

A Review of Critical Success Factor in Building Maintenance Management Practice for University Sector

S.H. Zulkarnain, E.M.A Zawawi, M.Y. A. Rahman, N.K.F. Mustafa

Abstract—Building maintenance plays an important role among other activities in building operation. Building defect and damages are part of the building maintenance ‘bread and butter’ as their input indicated in the building inspection is very much justified, particularly as to determine the building performance. There will be no escape route or short cut from building maintenance work. This study attempts to identify a competitive performance that translates the Critical Success Factor achievements and satisfactorily meet the university’s expectation. The quality and efficiency of maintenance management operation of building depends, to some extent, on the building condition information, the expectation from the university sector and the works carried out for each maintenance activity. This paper reviews the critical success factor in building maintenance management practice for university sectors from four (4) perspectives which include (1) customer (2) internal processes (3) financial and (4) learning and growth perspective. The enhancement of these perspectives is capable to reach the maintenance management goal for a better living environment in university campus.

Keywords—Building maintenance, Critical Success Factor, Management, University

I. INTRODUCTION

MAINTENANCE management is a medium provider and operator that oversee the components related to building condition and services installation so as to ensure it can perform at the optimum level. As explained in [1], maintenance management encompasses many operations and functions and can be described as “the effective and efficient utilization of resources to ensure that the process and its facilities are kept operable to a standard required by the users”. In Malaysia, the scenario of building maintenance is considered as one of the national agenda. Multitude barriers received by the services providers have undergone various difficulties in satisfying public interest have been progressively resolved as a sign towards becoming a more developed country. In the 9th Malaysian Plan, among five thrusts highlighted, the fourth thrust of the National Mission stated to improve the standard and sustainability of the quality of life. It was a continuing agenda from the previous

Malaysian Plan to provide basic needs such as water, energy, housing, transportation and other amenities but issues related to maintenance, upgrading and efficient usage of resources was the main emphasis. In real practice, building maintenance is the thing which we mostly tolerate. If the building is able to weather the elements, we may with delay taking action on it. Most buildings are always treated with ‘ad-hoc’ maintenance. In some instances, the building disrepair will wait until complaints are made before any repair work is done. It shows that the situation is not considered critical as it may. [2] revealed that, maintenance is 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 the 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 improper practices. Readiness towards providing the best building operation is one of the ultimate aims of a maintenance manager. A maintenance manager should instill full responsibility and plan all work beforehand as it will enhance the capability and competency in solving problems. By knowing what, when and how to respond to the relevant issues, it will prepare the building to be more reliable for the customer and keep the building status in good condition. An excellent practice of maintenance management is greatly needed to increase the life cycle of the property and to minimize unexpected breakdowns or deterioration effects. In this respect, the modern maintenance manager will have to rely as much as possible on knowledge of the managerial and social sciences as on the traditional knowledge of building construction and deterioration. Improper conduct and application of maintenance management procedure and systems may result in deteriorating the property itself. Therefore, the performance of the maintenance management operations have to be continuously reviewed and analyzed in order to ascertain a high quality service [2]. A building services, and facilities require maintenance to ensure its optimal performance over its life cycle [3]. Maintenance has been defined differently by authors. In this research, maintenance is defined as the mean of processes, activities, procedures and services applied to a building. It is undertaken in order to preserve, repair, enhance and care the building fabric and facilities at all time. [3] also suggested that while

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carrying out maintenance, the strategy must take into account current advancement in building regulations, standards and technologies.

II. TRADITIONAL MAINTENANCE MANAGEMENT SYSTEM

Property is increasingly being seen as a key resource by organizations which are not primarily in the property industry. Due to the inflexibility of buildings, owner and occupiers need to have clear strategies to manage, control and develop it profitably. Most of the property management companies still use the traditional maintenance management system for managing a building (See Fig. 1a). In addition, the traditional maintenance management system is still relevant and appropriate to be used in this current building condition. Maintenance management in the private and public sector has been rapidly changing throughout the years. This is due to several factors such as the enhancement of sophisticated technology, globalization and change of economy [4]. The following definitions for each type of maintenance are all given in BS 3811 and, for practical purposes, it is clear that the maintenance work load will consist of a mix of all these (See Fig. 1a) [5].

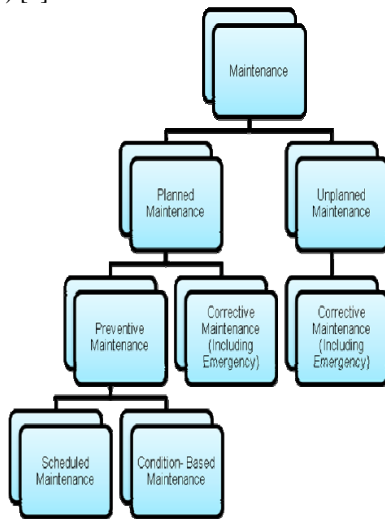


Fig. 1(a) Types of Maintenance.[5]

TABLE I
MAINTENANCE'S DEFINITION [5]

Type of Maintenance	Definition
Planned maintenance	This is maintenance organized and carried out with forethought, control and the use of records to a predetermined plan.
Unplanned maintenance	Ad hoc maintenance carried out to no predetermined plan.
Preventive maintenance	Maintenance carried out at predetermined intervals, or corresponding to prescribed criteria, and intended to reduce the probability of failure, or the performance degradation of an item.
Corrective maintenance	Maintenance carried out after a failure has occurred, intended to restore an item to a state in which it can perform its required function.

Emergency maintenance	Maintenance which it is necessary to put in hand immediately to avoid serious consequences.
Condition-based maintenance	Preventive maintenance initiated as a result of knowledge of the condition of an item from routine or continuous monitoring.
Scheduled maintenance	Preventive maintenance carried out to a pre-determined interval of time, number of operations, mileage, etc.

The selection of maintenance system to be operated in the building should take into consideration in terms of the life cycle of the building materials, services installation provided space function or activities to be carried out in that particular building. In some cases, when the material has reached the 'wear and tear' condition, the maintenance work is then required to rectify those defect. Therefore, it is very important to ensure that the design team understands materials performance in order to reduce the running cost during building operation. Using so called 'heavy duty' materials and yet producing high quality building fabric. By knowing the physical and detail life span of the materials will allow the maintenance team to forecast the budget allocated for replacement work and planned the maintenance work as per schedule. With a detail record of the previous maintenance work, it will act as a benchmark to the future maintenance activities where decision be made through this (See Fig 1b). It shows that, the maintenance work should not only rectify and making good all defects at the affected area but also at the same time should be properly recorded. It is a way to closely monitor the severity of the defects occurring in the building. Referring to the previous record will assist the maintenance team to overcome and provide an effective remedial works. In spite of planned maintenance, emergency maintenance will involve urgent and immediate work prior to the problem. It is to avoid the resultant consequences to other activities which may cause severe failures. By considering those planned and unplanned maintenance, the management should provide a realistic budget and come out with some emergency plans in dealing with uncertainties cases. Therefore, the implementation of an effective maintenance practice must inculcate some indicators to improvise the traditional maintenance management system to reach the needs and nature of the work.

III. MAINTENANCE NEEDS AND NATURE

It is highly desirable but hardly feasible to produce buildings that are maintenance-free, although much can be done at the design stage to reduce the amount of subsequent maintenance work. All elements of buildings deteriorate at a greater or lesser rate depending on material and methods of construction, environmental conditions and the use of the building [6].

A prime aim of maintenance is to preserve a building in its initial stage, as far as practicable, so that it effectively serves its purpose. The main purposes of maintaining buildings are[7]:-

- i. Retaining value of investment.
- ii. Maintaining the building in a condition in which it continues to fulfill its function.
- iii. Presenting a good appearance.

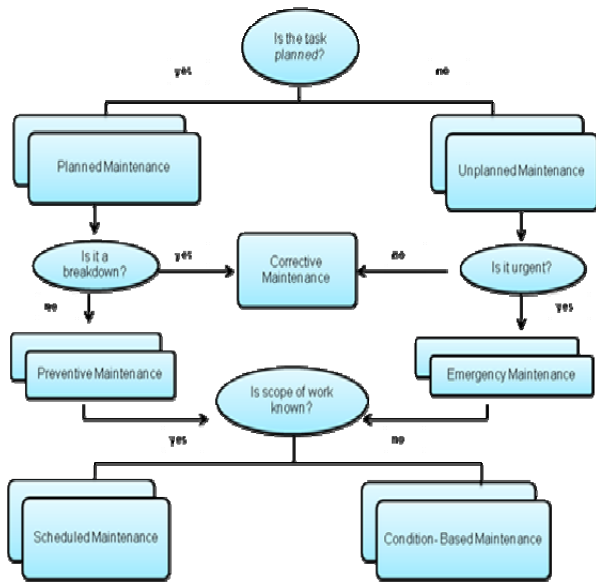


Fig. 1(b): Decision based type of maintenance.[5]

Maintenance work has also been categorized as “predictable” and “avoidable”[8]. Predictable maintenance is regularly periodic work that may be necessary to retain the performance characteristic of a product, as well as that required to replace or repair the product after it has achieved a useful life span. Avoidable maintenance is the work required to rectify failures caused by poor design, incorrect installation or the use of faulty materials. The function of maintenance can be divided into three (3) groups; (1) cleaning and servicing, (2) rectification and repair and (3) replacement [9]. Timely expenditure on the first two can postpone the need to replace materials or components, a very expensive business. Cleaning and servicing should be carried out regularly and may be combined with a system of reporting faults when become apparent, thereby avoiding the need for more expensive repairs or even replacement at a later stage [9].

IV. CRITICAL SUCCESS FACTOR IN BUILDING MAINTENANCE MANAGEMENT PRACTICE

Critical Success Factor is the indicator on how to achieve certain aims with rational and achievable target. It does not only relies on the process or system used but also reflects the feedback received from the end user. Technology is changing the business of maintenance management. Tremendous advances in applying technology for better management—physical technologies as well as information technology—are under way. Critical Success Factor is recommendation to upgrade the maintenance management system practiced. The Critical Success Factor (CSF) is derived from goals and objectives of the organizations where certain factors and processes have to be in place. They are those conditions, factors and processes that are essential for achieving breakthrough performance within the organization. So often, when implementing performance measurement systems within their organizations, most managers make the mistake of not

aligning measurements to strategy. They fail to identify the processes that are essential for driving up business performance. In other words, they fail to identify those processes that must be performed exceptionally well for the organization’s strategy to succeed.[10]

There are four questions to be asked in the context of a maintenance management function.

- i. First, there is the public – how do the public see us?
- ii. Second, we have to ask related to internal process – how efficient and effective is the maintenance and management activities?
- iii. The third perspective is financial – how are the maintenance management activities function in terms of value for money?
- iv. Fourth, learning and growth – how does the maintenance management activities continue to improve itself and to assist the core business?

To ensure satisfaction of various public needs, it is essential that maintenance management identifies, focuses on, and monitors key performance indicators.

V. BUILDING MAINTENANCE PERFORMANCE IN UNIVERSITY SECTOR

University possess of various educational facilities provided to the students who are the customers and staffs who are the operators. It will not only focus to the physical development such as building and infrastructure, but also include transportation, accommodation and others. University’s management act as a provider who aims to provide a better education environment in producing quality graduates. Therefore those facilities need to be maintained at all times and upgraded to meet the customers’ satisfaction. Property is important to all business and organizations. The cost of the asset alone, procuring, managing and operating it, should make it a resource that is high on the agenda of property managers. This applies to all organizations including universities. [11] [12] identified certain goals common to most building maintenance organizations and this evidence suggests a need for a balanced scorecard approach, which adequately reflects the characteristics, goals and critical success factors of the building maintenance organizations. It was found that the organization’s vision and objectives were to provide distinctive service combined with value for money, to respond quickly to changes of customers needs, to achieve continually improving services, to develop skills of all employees and finally to recognize their performance by means of opportunities for advancement. Obviously, an effective and useful critical success factor for use by building maintenance organizations has to reflect aims as in Table 2,3,4 and 5 [13]

TABLE II
CUSTOMER PERSPECTIVE CRITICAL SUCCESS FACTOR AND MEASURE.[13]

Critical success factors	Possible measures / measurement instrument
Customer satisfaction	Customer satisfaction surveys
Service quality	Post occupancy evaluation
Customer complaints	

Range of services offered	
Reaction to customer's needs	

The focal point of customer perspective identifies customer satisfaction, service quality, customer complaints, range of service offered and reaction to customer's needs. Among all factors, satisfaction will always be the number one. "Customer is always right" is a common phrase that translates complaints made to the provider. Thus, the feedback is very subjective depending on how quality the building and services were performed. But there will be some limitations which resist the capability in exploring more benefits. In some cases, we can not satisfy everybody in all aspects but try to keep it at the maximum.

TABLE III
INTERNAL PROCESSES PERSPECTIVE: CRITICAL SUCCESS FACTOR AND MEASURES.[13]

Critical success factors	Possible measures
Service excellent	Service standards, service quality survey
Technology capability	Equipment costs, post-occupancy evaluation
Understand the customers Employee competence	Customer satisfaction surveys Employee qualifications, training hours per employee, employee satisfaction index.
Process efficiency Teamwork and coordination	Output/cost ratio Interdependent meetings, interdependent training courses
Staff development	Courses completed, number of multi-skilled staff

In the internal processes perspective, one of the listed factors mentioned the technology capability. The maintenance management should update the necessity of technology used in maintenance practice such as equipment, machineries and software available. For example, the use of gondola in high-rise building helps the maintenance workers to carry out some repair works on the building exterior. Painting work can also be done in a very safe working platform. Providing with the latest technology is not enough. It requires the technical expert to operate and monitor those facilities. In addition there are lots of maintenance software which are widely used. This software is able to record and process data for future maintenance references.

Financial perspective also contributes to five critical success factors. With good financial standing, factors such as management expectations, financial growth, cost reduction-productivity improvement, asset utilization and management of working capital are seen to be the most important and critical in maintenance. It is to ensure a balance income and expenditure is achieved and worth for money spent.

TABLE IV
FINANCIAL PERSPECTIVE: CRITICAL SUCCESS FACTOR AND MEASURES.[13]

Critical success factors	Possible measures
Management expectations	Cash flow, cost reduction rates, costs per unit of output, new business development
Financial growth	Balance income and expenditure Financial reporting
Cost reduction, productivity improvement	Cost per unit, reduction of indirect costs, services sharing with other business units
Asset utilisation	Reduction of working capital
Management of working capital	Average rate of return

As mentioned in learning and growth perspective, the right time to develop new process is highly justified. It is where people should be mentally ready and physically prepared with any changes in the working environment as to meet a continuous service improvement. Vision and mission should be clearly explained and measurable.

TABLE V
LEARNING AND GROWTH PERSPECTIVE: CRITICAL SUCCESS FACTORS AND MEASURES.[13]

Critical success factors	Possible measures
Technology leadership Continuous service improvement	Time to develop new processes Service innovation cycle time, employee turnover, staff attitude survey, number of employee/customer suggestions, development area identified, new facilities/ service introduced
Upgrading staff competencies	Employee satisfaction, staff development programmes, courses completed, internal promotions made.

With reference to the perspectives highlighted, there should have commitment and integration between internal process, financial and learning and growth perspectives. The outcomes from the internal process will justify the financial values. Staffs should be equipped with technical knowledge in implementing all tasks efficiently. Team work spirit and good coordination among all levels are highly required to maintain quality of work constantly. Communication and service equipment should always be in good condition to ensure all processes are completely complied.

Nowadays, innovation is one of the improvement medium to upgrade the performance level of the product. Thus learning and growth should be of major concern in producing an outstanding output not only from the teaching staffs but also from the administrative level. Upgrading the staff competencies will enhance the staff's capability to think out of the box. With the combination of all perspectives, it finally will produce good feedback from the customers. The post occupancy evaluation is assessed and zero complaints should be met to increase the quality of maintenance management provided in the university.

VI. CONCLUSION

In conclusion, Critical Success Factors can be seen to help in producing a successful competitive performance for the university sector in the area of maintenance management. An understanding of critical success factors in the operation of the business can really strengthen the management strategy. Every single activity within the organisation will be directed towards achieving the overall success of the organisation. By considering the Critical Success Factor it would help the maintenance management organisation to improve current practice and performance of daily works in both the status and the standard of the maintenance system in the university sector. For best maintenance management practice in the University, the Critical Success Factors must be applied effectively to all activities as to ensure the standard of service provided to the public is excellent. With the blend of four (4) perspectives that are customer, internal processes, financial and learning and growth in the maintenance management practice, it will enhance the quality performance of the university campus tremendously.

REFERENCES

- [1] Allen, David (1993), Facilities, Bradford, Vol. 11, Iss 3, pg. 7.
- [2] E.M.A. Zawawi, S.N. Kamaruzaman, Z. Ithnin, S.H. Zulkarnain (2011), A conceptual framework for describing CSF of building maintenance management, Proceeding of the
- [3] Lateef, Abdul, O., Mohd Faris Khamidi, Arazi Idrus (2009), Maintenance Management of University Building, Proceeding International Symposium on Construction in Developing Economies: Commonalities Among Diversities, Penang, 5-7 October 2009, CIBW107, University Science Malaysia, pp.578-592.
- [4] Horner R.M.W., El-Haram M.A, Munns A.K. (1997), Building Maintenance Strategy: A new management Approach, Journal of Quality in Maintenance Engineering, Vol. 3, No.4, pp. 273-280.
- [5] B. Chanter, P. Swallow (2000), Building Maintenance Management, Blackwell Science, Ltd.
- [6] Department of the Environment (1972), Research and Development Bulletin, Building Maintenance – The Report of the Committee. HMSO.
- [7] J. Bennett (1985), Building Maintenance, Butterworth.
- [8] E.D. Mills (1980), Building Maintenance and Preservation, Butterworth.
- [9] D. Miles, P.Syagga (1987), Building Maintenance: A Management Manual, Intermediate Technology Publications.
- [10] Chisambara, Peter (2010), Identifying your Organisation Critical Success Factors.
- [11] Housley, J. (1997), Managing the estate in higher educational buildings, Facilities, 15 (3/4), pp.72-83.
- [12] Barret, P. (1995), Facilities Management: Towards Best Practice, Oxford:Blackwell Science.
- [13] K. Alexander, B. Atkin, J. Brochner, T. Haugen (2004), Facilities Management, Innovation and Performance.