THE CAUSE AND EFFECTS OF DEFERRED MAINTENANCE ON HIGHER EDUCATION BUILDINGS

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ABSTRACT: This paper presents a preliminary study of the causes and effects of deferred maintenance on higher education buildings. As higher education becomes a dynamic, global business and great national asset, the strategic management of higher education facilities becoming increasingly complex. A greater enrolment of students within higher expectation and changing needs has a major impact on how building should be planned, designed and maintained. Maintenance which is deferred because of insufficient funding may result in increased safety hazards, poor service to the public, higher costs in the future and inefficient operation. Furthermore a major concern faced by Higher Education administrators is finding the resources necessary to renew and renovate the existing physical facilities. Pressure on budget makes it difficult for facility managers to obtain needed financial resources without documentation that is understandable by non-technical people. Addressing deferred maintenance is a fundamental responsibility of the facilities management professional.

Keywords - Deferred maintenance, Facilities Management, Higher Education, Students.

1. INTRODUCTION

A major concern faced by higher education administrators is finding the resources necessary to renew and renovate the existing physical facilities. This is a particularly serious problem at public universities because of financial pressure on government budgets. For example, there are 13 public universities and 5 public university colleges in Malaysia, for which the funding depends on the Federal Government. Based on the latest statistics by the Higher Education Ministry of Malaysia management funding increased from 800 million in 1991 to 1800 million in 1999. This shows a rapid growth in higher education management funding and it will lead to a dilemma for the administrators in replacing and upgrading the existing physical assets. Over the years, when facilities expanded to meet the demands of a rapidly growing student population, budget restrictions resulted in the postponement of replacement capital equipment or major repairs to construct facilities. Fixed building equipment such as air conditioning systems, water pumps and electrical appliances are repaired to keep them working despite age and need for replacement. In addition new equipment which can provide opportunities for significant improvements in energy efficiency and technology are not purchased. These delays in replacements or upgrades of building equipment or component are typically described as capital renewal/deferred maintenance (CRDM). As student populations continue to increase, restrictions in government budgets postpone the construction of new facilities. This results in heavier use of existing facilities and increased rate of decay. Institutional administrators are often unfamiliar with the technical complexity of campus facilities and uncomfortable in providing the funds necessary to protect existing facilities. In addition, when funds become available for new facilities, there is little understanding of the future costs to preserve physical asset so they retain their value. The multi-year expenditure of a significant percentage of building replacement cost to preserve a building seems antithetical to prudent practices. This study reviews the causes and effects of deferred maintenance in higher education buildings. In doing so, this paper will explore the need for facilities management and discuss the management practice in higher education management.
2. DEFINITION

The general maintenance literature provides a number of different definitions of maintenance, as stated, including those given in the British Standard. Maintenance is the combination of all technical and associated administrative actions to repair an item or restore it to a state in which it can perform its required function (BS3811: 1974). The Chartered Institute of Building (CIOB) defined maintenance as work undertaken in order to keep, restore, or improve every facility i.e. every part of a building, its services and surrounds, to an agreed standard determined by the balance between the need and the available resources (CIOB, 1990). Maintenance also described as the act of keeping fixed assets in acceptable condition. It includes preventive maintenance, normal repairs, replacement of parts and structural components, and other activities needed to preserve the asset so that it continues to provide acceptable service and achieves its expected life. Management shall determine what level of service and condition is acceptable. Maintenance excludes activities aimed at expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than, those originally intended (SSFAS No. 6, Par. 78). The dictionary of property and construction law defines deferred maintenance as ‘any repair or maintenance of a piece of property that has been postponed, resulting a declined in property value’ (Rostron J. et al., 2001). The basic definition of deferred maintenance is maintenance that was not performed when it should have been or was scheduled to be and which, is put off or delayed for a future period (SSFAS No.6, Par.77). The glossary, taken from the book “Managing Factory Maintenance” by Joel Levitt defined deferred maintenance as all of the work that needs to be done that you choose not to do. You put it off, usually in hope of retiring the asset or getting authorization to do a major job that will include the deferred items. Deferred maintenance is also defined as maintenance and repair deficiencies that are unfunded at the end of the fiscal year on a planned or unplanned basis and are deferred to a future budget cycle or postponed until funds are available (Kaiser, 2004). Deferred maintenance (backlog of maintenance) occurs when routine maintenance and capital renewal do not occur in a timely manner (Ahoy, 2004). Accumulated Deferred Maintenance (ADM) refers to the backlog of unfunded major maintenance and renewal projects that have been deferred to future budgets. It results from the postponement of routine maintenance items which subsequently evolved into more seriously and costly concerns, and from deferral of major repair or restoration of facilities that are use beyond the life cycle originally envisioned for them or that has become obsolete. Higher education is education provided by universities, vocational universities (community colleges, liberal art colleges, technical colleges etc.) and other collegial institutions that award academic degrees, such as career colleges. Post-secondary or tertiary education, also referred to as third stage, third level education or higher education, is the non-compulsory educational level following the completion of a school providing a secondary condition, such as high school, secondary school or gymnasium (Wikipedia, 2006).

3. LITERATURE REVIEW ON DEFERRED MAINTENANCE

The issue of deferred maintenance at colleges and universities came to the forefront in 1987 with the publishing of a joint article and video by the Association of Physical Plant Administrator (APPA) now called the Association of Higher Education Facility Officers and National Association of College and University Business Officers (NACUBO) entitled ‘Deferred Maintenance the ticking time bomb’. Deferred maintenance had also been reviewed in several books by Harvey Kaiser, for APPA in 1979, 1984, 1987 and 1989.
In the Facilities Audit Workbook, 1987, Kaiser created a general outline to assess and compute the amount of deferred maintenance in any facility. This outline is one of several assessment tools for facilities developed over the years and will be useful in assessing deferred maintenance. According to Ahoy (2004) deferred maintenance or backlog of maintenance occurs when routine maintenance and capital renewal do not occur in a timely manner. Certain activities have been deferred for several reasons, usually the lack of adequate funding. Deferred maintenance consists of the backlog of maintenance projects that were not included in the maintenance process. These issues are complicated whether buildings are large or small and are as confusing for professionals with maintenance responsibilities, as for lay person. Maintenance competes for funding with other government programmes and is often postponed because appropriations are not available or were redirected to other priorities of projects. Deferred maintenance is often not immediately reported and sometimes not at all. Maintenance which is deferred because insufficient funding may result in increased safety hazards, poor service to the public, higher costs in the future and inefficient operations (National Oceanic and Atmospheric Administration (NOAA), 2004). In the fall of 1998, the New Mexico Commission on Higher Education Facilities Inventory and Space Utilization Project reported on the use of instructional and related functional spaces on each of the higher education campuses in the state. The Commission on Higher Education Facilities Committee together with the support of other institutions has completed the Facilities Inventory and Space Utilization Report. The purpose of this project is to provide the Commission with important information about how existing physical facilities are utilized on public higher education campuses. The steps taken based on the study is there is a need to eliminating the backlog of deferred maintenance. Maintenance projects have historically competed with new construction for funds allocated through the capital budget. As an initial step, it would be useful to estimate the level of deferred maintenance on each campus and thus arrive at a system wide estimate of capital investment needs. Having this as a base provides a starting point for developing a proposed financial plan to deal with the need. While there are numerous options, solutions cannot be recommended in the absence of the relevant cost estimates. Weidner (1999) found renewed growth of student populations has the potential to make future deferred maintenance problem greater still. His research suggested tools to identify vertical infrastructure maintenance needs are examined for accuracy against observed conditions at a large regional public university. Data developed for US Army Facilities model can utilized in three different ways to identify whether such data will be accurate in higher education facilities. The application methods explored are selected to utilize as much data as possible that is familiar to non-technical people while still providing a reasonable reflection of changing annual needs. The research concludes the accumulation of deferred maintenance at Eastern Illinois University is extremely high. This was consistent across the campus with faculty working in buildings with building condition ranging from 3 – 67. A separate survey of faculty and staff conducted in late 1995 also indicated moderate satisfaction with the condition of the building.

4. THE CAUSES OF DEFERRED MAINTENANCE

Based on the definition and literature review above, there is still the difficulty of understanding why the maintenance has been deferred. Among the reason of deferred maintenance could be a low priority of maintenance work at the first place, lack of funding, unforeseen expenses or redirected funds to other activities, building age, lack of management understanding on deferred maintenance issues, misunderstood needs assessment methodologies and tools and maybe due to lack of performance measure.
4.1 Maintenance has been a Low Priority

Under funding of maintenance has occurred in part because the state did not budget sufficient funds to maintain both student instruction and maintenance and special repairs (LAO Analysis 1995/96). Maintenance has been viewed as a lower priority than the need to maintain the quantity and quality of direct student instruction. It has been seen as more discretionary and therefore deferrable. As a result, spending on maintenance has lagged and facilities have prematurely deteriorated. In most cases maintenance decisions are based on expediency and over a period of time represent series of ad hoc and unrelated comprises between the immediate physical needs of the building and the availability of finance (Wordsworth, 2000). The core business managers were uninterested in considering any facets of maintenance management below an aggregated level of indicator for maintenance. This attitude can also lead to difficulties when negotiating flexibility in budgets, and probably also to a disinclination to invest in preventive maintenance (Hinks, J., 2004).

4.2 In adequate Planning and Funding

The primary reason that maintenance is deferred is because there simply isn’t the money to pay for it. If budget planning does not allocate adequate funding, or the budget is cut mid-year, an increase in deferred maintenance is inevitable. Additionally, if allocated funding is diverted to pay for emergencies and more visible projects, the risk of equipment failure and building deterioration increases. Inadequate funding of regular maintenance has also occurred in part because the segments redirected funds budgeted by the state for routine maintenance to other activities (LAO Analysis 1995/96). Deferred maintenance is usually high-cost work that must be postponed as a result of inadequate planning or funding. Examples include roof replacement, HVAC system replacement and painting work. Deferred maintenance adds to the backlog of maintenance and repairs, but is not included in the backlog calculations. It tends to be specific to the public sector. Analysis of expenditure by institutions over the last decades in UK shows that institution have invested very broadly the right amount to stand still in maintenance condition terms but this has not been sufficient to remedy the backlog (Scottish Executive Publications, 2004). The reasons for this under-investment are complex and multi-faceted. Mass expansion and real terms cuts in public funding contributed to a funding backlog estimated to be between £8 billion in United Kingdom (Blair, T. 2004). UK government invests less in Higher Education than many of their counterparts in other countries (Department for Education and Skills, 2003).

4.3 Aging and Deterioration of the University Buildings

Over a number of years, several reports have identified an alarmingly high backlog of building maintenance work in higher education institutions, which is confirmed by the poor state of many buildings (AIMS, 2000). As buildings age, components and facilities must be replaced to keep the building in good working condition. Small components and items can be replace according to the preventive maintenance schedule, but a major components such as replacing roof cover, boiler, chiller etc. must be budgeted separately as part of capital renewal process. The cost to replace, upgrade etc. will reach millions of dollars and if not properly planned and funds allocated it will lead to deferred maintenance problems. The aging and deterioration of universities facilities is permanent, on-going problem. It is essential to tackle it as there is a high demand for constructed facilities and space in order to perform
instruction, research and service. New programmes and curriculum changes now require further changes in the physical layout of the campus.

For example, New Mexico Highland University in the USA. The average age of its building is thirty-nine years (75% of which were built between 1950s and 1970s). Most of the buildings on campus need work due to deferred maintenance. Ninety percent of the buildings have water damage due to leaking roofs. Upgrading of electrical and sewer systems is needed as part of the intentional growth of the campus. The computer network has to expand to accommodate new facilities in the system. The fine arts building, Borris Hall has a long list of deferred maintenance problems, mainly environmental and problems with code compliance and roof drainage. The late 1980s brought a new direction and new programmes to the University, and as a result, building was reactivated without deferred maintenance investments (Weidner, 1999).

4.4 The Future Need of Higher Education

Fifty percent of higher education buildings in United Kingdom were built in the 1960s and 1970s to relatively low and inflexible specifications and now nearing the end of their design life. Yet there are significant new requirement from scientific and technology advances, from recent growth in research volumes and from registration. There are significant remedial investment needs in terms of the maintenance condition of buildings and services, their fitness for modern research purposes and the adequacy and the specification of the specialist contents that support research, namely libraries, information technology networks and scientific equipment (Scottish Executive Publications, 2004). The higher education infrastructure overall is old, designed in different era, poorly maintained and often not fit for 21st century purpose (Woodward, W., 2002). The funding backlog has caused a number of problems for UK universities. Building, maintenance, library and computer budgets have been cut and academics salaries have fallen far behind those of competing and comparative professions (Blair, T., 2004).

4.5 The Lack of Understanding

Understanding the extent of backlog is crucial to minimizing the volume of deferred maintenance and substantiating the need for funding. Understanding the deferred maintenance liability requires documentation of casual factors, and includes the impact of under funding annual operating budgeting for maintenance and replacement of building and infrastructure at the end of life cycle, and the gap between funding required for adequate capital asset maintenance and reinvestment. Although some public systems of higher education and individual institutions have addressed this problem aggressively in recent years, many struggle with identifying their needs and presenting a persuasive and credible argument for financial support necessary to restore deteriorating or remedy unsafe conditions (Kaiser, 2004). The facilities manager must understand the corporate goals of an organization and the interaction and relative importance of the social, political and economical forces which affect those goals. Obvious examples of the consequences of this lack of understanding include expenditure on maintenance of buildings that are to be rendered obsolete in the strategic plan (Worthing, 1994).
5. THE EFFECT OF DEFERRED MAINTENANCE

5.1 Financial Effect

When ongoing maintenance is not sustained at an appropriate level and repair projects not completed it requires more expensive investments and expenditure. In the UK many universities suffered from a dearth of capital investment from the seventies to the nineties. Higher Education Founding Council for England (HEFCE) estimates that 4.7 million square metres of buildings constructed between 1962 and 1975 are in poor condition. Bringing these up to scratch would cost £1.7 billion alone (HEFCE, 2004). In the United States, the Alabama Commission of Higher Education reports that 47.5 percent of the buildings being used by their colleges and universities were constructed between 1960 and 1980. Due to the increasing maintenance backlog, these colleges and universities are now facing deferred maintenance requirements approaching one billion dollars. In Scotland, the evidence shows that there is a clear problem among higher education institutions in terms of backlog maintenance which is currently being estimated to be around £430 million with almost 50% of Scottish higher education estates required major repair expenditure (Scottish Executive Publications 2004). Associate Physical Plant Administration (APPA’s) A Foundation To Uphold estimates $26 billion in total costs to eliminate accumulated deferred maintenance, of which $5.7 billion are urgent needs, representing a threat to the capability of higher education facilities to support the mission of their colleges and universities in US (Kaiser and Jerry, 1996).

5.2 Health and Safety Issues

As a result of deferred maintenance safety hazards will increase and will lead to user or tenant dissatisfaction, employee productivity decrease, and business operations affected. The issues of heath and safety are facing many institutions across the world. These issues mandated by the law such as the Health and Safety at Work etc Act 1974, Disabilities Act (Special Educational Needs and Disability Act 2001), energy conservation, encapsulation of asbestos (Control of Asbestos at Work Regulations 2002), providing safe domestic water supply, disposal of hazardous material (Control of Substances Hazardous to Health Regulations 2002), limitation of air pollution, mold growth etc. Cost of poor health and safety imposed by ill-health and accidents include sick pay, lost production, damaged equipment and materials, extra administration, losing skilled staff, training replacement staff, increased insurance premiums, loss of staff morale, bad publicity, compensation, fines and court costs (Poidevin J. and Perry P., 2004). One of the main conclusions in the UK National Audit Office Report 1994/95 state a backlog of maintenance work and work needed to comply with new health and safety legislation has put pressure on institutional expenditure. The majority of priority 1 and 2 maintenance work in former polytechnics and colleges is now reaching completion but the backlog of long term maintenance can contribute to the financial problems and over half of institutions did not think they had put aside suffusion provision in their July 1993 financial forecast to deal with all of their backlog (National Audit Office Press Notice 1994). Facilities management is firmly committed to pursuing a pro-active health and safety policy throughout all its dealing with the university community.
5.3 Higher Educational Issues

Many governments are facing similar issues relating higher education at the start of the 21st century. The issues address questions such as: how to have a successful and modernized higher education system, the right size of higher education system, provide the right numbers of graduates to meet the needs of the economy and society more widely etc. The UK Government is committed to increasing participation towards 50% of those aged 18-30 by 2010 (Department for education and skills, 2003). Deferred maintenance is other issue to concentrate on in order to cope with current agenda for higher education. Current levels of maintenance expenditure need to be improved otherwise a serious maintenance backlog would continue to expand over time. Performance evaluation will play an ever-increasing role in building design as external and internal factors place more demands upon the facility. Measuring performance explicitly focuses attention on feedback loops and this influences behavior (Barret, P. and Baldry, D., 2003). It is important for all parties involved in higher education management to understand the wider higher education environment. All outputs must be directed towards institutional aims and goals (Housley, J., 1997). Recent studies and research suggest that there is a direct relationship with the condition of facilities and its ability to serve a changing mission (National Research Council, 1998).

5.4 Building Deficiencies

As student populations continue to increase it will result in heavier use of existing facilities and increased rate of decay. Poor facilities don’t just make it tougher for students to learn effectively; they make it harder for universities to attract the best researchers and lecturers. Despite an overall reduction in condition type C or D, the cost of backlog maintenance reported at higher educational level in UK level has risen by 41 per cent since 2000-01. There has been no significant reported improvement in overall conditions during 2003-04. The estimated costs to upgrade space were elevated by 5 per cent. This perhaps reflects the needs of specific estates where the backlog issues are deteriorating and bearing higher relative costs. Overall conditions of space shows a very slight improvement at a sector level, but the costs of clearing backlog maintenance has increased (EMS annual report, 2005).

6. CONTRIBUTION OF FACILITIES MANAGEMENT

Facilities management is the process by which an organization ensures that its buildings, systems and services support core operation and processes as well as contribute to achieving its strategic objectives in changing condition. It focuses resources on meeting user needs to support key role of people in organizations, and strives to continuously improve quality, reduce risks and ensure value for money (Alexander, K., 1996). Facilities management is based on the premise that the efficiency of any organization is linked to the physical environment in which it operates and that the environment can be improved to increase efficiency (Grimshaw and Keeffe, 1993). Facilities management is an integrated approach to maintaining, improving and adapting the building of an organization in order to create an environment that strongly supports the primary objectives of that organization (Barret, P. and Baldry, D., 2003). Although facilities managers may prefer to operate individual contracted-out services on behalf of the organization, the function should be that of managing the property in the best interests of the core business (Speeding and Holmes, 1994).
Some of the factors which influence the type of strategic property decisions which are required for a higher education institution are changes in student numbers, changes in delivery courses and type of courses (Worthing, 1994). For many institutions, facility factors, where provided to high standard, are perceived as having an important influence on student’s choice of institution (Price, I. et al., 2003). One of the most important developments within universities in the last decade has been the growing recognition of the strategic importance of facilities management. If facilities are perceived to be poor performers then this is not likely to enhance their chances of contributing to the strategic direction of the higher educational institution (Barret, P. and Baldry, D., 2003). The concept of core activities and key support services has implications for financial model. At one institution, a facilities management approach was adopted to generate income for funding future core business (HEFCE, 2000). Deferred maintenance results from the deferring of repairs to plant, equipment or fabric due to lack of maintenance funding. Queensland University of Technology, Australia, policy is to catch up on maintenance backlog in a well defined, structured way by establishing annual rectification programmes through defining and prioritizing backlog. It is the responsibility of Facility Manager to conduct detailed audits of building services and fabric every three years, thereby providing an opportunity to update the University’s register of deferred maintenance work. Deferred maintenance is assigned as per one of the following criteria:

- Areas which will correct possible injuries health and safety issues.
- External maintenance of university’s fabric
- To works which will directly enhance the teaching and support activities of the university.

The University of Rochester, US using Integrated Facilities Assessment (IFA) to identify the demands for such issues as deferred maintenance, life safety, code compliance, accessibility, hazardous material, information technology and security along with the integration of current and future requirements (Tankel, P. and Gilmore, R., 2004). A university based in the North East of England was recognized as the most successful UK institution for widening participation in higher education and has received a substantial government funding to enhance this work. There was a large estate, it’s efficient operation and maintenance was very challenging due to scattered nature and varied age and suitability of premises and this was the major function of its facilities management department (Barret, P. and Baldry, D., 2003). The Open University has been using Performance Indicators (PI’s) to assess the relative proficiency and quality of resource utilization by comparison with other similar organizations (external comparisons), or targets set by organization itself (internal comparison). These are usually based on a mixture of both financial and non-financial information (McElevenny, B.A. and Levine, S.P., 2001). The implications of Balance Scorecards for facilities management are reviewed based on pilot study carried out in an institution for higher education and a set of propositions that may form the basis of further research. Facility Management’s ability to plan, anticipate and initiate change is enhanced if it utilities management tools such as Balance Scorecard (Amaratunga, D. and Baldry, D., 2004). An emphasis on student recruitment, combined with deferred maintenance backlogs and maintenance budget cuts, suggest that further study needs to be done on the intrinsic value of campus maintenance (Yeatts, G.D., 2003).
7. CONCLUSION
This paper has reviewed the background, causes and effect of deferred maintenance including the contribution of facilities management profession in addressing their services of higher education institutions. There is a need to understand the definitions and methodology to develop a credible and persuasive capital planning process. The facilities management department at higher educational institutions needs to identify funding and implementing programmes to reduce maintenance backlog in future. Reducing facilities deterioration and sustain functional facilities in support of institutional objective and mission is also a requirement. There is a challenge for higher education administrators to keep their campuses attractive to attract more students. With deferred maintenance backlogs, budget cuts for campus maintenance, increased enrolments resulting in more students on campus and the stress on facility managers to hold it all together, there is a need for find a way to prioritize limited funding and achieve sustainable university agenda.

8. REFERENCES


