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USER SATISFACTION ON FACILITIES AND MAINTENANCE SERVICES OF STRATIFIED RESIDENTIAL BUILDINGS IN MALAYSIA

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ABSTRACT

This paper aims to investigate the performance of facilities and maintenance services provided in the four cases around Klang Valley for medium-cost stratified residential buildings. The quantitative methodology was adopted via questionnaire surveys to 137 residents of the four residential case study buildings. The analyses are frequency of failure, performance indicator by Weighted Average Satisfaction index (WAS) for the attributes: waiting time request and response from staff, professionalism and expertise of staff, worthiness of paid maintenance fee and relative performance index (RPI_a) for the overall satisfaction for each facility as well as correlation test. Residents of the case studies were satisfied as the attributes of the performance recorded the WAS score of 40-79. The value of RPI_a is closer to 1.00, indicating that almost all the facilities contribute to the good performance of the buildings and indirectly enhance the residents' well-being. There is also a strong relationship between each attribute as the value of correlation is above 0.5 except for certain attributes in Case B. The present study suggests that maintenance services and facilities of residential buildings particularly should be in good condition and under proper care to enhance the performance of the buildings and the residents' well-being. The study also noted that end user behaviour together with well-planned and functional management also contributes to the performance of the buildings.

Keywords: Facilities Management, Performance, Residential Building, Strata, Users' Satisfaction.

1. INTRODUCTION

Facilities management (FM) integrates people, processes, and technology towards supporting business performance. FM also involves all types of building elements (Abdul-Rahman *et al*., 2014; Zawawi *et al.*, 2016) including building structures, finishes, materials, and services. Well-maintained building elements can prolong and extend the physical life of the building and avoid the process of decay (Chew *et al.*, 2004). Shah et al (2022) in their study proposed that FM is one of the critical success factors for affordable housing. This can be interpreted through the delivery of building maintenance for the housing. Stratified residentials refer to the community area of shared facilities (Che-Ghani et al., 2018). Owners of strata properties are bound to have the properties managed by an appointed management team. The management and maintenance of stratified buildings involves the Commissioner of Building Department (COB) and the Joint Management Body (JMB) (Fakhrudin et al., 2011). Stratified property residents are expected to adhere to rules and regulations set by the management in maintaining the shared facilities (Abd Wahab *et al.*, 2016). The scope of maintenance services can be categorized into two main components, namely technical and non-technical services. Technical services refer to mechanical and electrical services, while non-technical services are mainly custodial services. Other related non-technical services include health and safety management, engineering consultancy and energy management (Olanrewaju *et al*., 2011).

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In Malaysia, Joint Management Body (JMB) is formed between residents and developers, before the issuance of the individual strata titles to property owners. Upon the issuance of the strata titles, a Management Corporation (MC) may be formed to replace the JMB (Ch'ng, 2014). Strata Title Act (STA) in the Laws of Malaysia was implemented in 1985 to create the Management Corporation (MC) for the maintenance and management of stratified buildings. (Fakhrudin et al., 2011).

Shohet (2006) suggested that along with design and construction, maintenance is a pertinent component of a facility's life that can determine its effectiveness. However, the current practice of maintenance faces complex issues (Che-Ghani et al., 2023) and the issues of maintenance must be attended to urgently (Au-Yong et al., 2022a). It was reported that 70 per cent of residents in Malaysia are not concerned with the upkeep of their property for better living culture (Chandrasekaran, 2016). Users' activities and attitudes in using the shared facilities may affect the satisfaction of other residents, and therefore, residents must be well understood in their responsibilities in using shared facilities (Fakhruddin *et al.,* 2011). There is a high satisfaction rate of the residents if their housing and environment can fulfill their needs. Residents' satisfaction reflects their reaction to the physical and environmental components as well as social factors and economic conditions (Salleh, Yusof *et al.*, 2011). Residents' complaints about inefficient maintenance works and ineffective facility management can result in dissatisfaction from the residents (Che-Ani *et al*., 2009; Wing *et al.*, 2016). It is also proven that user satisfaction correlates directly with the performance of buildings (Ibem *et al*., 2013; Nawawi & Khalil, 2008). Their satisfaction towards building performance and its surroundings is an essential aspect in determining their demands and expectations.

Residents' demands and expectations of the building should be in line with their actions. For example, problems exist when some of the residents refuse to pay maintenance funds which will result in insufficient funds to maintain the facilities on time (Chandrasekaran, 2016; Che-Ani *et al.*, 2009). The fund is charged according to the unit size of the housing to upkeep the building's condition. Without a maintenance fund, the Joint Management Body (JMB) or Management Corporation (MC) cannot maintain the shared facilities in excellent condition and acceptable standards (Che-Ani *et al.*, 2009; Ch'ng, 2014; Ali *et al*., 2010). The fund was defined as a building maintenance fund or management fund for housing schemes in the Malaysian context and was administered by JMB or MC (Ali *et al*., 2010). The residents have the right to complain about any failure that occurs in their building as they are paying for the maintenance charges. In addition, their complaints will also ensure the facilities and maintenance services are in their best condition. Residents can channel their complaints towards management during common days or at the Annual General Meeting (AGM). At AGM, residents can discuss their monthly fees, complaints or any arising matters. Participation from residents is essential to enhance the effectiveness of the management since the activities are designed and dedicated to them (Che-Ani *et al.*, 2009). A collective voice during AGM is indeed a powerful voice to encourage the quality of services and improve the building's performance. Therefore, residents should know their responsibilities as members of their communities by supporting each other and adopting a neighbourly spirit (Che-Ani *et al*., 2009). Au-Yong et al (2022b) suggest that occupant awareness and involvement is crucial in operation and maintenance activities.

Hence, this paper would like to discuss the facilities and maintenance service performance provided by measuring the end user satisfaction. This is measured through several analyses like frequency of failure, performance indicator by Weighted Average Satisfaction index (WAS) for each attribute (request repair waiting period, waiting time for maintenance personnel response, professionalism and expertise of staff, the worthiness of paid maintenance fee) and relative performance index (RPI_a) for the overall satisfaction for each facility as well as correlation test. This paper further explores how end user satisfaction contributes to the performance of the facilities and maintenance services provided.

2. LITERATURE REVIEW

2.1 The need to maintain the building

Maintenance routine is essential to extend the lifespan of a building and reduce the cost of building and service failure, which ultimately ensures the sustainability of the building (Au-Yong *et al*., 2016). Management practices like maintenance inspection and repair service also influence residents' satisfaction. Accessibility of building services and facilities can motivate residential satisfaction. Thus, maintenance of the facilities is needed to sustain the good condition of the facilities (Au-Yong *et al.*, 2016).

The needs of building maintenance management are to reduce the rising cost-in-use, raise the economic value of the assets and increase the aesthetic value (Chew et al., 2004). Tedong and Zyed (2021) further adds that better facilities especially within a gated community contribute towards the value of properties. Saharuddin et al (2020) suggested that efficient maintenance programs can ensure buildings' functionality. Building maintenance combines technical and administrative actions (Ali *et al.*, 2010). The right building maintenance management is to perform the duties of building maintenance competently by having the right building maintenance plan and monitoring system. This action ensures that all items and elements in a building can perform the required function, to maintain the building in its initial state and minimize all undesirable influences like defects (Au-yong *et al.*, 2013; Chew *et al*., 2004). This also means that the buildings are able to function as per users' expectations (Ilesanmi, 2010).

The establishment of maintenance management organizations is to achieve the required standards of the buildings and also gain a constant level of services with minimum and satisfactory cost. Maintenance cost significantly influences the performance of maintenance systems and maintenance activities (Abdul-Rahman *et al*., 2014).

Chanter & Swallow (2007) believe maintenance costs can be higher than new construction costs because maintenance activities are always run on a small scale and in inhabited space. Ali *et al* (2010) mention that depending on the housing type, maintenance and operating costs contribute to one-third to one-half of the total cost of housing.

2.2 Performance Measurement of Building Maintenance

According to BS 5240, 'building performance' is defined as the behaviour of a product in use. It is implied by the physical performance characteristics of the building as a whole and of its parts. Building performance could affect the quality of buildings as the most vital part in determining building performance is to perform the functions of its intended use of the buildings (Abdul-Rahman *et al*., 2014; Chew *et al*., 2004). The concept of total building performance is advocated to fulfill the physiological, sociological, and psychological satisfaction of users (Chew *et al*., 2004; Olanrewaju *et al.*, 2011). The technical performance category represents the background environment of the building for running activities within it. Meanwhile, the functional performance of a building comprises elements that deal with the fit between the building and the activities of the building user (Abdul-Rahman *et al*., 2014). When measuring maintenance service, the effectiveness, efficiency or productivity of operations and planning in a certain period with the performance of the managerial and technical actions are paramount (Ali *et al*., 2010; Yusof *et al.*, 2014). Performance measurements should be initiated to understand the progress and improvement of maintenance practice (Myeda *et al.*, 2011). Measurement of maintenance performance is to evaluate maintenance activities by identifying weaknesses and strengths, resulting in the effectiveness of the existing strategy. For instance, performance can be determined by identifying the success or failure of the schedule, cost and functionality (Au-yong *et al*., 2013).

Chew *et al.* (2004) opine that to exercise optimal building performance throughout the building lifespan, customer expectations, operation and maintenance must be addressed by the management. The added value of performance can also be achieved from the triangulation of time, cost, and quality (Myeda et al., 2011).

The study looks at the important elements of performance measurement and links them with the users' satisfaction level, following the list of services offered (as shown in Figure 1).

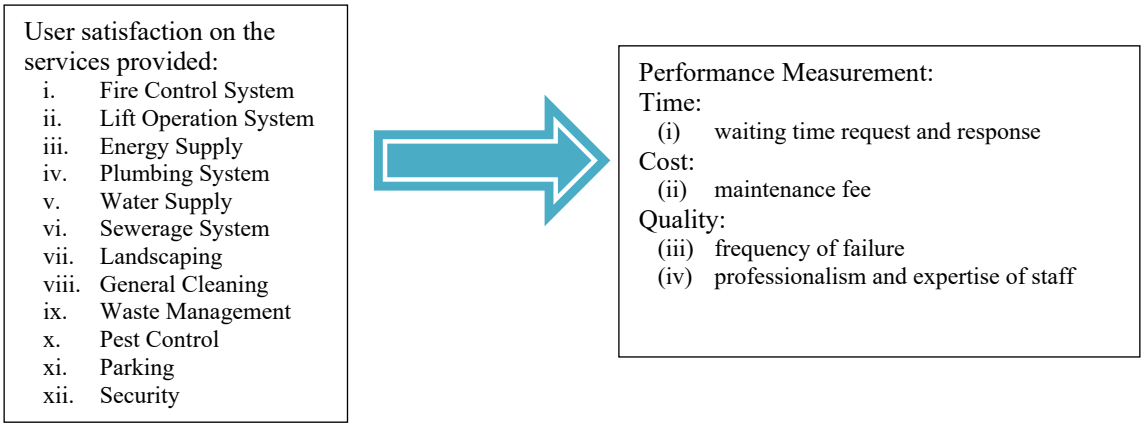

Figure 1: Framework of this performance measurement study

2.2.1Time – Waiting Time Request And Response

The performance of time is measured over the completion of tasks within the allocated duration (Yahya & Ibrahim, 2012). This includes the response time taken to execute work requests up to the return to service again (Shohet, 2003; Yahya & Ibrahim, 2012).

2.2.2Cost – Maintenance Fee

Cost performance quality can be calculated by measuring the completion of tasks within the estimated budget. Major cost elements normally include the costs of human resources, energy, consumables and spare parts (Yik & Lai, 2005; Yahya & Ibrahim, 2012).

2.2.3Quality - Frequency of failure, Professionalism and Expertise of staff

Quality performance may be measured over the frequency of failure, professionalism, and expertise of the staff. This includes the competency of maintenance practice in meeting the technical specification whilst maintaining a good function and appearance (Shohet, 2003; Yahya & Ibrahim, 2012). Quality performance reflects the professional conduct and competency of the practice (Myeda et al., 2023).

3. METHODOLOGY

The quantitative data collection methodology was adopted by applying a questionnaire survey technique. The research was conducted by distributing a questionnaire survey to the residents of four stratified residential buildings within the Klang Valley area. The survey includes facilities and services that were deemed impactful and relevant within the maintenance practice. The performance of facilities and services is measured against the three categories that are time, cost, and quality. The structure of the questionnaire survey is shown in Table 1. The questionnaire measures the respondents' levels of satisfaction by using the five-point Likert Scale, ranging from being extremely dissatisfied, through dissatisfied, slightly satisfied, satisfied, to extremely satisfied. Similarly, the frequency of failure ranges from very often, often, sometimes, rarely, to never.

Table 1: The structure of the questionnaire survey

<table>
<tr><td colspan="2">Questionnaire Respondent: Residents from Cases A, B, C and D</td></tr>
<tr><td>The frequency of failure for the facilities and maintenance services provided</td><td rowspan="6">i. Fire Control System
ii. Lift Operation System
iii. Energy Supply
iv. Plumbing System
v. Water Supply
vi. Sewerage System
vii. Landscaping
viii. General Cleaning
ix. Waste Management
x. Pest Control
xi. Parking
xii. Security</td></tr>
<tr><td>Are you satisfied with the waiting time request and response from staff for the facilities and maintenance services provided</td></tr>
<tr><td>Are you satisfied with the professionalism and expertise of staff for the facilities and maintenance services provided</td></tr>
<tr><td>Are you satisfied with the maintenance fee paid for the facilities and maintenance services provided</td></tr>
<tr><td>Overall satisfaction with the facilities and maintenance services provided</td></tr>
</table>

3.1 Background of the study

The analysis of the findings was done using SPSS version 25. The total respondents were 137 residents from four cases in a stratified residential building in the Klang Valley. Case Studies A, B, C and D each represent 37.9%, 32.9%, 15.3% and 13.9% of the total respondents, respectively. To confirm that the study is reliable, a reliability test is conducted by testing the consistency and stability of the variables. Cronbach's alpha indicates data consistency whereby the acceptable reliability should be above 0.70 (Au-yong *et al*., 2013). The Cronbach's Alpha for Case Studies A, B, C and D are above the value of 0.70 and therefore signified high-reliability data as shown in Table 2.

Table 2: Reliability analysis of the performance of all facilities and maintenance services across the case study buildings

Attributes of the performance	Case A	Case B	Case C	Case D
Waiting for time requests and responses from staff	0.955	0.976	0.967	0.974
Professionalism and expertise of staff	0.966	0.980	0.963	0.979
Frequency of failure of facilities	0.915	0.929	0.905	0.835
The worthiness of paid maintenance fee	0.967	0.984	0.961	0.973
Overall satisfaction	0.972	0.984	0.955	0.966

4. RESULTS AND DISCUSSION

4.1 Evaluation of Residents' Satisfaction with Each Facility and Maintenance Services

The data collected were analyzed through descriptive analysis of SPSS software by generating the frequencies and percentages of facilities' failure. As shown in Figure 2, residents evaluate the failure of facilities and services as 'sometimes failed', 'rarely failed' and 'never failed'. The failure of the facilities and services in Case A and Case B is "sometimes" and "rarely" failed respectively. For Case C, there were six facilities and services were rated as 'sometimes failed' and five facilities and services were rated as 'rarely failed'. Lastly, in Case D most of the facilities were rated as 'rarely failed'.

Figure 2 indicates the frequency of failure for the facilities and maintenance services provided in case studies A, B, C and D.

a) Fire Control System - 19 residents from case study A stated that the fire control system sometimes breakdowns at their homes. 32 residents from case studies B and D stated that the fire control system rarely failed. 9 residents from case study C stated that the fire control system never failed at their homes.
b) Lift Operation System - 63 residents from all case studies stated that the lift system sometime breakdown at their home
c) Energy Supply - 57 residents from all case studies stated that the energy supply rarely affected their area. It shows that the standby generator set at their home is in good condition
d) Plumbing System - 36 residents from A and C stated that the plumbing system at their unit sometime breakdown. 31 residents from B and D stated that the plumbing system rarely breaks down.
e) Water Supply - 25 residents from A sometimes dissatisfied with the water supply. 43 residents are rarely dissatisfied with the service.
f) Sewerage System - 26 residents from A stated that sometime the sewerage system of their unit failed. 44 from B, C and D stated that the sewerage system at their unit rarely failed.
g) Landscaping - 30 residents from A and C are sometimes dissatisfied with the landscaping service at their homes. 30 residents from B and D are rarely dissatisfied with landscaping performance.
h) General Cleaning - 52 residents from all case studies were dissatisfied with cleaner performance. 22 residents from B and D were rarely dissatisfied with the cleaner's performance
i) Waste Management - 31 residents from B, C and D are sometimes dissatisfied with the waste management at their homes. 44 residents from A, B and D are rarely dissatisfied with the waste management at their homes.
j) Pest Control - 29 residents from A and C are sometimes dissatisfied with pest control service performance. 38 residents B, C and D are rarely dissatisfied with the service. 6 residents from C were never dissatisfied with the service.
k) Parking - 55 residents from all case studies stated that the parking service from management rarely failed. But, 19 residents from case study A stated that the parking service at their home sometimes also failed. For example, the functioning of the barrier gate.
l) Security - 60 residents stated that the security performance at their home rarely fails in their duties.

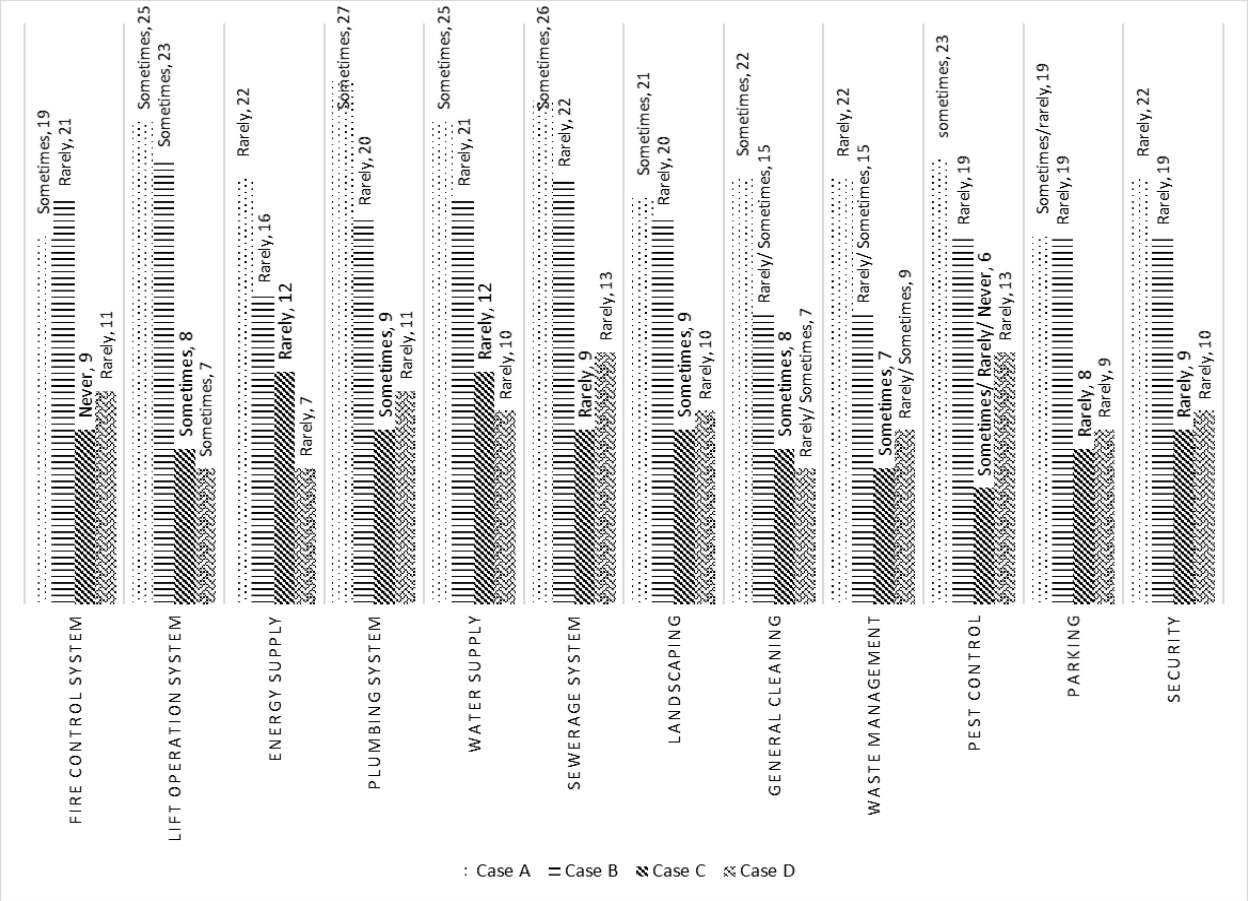

Figure 1. The highest rating scale indicated the failure frequency of the facilities and maintenance services

The performance of the facilities was determined based on the Weighted Average Satisfaction Index (WAS). The attributes of the performance are waiting for time request and response from staff, professionalism and expertise of staff and worthiness of paid maintenance fee. The residents were asked to rate each variable according to their satisfaction levels based on a five-point scale ranging from 'very dissatisfied' to 'very satisfied'. Following Liu (1999)'s analysis approach, the scores for the response category were very dissatisfied = 0; dissatisfied = 25; slightly satisfied = 50; satisfied = 75; very satisfied = 100.

As tabulated in Table 3, the facilities were categorised into WAS (40-49), WAS (50-59), WAS (60-69) and WAS (70-79). For Case A, residents were satisfied with the facilities provided as the weighted average satisfaction varies from WAS (50-59) to WAS (60-69).

In Case B, the residents were satisfied with the waiting time request and response from the staff, professionalism and expertise of the staff and the worthiness of paid maintenance fees of all the respected facilities. However, the results show that the residents were very satisfied with the professionalism and expertise of the staff in landscaping.

As for Case C, the weighted average satisfaction is WAS (40-49), WAS (60-69) and WAS (70-79) for all the respected facilities. The residents were dissatisfied with the waiting time requests and response from the staff, the professionalism and expertise of staff, as well as the worthiness of paid maintenance fees for the lift operation system in Case C. However, the residents were very satisfied with the waiting time request and response from the staff of the water supply. They were also very satisfied with the professionalism and expertise of the security staff. Hence, they felt the worthiness of paying the maintenance fee.

For Case D, residents were very satisfied with WAS (60-69) and WAS (70-79). The residents were very satisfied with the waste management, landscaping and sewerage system for the waiting time request and response from staff. They were also very satisfied with the professionalism and expertise of staff in all facilities except the lift operation system, general cleaning and security. The maintenance fee was very worth it except for the lift operation system, general cleaning, waste management, parking and security.

Table 3: Performance indicators for case study buildings according to the Weighted Average Satisfaction (WAS) scores

Performance Attributes	**Weighted Average Satisfaction (WAS) for Case Studies**			
	Case A	**Case B**	**Case C**	**Case D**
Waiting for time requests and responses from staff	WAS (50-59) WAS (60-69)	WAS (60-69)	WAS (40-49) WAS (60-69) WAS (70-79)	WAS (60-69) WAS (70-79)
Professionalism and expertise of staff	WAS (60-69)	WAS (60-69) WAS (70-79)	WAS (40-49) WAS (60-69) WAS (70-79)	WAS (60-69) WAS (70-79)
The worthiness of paid maintenance fee	WAS (50-59) WAS (60-69)	WAS (60-69)	WAS (40-49) WAS (60-69) WAS (70-79)	WAS (60-69) WAS (70-79)
Remarks	Satisfied	Satisfied to very satisfied	Dissatisfied to very satisfied	Satisfied to very satisfied

4.2 Overall residents' satisfaction

The average satisfaction score by all respondents on each attribute is indicated by the Mean Satisfaction Score (MSS). The Relative Performance Index (RPI_a) was analyzed for each building attribute as the sum of the actual satisfaction score on the five-point Likert scale rated by respondents on each building attribute (ASS_{act}) out of the maximum possible satisfaction score (ASS_{max}). The RPI_a is taken as a measure of the relative contribution or importance of each building attribute towards enhancing the well-being of the residents (Ibem et al., 2013, pp. 181–182). The formula is expressed mathematically as:

$$RPI_a = \frac{\sum ASS_{act}}{\sum ASS_{max}}$$

As shown in Table 4, the facilities with an RPI_a value closer to 1.00 contributes the most to building performance. For example, in Case A, water supply, landscaping, general cleaning and waste management are the facilities or services that have a high RPI_a , which is 0.7. For Case B, the RPI_a is 0.7422 for energy supply, sewerage system and landscaping. Residents in the Case C area are fully satisfied with the water supply provided for the area as the RPI_a is 0.7619. Lastly, for Case D, the high RPI_a is for the sewerage system and landscaping with a value equal to 0.7895

Table 4: The overall facilities satisfaction scores as rated by the residents

	Mean Satisfaction Score (MSS)				The sum of the Actual Satisfaction Score (ASS_{act})				Relative Performance Index (RPI_a)			
	Case A	Case B	Case C	Case D	Case A	Case B	Case C	Case D	Case A	Case B	Case C	Case D
Fire control system	3.38	3.56	3.76	3.79	176	160	79	72	0.6750	0.7111	0.7524	0.7579
Lift operation system	3.38	3.53	2.86	3.63	176	159	60	69	0.6769	0.7067	0.5714	0.7263
Energy supply	3.44	3.71	3.76	3.79	179	167	79	72	0.6885	0.7422	0.7524	0.7579
Plumbing system	3.35	3.62	3.71	3.79	174	163	78	72	0.6692	0.7244	0.7429	0.7579
Water supply	3.50	3.67	3.81	3.79	182	165	80	72	0.7000	0.7333	0.7619	0.7579
Sewerage system	3.46	3.71	3.67	3.95	180	167	77	75	0.6923	0.7422	0.7333	0.7895
Landscaping	3.50	3.71	3.62	3.95	182	167	76	75	0.7000	0.7422	0.7238	0.7895
General Cleaning	3.50	3.69	3.52	3.58	182	166	74	68	0.7000	0.7378	0.7048	0.7158
Waste management	3.50	3.64	3.43	3.79	182	164	72	72	0.7000	0.7289	0.6857	0.7579
Pest control	3.42	3.60	3.57	3.79	178	162	75	72	0.6846	0.7200	0.7143	0.7579
Parking	3.35	3.64	3.62	3.68	174	164	76	70	0.6692	0.7289	0.7238	0.7368
Security	3.46	3.67	3.71	3.42	180	165	78	65	0.6923	0.7333	0.7429	0.6842

4.3 Relationship of Performance Attributes

The next stage of analysis involved identifying significant relationships between the frequency of failure and residents' satisfaction with the facilities provided. The correlation test was performed to evaluate the relationship between facilities provided and maintenance performance, as indicated in Table 5. Pearson product-moment correlation was used in this study. It is a statistical correlation design to evaluate the strength of the linear relationship between two variables (Au-yong *et al*., 2013).

The relationships need to be tested for their significance. A p-value less than 0.05 is required to indicate that the relationship is statistically significant. Gray (2014) suggests that a correlation coefficient of -1.00 or +1.00 is a perfect negative or positive relationship, respectively, and a correlation of zero means no linear relationship exists (Gray, 2014). A correlation coefficient less than 0.3 implies a weak relationship, 0.3 to 0.5 for a moderate relationship, and 0.5 and above for a strong relationship between the two variables. The relationships between attributes were calculated in Table 5. For Case A, Case C and Case D - each of the attributes shows a strong relationship between the attributes. For Case B, the relationship between the frequency of failure and the waiting for time for requests and responses from staff shows a moderate relationship (0.347). The frequency of failure of facilities and staff competency also shows a moderate relationship (0.472). The rest of the attributes show a strong relationship with each other.

Table 5: The relationship between performance attributes

	Performance Attributes	Professionalism and expertise of staff	Frequency of failure of facilities	The worthiness of paid maintenance fee
Case Study A	Waiting for time requests and responses from staff	0.764	0.710	0.670
	Professionalism and expertise of staff		0.562	0.615
	Frequency of failure of facilities			0.608
Case Study B	Waiting for time requests and responses from staff	0.853	**0.347**	0.721
	Professionalism and expertise of staff		**0.472**	0.806
	Frequency of failure of facilities			0.498
Case Study C	Waiting for time requests and responses from staff	0.914	0.757	0.697
	Professionalism and expertise of staff		0.794	0.879
	Frequency of failure of facilities			0.732
Case Study D	Waiting for time requests and responses from staff	0.936	0.712	0.783
	Professionalism and expertise of staff		0.692	0.692
	Frequency of failure of facilities			0.688

5. CONCLUSIONS

The highest failure of the provided facilities and services as rated by the residents is only 'sometimes failed' for Case A and 'sometimes failed' and 'rarely failed' for Case B and Case C. For Case D, most of the facilities were rated as 'rarely failed' except for the lift operation system rated as 'sometimes failed'. All the cases were rated as satisfactory because the attributes of the performance rating ranged from WAS 40-79. It can be seen that the residents are almost satisfied with the facilities provided. The value of RPI_a is also closer to 1.00. It means that almost all the facilities contribute to the good performance of the buildings and indirectly enhance the well-being of the residents. There is also a strong relationship between each attribute as the value of correlation is above 0.5 except for certain attributes in Case B like the relationship between frequency of failure and waiting time request and response from staff and the relationship between frequency of failure of facilities and staff competency.

The present study suggests that the facilities and maintenance services should be in good condition and under proper care to enhance the performance of the building. End users' satisfaction is proven as a significant tool to measure building performance. However, the end user should not completely surrender the task of upkeep of the building solely to the management. They also have to contribute their energy to maintain their buildings and their facilities by implementing a maintenance culture in their daily life. Maintenance culture is vital to improve maintenance performance not only practically but also in terms of knowledge enhancement. It is paramount to inculcate a positive maintenance culture among building users to increase their awareness of the maintenance practice

and their roles and responsibilities as users. A well-planned and efficient management also contributes to the performance of the buildings. Hence, further research is recommended in investigating the performance of operation and maintenance services and facilities from the view of the building manager. By linking the views of residents and building managers, it will result in good performance of the buildings.

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6. REFERENCES

Abd Wahab, S. R. H., Ani, A. I. C., Sairi, A., Tawil, N. M., Razak, M. Z. A. (2016). A survey on the classification of maintenance funds for high-rise residential buildings in Klang Valley. *AIP Conference Proceedings*, *1761*. https://doi.org/10.1063/1.4960843

Abd Wahab, S. R. H., Che Ani, A. I., Sairi, A., Mohd Tawil, N., & Abd Razak, M. Z. (2016). Classification of High-Rise Residential Building Facilities: A Descriptive Survey on 170 Housing Scheme in Klang Valley. *MATEC Web of Conferences*, *66*, 103. https://doi.org/10.1051/matecconf/20166600103

Abdul-Rahman, H., Chen, W., Kamaruzazaman, S. N., Mohd-Rahim, F. A., Mohd-Danuri, M. S., & Lee, K. (2014). Case study of facility performance and user requirements in the University of Malaya research and development building. *Journal of Performance of Constructed Facilities*, *29*(5), 1–6. https://doi.org/10.1061/(ASCE)CF.1943-5509.0000629.

Ali, A. S., Kamaruzzaman, S. N., Sulaiman, R., & Cheong Peng, Y. (2010). Factors affecting housing maintenance cost in Malaysia. *Journal of Facilities Management*, *8*(4), 285–298. https://doi.org/10.1108/14725961011078990

Au-Yong, C. P., Ali, A. S., & Ahmad, F. (2013). Office building maintenance : A cost prediction model. *Građevinar*, *65*(9), 803–809.

Au-Yong, C. P., Ali, A. S., & Chua, S. J. L. (2016). Interval of Routine Maintenance and Maintenance Performance: A Literature Review. *MATEC Web of Conferences*, *66*, 7. https://doi.org/10.1051/matecconf/20166600007

Au-Yong C.P., Azmi N.F., Myeda N.E. (2022a). Promoting employee participation in the operation and maintenance of green office buildings by adopting the total productive maintenance (TPM) concept. Journal of Cleaner Production. 352(), . doi:10.1016/j.jclepro.2022.131608.

Au-Yong C.P., Myeda N.E., Azmi N.F. (2022b). Occupant awareness towards the application of total productive maintenance in green office building, Journal of Engineering Research (Kuwait). 10(2 A), 292-304. doi:10.36909/jer.10475

Ch'ng, B. (2014). 'Failure to form joint management bodies lead to bad maintenance', The Star Online, available at: https://www.thestar.com.my/news/community/2014/03/24/no-proper-management-failure-to-form-joint-management-bodies-lead-to-bad-maintenance/

Chandrasekaran, M. (September, 2016). 'Most High Rises in Malaysia are poorly managed', *Property Guru.*

Chanter, B., & Swallow, P. (2007). *Building Maintenance Management*.

Che-Ani, A. I., Jamil, M., Zain, M. F. M., Mohd-Nor, M. F. I., & Mohd-Tawil, N. (2009). A satisfaction survey of high-rise residential management in Malaysia: Sustainable indicators. *WIT Transactions on Ecology and the Environment*, *120*, 643–652. https://doi.org/10.2495/SDP090602

Che-Ghani, N.Z., Myeda, N.E., and Ali, A.S. (2018), End End User Characteristics in Promoting Maintenance Culture within Shared Facilities, Journal of Building Performance, Vol 9 (2).

Che-Ghani, N.Z., Myeda, N.E., and Ali, A.S. (2023), "Efficient operation and maintenance (O&M) framework in managing stratified residential properties", Journal of Facilities Management, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JFM-10-2021-0124

Chew, M. Y. L., Tan, S. S., & Kang, K. H. (2004). Building Maintainability — Review of State of the Art. *Journal of Architectural Engineering*, 10 (September), 80–87. https://doi.org/10.1061/(ASCE)1076-0431(2004)10:3(80)

Fakhrudin, I.H., Suleiman, M.Z. and Talib, R. (2011), 'The need to implement Malaysia's Building and Common Property Act 2007 (Act 663) in building maintenance management', *Journal of Facilities Management*, Vol.

9 No. 3, pp. 170–180.

Gray, D.E. (2014), Doing Research in the Real World, edited by Jai Seaman, Third Edit., SAGE Publications.

Ibem, E. O., Opoko, A. P., Adeboye, A. B., & Amole, D. (2013). Performance evaluation of residential buildings in public housing estates in Ogun State, Nigeria: Users' satisfaction perspective. *Frontiers of Architectural Research*, *2*(2), 178–190. https://doi.org/10.1016/j.foar.2013.02.001

Ilesanmi, A. O. (2010). Post-occupancy evaluation and residents' satisfaction with public housing in Lagos, Nigeria. *Journal of Building Appraisal*, *6*(2), 153–169. https://doi.org/10.1057/jba.2010.20

Liu, A. M. M. (1999). Residential satisfaction in housing estates: a Hong Kong perspective. Automation in construction, 8(4), 511-524.

Myeda, N. E., Kamaruzzaman, S. N., & Pitt, M. (2011). Measuring the performance of office buildings maintenance management in Malaysia. *Journal of Facilities Management*, *9*(3), 181–199. https://doi.org/10.1108/14725961111148090

Myeda, N. E., Chua, S. J. L., & Aqillah, N. S. (2023). Adopting quality management (QM) principles in managing facilities management service delivery. International Journal of Quality & Reliability Management, ahead-of-print(ahead-of-print). https://doi.org/10.1108/IJQRM-08-2022-0253

Nawawi, A. H., & Khalil, N. (2008). Post-occupancy evaluation correlated with building occupants' satisfaction: An approach to performance evaluation of government and public buildings. *Journal of Building Appraisal*, *4*(2), 59–69. https://doi.org/10.1057/jba.2008.22

Olanrewaju, A. L., Idrus, A., & Khamidi, M. F. (2011). Investigating building maintenance practices in Malaysia: a case study. *Structural Survey*, *29*(5), 397–410. https://doi.org/10.1108/02630801111182420.

Saharuddin, S., Khalil, N., & Saleh, A. A. (2020). Prioritising criteria of maintenance for green roof in high-rise residentials. Journal of Surveying, Construction and Property, 11(2), 27-39. https://doi.org/10.22452/jscp.sp2020no1.3

Salleh, A. N. A., Yusof, B. N. A., Salleh, C. A. G., & Johari, D. N. (2011). Tenant Satisfaction in Public Housing and its Relationship with Rent Arrears: Majlis Bandaraya Ipoh, Perak, Malaysia. *International Journal of Trade, Economics and Finance*, *12*(1), 10–18. https://doi.org/10.7763/IJTEF.2011.V2.72Shah, M. N., Mulliner, E., Singh, T. P., & Ahuja, A. K. (2022). Critical Success Factors For Affordable Housing: Evidence From Lower-Middle Income And High-Income Economies. Journal of Surveying, Construction and Property, 13(1), 1-19.

Shohet, I.M. (2006). 'Key Performance Indicators for Strategic Healthcare Facilities Maintenance', Journal of Construction Engineering and Management, Vol. 132 No. 4, pp. 345–352, https://doi.org/10.1061/(ASCE)0733-9364(2006)132:4(345) Tedong, P. A., & Zyed, Z. A. S. (2021). The Implications Of Guarded Neighborhood On Housing Prices In Urban Malaysia. Journal of Surveying, Construction and Property, 12(1), 60-69. https://doi.org/10.22452/jscp.vol12no1.6

Wing, A. C. K., Mohammed, A. H., & Abdullah, M. N. (2016). Factors for Maintenance Priority in Malaysian University. *Sains Humanika*, 8 (4–3), 1–5.

Yahya, M.R., Ibrahim, M.N. (2012). 'Building Maintenance Achievement in High Rise Commercial Building: A Study in Klang Valley, Malaysia', OIDA International Journal of Sustainable Development, Vol. 4 No. 6, pp. 39–46.

Yik, F.W.H., Lai, J.H.K. (2005). 'The trend of outsourcing for building services operation and maintenance in Hong Kong', Facilities, Vol. 23 No. 1/2, pp. 63–72.

Yusof, N., Abdullah, S., & Najib, N. 'Ulyani M. (2014). How does communication influence the perceived performance of maintenance services in multi-storey public housing? *International Journal of Strategic Property Management*, *18*(4), 380–392. https://doi.org/10.3846/1648715X.2014.971918

Zawawi, Z. A., Khalid, M. K. A., Ahmad, N. A., Zahari, N. F., & Salim, N. A. A. (2016). Operation And Maintenance In Facilities Management Practices : A Gap Analysis In Malaysia. In *MATEC Web of Conferences* (Vol. 66, p. 116).