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## **A REVIEW OF RISK CATEGORIES IDENTIFICATION ON HIGH-RISE RESIDENTIAL BUILDING (STRATA) OPERATIONS**

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### **Abstract**

High-rise residential buildings, or know as strata, significantly influence urban living, necessitating effective operation to preserve property values and harmonious communities. Generally, rapid urbanisation has expanded strata-titled properties, due to scarcity of land, congested building structures and of preferred property style living. Despite regulatory oversight, high-rise residential building communities face complex risks, prompting a need for tailored risk management strategies. The crucial process in risk management is risk identifying. Risk in strata can be varies based on its environment and purposes. This paper aims to identify risk categories inherent in high-rise residential building (strata) management. Using an interpretive in-depth literature review and selected strata cases as secondary documentary evidence of issues in high-rise residential building, nine critical risk categories were identified which is financial, legal and compliance, structural and maintenance, management and operational, resident-related, security and safety, environmental, technological, and reputational risks. Each risk significantly consequences on building operation, resident satisfaction, and overall sustainability. Conclusively, identify these risks through holistic review tailored to Malaysian strata buildings is vital in risk management process. Future proper risk management must emphasise and embedded in high-rise residential building (strata) operations to ensure excel building operation and satisfaction within resident communities.

**Keywords:** High-rise Residential, Strata Residential, Risk Categories, Risk Identification, Operation

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## **INTRODUCTION**

The increasing trend towards high density residential and commercial strata schemes in urban Malaysia highlights the need for a structured property oversight. In such complexes, effective management is the linchpin that protects real estate equity and reconciles the differing priorities of owners, residents and management bodies. So upgrading these administrative systems is key to dealing with the difficulties associated with shared space living (Abdullah et al., 2024). The management of strata properties under the Strata Titles Act 1985 requires a very structured approach. Those who are in charge need to balance the management of shared spaces with good financial stewardship and be deeply engaged in the social fabric and dynamics of the community residents (Mohd Hanafi & Hassan, 2019). Titled strata developments are an administrative nightmare to manage. It is a constant balancing act of conflicting interests of stakeholders from the spectrum of investors, tenants, management councils and service providers, while making sure that each stakeholder remains firmly within their own area of responsibility, in the community structure (Farhana et al., 2023).

High-rise residential building operation must execute effective risk management strategies to prevent these risks while building resilience and maintaining sustainability across strata communities. The complex aspects of managing high-rise residential building in Malaysia brings forward specific difficulties which require customised risk management strategies (Sufiya et al., 2023). Conventional risk management practices prove beneficial but fail to fully address the specific Malaysian context of strata management which includes strict regulations and diverse cultural aspects together with financial variation (Farhana et al., 2023). For an example the combination of inadequate reserve fund management along with delayed payments leads to poor property upkeep which then negatively influences resident satisfaction and lowers property market prices (Ismail et al., 2023). Organisations must carefully guide their operations through complex regulatory requirements set by the Strata Titles Act because improper management will create both major legal liabilities and operational disruptions (Kathitasapathy et al., 2023). As a result, this paper aims to identify risk categories inherent in high-rise residential building which known as strata management and its impact through comprehensive and in-depth literature review.

## **LITERATURE REVIEW**

### **High-Rise Residential Building Management**

Malaysia's current practices in high-rise residential building management are primarily governed by the Strata Management Act 2013, which establishes a comprehensive framework for the administration and regulation of strata-titled properties. According to Vern et al., (2019), the performance of Malaysian strata

schemes hinges largely on the Management Corporation (MC) as the primary regulatory body for communal upkeep, financial administration and strict enforcement of bylaws. Contemporary practices are actively promoting the integration of digital technology for maximising the ecosystem and promoting communal harmony. It simplifies fiscal reporting and communication, thereby strengthening the structural accountability (Radha & Najib Razali, 2023). The importance of professional building managers continues to grow as they manage property complexities and maintain legal compliance while representing property owners' various requirements.

Construction of strata complexes is speeding up, but management bodies still face considerable operational hurdles. These include rampant disputes between proprietors, weak enforcement of statutory bylaws and unfair charges for communal upkeep. According to (Ashiqin et al., 2023) argue that successful conflict resolution methods combined with ongoing professional development for building managers are essential elements of improved strata management systems. Strata development projects now increasingly adopt eco-friendly measures due to the rising focus on sustainable building practices (Ashiqin et al., 2024). Environmental conservation benefits from these initiatives because they simultaneously raise both property appeal and perceived value of high-rise building developments. In contrast, the interaction between the strata managers and occupants gives rise to significant socio-operational risks. These pre-existing frictions often take the form of competing stakeholder interests, territorial disputes over shared facilities, and persistent obstacles to cohesive dialogue and mutual cooperation (Abdul Jalil et al., 2023).

### **Risks In High-Rise Residential Building (Strata) Management**

The management risks of strata residential complexes are direct threats to the functional, financial and statutory integrity of a building. Without mitigation, these structural and operational deficiencies greatly impact the habitability of the premises, and detract from the overall quality of life in the community (Hillson & Murray-Webster, 2017). Consequently, these volatile variables add considerable uncertainty to strata governance. They demand rigorous diagnostic protocols and strong administrative controls to effectively prevent serious systemic failures. The risk assessment process requires comprehension of potential dangers together with evaluations regarding both how those threats might occur and their potential effects within strata communities (Rampini & Berssaneti, 2022). Within strata management operations numerous risks originate from financial misconduct alongside structural problems but also from legal violations and tensions between residents (Porath, 2023). The management of the buildings throughout Malaysia faces multiple risks which relate to issue and challenges toward both the functionality of operations and resident satisfaction.

The comprehensive examination of literature has identified nine (9) critical risk categories which primarily affect strata building operations. The table 1.0 summarise critical risk categories from selected literature review.

**Table 1:** Critical risk categories from selected literature review.

| <b>Risk Categories</b>                  | <b>Issues Arise</b>                                                                          | <b>Source</b>                   |
|-----------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------|
| <b>Governance and Legal Risk</b>        | Difficulties understanding Strata Act 2013                                                   | (Izanda et al., 2022)           |
|                                         | Poor decision-making by developers can result in governance structures                       | (Johnston & Too, 2015)          |
| <b>Structure &amp; Maintenance Risk</b> | Common maintenance issues                                                                    | (Ashiqin et al., 2023)          |
|                                         | Structural defects                                                                           | (Sood, 2016)                    |
|                                         | Poor maintenance practices                                                                   | (Zaimah Che-Ghani et al., 2016) |
|                                         | Infrastructure limitations                                                                   | (Harun et al., 2022)            |
| <b>Financial Risk</b>                   | Financial constraints                                                                        | (Aripin et al., 2024)           |
|                                         | Inaccurate budgeting, Unforeseen expenditures                                                | (Shazrin et al., 2023)          |
|                                         | Low collection service charges                                                               |                                 |
|                                         | Arrears of bills (utilities, quit rent, assessment, insurance)                               | (Mohamad, 2015)                 |
| <b>Management and Operational Risks</b> | Service quality gaps                                                                         | (Zahari et al., 2014)           |
|                                         | Hierarchical structure                                                                       | (Wernz & Deshmukh, 2007)        |
| <b>Resident-related risks</b>           | Diverse socioeconomic backgrounds of residents                                               | (Mehmood et al., 2024)          |
|                                         | Conversion of residential units into housing for foreign workers                             | (Suratman et al., 2019)         |
|                                         | Noise, parking, cleanliness, pets                                                            | (Mohamad, 2015)                 |
| <b>Environmental Risks</b>              | Flood risk management that does not address                                                  | (Moulds et al., 2021)           |
|                                         | Energy waste-electrical                                                                      | (Ashiqin et al., 2024)          |
| <b>Technological risks</b>              | Needs of digitalization of property management Financial systems and community communication | (Abdul Jalil et al., 2023)      |
|                                         | Challenges in terms of privacy and system transparency                                       | (Pettit et al., 2018)           |
| <b>Reputation Risks</b>                 | Short-term residential accommodations in strata.                                             | (Chua Abdullah & Ramly, 2024)   |
|                                         | Associated with a modern lifestyle, offering amenities                                       | (Abdullah et al., 2024)         |
| <b>Security &amp; Safety Risk</b>       | Limited by regulatory gaps                                                                   | (Pang & Chair, 2023)            |
|                                         | Fire safety challenges due to their architecture and multifunctionality                      | (Poliakova & Grigoryan, 2018)   |

| Risk Categories | Issues Arise                                      | Source                    |
|-----------------|---------------------------------------------------|---------------------------|
|                 | Conflicts and unneighbourhood                     | (Levin & Arthurson, 2020) |
|                 | Well-being critical factor for sustainable living | (Danivska et al., 2019)   |

### Financial Risk

The high-rise residential building management currently faces the financial risk as one of its top challenges. Flawed budget estimates combined with deficient financial strategy will result in inadequate money reserves which become critical when addressing standard maintenance needs or handling unexpected fix requirements and will challenge the building's structure integrity and ongoing functionality (Aripin et al., 2024). As funds reserved for emergencies dry up, they compound building management issues by forcing building management to request special payments from owners thereby damaging both resident relationships and financial health (Shazrin et al., 2023). The delay in receiving strata fees causes cash flow problems that forces difficult financial management in meeting timely obligations. These financial strains create operational difficulties for building management and produce unfair financial burdens for residents which can then lead to conflict in the community.

### Governance and Legal risks

This risk category emerges from mandatory compliance with Malaysian laws namely the Strata Management Act 2013 and the Strata Titles Act 1985. Failure to comply with regulations leads to legal challenges and financial consequences which damage both the power and functional capability of the strata council (Izanda et al., 2022). Poor bylaw enforcement by management combined with resident violations leads to disruptive situations in shared housing arrangements which require strong conflict management systems to sustain neighbourhood equilibrium. The legal risk experienced by strata communities creates management resource burdens and reduces residents' feelings of safety and equality. Additionally, the lack of proper governance in strata management can result in legal disputes, as disagreements over rules and financial management may escalate into lawsuits, further complicating the management of the property. These outcomes emphasize the importance of effective governance to maintain property values, ensure resident satisfaction, and prevent legal challenges (Johnston & Too, 2015).

### Structural and maintenance risks

The physical structure of the building stands under scrutiny. Neglected maintenance produces major structural problems like roof leaks and foundation problems while increasing repair costs and endangering resident safety (Ashiqin et al., 2023). Preventative maintenance saves infrastructure condition status from

deterioration several setbacks effect timely support when financial shortages exist together with poor management (Zaimah Che-Ghani et al., 2016). A reliable approach to maintenance and structural problems protects building lifespans and keeps residents healthy. Furthermore, maintenance challenges in risk management grow alongside environmental adjustments due to climate change and technology improvements which result in additional elements like sustainable building requirements and data protection threats these challenges highlight the inadequacy of existing management to fully encompass the unique and evolving risk landscape of Malaysian high-rise residential building management (Kathitasapathy et al., 2023).

### **Management and Operational Risks**

The efficiency of building operations remains dependent on the performance quality of the strata council together with property management procedures. Structures of poor governance and hidden transparency combined with ineffective communication diminish trust between management body and residents resulting in reduced cooperation and raised conflict levels (Zahari et al., 2014). The combination of insufficient record management and resource misallocation produces operational inefficiencies and financial issues which create additional operational risk for strata management (Wernz & Deshmukh, 2007).

### **Resident-related risks**

Occupant or tenant of strata actions could lead the building environment because their behaviours create distinct risk. Community harmony breaks down while living quality falls deteriorates because residents fail to follow strata rules while adding noise and pet disturbances (Mehmood et al., 2024). The presence of high vacancy rates creates financial pressure on remaining property owners whom are forced to shoulder heavier burdens which together with resident dissatisfaction reduces their interaction with the community (Suratman et al., 2019). To preserve both peace and fiscal health while ensuring cooperative neighbour relationships within the strata community owners must tackle resident-related risks.

### **Security and safety risks**

Security alongside safety risk stands as the primary concern when protecting the well-being of residents. The risks of building theft along with vandalism and unauthorized access rise due to inadequate security systems despite successful identification of weak surveillance options or short-handed security staff (Poliakova & Grigoryan, 2018). On the other hand, building safety requires thorough compliance to established safety rules and complete emergency planning because for instance fire risks together with poor emergency

preparations threaten both human life and structural assets (Danivska et al., 2019). All residents need stringent security and safety measures to maintain both their comfort and security within their living environment.

### **Environmental Risks**

Natural environmental hazards or natural disaster create an environmental risk that sustainability practices need to mitigate. As reported by the Malaysian Meteorological Department 2023, research shows that strata buildings face a growing threat from natural events such as floods and earthquakes which create destructiveness leading to substantial damage and lifestyle interruptions. The complete health assurance and protection of inhabitants demands urgent handling of environmental threats according (Moulds et al., 2021). Over time strata buildings operate successfully only if environmental risks receive proper management.

### **Technology risks**

Technology risk involves both the implementation and administration of technological systems throughout strata operations. Security in cyber matters presents strong risks to the protection of residents' private data alongside management (Abdul Jalil et al., 2023). Old technology decreases management effectiveness and communication capability then building system breakdowns in heating, ventilation, and air conditioning (HVAC) and elevators destroy residential comfort and security (Pettit et al., 2018). For example, participants within residential settings experience direct effects on their safety and comfort when building systems experience failures from issues like HVAC system malfunctions and elevator or security system breaks which demand immediate repair work and system modernisation.

### **Reputation Risks**

Public perception on strata building comes under its reputation which affects both its market desirability and monetary worth. Property value and occupancy rates suffer when potential renters or buyers withdraw because of negative public perceptions which arise from inadequate property management and ongoing problems (Chua Abdullah & Ramly, 2024). Hence, to ensure continues success, organisations need to actively manage their reputation since a positive community image depends on these efforts (Abdullah et al., 2024).

Therefore, each critical risk categories substantially affect high-rise building management operation together with residential quality of life standards. Strategic risk management plan with proactive attention needs to address these risk categories from financial stability, legal compliance, structural integrity, effective management, security safety practices, environmental sustainability

methods, resident relations quality, technological advancement implementation, till reputation management processes.

## **RESEARCH METHODOLOGY**

This study undertakes a comprehensive review of the literature and selected Malaysian strata cases are incorporated as secondary documentary evidence to examine the risk categories associated with the management of high-rise residential (strata) buildings. The literature selection focused on journal articles, conference papers, legal and regulatory documents, and relevant studies related to strata management, high-rise residential building operations. The reviewed literature was selected based on its relevance to risk issues affecting strata building operations, particularly within the Malaysian context, while also considering international studies that provide useful comparisons.

The analysis of the literature was conducted using a thematic analysis approach. First, repeated issues and problems reported in previous studies were extracted, such as poor maintenance practices and financial constraints. These extracted issues were then group according to their nature and operational implications. For example, issues such as low collection of service charges, inaccurate budgeting, and arrears of bills were grouped under financial risk, while structural defects, poor maintenance, and infrastructure limitations were grouped under structural and maintenance risk. Following the grouping process, similar groups were grouped into broader themes to form the main risk categories. Through this process, nine critical risk categories were identified from financial risk, governance and legal risk, structural and maintenance risk, management and operational risk, resident-related risk, security and safety risk, environmental risk, technology risk, and reputation risk. These categories were developed by comparing recurring themes across the reviewed literature and assessing their relevance to the operation of high-rise residential strata buildings. The identified risk categories were then assessed based on their potential consequences to strata building management. Seven consequence areas were used to interpret the significance of each risk category.

Overall, the methodological process involved four main stages starting from literature identification and selection, extraction of recurring strata management issues, thematic grouping and categorisation of risks, and assessment of risk consequences. This systematic process provides a stronger foundation for identifying risk categories and supports the development of a more structured risk management framework for high-rise residential building management.

## RESULTS AND FINDINGS

### Risk Categories Consequences in High-Rise Residential Building (Strata) Management

The findings of literature review and illustrative Malaysian case evidence reveal that in strata management risks of financial, legal, life-safety, stakeholder trust and operational are all interdependent and together they determine the operation and viability of a high-rise residential building. Poor financial planning, especially arrears in maintenance funding and poor management of reserves, may trigger financial cost stress, thus creating special levies or the need to borrow. Meanwhile, failure to govern or non-compliance with safety can subject the building to regulatory fines, lawsuits, and reputational damage. Life safety risks, including structural collapse or inadequate fire protection, directly jeopardize the welfare of residents and may trigger legal action and increased insurance rates. The lack of stakeholder trust, which is a result of poor communication, unaddressed conflicts, and unattended maintenance further worsens the position of the scheme, thus lowering property values and resident satisfaction. These pressures are compounded by operational inefficiencies, which may be caused by lack of management, misuse of resources, or technological breakdowns, and result in increased spending and poor quality of services. To ensure that these risks are mitigated, active managerial interventions and open communicative approaches are required to maintain a stable, efficient, and harmonious living environment. Table 2.0 below, interpret the consequences likelihood to happens associate with the identified critical risk categories of high-rise residential building management and Table 3.0 are findings from case studies evidence.

**Table 2:** The consequences likelihood to happen due to critical risk categories.

| Impacts                                                                                                                                               | Critical Risk Categories   |           |                            |                      |                     |            |            |                  |               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------|----------------------------|----------------------|---------------------|------------|------------|------------------|---------------|
|                                                                                                                                                       | Structural and Maintenance | Financial | Management and Operational | Legal and compliance | Security and Safety | Technology | Reputation | Resident-related | Environmental |
| <b>Financial cost stress</b><br>(Arkkoll et al., 2013), (Antoniades, 2008), (Peng Au-Yong et al., 2023), (Mohd Tawil Norngainy & Che-Ani A. I., 2010) | ✓                          | ✓         | ✓                          |                      |                     |            |            |                  |               |

| Impacts                                                                                                      | Critical Risk Categories   |           |                            |                      |                     |            |            |                  |               |
|--------------------------------------------------------------------------------------------------------------|----------------------------|-----------|----------------------------|----------------------|---------------------|------------|------------|------------------|---------------|
|                                                                                                              | Structural and Maintenance | Financial | Management and Operational | Legal and compliance | Security and Safety | Technology | Reputation | Resident-related | Environmental |
| <b>Legal and Liability exposure</b><br>(Hamzah & Abdullah, 2018), (Chong et al., 2021), (Zhang et al., 2024) |                            |           |                            | ✓                    | ✓                   |            |            |                  |               |
| <b>Life-safety and Physical harm</b><br>(Zhang et al., 2024), (Dan, 2021), (Gu et al., 2023)                 | ✓                          |           |                            |                      | ✓                   | ✓          |            |                  |               |
| <b>Stakeholder trust and Reputation</b><br>(Ashiqin et al., 2023), (Chong et al., 2021), (Antoniades, 2008)  |                            |           |                            | ✓                    |                     |            | ✓          | ✓                |               |
| <b>Operational performance</b><br>(Dan, 2021), (Arkcoll et al., 2013), (Dan, 2021)                           |                            |           | ✓                          |                      |                     | ✓          |            |                  |               |
| <b>Environmental resilience</b><br>(Farhana et al., 2023), (Ashiqin et al., 2023)                            |                            |           |                            |                      |                     |            |            |                  | ✓             |
| <b>Data and Cyber integrity</b><br>(Spanca & Salihu, 2024), (Sándor & Rajnai, 2023)                          |                            |           |                            |                      |                     | ✓          |            |                  |               |

**Table 3:** Malaysian Case Evidence on Strata Building Risks

| No. | Strata Case Study                                      | Issues                                                                       | Critical Risk Categories                              | Impacts                                                      |
|-----|--------------------------------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------|
| 1.0 | Flat PKNS Tapak Maha, Taman Datuk Harun, Petaling Jaya | Unpaid maintenance fees and owner default                                    | Financial, maintenance, management and operation      | Financial cost stress and operational disruption             |
| 2.0 | Pangsapuri Selayang Segar, Batu Caves                  | Maintenance fee payment, management upkeep issue and local authority concern | Governance, financial and resident related            | Poor upkeep, resident dissatisfaction, operational weakness. |
| 3.0 | Highland Towers, Ulu Klang                             | Drainage, retaining wall and slope-related failure                           | Structural and maintenance, environmental, safety     | Life-safety harm, liability, reputation damage.              |
| 4.0 | PJ8 Service Suite, Petaling Jaya                       | Service charge dispute and tribunal court proceeding                         | Financial and governance                              | Legal liability and stakeholder trust issue                  |
| 5.0 | Verve Suites Mont' Kiara                               | Short-term rental dispute and enforcement of house rules                     | Governance and legal, resident-related and reputation | Legal exposure, community conflict and reputation risk       |

### Financial cost

Financial cost stress in strata schemes can be described as a situation where the owners corporation and by extension individual lot owners are required to cover expenditures that are beyond the expected inflow based on monthly levies and the ability of the sinking fund or maintenance fees. These shortcomings force the corporations to introduce special levies, borrow strata loans, or enforce arrears hence all of which impose a sudden or long-term financial burden on the household budgets (Arkcoll et al., 2013). A previous study proves that almost two-fifths of Australian schemes have already levied at least one special levy, thus showing the extent of the phenomenon and proving that poor reserve planning is one of the main triggers of owner distress (Antoniades, 2008). For example, reports on Flat PKNS Tapak Maha in Taman Datuk Harun, Petaling Jaya, highlighted long-standing unpaid maintenance fees, with one report stating that about 50% of owners had defaulted on the monthly maintenance fee (Bavani, 2023).

The first pathway through which financial cost impact occurs is structural and maintenance risk. Previous empirical survey of high-rise complexes in Malaysia shows that chronic defects such as cracks in the facade, water leakage, and clogged drainage are the most significant cause of unplanned spending since every unaddressed issue accumulates to larger cost repairs in the

long term (Ashiqin et al., 2023). Moreover, Peng Au-Yong et al., (2023) show that there is a statistically significant correlation between the ineffective preventive maintenance procedures and maintenance budget overruns, proving that physical neglect is directly converted into cost variance. Concisely, all deferred repairs translate to future capital shocks, which have to be financed by special assessments or new debt, thus increasing financial cost impacts.

Next, the management and operational risk is a compounding factor that increases the recurrent spending, reduces the revenue collection and continues the financial distress of community bodies corporate like JMB and MC. Mohd Tawil Norngainy & Che-Ani A. I., (2010) reveal that 50% of the strata building surveyed in Malaysia receive less than 50% of the prescribed service charges, generating an ongoing cash-flow deficit that slows down necessary works and triggers a downward spiral of non-payment and increasing arrears. Peng Au-Yong et al., (2023) then single out the lack of staffing, skills, and ineffective procurement as prevailing factors increasing operating expenses and maintenance outages. Duplicated contractor work and reactive maintenance build up, annual budgets are overrun, reserves are drawn down more quickly than anticipated and the building management is forced to request special levies or loans, thereby continuing the financial cost impact.

The three domains of risk that are intertwined, structure and maintenance risk, financial planning risk and managerial risk, interact to create a self-reinforcing cycle of unplanned spending and revenue deficit. The structural failures impose heavy capital needs, the reserve strategies are ineffective or none existent to cushion these needs and the operational weaknesses increase the operating costs and reduce the collection of revenue by imposing levies. The net effect is a state of financial cost impact that threatens the solvency of building management as well as the capacity of residents to afford high-rise residential housing.

### **Legal and Liability Exposure**

Legal and liability exposure in a strata context refers to the likelihood that building management or owners will incur sanctions, claims of compensation or legal action because of a building failing to meet statutory requirements or generally accepted standards of care. The consequences of such exposure usually include tribunal fees, court costs, fines, rectification orders, and high insurance premiums, whereas owners have to deal with personal liability issues and risk losing their reputation (Hamzah & Abdullah, 2018). The PJ8 Service Suite case in Petaling Jaya shows how disagreement over service charges can escalate into tribunal and court proceedings, with the JMB counterclaiming a service-charge shortfall amounting to RM314,086 (Raymond Mah & Fung Kar Men,

2024). Such exposures therefore undermine the financial stability of the common property and undermine the trust that the residents have in the governance system.

Failure of governance is one of the main channels through which liability can occur. Modern empirical studies of the Malaysian Strata Management Tribunal reveal that thousands of cases are recorded annually, many of which are initiated by failure to comply with the procedures of meetings, enforcement of by-laws, or misconduct of joint management body or management cooperation in their fiduciary duties (Hamzah & Abdullah, 2018). (Chong et al., 2021) also show that poor early briefings and poor stakeholder communication significantly raise the frequency of such disputes, thus causing legal costs, delaying decision making, and causing reputational damage.

Risk that are related to security and safety are equally a powerful source of liability. Zhanget al., (2024) reveal that the lack of fire protection and limited access to the appliances are the key factors that determine the occurrence of severe loss events in Chinese high-rise building, which highlights the legal responsibility of the management to ensure life-safety systems. Taken together, these studies demonstrate that physical safety deficiencies may trigger class actions, mandatory remediation orders, and increasing premiums each of which is a legal liability consequence.

### **Life safety and Physical harm**

The sphere of strata building of life safety and physical harm risk includes those conditions that endanger the lives of occupants or cause them bodily harm, such as fires, structural collapse, equipment failures. The occurrence of these risks triggers the direct humanitarian impact, puts strata title committees in the line of fire, and can necessitate mandatory evacuation or compulsory rectification orders that ripple into the scheme finances and reputation.

Fire remains the most serious life safety hazard facing high-rise residential building, in large part due to high occupancy levels, limited escape routes, and high levels of combustible materials. (Zhang et al., 2024) show that residential towers with poor fire safety facilities have not only a high rate of fire incidence but also a greater level of negative consequences. These results confirm the legal duty that is placed on building managers to maintain safety systems that meet the existing building codes.

According to Dan, 2021 outlined repeated failures in cantilever-slab fractures, surface spalling, and balcony railing detachment, which were attributed to injuries and could lead to deaths victims. The study showed how the latent design defects in common property can unexpectedly transform the normal wear into life safety disasters. A case study of Highland Towers Condominium collapse in Taman Hillview, Ulu Klang, Selangor demonstrates unstable

foundation, inadequate drainage, retaining-wall failure, and human reliability can escalate into severe physical harm (Bin Azuwa & Bin Mat Yahaya, 2023).

The third channel of harm is technological failures, especially elevator entrapment. Gu et al., (2023) also emphasised that the breakdown of elevator systems in a dense urban cluster would be even more dangerous in the case of an earthquake, as it could leave passengers trapped.

### **Stakeholder trust and Reputation**

Trust and reputation of stakeholders in strata schemes are essential pillars that support the sustenance of peaceful communal coexistence and effectiveness of governance. The instances of governance failure, such as ineffective communication or lack of transparency, may have a significant adverse effect on the confidence of the stakeholders. Ashiqin et al., (2023) reveal that in the case of management bodies that experience insufficient interaction with owners, especially at the Annual General Meeting (AGM) or other critical decision-making points, the level of resident dissatisfaction increases and the reputation suffers. These findings support the importance of frequent, transparent communication as a necessary condition to maintain trust and reduce conflicts. In its turn, evidence of governance studies shows that unresolved disputes over common area use or financial mismanagement, when not addressed, contribute to the development of negative perceptions, further degrading reputation and overall satisfaction (Chong et al., 2021).

Previous record studies have linked substandard maintenance and safety related incidences to reputational damage that is attributed to strata schemes in Australia. Antoniadis, (2008) states that the strata management failures such as frequent flooding or structural flaws erroneously reduce the satisfaction of the residents and destroy the interpersonal trust. When such issues are not addressed in a timely manner, they often lead to complaints by the people and media coverage, which damages the image of the scheme. Failure to carry out repairs and maintenance for a long time can also affect the sale of the property and deter potential tenants, thus affecting the image and financial stability of the strata community.

### **Operational performance**

Operational performance consequences refer to the level of efficiency and effectiveness that defines the day-to-day management operations especially maintenance activities, financial management, security operations as well as the extent of communication between management body and residents. When performance in the operations is low, high costs, low quality of life and widespread dissatisfaction among residents usually follow, endangering property values and lowering resident retention rates. In addition, the Verve Suites Mont'

Kiara case demonstrates how house rules, short-term rental activities and residents' use of strata parcels can create legal and governance challenges (Tuan Mat et al., 2020). On the other hand, an excellent performance of operations allows an easy management of the common property resources, increases the satisfaction of residents and encourages the long-term sustainability of the building.

Unacceptable performance of the operations often leads to high maintenance expenses. Poor maintenance planning and poor repair implementation increase the overall financial expenditure in the long run. The study conducted by Peng Au-Yong et al., (2023) shows that postponed maintenance, namely, the postponement of plumbing or structural repairs, usually ends up with a more costly remedial action later. This inefficiency increases the financial strain on strata cooperation management necessitating reallocation of funds across other budget items or introduction of special levies the cost pressure that follows only adds to the financial pressures already being experienced.

Inefficiencies in operations are a chronic problem in the strata housing. As the study by Arkcoll et al., (2013) shows, inappropriate financial management and failure to adhere to the planned operation budget may force strata corporations to spend more than they should. This kind of misuse of resources worsens the state of the common areas and lowers the overall quality of services provided to the residents. Poorly planned and implemented spending on key services such as cleaning, landscaping, and building security reeves dissatisfaction among property owners, creates conflict, and finally, lowers assessed values. Similarly, the case of Pangsapuri Selayang Segar in Batu Caves illustrates the connection between resident payment behaviour, JMB formation, common property upkeep and local authority intervention. These cases reflect the interdependence between financial risk, management and operational risk in strata building operations (Chen, 2026).

In addition to operational inefficiencies, security failures are another vector that may decrease performance. According to Dan, (2021), poorly maintained or insufficiently financed security systems, such as the access control systems of the building or video surveillance, increase the likelihood of safety violations, which undermines the feeling of security and the general confidence in management among residents. The more the security concerns, the worse the operational performance as more resources are needed to curb the same.

### **Environmental resilience**

Environmental resilience has become a key managerial issue in high-rise residential buildings over the past years. Failure to consider resilient design and maintenance activities is likely to increase maintenance cost, trigger property deterioration, subject property owners to regulatory fines, and reduce asset value.

In the field of sustainable building design, reducing the energy requirement of a building is one of the most important factors that determine the overall performance. According to the results of Ashiqin et al., (2024), high-rise buildings with energy efficient technologies, demonstrate a lower level of operational expenses, which is explained by the decreased reliance on external sources of energy and drinking water. On the other hand, the failure to implement such sustainability interventions is associated with high utility costs, increased carbon footprint, and increased exposure to environmental fluctuations.

Furthermore, the direct impact of environmental resilience is on property values. The modern market players are placing high value on the assets that have sustainable characteristics. The properties with increased energy efficiency, resilience to climate effects and compliance with environmental regulations are typically evaluated as more appealing investment. Past studies show that such assets fetch better resale prices and have an increased demand. Farhana et al., (2023) in their study further show that real estate units that incorporate sustainability features, that is, energy-efficient lighting and climate-responsive design, perform better than traditional properties in marketability. In comparison, buildings that do not consider the resilience of the environment can face low marketability, triggering a decline in property values and negative impacts on the financial returns.

#### **Data and Cyber integrity**

Data management systems are currently a part and parcel of strata housing operation. The online platforms regulate communication, maintenance, security, and financial management in high-rise residential buildings. Even though such integration can be used to improve organisational efficiency, it also comes with significant risks of data security and vulnerabilities to cybersecurity attacks. The breach of data is one of the biggest risks to privacy, may interfere with regular business, and subject strata management bodies to legal and financial consequences. The management expose sensitive information, thus making identity theft, financial fraud, and reputation damage more probable (Spanca & Salihu, 2024).

The above highlight the likelihood of occurrence from various risks in high-rise residential building (strata) management. Having identified the most significant relationships between specific risks and their influence on the strata community, the research provides an in-depth understanding of how the operational, financial, legal, and safety issues can affect the stability and performance of high-rise residential projects. Most of the risk have consequences on life safety physical harm, operational performance and data cyber security towards high-rise residential (strata) management. Hence, it is vital to propose a

systematic, efficient risk management framework for high-rise residential building management.

## CONCLUSION

This study identified nine critical risk categories affecting high-rise residential building operations in Malaysia, namely financial, governance and legal, structural and maintenance, management and operational, resident-related, security and safety, environmental, technological, and reputational risks. The findings show that these risks are interdependent, where poor financial management may delay maintenance and affect safety, while weak governance may increase legal disputes, reduce resident trust, and disrupt operational performance. Therefore, risk management in strata buildings should be treated as an integrated governance and operational process rather than a fragmented response to individual problems. The study recommends that JMBs, MCs and property managers adopt a structured risk management approach based on MS ISO 31000 or AS/NZS ISO 31000, including the preparation of a building risk register, classification of operational risks, probability and impact assessment, assignment of responsible parties, and periodic review of mitigation actions. For policymakers, the findings suggest the need to strengthen strata governance through annual risk management plans, standardised risk reporting templates, and clearer guidance for COBs, JMBs and MCs in managing financial, maintenance, legal, safety, environmental and technological risks. Future research should validate the identified risk categories through interviews, focus group discussions or surveys involving strata stakeholders, develop a strata-specific risk assessment matrix, and compare risk priorities across strata buildings. Overall, this study provides an initial foundation for developing a practical risk management framework that can improve decision-making, reduce disputes, protect property value and promote safer and more sustainable high-rise residential communities. Finally, this research presented in this paper is initially and part of an ongoing PhD research in design and built environment of Universiti Teknologi MARA.

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