Factors affecting effective facilities management practices in South Africa: a case study of Kwazulu Natal Province

Modupe Cecilia Mewomo and Petronella Minehle Ndlovu
Department of Construction Management and Quantity Surveying, Durban University of Technology, Durban, South Africa, and

Comfort Olubukola Iyiola
Department of Construction Management and Quantity Surveying, Durban University of Technology – Steve Biko Campus, Durban, South Africa

Received 24 September 2021
Revised 5 April 2022
3 June 2022
Accepted 3 June 2022

Abstract

Purpose – Although facilities management (FM) has been advocated in the construction industry to address the issues of facilities in buildings, their adoption is still plagued with barriers. The factors affecting FM practices need detailed investigation. However, few studies have been conducted on the factors affecting FM practices in developing countries such as South Africa. This study aims to investigate the factors affecting effective FM practices in public buildings in South Africa.

Design/methodology/approach – To achieve this aim, a quantitative survey was carried out using questionnaire to gather relevant data in the study area. The collected data were analysed using descriptive statistics and principal component (factor) analysis. The study was conducted on 39 facilities managers in the Department of Public Works in KwaZulu-Natal Province, South Africa.

Findings – The descriptive analysis revealed that availability of funds, occupants' knowledge of FM, absence of policy guiding FM practice, state of deterioration of facilities and design concepts and scope were significant challenges affecting effective FM practices in public buildings in South Africa. The result of the principal component analysis of the factors affecting FM practices were grouped into organisational factors, structural/design errors and end users' elements.

Research limitations/implications – As it is widely understood that "money" plays a significant role in the performance of any activity or function, administrators/governments of public facilities should strive to plan and make appropriate finances accessible to facilities managers. Participation of facilities managers in the planning stage can also help reduce design flaws and their maintenance implications. In addition, adequate training for professionals can improve FM awareness and productivity.

Originality/value – The paper reveals the structural framework of the factors that can influence the effective facilities management practices in public buildings.

Keywords Facilities management, Public buildings, South Africa

Paper type Research paper

Facilities
Vol. 40 No. 15/16, 2022
pp. 107-124
Emerald Publishing Limited
0263-2772
DOI 10.1108/F-09-2021-0087

1. Introduction

The rapid technology breakthroughs and increased competitiveness in today's economy have made the construction industry develop an effective supporting services system to ensure long-term building functionality and profitable operation (Støre-Valen and Buser, 2019). Meanwhile, implementing such an effective system provided by facilities management (FM) remains a significant obstacle (Abu Jawdeh, 2013). According to Abigo *et al.* (2012), developing countries still contend with design and project execution problems. The issues related to environmental sustainability, detrimental construction fabrics and mediocre management and maintenance of buildings are still lingering. Moreover, various building professionals' lack of adherence to building practices has negatively impacted building occupants' functionality, comfort and health (Jiboye, 2012). This has resulted in the continual maintenance of poorly designed buildings and the dissatisfaction of the building occupants. Olaniyi (2017) mentioned that facilities managers with good knowledge and vast technical skill in construction management are not usually consulted during the design stage. Due to this, facilities managers are poorly represented in the planning phase of a new project when critical decisions influencing the building's lasting sustainability are addressed (Støre-Valen and Busan, 2019). While the decision taken at the design stage is crucial to the effective operation and utilisation of the building, facility managers may only be involved during the construction and post-construction stage of the building process (Olotuah, 2015). According to Ikedaishi *et al.* (2012), facilities managers are not usually consulted or involved during the operations, installation and maintenance of services within a building. Therefore, FM services suffer. Regrettably, the facilities managers do not usually request feedback from the building users (Elmualim *et al.*, 2017). Consequently, buildings deteriorate quickly due to the unavailability of building performance information on which the designers can improve their designs. Often, facilities professionals end their professional roles at the end of the construction stage (Odediran *et al.*, 2015). According to research, building facilities are only given specific attention by management in exceptional cases (Odediran *et al.*, 2015). According to Asiabaka (2008), FM is a part of the educational system sometimes disregarded in developing countries. Little priority is devoted to their maintenance when new buildings are built and taken over by the relevant authorities. According to Mohammed and Hassanain (2010), the most pressing issue is how building tenants or maintenance employees manage the structure once the construction process is concluded. According to Akinsola *et al.* (2012), most facilities lack an effective maintenance strategy. Preventive maintenance and emergency repair requirements are expected to emerge as the facility or building ages, so preventive maintenance is critical. Furthermore, Kamaruzzaman *et al.* (2017) suggested that the fundamental issue with FM in a building is being handled unprofessionally by facilities managers, resulting in negative consequences on building facilities. The detrimental performance of facilities in a building may potentially harm the building occupants in terms of health, safety and comfort (Lai and Yik, 2011). From the preceding, many public buildings in developing countries have not yet benefited from the advantages derived from the practice of FM. The present study will fill the gap by providing an in-depth application of the significant challenges influencing the effectiveness of FM practices.

2. Literature review

Investing in building facilities and making a profit is the primary goal of the FM organisation. The difficulty for professionals is to stay profitable while dealing with ever-tightening legislation and occupant demands. Meanwhile, the environmental benefits of sustainable practices are recognised by all, and the increased cost and often ambiguous

financial return of these initiatives are still perceived as roadblocks (Aliyu *et al.*, 2016). Early FM engagement during the pre-construction stage, according to Xianhai (2013), can lead to concerns such as inefficient use of building materials and equipment. Changes in environmental circumstances and a lack of a maintenance culture contribute to the ageing and damage of building facilities, according to Asiabaka (2008). Time restrictions, a shortage of understanding and a lack of top managers' commitment were the critical challenges to implementing a consistent and complete sustainable FM practice (Elmualim *et al.*, 2010). Sarpin *et al.* (2016) briefly assessed the shortcomings and obstacles to sustainable development in FM practices. The study identified the competence of professionals, knowledge, organisational factors and authority issues. Education, environmental policies/legislation and FM skills are required to provide a positive working environment to monitor the output of FM service to guarantee the country's economic success (Akinsola *et al.*, 2012). In addition, Asiabaka (2008) described a lack of policy guidance for infrastructural growth, a lack of managerial process expertise, nonchalant or passive attitudes towards facilities deterioration, a lack of qualified experts, insufficient qualifications and insufficient funding as fundamental factors affecting FM practices. According to Chandrashekaran and Gopalakrishnan (2008), a shortage of adequate funds for FM in organisations is a significant factor affecting FM. This typically results in the postponement of significant facility repairs and replacements. According to Talib *et al.* (2014), the fundamental problems influencing FM in public buildings are a lack of preventive maintenance, insufficient funding for facilities and a shortage of FM regulatory requirements. Moum *et al.* (2017) highlight the need for long-term FM commitment, transparency, trust and a positive client and team relationship as critical success factors for FM practices. According to Häkkinen and Belloni (2011), the essential challenges to FM are a lack of steering mechanisms, financial abilities, client comprehension, process expertise and the lack of methodologies, tools and competencies connected to the FM process.

The low level of innovation, insufficient finance and poor policy enforcement, according to Odediran *et al.* (2015), are all significant problems in FM practice. According to Asiabaka (2008), prevailing factors influencing FM practices include a lack of awareness of managerial processes, a casual or passive attitude about facilities degrading, a lack of educated professionals, relevant skills and insufficient funds. Inadequate knowledge, improper regulation and quality control, procurement process, shortage of skill/workforce, mistrust between managers and stakeholders, type of employer, political barrier/government intervention and personal and labour issues, according to Ikedaishi *et al.* (2012), are all influencing factors in ineffective FM practices. Design errors, a lack of a maintenance schedule, a lack of understanding of FM, underestimating the impacts of FM and worse maintenance efficiency are all critical variables that affect FM services in companies, according to Islam *et al.* (2019). Femi (2014) backed up this point by stressing that designers make the mistake of assuming that using aesthetically pleasant materials will result in less building maintenance. Similarly, Hasan *et al.* (2016) discovered that selecting high-quality materials is one of the most successful techniques for reducing building flaws. Similarly, Olanrewaju and Anifowose (2015) cited the usage of untested materials as a primary cause of fault, stating that early engagement of qualified and competent specialists might alleviate these problems. According to Jandali and Sweis (2018), design stage-related elements were among the factors that significantly impacted a hospital's maintenance management performance. These reasons included, among others, a lack of information from the maintenance department to the design team and the exclusion of a maintainability evaluation. Furthermore, Waziri and Vanduhe (2013) ascribed maintenance issues to shoddy

craftsmanship, design accuracy adequate to user needs, low-cost and low-quality materials and the most significant element, a lack of money for building maintenance.

Cobbinah (2010) attributed the factors to lack of funds, improper maintenance culture, increased cost of maintenance, pressure from end-users, errors during construction and ineffective maintenance carried out by facility personnel. Koleoso *et al.* (2017) mentioned that the time at which work is completed, mistakes during the construction process, design problems, late response in carrying out maintenance, unavailability of competent maintenance personnel, scared skilled workers, insufficient finance, age of buildings and the general condition of the building all affect FM practices. Several other studies have also emphasised the problems faced by FM practitioners when conversing with end-users (Shah, 2007; Then, 2013; Thomsen *et al.*, 2013; Risholt *et al.*, 2013; Moum *et al.*, 2017). Focusing on measurable aspects and technological capabilities, facility managers frequently overlook issues such as everyday facility use and users' behaviour alignment with recommended solutions (Sezer, 2012; Gram-Hanssen *et al.*, 2017). Also, the use of buildings by end-users in a way that was not intended can potentially jeopardise effective FM practices (Gram-Hanssen *et al.*, 2017).

3. Methodology

3.1 Identification of factors influencing effective facilities management practices

Previous studies by Myeda and Pitt (2014), Odediran *et al.* (2015), Ikedaishi and Okwuashi (2015) and Islam *et al.* (2019) have reported that several factors influence effective FM practices in public buildings. Following a comprehensive evaluation of this research, this study found 22 possible factors shown in Table 3. There are lists of factors well-documented in earlier studies that are more applicable. Availability of funding, design principles and scope and a lack of a sound maintenance system, for instance, are all recognised as critical elements determining its success in the literature.

3.2 Data collection

A quantitative approach collects data dependent on a study population (Tan, 2011). It has been used in FM research to get professional perspectives (Elmualim *et al.*, 2010; Muin *et al.*, 2021). A structured questionnaire was used in this study to evaluate the impediments of the crucial components influencing FM activities. As a result, the analysis presented in this publication is a questionnaire-based quantitative approach (Creswell, 2014). The research objectives and respondents' information were introduced in the first section of the questionnaire, followed by questions designed to obtain background information from the respondents. Afterwards, the respondents were asked to rate the 22 factors influencing FM practices using a five-point Likert scale (1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, 5 – strongly agree).

Facilities managers with knowledge and awareness of facilities in South Africa made up the population. A total of 39 research questionnaires were distributed to facilities managers in the Department of Public Works (DPW) in KwaZulu-Natal (KZN) Province to seek the opinion of these respondents. KZN Province was selected as a case study because it is the biggest province in South Africa with many public buildings and facilities managers. Specifically, there are 13 DPW districts under the leadership of 39 facilities managers consisting of three facilities managers per district who are highly knowledgeable on FM issues. All the 39 facilities managers were purposefully selected to participate in the research. Therefore, 39 questionnaires were distributed and duly filled and returned, yielding a 100.0% response rate. Quantitative research could still be conducted despite the limited sample size since the central limit theorem is considered valid with a sample size of 30 or more, according to the widely recognised rule (Ott and Longnecker, 2010; Hwang *et al.*, 2015).

3.3 Procedures for data analysis

3.3.1 Cronbach's alpha. Cronbach's alpha is one of the most widely used metrics for evaluating scale dependability. Cronbach's alpha is used to examine the questionnaire's reliability by measuring the average association or internal reliability among features in a research questionnaire or internal consistency among factors in a survey questionnaire. Cronbach's alpha coefficient (α) measures the consistency of components retrieved from multi-point and dichotomous structured ratings or questionnaires and varies from zero to one (Jarkas, 2015). The higher the (α) value, the more reliable is the adopted scale of measurement. However, the scale is reliable if the (α) value is not less than 0.70 (Taber, 2018). Based on this assertion and using the SPSS 20.0 statistical software, the computed (α) value for the 22 variables was 0.748, indicating that the five-point Likert scale measurement was reliable at a 5% significance level. Therefore, the collected sample can be treated as a whole and thus suitable for further analysis such as factor analysis (FA).

3.3.2 Descriptive statistics (mean score analysis). As a commonly used statistical method for determining relative importance (Olanrewaju *et al.*, 2020), the mean score analysis determined the ranking order of the 22 influencing factors in descending order, according to the participants' perceptions. If several influencing factors have the same mean score, the element with the lowest standard deviation (SD) was given the highest rank.

3.3.3 Factor analysis technique. The fundamental categorised variables revealed in this study were determined using FA. FA is a statistical technique for identifying a limited number of component groupings that can depict correlations between many connected variables (Aluko *et al.*, 2021). Obtaining principal components of the responses is an effective strategy for regrouping and reducing a massive range of variables to smaller components (Iyiola and Mewomo, 2022a). However, before using FA, it is necessary to assess its suitability. To determine the suitability of the principal component analysis, the Kaiser–Meyer–Olkin (KMO) measure of sample adequacy and Bartlett's test of sphericity were used in this study. The KMO is an indicator of sampling adequacy that represents the ratio of the squared correlation between the variables to the squared partial correlation between the variables (Field, 2013). The KMO value is a number that varies from zero to one. A score of 0 indicates that the sum of partial correlations is large relative to the sum of correlations, implying that the pattern of correlations has diffused. Hence, FA is unsuitable (Norusis, 2008). On the other hand, a score near one indicates that correlation patterns are highly compact, so FA would give reliable and distinct components (Field, 2013). The KMO value should be above the acceptable threshold of 0.50 to be considered suitable for FA (Field, 2009; Aluko *et al.*, 2021; Aluko and Mewomo, 2021). However, as demonstrated in Table 1, the level of acceptance of KMO values varies depending on the KMO value. The Bartlett sphericity test is a statistical test that emphasises the occurrence of correlations between variables (Iyiola and Mewomo, 2022b). It is used to see if the original correlation matrix is an identity matrix, which means there is no relationship between the variables and hence FA is not applicable (Pett *et al.*, 2003). The population correlation matrix is not an identity matrix when the test statistic for sphericity is enormous, and the associated significance level is minimal; hence FA is suitable (Pallant, 2010) (Figure 1).

4. Results and discussion

Two main approaches were used to analyse the factors affecting FM practices; ranking analysis and FA. This section presents the result of the study. Firstly, the development of the ranking analysis was presented. Afterwards, the result of the FA was presented in this section.

Table 2 shows the general information of the respondents. According to the data collected, males made up 21% of the respondents (53.8%), while females were 18% (46.2%). The result also revealed that 32 (82.1%) of the respondents had a National diploma as their highest level of education, while 6 (15.4%) had a bachelor's degree/BTech. An Honorary Degree is the highest degree of education held by 1 (2.6%) of the respondents. The findings also revealed that 15 (38.5%) respondents have less than five years of FM experience. The majority of the participants (59.0%) have between six and 10 years of FM experience, while the remaining 2.6% have between 11 and 15 years.

4.1 Result of descriptive analysis

Table 3 revealed the descriptive analysis of the challenges inhibiting effective FM in public buildings. Table 3 showed that the major challenges affecting FM services are; Availability of fund (M = 4.205, SD = 1.005), Occupants knowledge of FM (M = 4.128, SD = 1.105), Absence of a policy guideline for FM practice (M = 4.128, SD = 0.951), State of deterioration of facilities (M = 4.077, SD = 1.036) and design concepts and scope (M = 4.051, SD = 0.916).

Table 1. Acceptable KMO value (Field, 2009)

KMO value	Level of acceptance
>0.90	Excellent
0.80 to 0.90	Great
0.70 to 0.80	Good
0.50 to 0.70	Mediocre
<0.50	Inappropriate

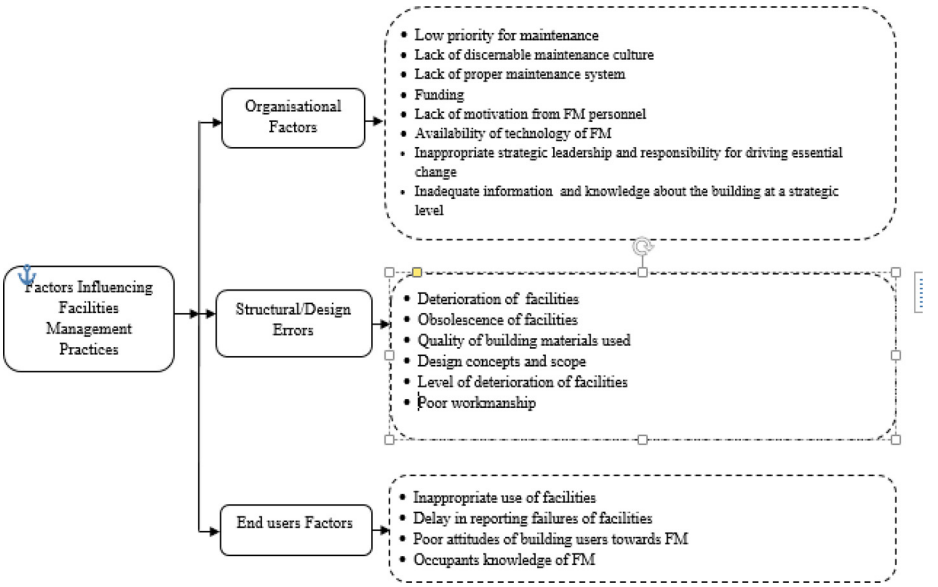

Figure 1. Structural framework showing factors influencing facilities management practices in public buildings

Socio-demographic information	Frequency (n)	(%)
Gender		
Male	18	46.2
Female	21	53.8
Education		
National Science Certificate	0	0.0
National Diploma	32	82.1
Bachelor of Science/BTech	6	15.4
Master's Degree	0	0.0
Honorary Degree	1	2.6
Doctorate (PhD)	0	0.0
Years of Experience in Facilities Management		
Less than five years	15	38.5
6–10 years	23	59.0
11–15 years	1	2.6
16–20 years	0	0.0
More than 20 years	0	0.0

Table 2. Background information of respondents

Challenges affecting FM practices in public buildings	Mean	SD	Rank
Availability of fund	4.205	1.005	1
Occupants' knowledge of FM	4.128	1.105	2
Absence of a policy guiding FM practice	4.128	0.951	3
State of deterioration of facilities	4.077	1.036	4
Design concepts and scope	4.051	0.916	5
Availability of technology for FM services	3.769	0.959	6
Lack of proper maintenance system	3.744	1.019	7
Training for FM professionals	3.718	0.916	8
Incompetent professionals to render FM services	3.718	0.972	9
Quality of building materials used	3.513	0.997	10
Poor attitudes of building users towards FM services	3.410	1.044	11
Delay in reporting failures of facilities	3.077	1.109	12
Lack of motivation for FM personnel	2.949	1.075	13
Poor integration of stakeholder knowledge	2.923	1.156	14
Deterioration of facilities	2.769	1.087	15
Poor workmanship	2.769	1.038	16
Inadequate information and knowledge about the building	2.769	1.111	17
Obsolescence of facilities	2.744	1.186	18
Inappropriate use of facilities	2.744	1.251	19
Low discernible maintenance culture	2.744	1.019	20
Low priorities for maintenance	2.692	1.104	21
Inappropriate strategic leadership and responsibility for driving essential change	2.564	1.209	22

Table 3. Challenges inhibiting effective FM in South Africa's public buildings

4.2 Result of factor analysis

The 22 critical factors (variables) in the findings of this research were subjected to FA to comprehend the factors affecting FM practices in South Africa entirely. The KMO value is 0.686, which is satisfactory because it meets the acceptable threshold, as shown in Table 1. Table 6 shows that all factor loadings were greater than or equal to 0.50, with all over 0.50; thus, all variables were included in the principal component. Table 4 shows that the

population correlation matrix is not an identity matrix because the chi-square value in Bartlett's sphericity test is immense (805.726), and the corresponding significance level is minimal (0.000). This, therefore, justify the use of using principal component analysis.

The principal component analysis approach was used to identify underlying factors for factor extraction. The outcome of the principal component analysis following Varimax rotation is summarised in Table 5. Three underlying groupings (components) were retrieved with eigenvalues greater than 1, accounting for 75.99% of the overall variance. This indicates that factors influencing FM practices with these three components explain the highest percentage (>50%) of the variance. The rate of variance defined by each component is also shown in the result. The first component accounts for 38.56% of the total variation, while the others account for 31.79%, 5.65% and 5.65%, respectively. The factors were classified into three groups.

Table 6 (Pattern matrix) shows the distribution pattern of variables that make up each component to identify the category of factors under each factor loading. As indicated in Table 6, the variables that loaded highly in components one to three were given unique names. Elements loaded in component one were referred to as organisational factors. In contrast, those loaded in component two were design/structural errors and those loaded in component three were referred to as end-user factors, respectively.

5. Discussion

5.1 Structural/design errors

The descriptive analysis in Table 3 revealed that FM is strongly affected by the availability of funds, occupants' knowledge of FM, absence of a policy guiding FM practice, state of deterioration of facilities and design concepts and scope were significant challenges affecting effective FM practices in public buildings in South Africa. This result was also in confirmation by the opinion of Mohammed and Hassanain (2010) and Akinsola *et al.* (2012). Since it is widely known that "money" plays a significant role in the performance of any task and procedure, owners of public buildings should make every effort to prepare and make appropriate finance accessible to facilities managers. South Africa's Government should also pay more attention to FM by ensuring that effective regulations are established to make FM practices mandatory in public buildings and tighter steps to remedy users' bad handling and mishandling of public facilities. This was also supported by the findings of Ogungbile and Oke (2015). One of the critical variables affecting effective FM procedures in public buildings is structural/design errors. Design errors result from mistakes in working drawings, detailing and specifications. Garcez *et al.* (2015), Salim *et al.* (2016), Isa *et al.* (2016) and Carretero-Ayuso and García-Sanz-Calcedo (2018) highlighted that neglecting maintenance during the initial stage of design can contribute to the increased life cycle, operation and maintenance expenses. Therefore, it is necessary to think about the maintenance from the beginning of the project.

Hassanain *et al.* (2014a) emphasised the importance of considering maintenance in the early stage of the construction process, suggesting that planned maintenance should

Table 4. KMO and Barlett's test of sample adequacy

KMO and Barlett's test of sample adequacy	
Kaiser–Meyer–Olkin measure of sampling adequacy	0.686
Approx. chi-square	805.726
Bartlett's test of sphericity	190
	0.000

Table 5. Total variance explained

Component S/N	Initial eigenvalues			Loadings Extraction sums of squared loadings			Loadings Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	8.482	38.556	38.556	8.482	38.556	38.556	8.261	37.549	37.549
2	6.993	31.787	70.343	6.993	31.787	70.343	6.658	30.264	67.812
3	1.244	5.654	75.996	1.244	5.654	75.996	1.801	8.184	75.996
4	0.960	4.362	80.358						
5	0.787	3.575	83.993						
6	0.688	3.128	87.061						
7	0.521	2.370	89.431						
8	0.484	2.201	91.632						
9	0.385	1.749	93.381						
10	0.342	1.555	94.936						
11	0.253	1.151	96.087						
12	0.185	0.842	96.929						
13	0.174	0.791	97.720						
14	0.126	0.574	98.294						
15	0.110	0.499	98.793						
16	0.090	0.407	99.200						
17	0.056	0.253	99.454						
18	0.051	0.232	99.686						
19	0.031	0.140	99.826						
20	0.023	0.105	99.931						
21	0.011	0.050	99.981						
22	0.004	0.019	100.000						

	Components		
	1	2	3
Low priorities for maintenance	0.931		
Low discernable maintenance culture	0.919		
Inadequate information and knowledge about the building	0.890		
Poor integration of stakeholder knowledge	0.876		
Inappropriate strategic leadership and responsibility for driving essential change	0.856		
Inadequate motivation for FM personnel	0.856		
Absence of a policy guiding FM practice	0.854		
Availability of funds	0.852		
Incompetent professionals to render FM services	0.843		
Lack of proper maintenance plan	0.793		
Training of FM personnel	0.659		
Availability of technology for FM	0.869		
Deterioration of facilities		0.875	
Obsolescence of facilities		0.516	
Level of deterioration of facilities		0.864	
Quality of building materials used		0.840	
Design concepts and scope		0.773	
Poor workmanship		0.922	
Inappropriate use of facilities			0.731
Delay in reporting failures of facilities			0.696
Poor attitudes of building users toward FM			0.696
Occupants' knowledge of FM			0.703

Table 6.
Rotated component matrix

begin at the design phase and continue throughout the facility's life span. Maintainability should be included in the design and construction phases to reduce operating and maintenance expenses while also simplifying the work necessary for maintenance (Hassanain *et al.*, 2014a, 2014b). Reworks are expected during the post-occupancy phase because of failed components. As a result, in the post-occupancy stage, unanticipated changes in designed facilities, costly maintenance and repair and numerous problems can arise in building components. According to Femi (2014), enhancing design quality can drastically reduce FM costs. Gatlin (2013) also mentioned that minimising design flaws can reduce many maintenance costs. Furthermore, Yap *et al.* (2017) found that cost-effectiveness can add value to construction projects by lowering the design error rate. It is believed that the absence of facilities managers and FM components throughout the design phase will pose a severe threat to the building's structural and functional integrity, necessitating additional maintenance efforts and an increase in the cost of maintenance. Therefore, the facilities manager's involvement in the design and construction process will reduce maintenance challenges (Ofori *et al.*, 2015). Another criterion for a successful building project is an understanding of FM. A lack of knowledge of FM would result in a serious maintenance issue. Also, problems with the maintainability and functionality of facilities may develop in the post-occupancy phase. Therefore, a lack of understanding of FM among design professionals may build defects and rework. Regular FM training programs with adequate skills and knowledge can increase the competency of all FM professionals. Therefore, organisations should give their workers constant training/education on improving FM practices. This finding is confirmed by the conclusions from Mohammed and Hassanain (2010), Akinsola *et al.* (2012), Agola and Kashiyanu (2015) and Jandali and Sweis (2018).

5.2 Organisational factors

The result in Table 6 also revealed that organisational factors are one of the factors influencing FM practices in buildings. This study attributed organisation factors to the following; low priorities for maintenance, lack of discernable maintenance culture, inadequate information about the structure, lack of integration of stakeholder knowledge, ineffective leadership and responsibility for driving essential change, lack of motivation for FM personnel, absence of a policy guiding FM practice, funding/financing, lack of competent professionals to render FM services, lack of proper maintenance system, training and development of FM personnel and availability of technology for FM. According to Odediran *et al.* (2015), FM in buildings is a complex process that necessitates many resources to carry out FM services. The success of FM services is mainly dependent on the availability of resources such as funds, time and workforce inside the organisation. As a result, individuals and governments in society must reimburse more funds to FM services to promote FM in buildings. Recently, Kate (2020) also mentioned that providing sufficient funds and creating adequate awareness can help improve FM practices in public buildings and society. It also involves a wide range of stakeholders across time and necessitates simultaneous attention to technical and non-technical challenges (Koleoso *et al.*, 2017). All significant actors must participate and commit for a long-term (Støre-Valen and Buser, 2019). An absence of strategic leadership and responsibility for bringing about necessary change was also cited as an issue.

One of the essential requirements for successful FM practices is leadership (Ikedaishi and Okwuashi, 2012). According to Obradovic *et al.* (2013), the success of a construction project is determined not by the number of specialists involved but by how successfully these individuals interact with one another and collaborate towards a shared vision of an integrated result. A competent leader can get tasks accomplished by focusing on people's efforts towards a similar objective and allowing them to work together as a team (Woon *et al.*, 2015). The lack of qualified personnel to provide FM services was also cited as a significant stumbling block to developing FM practices (Odediran *et al.*, 2015). The outcomes of this study reinforce the notion that a facilities manager's knowledge and expertise are critical in ensuring the effectiveness and performance of FM (Firdauz *et al.*, 2015). Since there are more sophisticated buildings, managing facilities in a building have gotten more difficult (Islam *et al.*, 2019). To provide successful FM practices, facilities experts must possess diverse abilities. According to Pathirage *et al.* (2008), knowledge management methods in FM organisations requires strategic design, the implementation of procedures and performance review. According to Asiabaka (2008), the expanded educational goals and objectives necessitated the inclusion of several minds and specialists from other fields of knowledge in the FM process and collaborative initiatives that introduce new ideas and views into FM. Maintaining complex structures and remodelling and updating existing ones necessitates a high level of skill and expertise and a significant investment in both people and material resources. This is because the ageing and damage of facilities and equipment are caused by changes in weather conditions and an absence of maintenance culture (Lind and Muyingo, 2012).

5.3 End-users factors

End-user factors were attributed to irresponsible use of facilities, failure to disclose faults in facilities promptly, poor attitudes of building users towards FM and occupants' knowledge of FM. Users' involvement in FM projects is significant (Thomsen *et al.*, 2013; Risholt *et al.*, 2013; Moum *et al.*, 2017). Facility managers must make a more substantial effort to educate the public (particularly building owners and administrators) about FM's need for and benefits in public

buildings. The importance of maintenance and resilience should be emphasised (Ogungbile and Oke, 2015). This is especially important for the owner, as they substantially impact FM concerns throughout the design stage. Awareness may be promoted by hosting international conferences and workshops showing the best international techniques (Fatayer *et al.*, 2019). Asiabaka (2008) noted that lack of awareness of managerial systems, nonchalant or passive attitudes towards facilities rotting, unavailability of qualified experts, insufficient expertise and inadequate financing are significant areas that need attention.

Individual needs to be aware of the importance of FM practices because awareness is one of the crucial factors that could influence FM practice in public buildings. Lack of awareness of the importance of FM practices in the building will prevent owners and administrators of public buildings from seeing why skilled workmanship and expertise are needed to carry out FM services (Haugen and Klungseth, 2017). Awareness and knowledge are the first stumbling blocks that must be conquered in achieving effective facility management practices. Individual awareness, knowledge and understanding, according to Spagnolli (2011), determine the extent of commitment that will be put into action and the adoption of any concept. The importance of ensuring that information reaches individuals clearly and effectively is emphasised in this study, but it also offers more extensive and distinctive techniques for integrating users and stakeholders. According to the findings, developing unique and innovative solutions that meet users' needs necessitates a collaborative approach known as co-creation (Alexander, 2012; Price, 2018). At the initial planning and development stages, this coordinated approach is viewed as critical throughout the early construction phases.

6. Conclusion and recommendation

Based on the discussion of the findings of this study, it was concluded that the most predominant challenges in FM public sector buildings are insufficient funding, irregular or fixed budget, the absence of a policy guideline for the development of infrastructure and maintenance of facilities in buildings, poor workmanship, lack of discernable maintenance culture, construction of facilities, an inspection of facilities, deterioration of structures or facilities as a result of their age and reckless use of facilities. The study concluded that structural/design errors, financial factors and awareness factors significantly affect effective FM practices in South Africa. FM is a substantial concern in South African and international construction projects. Based on the findings, specific recommendations are proposed to reduce the effects of the listed factors on the performance of the building. Firstly, facility managers can help remove design flaws and their impact on facilities during the design phase by reviewing operational design possibilities and the structural engineer's selection of the structure of a building. If more robust integration is to be accomplished in the future, this situation must be addressed. Also included in the design stage should be good maintenance planning or maintainability. Furthermore, proper training can boost the workforce and production. In addition, sufficient financing is required for the smooth operation of FM. This research has revealed the most critical elements that influence FM. The importance of maintainability should be made more widely known. This is especially important for the owner, as they have a big say in how maintainability is considered during the design process. The staging of international seminars and workshops showing the most excellent global practices could help raise awareness. As a result, this research is helpful to designers and facility managers since it will inspire authorities and policymakers in the field of FM to focus on the most relevant variables and discover strategies to minimise them. This research suggests new approaches to solving FM issues in buildings and society. Additionally, FM managers must set time-bound goals and objectives to improve the state of the facilities and FM procedures. In addition, facilities in the buildings should be inspected regularly. This is necessary because it will allow

organisations to understand the current state of their facilities, which will aid in formulating time-bound policies. FM planning ahead is also vital for improving FM practices because any organisation that wants to forge ahead in its FM procedures should plan. As a result, a managerial strategy is very iessentialide employees in terms of FM performance expectations. Facilities auditing can also be used to analyse the condition of facilities to determine the best course of action for improving their performance. There could be damage to some facilities beyond repair, and such components can impact the overall system's efficiency. Finally, strategic planning is necessary since the technique used to manage one component in a facility may not be entirely relevant for another component in the same facility. As a result, FM experts must be actively engaged in creating goals and planning for effective FM procedures. Furthermore, one of the most significant possible advancements in FM is the use of technology. As a result, standardisation and digitisation are projected to improve FM processes and lead to better information-based decisions.

The findings of this study help to bridge the information gap in developing nations about FM. Still, they also serve as a helpful guideline for policymakers and practitioners to take appropriate initiatives to strengthen FM practices. Furthermore, international organisations and advocates interested in supporting FM techniques in South Africa to create more sustainable facility improvements might benefit from this research.

Even though the objective was met, certain limitations to this study should be recognised. These constraints should be acknowledged in future research and when interpreting and generalising the findings. Firstly, because the criticalities assessment in this study was subjective, it could be impacted by the respondents' attitudes and experiences. Apart from that, while the sample size and KMO value of this study were suitable for conducting statistical analyses, it should be noted that they are still limited. Increasing the sample size could increase the KMO value; therefore, further research with a bigger sample size would be helpful to evaluate whether the results will change considerably from those given in this study. Finally, while the results of this study may be beneficial to policymakers and practitioners in other developing countries around the world, data from other countries may provide different results. Similar studies might also be conducted in many developing nations to identify significant differences, which would aid in developing approaches to improve its effectiveness. The outcomes of a large-scale study on the promotion of FM practices in a developing nation are summarised in this publication. While this work focuses on the factors that influence FM practices, a future research publication will focus on empirical data on ways to overcome obstacles and promoting more excellent FM practices. Interrelationships between influencing factors and their effects on FM practices will be investigated/modelled in a future study.

References

Abigo, A., Madgwick, D., Gidado, K. and Okonji, S. (2012), *Embedding Sustainable FM in the Management of Public Buildings in Nigeria. EPPM*, University of Brighton, Brighton, UK, pp. 10-11.

Agola, J. and Kashiyanu, B. (2015), "Conceptual study on construction defects and its solution", *International Journal of Advanced Research in Engineering and Scientific Management*, Vol. 1 No. 6, pp. 1-7.

Akinsola, O.E., Hussaini, P.O., Oyenuga, S.O. and Fatokun, A.O. (2012), "Critical factors influencing facility maintenance management of tertiary institutional buildings in Southwest Nigeria", *Mediterranean Journal of Social Sciences*, Vol. 3 No. 11, pp. 489-496.

Alexander, K. (2012), "Co-creation of value in FM", in Alexander, K. and Price, I. (Eds), *Managing Organizational Ecologies: Space, Management, and Organizations*, Routledge, New York, NY, pp. 155-166.

Aliyu, A.A., Funtua, H.A., Mammadi, A., Bukar, B.G., Garkuwa, A.I. and Abubakar, M.M. (2016), "Management problems associated with multi-tenanted high-rise commercial buildings in Kaduna metropolis", *Nigeria Civil and Environmental Research*, Vol. 8 No. 1.

Aluko, O.R. and Mewomo, M.C. (2021), "Critical factors affecting quality of building projects: professionals service providers' perspectives", *Journal of Construction Project Management and Innovation*, Vol. 11 No. 2, pp. 1-16, ISSN 2223-7852.

Aluko, O.R., Idoro, G.I. and Mewomo, M.C. (2021), "Relationship between perceived service quality and client satisfaction indicators of engineering consultancy services in building projects", *Journal of Engineering, Design and Technology*, Vol. 19 No. 2, pp. 557-577.

Asiabaka, I.P. (2008), "The need for effective facility management in schools in Nigeria", *New York Science Journal*, Vol. 1 No. 2, pp. 10-21.

Breesam, Jawad. (2020), "Factors affecting maintenance procedures for public buildings, IOP conf", *Series: Materials Science and Engineering*, Vol. 1090 No. 1, p. 12120, doi: 10.1088/1757-899X/1090/1/012120.

Carretero-Ayuso, M.J. and García-Sanz-Calcedo, J. (2018), "Analytical study on design deficiencies in the envelope projects of healthcare buildings in Spain", *Sustainable Cities and Society*, Vol. 42, pp. 139-147.

Chandrashekaran, A. and Gopalakrishnan, B. (2008), "Maintenance risk reduction for effective FM", *Journal of Facilities Management*, Vol. 6 No. 1, pp. 52-68.

Cobbinah, P.J. (2010), "Maintenance of buildings of public institutions in Ghana case study of selected institutions in the Ashanti region", Doctoral dissertation.

Creswell, J.W. (2014), *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 4th ed., Sage publications, Thousand Oaks, CA.

Elmualim, A., Czwakiel, A., Valle, R., Ludlow, G. and Shah, S. (2017), "The practice of sustainable facilities management: design sentiments and the knowledge chasm", *Design Management for Sustainability*, Routledge, pp. 91-102.

Elmualim, A., Shockley, D., Valle, R., Ludlow, G. and Shah, S. (2010), "Barriers and commitment of facilities management profession to the sustainability agenda", *Building and Environment*, Vol. 45 No. 1, pp. 58-64.

Fatayer, F.A., Hassanain, M.A., Abdallah, A. and Al-Hammad, A.-M. (2019), "Investigation of facilities management practices for providing feedback during the design development and review stages", *International Journal of Building Pathology and Adaptation*, Vol. 37 No. 5, pp. 597-614, doi: 10.1108/IJBPA-05-2018-0040.

Femi, O.T. (2014), "Effects of faulty design and construction on building maintenance", *Int. J. Tech. Enhanced Emerging Eng. Res.*, Vol. 2 No. 5, pp. 59-64.

Field, A. (2009), *Discovering Statistics Using SPSS*, 3rd ed., Sage, London.

Field, A. (2013), *Discovering Statistics Using IBM SPSS Statistics*, 4th ed., Sage, London.

Firdauz, A.M., Sapri, M. and Mohammad, I.S. (2015), Facility management knowledge development in Malaysia: Added value in hospitality managerial competency, *Facilities*, Vol. 33 No. 1/2, pp. 99-118.

Garcez, N., Lopes, N., De Brito, J., Sá, G. and Silvestre, J.D. (2015), "Influence of design on the service life of pitched roof cladding", *Journal of Performance of Constructed Facilities*, Vol. 29 No. 3, pp. 1-11.

Gatlin, F. (2013), "Identifying and managing design and construction defects", *Construction Insight from Hindsight*, Vol. 5 No. 2, pp. 1-7.

Gram-Hanssen, K., Georg, S., Christiansen, E.T. and Heiselberg, P.K. (2017), "How building regulations ignore the use of buildings, what that means for energy consumption and what to do about it", *Proceedings of ECEEE: Consumption, Efficiency and Limits*, 29 May-3 June, Hyéres, pp. 2095-2104.

Häkkinen, T. and Belloni, K. (2011), "Barriers and drivers for sustainable building", *Building Research and Information*, Vol. 39 No. 3, pp. 239-255.

Hasan, M.I.M., Razak, N.N.A., Endut, I.R., Samah, S.A.A., Ridzuan, A.R.M. and Saaidin, S. (2016), "Minimizing defects in building construction project", *Jurnal Teknologi*, Vol. 78 Nos 5/2, pp. 79-84.

Hassanain, M.A., Al-Hammad, A.M. and Fatayer, F. (2014a), "Assessment of defects in HVAC systems caused by lack of maintenance feedback to the design team", *Architectural Science Review*, Vol. 57 No. 3, pp. 188-195.

Hassanain, M.A., Al-Hammad, A.M. and Fatayer, F. (2014b), "Assessment of architectural defects attributed to lack of maintenance feedback to the design team", *Architectural Science Review*, Vol. 57 No. 2, pp. 132-138.

Haugen, T.B. and Klungseth, N.J. (2017), "In-house or outsourcing FM services in the public sector: a review of 25 years research and development", *Journal of Facilities Management*, Vol. 15 No. 3, pp. 262-284, doi: 10.1108/JFM-06-2016-0022.

Hwang, B.G., Zhao, X., Lee, Y.L. and Zhong, Y. (2015), "Addressing risks in green retrofit projects: the case of Singapore", *Project Management Journal*, Vol. 46 No. 4, pp. 76-89.

Ikedaishi, D. and Okwuashi, O. (2015), "Significant factors influencing outsourcing decision for facilities management (FM) services: a study on Nigeria's public hospitals", *Property Management*, Vol. 33 No. 1.

Ikedaishi, D.I., Ogunlana, S.O., Boateng, P. and Okwuashi, O. (2012), "Analysis of risks associated with FM outsourcing: a multivariate approach", *Journal of Facilities Management*, Vol. 10 No. 4, pp. 301-316.

Isa, H.M., Ismail, K., Zainol, H. and Othman, M.F. (2016), "Tracking architectural defects in university building in Malaysia", *Proceedings of the 4th International Building Control Conference, MATEC Web Conference*, Vol. 66, pp. 1-6.

Islam, R., Nazifa, T.H. and Mohamed, S.F. (2019), "Factors influencing facilities management cost performance in building projects", *Journal of Performance of Constructed Facilities*, Vol. 33 No. 3, p. 4019036.

Iyiola, C.O. and Mewomo, M.C. (2022a), "An empirical survey of critical factors influencing students' electricity use behaviour in halls of residence", *Journal of Engineering, Design and Technology*, Vol. ahead of print No. ahead of print.

Iyiola, C.O. and Mewomo, M.C. (2022b), "Assessment of health hazards and safety practices on construction sites in Lagos state", *Nigeria. Journal of Construction*, Vol. 14 No. 2, pp. 19-29.

Jandali, D. and Sweis, R. (2018), "Assessment of factors affecting maintenance management of hospital buildings in Jordan", *Journal of Quality in Maintenance Engineering*, Vol. 24 No. 1, pp. 37-60, doi: 10.1108/JQME-12-2016-0074.

Jarkas, A.M. (2015), "Factors influencing labour productivity in Bahrain's construction industry", *International Journal of Construction Management*, Vol. 15 No. 1, pp. 94-108.

Jawdeh, H.B. (2013), "Improving the integration of building design and facilities management", Unpublished PhD. A thesis submitted to the School of the Built Environment, College of Science and Technology, University of Salford, Salford, UK.

Jiboye, A.D. (2012), "Post-occupancy evaluation of residential satisfaction in Lagos, Nigeria: feedback for residential improvement", *Frontiers of Architectural Research*, Vol. 1, pp. 236-243.

Koleoso, H.A., Omirin, M.M. and Adewunmi, Y.A. (2017), "Performance measurement scale for facilities management service in Lagos-Nigeria", *Journal of Facilities Management*, Vol. 15 No. 2, pp. 128-152.

Kamaruzzaman, S.N., Isa, N.M., Mohamed, O. and Berawi, M.A. (2017), "Review of facilities management functions in value management practices", *Architecture*, Vol. 8 No. 5.

Lai, J.H. and Yik, F.W. (2011), "An analytical method to evaluate facility management services for residential buildings", *Building and Environment*, Vol. 46 No. 1, pp. 165-175.

Lind, H. and Muyingo, H. (2012), "Building maintenance strategies: planning under uncertainty", *Property Management*, Vol. 30 No. 1, pp. 14-28, doi: 10.1108/02637471211198152.

Mewomo, M.C., Ndlovu, P.M. and Iyiola, C.O. (2021), "The current nature of facilities management practices on public sector buildings in South Africa", *Journal of Construction*, Vol. 14 No. 1, pp. 15-23.

Mohammed, M.A. and Hassanain, M.A. (2010), "Towards improvement in facilities operation and maintenance through feedback to the design team", *The Built and Human Environment Review*, Vol. 3, pp. 72-87.

Moum, A., Hauge, Å.L. and Thomsen, J. (2017), "Four Norwegian zero emission pilot buildings – building process and user evaluation", sintef byggforsk", available at: https://sintefbok.no/book/index/1128/four_norwegian_zero_emission_pilot_buildings_building_process_and_user_evaluation (accessed 7 June 2018).

Muin, Z.A., Sapri, M., Sipan, I. and Hashim, H.A. (2021), "An investigation of facilities management implementation process for Malaysian state mosque", *International Journal of Real Estate Studies*, Vol. 15 No. 2, pp. 103-113.

Myeda, N.E. and Pitt, M. (2014), "Facilities management in Malaysia: understanding the development and practice", Facilities.

Norusis, M.J. (2008), *SPSS 16.0 Advanced Statistical Procedures Companion*, Prentice-Hall, Upper Saddle River, NJ.

Odediran, S.J., Gbadegesin, J.T. and Babalola, M.O. (2015), "Facility management practices in the Nigerian public universities", *Journal of Facilities Management*, Vol. 13 No. 1, pp. 5-26.

Obradovic, V., Jovanovic, P., Petrovic, D., Mihic, M. and Mitrovic, Z. (2013), "Project managers' emotional intelligence – a ticket to success", *Procedia-Social and Behavioral Sciences*, Vol. 74, pp. 274-284.

Ofori, I., Duodu, P. and Bonney, S. (2015), "Establishing factors influencing building maintenance practices: Ghanaian perspective", *Journal of Economic Sustainable Development*, Vol. 6 No. 24, pp. 184-193.

Ogungbile, A.J. and Oke, A.E. (2015), "Assessment of facility management practices in public and private buildings in Akure and Ibadan cities, South-Western Nigeria", *Journal of Facilities Management*, pp. 830-843.

Olaniyi, O.O. (2017), "Development of a facilities management framework for sustainable building practices in Nigeria", Unpublished Doctoral dissertation, University of Central Lancashire.

Olanrewaju, S. and Anifowose, O. (2015), "The challenges of building maintenance in Nigeria: a case study of EKITI state", *European Journal of Educational and Development Psychology*, Vol. 3 No. 2, pp. 30-39.

Olanrewaju, O.I., Chileshe, N., Babarinde, S.A. and Sandanayake, M. (2020), "Investigating the barriers to building information modeling (BIM) implementation within the Nigerian construction industry", *Engineering, Construction and Architectural Management*, Vol. 27 No. 10.

Olotuah, A.O. (2015), "Climate-responsive architecture and sustainable housing in Nigeria", *Global Journal of Research and Review*, Vol. 2 No. 4, pp. 94-99.

Ott, R.L. and Longnecker, M. (2010), *An Introduction to Statistical Methods and Data Analysis*, Brooks/Cole, Belmont, CA.

Pallant, J. (2010), *SPSS Survival Manual*, 4th ed., Allen and Unwin Book, New South Wales.

Pett, M.A., Lackey, N.R. and Sullivan, J.J. (2003), *Making Sense of Factor Analysis: The Use of Factor Analysis for Instrument Development in Health Care Research*, Sage, Thousand Oaks, CA.

Price, I. (2018), "Exploring FM's dominant logics", *Facilities*, Vol. 36 Nos 1/2, pp. 37-48.

Pathirage, C., Haigh, R., Amaratunga, D. and Baldry, D. (2008), "Knowledge management practices in facilities organisations: a case study", *Journal of Facilities Management*, Vol. 6 No. 1, pp. 5-22.

Risholt, B., Time, B. and Hestnes, A.G. (2013), "Sustainability assessment of nearly zero energy renovation of dwellings based on energy, economy and home quality indicators", *Energy and Buildings*, Vol. 60, pp. 217-224.

Salim, N.A.A., Salleh, N.M. and Zahari, N.F. (2016), "Design failure affecting maintenance management on public higher education institution in Malaysia", *Proceedings of the 4th International Building Control Conference, MATEC Web Conference*, Vol. 66, pp. 1-7.

Sarpin, N., Yang, J. and Xia, B. (2016), "Developing a people capability framework to promote sustainability in facility management practices", *Facilities*, Vol. 34 Nos 7/8, pp. 450-467.

Sezer, A. (2012), Environmental assessment tools and efficiency in housing and office refurbishment", in Smith, S.D. (Ed.), *Proceedings of the 28th Annual ARCOM Conference, 3-5 September 2012, Association of Researchers in Construction Management, Edinburgh*, pp. 1331-1341.

Shah, S. (2007), *Sustainable Practice for the Facilities Manager*, Blackwell Publication, Oxford.

Støre-Valen, M. and Buser, M. (2019), "Implementing sustainable facility management: challenges and barriers encountered by Scandinavian FM practitioners", *Facilities*, Vol. 37 Nos 9/10, pp. 550-570, doi: 10.1108/F-01-2018-0013.

Spagnolli, A., Corradi, N., Gamberini, L., Hoggan, E.,Støre-Valen, M., Jacucci, G., Katzeff, C. and Jonsson, L. (2011), "Eco-feedback on the go: motivating energy awareness", *Computer*, Vol. 44 No. 5, pp. 38-45.

Tan, Z., Li, J., Wu, Z., Zheng, J. and He, W. (2011), "An evaluation of maintenance strategy using risk based inspection", *Safety science*, Vol. 49 No. 6, pp. 852-860.

Taber, K.S. (2018), "The use of Cronbach's alpha when developing and reporting research instruments in science education", *Research in Science Education*, Vol. 48 No. 6, pp. 1273-1296.

Talib, R., Ahmad, G., Zakaria, N. and Sulieman, M.Z. (2014), "Assessment of factors affecting building maintenance and defects of public buildings in Penang", *Malaysia Archit. Res*, Vol. 4 No. 2, pp. 48-53.

Then, D.S.S. (2013), "Issues of Breadth and depth in facilities management – reflections of 30 years of educational development", in *Proceedings of Facilities Management and Maintenance, CIB World Building Congress Construction and Society, Brisbane*, pp. 5-9.

Thomsen, J., Berker, T., Hauge, Å.L., Denizou, K., Wågø, S. and Jerkø, S. (2013), "The interaction between building and users in passive and zero-energy housing and offices: the role of interfaces, knowledge and user commitment", *Smart and Sustainable Built Environment*, Vol. 2 No. 1, pp. 43-59.

Woon, N.B., Mohammad, I. S., Baba, M., Zainol, N.N. and Nazri, A.Q. (2015), "Critical success factors for post occupancy evaluation of building performance: a literature analysis", *Jurnal Teknologi*, Vol. 74 No. 2.

Waziri, B.S. and Vanduhe, B.A. (2013), "Evaluation of factors affecting residential building maintenance in Nigeria: users' perspective civ", *Environ. Res*, Vol. 3 No. 8, pp. 19-25.

Xianhai, M. (2013), "Involvement of facilities management specialists in building design: United Kingdom experience", *Journal of Performance of Constructed Facilities*, Vol. 27 No. 5, pp. 500-507.

Yap, J.B., Low, P.L. and Wang, C. (2017), "Rework in Malaysian building construction: impacts, causes and potential solutions", *Journal of Engineering, Design and Technology*, Vol. 15 No. 5, pp. 591-618, doi: 10.1108/JEDT-01-2017-0002.

Further reading

Adejimi, A. (2005), "Poor building maintenance in Nigeria: are architects free from blames?", *Proceeding ENHR International Conference Housing, New Challenges Innovation. Tomorrow's Cities, Iceland*, Vol. 29, pp. 1-16.

Adenuga, O.A., Odusami, K.T. and Faremi, J.O. (2007), "Assessment of factors influencing maintenance management of public hospitals in Lagos state", *Nigeria: The Construction and Building*

Research Conference (COBRA) of the Royal Institution of Chartered Surveyors, GA Tech, Atlanta, pp. 6-7.

Adewunmi, Y., Ajayi, C. and Ogunba, O. (2009), "Facilities management: factors influencing the role of Nigerian estate surveyors", *Journal of Facilities Management*, Vol. 7 No. 3, pp. 246-258.

Ali, A., Keong, K., Zakaria, N., Zolkafli, U. and Akashah, F. (2013), "The effect of design on maintenance for school buildings in Penang, Malaysia", *Structural Survey*, Vol. 31 No. 3, pp. 194-201.

Ebenehi, I.Y., Mohamed, S., Sarpin, N., Wee, S.T. and Adaji, A.A. (2018), "Building users' appraisal of effective fire safety management for building facilities in Malaysian higher education institutions: a pilot study", *Path of Science*, Vol. 4 No. 12, pp. 2001-2010.

Hopland, A.O. and Nyhus, O.H. (2015), "Does student's satisfaction with school facilities affect exam result?", *An Empirical Investigation. Facilities*, Vol. 17 Nos 1/2, pp. 31-53.

Kaiser, H.F. (1960), "The application of electronic computer to factor analysis", *Educational and Psychological Measurement*, Vol. 20 No. 1, pp. 141-157.

Lavy, S. and Bilbo, D. (2010), "Facilities maintenance management practices in large public schools, Texas, facilities", *Facilities*, Vol. 27 Nos 1/2, pp. 5-20.

Menassa, C. and Baer, B. (2014), "A framework to assess the role of stakeholders in sustainable building retrofit decisions", *Sustainable Cities and Society*, Vol. 10, pp. 207-221.

Nurul, N.O.B. and Md Azree, O.M. (2014), "General building defects: causes, symptoms and remedial work", *European Journal of Lipid Science and Technology*, Vol. 3 No. 1, pp. 4-17.

Ojara, E.S. (2013), "The challenges of housing maintenance in Nigeria", Unpublished HND Project, Department of Building Technology, the Federal Polytechnic, Ado Ekiti, Nigeria.

Oladokun, S.O. and Ajayi, C.A. (2019), "Assessing users' perception of facilities management services in a public university: a case study approach", *Journal of Facility Management and Research*, Vol. 2 No. 2, pp. 62-73.

Patton, M.Q. (2001), *Qualitative Research and Evaluation Components*, Sage, Thousand Oaks, CA.

Rose, R., Cain, D.A., Dempsey, J.J. and Schneider, R. (2007), "Building: the gift that keeps on taking a framework for integrated decision making", *APPA and the Centre for Facilities Research*, Alexandria, VA.

Zhao, X., Hwang, B.G., Low, S.P. and Wu, P. (2014), "Reducing hindrances to enterprise risk management implementation in construction firms", *Journal of Construction, Engineering, and Management*, Vol. 141 No. 3, p. 4014083, doi: 10.1061/(ASCE)CO.1943-7862.0000945.

Corresponding author
Modupe Cecilia Mewomo can be contacted at: modupem@dut.ac.za