

Maintenance priority in high-rise housings: practitioners' perspective versus actual practice

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ABSTRACT

Residential buildings need proper building maintenance management to allow residents living in comfort and building owners to preserve their properties. Apart from ensuring the safety of residents, the aesthetic values of the building can be also preserved. Maintenance priority plays a vital role in enhancing the maintenance management process, especially when the building managers face budget and cost constraints. It has been a challenging task for the decision maker to decide which maintenance work should come first. Many practitioners have been determining maintenance priority in a cursory manner simply based upon biased past experience, subjective or personal evaluation, and conservative decisions, and some even use a specific building maintenance manual by default without making a deliberated choice. Thus, this research seeks to investigate the differences between perspective and actual practice of practitioners in prioritising the maintenance of building facilities and services. A questionnaire survey was conducted among building maintenance personnel for high-rise residential buildings in Peninsular Malaysia with 321 valid questionnaire responses. Wilcoxon signed-rank test was performed to examine the difference between practitioners' perspective and actual practice towards maintenance priority of building facilities and services. The findings revealed that facilities that deal with daily necessities and safety such as power supply, water supply, lift system, and fire protection system were ranked higher in both practitioners' perspective and actual practice compared to other facilities and services. It is also proven that there is a significant difference between practitioners' perspective and actual practice towards all building facilities and services.

Keywords: building facilities; building maintenance; building services; maintenance priority; residential building.

INTRODUCTION

In Malaysia, the trend of maintenance is more towards reactive approach where repair and replace works are carried out upon breakdown. Meanwhile, Lateef (2008) mentioned that building maintenance in Malaysia is conditionally driven and is usually performed when there is budget allocation. Maintenance managers are still practising inappropriate procedures in maintenance management without considering the clients and users' satisfaction as well as the building and services performance (Zawawi et al., 2011) whereby preventive maintenance is often neglected or underutilised, as the public do not see the direct benefits of it.

Lack of concern towards building maintenance, especially preventive maintenance, happens in domestic housing industry (Tiun, 2009; Yusof et al., 2012). The poor maintenance in majority of the high-rise housing schemes is mainly due to the inadequate maintenance fund (Abd Wahab et al., 2016). Subsequently, many complaints of dissatisfaction towards dilapidated condition of the residential buildings and the poor condition of facilities and services are recorded (Abdul Karim, 2012). Thus, it is urgent to improve the maintenance management in high-rise residential building in order to achieve the strategic thrust of providing adequate, affordable, and quality houses, with greater prominence given to a good environment under Malaysian Vision 2020 (Zairul et al., 2015).

Public often overlooked the importance of building maintenance, especially when extensive cost is required for maintenance operations (Lateef, 2008). In fact, the public must be aware of the importance of maintenance and practise the maintenance culture. Abdullah Sani et al. (2012) defined maintenance culture as “*the value, way of thinking, behaviour, perception, and the underlying assumptions of any person or group or society that considers maintenance as a matter that is important (priority) and practices it in their life*”. He further mentioned that a person or group who practises maintenance culture would intend to maintain, preserve, and protect the facilities from being deteriorated or damaged.

Numerous researches have suggested the scheduled maintenance as a strategy to tackle the issues (Au-Yong et al., 2013; Flores-Colen & De Brito, 2010; Forster & Kayan, 2009). However, the success of the maintenance strategy cannot be attained without proper planning of maintenance priority, specifically when time and cost are critical concerns (Edward et al., 1998; Eti et al., 2006; Irigaray & Gilibert, 2009; Wu et al., 2006). Therefore, prioritising the maintenance of different building facilities and services might be beneficial to optimise the cost performance and occupants' satisfaction. Yet, the gap between the planning and implementation of maintenance priorities remains unknown due to the contradicting maintenance preferences between residents and maintenance practitioners (Yusof et al., 2012). As such, this paper aims to investigate the maintenance priority towards building facilities and services of high-rise residential building in the aspects of practitioners' perspective and actual practice.

MAINTENANCE PRIORITY

Due to time or budget constraints, maintenance prioritisation is introduced, where it secures the maintenance fund for the tasks with higher priority. Shen (1997) mentioned a developed guideline for determining the maintenance priorities as follows in descending order:

- a) Work necessary to maintain the safety of occupants (e.g., building structures).
- b) Work necessary to ensure property habitable (e.g., aspects of hygiene, security, electrical, and water supply).
- c) Work necessary to retain buildings operable (e.g., vertical transportation system and telecommunication system).
- d) Work necessary for the property appearance, the provision or upkeep of non-essential services or facilities (e.g., swimming pool and landscaping).

Setting up the maintenance priorities is a difficult task even by the professional property managers (Shen et al., 1998) whereby the determination on maintenance priority is based on subjective or personal evaluation, which usually implicates the insufficient resources and inadequate budget (Yusof et al., 2012). Chew et al. (2004) argued that it is difficult to implement the maintenance priority as many parties such as building owners, occupants, or residents, and property managers, are reluctant to spend more on achieving better maintenance standard.

However, prioritising the maintenance tasks of building services and facilities is critical. Commonly, maintenance actions are prioritised by taking into consideration the cost and risk factors, which seek to minimise the risk of failure whilst maximising maintenance performance (Sharp & Jones, 2012). Velmurugan and Dhingra (2015) stated that the priorities of maintenance work order contribute to the effective implementation of maintenance strategy. Sometimes, maintenance priorities are compulsory when they involve the corrective maintenance for severe facilities (Ismail, 2014).

Therefore, maintenance priorities assist the maintenance personnel and buildings' owners to address the maintenance issues that are most critical and subsequently allow them to deliver maintenance that better meets the occupants' needs (Sharp & Jones, 2012).

BUILDING SERVICES AND FACILITIES THAT REQUIRE MAINTENANCE

Commonly, buildings deteriorate under different circumstances, such as wear and tear, climate change, and ageing process. Taking into cognizance the high occupancy rate in high-rise housings, adequate care and maintenance is necessary to slow down the deteriorating rate or prolong the buildings and systems lifetime at an acceptable operating

condition. Hence, the property value and return on investment can be retained (Tiun, 2009). In fact, execution of maintenance works is essential to secure the habitability of property and operability of building (Yusof et al., 2012).

Anyhow, the public is demanding more towards quality living nowadays. Instead of buying a house with basic amenities, the house buyers prefer to buy a housing property fitted out with value-added facilities like sport facilities, swimming pool, landscaping, and others (Tiun, 2009), whereby the availability of building services such as power supply, water supply, sewerage and drainage, telecommunication, lifts, security, and fire services systems, as well as the value-added facilities, is now on high demand (Mohit et al., 2010). The design and construction of high-rise housings become even more sophisticated. Unavoidably, all the facilities require maintenance to upkeep their conditions in operable standard.

Table 1. Facilities and services that require maintenance.

Facilities and Services	Citations
Lift system	Alonso Pérez et al. (2010); Kamarazaly et al. (2013)
Water supply	Goulden and Spence (2015); IFMA (2015); Park et al. (2015)
Power supply	Suruhanjaya Tenaga (1994); Moreno-Muñoz et al. (2007); Meng (2013); Hassanain et al. (2015); Suárez-Warden and Mendivil (2015)
Security system	Williamson et al. (2013); Caballé et al. (2015); Walker and Tough (2015)
Fire protection system	Azmi et al. (2009); Harris (2011); Xin and Huang (2013); Festag (2016); Fleming (2016); Yao et al. (2016)
Cleaning services	Choi et al. (2015); Leone et al. (2015); Ait Bamaï et al. (2016); Fattorini et al. (2016)
Landscaping and gardening	Olesen et al. (2013); Korpela et al. (2015); Othman et al. (2015); Wu et al. (2016)
Painting	Lo et al. (2016); Pan et al. (2016); Said et al. (2016)
Swimming pool	Righi et al. (2014); Arkanova and Kuznetsova (2016); Tardif et al. (2016); Tomlinson et al. (2016)
Sport and recreational facilities	Chow (2013); Broekhuizen et al. (2014); Silver et al. (2014); Weissfeld (2015)
Social facilities	Azcarate et al. (2016); Chen et al. (2016)

Maintaining all the building systems and facilities simultaneously may involve massive cost, which the housing committees and owners will definitely not be able to afford. Therefore, implementation of maintenance prioritisation is critical to optimise the condition of buildings and systems, property values, and safety and health of the residents at an affordable cost (Velmurugan & Dhingra, 2015). Based on a thorough literature review, the building facilities and services in high-rise housings that require maintenance prioritisation are as shown in Table 1.

RESEARCH METHOD

Since the research aimed to investigate the differences between perspective and actual practice of practitioners in prioritising the maintenance of building facilities and services, questionnaire survey was adopted to collect the data, whereby Graziano and Raulin (2010) mentioned that questionnaire survey is able to gather respondents' experiences,

perceptions, attitudes, or practices in their natural environment. Before data collection stage, literature review was conducted to determine the building facilities and services that require maintenance priority as research variables. The research targeted the population of high-rise residential buildings (7-storey and above) in Peninsular Malaysia. According to NAPIC (2016), there were 1902 schemes of high-rise residential buildings in Peninsular Malaysia. Krejcie and Morgan (1970) computed that the minimal sample size for research population of 1900 is 320. So, the questionnaire was randomly distributed to the potential respondents. The respondents were maintenance personnel involved in the high-rise residential buildings, including building manager, building executive or supervisor, building technician, and other building management staff. They were eligible to provide reliable and valid information about the maintenance practice in the residential building they work in. Then, the respondents were asked to rate the maintenance priority towards different building facilities and services based on their perspective and actual practice. The practitioners' perspective referred to the respondents' experience and their expert opinion, while the actual practice referred to the current and exact implementation of maintenance priority at their respective properties that might be influenced by various factors like budget limitation, client requirement, etc. The rating was designed in five-point Likert's scale, namely, Very low priority (1), Low priority (2), Moderate Priority (3), High priority (4), and Very high priority (5). As a result, a total of 321 returned questionnaires were determined to be valid for data analysis purpose, whereby, out of 328 returned questionnaires, seven were incomplete and thus filtered out for analysis process. The method of analysis used for determining the maintenance priority towards building facilities and services was mean and ranking analysis. In order to examine the difference between the perspective and actual practice towards maintenance priority, Wilcoxon signed-rank test was also used for ordinal data analysis as referred to by Jolaoso et al. (2012) and Ogungbile and Oke (2015). The Z-score of Wilcoxon signed-rank test can be calculated via Equation (1) to Equation (3) as follows:

$$\mu_T = \frac{n(n+1)}{4} \quad (1)$$

$$\sigma_T = \sqrt{\frac{n(n-1)(2n+1)}{24}} \quad (2)$$

$$Z = \frac{T - \mu_T}{\sigma_T} \quad (3)$$

where n = sample size

T = total ranks for either + or – differences, whichever is less.

Meanwhile, reliability analysis was run for the research variables to examine the consistency of the scale of data and evaluate the reliability of the data (Leech et al., 2011). The Cronbach's alpha coefficient test showed that the coefficients for the variables from practitioners' perspective and actual practice were 0.896 and 0.894, respectively, whereby a coefficient of more than 0.70 indicates good reliability.

FINDINGS AND DISCUSSION

Eleven main building facilities and services in high-rise residential building were identified through literature review as shown in Table 1. The maintenance priority towards them was examined by using mean and ranking analysis as shown in Table 2. The result showed the ranking of maintenance priorities in two aspects, namely, practitioners' perspective and actual practice.

Table 2. Ranking analysis of maintenance priority towards building facilities and services.

Practitioners' perspective			Actual practice		
Rank	Maintenance priority	Mean (n=321)	Rank	Maintenance priority	Mean (n=321)
1	Power supply	4.43	1	Lift system	4.11
2	Fire protection system	4.40	2	Power supply	4.02
3	Water supply	4.37	3	Cleaning services	3.98
4	Lift system	4.36	4	Fire protection system	3.97
5	Cleaning services	4.30	5	Water supply	3.96
6	Security system	4.27	6	Security system	3.87
7	Landscaping and gardening	3.97	7	Swimming pool	3.81
8	Swimming pool	3.93	8	Landscaping and gardening	3.75
9	Painting	3.81	9	Painting	3.55
10	Sport and recreational facilities	3.76	10	Sport and recreational facilities	3.53
11	Social facilities	3.75	11	Social facilities	3.52

From practitioners' perspective, the top prioritised building system was power supply, with the mean score of 4.43, whereby most of the building facilities require electricity to operate. The maintenance of power supply system is critical to ensure its functionality and, hence, continuously distribute the electricity for operation of different building facilities. Thus, Suruhanjaya Tenaga (1994) gave instructions that all power supply installations must be checked and tested by a competent technician regularly. In the actual practice, however, the maintenance priority of power supply system was ranked second with mean score of 4.02. This is probably due to the long interval of system maintenance issued by the Suruhanjaya Tenaga (1994), which is at least once every five years.

Then, maintenance priority on fire protection system was second-ranked under practitioners' perspective, with the mean score of 4.40. Installation of fire protection system is mandatory in every building and requires approval from the Fire and Rescue Department Malaysia (FRDM) (Azmi et al., 2009). Meanwhile, Xin and Huang (2013) stated that regular inspection and maintenance of the system are the key to make sure the system functions reliably in case of fire event. Therefore, high maintenance priority on the system was perceived. Nevertheless, maintenance priority of the system was ranked fourth in actual practice with mean score of 3.97, whereby the event of fire rarely occurs. The building owners deem it a financial waste to highly prioritise the maintenance of fire protection system.

Next, the result of practitioners' perspective revealed that water supply system was ranked third in maintenance priority, with the mean score of 4.37. Similar to power supply, water supply is a basic need of the people in daily activities. Therefore, the maintenance of water supply system should be prioritised to avoid water disruption problem. As supported by Goulden and Spence (2015), maintenance of the system is crucial and shall include flushing, cleaning, valve exercising, mechanical scrapping, pigging, swabbing, chemical cleaning, or flow jetting. In actual practice somehow, maintenance priority of the system was ranked fifth with the mean score of 3.96. In fact, the components of water supply system are comparably long lasting. Thus, it is less prioritised in maintenance.

Furthermore, the practitioners perceived high maintenance priority towards lift system. The system was ranked fourth with mean score of 4.36. In actual practice, it was even top ranked with mean score of 4.11, whereby the reliability of lift system concerns with the safety use by the residents. The specific periodic inspection and test should be performed according to the legislation, maintenance manuals, and technical document (Alonso Pérez et al., 2010). Basically, the routine inspection and maintenance cover lift machine and support, machinery room, lift well, lift well enclosure, landing door locking device, emergency hatches, ventilation, safety gears, and other components of the

system (Kamarazaly et al., 2013). Indeed, the maintenance priority would also ensure ease of access from a level to another in high-rise buildings.

Cleaning services were the fifth-ranked priority under practitioners' perspective, with a mean score of 4.30. The cleanliness of a space would affect the user comfort. Although cleaning services are seen as a simple task, they always receive much more complaints as modern living highly demands for cleanliness and hygienic environment. Due to frequent complaints, the cleaning services were ranked third in actual practice with a mean score of 3.98. In fact, cleaning services are not only dealing with hygienic issue; they are crucial in safety aspect too. The argument was supported by Choi et al. (2015), who mentioned that cleaning and maintaining the floor are vital because the floor is exposed to accidents like tripping or slipping.

Residential buildings and their compound are equipped with security systems to maintain safety and security of the residents as well as their physical assets. Commonly, the security system consists of closed-circuit television (CCTV), access card system, car park management system, etc. From practitioners' perspective and actual practice, maintenance priority of security system was both ranked sixth, with mean scores of 4.27 and 3.87, respectively, whereby the access card system is the first-tier security system that restricts unauthorised trespasser to enter the housing compound. Thus, the access card system must be maintained and its database should be updated regularly (Williamson et al., 2013). In case of any break in, the record of CCTV can be used to assist the identification of aggressor or suspect (Walker & Tough, 2015). Therefore, the functionality of CCTV must be retained through appropriate maintenance.

According to the analysis result as shown in Table 2, the practitioners' perspective towards the rest facilities were ranked lower with the mean score of less than 4.00. Subsequently, it can be assumed that they were less prioritised compared to those critical one. However, their maintenance works cannot be neglected as most of the facilities are meant for the enjoyment of residents in terms of recreational, sport, and community activities (Chen et al., 2016; Chow, 2013; Korpela et al., 2015; Silver et al., 2014).

In order to check whether there is any significant difference between the practitioners' perspective and actual practice towards maintenance priority of building facilities and services, Wilcoxon signed-rank test was performed. Subsequently, the test result was tabulated in Table 3. The test indicated that the differences between practitioners' perspective and actual practice towards all building facilities and services were significant, $p < 0.05$ in each case. Meanwhile, Table 2 showed that the maintenance priority towards all building facilities and services was lesser in actual practice compared to practitioners' perspective, in which the mean score of actual practice was lower than practitioners' perspective.

Table 3. Wilcoxon signed-rank test of maintenance priority towards building facilities and services.

Practice – perspective of maintenance priority	Z-score	p-value
Lift system	-5.791 ^a	.000
Water supply	-7.824 ^a	.000
Power supply	-8.090 ^a	.000
Security system	-7.044 ^a	.000
Fire protection system	-8.297 ^a	.000
Cleaning services	-6.725 ^a	.000
Landscaping and gardening	-4.603 ^a	.000
Painting	-4.842 ^a	.000
Swimming pool	-2.699 ^a	.007
Sport and recreational facilities	-4.678 ^a	.000
Social facilities	-4.647 ^a	.000

a. Based on positive ranks.

b. Wilcoxon Signed Ranks Test

In fact, the practitioners' perspective towards the maintenance priority of building facilities and services should be similar in actual practice. The practitioners' perspective reflects the planning of maintenance priority based on their knowledge and experience. However, the result demonstrated that the maintenance priority in actual practice was lower than practitioners' perspective, which might be affected by other factors such as resident committee or client influence, budget constraint, improper maintenance implementation, and others. Consequently, this study recommends further research to identify the factors that affecting planning and implementation of maintenance priority.

Indeed, the priority setting aims to optimise the performance of the property assets and maximise their lifetime. Meanwhile, it helps to utilise the resources effectively without jeopardising the importance of maintenance. Several criteria are taken into account when deciding the priority setting, as the criticality of the asset and components, cost of failure or damage, available resources, risk of inadequate maintenance, etc. Commonly, the maintenance staff or experts are more competent to plan and execute the maintenance priority for the benefit of asset maintenance and protection. Chong et al. (2016) proposed that balance between the completion of maintenance tasks and the client requirements is the basis of priority setting. Thus, it is of paramount importance that the resident committee or client would accept and support the maintenance priority opted by the maintenance staff or experts. Furthermore, it is advisable that the relevant authority (like Commissioner of Building in Malaysia) could regulate a policy, enforcing the resident committee or client to consult with the maintenance staff or experts for setting the maintenance priority in planned maintenance approach. Then, ad hoc maintenance can gradually be abolished and replaced with preventive maintenance that is more effective to prolong the life cycle and to enhance the quality of assets.

CONCLUSION

Priority setting is very critical in building maintenance management because it will contribute towards the implementation of maintenance strategy subsequently improving the maintenance performance and user satisfaction. This study highlights the needs of priority setting in high-rise residential building in Peninsular Malaysia. The research demonstrated that the differences in maintenance priority in actual practice and practitioners' perspective were significant for all building facilities and services but the maintenance priority was lesser in actual practice compared to practitioners' perspective. It reflected that the practitioners set the priority based on the urgencies, needs, and necessities but in actual practices the priority setting will be affected by many other factors such as clients' decision, users' demand, budget, and time constraints. As the process of maintenance work can be affected by the priority setting, it is definitely critical for the building managers to have a guide on how to set the maintenance priority. Thus, the factors that affect the decision makers in setting maintenance priority need to be determined to form a framework. The findings of this research provide input towards the development of maintenance priority setting. In conclusion, the decision of the practitioners in setting maintenance priority plays a vital role to ensure maintenance achieves optimum result. The practitioners are encouraged to set the priority of maintenance work in a deliberate manner.

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أولوية الصيانة في المساكن العالية : رؤية المهنيين مقابل الممارسة الفعلية

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الخلاصة

تحتاج الأبنية السكنية الى ادارة مناسبة لصيانة البناء وذلك لتأمين العيش المريح للسكان وتمكين أصحاب البناء من المحافظة على ممتلكاتهم. اضافة الى تأمين الأمان للسكان تؤمن صيانة الأبنية الحفاظ على القيم الجمالية للمبنى. تلعب أولوية الصيانة دورا حيويا في تعزيز عملية ادارة الصيانة خاصة عندما يواجه مدير و البناء صعوبات تتعلق بالميزانية والتكلفة. يشكل القرار حول أي من اعمال الصيانة يجب أن يأتي أولا، تحديا لصانع القرار. لقد دأب العديد من ممارسي المهنة على تقرير الاولوية في الصيانة بطريقة سطحية تعتمد ببساطة على الخبرة السابقة غير المكتملة وعلى التقييم الشخصي الذاتي والقرارات المحافظة حتى أن البعض يستعمل الكراسات الخاصة بصيانة الابنية كما هي موضوعه دون التأيي باتخاذ القرار. بناء على ذلك فان هذا البحث ينشد التحري عن الفروق ما بين رؤية وممارسة المهنيين في وضع الأولويات لصيانة خدمات ومنافع البناء. لقد تم اجراء استبيان أسئلة بين العاملين في صيانة الأبنية السكنية المرتفعة في شبه جزيرة ماليزيا ونتيجة لذلك فقد تم الحصول على 321 استبيان صالح للتحليل. تم اجراء اختبار ويلكسون (Wilcoxon signed-rank test) لفحص الفرق ما بين رؤية المهنيين والممارسة الفعلية نحو أولويات الصيانة لخدمات ومنافع الأبنية. أظهرت النتائج أن المرافق التي تخص الضرورات اليومية والأمان مثل تزويد الطاقة وتزويد المياه ونظام المصاعد ونظام الحماية من الحريق تم تصنيفها بشكل أعلى ضمن رؤية المهنيين والممارسة الفعلية مقارنة مع المرافق والخدمات الأخرى. تم ايضا اثبات وجود فروق هامة ما بين رؤية المهنيين والممارسة الفعلية نحو كل مرافق وخدمات البناء.

كلما مفتاحية: مرافق البناء، صيانة البناء، خدمات البناء، أولوية الصيانة، البناء السكني