2025)

CHAPTER IV

SURVEY ANALYSIS

4.1 Survey Profile

In order to achievement of this study, a structured survey was conducted to collect primary data from individuals directly involved in fire safety operations. The survey took place in May 2025 using Google Forms as the data collection tool. This online method was chosen for its accessibility and efficiency, particularly given the wide geographic coverage across all 45 townships within the Yangon Region. The approach allowed for convenient participation from respondents stationed at different locations, many of whom are regularly active in emergency settings.

A total of 171 valid responses were gathered from members of the Myanmar Fire Services Department (MFSD), auxiliary fire brigade, and trained volunteers. The respondents were selected to represent fire stations across the 45 townships in Yangon Region, ensuring that various locations and on-the-ground experiences were fairly included in the study.

All participants had completed formal training or awareness sessions related to fire safety. In addition, they had practical field experience, having actively participated in fire suppression and emergency response operations. This combination of theoretical knowledge and hands-on involvement provided the study with reliable, experience-based insights. The questionnaire focused on assessing key elements such as fire prevention, preparedness, emergency response, equipment readiness, and capacity building. The diverse yet relevant backgrounds of the respondents helped strengthen the study's findings and its overall evaluation of Yangon's fire risk management system.

The questions were designed to reflect these core areas, while also aligning with the study's specific objectives. And then, the questionnaire used in this study was developed based on a careful review of previous academic research, institutional reports, and international guidelines related to fire risk management. Existing literature provided insight into common frameworks, challenges, and key factors that influence effective fire safety systems. In particular, components such as fire prevention, preparedness, response, equipment readiness, and capacity building were identified as essential domains for evaluating fire risk management performance.

Overall, the respondents in this survey are individuals who not only have prior experience in fire safety but are also actively involved in response activities at present. of fire fighters, auxiliary fire fighters and trained volunteers who are actively involved in fire safety work across Yangon Region. Their varied experiences, regular training, and real-life participation in fire response activities provide useful and reliable insights into how fire safety is currently practiced. These findings help show which parts of the fire risk management system are working well and which areas still need more support or improvement.

4.2 Survey Design

The survey design for the study on fire risk management in Yangon involved a descriptive quantitative methodology, collecting data from 171 respondents across fire stations within Yangon Region through structured questionnaires. Participants included Myanmar Fire Services Department (MFSD) staff and trained volunteers working in fire-prone areas. This sampling aligned with the study's goal to assess fire prevention, emergency response, and capacity-building efforts.

A total of 171 respondents were selected from 45 townships across Yangon Region to ensure broad and representative coverage of the area. This sample size was chosen to capture diverse perspectives from personnel actively involved in fire safety operations throughout Yangon region.

4.3 Survey Result

This survey aims to evaluate the effectiveness of fire prevention, emergency response, and recovery operations in Yangon. Based on data collected from 171 participants, the study identifies key challenges related to fire risk awareness, practical implementation, and resource allocation.

(a) Reliability and Validity

Reliability and validity are fundamental concepts in research that ensure the quality and trustworthiness of measurement tools. Reliability refers to the consistency of a measure, indicating that it produces stable and repeatable results under similar conditions. Validity, on the other hand, assesses whether the instrument accurately measures what it intends to measure. In the context of the study on fire risk management in Yangon, these properties are evaluated using Cronbach's Alpha, a statistical measure of internal consistency, to ensure the reliability of the survey items across various factors.

Table 4.1 Reliability Analysis

| Sr. No | Factors | No of Items | Cronbach's Alpha | Internal Consistency |
|--------|--|-------------|------------------|----------------------|
| 1 | Fire Risk Management | 5 | .772 | Acceptable |
| 2 | Fire Prevention | 5 | .840 | Good |
| 3 | Fire Preparedness | 5 | .803 | Good |
| 4 | Fire Response | 5 | .839 | Good |
| 5 | Effectiveness of Capacity Building Efforts | 5 | .845 | Good |
| 6 | Fire safety Equipment/System | 5 | .842 | Good |

Source: Survey Data (2025)

According to the table 4.1 "Reliability Analysis" presents the reliability analysis for six factors related to fire risk management, each assessed with five items. Cronbach's Alpha values range from .772 to .845, indicating the internal consistency of the scales. The factor "Fire Risk Management" has a Cronbach's Alpha of .772, deemed acceptable, suggesting moderate consistency. The other factors—Fire Prevention (.840), Fire Preparedness (.803), Fire Response (.839), Effectiveness of Capacity Building Efforts (.845), and Fire Safety Equipment/System (.842)—all exhibit Cronbach's Alpha values above .8, classified as "Good," reflecting high internal consistency. This indicates that the survey items reliably measure each factor, supporting the validity of the research framework for evaluating fire risk management effectiveness in Yangon.

(b) Demographic Profile of the respondents

Demographic information provides essential context for understanding the characteristics of the population involved in the study, enabling a deeper analysis of fire risk management in Yangon. This section presents data on respondents' gender, age, education level, current position, and working experience, collected through structured questionnaires from personnel of the Myanmar Fire Services Department (MFSD), trained volunteers, and community members. Such details help identify patterns and variations in perceptions and preparedness across different demographic groups, contributing to tailored recommendations for enhancing fire safety initiatives.

Table 4.2 Demographic Information

| Demographic Factors | | Frequency | Percent |
|--|----------------------|-----------|---------|
| Age Group | 18-25 | 22 | 12.9 |
| | 26-35 | 40 | 23.4 |
| | 36-45 | 70 | 40.9 |
| | above 45 | 39 | 22.8 |
| Gender | Male | 131 | 76.6 |
| | Female | 40 | 23.4 |
| Occupation | Auxiliary fire force | 24 | 14.0 |
| | Firefighter | 61 | 35.7 |
| | Volunteer | 86 | 50.3 |
| Education Level | Below high school | 9 | 5.3 |
| | High school graduate | 52 | 30.4 |
| | Diploma | 12 | 7.0 |
| | Bachelor | 96 | 56.1 |
| | Master or above | 2 | 1.2 |
| Have you ever participated in any fire safety training or awareness campaign? | Yes | 171 | 100.0 |
| Are you currently part of any community-based disaster response or safety group? | Yes | 118 | 69.0 |
| | No | 53 | 31.0 |

Source: Survey Data (2025)

The research objective is to examine the fire risk management system by encompassing prevention, preparedness, response, safety equipment and capacity building that is supported by the demographic data, which provides a detailed profile of the 171 respondents. The age distribution shows a significant concentration in the 36-45 age group (40.9%), indicating a mature workforce likely to have substantial experience, which could enhance response capabilities. The gender breakdown, with 76.6% male and 23.4% female respondents, highlights a male-dominated field, potentially influencing training and participation dynamics. Occupation data reveals a high proportion of volunteers (50.3%) alongside firefighters (35.7%) and auxiliary fire force members (14.0%), suggesting a reliance on community involvement, a key aspect of capacity building. Education levels, predominantly Bachelor's degree holders

(56.1%), indicate a relatively well-educated sample, which may improve understanding and implementation of fire safety measures. The geographic distribution across Yangon's districts (South 43.3%, West 18.1%, North 23.4%, East 15.2, the findings can be seen as representing the entire Yangon Region. This broad coverage helps ensure that the results reflect the overall fire risk situation across Yanong. Universal participation in fire safety training (100%) and significant involvement in community-based groups (69%) underscore the effectiveness of capacity-building efforts, aligning with the objective to assess their impact on operational readiness and community preparedness across prevention, response, and overall management.

4.3.3 Assessing on Fire Risk management in Yangon

This section presents data collected from a survey examining effectiveness of fire risk management in Yangon. Myanmar Fire Department staff and trained volunteers were asked to share their perspectives on various topics, including fire risk management, fire prevention, fire preparation, fire response, capacity building effort and fire safety equipment by utilizing a Likert scale for their responses.

(a) Fire Risk Management

Fire risk management in Yangon is a critical component aimed at reducing fire hazards through a well-structured system of prevention, preparedness, and response. In line with the objective of this study, which is to examine the fire risk management system by encompassing not only prevention, preparedness, and response but also the role of safety equipment and capacity-building efforts, this section provides an overview of the integrated framework in place. It highlights how the Myanmar Fire Services Department (MFSD), together with trained volunteers, works toward strengthening fire safety through regular training, equipment readiness, and community engagement. The analysis examines both the parts of the system that work well and those that require improvement, offering a clearer understanding of how fire safety can be better strengthened in Yangon's unique urban environment.

Table 4.3 Fire risk management

| Sr No | Descriptions | Mean | Standard Deviation |
|-------|--|------|--------------------|
| 1 | Our fire risk management plan helps reduce fire risks effectively. | 4.00 | 0.79 |
| 2 | Risk assessments are conducted regularly in high-risk areas. | 3.97 | 0.73 |

| | | | |
|--------------------|---|------|------|
| 3 | Community engagement is part of our fire risk management strategy. | 3.84 | 0.72 |
| 4 | Resource allocation for fire risk management is sufficient. | 4.30 | 0.74 |
| 5 | Fire risk data is systematically collected and analyzed for planning. | 4.10 | 0.77 |
| Overall mean value | | 4.04 | |

Source: Survey Data (2025)

The fire risk management efforts in Yangon play an important role in improving overall fire safety across the city. The management plan in place is seen as helpful in reducing the chances of fires happening, showing that there is a clear and effective strategy guiding these efforts. One of the key strengths of this system is the careful collection and use of information related to fire risks. By gathering detailed data and analyzing it carefully, the authorities are able to plan better and make more informed decisions to prevent fires before they occur. Another positive aspect is that resources, such as funding, equipment, and personnel, are generally provided at a sufficient level to support these fire risk management activities. This shows that there is good support and investment toward keeping the city safe from fire hazards. Regular checks and evaluations are also carried out in areas known to be more prone to fires, which helps in identifying risks early and addressing them promptly. However, involving the local community more actively in fire risk management is an area that could see improvement. Encouraging greater participation and awareness among residents would strengthen prevention efforts, making it easier to reduce fire incidents and ensure people are better prepared. Overall, the fire risk management system in Yangon is functioning well but could become even stronger by building deeper connections with the community. This analysis reinforces the study's focus on assessing strengths and weaknesses in fire risk management to bolster overall safety and preparedness.

(b) Fire Prevention

Fire prevention in Yangon focuses on proactive measures to reduce the incidence and impact of fire hazards, aligning with the research objective of evaluating the effectiveness of fire risk management systems. This section examines key strategies, including training programs, public awareness campaigns, and community involvement, which aim to strengthen preventive efforts by addressing the strengths and weaknesses within the system. By assessing

these initiatives, particularly for Myanmar Fire Services Department (MFSD) staff and trained volunteers, the study seeks to enhance overall fire safety and resilience in Yangon.

Table 4.4 Fire Prevention

| Sr No | Descriptions | Mean | Standard Deviation |
|--------------------|--|------|--------------------|
| 1 | We received the trainings in fire prevention techniques. | 4.42 | 0.69 |
| 2 | Fire safety education and awareness programs are regularly conducted. | 4.25 | 0.71 |
| 3 | Fire prevention efforts work well overall, though need to enhance | 4.06 | 0.76 |
| 4 | Fire prevention policies are clearly communicated to all team members. | 4.00 | 0.84 |
| 5 | There is sufficient community involvement in fire prevention activities. | 4.13 | 0.75 |
| Overall mean value | | 4.17 | |

Source: Survey Data (2025)

The fire prevention efforts in Yangon play a very important role in reducing the chances of fires and protecting the community. One of the strongest points is the training that people receive on how to prevent fires. Many respondents feel that these training sessions are very useful and help them understand the best ways to avoid fire risks. In addition, regular education and awareness programs are carried out to inform the public about fire safety. These programs help people learn what to do to keep themselves and their surroundings safe from fire hazards. Community participation in fire prevention activities is also good, showing that many people are willing to work together to prevent fires. While the overall fire prevention work is strong, there is still room to improve and make the efforts even more effective. Lastly, the rules and policies related to fire prevention are clearly shared with all team members, ensuring everyone knows their responsibilities and how to act in order to reduce fire risks. This strong combination of training, education, community involvement, and clear communication helps Yangon better manage fire risks and protect its residents. This analysis supports the study’s focus on assessing prevention strengths and identifying areas for enhancement to strengthen overall fire risk management in Yangon.

(c) Fire Preparedness

Fire preparedness in Yangon emphasizes proactive planning and readiness to mitigate the impact of fire incidents, aligning with the research objective of evaluating the effectiveness of fire risk management systems. This section explores critical elements such as contingency plans, emergency drills, and community assessments, which aim to enhance the capacity of Myanmar Fire Services Department (MFSD) staff and trained volunteers to respond effectively. By analyzing the strengths and weaknesses of these preparedness measures, the study seeks to improve overall fire safety and resilience in Yangon.

Table 4.5 Fire Preparedness

| Sr No | Descriptions | Mean | Standard Deviation |
|--------------------|--|------|--------------------|
| 1 | We have clear and practiced fire emergency plans. | 3.74 | 0.74 |
| 2 | Fire drills and preparedness exercises are conducted regularly within our team and community | 4.03 | 0.76 |
| 3 | As team members, I know the specific roles during a fire emergency. | 3.82 | 0.74 |
| 4 | The community is aware of fire preparedness measures | 4.10 | 0.76 |
| 5 | There is sufficient access to firefighting tools and emergency supplies for preparedness | 4.19 | 0.71 |
| Overall mean Value | | 3.98 | |

Source: Survey Data (2025)

The result of fire preparedness in Yangon shows a fair amount of readiness to handle fire emergencies. One of the strongest points is that there are enough firefighting tools and emergency supplies available, which is very important for managing fires effectively. The community also seems to have a good understanding of fire preparedness measures, meaning that efforts to inform and educate people about how to stay safe during fires are working well. Regular fire drills and training exercises are happening both within teams and the wider community, helping everyone stay alert and ready to act when needed. Team members generally know what their specific duties are during a fire emergency, but there is still room to improve how clearly these roles are understood. The area that needs the most attention is having clear and well-practiced fire emergency plans. These plans are essential for guiding actions during a crisis, and making them easier to understand and practice more often would strengthen

overall preparedness. Improving this aspect could help make the entire system more reliable and effective in protecting lives and property. This analysis supports the study’s focus on assessing preparedness strengths, such as resource access and community awareness, while identifying weaknesses in emergency planning to strengthen overall fire risk management in Yangon.

(d) Fire Response

Fire response in Yangon focuses on the immediate actions taken to contain fire incidents and protect lives and property, aligning with the research objective of evaluating the effectiveness of fire risk management systems. This section examines key aspects such as emergency protocols, equipment utilization, and inter-agency coordination, which are essential for enhancing the capabilities of Myanmar Fire Services Department (MFSD) staff and trained volunteers. By assessing the strengths and weaknesses of these response measures, the study aims to improve overall fire safety and resilience in Yangon.

Table 4.6 Fire response

| Sr No | Descriptions | Mean | Standard Deviation |
|--------------------|--|------|--------------------|
| 1 | Our fire response operations are timely and well-coordinated | 3.92 | 0.71 |
| 2 | Firefighting equipment and tools are sufficient and in good condition. | 3.99 | 0.73 |
| 3 | Communication during fire emergencies is effective. | 3.96 | 0.73 |
| 4 | Resource limitations affect the effectiveness of our fire response. | 4.13 | 0.67 |
| 5 | Emergency response protocols are well-documented and accessible. | 4.09 | 0.71 |
| Overall mean Value | | 4.02 | |

Source: Survey Data (2025)

The results from the study show that the fire response system in Yangon is seen as somewhat effective but still facing a number of important challenges. Many people shared that emergency procedures, such as steps to take during a fire, are clearly written and easy to understand. This helps emergency teams respond in a more organized way and makes it easier for different groups, like firefighters, police, and medical teams, to work together. Respondents also mentioned that the equipment used in firefighting—such as hoses, protective suits, and fire trucks is mostly available and in good working condition. This is a positive sign that the

basic tools needed for fire emergencies are being maintained in many areas. However, the study also shows that communication during fire events is not always perfect. While there is a general sense that messages are being shared between teams, some people believe that better systems or faster communication methods are needed, especially in large or high-risk areas. A key concern raised by many is the lack of enough resources. This includes not only equipment but also things like trained staff, vehicles, and fuel. These shortages make it harder for fire teams to respond quickly, especially during peak hours or in neighborhoods far from fire stations. This analysis supports the study’s focus on assessing response strengths, such as accessible protocols, while identifying weaknesses like resource limitations and coordination to improve overall fire risk management in Yangon.

(e) Fire Safety Equipment / System

The Fire Safety Equipment/System in Yangon focuses on the availability, accessibility, and maintenance of tools and technologies essential for effective fire risk management, aligning with the research objective of evaluating the effectiveness of these systems. This section examines key aspects such as fire extinguishers, detection systems, and maintenance practices, which support the capabilities of Myanmar Fire Services Department (MFSD) staff and trained volunteers across prevention, preparedness, and response phases. By assessing the strengths and weaknesses of these equipment-related measures, the study aims to enhance overall fire safety and resilience in Yangon.

Table 4.7 Fire Safety Equipment / System

| Sr No | Descriptions | Mean | Standard Deviation |
|--------------------|---|------|--------------------|
| 1 | Fire extinguishers and hoses are easily accessible in all key areas. | 4.08 | 0.84 |
| 2 | Staff and volunteers know how to properly use fire safety equipment during emergencies. | 4.01 | 0.88 |
| 3 | Fire safety equipment is well-maintained and ready for use at all times | 3.98 | 1.04 |
| 4 | There are gaps in coverage where fire safety equipment is lacking or insufficient | 3.85 | 0.95 |
| 5 | In some cases, maintenance of fire safety systems is delayed due to funding or resource limits. | 3.86 | 0.97 |
| Overall mean value | | 3.96 | |

Source: Survey Data (2025)

The survey results show that people in Yangon generally have a positive view of the availability and condition of fire safety equipment. Many respondents believe that fire extinguishers and hoses are easy to find in important places, which is helpful for quick action during a fire. Most staff and volunteers also feel confident in using the equipment correctly, showing that some training efforts are working. In many areas, the fire safety tools are kept in good condition and are ready to use. However, there are still some problems. In certain places, fire safety tools are either missing or not enough, which creates risks. Also, the maintenance of these systems is sometimes delayed because of limited money or resources. These results show that while some parts of the fire safety system are strong, especially in terms of access and training, there are still important issues that need to be solved especially in making sure all areas are covered and that equipment is regularly maintained. This analysis supports the study's focus on assessing equipment-related strengths, such as accessibility and maintenance, while identifying gaps in coverage and funding as areas needing attention to enhance fire risk management in Yangon.

(f) Capacity Building Effort

The effectiveness of capacity building efforts in Yangon centers on enhancing the skills, knowledge, and readiness of Myanmar Fire Services Department (MFSD) staff and trained volunteers, aligning with the research objective of evaluating the effectiveness of fire risk management systems. This section explores key components such as training programs, refresher courses, and trainer expertise, which aim to strengthen the human resources critical to fire prevention, preparedness, and response. By assessing the strengths and weaknesses of these efforts, the study seeks to improve overall fire safety and resilience in Yangon.

Table 4.8 Capacity Building Effort

| Sr No | Descriptions | Mean | Standard Deviation |
|-------|---|------|--------------------|
| 1 | I feel confident applying what I learned during real emergencies. | 3.97 | 0.72 |
| 2 | Training or awareness sessions are accessible and regularly available to all relevant person. | 4.01 | 0.69 |
| 3 | Training has improved my skills and ability to respond effectively to fire emergencies. | 4.01 | 0.69 |
| 4 | I have access to refresher or continuous training opportunities. | 3.97 | 0.70 |

| | | | |
|--------------------|--|------|------|
| 5 | Trainers are experienced and knowledgeable in fire risk management | 3.95 | 0.75 |
| Overall mean value | | 3.98 | |

Source: Survey Data (2025)

The results of the study show that the training and learning programs for fire safety in Yangon are generally seen as helpful and effective by the participants. Many respondents said that they gained useful knowledge and felt more confident when applying what they learned during real fire emergencies. They believe that these programs have helped them improve their practical skills and response ability. The findings also show that most participants found the training sessions to be accessible and available on a regular basis, especially for those directly involved in fire response. This suggests that the programs are reaching the right people. However, while many participants said they had some access to follow-up or refresher training, this area still needs more attention. Some people noted that refresher sessions are not always offered regularly, and not everyone has equal opportunities to attend them. Another area that needs improvement is the quality and consistency of trainers. Although many respondents agreed that trainers are knowledgeable, a few expressed concerns that some instructors may lack real-life experience or advanced teaching skills. The findings suggest that capacity-building efforts have made a positive difference in fire risk management in Yangon. They have improved confidence, knowledge, and response skills among trained individuals. However, to make these programs even stronger, more effort is needed to ensure regular refresher training and to improve the quality and experience level of trainers. This will help firefighters and volunteers stay well-prepared and confident in managing fire emergencies across the city. This analysis supports the study's focus on assessing the positive impact of capacity building on operational readiness, while highlighting the need to ensure consistent trainer quality and expanded refresher opportunities to further strengthen fire risk management in Yangon.

(g) Results of Summary

Understanding the key factors that influence the effectiveness of fire risk management in Yangon is essential, particularly within the context of rapid urbanization, resource limitations, and community engagement. The challenges and performance of Yangon's fire risk management system are shaped by several interrelated variables that affect prevention, preparedness, response, and overall resilience. This section synthesizes the overall mean values of the main components contributing to fire safety management. By analyzing critical factors such as fire prevention (mean = 4.17), preparedness (mean = 3.98), response (mean = 4.02),

equipment/system functionality (mean = 3.96), and capacity-building effectiveness (mean = 3.90), the study highlights both strengths and areas requiring improvement. These findings offer valuable insights for policymakers, MFSD officials, and community stakeholders aiming to enhance the overall effectiveness of fire risk management in Yangon through targeted investment, training, and system integration.

Table 4.9 Summary Result Overall Mean of Fire Risk Management

| Variables | | Overall Mean |
|-----------|--|--------------|
| 1 | Fire risk management factors | 4.04 |
| 2 | Fire Prevention factor | 4.17 |
| 3 | Fire Preparedness Factor | 3.98 |
| 4 | Fire response factor | 4.02 |
| 5 | Fire Safety Equipment / System factor | 3.96 |
| 6 | Effectiveness of Capacity Building Effort factor | 3.98 |

Source: Survey data (2025)

(a) Fire Risk Management

The overall mean score of 4.04 for fire risk management factors suggests a generally positive perception of the fire risk management system among the respondents. This indicates that the fundamental components ranging from prevention and preparedness to response are functioning at a satisfactory level. However, while the score is relatively high, it still leaves room for improvement, especially in terms of integration, coordination, and sustainability of fire management strategies. This score reflects a balanced system but also highlights the need for continuous monitoring and policy refinement.

(b) Fire Prevention

With the highest mean score of 4.17 among all variables, the fire prevention factor appears to be the most robust aspect of the fire risk management framework. This implies that fire prevention measures such as fire inspections, building regulations, and community-based preventive programs are being effectively implemented and perceived as successful by stakeholders. The strong emphasis on prevention indicates proactive risk reduction efforts, which is a critical pillar in minimizing the frequency and impact of fire incidents.

(c) Fire Preparedness

The fire preparedness factor received a mean score of 3.98, indicating a moderately strong but slightly weaker area compared to prevention. This score suggests that while training, drills, and contingency planning are in place, there may be inconsistencies or limitations in preparedness efforts across different sectors or communities. Strengthening emergency planning, community engagement, and resource availability can help enhance overall readiness for fire incidents.

(d) Fire Response

The fire response factor scored a relatively high mean of 4.02, reflecting a generally favorable view of emergency response capabilities. This includes the availability and performance of fire services, response time, and coordination during actual fire events. The score suggests that response mechanisms are relatively effective, but improvements in communication systems, access to fire sites, and inter-agency collaboration could further enhance operational effectiveness.

(e) Fire Safety Equipment/System

The lowest mean score of 3.96 was recorded for the fire safety equipment/system factor, indicating a relatively weaker aspect of fire risk management. This suggests potential gaps in the availability, quality, or maintenance of fire safety systems such as alarms, extinguishers, sprinklers, and hydrants. It highlights the need for improved investment in modern equipment, regular inspections, and enforcement of compliance standards in both public and private buildings to ensure effective fire safety infrastructure.

(f) Effectiveness of Capacity Building

The effectiveness of capacity building efforts scored 3.98, indicating a reasonably good but improvable area. This reflects ongoing training and development programs for firefighters and related personnel, as well as institutional strengthening efforts. While the score shows recognition of these efforts, it also points to the need for more regular, inclusive, and up-to-date training initiatives to ensure sustained professional development and enhanced fire risk management capabilities.

CHAPTER V

CONCLUSION

This conclusion consolidates the findings from the study on the factors influencing Fire Risk Management Effectiveness in Yangon. By analyzing key variables such as Fire Prevention, Fire Preparedness, Fire Response, Capacity Building Efforts, and Fire Safety Equipment/System, this research offers valuable insights for policymakers, the Myanmar Fire Services Department (MFSD), and community stakeholders. The following sections summarize the key findings, discuss their implications, provide actionable recommendations, and propose directions for future research to further strengthen fire safety and resilience in Yangon.

5.1 Findings

This study is an overview of influencing fire risk management in Yangon. It focuses on six main areas that affect how the city prevents fires, gets ready for them, and responds when they happen. The results can help fire service staff, firefighters, and community members who are involved in fire response efforts.

The study shows that fire prevention activities in Yangon are working quite well. Most of the people had received training about how to prevent fires. The training system is being carried out regularly and is reaching the people who need them most. There are also many awareness sessions to reach the public about fire safety. The public awareness sessions seem to help people become more aware and careful. And then, the level of participation from the community is good, but there is still room to get more people involved in prevention activities.

In the area of fire risk management, many people believe that the plans in place are useful in reducing fire risks. Information about fire dangers is collected and used for making decisions. Resources such as people, equipment, and funds are also being used properly in many cases.

As for fire preparedness, there are signs that some steps are being taken, like regular drills and the availability of emergency tools. People also seem to know what to do when a fire happens. But even with these efforts, having well-practiced and easy-to-follow emergency

plans still seems weak. Some people are not fully clear about what steps to take during a real emergency, and this could reduce the effectiveness of their actions.

When looking at how fires are handled during emergencies, the system appears to be working in many ways. Equipment is often available and response teams try to act quickly. But there are problems too. In some areas, there are not enough staff or supplies, and this can slow down their response. Communication during emergencies also needs some improvement.

Fire safety tools are mostly available in important places, and many people know how to use them. But in some locations, there are not enough tools, or the tools are not being maintained regularly. This creates risks if a fire breaks out in those areas. Finally, the training and learning programs have helped people feel readiness to respond to fires. Refresher training is available, though not always regularly, which shows that the system has strong foundations.

5.2 Suggestions

Based on the findings from this study, it is clear that Yangon faces many challenges in managing fire risks. Although there are some good efforts already in place, there are still many gaps that need to be filled. To improve the city's fire safety, this section gives practical suggestions for each of the six key areas studied. These recommendations aim to help the government, fire departments, and local communities work together to reduce fire risks and improve public safety in both the short and long term.

To make fire risk management stronger in Yangon, fire prevention training should continue and reach more people. Regular programs to share knowledge with the public should also keep going, as these helps reduce fire risks before they happen. It is also important to encourage more community members to join in these efforts so that everyone has a part in keeping their neighborhoods safe. In order to manage fire risks better, local people should be more involved when emergency plans for community are being made. When the people who live in the area are included, the decisions become more practical and useful. This will also help raise awareness and increase responsibility within the community.

For fire preparedness, it would be helpful to have more clear and easy-to-practice emergency plans. People should not only know what to do in theory, but also practice it often. This kind of preparation will build confidence and improve response during real situations. In addition, drills should include both the emergency teams and the general public to make sure everyone is ready.

Regarding fire response, it is important to improve access to staff, vehicles, and tools. If the teams have what they need, they can act more quickly and save more lives. Communication systems also need to be improved so that information can be shared faster during fire emergencies. To take part effectively in fire prevention and response activities, community members need to understand the plans that have already been made by the fire department. It is the responsibility of the department to clearly explain these plans, so that local people can aware how they can be involved.

Fire safety tools should be checked and maintained more regularly. All areas, not just the main ones, should have enough equipment. As for training, refresher sessions should be provided on a regular basis so that people don't forget what they've learned. By having refresher training more often, there are more effective and readiness of the team will be improved. The trainers should also have enough experience to guide others well. By focusing on these areas, the fire safety system in Yangon can become stronger and more reliable in the future.

In addition to establishing a monitoring system, it is also important to regularly check fire alarm systems, especially in high-risk locations such as schools, hospitals, markets, factories, and apartment buildings. These places are often crowded or contain flammable materials, so early warning through a working fire alarm can save lives and reduce damage. Routine checks should ensure that alarms are properly installed, functional, and audible in all necessary areas. By including fire alarm inspections as part of regular monitoring, overall fire preparedness and safety can be greatly improved

Action should always be taken in accordance with the fire safety laws that have been established. These laws provide clear guidelines and standards designed to prevent fires and protect lives and property. Following legal requirements ensures that fire risks are managed properly and that responsible parties are held accountable. By enforcing these regulations consistently, communities can reduce fire incidents and improve overall safety. Therefore, it is essential for authorities and individuals alike to comply fully with the fire-related laws to maintain a safe environment.

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APPENDIX_A

Questionnaire for Assessment on Fire Risk Management in Yangon

Dears,

My name is May Myo Thu, a Master of Development Studies (MDevS) student at Yangon University of Economics. I am conducting a survey for my thesis titled, **Assessment on Fire Risk Management in Yangon**: This research aims to evaluate the strengths and weaknesses, challenges, and opportunities for strategic improvements of Yangon's fire response and rescue operations in high-risk urban areas and to critically assess the effectiveness of capacity-building efforts for staff and volunteers.

I deeply appreciate your valuable time and participation in this survey.

Your responses will remain completely confidential and will only be used for research analysis.

1. Part 1: Demographic Information

2. What is your age?

18–25

26–35

36–45

46–55

Above 55

3. What is your gender?

Male

Female

Other

Prefer not to say

4. What is your occupation?

Firefighter

Volunteer (CBRRT, MRCS, etc.)

Government official (e.g., YCDC)

Auxiliary Fire Force

Other: _____

5. What is your highest level of education?
- Primary
 - Secondary
 - Diploma
 - Bachelor's Degree
 - Master's or above
6. Which township in Yangon do you reside or work in?
- Hlaing Tharyar
 - South Dagon
 - Mayankone
 - Shwe Pyi Thar
 - Other: _____
7. How long have you lived or worked in this area?
- Less than 1 year
 - 1–3 years
 - 4–6 years
 - More than 6 years
8. Have you ever participated in any fire safety training or awareness campaign?
- Yes
 - No
9. Are you currently part of any community-based disaster response or safety group?
- Yes
 - No

Assessment on Fire Risk Management in Yangon

Please tick one box to indicate the extent to which you agree or disagree with each of the following statements.

Index: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

(a) Fire Risk Management

| No. | Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|-----|---|-------------------|----------|---------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1. | Our fire risk management plan helps reduce fire risks effectively. | | | | | |
| 2. | Risk assessments are conducted regularly in high-risk areas. | | | | | |
| 3. | Community engagement is part of our fire risk management strategy. | | | | | |
| 4. | Resource allocation for fire risk management is sufficient. | | | | | |
| 5. | Fire risk data is systematically collected and analyzed for planning. | | | | | |

What are the effectiveness fire risk management system is, including the risk management plans, regular risk assessments, community involvement, data use, public awareness efforts, funding, and coordination with stakeholders?

(b) Fire Prevention

| No. | Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|-----|---|-------------------|----------|---------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1. | We received the trainings in fire prevention techniques. | | | | | |
| 2. | Fire safety education and awareness programs are regularly conducted. | | | | | |

| | | | | | | |
|----|--|--|--|--|--|--|
| 3. | Fire prevention efforts work well overall, though need to enhance them further | | | | | |
| 4. | Fire prevention policies are clearly communicated to all team members. | | | | | |
| 5. | There is sufficient community involvement in fire prevention activities. | | | | | |

What are the factors to improvement in fire prevention practices and strategies?

(c) Fire Preparedness

| No. | Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|-----|---|-------------------|----------|---------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1. | We have clear and practiced fire emergency plans | | | | | |
| 2. | Fire drills and preparedness exercises are conducted regularly within our team and community. | | | | | |
| 3. | As team members, I know the specific roles during a fire emergency. | | | | | |
| 4. | The community is aware of fire preparedness measures | | | | | |
| 5. | There is sufficient access to firefighting tools and emergency supplies for preparedness. | | | | | |

What improvements do you think are still needed in fire preparedness?

(d) Fire Response

| No. | Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|-----|--|-------------------|----------|---------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1. | Our fire response operations are timely and well-coordinated | | | | | |
| 2. | Firefighting equipment and tools are sufficient and in good condition. | | | | | |
| 3. | Communication during fire emergencies is effective. | | | | | |
| 4. | Resource limitations affect the effectiveness of our fire response. | | | | | |
| 5. | Emergency response protocols are well-documented and accessible. | | | | | |

(e). Effectiveness of Capacity Building Efforts

| No. | Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|-----|--|-------------------|----------|---------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1. | I feel confident applying what I learned during real emergencies. | | | | | |
| 2. | Training or awareness sessions are accessible and regularly available to all relevant person | | | | | |
| 3. | Training has improved my skills and ability to respond effectively to fire emergencies. | | | | | |

| | | | | | | |
|----|--|--|--|--|--|--|
| 4. | I have access to refresher or continuous training opportunities. | | | | | |
| 5. | Trainers are experienced and knowledgeable in fire risk management | | | | | |

(f). Fire Safety Equipment/System

| No. | Statement | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|-----|---|-------------------|----------|---------|-------|----------------|
| | | 1 | 2 | 3 | 4 | 5 |
| 1. | Fire extinguishers and hoses are easily accessible in all key areas | | | | | |
| 2. | Staff and volunteers know how to properly use fire safety equipment during emergencies | | | | | |
| 3. | Fire safety equipment is well-maintained and ready for use at all times | | | | | |
| 4. | There are gaps in coverage where fire safety equipment is lacking or insufficient | | | | | |
| 5. | In some cases, maintenance of fire safety systems is delayed due to funding or resource limits. | | | | | |

What improvements are needed to ensure that fire safety equipment and systems fully support fire prevention and response efforts?

Do you have any suggestions Assessment on Fire Risk Management in Yangon?

Thank you

May Myo Thu

Yangon University of Economics

APPENDIX_B

SPSS OUTPUT

| Age Group | | | | | |
|------------------|----------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 18-25 | 22 | 12.9 | 12.9 | 12.9 |
| | 26-35 | 40 | 23.4 | 23.4 | 36.3 |
| | 36-45 | 70 | 40.9 | 40.9 | 77.2 |
| | above 45 | 39 | 22.8 | 22.8 | 100.0 |
| | Total | 171 | 100.0 | 100.0 | |

| Gender | | | | | |
|---------------|--------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | male | 131 | 76.6 | 76.6 | 76.6 |
| | female | 40 | 23.4 | 23.4 | 100.0 |
| | Total | 171 | 100.0 | 100.0 | |

| Occupation | | | | | |
|-------------------|----------------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Auxiliary fire force | 24 | 14.0 | 14.0 | 14.0 |
| | Firefighter | 61 | 35.7 | 35.7 | 49.7 |
| | Volunteer | 86 | 50.3 | 50.3 | 100.0 |
| | Total | 171 | 100.0 | 100.0 | |

| Education Level | | | | | |
|------------------------|----------------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Below high school | 9 | 5.3 | 5.3 | 5.3 |
| | High school graduate | 52 | 30.4 | 30.4 | 35.7 |
| | Diploma | 12 | 7.0 | 7.0 | 42.7 |
| | Bachelor | 96 | 56.1 | 56.1 | 98.8 |
| | Master or above | 2 | 1.2 | 1.2 | 100.0 |
| | Total | 171 | 100.0 | 100.0 | |

| How long have you lived in this area? | | | | | |
|--|------------------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | Less than 1 year | 1 | .6 | .6 | .6 |
| | 1-3 year | 15 | 8.8 | 8.8 | 9.4 |
| | 4-6 year | 67 | 39.2 | 39.2 | 48.5 |
| | More than 6 year | 88 | 51.5 | 51.5 | 100.0 |
| | Total | 171 | 100.0 | 100.0 | |

| Have you ever participated in any fire safety training or awareness campaign? | | | | | |
|--|-----|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | yes | 171 | 100.0 | 100.0 | 100.0 |

| Are you currently part of any community-based disaster response or safety group? | | | | | |
|---|-------|-----------|---------|---------------|--------------------|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | yes | 118 | 69.0 | 69.0 | 69.0 |
| | No | 53 | 31.0 | 31.0 | 100.0 |
| | Total | 171 | 100.0 | 100.0 | |

(a) Fire Risk Management

| Descriptive Statistics | | | | | |
|--|-----|---------|---------|--------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| Our fire risk management plan helps reduce fire risks effectively. | 171 | 3.00 | 5.00 | 4.0000 | .79705 |
| Risk assessments are conducted regularly in high-risk areas. | 171 | 3.00 | 5.00 | 3.9766 | .73527 |
| Community engagement is part of our fire risk management strategy. | 171 | 3.00 | 5.00 | 3.8480 | .72780 |

| | | | | | |
|---|-----|------|------|--------|--------|
| Adequate resource allocation is necessary to ensure sufficient | 171 | 3.00 | 5.00 | 4.3041 | .74434 |
| Fire risk data is systematically collected and analyzed for planning. | 171 | 3.00 | 5.00 | 4.1053 | .77500 |
| Valid N (listwise) | 171 | | | | |

(b) Fire Prevention

| Descriptive Statistics | | | | | |
|--|-----|---------|---------|--------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| We received the trainings in fire prevention techniques | 171 | 3.00 | 5.00 | 4.4211 | .69318 |
| Fire safety education and awareness programs are regularly conducted. | 171 | 3.00 | 5.00 | 4.2515 | .71203 |
| Fire prevention efforts work well overall, though need to enhance | 171 | 3.00 | 5.00 | 4.0643 | .76809 |
| Fire prevention policies are clearly communicated to all team members. | 171 | 1.00 | 5.00 | 4.0000 | .84714 |
| There is sufficient community involvement in fire prevention activities. | 171 | 3.00 | 5.00 | 4.1345 | .75110 |
| Valid N (listwise) | 171 | | | | |

(c) Fire Preparedness

| Descriptive Statistics | | | | | |
|---|-----|---------|---------|--------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| We have clear and practiced fire emergency plans. | 171 | 3.00 | 5.00 | 3.7427 | .74628 |

| | | | | | |
|--|-----|------|------|--------|--------|
| Fire drills and preparedness exercises are conducted regularly within our team and community | 171 | 3.00 | 5.00 | 4.0292 | .76256 |
| As team members, I know the specific roles during a fire emergency. | 171 | 3.00 | 5.00 | 3.8187 | .74904 |
| The community is aware of fire preparedness measures | 171 | 3.00 | 5.00 | 4.0994 | .76431 |
| There is sufficient access to firefighting tools and emergency supplies for preparedness | 171 | 3.00 | 5.00 | 4.1871 | .71952 |
| Valid N (listwise) | 171 | | | | |

(d) Fire Response

| Descriptive Statistics | | | | | |
|--|-----|---------|---------|--------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| Our fire response operations are timely and well-coordinated | 171 | 3.00 | 5.00 | 3.9240 | .71952 |
| Firefighting equipment and tools are sufficient and in good condition. | 171 | 3.00 | 5.00 | 3.9942 | .73161 |
| Communication during fire emergencies is effective. | 171 | 3.00 | 5.00 | 3.9649 | .73480 |
| Resource limitations affect the effectiveness of our fire response. | 171 | 2.00 | 5.00 | 4.1287 | .67375 |
| Emergency response protocols are well-documented and accessible. | 171 | 3.00 | 5.00 | 4.0877 | .71818 |
| Valid N (listwise) | 171 | | | | |

(e) Effectiveness of Capacity Building Efforts

| Descriptive Statistics | | | | | |
|---|-----|---------|---------|--------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| I feel confident applying what I learned during real emergencies. | 171 | 3.00 | 5.00 | 3.9708 | .72296 |
| Training or awareness sessions are accessible and regularly available to all relevant person. | 171 | 3.00 | 5.00 | 4.0058 | .69024 |
| Training has improved my skills and ability to respond effectively to fire emergencies. | 171 | 2.00 | 5.00 | 4.0058 | .69871 |
| I have access to refresher or continuous training opportunities. | 171 | 2.00 | 5.00 | 3.9708 | .70650 |
| Trainers are experienced and knowledgeable in fire risk management | 171 | 1.00 | 5.00 | 3.9532 | .75781 |
| Valid N (listwise) | 171 | | | | |

(f) Fire Safety Equipment/System

| Descriptive Statistics | | | | | |
|---|-----|---------|---------|--------|----------------|
| | N | Minimum | Maximum | Mean | Std. Deviation |
| Fire extinguishers and hoses are easily accessible in all key areas. | 171 | 1.00 | 5.00 | 4.0760 | .84718 |
| Staff and volunteers know how to properly use fire safety equipment during emergencies. | 171 | 1.00 | 5.00 | 4.0117 | .88775 |
| Fire safety equipment is well-maintained and ready for use at all times | 171 | 1.00 | 5.00 | 3.9825 | 1.04866 |

| | | | | | |
|---|-----|------|------|--------|--------|
| There are gaps in coverage where fire safety equipment is lacking or insufficient | 171 | 1.00 | 5.00 | 3.8480 | .95192 |
| In some cases, maintenance of fire safety systems is delayed due to funding or resource limits. | 171 | 1.00 | 5.00 | 3.8596 | .97206 |
| Valid N (listwise) | 171 | | | | |