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Research paper

Hospital Building Maintenance Management Model

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Abstract

Wellness of the patients correlated with the hospital building performance. For building to achieve it design objectives and provide value added services to owners, users and other stakeholders, maintenance functions are strategic. As a result, management of the maintenance of hospital buildings is a delicate and expensive task to perform. Despite the fact that there is a lack of representative data on the maintenance of hospital buildings in Malaysia, there is a growing concern surrounding the subject. Fire outbreaks and decay in hospital buildings suggest a need to conduct critical research to investigate the maintenance management practices of hospital buildings. This paper reports part of an ongoing research that aims to develop a maintenance model for hospital buildings. Hence, this current research reports the results of literature reviews and observations on hospital buildings in Malaysia and their maintenance practices. Upon reviewing the literature, a conceptual framework of maintenance model for hospital buildings was proposed. The research found that the current approaches to maintenance management in the hospital buildings were corrective, fragmented, cost-driven and expensive. The procurement of maintenance services was mainly outsourcings. All these call into question, the decision making processes of the hospital maintenance organisations. Collectively, the above considerations have led to the formulation of the main research question- what are the critical success factors [CSFs] for the maintenance of hospital buildings? The current study also discussed a proposed research methodology for the main research. Furthermore, issues pertaining to the research design, ontology and epistemology were briefly discussed. It was established that to enrich the findings of the main research, it was imperative to collect primary data using both quantitative and qualitative research paradigms.

Keywords: *Critical Success Factors; Building Performance; Productivity; Wellbeing; Place Managers*

1. Introduction

Buildings can be likened to life supports. A building's performance contributes to the wellness, productivity, behaviour, satisfaction, and security of its occupants. Hospital buildings are unique with regards to purpose, complexity, and size. Hospital buildings are important for any community and the way the building are designed, constructed and operated have profound impact on users health and the health of the environment [1]. Hospitals are care centers and hubs for scientific and medical knowledge. However, similar to universities and hotels [2], hospitals are building based organisations because the expenditure on the building is more than 50% of their asset base. Apart from the salaries of medical staff and nurses, the operational cost of a hospital building is the most significant item on a hospital balance sheet. Hospitals have both negative and positive roles in the area they are located. For instance, sometimes they help to save lives, prevent diseases, deliver cures and provide a livelihood for many. Conversely, sometimes the size and nature of the services they offer contributes to environmental degradation, waste generation and becomes a source of diseases being spread, especially if the buildings are not operating at an optimum level or are performing poorly. In addition to this, hospitals operate daily and throughout the year, thus, they consume large amounts of water, electricity, cause a lot of traffic and generate a lot of noise. Hospitals are large enterprises and are one of the most challenging buildings to construct and operate. The construction, operation, and maintenance of hospitals depend on the functional and psychological needs of the main occupants [i.e. patients]. Furthermore, hospital buildings contain various types of equipment, plants, laboratories, more so than any other types of buildings. Hospital buildings have a diverse range of uses and serve multiple purposes. Some hospitals now have sports, cultural and recreational facilities. The occupants of the hospital buildings, especially the patients, depend on the building performance to facilitate their recuperation process and procedures. Medical and nursing staff and visitors depend on the performance of the hospital building to increase their productivity and to protect them from diseases and sickness. Due to this strategic reason, hospitals, similar to universities, schools and hotels, seldom relocate. Hence, they tend to extend and refurbish their buildings. Hospitals operate throughout the year, thus maintenance organisations must be efficient and on call at all times. The implication of this on the procurement method is that insource maintenance is most appropriate. A key concern of hospital management is for the continued operation of the hospital, and for this to happen, maintenance functions are required. The lack of maintenance on hospital buildings will mean that the buildings cannot add value to hospital's corporate objectives and users /clients expected functions and roles. A hospital building requires continual maintenance to meet its design and construction functions and to maintain the satisfaction levels of its users. As a result, hospital building maintenance departments are under severe pressure. Despite this pressure, allocations to hospitals are being slashed and buildings are aging. A building requires maintenance to ensure optimal performance occurs over its building cycle. Maintenance has been defined differently by authors. The current study defined maintenance as the means [i.e. processes, activities, procedures and services] involved in preserving, repairing, enhancing and caring for

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a building's structure and services after completion, refurbishment, conversion, alteration or replacement of the building to current standards, to enable it to serve its intended function throughout its entire lifespan, without drastically upsetting its basic features and use [2]. The definition reflects the current philosophy on systemic building maintenance management. While the maintenance management of hospital buildings has been investigated in countries like Israel, UK and US, the maintenance of Malaysian hospital buildings has yet to receive any practical investigations. Despite this, recently it has been noticeable that there has been a growing concern on the subject. Similar to many developed and rapidly developing countries, the hospital buildings in Malaysia are becoming increasingly complex and sophisticated in terms of design, construction, and function. It is imperative that building maintenance practices in Malaysian hospitals are investigated considering the recent incidence of fire outbreaks and decay in hospital buildings. There is need to have theoretical insight into hospital building maintenance practices in Malaysia. Existing studies have only focused on design, construction and safety aspects of a hospital, but interestingly, the maintenance aspects have been conspicuously neglected, despite the important role maintenance aspects play in buildings. A review of government sponsored and media reports show that, maintenance decision are not based on sound information. However, the major concern of maintenance activity is to provide justifications to authenticate the maintenance demand and expenditure. This will require the maintenance organisations to ensure that the maintenance objectives set out in the maintenance strategy are measurable with factors that determine performance in critical areas. Therefore, a question that may be asked, how do the maintenance organisations make their decisions? How do they prioritize maintenance demand? A major implication of these that the critical success factors [CSFs] for hospital building maintenance required investigations. The practical implication of this, is that, evaluating the CSFs for the hospital building maintenance is crucial for the maintenance department in order to the convince the management/government that the services/ practices are adding value to the hospitals and that the decisions are made based on sound information and thus delivering value for money invested in maintenance.

2. Literature Review and Theoretical Framework

According to the Malaysian Government, "The goal is nothing less than a better quality of life for all Malaysians" and in order to fulfill this goal, "every household will have access to efficient infrastructure and public amenities, quality healthcare and education, quality and affordable housing, and comprehensive support services"[3]. The opening quotation above signifies the government's commitment towards economic growth and economic development. The quality of life of Malaysians is improving through better access to healthcare, public transport, electricity and water. Their well-being has increased by some 24% between 2000 and 2014. The government is improving access to quality health care services by upgrading healthcare infrastructures, enhancing the capacities and capabilities of health care personnel and regulating the delivery of private health care. Malaysia aspires to create a seamless and integrated healthcare system by incorporating a competitive healthcare travel industry with strong values of professionalism and state-of-the-art medical technology. The total expenditure on health per capita per person in Malaysia is small compared to countries like Singapore [US$1, 148 per person] and the United Kingdom [US$3, 867 per person] [3]. However, expenditure in the health sector has increased by some 230% since 1997. See Table 1. In 2013, 43% of government expenditure was made by the Ministry of Health [Table 2].

The government aims to make Malaysia the preferred healthcare destination in the south East Asia and as part of an initiative to promote the Malaysian healthcare industry, Malaysian Healthcare was branded with the tagline "Quality Care for Your Peace of Mind", this was launched on the 9th of June 2009. The Malaysia Healthcare Travel Council [MHTC], which is a primary agency to promote and develop health tourism, was launched on the 21st of December 2009. These efforts have enabled more than 1 million foreign patients with total medical receipts of around RM800 million to be attracted to Malaysia during the Tenth Malaysian Plan [Government of Malaysia, 2015]. Furthermore, the Malaysian healthcare travel industry grew by 12.3% between 2006 and 2008. The prospect and demand for the delivery of healthcare has been very high due to a combination of factors such as an aging population, nature of work, life style and increased wealth. Malaysia faces an increase in lifestyle-related diseases. By 2020, Malaysia will have reached an aged nation status, with 10% of the total population above the age of 60 [3]. In 2008, there were 58,530 hospital beds in Malaysian hospitals with 2.95 million admissions [3] and Government of Malaysia, 2015]. The number of hospital beds increased to 58,530 in 2014 from 55,180 in 2010 [Government of Malaysia, 2015]. Public hospital beds accounted for 78% of total hospital beds in 2008 [3] and 75% in 2014 [Government of Malaysia, 2015]. The doctor to population ratio has decreased from 1:859 in 2010 to 1:581 in 2014. During the Eleventh Plan, the government targeted a ratio of 2.3 hospital beds per 1000 in a population and a doctor to population ratio of 1:400 as explained in Table 1.

Table 1: Total Expenditure on Health by Sources of financing [Public & Private Sectors], and per capita spending 1997-2013

Year	Total Expenditure, Constant [RM Million]	Expenditure as % GDP	Per capital spending, constant [RM]
1997	13,723	2.95	630
1998	13,669	3.16	612
1999	14,999	3.27	655
2000	16,975	3.28	723
2001	19,220	3.68	797
2002	20,367	3.70	824
2003	24,763	4.28	978
2004	25,125	4.06	970
2005	24,358	3.58	920
2006	28,373	3.95	1,057
2007	29,966	3.93	1,102
2008	30,267	3.79	1,099
2009	34,739	4.41	1,245
2010	37,827	4.47	1,323
2011	38,871	4.36	1,338
2012	42,347	4.50	1,435
2013	44,748	4.53	1,494

The government aimed to increase performance and efficiency of Malaysian healthcare facilities and recognized the need for more buildings. In line with this, the government affirmed its commitment to upgrade existing health care facilities and assets. Furthermore, the government declared that the development of new healthcare facilities would take into account functionality, cost effectiveness, and other performance requirements [Government of Malaysia, 2015]. There has been an increased demand for hospital facilities. Thus, hospitals are expanding their branches. New hospitals are being set up and existing hospital facilities are being extended and refurbished to meet the growing demand and increased customer requirements. Currently, there are 273 private hospitals [Government of Malaysia, 2015] and 540 public hospitals in Malaysia. Moreover, there are 9000 various types of clinics [MOH, 2017a]. The hospitals are generally divided into general hospitals, teaching hospitals, district hospitals and specialist hospitals. In response to market demand and taking into account experiences from other major countries, hospital buildings in Malaysia are large, elegant and complex. Nevertheless, Malaysian hospitals are already stretched to their maximum capacity and public hospitals are overstretched [Government of Malaysia, 2015]. The hospital buildings are inadequate to cater for the increased number of patients, equipment, instruments, and staff. The inadequacy is impacting the overall performance of hospitals and more specifically, the hospital buildings. Despite the fact that there is dearth of academic literature and reports on the performance of hospital

buildings, there is sufficient evidence to suggest that hospital buildings are not well maintained. Media reports and anecdotal evidences have led to the conclusion that the maintenance practices of hospital buildings are corrective, routine, cost driven, and preventive. These practices occur against a backdrop of increased expenditure on hospital buildings. A few key examples which illustrate the decay and poor performance of hospital buildings are sewage pipe leakages, fungal infections, and ceiling collapse incidences which are common in hospital buildings.

Table 2: Total Health Expenditure by Sources of Financing, 2013 [MOH 2015]

Sources of Financing	RM Million	Percent
Ministry of Health	19,370	43.29
Private household out-of-pocket expenditures	17,439	38.97
Private insurance enterprises [other than social insurance]	2,892	6.46
Other federal agencies [including statutory bodies]	1,705	3.81
Ministry of Education	1,374	3.07
All Corporations [other than health insurance]	969	2.16
Social Security Organization	213	0.48
Local Authorities	188	0.42
Other state agencies [including statutory bodies]	132	0.30
State Government[General]	116	0.26
Private MCOs and other similar entities	115	0.26
Ministry of Defence	114	0.25
Non-profit organisations serving households	78	0.17
Employee Provident Funds	42	0.09
Rest of the world	2	0.00
Total	44,748	100.00

Further examples of the deterioration of hospital buildings was the defective air-conditioning systems reported at Tengku Ampuan Rahimah Hospital, and the fungal infections and ceiling collapses reported at the Sultanah Aminah Hospital Johor, Hospital Umum Sarawak, Hospital Temerloh Pahang, and Hospital Sultan Abdul Halim [The Star Online, 2013]. In addition to this, there was a collapsed ceiling at Taiping Clinic, a short circuit Hospital Raja Permaisuri Bainun [Lau, 2016], and a faulty manhole at Penang Hospital [The Star, 2011]. As a result, many have described hospitals to be "Rumah Sakit' [or sick house]. Meanwhile, the hefty water and electricity bills at government hospitals can be partly attributed to poor maintenance of the hospital buildings. There are many studies that suggest poor maintenance of buildings leads to high water and energy consumption levels. For instance, the Sultan Haji Ahmad Shah Hospital, Pahang's electricity bill reached RM650, 000 in 2011 [The Star Online, 2011]. According to the Auditor-General's [A-G] 2015 Report, planned preventative maintenance has been suspended in many government hospitals since 2013. The recent fire outbreak in Sultan Aminan, Johor was found to be due to faulty capacitors in one of the lights [MOH, 2017b]. The A-G report found that the management of Facility Engineering Maintenance Services [FEMs] was inadequate. Results from a fire safety audit conducted on 46 hospitals built more than 50 years ago, revealed many risks including faulty electrical networks and outdated systems [MOH, 2017b]. Implementing the recommendations in the report involves upgrading faulty and outdated systems, which will cost RM379.34 million. FEMs have been privatized since 1 January 1997. Nevertheless, various aspects of hospital buildings, including the design [4], procurement and project management [5], post occupancy evaluation Woon et al., 2014], and fire safety [6] has been conducted. Many have also addressed approaches that comply with sustainability or green design requirements in the construction of hospitals. The performance of the hospital buildings are critical issues. Nevertheless, there is an absence of empirical research that addresses the maintenance management of hospital buildings. Addressing the procurement, sustainability and design aspects of a building will contribute to a hospital's building maintainability, but these factors have little to do with maintenance management practices [2]. To further illustrate the problem, buildings require maintenance to provide the design and construction's objectives, irrespective of their design and quality of materials. Building materials and components have a finite live span. Furthermore, because hospitals seldom relocate to new places, the need for maintenance will increase. In addition to this, technological factors as well as refurbishments and extensions of existing buildings are common in Malaysia, which creates a need for more building maintenance. Maintenance is high at points of intersections between old and new parts of buildings. Regardless whether a new building is free from defects, maintenance is required to increase productivity of a building, otherwise a building will be too expensive to own and operate. In financial management terminology, this is where inputs are more than outputs, or expenditure exceeds revenue/profit. In this context, maintenance services will not have an acceptable value. Hence, the maintenance process the terms how, when, what and why are very critical, as it will explain the essentials of maintenance management. What explain maintenance demand depend on these critical areas.

Hospital buildings are procured to create a suitable, conducive and adequate environment that can support and encourage patients' recovery and allow non-medical staff to perform their duties productively. A failure in the supply of these essential services is a loss in value to hospitals and customers. Many believe that the environment people live in is far more effective at improving people's health than medical treatment [7] and [8], which confirms the importance of hospital buildings. In other words, the performances of the hospital buildings are a major factor that determines the wellness of patients. There is still a need for an expansive supply of hospital buildings, in Malaysia however, the need for maintaining existing hospital buildings has increased exponentially. [2] drew attention to the uniqueness of building maintenance and stressed that a new or refurbished building needs maintenance. Maintenance of a building seeks to ensure that a building is operating efficiently at its peak, thereby creating value for investments. Building maintenance is the only way that the design life / service of a building can be attained [9]. The maintenance of buildings consumes a great portion of limited resources. The costs of buildings are comprised of construction costs and cost-in-use, however, the operating cost of a building is relatively significant compared to construction costs. Around 75% of the cost in use of a building is attributed to maintenance [10] and around 90% of building projects require maintenance work over a building lifespan [11] and [12]. This means that as soon as a building is complete, maintenance problems surface. The corporate objectives of hospitals place buildings in a strategic position since it is in and around buildings that patients' treatments and recuperations take place. The functional performances of hospital buildings are reflections of patient well-being and the quality of the healthcare service delivery. Hospital uses their building to advertise their presence.

Thus, a well-maintained building is critical for delivery of a hospital's corporate business objectives. When maintenance of a building is not well managed, it often leads to buildings that will be very expensive to own or operate in the long run [13] and [14]. Furthermore, the purpose which a building is used for, the suitability of its design for that purpose and the intensity and ways in which it is used will directly and indirectly determine the appropriate maintenance management system. For instance, the value of a building varies according to the use of the building [11] and [15] and maintain and different maintenance standards may be adopted for the different types of buildings Therefore, maintenance management has to be considered in terms of the building's function, the users' perceptions of the building's performance and its relevance to their primary needs [2]. This means that the users' requirements are essential prerequisite for the evaluation of a building [15]. It is only then that maintenance activities can be planned, controlled, organized and coordinated proactively and systematically. It is only then value based maintenance can be provided because the maintenance costs in relation to quality of service obtained will be less.

The corrective and condition based maintenance practice currently in place is Malaysia make maintenance services to be expensive yet with low customers satisfactions. Therefore, there is a need for

an alternative maintenance management system that will put the building users [patients, medical and nursing staff] at the center of the maintenance management system. In comparison with other types of organisations, the maintenance of hospital buildings are the most complicated and dynamic. The maintenance process of hospitals is problematized by many complications. For example, there are factors to consider such as when spaces and plants will be available for inspection and repairs, when to carry out maintenance because of patients conditions and treatment, disruptions to electricity, gas and water supplies, meeting patient volumes, protection against contagious diseases, what form of maintenance procurement to use, determination of the urgency of repairs, the duration of maintenance and the available budget. The hospital maintenance departments have to make decisions on what, when and how to maintain a building against this background of complexities. In other words, the policy question is: what are the critical success factors 'CSFs' for hospital building maintenance? At a practical level, what determine the maintenance demand of hospital building? On what basis do the maintenance organisation based their building maintenance decision? How do they know these factors?

Critical success factors of a project are the key factors that are required to make projects achieve its design functions and meet stakeholders' requirements. CSFs analysis could enable the identification of key important areas on a project, which is of considerable interest to stakeholders, to help achieve a project's goal [16] and [17]. The CSFs involved in a maintenance process represents the diverse activities that make up maintenance processes and activities, supporting decision making at each step of the delivery of maintenance services. The factors are required to make both strategic and tactical decisions. Some the factors are obvious are common, some are obvious but not common and some are not obvious. Some are financial and the others are not. Existing research outside Malaysia has addressed the key performance indicators for the maintenance of hospital buildings [18, 19], [9], [20-22]. The indicators includes building performance indicators, manpower source diagrams, maintenance efficiency indicators and managerial span of control [18, 19], business availability, urgent repair request indexes, manpower utilization indexes, preventive maintenance ratios, average time to repair and maintenance productivity, soft indicators. Nonetheless, there were several inadequacies with the existing research. First, the performance indicators developed were quantitative. Quantitative dimensions were not useful for hospital maintenance because of the strategic requirements and urgency required. Often with hospital buildings, planning or cost of maintenance is of less importance because time is essential. Second, although, some authors justified the inclusion of 'soft' indicators in their research, the indicators used were not for maintenance services, but for architectural and morphological dimensions. Furthermore, the empirical data was not drawn from hospital buildings, but court building complexes. Thirdly, although all the researchers applied statistical methods to analyze their data, the methods used such as regression, correlation and factor analysis may not be adequately capable of accurately producing informed results. Hence, AHP and PLS-SEM would yield more reliable and interpretative results for this purpose. Fourthly, key performance indicators [KPI] are not the same as critical success factors [CSFs]. While critical success factors are processes to make decisions to produce predetermined results, key performance indicators are used to measure results. While both are similar, they are not the same in all respects. For example, critical success factors could be likened to quality assurance, whereas key performance indicators / critical success criteria are more like quality control.

3. Methodology / Materials

Many tend to confuse research methodology with research methods, and even research design, but they are not the same. Research methodology is concern with explaining the science ofresearch methods. In research methodology, researchers engage in research designs and research methods by analyzing the choice of methods, respondents, variables and other factors. To put it simply, it is concerned with the scientific justifications of a chosen design. It also explains the philosophical perspective of the research. A research philosophy is considered to be a set of beliefs related to the development and nature of knowledge. Research methodology explains the reasons that underlie research design. In other words, research methodology provides justifications for the chosen research methods and constructs. Research methodology details the suitable paradigm for research. Research design is an aspect of research methodology that concerns itself with the nature and kind of information required to achieve the aims of the research or to test or develop theories. More specifically, it is the logical description and connection of data collection methods and data analysis methods to achieve the aims of a research. For instance, it provides answers to questions such as 'how do I use data to determine if a research question is answered or not', or 'what type of tests do I need to conduct', or 'what types of data does a researcher need to test their theory'. It also identifies a data collection method that is suitable to achieve a research's aims. For example, does a conduct survey, experiment or case study need to be carried out? There are two types of questions in research design, namely the descriptive question and the explanatory question. They are sometimes referred to as descriptive research and explanatory research. The distinction between the two is pertinent for a number of reasons. Descriptive questions are concerned with what is currently going into a 'system'. On the other hand, the explanatory question provides insight into why something is going in a system. Since the essence of this research is to incite the why question, this research can be deemed as explanatory in nature. This research is also a social research because it aims to find patterns of regularity in social life [see also, [23]. In addition to this, building maintenance has received attention in literature lately and literatures on maintenance of hospital buildings are nascent. Hence, the theory is latent or implicit in the literature. Therefore, this research is not directed by any sound theories in literature, but formulated based on both positive statements and normative statements based on practices, experience and cross-examinations of literature.

Fig. 1 displayed the research methodology framework for this research. The current study made an observation that the performance of a building [physical; since we only observed the conditions] was low and was attributed to maintenance practices. This conjecture was supported by reports in the media and government reports. The main research which this paper formed part of began with a sense of dissatisfaction with the present performance of hospital buildings and the maintenance management practices, procedures and processes. To put this study into a context of conducting research, it is believed that that there is a need to examine the maintenance management practices of a hospital building because the maintenance practices in use are not value–based. The above discussion draws attention to interesting issues in research philosophy; namely, the ontological and epistemological perspectives of research. Initially an ontological perspective was considered, which then identified epistemological assumptions. The epistemological assumptions dictated methodological perspectives, which in turn identified the appropriate research method to be used. This process was carried out to ensure that the research method was not treated purely as a technical exercise [23].

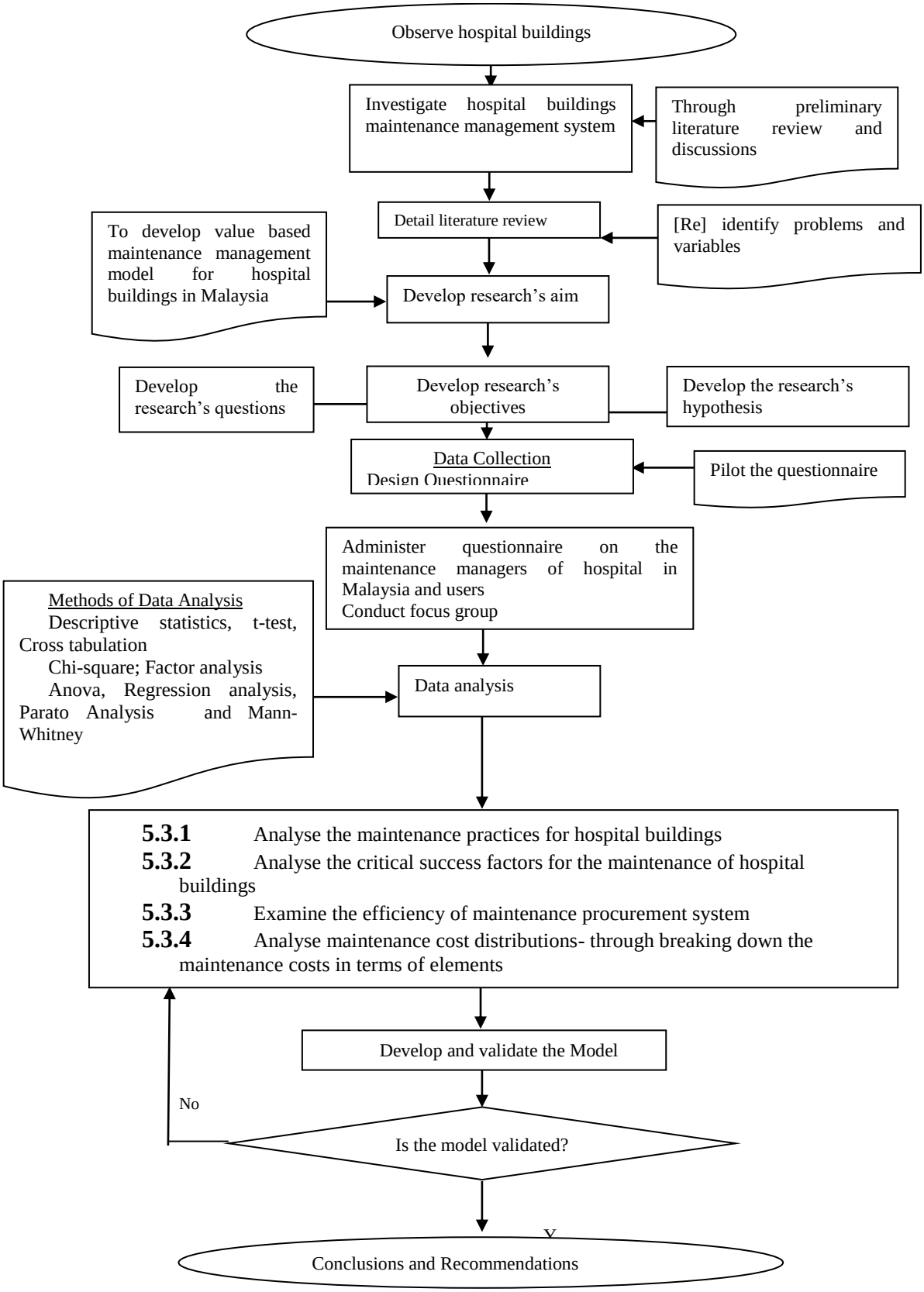


Fig. 1: Research Process Model

Therefore it is tempting to assume that the 'reality' was out there, and that we should consider using an objective ontological approach. Nonetheless, because both the objects and subjects of this current study were humans and maintenance organisations/ hospital management, the constructivism ontological approach was appropriate since the personal believe of the stakeholders' influenced the interpretations of the maintenance practices they adopted. However, the issue of how do we come to know what we know often crops up. In other words, how do we intend to know the truth about maintenance practices of hospital buildings? Epistemology is concerned with determining what we know and the researcher relationship with the data. The epistemological posture of this research was based on reasoning, experience and review of academic literature, formal reports and media reports. Moreover, the research problem was considered from a pragmatist view, which argued that the most important determinant of the research

philosophy adopted was the research problem, not the methods used. Furthermore, both positivism and interpretivism epistemological perspectives were be combined in this study because it was believed that knowledge could also be acquired using both empirical data and reasoning. However, to gain from both ontological philosophies, this research combined both qualitative and quantitative paradigms in the examination of the 'truth' about hospital building maintenance.

4. Results and Findings

The research gathered different epistemological perspectives and reasoning [by combining both deductive and inductive methods, experiences and research [the literature review presented above]. It was found that various factors were accountable for the poor performance of maintenance delivery. The factors include [1] procurement systems for maintenance that were used by hospitals, [2] the benchmark for prioritising maintenance works, and [3] the methods of budgeting. It is crucial for maintenance organisations to be familiar with the requirements for various methods of procuring maintenance services. As previously contended, the magnitude, unpredictability, and urgency required for hospital building maintenance makes it unprofitable to rely on the outsource practice. Evidences based on discussions with selected maintenance organisations together with the analyses of various reports, suggest that the budget allocations are based on historical records. This method has an advantage of reducing unnecessary maintenance budgets. However, there are many limitations to this method, such as unreliable maintenance cost estimations for the next year and delays in receiving further funds if a maintenance cost falls outside an allocated budget. Mere reasoning as method of solving method has received concern criticisms. Reasoning is resorted to when there is lack of sufficient data and due to limitations of experience of the decision makers. It was also found through examinations of government reports, media reports and complaints from the hospital users, that the methods of prioritising maintenance demands were reactive and retrogressive. Although, the priority for repairs were often determined in terms of risks associated with defects to hospital building users and the public, but the maintenance organisations placed significant emphasis on costs. While, it was not surprising that cost turnout to be a decisive element, this is risky to say the least because when other serious issues like safety and wellbeing are downgraded for cost, and this will lead to problem especially with the quality, safety and security. Cost management of a hospital is critical; however, a building's performance should be given substantial consideration compared to building conditions. A simplified theoretical model for this research is presented in Fig. 2. The central argument behind the model is that the method of procurement, method of prioritizing maintenance demands and budgetary allocations for maintenance must be integrated in the determination of what constitutes factors that determine maintenance practices. A failure to do so will impact the performance of hospital buildings.

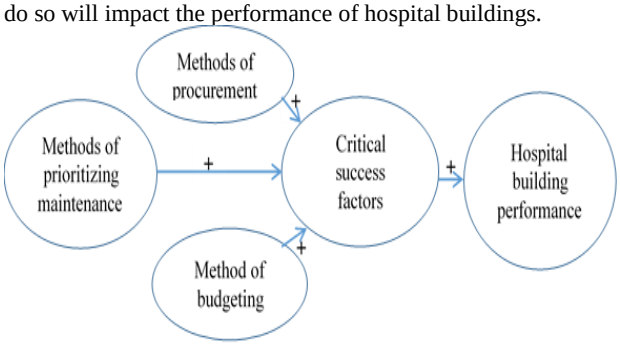


Fig. 2: Simplified Theoretical Model and Hypotheses

5. Conclusion and Future Research

This study is intended to garner attention to the strategics essence of the development of critical success factors for the maintenance of hospital buildings. The authors posit that the reliability of maintenance decisions depend on correctness and completeness of the identified CSFs. Therefore, engaging both the maintenance organisations and the buildings users to offer extensive CSFs are obligatory. The continued performance of a hospital is also critical, however, the continued operations of a building depends on a hospital's building maintenance management practices. The maintenance management of hospital buildings presents different challenges compared to other types of buildings. Hence current hospital operations require systemic rethinking. Maintenance is usually budget-driven rather than needs driven. Deferring maintenance is not effective, as the defective components of a building will continue to degenerate until such a time that the building could be unsafe for use. Moreover, if a building is only repaired before it gets to a critical stage, the amount of work involved will be more and the users will be significantly frustrated. Maintenance management is not usually regarded to be top management's responsibility; it is normally deemed to be an operational function. Unfortunately, it only receives management attention when everything goes wrong. Ultimately, users will not be satisfied with the quality of the service they are receiving, and maintenance backlogs will be on the increase. Therefore, in order to save costs, increase savings, improve building performances, as well patients' recovery and other users' productivity, existing maintenance practices need to be enhanced by basing maintenance service delivery in terms of value-based delivery.

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