

AN INTEGRATED FRAMEWORK FOR MAINTENANCE OF PUBLIC BUILDINGS IN GHANA

Owusu, D.¹ and Aigbavboa, C. O.²

¹*Building Technology Department, Cape Coast Polytechnic, Ghana*

²*Faculty of Engineering and Built Environment, University of Johannesburg, South Africa*

ABSTRACT

Maintenance works is an important function in organizations with significant investment in physical assets. This aids to prolong the life of these assets and plays an important role in achieving organizational goals. Acknowledging the need of a systematic maintenance for public buildings, this research therefore is seen as the vital approach to highlight and to assist the improvement on the maintenance for public buildings. This research intends to integrate two key elements, namely, the importance and the needs of the maintenance, with the aim of developing an integrated framework for a systematic maintenance programme for public buildings in Ghana. The study is a social research which is focused on obtaining perceptions or opinions of the caretakers, maintenance experts and other stakeholders who are key in the implementation of maintenance programmes for public buildings. The nature of this investigation will be undertaken through a cross sectional survey design and will make use of a mix of qualitative and quantitative research strategies. This study will be conducted in government owned universities in Ghana. The research will be limited to respondents who are involved in maintenance of these public universities. The respondents will represent government departments, budget officers, maintenance officers, community consultants, contractors, designers, engineers, project managers, town planners and cultural heritage preservation experts. The involvement of multiple project stakeholders in this study will provide in-depth views and aid validate the research findings. The study will employ both probabilistic and non-probabilistic sampling techniques. Purposive sampling will be use to narrow the sample frame to only universities owned by the government and used in selecting the experts and other key stakeholders while systematic sampling will be used to select the actual buildings from various universities to be analyzed. Data collection instruments will include questionnaires, observation list, Delphi methods, and a variety of other techniques. Primary and secondary methods of data collection will be used. Secondary data will be collected from analysis of related and relevant literature in books, articles in accredited journals, published and unpublished works such as dissertations. Records from the maintenance departments and web-based publications on the specified field of study will also be used for the study. For the primary data, questionnaire survey, observational survey and

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O.² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Oppong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Proc 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

Delphi method will be used to collect data. The study is envisaged to establish the critical success factors in the maintenance management process that contribute to maintenance of public building and develop an integrated framework for maintenance management system of public buildings in Ghana.

Keywords: *maintenance, public buildings, integrated framework, maintenance management system*

BACKGROUND OF THE STUDY

The success and progress of human society depends on physical infrastructure for distributing resources and essential services to the public. The quality and efficiency of this infrastructure affects the quality of life, the health of the social system, and the continuity of economic and business activity. A nation's economic strength is reflected in its infrastructure assets. Preserving public buildings is important because they represent significant investments of tax payers' money. Many Ghanaian public structures are often inadequately maintained and windows and doors and other building elements and facilities frequently show evidence of lack of maintenance and repair. Some residential and office buildings of public institutions have not seen any significant maintenance or show little signs of maintenance since they were constructed, some dating back to the colonial era. This has resulted in such buildings being in a dilapidated state with some being abandoned. This lack of maintenance by the authorities and occupants of these facilities often leads to reduced lifespan of these buildings (Melvin, 1992), which invariably defeat the purpose for which they are put up i.e. to ensure that the nation's stock of buildings, both as a factor of production and accommodation, was used effectively as possible.

Building maintenance is traditionally, a labour intensive activity and its operation processes are not noticeable and not attractive (Jones and Collis 1996; Wood 1999). However, as times change, top management including organizations' leaders as well as senior managers are now more concerned because building maintenance serves as a supporting activity for the core business (Mak 1997; Chan et al. 2001; Tranfield and Denyer 2004; Osgood 2004). Top management at the strategic level always challenges operation process efficiency from the planning stage to implementation. On the other hand, maintenance personnel at the operational level are faced with the challenge of insufficient maintenance resources and lack of support from top management (Lee and Scot, 2008). These misalignments do not help the effectiveness of maintenance and operation of public building. The application of maintenance policy and strategy influences the building maintenance operation processes.

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Oppong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

The main components of maintenance policy (i.e. maintenance strategy, maintenance standards and maintenance resources) are developed from the principle of understanding the length of time for which the building requires maintaining for the present use, the life requirements of the buildings and their fittings and services, the standard to which the buildings and its services are to be maintained. The reaction time is defined as time between a defect occurring and the legal and statutory requirements (RICS, 1990; Seeley, 1987; Lee, 1987; Barrett, 1995; Chanter and Swallow, 1996). The maintenance policy is to integrate different maintenance strategies including corrective, preventive and condition based maintenance since recent maintenance strategies are developed from the corrective, preventive and condition based (Horner et al., 1997; Chan et al., 2001).

Maintenance strategy depends on various factors such as standard, resources and the objectives of the organizations. While these factors influence adopting appropriate maintenance strategy, some studies suggest that preventive maintenance pose more challenges among other maintenance strategy (Wood, 1999, 2003a; Horner et al., 1997; Spedding, 1987). Loosemore and Hsin (2001) argued that the understanding of the relationship of planned preventive maintenance to a building and the core business objectives is inadequate. On the contrary, there are some suggestions for the better use of planned preventive maintenance (Shen and Lo, 1999; Tse, 2002; Chan et al. 2001). To this, Coetzee (1999) suggests that planned preventive maintenance could be of better use if it is based on the detail design of the maintenance cycle processes for the specific organization.

Some studies (Then 1996; Zavadskas et al. 1998; Wood 2003a) suggest that maintenance standard depends on the maintenance resources available, the degree of maintenance standard and business objectives. Then (1996) argues that the maintenance standard is essential to the maintenance process, which is limited by health, safety and use. Zavadskas et al. (1998) suggests understanding more about the organization's objectives and management may raise the maintenance standard. A balanced approach between top management at the strategic level and maintenance personnel at the operational level is required. Top management is interesting in focusing on the maintenance resources to see if there is any ways to minimize the building maintenance cost. Maintenance at the operational level argues that the maintenance budget is always below the maintenance needs (Tse 2002; Lo et al. 2000; Lam 2000; Shen and Lo 1999, Pitt 1997) while the top management at the strategic level criticizes the inefficiency of the maintenance, which contributes to the wastage and makes it difficult to get more resources.

Acknowledging the need of a systematic maintenance for public buildings, this research therefore is seen as the vital approach to highlight and to assist the improvement on the

callyclarke@gmail.com
caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Oppong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

maintenance for public buildings within the local context. This research intends to integrate two key elements, namely, the importance and the needs of the maintenance, with the main purpose of developing a framework for a systematic maintenance programme for public buildings in Ghana. The study focuses on developing an integrated framework for building maintenance activities of public building. The study will extensively examine the practice of preventive maintenance and establish obstacles limiting local governments' ability to perform preventive maintenance of public buildings within their jurisdiction.

PROBLEM STATEMENT

All buildings should meet certain safety and health regulations. These regulations ensure that built facilities are well maintained to ensure that they are structurally safe in order to provide a safe environment to live in and ensure that they are not a danger to the health of occupants. Equally the facilities must be in a condition that ensures that they are functionally sound and meet the expectations of users. According to Choka (2012) to achieve this, maintenance works must be effectively and efficiently managed. Maintenance management is crucial especially in current times where maintenance budgets are constrained. Maintenance management is an area that has been given very little attention in public institutions in Ghana resulting in deteriorating of buildings. The current state of buildings or built facilities in some public universities is a symptom of an inherent problem with the management of maintenance works in these public institutions.

The current condition of some public universities buildings and the backlog of deferred maintenance is, in part, a product of the poor maintenance practices used by these institutions. Buildings are assets whose life may span over several decades; in fact, records have indicated that some buildings have existed for over centuries. The lifespan of a building to a large extent depends on the level of maintenance it is subjected to. Maintenance work will be inevitable, as it is in the nature of materials to deteriorate over time with usage and exposure to the elements of climate. All things being equal, a properly maintained building will last longer than a scantily maintained building. Physical development is one of the sectors that swallow the greater part of governments' revenue. It is therefore imperative that these developments which include public buildings are well maintained so that they can serve adequately the functions which they were put up for.

Regardless of the heavy investment in physical infrastructure including public buildings, most public institutions allow their buildings to care for themselves without any sustainable maintenance plan to retain them. Maintenance should be a part of the usual cost of operating a building, according to experts, but it is more likely to be short-changed relative to other operating costs and there is a persistent problem of underfunding of maintenance and repair.

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Oppong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

Public institution managers are faced with the constant challenge of balancing competing public priorities and limited fiscal resources and often find it stress-free to neglect the maintenance and repair of public buildings. The neglect of maintenance has a cumulative effect with rapidly increasing deterioration of the fabric and finishes of a building accompanied by harmful effects on the occupants and contents of the building. Some residential and office buildings of public institutions have not seen any considerable maintenance since they were constructed and this has resulted in most of them suffering from dilapidation with others being completely abandoned. The lack of maintenance of public buildings often leads to reduced lifespan of the buildings and invariably affects the uses of these buildings. The occupants are mostly driven by the way of thinking that public property is nobody's property and therefore make no conscious effort to maintain them. Lack of maintenance of buildings has become a national tormentor and is a serious hindrance to the development of the nation.

Some studies have described the problem of maintenance of public buildings in developing countries as running down of important national capital assets beyond economic repair (Choka, 2012). Most public institutions in Ghana have in the last decade faced challenges to maintain their buildings due to lack of funds resulting from backlog of deferred maintenance. Maintenance is an area where public universities would probably cut down on expenditure. Maintenance management therefore plays a very important role by ensuring limited resources are managed to obtain the best possible outcome for these universities. The ad hoc approach to maintenance may seem attractive but is unlikely to obtain value for money or an efficient maintenance system (Seeley, 1987). It is important for managers in public universities to embrace modern maintenance management systems to ensure that with the little resources available, the built asset portfolio owned by the universities is in good maintenance condition. In as much as maintenance services do not form a core function, their contribution to the universities core functions of teaching and research should not be underestimated. The deterioration of buildings due to lack of maintenance can lead to future financial burdens, pose legal and other issues that will affect the delivery of teaching and research. By engaging in strategic approach to maintenance public universities are bound to benefit from the increase and enhance effective use of the universities' physical assets.

In Ghana, maintenance of public buildings is being executed ineffectively in a haphazard manner and without adequate budgetary support. According to Idrus et al (2009), effective building maintenance is necessary to maximize service life of buildings by delaying deterioration, decay and failure thereby enhancing service delivery. The haphazard and ineffective systems currently being applied coupled with low budgetary allocations imply that maintenance targets cannot be met resulting to serious defects build up. The consequences for

callyclarke@gmail.com
caighbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O.² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Opong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

ever increasing defects build up include disruption of delivery of services through equipment breakdowns or building element/component failures. It is against this background that this study has been crafted to investigate the existing maintenance framework with a view to developing an appropriate maintenance model framework for maintaining public buildings.

AIM OF THE STUDY

The study is aimed at developing an integrated framework for building maintenance activities of public buildings in Ghana. The study will extensively examine the practice of preventive maintenance and establish obstacles limiting local governments' ability to perform preventive maintenance of public buildings within their jurisdiction.

OBJECTIVES OF THE STUDY

The specific objectives of the study are:

1. to critically examine the maintenance management systems of public buildings and highlight the shortcomings and inadequacies in the system
2. to identify and examine the challenges faced in implementing a maintenance management system
3. to establish the critical success factors in the maintenance management process that contribute to maintenance of public building
4. to critically evaluate maintenance strategies and determine the extent to which models/frameworks can be applied to building maintenance
5. to develop and validate a framework for maintenance management system of public buildings

RESEARCH QUESTION

The research seeks to answer the following questions

1. To what extent do maintenance management systems contribute to effective management of public buildings?
2. What are the shortcomings and inadequacies in the maintenance management system?
3. What are the challenges faced in implementing a maintenance management system?
4. What are the critical success factors in maintenance management process that contribute to maintenance of public building?
5. To what extent do the critical success factors influence maintenance of public buildings?
6. What maintenance strategies and practices contribute to effective maintenance management?
7. To which extent can models/frameworks be applied to public building maintenance?

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu,J.N., Nani G., Atepor, L., Oppong, R.A., Adetunji,M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

8. Which framework can possibly improve the maintenance management system of public buildings?

SIGNIFICANCE OF THE STUDY

Whereas the importance of maintenance to public office buildings cannot be understated, there is no effective framework within which to execute maintenance works leading to uncoordinated, costly maintenance systems. The study therefore endeavors to investigate the existing maintenance framework with a view to making it more effective and efficient. Besides adding to existing body of knowledge the field of study, the findings are intended to offer an effective maintenance management framework for adoption by institutions as well as government towards stimulating maintenance systems for public buildings. The outcome of this research is also expected to function as a decision-making tool to encourage more methodical approaches to decision-making in maintenance of public buildings. It is also anticipated that the proposed framework will aid consultation, collaboration and communication among all stakeholders involved in the process of maintenance of public buildings.

SCOPE OF THE STUDY

The study will focus on maintenance of built facilities that contribute directly to the core functions of the public universities in Ghana; teaching and research because of limited time and resources. This will focus mainly on administration blocks, lecture halls, libraries and laboratories. The research will cover the maintenance of selected facilities at the six public universities; University of Ghana, Kwame Nkrumah University of Science and Technology, University of Cape Coast, University of Education, University for Development Studies and the University of Mines and Technology. These Universities were selected as the case study given that they are fully fledged universities own by the government. This implies that the tax payers' monies are used to a large extent for provision of infrastructure and other developments in these universities. These universities also have arguably the largest built asset portfolio than other private owned universities in Ghana. Some of the buildings in some of these institutions are as old as have the respective university had been in existence. The large built asset portfolio and ageing building poses unique maintenance challenges for maintenance managers. The universities also have a relatively better developed maintenance departments and as such are expected to have a better developed maintenance management systems. These universities would probably then serve as a benchmark for best practice on maintenance management system in Ghanaian public universities.

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O.² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Oppong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

RESEARCH METHODOLOGY

Research Approach and Design

The study is a social research which is focused on obtaining perceptions or opinions of the caretakers, maintenance experts and other stakeholders who are key in the implementation of maintenance programmes for public buildings. The nature of this investigation is best undertaken through a cross sectional survey design (Bryman 2008, Mugenda and Mugenda 2003). The study will make use of different methods of investigation. In this study, a mix of qualitative and quantitative research strategies will be adopted. This approach will be used in order to answer the research questions and as well meet the objectives of the study; thus developing an integrated framework for maintenance of public buildings in Ghana and other developing countries. The qualitative strategy will primarily be employed to identify the different expectations and perceptions of various stakeholders, and their motivations with regard to maintenance activities in the public sector; and to identify possible solutions to critical maintenance issues relating to public buildings. On the other hand, the quantitative strategy will be applied to determine used maintenance criteria and indicators and the critical success factors that impact on the gap between maintenance expectations and actual deliverables after maintenance activities are completed.

Research Area and Targeted Respondents

This study will be conducted in government owned universities in Ghana. The research will be limited to respondents who are involved in maintenance of these public universities. People who have extensive experience and possess decision-making roles in their respective organizations, and have some exposure to sustainable development concepts will be used for the study. They will represent government departments, budget officers, maintenance officers, community consultants, contractors, designers, engineers, project managers, town planners and cultural heritage experts. The involvement of multiple project stakeholders in this study will provide in-depth views and aid validate the research findings.

Sample and Data Collection

According to Babbie (1990), sampling is necessary in research because of the constraints of time and cost attending all element of the population especially when the population is large. The sample size of an empirical study is an important characteristic of the study especially where the target is to make deductions about a population from a sample. The study will employ both probabilistic and non-probabilistic sampling techniques. Purposive sampling will be use to narrow the sample frame to only universities owned by the government and used in selecting the experts and other key stakeholders while systematic sampling will be used to select the actual buildings to be analyzed.

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O.² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu,J.N., Nani G., Atepor, L., Opong, R.A., Adetunji,M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

Considering the types of data needed, this study requires a combination of data collection methods. In their view, Fellow and Lui (1997) posit that for the body of knowledge for construction to be established and move forward with confidence then appropriate methodologies and methods of research should be applied with rigor in related studies. In view of this, methods of data collection will be given careful attention. Data collection methods will include Delphi, questionnaires, observations, and a variety of other motivational techniques (Robson, 2002).

To fulfill the intended objectives of the study, primary and secondary methods of data collection will be used. Secondary data will be collected from analysis of related and relevant literature in books, articles in accredited journals, published and unpublished works such as dissertations. Records from the maintenance departments and web-based publications on the specified field of study will also be used for the study. For the primary data, three methods will be used to collect the data. These methods will be the questionnaire survey method, observational survey and Delphi method.

The proposed use of questionnaires which will be self-administered to respondents will considerably reduce the time and cost involved. The questionnaire will be constructed to cover the objectives of the study and other variables to be identified in literature relating to the main study so that data collected conforms to these objectives and assists in a better understanding the research problem. The observational survey will mainly focus on the condition assessment of the sampled buildings. The researcher will have predetermined aspects of maintenance condition which will form the basis of the observation schedule to be used. The purpose of observation schedule is to record the status of the buildings as they are in their natural setting. The researcher will therefore be a non participant observer; simply observing and recording the phenomena of concern to the study. Delphi method will be used to identify the primary maintenance criteria and indicators and the critical success factors that impact on the gap between maintenance expectations and actual deliverables after maintenance activities are completed. Data from the Delphi method will be obtained from experts in institutions that have a role to play in maintenance of public buildings in Ghana.

CONCLUSION

This study is a PhD research at its proposal stage. The study seeks to focus on developing an integrated framework for building maintenance activities of public building. The study however intends to highlight the establishment of maintenance management, the responses on the importance of maintenance works to be undertaken for public buildings, factors governing the effectiveness of maintenance works on public buildings and maintenance approaches, inclusive of maintenance programmed undertaken on the structural, non-

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O.² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Oppong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

structural elements as well as the services systems. Five objectives and eight research questions have been developed to help achieve the aim of the study

As indicated in the background of the study, a nation's economic strength is reflected in its infrastructure assets hence preserving public buildings is important because they represent significant investments of tax payers' money. Many Ghanaian public structures are often inadequately maintained with some building elements and facilities frequently showing evidence of lack of maintenance and repair. Some residential and office buildings of public institutions have not seen any significant maintenance or show little signs of maintenance since they were constructed, some dating back to the colonial era. This has resulted in such buildings being in a dilapidated state with some being abandoned. In view of this, the study focuses on developing an integrated framework for building maintenance activities of public building. The study will extensively examine the practice of preventive maintenance and establish obstacles limiting local governments' ability to perform preventive maintenance of public buildings within their jurisdiction. On completion, the study seeks to function as a decision-making tool to promote systematic and combined approaches to decision-making in the implementation of maintenance strategies in the course of maintenance of public buildings.

REFERENCE

- Babbie, E. R. (1990), Survey Research Methods, Belmont, California: Wadsworth Pub. Co.
- Barrett, P. (1995), Facilities Management: Towards Better Practice, Blackwell Science, Oxford
- Bryman, A. (2008), Social Research Methods, Oxford University Press, London, United Kingdom.
- Chan, K.T., Lee R.H.K. and Burnett, J. (2001), Maintenance Performance: A Case Study of Hospitality Engineering Systems, Facilities, 494-503.
- Chan, K.T., Lee R.H.K. and Burnett, J. (2001), Maintenance Performance: A Case Study of Hospitality Engineering Systems, Facilities, 494-503.
- Chanter B and Swallow P (1996), Maintenance Organization, Building Maintenance Management, Blackwell Science, London.
- Choka, D.G. (2012) A Study on the Impact of Maintenance Management Systems on Maintenance Condition of Built Facilities (Case Study of Public Universities in Kenya) Unpublished Thesis, Department of Real Estate & Construction Management, University of Nairobi
- Coetzee, J.L. (1999), A Holistic Approach to the Maintenance Problem, Journal of Quality in Maintenance Engineering, 276-280.

callyclarke@gmail.com

caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O.² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu, J.N., Nani G., Atepor, L., Opong, R.A., Adetunji, M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) Procs 5th Applied Research Conference in Africa. (ARCA) Conference, 25-27 August 2016, Cape Coast, Ghana. 554-565

- Horner, R.M.W., El –Haram, M.A. and Munns A. K. (1997), Building Maintenance Strategy: A New Management Approach, *Journal of Quality in Maintenance Engineering*, 273-280.
- Horner, R.M.W., El –Haram, M.A. and Munns A. K. (1997), Building Maintenance Strategy: A New Management Approach, *Journal of Quality in Maintenance Engineering*, 273-280.
- Idrus, A. Khamidi, F. and Lateef, A. (2009), Value Based Maintenance Management Model for University Buildings in Malaysia, *Journal of Sustainable Development* Vol. 2 (3).
- Jones, K. and Collis, S. (1996), Computerized Maintenance Management Systems, *Property Management*, 33-37.
- Lam, K.C. (2000), Planning and Execution of Business–Centered Maintenance for Perfect Buildings, http://www.cibse.org/pdfs/centered_maintenance.pdf accessed on February 20, 2016.
- Lee R (1987), *Building Maintenance Management*, William Collins Sons & Co. Ltd. London.
- Lee, H.H.Y and Scot, D. (2008) Development of a Conceptual Framework for the Study of Building Maintenance Operation Processes in the Context of Facility Management, *Surveying and Built Environment* Vol. 19(1), 81-101 ISSN 1816-9554
- Lo, S.M., Lam, K.C. and Yuen, K.K. (2000), Views of Building Surveyors and Building Services Engineers on Priority setting of Fire Safety Attributes for Building Maintenance, *Facilities*, 513-523.
- Loosemore, M. and Hsin Y.Y. (2001), Customer-focused Benchmarking for Facilities Management, *Facilities*, 464-476.
- Mak, A.W.Y. (1997) *Club Management: The American Club and Residential Club in Private Housing Estate*, Unpublished Dissertation, Centre of Urban Planning and Environmental Management, The University of Hong Kong.
- Melvin, E. (1992) *Plan, Predict, Prevent: How to Reinvest in Public Buildings*.
- Mugenda, O. and Mugenda, A. (2003), *Research Methods: Qualitative and Quantitative Approaches*, Laba Graphics Services Ltd, Nairobi, Kenya
- Osgood Jr, R.T. (2004), Translating Business Strategy into Facility Action: The Strategy Alignment Model, *Facility Management Journal*, March/April, 31- 35.
- Pitt, T.J. (1997), Data Requirements for the Prioritization of Predictive Building Maintenance, *Facilities*, 97- 104.
- RICS (1990), *Planned Building Maintenance: A Guidance Note*, Royal Institution of Chartered Surveyors, London.
- Seeley, I.H. (1987), *Building Maintenance*. The Macmillan Press. London, U.K.
- Seeley, I.H. (1987), *Building Maintenance*. The Macmillan Press. London, U.K.

callyclarke@gmail.com
caigbavboa@uj.ac.za

Owusu, D.¹ and Aigbavboa, C.O.² (2016) An Integrated Framework For Maintenance Of Public Buildings In Ghana In: Mojekwu,J.N., Nani G., Atepor, L., Opong, R.A., Adetunji,M.O., Ogunsumi, L., Tetteh, U.S., Awere E., Ocran, S.P., and Bamfo-Agyei, E. (Eds) *Procs 5th Applied Research Conference in Africa. (ARCA Conference, 25-27 August 2016, Cape Coast, Ghana.* 554-565

- Shen, Q. P. and Lo, K.K. (1999), Optimization of Resources in Building Maintenance - An Analytical Approach, The Journal of Building Surveying, Hong Kong Institute of Surveyors, 27-32.
- Spedding, A. (1987), Building Maintenance Economics and Management, E. & F. N. Spon Ltd. London.
- Then, D.S.S (1996), A Conceptual Framework for Describing Built Assets Maintenance Standards, Facilities, 12-15.
- Tranfield, D. and Denyer, D. (2004), A Framework for the Strategic Management of Long Term Assets (SMoLTA), Management Decision, 42:2, 277-291.
- Tse, P.W. (2002), Maintenance Practices in Hong Kong and the Use of the Intelligent Scheduler, Journal of Quality in Maintenance Engineering, 8:4, 369-380.
- Wood B (1999), Intelligent Building Care, Facilities, 189-194.
- Wood B (1999), Intelligent Building Care, Facilities, 189-194.
- Wood, B. (2003a), Approaching the Care-Free Building, Facilities, 74-79.
- Zavadskas, E., Bejder, E. and Kaklauskas, A. (1998), Raising the Efficiency of the Building Life time with Special Emphasis on Maintenance, Facilities,334-340.