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Maintenance of Government Buildings in Ghana: The Case of Selected Public Residential Buildings In Ejisu-Ashanti

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Abstract

An out-of-sample portfolio allocation study is undertaken. We find that our simple and positive-definite covariance Building maintenance has become a topical issue for discussion in recent times as it's essential to increase the life span of buildings. Building maintenance seems expensive such that it is sometimes advisable to rebuild than to repair. Government residential buildings are not far from this unbearable maintenance cost issue. There is therefore the need to help set sustainable approaches to mitigate the high cost of maintenance work on buildings. The study therefore, seeks to assess the state and possibility of maintenance works on public residential buildings in Ejisu in the Ashanti Region of Ghana. The survey combines both qualitative and quantitative methods relying on questionnaire and structured interviews to seek residents' opinion. The study focuses on public residential buildings employing purposive sampling technique for the survey. The findings revealed that absence of planned maintenance policy and improper maintenance, pressure on facilities vis-à-vis age of the buildings cause elements of building such as doors, windows, ceilings, cables etc. in deplorable state. In conclusion, ways to mitigate the situation such as the introduction of sustainable maintenance policy, introduction of innovative building system, the use of quality materials and professionals for maintenance among others were suggested for sustainable housing provision.

Keywords: building maintenance, public buildings, residential, sustainable approach.

INTRODUCTION

Poor building maintenance habits contributes to inadequate housing provision and reduction in property value in Ghana (Quayson and Akomah, 2016; Obeng-Odoom and Amedzro, 2011; Afranie and Osei-Tutu, 1999).Housing delivery in Ghana has been inadequate with about 2.4 million units deficit (Ghana Statistical Service - GSS, 2012). This housing deficit gap must be bridged with immediate effect to reduce high demand on the existing housing which has increased rent and prices of house especially in the urban areas as the country moves into the lower middle income economy (Nketiah-Amponsah, 2015). Even though successive governments are more interested in the provision of new housing units, a more sustainable way of reducing the housing deficit is to ensure regular maintenance of existing ones (Harding et al., 2007). Maintenance is the combination of all technical and associated administrative actions with the aim of retaining an item in, or restoring it to a state in which it can perform its required function as well as protection and satisfactory operation of assets (BS 3811, 1984; Wahab and Basari, 2013). Maintenance includes processes and services to preserve, repair, protect and care for a building's fabric and engineering services after completion, repair, refurbishment or replacement to current standards. This enables it to serve its intended functions throughout its entire life span without drastically upsetting its basic features and use (Olanrewaju, 2010).

Irrespective of how a building is structurally sound, it is susceptible to maintenance. However, neglect of maintenance in the life cycle of buildings has resulted in rapid deterioration of fabric and finishes of buildings accompanied by harmful effects on the contents and occupants (Seeley,1987). One of the major forces that catalyse the growing of economic, social and technological advancement of any nation is the development of maintenance culture (Celestine 1989) for which cost is an essential component. Lack of maintenance reduces the life span of buildings which sometimes causes accident to occupants and obviously defeats the purpose for which they were constructed.

Cost reduction is the achievement of real and permanent reduction in the unit cost of goods manufactured or services rendered without impairing their suitability for the use intended or diminution in the quality of the product (Business dictionary, 2013). A sustainable approach which will help to reduce maintenance cost and contributes to the preservation and enhancement of the life span of buildings (Zubairu, 1999), will be needed to help solve many problems relating to maintenance.A building is a structure which provides shelter for human habitation and the life span of a building shouldnot be less than60 years (Seeley, 1987). However, most buildings deterioratefaster than expected such that it becomes cheaper to rebuild than to maintain (Seeley, 1983).Life span of a buildingis largely influenced by the quality and kind of maintenance that is carried out in a building (Zubairu, 1999). In many cases, maintenance is one of the first costs to be taken out of a facility manager's budget because building owners and financial decision makers often do not understand the benefits of maintenance (Pugh, 2010).

Maintenance may be corrective, planned or emergency based on the objectives to prolong a building's life span (Reffat et al., 2004; Telang and Telang, 2010). The cost of building maintenance include operating cost, maintenance and repair cost, renewal cost and adaptation cost. The study seeks to identify the state and possibility of maintenance works on some government (public) residential buildings and make suggestions toward the adaptation of sustainable maintenance approaches which are significant to national development in the provision of housing. A major limitation in this research was the respondent's attitude towards the study as they were suspicious about the objectives of the study.

Sustainable Maintenance Culture to Cost Reduction

The issues of sustainable maintenance have been intensively tackled for years in Central Europe and other countries (Aiste et al. 2008). Sustainability is defined as "providing for the needs of the present without detracting from the ability to fulfil the needs of the future" (ASHRAE, 2006). Recently, more attention is paid to sustainable, complex refurbishment satisfying integrated social, technical, economic, ecological needs of various stakeholders groups (Aiste et al. 2008). The issue of building maintenance sustainability is in tandem with green building, in other words, green maintenance which lower energy costs through the use of simpler, low-tech heating and power installations; lower maintenance costs due to simple building services, which are easily accessible, and low-tech equipment, which is cheaper to repair or replace; and" healthier" buildings (Keeping and Shiers, 1996). Sustainable maintenance includes a reduction in energy use and related building operational expenses, increased use of environment-friendly materials and renewable energy sources and economically favourable and innovative planning, building and using measures(Sitar et al., 2006). Sustainable maintenance therefore, integrates all the possible economic, social and environmental needs making it sophisticated such that it must be considered at the design stage of a building (Aiste et al. 2008; Adenuga et al., 2010).

STUDY AREA AND METHODS

Study Area

The study area is Ejisu, the capital town of Ejisu-Juaben Municipality with two paramount areas namely, the Juaben Traditional Areal and the Ejisu Traditional Area. The municipality lies within Latitudes 1o 15′ N and 1o 45′ N and Longitude 6o 15′ W and 7o 00′ W, occupying a land area of 582.5 km2 (Figure 1). The Municipality lies in the central part of the Ashanti Region of Ghana and covers an area of 637.2km² constituting about 10% of the entire Ashanti Region. The region is a commercial hub linking the southern part of Ghana to the North. The population of the Municipality is about 143,762 with an average size of 4.1 persons per household which is slightly lower than the regional average of 4.4. There are about 196persons per sq. Km (56.7%) of households in the Municipality occupy Compound houses and about one-quarter (25.9%) of households occupy Separate houses. Semi-detached houses (6.7%) and Flats/apartment (6.1%) provide dwellings for more than a tenth of households in the Municipality (Ghana Statistical Service-GSS, 2010).

Completion of some public buildings such as the railway quarters among others (Figure 2, 3and 4) in Ejisu dates back to the 1900's. Generally government residential buildings in the Municipal capital are not maintained and are in a deplorable state, some of the indicators are, cracks, discoloured elements and deterioration. Most of these residential buildings which accommodate public servants have not seen any significant maintenance or shown signs of maintenance since they were constructed (Figure 5, 6, 7, 8, 9, 10 and 11).

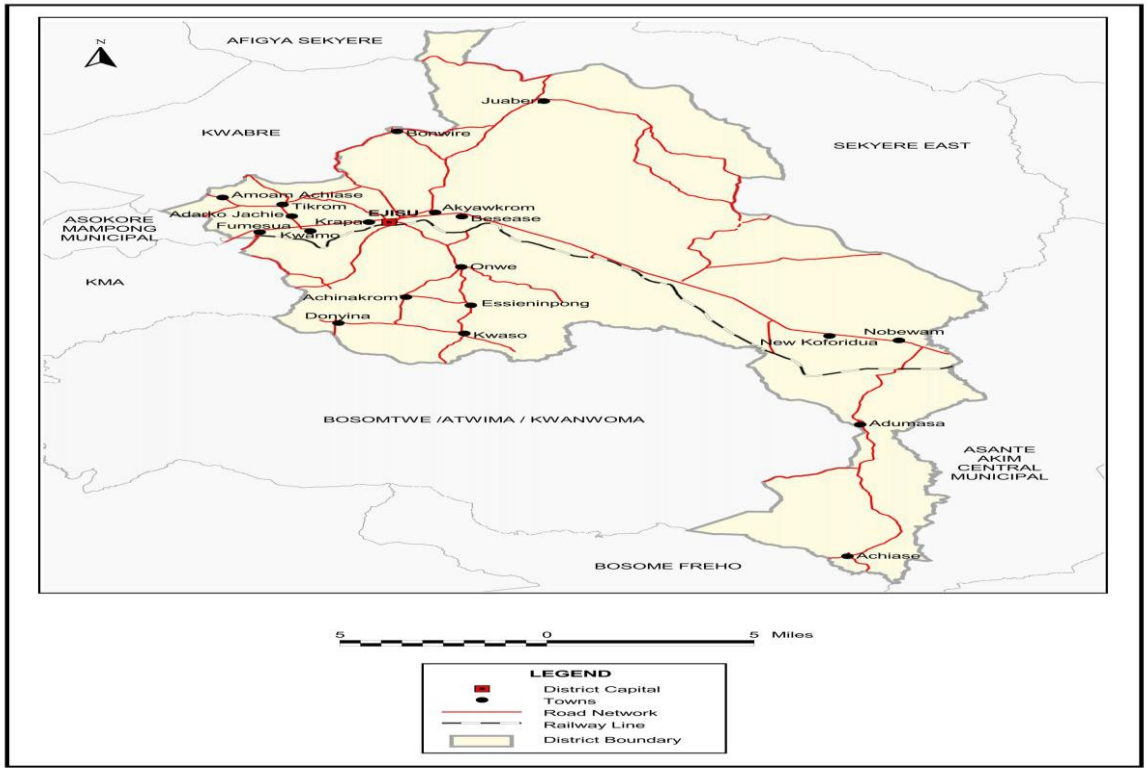

Figure 1. District map of Ejisu-Juaben Municipality. Source: GSS, 2014.

Fig. 2. Staff Residence of Railway Authority in Ejisu. Source: Author's field survey, 2017.

Fig. 3. Staff Residence of Railway Authority in Ejisu. Author's Source: field survey, 2017.

Fig. 4. Staff Residence of Railway Authority in Ejisu. Source: Author's field survey, 2017.

Fig. 5. Staff Residence for the Municipal Assembly. Source: Author's field survey, 2017.

Fig. 6. Staff residence for Ejisuman Senior High School. Source: Author's field survey, 2017.

Fig. 7. Staff residence for Ejisuman Senior High School. Source: Authors's field survey, 2017.

Fig. 8. Staff residence for Ejisuman Senior High School. Source: Author's field survey, 2017.

Fig. 9. Staff residence for the Police Service in Ejisu. Source: Author's field survey, 2017

Fig. 10. Staff residence for the Police Service in Ejisu. Source: Author's field survey, 2017

Fig. 11. Staff residence for the Police Service in Ejisu. Source: Author's field survey, 2017

METHODS

This study uses a case study approach with questionnaire and interviews for data collection. The type of bungalows (buildings) captured in the survey belong to the following institutions in Ejisu as shown in table 1; The Ghana Education Service (The Ejisuman Senior High School and the Ejisu Senior High Technical School), The Ejisu Government Hospital, The Ejisu-Juaben Municipal Assembly, The Police Service, and The Railway Authority, all within the Ejisu Township. A total of 18 Bungalows, 78 Apartments and 112 Households were studied. Facilities in each bungalow include bedrooms, a living area, toilet, bath and kitchen. Each bungalow was recorded to have at least two bedrooms, a hall, a toilet and bath, a kitchen and a court yard. Some of the apartments also have two bedrooms, a toilet and bath, a kitchen and a yard whilst others have one bedroom, a shared toilet and bath, and a kitchen. In reality the number of apartments should be equivalent to

the number of households. The number of households however in the study as shown in the Table 1 is more than the number of apartments in each category. This exerts pressure on usage of available facilities.

Table 1: Public Institutions in Ejisu and Households

Public Institution	Number of Bungalows	Number of Apartments	Number of Households
Ejisuman Senior High School	3	23	32
Ejisu Senior High Technical School	2	0	2
Ejisu-Juaben Municipal Assembly	5	25	32
Ejisu Government Hospital	2	7	14
Railway Authority	6	17	23
Police Service	0	6	9
Total	18	78	112

Source: field survey, (February, 2016)

This survey was conducted after frequent visits to some occupants of these buildings by the authors prior to the study with the buildings showing cracks on the walls, rotten window and door frames, leaking roofs, missing louver blades, rotten ceilings, floors wearing or peeling-off, faded and discoloured surface coating (painting). A purposive sample size of 78 apartments were considered. Seventy-eight questionnaires were therefore administered with Sixty-two responding which represents79.49%. Purposive sampling technique was used because the survey has to do with selecting the people to be interviewed based on the interviewer's knowledge on the appropriateness and typicality of the sample selected (Ofide et. al., 2015; Cohen et al., 2005).Data collected was analysed using statistical Package for Social Sciences (SPSS) and Relative Important Index (RII)to enable the relative importance value for each variable in a category to be calculated. The relative importance index for each factor is given by this formula:

$$\textit{Relative Importance Index (RII)} = \frac{\sum W}{AN}$$

Where;
W= the weight given to each variable by the respondents, ranging from 1 to 5;
A= the highest weight (i.e. 5 in the study)
N= the total number of samples.

DATA ANALYSIS AND DISCUSSION

Focal Person(s) Responsible for Maintenance

It was significant to ascertain who is responsible for undertaking maintenance works on individual bungalow. From the survey, thirty-two (32) respondents representing 51.6%held that the government is responsible for ensuring maintenance operations on the buildings. On the other hand, fifteen (15) respondents representing a responsive 24.2% were of the opinion that the occupants are responsible for maintenance of the buildings while fifteen (15) felt both the occupants and the government are responsible for maintenance works (Table 2). An interview with the Municipal Engineer at Ejisu revealed that, it is the sole responsibility of the government to maintain state-owned buildings. This should be done in conjunction with occupants as they are monthly deducted a little of their salary to help cater for maintenance activities. However, according to occupants, though the deductions are made, there has always been difficulties in the government responding to their maintenance needs.

Table 2. Focal Person(s) Responsible for Maintenance

Focal Person(s)	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Occupants	15	24.2	24.2	24.2
Government	32	51.6	51.6	75.8
Occupants and house owners	15	24.2	24.2	100
Total	**62**	**100**	**100**	

Source: field survey, (2017)

Occupants Stay in the Buildings

The survey inquired as to how long occupants have lived in individual apartment. From table 3, six (6) out of sixty-two (62) occupants representing 9.7% were recorded to have stayed in their various bungalows for up to four years. Minimum three (3) occupants each representing 4.8% of the respondents have stayed in their bungalows for between five to nine years and ten to fourteen years. Majority of the occupants (45) representing 72.6% respondents have lived in their apartments for over twenty years while five respondents have lived in their apartments between fifteen and nineteen years.

Table 3. Length of stay of households

Years of stay	Frequency	Percentage	Valid Percentage	Cumulative Percentage
20years and above	45	72.6	72.6	72.6
15-19	5	8.1	8.1	80.7
10-14	3	4.8	4.8	85.5
5-9	3	4.8	4.8	90.3
0-4	6	9.7	9.7	100
Total	**62**	**100**	**100**	

Source: field survey, (2017)

Conditions of Building Elements

Respondents were asked to rank the condition of building elements including floors, doors and windows, walls, roofs, ceilings, electrical, plumbing, foundation and finishes on a scale of 1 to 5 representing ***'Serious defects'*** to '***No idea'***. From the survey as shown in table 4,almost all the building elements were in a bad state. By ranking, plumbing system was found to be the 1st element (highly) deteriorated. This is evident through leakages in bathrooms, kitchen and other parts of the buildings with pipes. Foundation (mostly strip) was ranked 2nd as field observation indicates exposure of foundation of most buildings and needed immediate attention. The 3rd major element that were found of lacking proper maintenance was the electrical system. Most of the cables and fixtures were exposed and from the interviews, have not been changed after the building was completed. It was quite unfortunate that "Finishes and the overall appearance of the building" was ranked 4th. Observations at the field showed that rendering on walls had cracks with faded paints. Some occupants have tried to put up new ceiling materials as the ceilings were in a deplorable state due to rain water leakages from roofs. This was ranked 5th. On average, all the bungalows/apartments were not in proper condition as responded by most of the occupants. The difference in their indexes were not significant and most were found below the average of 5 which shows that possibly due to ageing of the individual buildings, most of elements were deemed to be dilapidated.

Table 4. Conditions of Building Elements

No.	Building Element	Ranks					Total	∑W	Mean	RII	Remarks
		5	**4**	**3**	**2**	**1**					
1	Plumbing system	27	20	12	0	3	62	254	4.097	0.819	1
2	Foundation	18	21	20	0	3	62	237	3.823	0.765	2
3	Electrical system	6	27	26	3	0	62	222	3.581	0.716	3
4	Finishes/Appearance	9	21	24	8	0	62	217	3.500	0.700	4
5	Roof system	9	12	35	6	0	62	210	3.387	0.677	5
6	Ceiling	9	18	18	17	0	62	205	3.306	0.661	6
7	Doors and Windows	0	9	50	3	0	62	192	3.097	0.619	7
8	Walls	0	12	41	9	0	62	189	3.048	0.610	8
9	Floor	0	12	38	12	0	62	186	3.000	0.600	9

Source: field survey, (2017)

Notification Versus Maintenance

This question was asked to ascertain the effectiveness of maintenance activities by government and to know how individuals help to maintain the buildings. From the survey (table 5), 8 occupants representing 12.9% of the respondents claimed that it takes between 6 to 12 months, after notification, for some maintenance work to be executed by the various institutions. Majority (24) of the respondents which represent 38.7% indicated that it takes more than 12 months for some maintenance work do be done. 16 occupants (25.8%), have lived in their apartments for over twenty years but have never witnessed any maintenance work. A minimum 9.7% claimed that their maintenance notification was responded by the government within one month.

Table 5. Notification versus Maintenance

Duration for maintenance works by government	Frequency	Percentage
Less than a month	6	9.7
1-3 Months	8	12.9
6-12 Months	8	12.9
More than 12 Months	24	38.7
Other (Please specify)	16	25.5
Total	**62**	**100**

Source: field survey, (2017)

Factors Affecting Building Defects And Maintenance Cost

Ranked on a 5-1 scale (i.e. 5=Very High to 1=Very low).

Age of buildings is ranked the 1st factor affecting high maintenance cost of buildings. There was no doubt" ageing of the building" was the highest factor to pop up since most of the buildings were found to have been in existence for more than forty years without proper maintenance. This affirms a report by Al-Khatam (2003) that building components have expected life, at the end of which replacement would be imperative. The 2nd factor leading to high maintenance cost was found to be as a result of unplanned maintenance policy. The 3rd factor was "Pressure on facilities". Building materials are always costly. Therefore, without proper maintenance plan, emergency maintenance works are sometimes executed. Fluctuation which leads to price increase of materials needed to carry out maintenance works eventually increase the maintenance cost. Improper maintenance and poor drainage system were 4th and 5th respectively to high maintenance cost of the buildings. Design (construction) defects and poor workmanship at the construction stage and Complexity of the building were ranked last and last but one respectively

6. Factors affecting building defects and maintenance cost

No.	Building Element	Ranks					Total	∑W	Mean	RII	Remarks
		5	4	3	2	1					
1	Aging of the building	33	17	7	5	0	62	264	4.258	0.852	1
2	Unplanned maintenance policy	29	15	13	2	3	62	251	4.048	0.810	2
3	Pressure on facilities	12	29	7	12	2	62	223	3.597	0.719	3
4	Lack of periodic maintenance works	20	12	18	7	5	62	221	3.565	0.713	4
5	Poor drainage system	12	20	14	10	6	62	208	3.355	0.671	5
6	Misuse of the building	12	20	11	10	9	62	202	3.258	0.652	6
7	Poor quality control	8	15	28	5	6	62	200	3.226	0.645	7
8	Weather effect on building	3	25	18	11	5	62	196	3.161	0.632	8
9	Fluctuation of material prices	9	8	30	12	3	62	194	3.129	0.626	9
10	Difficulty in identifying true cause of defects	9	15	18	12	8	62	191	3.081	0.616	10
11	Poor quality building materials	9	12	17	13	11	62	181	2.919	0.584	11
12	Complex design of the building aiding to difficulty in taking maintenance works	5	9	21	19	8	62	170	2.742	0.548	12
13	Design defect and poor workmanship in the initial construction stage	5	9	11	13	24	62	144	2.323	0.465	13

Source: field survey, (2017)

Sustainable Approach to Maintenance Cost Reduction

Ranked on a 5-1 scale according to their degree of importance. (i.e. 5 = Very Necessary to 1=Not Necessary)

The 1st sustainable factor to help in reducing maintenance cost as agreed by respondents was the introduction of innovative building maintenance policy and plan which is planned as suggested by Reffat et al., (2004).The second factor was the introduction of user friendly apartments. Occupants in buildings must feel relieved in their homes. Proper allocation of spaces in residential buildings should be encouraged. The 3rd sustainable factor indicated by respondents was the use of simple building services like drainage, electrical installations, etc. Services defects are very difficult to repair since they are mostly embedded in the carcass of structures. This confirms Adenuga et al., (2010) suggestion that it is more sustainable to consider electrical and mechanical engineering details at the design stage to forestall maintenance problems with respect to building services. The last two factors were "the introduction of easily accessible building services" and "economically favourable buildings". Buildings should be such that occupants would not spend too much to repair so as to motivate them to undertake maintenance activities. This is what Seeley, (1983) mentioned that it sometimes become cheaper to rebuild due to the high cost of maintenance. Considering the difference in RII of the factors and the fact that they are all above 0.5 or 50%, it means all the factors are highly considered in maintenance cost reduction

Table 7. Factors to Sustainable maintenance

No.	Factors to sustainable maintenance	Ranks					Total	∑W	Mean	RII	Remarks
		5	4	3	2	1					
1	Innovative building and maintenance policy	41	15	6	0	0	62	283	4.565	0.913	1
2	User friendly apartments	38	18	6	0	0	62	280	4.516	0.903	2
3	Simple building services (e.g. Drainage, electrical installations, etc.)	33	23	6	0	0	62	275	4.435	0.887	3
4	Regular assessment of building	35	18	9	0	0	62	274	4.419	0.884	4
5	Environmentally favorable building	33	20	9	0	0	62	272	4.387	0.877	5
6	Occupants education on building maintenance culture	30	24	8	0	0	62	270	4.355	0.871	6
7	Safe and healthier building	32	18	12	0	0	62	268	4.323	0.865	7
8	Efficient use of energy, water and other resources	35	15	7	5	0	62	266	4.290	0.858	8
9	Easily accessible building services	26	16	15	5	0	62	249	4.016	0.803	9
10	Economically favorable building	18	23	18	3	0	62	242	3.903	0.781	10

Source: field survey, (2017)

CONCLUSION AND RECOMMENDATIONS

The study establishes that most public (government) residential buildings are in a deplorable state and require immediate attention. Elements like the mechanical and electrical systems, doors and windows, overall finishes, foundations etc. need to be replaced and retrofitted. It was also found and asserted by respondents that ageing of the buildings, absence of planned maintenance policy, low material standards, etc. have resulted in a high cost of maintenance.

The following are some recommended ways to sustainable healthy residential buildings for government and low maintenance cost. An introduction of Innovative building system which is the use of modern technological building design and materials to create conducive atmosphere for occupants to help minimize pressure on facilities. To further reduce pressure on available facilities, households should correspond to the apartments. There should be a planned maintenance policy for occupants (tenants) and government (landlord) to strictly adhere to. Planned maintenance policy will moreover ensure regular assessment of the building elements to reduce rate of deterioration. This calls for a proper evaluation of the maintenance policy on government residential buildings to deal with new problems as they arise. One of the problems encountered was the unavailability of funds to carry out maintenance works.

Government through Ministry of works and Housing, should setup effective maintenance policy to generate funds (Maintenance Fund) to carry out prompt and regular maintenance on buildings. Consultants should ensure specification of high quality building materials at the design stage and through the life cycle maintenance of public buildings. This will minimize the frequent report of defects by occupants. Sustainability and innovation should be the hallmark in subsequent construction of bungalows and general buildings. Consultants must ensure the use of sustainable local building materials such as clay burnt bricks for walls to increase the life span of buildings. As a lower middle income country, the government and the general public should adhere to laws and agreements which helps to maintain state-owned buildings in order to save money and ultimately increase the housing stock.

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