

# Factors for Effective Repair and Maintenance Services in the Housing Industry: A systematic literature review

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## Abstract

Most of the residents in high-rise housing do not realise the importance of proper building management until the physical buildings and shared facilities have deteriorated. Accordingly, this paper identified the factors for effective repair and maintenance services in a housing setting by utilising a systematic literature review method. Relevant information was analysed through content analysis techniques across various peer-reviewed journal articles. The results yielded the potential factors for effective repair and maintenance services in high-rise housing. This study thus contributes to the field by deriving valuable reference for property management companies tasked with managing such houses in consideration of the factors necessary for effective repair and maintenance towards building quality and sustainability.

Keywords: high-rise housing; house; effective repair and maintenance services

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DOI: <https://doi.org/10.21834/aje-bs.v5i15.358>

## **1.0 Introduction**

The world is undergoing a booming urban population growth, thereby resulting in an increased population density. According to the United Nations (UN) (2018), the global urban population snowballed from 751 million in the 1975s to 4.2 billion in 2018. In particular, 82 % of the North American population was recorded to live in the urban areas in 2018, while Latin America and the Caribbean reported an urban population of 81 %, followed by Europe (74 %) and Oceania (68%). Collectively, these locations are deemed the most urbanised regions across the world. In contrast, the Asian region is associated with the level of urbanisation that is currently approximating to 50 % of the population. This phenomenon greatly affects the housing stock demand; the scarcity of land areas has resulted in urban cities and their incapability to expand horizontally further. Consequently, high-rise strata housing as a possible solution in order to cater to the increasing population growth and development density in such areas (Verhaeghe, Coenen, and Putte, 2016).

Unlike the free-standing houses, high-rise type of living areas come complete with the facilities and amenities allocated at the common areas (Musa, Sarip, Aziz, Hanif, Al-Sadat, and Tedong, 2015), such as parking area, lighting, lifts, swimming pool, gym, and other developer-provided common facilities. With adequate management and maintenance, these components can create and sustain a healthy living environment (Sia, Yew, Lim, and Dongqing, 2017). However, this type of housing is less satisfactory compared to other housing forms (Gifford, 2011), as it poses higher risks in older buildings as opposed to the large and modern ones. These risks may result in catastrophic consequences should any building failures occur (Yau, Ho, and Chau, 2008), whereby ignorance in taking care of such buildings may further lead to high levels of housing deterioration (Ganisen, Nesan, Mohammad, Mohammed, and Kanniyapan, 2015; Vergara, Gruis, and Flier, 2019). Such elements collectively and undoubtedly render an increase in maintenance activities and the ultimatum of unreliable operation costs (Ganisen et al., 2015; Mohamed Isa and Usmen, 2015).

High-rise type of housing relies on the category of residential management (e.g. management body or property management companies) due to the negative impact of poor management execution upon quality governance, which affects the way the building is managed and maintained. Therefore, controlling the root cause of maintainability risks preserves the structure physically and ensures the facility performance (Silva and Ranasinghe, 2010). Accordingly, a capable management team is crucial to guarantee the appropriate management and maintenance of a building. Previous findings have reported that organisations that can properly manage such buildings are positively correlated with the building performance (Au-Yong, Shah Ali, Ahmad, and Chua, 2017). Qualitative findings by Levy and Sim (2014) have further reiterated the influence of the practices undertaken by a management body in managing the buildings towards the satisfaction level of their residents. In the same vein, earlier research by Christudason (2008) has underlined the choice of a veritable residential management housing involves the act of making discreet inquiries on the prior track records. This is attributable to their consequent impact

on the performance of the building. In concurrence, current research works undertaken by using quantitative methods and expert interviews have proven that active collection and timely response to new information contribute towards building performance. This includes the elements such as resident complaints or facility failures, which are documented on an ongoing basis, and the subsequent progression towards effective repair and maintenance of the management (Shin, Soo Lee, Park, and Lee, 2018).

In western countries such as New Zealand, Levy and Sim (2014) have reported that the residents opt to replace the management body due to them experiencing dissatisfaction and frustration of the managerial performance. Meanwhile, Tucker, Turley and Holgate (2014) have identified the critical factors towards cost-effectiveness in dealing with uncertain financial conditions in social housing maintenance management in the context of the United Kingdom (UK). Meanwhile, a study based in Australia by Johnston and Too (2015) has upheld the notion that poorly executed management systems result in negative quality governance, which in turn leads to various issues. They include committee and management issues, meeting issues, transparency and accountability issues, business activity issues, financial management issues, administration issues, by-laws issues, and asset and shared property issues. In Asian countries, previous studies have recorded the prevalence of practices such as dealing with collective action problems (Chu, Chang, and Sing, 2013; Ho and Gao, 2013), free-riders (Christudason, 2004; Yau, 2018), and power monopoly (Lam, 2008), as well as their link with an ineffective maintenance management problem.

Similarly, in Malaysia, ineffective maintenance management is a critical issue in dealing with high-rise strata housing. In line with the trend of high-rise housing, this study is imperative to safeguard the implications of high-rise strata housing growth. The abundance of studies depicting the factors of effective repair and maintenance services in non-residential buildings is undeniable but reviews of studies undertaken in a housing setting are lacking. Therefore, this paper aims to identify the factors for effective repair and maintenance services in a housing setting.

## **2.0 Methodology of the study**

A systematic review is an examination of formulated questions, which utilises systematic and explicit methods to identify, select, and critically appraise relevant research and to collect and analyse data sourced from studies included in the review. The conduct of the systematic review is thus in line with the Preferred Reporting Items for Systematic Reviews Statistical and Meta-Analyses (PRISMA) Standard (Moher, Liberati, Tetzlaff, and Altman, 2009). It involves the identification of literature and the eligibility and exclusion criteria, followed by data abstraction and lastly, analysis.

## **3.0 Literature Identification**

Identification of literature undertaken was via queries into the databases of peer-reviewed

sources, namely Web of Science (WoS) and Scopus. The publication selection across these two databases encompasses more than 20,000 journals under the umbrella of 256 disciplines. During this phase, the queries were made according to specific keywords (see Table 1), whereby the search resulted in 95 articles. Table 1 summarises the search string.

Identification of additional records was completed by examining the reference list containing all articles recovered through the database search in order to capture any relevant studies that were missing when using the search strategy detailed in the menu above.

Table 1: The search string for the systematic review process

Databases	Keywords used
Scopus	TITLE-ABS-KEY (("Efficient maintenance management" OR "effective maintenance management" OR "maintenance management" AND "house**") AND (LIMIT-TO (DOCTYPE , "ar" ) ) AND (LIMIT-TO (LANGUAGE , TS = (("Efficient maintenance management" OR "effective maintenance management" OR "maintenance management" AND "house**"))
Web of Science	

(Source: Authors' sources)

#### 4.0 Eligibility and exclusion criteria

At this stage, eight duplicate materials were removed out of 95 items identified prior. Screening of the identified literature was according to several eligibility and exclusion criteria. First, with regard to the literature type, only journal articles with empirical data were selected. The resulting selection excluded review articles, conference proceedings, books, book series, and chapters in books. Secondly, the authors only considered peer-reviewed articles written in the English language and obtained from scholarly journals in order to avoid any confusion and difficulties during the translation process. Thirdly, in terms of the timeline, a period of the last ten years (from 2009 to 2019) was selected, which was deemed an adequate duration to observe the evolution of research and related publications. Lastly, in line with the study objectives focused on the factors for effective repair and maintenance services, only articles emphasised on building maintenance were chosen (see Table 2).

Table 2. The Inclusion and Exclusion Criteria

Criterion	Eligibility	Exclusion
Literature type	Journal (research articles)	Review articles, conference proceedings, book, book series, and chapter in books
Language	English	Non-English
Timeline	Between 2009 to November 2019	<2009

(Source: Authors' sources)

The process resulted in the exclusion of 59 journal article, whereas the remaining 21 items were processed for their final eligibility before further analysis (see Fig. 1).

#### **4.1 Data abstraction and analysis**

Assessment and analysis of the remaining articles were done by reading through their abstracts. Subsequently, an examination of the full-text articles identified the themes and sub-themes and filtered according to the objectives of this paper. The establishment of such themes and sub-themes incorporated the content analysis of data related to effective repair and maintenance in the housing industry context.

#### **4.2 Result of the study**

The review resulted in six themes and 12 sub-themes concerning the factors of effective repair and maintenance services. The six main themes were resident expectation (i.e. one sub-theme), staff competence (i.e. two sub-themes), learning and growth (i.e. two sub-themes), financial (i.e. two sub-themes), physical building conditions (i.e. three sub-themes), and strategic management (i.e. two sub-themes). The results yielded a comprehensive analysis of the current factors for effective repair and maintenance services. A majority of the studies employed quantitative approaches. Meanwhile, those utilising qualitative and mixed-method ranged from experiences sourced in Malaysia, Saudi Arabia, Nigeria, Taiwan, China, Hong Kong, United Kingdom, Chile, United States, and Australia. The 1<sup>st</sup> para should start here.

#### **4.3 Findings of the study**

This section concentrates on the main factors of effective repair and maintenance in the housing industry, specifically resident expectation, staff competence, learning and growth, physical building conditions, financial management and strategic management (See Table 3).

##### **4.3.1 Resident Expectation**

Resident expectation ultimately requires managerial organisations to consider the inhabitants' needs. These organisations should further allocate the organisational performance as neither under nor over performing. Nine articles identified have studied this particular factor in attaining effective repair and maintenance services (i.e. Tan, Shen, Langston, Lu, and Yam, 2014; Tucker, Turley, and Holgate, 2014; Wang, Chang, Zhang, Qin, and Jiang, 2015; Ganisen, Mohammed, Nesan, and Kanniyapan, 2015; Mukhtar, Amirudin, Sofield, and Mohamad, 2017; Au-Yong, Azmi, and Mahassan, 2018; Au-Yong, Ali, and Chua, 2019; Sivanathan, Juhari, Khair, Thanaraju, Azmi, and Khan, 2019; Vergara, Gruis, and Flier, 2019). In particular, this factor is a significant determinant for efficient repair and maintenance services in order for the organisation to provide quality goods and services, effective delivery, and ensure overall resident satisfaction (Amaratunga and Baldry, 2003).

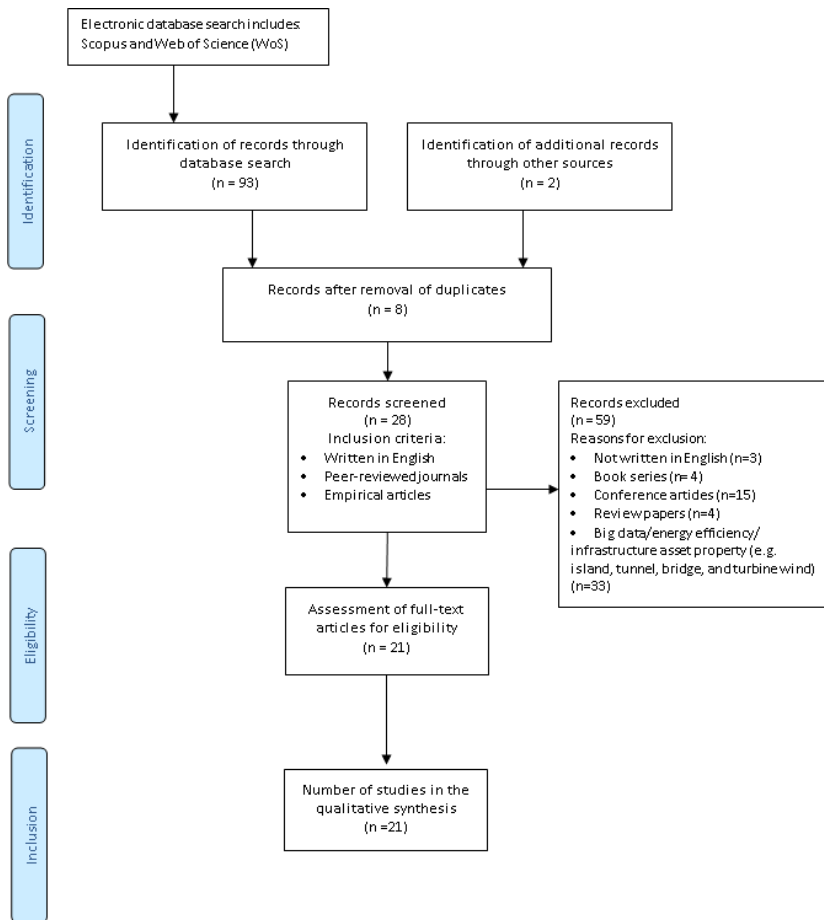


Figure 1: The flow diagram of the research. (Adaptation from Moher et al., 2009)

### 4.3.2 Staff Competence

The competence of the staff roster consists of specific knowledge, motivation, skills, or social characteristics and roles per the demands of an organisation. A total of three articles have reported on this factor as one of the determinants for effective repair and maintenance in housing buildings. Under the theme, two sub-themes are identified, namely skilled personnel and experienced personnel.

According to Wang, Chang, Zhang, Qin, and Jiang (2014), staff competence promotes professional levels of service and improves the quality of repair and maintenance operations in Taiwan and China. Therefore, a personnel qualification certification system is

necessary for any individual aspiring to join the repair and maintenance operations. In Hong Kong, the company certification practice reflects the reputation of as company: it indicates that they employ qualified staff only (Tan, Shen, Langston, Lu, and Yam, 2014). Furthermore, it is believed that skilled and experienced personnel can provide quality service delivery in terms of repair and maintenance activities. Meanwhile, a study by Akinsola, Hussaini, Oyenuga, and Fatokun (2012) has focused on adequate and skilful personnel characteristics in order to avoid job delays, whereby it indicates that the maintenance team promptly responds to any complaints received.

#### **4.3.3 Learning and Growth**

The learning and growth factor pertains to the extent to which an organisation learns and improves its performance continuously. Scrutiny onto a total of three studies highlighting this element thus establishes two sub-themes, namely adapting to changes and technology advancement. According to the articles, the employee ability towards adapting to any changes (Perkins, Grey, and Remmers, 2014) and technology advancement (Lin and Su, 2013; Assaf, Al-Hammad, and Al-Shihah, 2010) is vital in ensuring one's alignment with the organisational goals. Hence, organisations focusing on effective repair and maintenance must create long-term growth and improve continuously. The competence of the staff roster consists of specific knowledge, motivation, skills, or social characteristics and roles per the demands of an organisation. A total of three articles have reported on this factor as one of the determinants for effective repair and maintenance in housing buildings. Under the theme, two sub-themes are identified, namely skilled personnel and experienced personnel.

#### **4.3.4 Financial Management**

The financial factor is deemed as essential to the organisational survival in managing and running repair and maintenance activities towards achieving a sustainable building life. Three studies have emphasised on the sub-themes of budget allocation (Syah Ali, Kamaruzzaman, Sulaiman, and Au-Yong, 2010; Akinsola et al., 2012; Au-Yong, Jin, et al., 2019) and collection of fund from the residents (Syah Ali, Kamaruzzaman, Sulaiman, and Au-Yong, 2010; Wang et al., 2015; Vergara, Gruis, and Flier, 2019).

In high-rise strata housing, loan facilities are crucial to pay the management fund for administration and utilities, exclusive facilities, and necessary facilities, respectively, as well as the maintenance fund for support facilities and management sinking fund (Abd Wahab, Che Ani, Sairi, Mohd Tawil, and Abd Razak, 2016). Financial management, in particular, plays a key role in the housing industry as various management tasks, especially the maintenance activities, are only possible with sufficient financial resources. Therefore, the management should creatively manage the issue of defaulters in order to minimise arrears from occurring.

#### **4.3.5 Strategic Management**

Strategic management is the organisational management resource towards achieving its

goals. Three studies out of 17 articles reported quality improvement and response time as the critical factors for effective repair and maintenance services. Accordingly, Assaf et al. (2010); Tucker, Turley, and Holgate (2014); and Vergara et al. (2019) have highlighted quality improvement as a necessity in maintaining the business and building-related trust between the management body and residents. Besides, the response time following complaints lodged can impact the residents' level of satisfaction (Akinsola et al., 2012; Tan et al., 2014; Vergara et al., 2019). The faster response is elicited, the higher the residents' satisfaction.

#### **4.3.6 Physical Building Condition**

Almost half of the identified articles focused on the factor of physical building condition. The findings obtained underlined this factor as the most critical determinant among those identified in this study as its frequency was the highest. Data analysis subsequently established three sub-themes, namely: building materials (Syah Ali et al., 2010); building age (Syah Ali et al., 2010); and building design (De Silva et al., 2012; Ganisen, Mohammed, Nesan and Kanniyapan, 2015; Sajan, 2015; Adewunmi, Omirin, and Koleoso, 2016; Mukhtar, Amirudin, Sofield, and Mohamad, 2017; Vergara et al., 2019; Fatayer, Hassanain, Abdallah, and Al-Hammad, 2019).

A total of six articles have emphasised on the design adequacies, which affect the effectiveness of the repair and maintenance activities undertaken during the post-occupancy period. Additionally, Syah Ali et al. (2010) have reiterated that quality materials and specification compliance both influence the effectiveness of maintenance works conducted. Finally, the third sub-theme (i.e. building age) as seen from later research works has indicated that the age of a building may impact the effectiveness of the repair and maintenance works.

## **5.0 Discussion**

This study attempted to systematically analyse existing studies on the factors of effective repair and maintenance services in the housing industry. In general, preserving the physical building condition could maintain the sustainability and lifespan of housing. Consequently, an increase in the high-rise strata housing stocks during the current years is a vital signal for the government and developers alike in order to highlight the issue.

The review sourced from two databases revealed 21 articles detailing the factors of effective repair and maintenance services in the housing industry. Within the evaluative scope, six themes and 11 sub-themes emerged, namely resident expectation, staff competence, learning and growth, financials, strategic management, and physical building conditions.

More than half of the identified articles concentrated on the element of building design. This shows that managing the repair and maintenance management across the housing setting is a complex issue as it involves pre and post-construction involvement of the



stakeholders, encompassing the initial stage of design until the end of building life. The root of maintenance risk should thus be taken into consideration from the stage of the schematic design itself by the design team, as well as the developer. These parties should be aware that their design can minimise the operation maintenance cost for the whole building life cycle, thereby rendering the facility managers' experience and knowledge as highly pivotal. Additionally, the property management performance and work culture should further implement practices such as dealing with human behaviour, debt collection, and prioritisation of the maintenance activities.

## 6.0 Conclusion and Recommendations

The results indicated six potentially significant factors and variables for effective repair and maintenance services in the housing setting, namely resident expectation, staff competence, learning and growth, financials, physical building conditions, and strategic management. Collectively, the findings obtained were one of the first attempts towards building a complete theory in the maintenance housing setting, thus offering significant implications for an effective repair and maintenance management in general. Nonetheless, the study is not exempted from limitations.

Table 3: The findings of the study

Theme	Sub-theme	References
Resident Expectation		Tucker, Turley & Holgate (2014); Tan, Shen, Langston, Lu & Yam (2014); Wang, Chang Zhang, Qin & Jiang (2014); Ganisen, Mohammed, Nesan & Kanniyapan (2015); Mukhtar, Amirudin, Sofield & Mohamad (2017); Yong, Azmi, Mahassan (2018); Sivanathan, Juhari, Khair, Thanaraju, Azmi & Khan (2019); Yong, Ali, Chua (2019); Vergara, Gruis & Flier (2019)
Competence Staff	<i>Skilled personnel</i>	Akinsola, Hussaini, Oyenuga & Fatokun (2012); Tan, Shen, Langston, Lu & Yam (2014); Wang, Chang Zhang, Qin & Jiang (2014)
	<i>Experience personnel</i>	Tan, Shen, Langston, Lu & Yam (2014); Wang, Chang Zhang, Qin & Jiang (2014)
Learning & Growth	<i>Adapt changes Technology advancement</i>	Perkins, Grey & Remmers (2014) Assaf, Al-Hammat, Al-Shihah (1995); Lin & Su (2013)
Financial Management	<i>Collection Fund</i>	Syah Ali, Kamaruzzaman, Sulaiman & Yong (2010); Wang, Chang Zhang, Qin & Jiang (2014); Vergara, Gruis & Flier (2019)
	<i>Budget Allocation</i>	Syah Ali, Kamaruzzaman, Sulaiman & Yong (2010); Wang, Chang Zhang, Qin & Jiang (2014); Vergara, Gruis & Flier (2019)
Physical Building Condition	<i>Building material</i>	Syah Ali, Kamaruzzaman, Sulaiman & Yong (2010)
	<i>Building age</i>	Syah Ali, Kamaruzzaman, Sulaiman & Yong (2010)
	<i>Building design</i>	De Silva, Ranasinghe & De Silva (2012); Wang,

Strategic Management	<i>Quality Management</i>	Chang Zhang, Qin & Jiang (2014); Ganisen, Mohammed, Nesan & Kanniyapan (2015); Sajan (2015); Adewunmi, Omirin & Koleoso (2016); Fatayer, Hassanain, Addallah & Al-Hammad (2019)
	<i>Response Time</i>	Assaf, Al-Hammat, Al-Shihah (1995); Tucker, Turley & Holgate (2014); Vergara, Gruis & Flier (2019)
		Assaf, Al-Hammat, Al-Shihah (1995); Akinsola, Hussaini, Oyenuga & Fatokun (2012); Tan, Shen, Langston, Lu & Yam (2014); Vergara, Gruis & Flier (2019)

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Ultimately, one should give caution in subjecting a generalisation of the results obtained unto a property management company. The authors are otherwise of the opinion that these factors are neither feasible nor necessary. Therefore, future works may integrate more than ten years' worth and duration of study materials and reviews in order to identify more factors of effective repair and maintenance services in the housing industry. As this work is conceptual in nature, empirical work is thereby necessary to refine and validate these factors.

## Acknowledgement

The authors wish to express their gratitude towards Universiti Teknologi MARA, Perak Branch, Seri Iskandar Campus for the support in the form of a grant [900-KPK/PJ/GKIPP/01(0013/2018)], which made this paper possible. The authors also wish to acknowledge two anonymous referees and the managing editor of this conference for their constructive comments, which have greatly improved the paper. Acknowledge the body which funded the study.

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