Measuring the Performance of Office Buildings Maintenance Management in Indonesia

S. Maulana B., Afriandi G., TB. Muhammad K.H., Daniel F.
Industrial Engineering Department
Universitas Indonesia
Salemba, DKI-Jakarta, Indonesia
sri.maulana@ui.ac.id, afriandi.ginting@ui.ac.id, tb.muhammad@ui.ac.id,
daniel.febrianto@ui.ac.id

Abstract

Maintenance planning contributes positively in effective maintenance activity. A quantitative method was adopted with the selection of 30 offices as the case studies. In total, 53 questionnaires were distributed to the end-users of the buildings. This paper proposes a performance measurement system that is proved to be practical and suitable to measure the effectiveness of maintenance service delivery of office buildings. This research concluded the priority performance of end-users in office building maintenance is diverse, and therefore there needs to be a clear benchmark and a development for performance measurement system from a strategic approach to identify the key aspects of performance to enhance maintenance service delivery.

Keywords
Preventive Maintenance, Office Building, Performance Measurement, Performance Evaluation and Indonesia.

1. Introduction

Maintenance management or operations management are functions that transform input including people, capital, energy, materials and technology into outputs namely goods and services (Schmberger and Knod, 1997). Basically, the maintenance function is the tactical role of maintaining, servicing and fixing facilities already in place (Tsang, 1998). It was also described as a systematic direction and control of operation processes (Certo, 2000). These definitions have highlighted maintenance management as a systematic design used by the people that operate organisations in order to control the overall operation processes in transforming the inputs into goods and/or services. Maintenance group is responsible for the development, implementation, and periodic evaluation of an effective asset maintenance plan (Mobley et al., p. 1.20, 2008).

Historically, facilities were ageing and constantly being renovated in a piecemeal fashion where actions were taken at different times or ways rather than being carefully planned from the beginning. Many renovations were limited in scope due to funding restraints and many times result in cosmetic change with few or no infrastructure improvements (Pitt et al., 2011). 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. The growing acceptance of a need to measure the performance of services and facilities provided is in contrast to a lack of a systematic process for determining the appropriate measures (Amaratunga, 2000).

Measurement of maintenance performance is an assessment that helps to identify the strengths and weaknesses of the maintenance activities (Au-Yong et al., 2014). According to Groote (1995), the competency of the maintenance labor force is an important factor that affecting the maintenance performance. Its mean that successful of maintenance performance, depend on the skill and knowledge maintenance personnel (Fatoni and Nurcahyo, 2018). Meanwhile, Hinks (2004) describes the position of maintenance management performance 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 established indicator level. They also did not generally consider any management process as they relied more on reactive actions based on clients' or users' complaints (Pitt et al., 2011).

It can be broadly concluded that the managers prefer carrying out reactive maintenance works rather than proactive works and at times do not consider clients satisfaction or indeed the service performance. There is also an increasing concern that maintenance management has been unprofessionally applied by the maintenance managers in many cases. Most maintenance procedures allow for an oversight of common performance indicators, which usually represents the operational view of maintenance. However, there is little literature available that covers the development of a systematic approach to performance measurement in maintenance, one that embraces every aspect of maintenance, namely strategic, tactical and operational (Kutucuoglu et al., 2001).

1.1 Objectives

Measurement of maintenance performance is an assessment that helps to identify the strengths and weaknesses of the maintenance activities (Au-Yong et al., 2014). According to Groote (1995), the competency of the maintenance labor force is an important factor that affecting the maintenance performance. Its mean that successful of maintenance performance, depend on the skill and knowledge maintenance personnel (Fatoni and Nurcahyo, 2018). This research is geared towards finding out the business process leading to the development of standard procedure in the process of maintenance service, implementation, supervision works.

2. Literature Review

Maintenance performance indicators are utilized to evaluate the effectiveness of maintenance carried out (Wireman, 1998). Maintenance performance indicators could be used for financial reports, for monitoring the performance of employees, customer satisfaction, the health safety environment rating and overall equipment effectiveness as well as many other applications. If maintenance performance indicators are identified properly then maintenance performance can provide or identify resource allocation and control, problem areas, the maintenance contribution, benchmarking, personnel performance and the contribution to maintenance and overall business objectives (Kumar and Ellingsen, 2000).

TABLE 1. PERFORMANCE MEASUREMENT INDICATORS/PERSPECTIVES

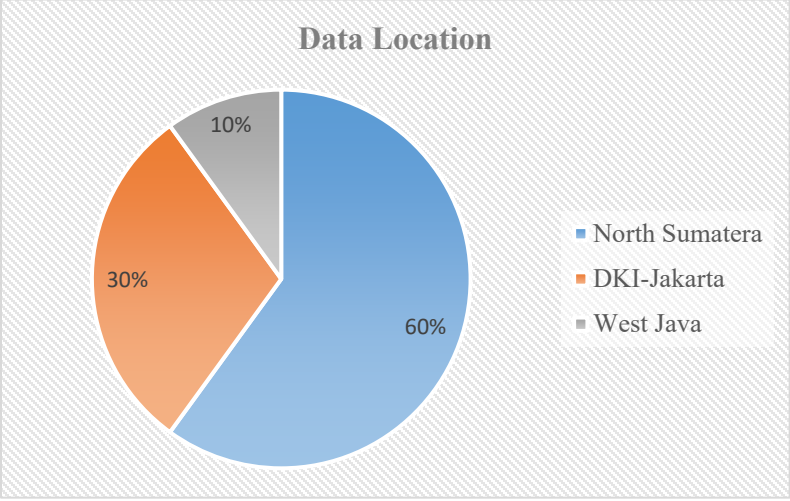
Baharum et al. (2006)	1. Fuctional - service quality 2. Technical - property quality 3. Image - Property quality
Brown et al. (1994)	1. Customer satisfaction measures 2. Financial measures 3. Product/service quality measures 4. Employee satisfaction measures 5. Operational measures 6. Public responsibility measures
Campbell (1995)	1. Equipment performance 2. Cost performance 3. Process performance
Coetzee (1998)	1. Machine/facility maintenance efficiency 2. Task efficiency 3. Organisational efficiency 4. Profit/cost efficiency
Kutucuoglu (2001)	1. Equipment related performance 2. Task related performance 3. Cost related performance 4. Immediate customer impact related performance 5. Learning and growth related perfomanace
Fatoni and Nurcahyo (2011)	1. Training factors
Kaplan and Norton (1992)	Tangible aspect: 1. Financial aspect Intangible aspect: 1. Customers 2. Internal processes 3. Innovation and learning

Wordsworth (2001)	1. Equipment related performance 2. Task related performance 3. Cost related performance 4. Immediate customer impact related performance 5. Learningand growth related performance
Cupello (1994)	1. Customer satisfaction measures 2. Employee satisfaction measures 3. Project performace measures 4. Supplier performance measures

Maintenance planning capability maturity gives guidelines to the organization to achieve excellence process in maintenance planning. (Nurcahyo et al., 2018). Based on literature reviews on service characteristics outlined for the management service provided (Baharum et al., 2006; Al-Turki and Duffuaa, 2003; Isa, 2002; Spencer andHinks, 2007, Fatoni and Nurcahyo, 2011), the service characteristics chosen for this study is based on four service characteristics as tangibles, reliability, responsiveness and assurance. The dimensions determine the approaches used by the maintenance managers to communicate and deal with the building end-users.

3. Data Collection and Methods

For this study case we chose office buildings in the area of Indonesia, whereby the important focus groups involved are the office managers and end-users, respectively. This study use data collection technique of quantitative methods, which is surveys & questionnaire. Building managers were asked on 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. Results of the questionnaire were then analysed for the research evaluation on the systems applied by the building managers. In total, 53 sets of questionnaires were distributed to the 53 office spaces in 13 buildings and 30 sets were returned for analysis. Those 30 sets that are returned are 18 from North Sumatera, 9 from DKI-Jakarta and 3 from West Java. The authors personally distributed the questionnaires to the respondents and opted for follow up phone surveys for the late respondents. The analysis of data from the questionnaires responses provides precise data from which tables are produced.



4. Results and Discussion

Maintenance services as one of the main aspects of maintenance management systems comprises of four elements that are namely tangibles, reliability, responsiveness and assurance. Results from Table 2 indicate that only tangibles and assurance service characteristics score more than 50 percent. As for **tangibles**, the average percentage of its conforming criteria is **58.6 percent** with low percentage in implementation of non-conformance system for staff (20 percent) and implementation of communication tools (33.3 percent), while customer service training and rules regarding uniform have a very high percentage, in means many companies expected their staff to able to work with little to none supervision. **Reliability** attains the average percentage of **45.34 percent** with major impact from legal compliance plan (86.7 percent) while communication between management staff at the lowest point (26.7 percent) which means there is trust issue between officers in maintenance management. The only service elements that has very low percentage is **responsiveness** with only **20 percent**, which means there is little to no standard on when a complaint can be resolved, customers is being made to wait, and lastly **assurance** show a significant amount of average percentage **70 percent** the highest of all elements and that could mean there is a high standard on how maintenance is done.

TABLE 2. OFFICE MAINTENANCE SERVICE (%)

1. Tangibles	**58.6**
Staff equip with adequate office maintenance facilities and equipment	53.3
Company have rules regarding employee's uniform	100.0
Customer service training for all staff periodically	86.7
Implementation of non-conformance system for staff	20.0
Communication tools for staff for easier communication	33.3
2. Reliability	**45.34**
Revision for building maintenance plan at least twice a year	40.0
Legal plan against violations committed by tenants or employees	86.7
Company consult with building management or end-user if there are problems	33.3
Communication between management staff is going well	26.7
System for measuring and tracking the level of service provided	40.0
3. Responsiveness	**26.65**
Time limits for responding and resolving maintenance complaints	33.3
24 hours services	20.0
4. Assurance	**70.0**
Implementation of preventive maintenance plan	100.0
Evaluation for preventive maintenance system implementation periodically	40.0

Table 3 compromises of hygiene maintenance with high cleaning maintenance in 93.3 percent although cleaning employees are no adequate, which then we can assume that the cleaning maintenance isn't done very well.

TABLE 3. OFFICE MAINTENANCE HYGIENE (%)

Cleaning maintenance periodically	93.3
Implement supervision for cleaning maintenance activities	53.3
Current number of cleaning employees adequate	33.3

In table 4 we can see that landscape maintenance has high priority with 93.3 percent even though lightning for landscape isn't a priority for most companies and only 60 percent of the maintenance managers instruct the maintenance personnel to conduct daily checking on both indoor and outdoor plants.

TABLE 4. OFFICE MAINTENANCE LANDSCAPE (%)

Landscape maintenance periodically	93.3
Health maintenance for plants inside and outside of building	60.0
Adequate lighting for landscape	13.3

Table 5, there are three health and safety elements namely regulations, sanitation and security guard that receives a full commitment (100 percent) from all maintenance managers implementing all their respective service criteria. The other service elements such as mechanical and electrical and equipment receive very low outcome.

TABLE 5. OFFICE MAINTENANCE HEALTH AND SAFETY (%)

Implementation of health & safety regulations	100.0
Preventive maintenance for electrical and mechanical equipment	13.3
Preventive maintenance for health and safety equipment	26.7
Preventive maintenance for sanitation and plumbing equipment	100.0
Sufficient security guard	100.0

In table 6 supervision for access in and out of building is at the highest priority with 100 percent conformity from all managers. It is clear that thievery is a major problem in our society with zero trust from management. Parking area is at the lowest with 33.3 percent, many managers confirm that it's due to lack of space and hoping that more staff use public transportation.

TABLE 6. OFFICE ACCESS AND INFORMATION (%)

Supervision system for entering and leaving the building	100.0
Sufficient signs board in appropriate and required place	46.7
Sufficient parking area for at least 50% staff	33.3

Building's image as one more important class of maintenance management system encompasses both external and internal images of a building. Table 7 signifies that all maintenance managers implement two of the essential criteria for an external image such as maintaining an excellent condition of building finishes and functionality of building

signage and also the adherence to desired corporate image preferred by clients. However, an adequate amount of them (55 percent) conduct at least once a year of external cleaning work. The internal image on the other hand shows excellent conformity of the service elements (100 percent) resulting in all office buildings are in excellent physical condition.

TABLE 7. OFFICE IMAGE (%)

Preventive maintenance for building external image or exterior	55.0
Preventive maintenance for building internal image or interior	100.0

4.1 Proposed Improvements

An improvement can be applied in the methods of data gathering. In this paper, quantitative with survey and questionnaire is used as a data source, therefore further research using more accurate and cross-validation is necessary. Qualitative data research such as focus group interviews, one-on-one interviews, observation, and data sampling is an example of an improvement that can be used.

4.2 Validation

All data were processed by using Statistical Analysis Software SPSS 16.0. Non-parametric techniques were used as the overall data were not normally distributed ($\rho < 0.05$). Reliability test also proved that the variables were consistent ($\alpha = 0.758$).

5. Conclusion

Scrutiny of the conformity of the service element criteria shows that the majority of the maintenance managers did not emphasize several criteria pertaining to responsiveness and reliability service characteristics. As for building services, excellent implementation of cleaning, access, safety and security systems were accomplished. However, little emphasis was given by maintenance managers on criteria of several service elements such as landscaping, lighting, parking and mechanical maintenance. Building image on the other hand showed a high conformity by all maintenance managers particularly on internal image service criteria.

This study has given an overview of the scenario of maintenance management in office buildings in Indonesia, particularly on the development of maintenance management systems and also performance measurement systems. The findings suggest that in general the common maintenance management systems applied for office building comprises of two major aspects namely technical and image with functional as service quality has little influence.

This work 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 levels 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 determines the performance of maintenance management systems. At the same time, the difference shown in the priorities of maintenance management service elements signify that a strong emphasis on users' needs and requirements is required from maintenance managers.

This paper concludes that maintenance management guidelines and benchmark should be established in Indonesia to standardize the practices of office building maintenance managers. In relation to this, a statutory act on the compliance of maintenance management system criteria and regulations should be established to improve the maintenance management performance.

References

Armyn Machfudiyanto, R., Latief, Y., Susilo Soepandji, B., & Anggia Putri, P. (2018). Improving business processes to develop standard operation procedures on government building maintenance work in Indonesia. MATEC Web of Conferences, 195, 06006. doi:10.1051/matecconf/201819506006.

Ahuja, I. P. S., & Khamba, J. S. (2008). Total productive maintenance: literature review and directions. International Journal of Quality & Reliability Management, 25(7), 709–756. doi:10.1108/02656710810890890.

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

Kanta Patra, N., Tripathy, J. K., & Choudhary, B. K. (2005). Implementing the office total productive maintenance ("office TPM") program: a library case study. Library Review, 54(7), 415–424. doi:10.1108/00242530510611910

Hatry, H.P. (1978), "The status of productivity measurement in public sector", Public Administration Review, Vol. 38 No. 1, pp. 28-33.

Jonsson, P. and Lesshammar, M. (1999), "Evaluation and improvement of manufacturing performance measurement systems: the role of OEE", International Journal of Operations & Production Management, Vol. 19 No. 1, pp. 55-78.

Baharum, Z.A., Nawawi, A.H. and Sat, Z.M. (2006), "PROPERTYQUAL: a service quality instrument in property management of purpose-built office buildings in Malaysia", paper presented at 2nd ASEAN Postgraduate Seminar (PGS) 2006, University of Malaya, Kuala Lumpur, 4-6 December.

Nurcahyo, R., Darmawan, D., Jannis, Y., Kurniati, A., & Habiburrahman, M. (2018). Maintenance Planning Key Process Area: Case Study at Oil Gas Industry in Indonesia. 2018 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM). doi:10.1109/ieem.2018.8607527

Brown, M.G., Hitchcock, D.E. and Willard, M.L. (1994), Why TQM Fails? Irwin, Burr Ridge, IL. Campbell, J.D. (1995), Uptime: Strategies for Excellence in Maintenance Management, Productivity Press, Cambridge.

Certo, S. (2000), Modern Management, Prentice-Hall, Upper Saddle River, NJ.

Coetzee, J.L. (1998), Maintenance, South Maintenance Publishers, Hatfield.

Cupello, J.M. (1994), "A new paradigm for measuring TQM progress", Quality Progress, Vol. 27 No. 5, pp. 79-82.

Nurcahyo, R. and Fatoni (2018). Impact of Training on Maintenance Performance Effectiveness. Proceedings of the International Conference on Industrial Engineering and Operations Management, Volume 2018, Issue JUL, 2018, Pages 619-628

Kutucuoglu, K.Y., Hamali, J., Irani, Z. and Sharp, J.M. (2001), "A framework for managing maintenance using performance measurement systems", International Journal of Operations & Production Management, Vol. 21 No. 1, pp. 173-95.