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Perception of Maintenance Management Strategy on Healthcare Facilities

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Abstract

Main objective of this research is to look into the relationship between maintenance strategies implemented in healthcare facilities. The aim of this paper is to provide an overview of types of maintenance strategy applied to maintain facilities while satisfying the end user. Interviews and surveys were conducted to generate data from facility managers and end users in selected hospitals. The results show that there is a relationship between types of maintenance strategy implemented and end user satisfaction. Null Hypothesis was rejected due to the level of significant $p > 0.05$ and $p > 0.01$.

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1. Introduction

Malaysia government is very serious about delivering health service to all Malaysians. In the 10th Malaysia Plan, the government highlighted that there would be enforcement of quality care in both the public and private healthcare sectors. On the awareness of the importance on hospitals, the government has allocate about RM600m for developing hospitals and clinic since was implemented. Under 10th Malaysia Plan, the government plans to develop another 156 clinic in urban areas, 41 community clinics and 50 1 Malaysia clinics, which requires a budget of RM637m. The government is also trying to track

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and map existing healthcare providers in order to identify gaps and streamline health service delivery with a review of financing options for managing rising costs and ensuring healthcare remains accessible and affordable. Traditional methods of maintenance practice need to be transformed strategically to achieve better performance with respect to facilities and environment. Furthermore, most of the public buildings in Malaysia are owned by Federal government. However, awareness of the importance of the management and maintenance of buildings and facilities has not been emphasized explicitly and systematically, which has resulted in lower quality maintenance and remedial works. Therefore, complicated building such as hospitals with numerous assets that operate most of the time daily basic need more attention to prolong their life cycle. There are some difficulties in predicting the types of maintenance that can be implemented by facilities maintenance management. Every customer that uses the facilities of a hospital should feel optimal satisfaction with the services provided by the hospital management. Customers who come for treatment should not feel upset in unknown and provoking situations. Hospital management needs to have a strategic maintenance plan to monitor each facility and to help it perform well with less opportunity for failure. Hence, facilities for end users in hospitals should be maintained and monitored according to their function. This paper seeks to report on types of maintenance strategy applied to hospital facilities in order to increase the level of customer satisfaction with their performance. It also illustrates the effect of end user satisfaction on building assets.

2. Literature Review

2.1. Healthcare

The health services provided by hospitals have led to become very important buildings. Various facilities and equipment runs alternately to support the systems in the hospital building. Healthcare has different groups of stakeholder such as patients, public or visitor, administrative and medical staff. According to Loosemore and Hsin, as cited in (Ali, Mohamad, & Wan, 2009) it forms a complicated network that needs to look into and the complexity of many services that require high support as the main challenges in managing hospital facilities. Facility managers play an important role to forecasting the condition of the facilities on their experience and their different values, beliefs, perceptions and expectations. Hospitals are a vital component of the healthcare system (McKee & Healy, 2002) but they are an expensive way to deliver medical care (Shohet & Lavy, 2004). Therefore, although hospitals deal with patients who cannot be treated elsewhere at the time when hospital treatment can still be effective (Shohet & Lavy, 2004), hospitals increasingly focus on critical short-term care. They only admit people who are in a serious condition which requires an intensive level of medical or nursing care or individual diagnoses and treatment (McKee & Healy, 2002). There are difficulties in forecasting hospital requirements into the future. The problem is most of the facility managers not participating in the briefing, designing and cost analyzing stages of new building developments (Shohet & Lavy, 2004). As health facilities tend to operate 24 hours a day (Shohet, 2003) making facilities performance function particularly is very critical. The healthcare industry is a customized sector which cannot afford “trial and error” approaches or service failures with patients as a mistake can cost the life of a human being.

2.2. Maintenance management strategy

A building and its maintenance have a very close relationship from the main entrance to everything consists else inside. BS 3811, 1964 define maintenance as “a combination of any actions carried out to retain an item in, or restore it to, an acceptable condition or standard”. In 1987, BS3811 upgraded the definition to a “combination of all technical and administrative actions, including supervision actions,

intended to retain an item in, or restore it to, a state in which it can perform a required function.” The definition of maintenance keeps on changing according to needs and circumstances. In fact, the main purpose of maintenance is to improve and sustain facility function, services and surrounding area using a systematic system and standard regulations which are to be followed and accepted in the current facility by a competent person in-charge.(Shohet, 2002; Lavy & Shohet, 2009;Cholasuke, Bhardwa, & Antony, 2004;Matthew L Hicks, 2004)

According to (Ahmad Riza, 2006) building size and users’ standards are the main factors in maintaining buildings in Malaysia. A proper maintenance management strategy helps to minimize the problem of a major breakdown. The Malaysian government has already provided US\$330m for maintenance especially for upgrading, renovating and maintaining various facilities as stated in the Ninth Malaysia Plan (2006-2010). Unfortunately, maintenance management practices are not effectively carried out in Malaysia (Ahmad Riza, 2006). In complex and complicated buildings such as hospitals which have a lot of very critical mechanical and electrical equipment, due to a shortage of budget for maintenance, a strategic plan needs to be developed (Loosemore & Hsin, 2001 and Shohet, 2003). Managing health care facility requires a special touch to improve outcomes and allow cost reductions (Hoadley, 2010).

There are various factors that affect the performance of hospital such as actual occupancy relative to planned occupancy, age of the building, building surrounding, managerial resources invested and labor sources for implementing maintenance work either in-house or outsourced. Sometimes, what makes any organization fail is bad planning by the management. As reported by (Hicks, 2004) who claims that every strategic plan needs to be planned base on the vision, mission and goals of the organization itself. Referring to the objectives and goals of managing maintenance in healthcare, in simple terms, the best maintenance strategy is to retain all owner assets while improving their performance. Many organizations that begin to implement maintenance strategy within a hospital environment do not succeed (Hicks, 2004). However, customer will be the right person to evaluate on performance. It is not the problem of cost or customer, but the main point is maintenance is something needs to plan ahead. However Horner, El-Haram, & Munns, (1997) state that currently building maintenance strategies whether based on planned or un-planned maintenance is most likely to be budget driven. They also claim that current maintenance is being carried out not according to actual need but according to the previous financial situation.

2.3. Types of maintenance strategy

Strategic plans have a long-term focus and address issues related to the organization business objectives. A maintenance strategy is an integrated system that is needed by corporate management to highlight the significance of a particular piece of equipment that impacts particular types of maintenance work.(Lahiri, Sinha, Chowdhury, Chowdhury, & Crossley, 2008) A maintenance strategy is developed based on corporate business objectives and a clear understanding of the role of maintenance in line with corporate strategy. (Al-Turki, 2011; Muchiri, Pintelon, Gelders, & Martin, 2011;Alsyouf, 2009;Lahiri et al., 2008).It requires the definition of maintenance objectives as an input which will derive directly from the business (Márquez, León, Fernández, Márquez, & Campos, 2009). A developed maintenance strategy will not be effective if the foundation not planned properly for each equipment.(Onawoga, Sc, Akinyemi, & Sc, 2010) The relationship between asset and maintenance strategy shown in Fig. 1.

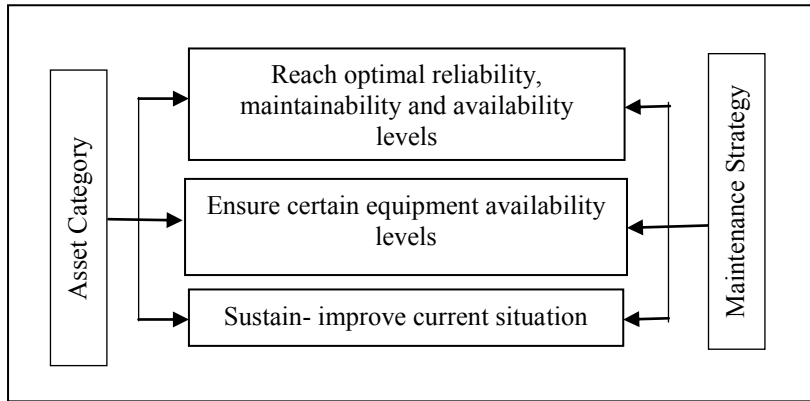


Fig. 1. Relationship between asset category and maintenance strategy

Source: Márquez et al. (2009)

There are two types of maintenance strategy that is plan and unplanned strategy. Fig. 2. shows the types of maintenance strategy according to category and table 2.0 describe types of maintenance in detail.

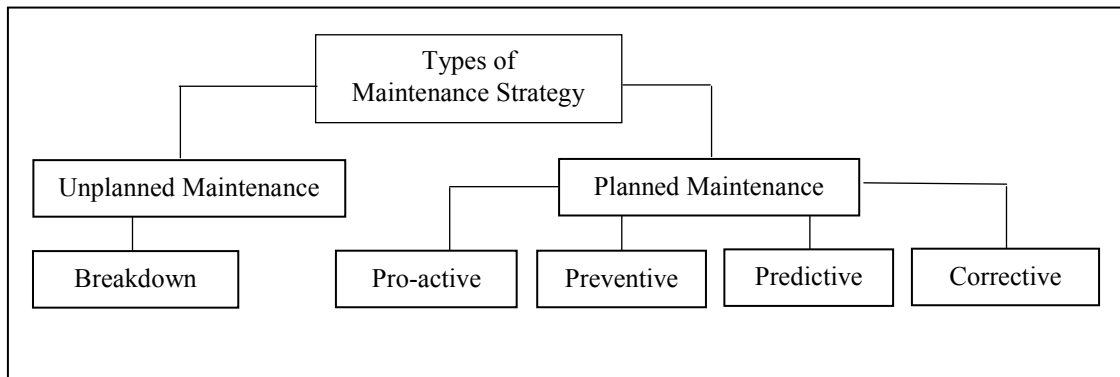


Fig. 2. Types of maintenance strategy

Sources: Adapted from BS 3811 (1987 as cited Hisham (2003); Nik Elyna (2010); Yaakob (2005); Swanson (2001) and Horner et al. (1997)

2.3.1. *Unplanned maintenance strategy*

It is also called reactive maintenance or emergency maintenance. It is maintenance with respect to unexpected cases and leads to high maintenance cost.

2.3.2. *Planned maintenance strategy*

Widely used in maintenance management. The basis of planned maintenance is reliable and accurate data. Management normally plans its maintenance work properly especially the person in charge of monitoring the maintenance work.

- Pro-active maintenance

As mentioned by (Hisham, 2003) proactive maintenance is one type of maintenance that detect the failure from the source of the failure. It can lead to extending the life of equipment and enhancing production capacity. Proactive maintenance is not similar to preventive or predictive maintenance. Hisham, (2003) stated that proactive maintenance is designed to extend the useful age of the equipment to wear-out stage by adopting a high level of mastery with respect to operating precision.

- Preventive maintenance

With this type of strategy, the efficiency of the equipment is assessed at regular time intervals, which can extend the life of the equipment. It is designed to overcome the disadvantages of corrective maintenance by reducing the probability of the occurrence of failure and avoiding sudden failure (Horner et al., 1997). This strategy helps to minimize the cost of building operations besides protecting assets and prolonging the useful life of production equipment while at the same time can improve system reliability. This strategy can prevent premature failure and reduce the frequency of the failures. It can also reduce the severity of failure and mitigate its consequences besides providing warning of an impending or incipient failure thus allowing planned repair. The management department will also be happy because the overall cost of asset management is being decreasing. According to Raymond and Joan (1991) as cited by (Horner et al., 1997) preventive maintenance is better than corrective because it plan onward and reduced maintenance cost of major damage, downtime can be minimized and improve asset safety.

- Corrective maintenance or condition based maintenance.

Corrective maintenance tasks often take place in response to breakdown or user request. It is completely different from preventive maintenance because it based on the condition of the equipment. As mentioned by (Horner et al., 1997), corrective maintenance is the simplest maintenance strategy, which involves just the repair or replacement of an element that has failed in its function. Nik Elyna (2010) mentions that the corrective maintenance is the most maintenance managers depend on to perform daily maintenance tasks. Corrective maintenance can be extremely expensive because the failure of an item can cause a large amount of consequential damage to other elements in the building and failure of an item can occur at a time that is inconvenient to both the user and the maintaining authority. (Horner et al., 1997)

- Predictive maintenance

This type of maintenance is more like the condition-based or condition monitoring approach to maintenance. This approach helps by measuring the condition of the equipment using tools such as vibration analysis, infrared thermographs, ultrasonic detection (Hisham, 2003) and it involves inspections at equipment running conditions and during stoppage periods (Onawoga et al., 2010). A balanced approach is needed for each maintenance strategy because these strategies have different function. The maintenance strategy used depends on problem detected, but the most important thing is how the maintenance strategy is being planned. Although all maintenance strategy can help lengthen equipment life except for corrective maintenance, but the most relevant of maintenance strategy type is preventive maintenance. Preventive maintenance provides a proper schedule for maintaining the facilities and its helps maintenance management and cost planning.

2.4. Performance

Moullin, 2007 defines performance the evaluation of how good organizations being manage and the value they deliver for customers and other stakeholders. Satisfying the end user such as the patient, medical or administrative staff and visitor can lead to sustainable value creation (Kaplan & Norton, 2004). Saving lives and providing patients with good services are the main business function for healthcare. It is important for healthcare to provide an adequate and appropriate medical support to satisfy patients' during treatment. At the same time healthcare personnel can use the medical support for research

purposes. As describe by (Parida & Kumar, 2006) Maintenance Performance Measurement (MPM) is defines as “the multidisciplinary process of measuring and justifying the value created by maintenance investment, and taking care of the organization’s stockholder requirements viewed strategically from the overall business perspective.” MPM is an important process used to evaluate current and previous jobs done in order to satisfy end user needs. Healthcare need to provide continues training for health-care personnel to improve the physical environment. It is also important for healthcare personnel to provide health care to the local and wider community by giving great clinical service (Loosemore & Hsin, 2001). The implementation of maintenance strategies will benefit to the management but for end user satisfaction, it will be based on quality performance of the service provided. Hisham, 2003 mentions that having proper maintenance strategy for plant equipment can significantly reduces the overall operating costs, boost the productivity of the plant and lastly satisfy the end user.

3. Methodology

In the 10th Malaysia Plan, has highlighted that there would be enforcement in relation to improvement of the quality of healthcare in public and private hospitals. Parallel to the government’s intention, this paper focuses to manage the facilities and hence satisfy end users by types of maintenance strategy use in hospital building.

3.1. Research approach

In order to look into the relationship between maintenance strategies and end user satisfaction, this study focused on 18 hospitals in the Klang Valley district for its source of information. The objective of the study was to investigate the relationship between maintenance strategies and customer satisfaction in the hospital. An assumption hypothesis to confirm $H_0 =$ Higher level of maintenance strategy has a positive on customer satisfaction level was tested. The main purpose in conducting hypothesis test is to reject the null hypothesis or to accept. In order to accept or reject the null hypothesis, the r-value (correlation value) from the Kendall’s correlation analysis (SPSS output) will be evaluated. If the p-value is less than the significance level ($p < 0.05$), the null hypothesis (H_0) will be accepted. This study used questionnaires and surveys as a means of data collection. The data were analyzed using correlation to look into the relationship between maintenance strategies towards customer satisfaction. Hospitals were selected based on their having a facility manager who had more than five (5) years’ experience in managing hospital facilities. This study used two (2) types of data collection, the first set of data come from the facility managers to get their viewpoints on current maintenance strategy practices and the second set of data come from end user to assess their level of satisfaction. The questionnaire for the person in-charge divided into two (2) sections, Section A: General information on hospital management and Section B: Maintenance strategy applied. Further interview were carried out to get clearer information regarding the answers given. Meanwhile, in order to get information on end user satisfaction, 30 hospital staff, 30 patients or visitors who were in the building while the survey was carried out were asked to complete a questionnaire. The questionnaire use Likert scale with five (5) categories to measure level of satisfaction regarding 10 facilities in the building. The categories were 1: Very unsatisfied, 2: Unsatisfied, 3: Moderated satisfied, 4: Satisfied and 5: Highly Satisfied. The results of both questionnaires were discussed below in data analysis section.

4. Findings

The findings based on the questionnaires and further interviews with person in-charge of maintenance at the selected hospital.

4.1. Section A: General information on hospital management

The results show that out of total 18 hospitals in Klang Valley, only four (4) hospitals located in buildings aged more than 20 years old. It is confirmed that most of the hospitals in the Klang Valley are aware of the Malaysian Government concern with focusing on building maintenance. The management of each hospital also outsources its maintenance work such as maintenance of mechanical, electrical and biomedical equipment to Concession Company or competent company that is an expert in maintenance work. The hospital prefers to outsource major maintenance work since that it is easier for them to monitor and to provide the best service for end user. From the questionnaire, 18 hospitals indicate that they have an expert person in charge of maintenance management with more than 10 years' experiences. The manpower to bed ratio one (1) is between 10-25 beds. It shows that each hospital in the Klang Valley has enough manpower to look into the condition of its facilities.

4.2. Section B: Maintenance strategy applied

Analysis shows that Facility Manager in every hospital agreed that preventive maintenance is the best maintenance strategy with average mean value (4.52). Meanwhile, proactive maintenance with average mean (4.30) becomes the second popular types of strategy practice in hospital. The most variable agreed by the facility manager for proactive maintenance strategy is on monitoring and correction on root failures where the average mean (4.44), then followed with it can extend assets life while reducing downtime (4.33), and (4.22) for the most important strategy in maintenance and design plan for resolve problem for assets over a period of time. In preventive maintenance strategy, the most agreed by the Facility Manager are that can be planned ahead and can perform well to user with (4.72). Then the second mean is (4.56) which the same for saying that preventive maintenance is the most effective strategy in maintenance and it can protect and prolong the useful life of production equipment. The less agreed by the Facility Manager in preventive maintenance strategy are that can avoid unexpected equipment failures that causes production loss with average mean value (4.44) and reduce maintenance and repairs cost (4.33).

However the other three (3) maintenance strategy are not left behind and the average mean value are predictive maintenance (4.29), corrective maintenance (4.13) and breakdown maintenance (3.91). For predictive maintenance strategy, facility manager agreed that it is use to make decision based on facilities condition and to plan on future maintenance by predicting based on previous assets with mean of 14 hospitals are (4.44). Facility manager also agreed about (4.28) that predictive maintenance only can be applied by using tool to detect facilities problems. This types of maintenance also agreed by facility manager that it can helps for future maintenance strategy in maintenance plan stage (4.17) and it is carries based on previous assets performance (4.11) The second last and less agreed by the facility manager is corrective maintenance strategy types where they agreed that in corrective maintenance correction will be done when the facilities going to fail with mean (4.17) and followed by mean (4.11) for corrective maintenance is the best strategy in maintaining hospital facilities and it is required to prevent equipment failure by early detection and correction. Finally the less agreed by the facility manager is breakdown maintenance with average mean value (3.91). The most agreed in breakdown maintenance is this type of maintenance need to be fixed when it is broken and need a large amount of maintenance budget with

mean (4.06) then followed by a need of contingency plan (4.00), shortage life of assets (3.89) and can reduce quality of work (3.67).

While answering the questionnaire given the Facility Manager also explained that preventive maintenance is more practical in hospital due to it having a proper scheduled plan. This is because, in hospital most of the facilities being run 24 hours in a week and it is not easy for maintenance person to look into the facilities in detail as explain needed by proactive and predictive maintenance. They only can follow plan that has been scheduled as agreed by the users. Mostly in hospital, preventive maintenance will need maintenance person in-charge to do routine inspection for every facility in the hospital. From the routine inspection done, sometimes they can detect the minor problem on facility and immediately corrective maintenance will take place. It shows that the relationship between types of maintenance strategy in order to have good strategy in maintenance work support by correlation done.

4.3. Survey

In order to evaluate the level of end user satisfaction with maintenance practices, 10 items on services were observed. The qualities to be observed were on electrical supply, cold and hot water supply, drainage system, air-conditioning and ventilation system, fire protection system, communication system, vertical transportation system, building security system and building condition. This survey only covered for 14 out of the 18 hospitals due to privacy and confidential issues regarding hospital policies. The results show that, the level of satisfaction with quality or services performance of services provided is in the medium range. The average mean for level of service performance satisfaction is between 3.73 and 4.44.

4.4. Relationship between Maintenance strategy and end user

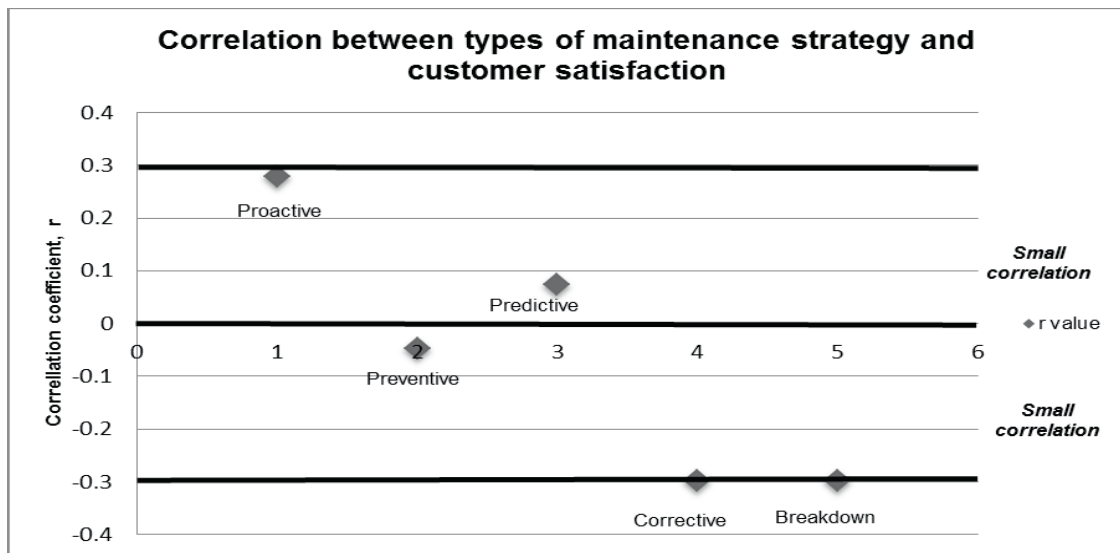


Fig. 1. Correlation result between types of maintenance strategy and customer satisfaction

Fig. 1 shows the results that end user satisfaction has a relation with maintenance strategy, but the correlation is small. The correlation coefficient types of maintenance strategy with respect to end user satisfaction are; proactive maintenance $r=0.278$, preventive maintenance $r=-0.048$, predictive maintenance $r=0.073$, corrective maintenance and breakdown maintenance $r=-0.297$. An assumption of, H_0 =Higher level of maintenance strategy has positive on customer satisfaction is accepted due to no strong evidence to prove on the correlation result because level of significant is more than $p>0.05$ and $p>0.01$.

5. Conclusion

The findings show that there is a correlation between maintenance strategies and customer satisfaction but with small significant level. The major conclusion drawn from the case study is that customer satisfaction with maintenance performance has a relationship with types of maintenance strategy used by hospital management. In order to improve the level of customer satisfaction with hospital facilities, management needs to look into types of maintenance strategy implemented previously and plan according to facilities requirement. A theoretical framework is a model with a symbolic representation a set of concepts, which is created to depict relationships. It is function to guide research in order to determine what things will be measure and to understand the relationships (Borgatti & Everett, 1999). From the variables describe, it can be seen that any one of the maintenance strategies leads to customer satisfaction with hospital performance. This study confirms that there is a relationship between maintenance strategy and customer satisfaction with as proposed by (Kutucuoglu, Hamali, Irani, & Sharp, 2001) who found that maintenance strategy has an effect on building performance by evaluating customer satisfaction.

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