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PERFORMANCE LEVELS OF HIGH-RISE PRIVATE OFFICE BUILDINGS MAINTENANCE MANAGEMENT IN MALAYSIA

POZIOMY WYDAJNOŚCI ZARZĄDZANIA UTRZYMANIEM RUCHU W PRYWATNYCH WIELOKONDYGNACYJNYCH BUDYNKACH BIUROWYCH W MALEZJI

Maintenance management is an essential aspect in determining the performance and quality of properties such as office buildings. The fundamental issues related to techniques and approaches concerned are generally taken lightly by the practitioners which lead to inefficiency of maintenance management practice in the market today. The paper aims to determine the current standard and performance of maintenance management system by applying the study to high-rise private office buildings. These objectives are to be achieved by evaluating and analysing perceptions of the end users from five (5) high-rise office buildings in Klang Valley by using a mixed method combination of both quantitative and qualitative methods. Research findings signify that the performance of high-rise office buildings are generally rated as average by the end users and results from interviews with the maintenance managers denote the detailed systems applied. There is a positive relationship between the maintenance management systems and performance of maintenance management. This paper provides an important research which uncovered the scenario in the industry and the key perceptions by the building end users. This research is anticipated to be significantly beneficial and can be further used as a piece of information specifying on high rise private office buildings.

Keywords: Maintenance management, performance levels, end users, high-rise office buildings, performance measurement.

Zarządzanie utrzymaniem ruchu jest ważnym aspektem przy określaniu wydajności i jakości mienia, takiego jak na przykład budynki biurowe. Podstawowe zagadnienia związane z odpowiednimi technikami i metodami są na ogół traktowane dość pochopnie przez praktyków, co może prowadzić do powszechnej nieefektywności zarządzania utrzymaniem ruchu. Celem artykułu jest określenie bieżącego poziomu i wydajności systemu zarządzania utrzymaniem ruchu poprzez badania, których przedmiotem są wielokondygnacyjne prywatne budynki biurowe. Cele te zrealizowano poprzez ocenę i analizę obserwacji użytkowników końcowych z pięciu wielokondygnacyjnych budynków biurowych w Dolinie Klang przy użyciu metody mieszanej łączącej podejście ilościowe i jakościowe. Wyniki badań pokazują, iż wydajność wielokondygnacyjnych budynków biurowych jest ogólnie oceniana przez użytkowników końcowych jako przeciętna, podczas gdy rezultaty wywiadów ze specjalistami utrzymania ruchu dostarczyły informacji nt. stosowanych systemów. Istnieje pozytywny związek między systemami zarządzania utrzymaniem ruchu oraz jego wydajnością. Niniejszy artykuł przedstawia ważne badania, które prezentują praktyki stosowane w przemyśle jak również kluczowe spostrzeżenia użytkowników końcowych budynków. Badania mogą mieć korzystne przełożenie; mogą także znaleźć dalsze zastosowanie jako źródło szczegółowych informacji nt. wielokondygnacyjnych prywatnych budynków biurowych.

Słowa kluczowe: zarządzanie utrzymaniem ruchu, poziomy wydajności, odbiorcy końcowi, wielokondygnacyjne budynki biurowe, pomiar wydajności.

1. Introduction

Maintenance Management or Operations Management has been defined as a function that transforms input including people, capital, energy, materials and technology into outputs namely goods and services [22]. Coetzee [7] defines it as an activity that aims to optimise the availability and reliability of production equipment and maintain its operability at an acceptable cost level. Subsequently, Certo [6] has labeled operations management as a systematic direction and control of operation processes. These definitions have highlighted maintenance management as a systematic design used by the people that operate

the organizations to control the overall operation processes in transforming the inputs into goods and services.

Bernard et al. [5] report that the 'Deferred Maintenance Concept' that was well known 10 years earlier was still ongoing in the maintenance department. The deferred maintenance concept that is basically of postponing works and accumulating overdue maintenance works has entailed enormous amounts of money to be expended. He also claimed that facilities were aging and constantly being renovated in piecemeal fashion which means that the actions were taken at different times or ways rather than carefully planned from the begin-

ning. Bernard et al. [5] also add that many renovations were limited in scope due to funding restraints and many times result in cosmetic change with few or no infrastructure improvements. This fragmentation could further lead to inefficiency of mechanical systems, customer complaints due to dissatisfaction with their facility or space environmental conditions, and eventually higher utility bills and maintenance costs.

Meanwhile, Hinks [11] relates a maintenance management performance scenario from his interviews with the facility managers to find their agreed set of indicators. The managers were uninterested in considering any facets of maintenance management performance below an aggregated level of indicator for maintenance. He also claims that the business managers did not consider any management details as they relied more on reactive actions based on clients' or users' complaints.

This indicates that maintenance managements are still being practiced in improper procedure by the maintenance managers which subsequently caused bad impacts to the facilities and the services provided. It can be seen that the managers prefer carrying out reactive maintenance works rather than proactive works and at times do not consider for clients satisfaction and also the performance of services. There is an increasing concern that the maintenance management has been unprofessionally applied by the maintenance managers and no research has so far outlined the critical factors and deliberation on such impractical practices.

While Gelders et al. [10] suggested that there are four (4) measurements of benchmarking to be looked at like financial (shareholder's views), customers, internal processes (the long- and short-term means to achieve financial and customer objectives), learning and growth (capability to improve and create value). In this scope, customer group that comprises of either clients or building occupants can be also known as end users. It is undeniably true that end users' perceptions and satisfaction level are able to conduct the maintenance managers to choose the right channel and implementation to upgrade the building performance.

Therefore, maintenance management is conclusively proven as an essential facet of a property's performance. An efficient maintenance management will produce a systematic and excellent maintenance management which increases the operation productivity and performance whereas improper conduct decreases the performance level and affect the life cycle of a property. Evaluation on the end users' response can lead to the building performance analysis which will later help to identify the gaps existed between the service provided and satisfaction level. Therefore, measurement is needed to be evaluated in order to maintain an impressive standard of performance and benchmarking is suggested as one highly influential tool to identify actual and current performance of a practice to suit the best practices available in the market.

2. Maintenance Management: Roles & Current Scenario

In emphasising the importance of maintenance management in the property industry today, various literature concerning maintenance management and end users' perceptions and satisfaction key factors are reviewed. The significance of maintenance and its position in the world's diverse industries can be seen in progressive developments of manufacturing, refineries, mining and building. Egbu [9] signifies the role of maintenance as the major driver of economic growth whereby it generates 45-60% of fixed capital formation in many countries and also generates 5-15% of Gross Domestic Product (GDP). The role of maintenance in modern manufacturing is becoming ever more important with companies adopting maintenance as a profit-generating business element [14].

While in refineries, the maintenance and operations department are very large and each department consists of up to 30% of the total

staffing [8]. A study by the Swedish mining industry shows that the cost of maintenance in a highly mechanised mine can be 40-60% of the operating cost [7]. Facilities and maintenance management also contributes from 5 to 10% of employment in individual countries whereby it supplies approximately 111 million people which constitutes the majority of labour force which is 75% in developing countries [9]. The role is particularly effective in developing countries due to the rapid and large-scale urbanization which require large scale of facilities and maintenance management.

Wordsworth [25] reports that building maintenance accounts for over half the building industry's total output, and for over two third of the contracts let. Subsequently, the role of maintenance manager continues to expand, as more demands are made by users regarding the economic and functional efficiency of the buildings in which they live and work. Maintenance provides critical support for heavy and capital-intensive industry by keeping machinery and equipment in a safe operating condition [21].

Tsang [24] opines that maintenance works as an important support function in business with significant investment in physical assets and plays an important role in achieving organizational goals. Ahmad [1] points that property for instance building is a valuable physical asset that requires an efficient maintenance management. Yasmin [26] also believes that any organisation which manages high-rise commercial buildings must emphasise the effectiveness and efficiency in their operations. This can also be related to the office buildings as it also requires a good maintenance management system. The condition and quality of the buildings also reflect public pride or indifference, the level of prosperity in the area, social values and behaviour and all the many influences both past and present combine to give a community its unique character.

Nevertheless, improper conduct and application of maintenance management procedure and systems may result in deteriorating the property itself. The impact may be seen in demoting a planned financial costing and the loss in value of the property. As such, an excellent practice of maintenance management is needed to increase the life cycle of property and to minimise unexpected breakdowns or deterioration effects. Therefore, the performances of maintenance management operations have to be continuously reviewed and analysed in order to ascertain a high quality service.

According to Egbu [9], buildings in overall contribute 33% to CO₂ emissions, which gives a substantial impact to the environment.

Table 1. Chronology of the Building Defects Occurrence.

Year	Chronology Of The Occurrence Of Building Defects
2005	Collapsed ceiling at the Parliament House, Jalan Duta Kuala Lumpur
2006	Fungus defects on wall at the Hospital Sultanah Aminah, Johor Bahru
2007	Defects at the Navy Recruit Training Centre (PULAREK), Johor
2007	Floods from 7 th Floor down to 2 nd Floor of the Immigration Department, Putrajaya
2007	Collapse of plaster ceiling at the Entrepreneur and Co-operative Development Ministry, Putrajaya
2007	Collapse of ceiling at the new court complex at Jalan Duta, Kuala Lumpur
2007	Collapse of ceiling at the Parliament House, Jln Duta, Kuala Lumpur
2007	Floods caused by leaking pipes, roof and wiring problems at the new court complex at Jalan Duta, Kuala Lumpur
2007	Collapse of ceiling at the Hospital Sultan Abdul Halim, Sg. Petani, Kedah

Legislation and stakeholder concern increasingly require facility managers to reduce CO₂ emissions. In this respect, the management of buildings needs to be emphasized and systematically controlled. The government and office buildings managers need to take cognizance of this and plan for a better eco-friendly management. In 2006, the government has allocated about one trillion Ringgit towards maintaining the public building facilities [9]. However, in the Malaysian context, the government is yet to implement any guidelines for maintenance management and also the performance measurement of the system applied [3]. Therefore, maintenance agents or companies from both public and private sectors have no systematic guidelines to be followed and no specific compliance to be adhered to in order to deliver for the best [20].

3. Performance Measurement

Several frameworks have been developed for measuring performance over the years. Until 1980, the performance measurement was based on mostly financial measures [23]. According to Kaplan and Norton [13], the approach at that time looks into 4 perspectives that focus on financial aspects, customers, internal processes and innovation and learning. Subsequently, various researchers have developed frameworks considering non-financial measurements and intangible assets to achieve competitive advantages [13].

A performance measurement system is developed by author for the research methodology purposes by incorporating the common maintenance management systems applied into it (Figure 1). Based on the literature review, the performance or maintenance indicators are identified complete with the performance indicators respectively. Functional indicator for instance outlines the management service delivery as its significant aspect. In this scope, the research assesses the performance of the service based on the characteristics such as reliability in which the assurance or confidence delivered by the managers, responsiveness as to whether positive or negative response is given and also timeliness which emphasizes on the promptness of response or action taken.

As for the technical indicator, building maintenance with detailed list of the maintenance dimensions are identified with reference to the literature review and basic services provided generally by office

building managers for instance cleaning, landscaping, general maintenance, lightings, air-conditioning, lift or escalators, mechanical and electrical (M&E), sanitary & plumbing, access, signage and also parking. These maintenance services are regarded as the backbone of maintenance management of an office building. This is in accordance with opinion from Egbu [9] which explains that the importance of building services to the success of an organization has never been greater and continues to grow. Alternatively, for image indicator, focus on the quality of external and internal finishes of the building.

The three maintenance indicators namely functional-management service, technical-building maintenance and image-building image with respective dimensions are to be measured with both focus groups that are maintenance managers and end users. Different performance key factors are designed for the focus groups like time, quality and costs are targeted as the benchmarking or key factor to measure the level of performance for maintenance managers' scope while only time and quality factors are designated for end users as cost factor is most likely be unsuitable to be measured for this group.

All elements in this system are in overall interrelated and play important roles in sustaining the overall performance of maintenance management. These elements also meet the characteristics defined by Al-Sultan and Duffuaa [2] as it is believed to be relevant, interpretable, valid, time effectiveness and also easy to be implemented.

4. Significance of Customers' Opinions

A fundamental premise to the service concept is the notion of satisfying the customers' needs. A satisfied customer is to enhance a service and the firm's bottom line in multiple ways. Increased customer satisfaction generates positive reviews and brings in new customers to the firm. There are many studies that highlight the importance of customer satisfaction for a firm's success and how customer satisfaction can be measured. However, most of these studies are limited to the area of business-to-consumer marketing and not for the maintenance services provided. Myeda et al. [19] also signifies that maintenance managers should value the important roles of end users in evaluating the performance of maintenance services with a great attention given on their needs and requirements. Consultations with the end users should be a mechanism to establish a proactive management process.

Therefore this study determines to explore customer satisfaction as a function of end users' perceptions about the maintenance services

Maintenance Aspects	Performance Measurement Dimensions	Focus Groups	Performance Key Metrics
Functional Management Service Delivery	Delivery Characteristics <i>Assurance</i> <i>Reliability</i> <i>Responsiveness</i> <i>Timeliness</i> <i>Validity</i>	<ul style="list-style-type: none"> • Maintenance Managers • End Users 	<ul style="list-style-type: none"> • Time/ Use • Quality
Technical Maintenance Services	Maintenance Services <i>Cleaning & landscaping</i> <i>General Maintenance</i> <i>Lightings</i> <i>Air-Conditionings</i> <i>Lifts/ Escalators</i> <i>M&E</i> <i>Sanitary & Washing Facilities</i> <i>Access, Signage & Parking</i> <i>Safety & Security</i>		
Image Building Image	Building Image <i>External Image</i> <i>Internal Image</i>		

Fig. 1. Performance Measurement System designed

and then relate the importance of these perceptions to the performance level of the maintenance services provided. This is as customers or in this research more accurately referred as end users gives the most accurate results and perceptions of the services delivered to them. According to Spires [23], there is a clear trend towards customers demanding industry specialized systems. The pressures and influences on suppliers to accommodate this demand are vast, but unless a supplier is of sufficient size to afford the continual improvement required for product development, they will struggle to achieve profitability and long-term stability becomes less likely.

As a result, smaller companies will either become niche specialists, or within the asset and maintenance management market. Form strategic alliances with one or more of the bigger companies, or quite simply go out of business. However, even for large companies, such development costs are a major expense, and to supply a unique system for each customer is not practicable. The solution is products that are modular, off the shelf, but also highly configurable to suit each customer's requirements [23]. Through customer demands we will see a rationalization of suppliers of such solutions, and companies operating in this sector today may not necessarily survive in their existing form tomorrow. Product offerings will also change and evolve into modular, industry-standard systems, which through extreme flexibility will allow enough bespoke capability to satisfy individual customer requirements, while techniques such as Reliability Centered Maintenance (RCM) will gain acceptance as more firms strive to achieve "best practice" [25].

Finally, there are also wider complications for the whole of industry. According to Spires [23], existing evidence has identified that the most successful implementations of asset and maintenance management solutions are in companies, which embrace the concept of "best practice" as a total company culture. As a result, more and more companies will look to establish overall "best business practice" which indirectly benefits industry in general.

5. Research Methodology

Pragmatic Worldview

This study is based on pragmatic principle that is suitable for mixed method research, where Morgan [18] signifies that the approach is to focus on the research problem in social science and then using pluralistic approaches to derive knowledge about the problem. Johnson and Onwuegbuzie [12] also believes that pragmatic principle also justify for the methodology of combining both qualitative and quantitative approaches. This is supported by Mertens [16] in which studies in communities using mixed methods approach have the potential to address persistent inequalities and challenging social conditions. This can be achieved by an exploration of both the study's strength and challenges through multiple methods. Mixed method is also a systematic inquiry into the variations of social constructions of meaning among interview and survey respondents may not only help in validating research instruments and scales, but may go further in that they could produce complementary subsets of results, which would enrich overall study [4]. This also helps in shaping better exploration, guide analysis and interpretation.

Mixed Method Design

Leech and Onwuegbuzie [15] also suggested that there are three dimensions of mixed method design. The typology is conceptualized on the level of mixing (partially mixed or fully mixed), time orientation (concurrent or sequential) and emphasise on approaches (equal status or dominant). As for this study, both quantitative and qualitative data were connected throughout the data collection and analysis phases. The conclusions of the study were drawn between the two

bases of data analysis and findings. This study adopts the fully mixed methods, which is also the highest degree of mixing research methods and research paradigm characteristics [15]. This study fits the criteria as it adopts both quantitative and qualitative approach across the other components namely the research objective, type of data and operation methods, type of analysis and finally type of interference). The term fully mixed also refers to the fact that the mixed methods approach was implemented at various stages of the research including in the data analysis process where some of the qualitative data were converted into numbers. There are also various preceding studies that have converted qualitative data into numbers [17].

The time orientation is concurrent, where both questionnaires survey and case study interviews being conducted at the same time. The weightage is also the same where the status is equal as the end results are equally important to achieve the objective of the study.

Data Collection

The research adopted mixed method; a combination of both quantitative and qualitative methods. Five (5) high-rise office buildings in the vicinity of Kuala Lumpur were selected for the case studies whereby the important focus groups involved were maintenance managers and respective end users. Multiple data collection techniques were used in qualitative and quantitative data collection processes including focused interviews, case studies and observation. Evidently, the case studies data collection technique is appropriate to achieve the approach of our study that is to study and analyse the management systems and end users' perceptions from five (5) different office buildings.

Interviews were conducted specifically to the maintenance managers of five (5) chosen high-rise office buildings. Maintenance managers were enquired on information pertaining the building background, maintenance services provided, systems used, manpower, subcontractors as well as problems and improvements that have been completed or in progress for the building. The questions were prepared based on the semi-structured and also open-ended ad hoc conversations. Results of the interviews were necessary for the research evaluation on the systems applied by the maintenance managers and subsequently for the relationships identification between the main two variables.

Observation is also one vital step to fulfill the objective of this research as it will record the patterns of certain scenarios or behaviours occur in specific settings. Observations were conducted during site visit to the chosen case study areas and also while conducting the interviews. It was based on direct observation on the processes involved of the maintenance management system at each of the case study premises.

Questionnaire survey captures information through the input of responses to a research instrument containing questions that was through the 252 sets of questionnaires distributed to the five (5) office buildings respectively. Researcher has personally distributed the questionnaires to the respondents and opted for follow up phone surveys for the late respondents. Questionnaires were distributed from June 2008 and collected in late August for data analysis. Sets of questionnaires with structured and semi-structured / open-ended questions were distributed to the respective building end users so as to discover regularities among groups of maintenance management by comparison of answers to the same set of questions. The analysis of data from the questionnaires responses provides precise data from which tables and graphs are produced.

Data Analysis

The steps involved in analysing the data started with categorising all the results and also putting them into appropriate groups for coding purposes.

Results for the maintenance management system were derived from the checklist on their conformity to the respective maintenance management system maintenance aspects; functional, technical and building image. The characteristics of service conformity for the maintenance aspects were drawn from literature review and categorized as shown in Table 2.

The Statistical Analysis Software 16.0 was used to analyse the correlation between the performance of maintenance management and also maintenance management systems applied. The correlation coefficients will indicate the correlation strength, which will also highlights the impact that each factor represents.

6. Discussions & Findings: Relationship between Maintenance Management System and Performance of Office Buildings Maintenance Management

Based on Figure 2, there are three maintenance elements that record medium correlation that is Tangibles, Internal Image and External Image with respective coefficients of 0.67, 0.61 and 0.62. Assurance ($r=0.41$, $p>0.05$) and Cleaning ($r=0.33$, $p>0.05$) signify low correlation between their levels of performance and systems. Meanwhile the other fourteen (14) maintenance elements that are also the variables record very low correlations for the respective correlations are between 0.01 and 0.30. Overall, it can be concluded that there is a minimal impact of correlation between the maintenance management performance and systems applied.

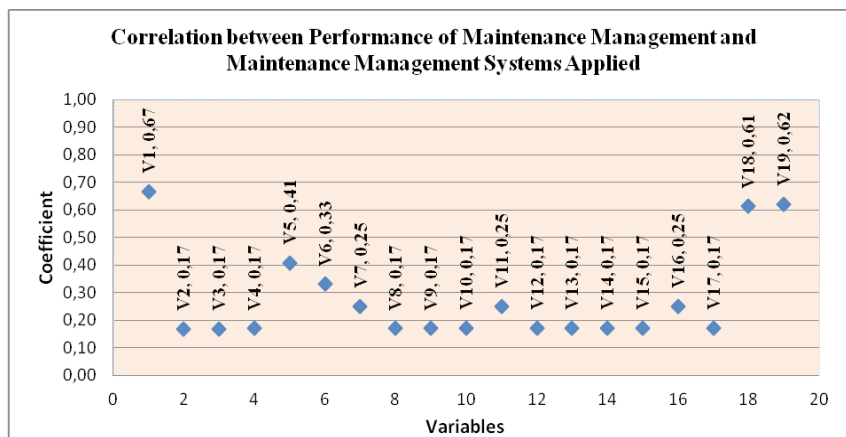


Fig.2. Performance of building image

7. Conclusion

This study has given an overview of the scenario of maintenance management of high-rise office buildings particularly on the development of maintenance management system and also performance measurement systems. Investigations on the maintenance management system and performance of maintenance management along with the relationship between them are accomplished. The findings suggest that in general the common maintenance management systems applied for office building comprises of three (3) major aspects namely Functional, Technical and Image. Important service elements for instance Service Characteristics, Building Services and Building Image encompass the three (3) major aspects respectively. This study has also found that generally all five (5) office buildings chosen have an average maintenance management performance as rated by respective end users. Findings also signify that in general background of the respondents has a significant relationship with the performance of maintenance management system. The most significant finding from the study is that there is a positive relationship between the maintenance management systems and performance of maintenance management especially in several elements of Service Characteristics and Building Services. Besides, it is also noted that maintenance managers have a similar perception in the importance ranking of maintenance management service elements with a fractionally difference of ranking order.

This survey has shown that benchmarking or assessment on the performance of maintenance management is very important as it enables the maintenance managers to comprehend the strengths, weaknesses and also significance of the service provided and also both tangible and intangible values of the building. Indirectly, maintenance managers can identify any probable threats or risks of their services. Concurrently, the establishment of maintenance management performance level is beneficial for the maintenance managers to implement immediate actions to improve the performance. It also serves as a signal that a major transformation is highly required to enhance the quality of performance. The positive relationship also ascertains that the implementation standard of maintenance management systems determine the performance of maintenance management system. At the same time, the difference shown in the priorities of maintenance management service elements signifies a strong emphasis on users' needs and requirements is required from maintenance managers.

In general, therefore, it seems that the study has achieved the aims of the study through a valid performance measurement design. The high value of Alpha's Cronbach validates that the variables used for the survey are reliable and the performance measurement design can be considered as a robust instrument to measure maintenance management performance.

8. Recommendations

8. Recommendations

It is strongly advised that maintenance managers should value the important roles of end users in evaluating the performance of maintenance services with a great attention given on their needs and requirements. Consultations with the end users should be a mechanism to establish a proactive management process. Maintenance managers must also consider implementing a continuous benchmarking or assessments on the services provided and subsequently focus on any critical service elements identified. A thorough analysis on the implementation of all maintenance services and respective sub-contractors helps to identify the weaknesses and criteria that need to be improved.

Besides, it is highly recommended that a maintenance management guideline is provided to standardize the maintenance standard practiced office building maintenance managers. In relation with this, a statutory act on the compliance of maintenance management system criteria and regulations should be established to improve the maintenance management performance and also to avoid any mismanagement which could result to corruptions and abuse of power.

Future research on the maintenance scope is most encouraged specifically on performance level of maintenance management on a larger scale, the implications of maintenance management failure, cost analysis of maintenance management, performance measurement assessment on all classes of residential housing and public buildings and a proposal on maintenance management statutory acts.

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