# BUILT AND FORGOTTEN: UNVEILING THE DEFECTS ASSOCIATED WITH THE GHANA COCOA BOARD (COCOBOD) JUBILEE HOUSE IN KUMASI

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**Abstract**
Lack of attention given to government buildings in Ghana has resulted in the deplorable states of such buildings. This study sought to identify and examine key defects associated with the Ghana Cocoa Board (Cocobod) Regional Office building in Kumasi. A mixed research strategy which involved the use of on-site building observations and case studies was adopted. A checklist was prepared to assist in the identification of the defects, and the on-site building inspection assisted in examining the key defects identified. The findings from the study revealed that peeling of paints, leakages in ceilings, staining/discolouration of walls, dampness in walls and floors, electrical defects and cracked walls were among the key defects associated with the building. The on-site inspection carried out confirmed the severity of these defects, and revealed that the building was in a deplorable state. Though this study may not indicate the entire scenario of the deplorable states of many government buildings, it tries to explore some common defects affecting one of such buildings and the need to pay attention to them. The findings from this study provides the platform for all stakeholders involved to come together and fight the deteriorating states of government buildings in the country.

**Key words**: Government buildings, defects, Cocobod, Ghana, Jubilee House.

## INTRODUCTION
A building as an environmental envelope provides protection for its occupants against the inclement weather, animals and unwanted environmental nuisance in order to promote the necessary environment for good living (Essienyi, 2011). The provision of buildings has always been a major concern for both government and private individuals because it provides one of the basic needs of humans, that is shelter (Essienyi, 2011). According to Ming and Mydin (2012), buildings can be divided into residential, commercial and industrial buildings. Basic elements such as foundations, floors, walls, beams, columns, roofs, etc. are needed to have a complete and stable building (Ming and Mydin, 2012).

In Ghana the development in the construction sector is very enormous, with a number of commercial buildings, residential buildings, public buildings, industrial buildings, etc. springing up. Most of the public buildings which include educational buildings, hospital buildings, and offices, among others are financed by the government. These buildings in many instances are affected by numerous defects. The defects usually result from either design deficiencies or inadequate maintenance (Allotey, 2014). For public buildings, the former, which is design deficiencies is usually not encountered because of the proper supervision of such projects. However, the later, which is the inadequate maintenance of the buildings which lead to several defects is very common. Many building owners and public institutions in Ghana do not pay attention to the need to carry out consistent maintenance on their buildings. This is because such maintenance works are perceived as using the scarce resources unnecessarily and adding little to quality of the working environment (Issahaku, 2013; Mustapha and Agbevade 2011). The defects which result from inadequate maintenance of buildings are normally caused by physical, biological, chemical and mechanical agents. Such defects may cause unexpected accidents and in some cases deaths (Mydin *et al.,* 2014; Soleimanzadeh and Mydin, 2013). Also, these defects in most cases have negative impacts not only on the users but society as a whole due to the possible dangers associated with them (Allotey, 2014). Defects are fatally disparaging and critical because they cause impairments of users, damage to buildings, among others (Soleimanzadeh and Mydin, 2013). The Ghana National Building Regulations, 1996 (L.I. 1630) 12(1) specifies ‘compulsory maintenance works’ to be carried out on buildings with defects. However, defects are not clearly defined in the regulation. This study was worth considering because many of the buildings in Ghana, especially government buildings suffer from diverse defects and have been rejected. The study was therefore carried out to identify and examine the key defects associated with the Ghana Cocoa Board (Cocobod) Regional Office building in Kumasi. The paper is made up of five main sections. It starts with the introduction, followed by a review of in-depth literature on the subject matter. It continues by describing the methods used to carry out the study, which is then followed with the results and discussion. After the results are presented and discussed, conclusions are drawn.

## LITERATURE REVIEW

### Defects in buildings

Defects and deterioration are common problems in buildings. Over the years, there have been numerous definitions for defects in buildings. The British Standard Code of Practice, BS 3811, (1984) defined defects as deterioration of building features and services to unsatisfactory quality levels of requirement of users. Alan (1990) defined defects in building works as premature failure resulting from errors of workmanship, design, the use of faulty materials or inadequate maintenance. According to the Webster's Dictionary, a defect is defined as lack of something necessary for completeness (Ahzahar *et al.,* 2011; Alhajeri, 2008). In the view of Cho *et al.* (2006), building works which fall short of complying with the requirements of contract, specifications or contract drawings, together with conditions of its quality and any implied terms, durability, workmanship, design or performance, aesthetics, etc. can be defined as defective building works. A building defect may include any problem that reduces the value of a home, condominium, or building (Ahzahar *et al.,* 2011). Allotey (2014) defined a building defect as any characteristic exhibited which hinders the usability of the building for the purpose which it was designed and constructed. For the purpose of this study, the definition of defect as outlined by the BS 3811 was adopted. As a result defect was defined as the deterioration of building features and services to unsatisfactory quality levels of requirement of users.

### Causes of defects in buildings

All elements of buildings are prone to defects. The origin and types of defects in buildings have been extensively reported (Mydin *et al.,* 2014; Shittu *et al.,* 2013; Suffian, 2013; Buys and le Roux, 2013; Ming and Mydin, 2012; Olanrewaju, 2012; Mahli *et al.,* 2012; Chong and Low, 2006; Love *et al.,* 1999; Porteous, 1992; Hammarlund and Josephson, 1991).

Defects in buildings could originate from design errors and omissions, carelessness, negligence, lack of knowledge, etc. (Georgiou *et al.,* 1999; Atkinson, 1998; Reason, 1990). According to Kaplan (1992), defects may also originate from procedural inadequacies and human errors. Shittu *et al.* (2013) listed the origin of defects in buildings to include errors in building design, flaws from the manufacturer, defects in materials, wrong use or inappropriate installation of equipment, inconformity to specifications by contractors, etc. According to Manning (2005), the origin of defects could also be grouped into design deficiencies, material deficiencies, construction deficiencies and subsurface deficiencies. Stephenson *et al.* (2002) grouped the origin of defects into natural phenomena, design errors, workmanship errors, faulty materials, procedural errors, lack of maintenance and abuse or misuse of buildings. From the critical review of literature, it can be said that defects in buildings may originate from design errors, construction errors, material deficiencies, procedural errors and workmanship errors.

### Studies on common defects found in buildings

Marshall *et al.* (2009) in their study identified typical defects found in poorly designed, built and/managed domestic properties to include cracks in walls, bulging/bowing of walls, rising dampness, uneven ground floor slabs, movement in upper floors, damp penetration of roofs, cracks to renders, loose/hollow render, condensation, faulty heating, plumbing and electrical, and blockages/leaks to drainage. In a study by Pan and Thomas (2013) to identify defects of new-build dwellings constructed to building regulations in the United Kingdom (UK), thirteen defects were identified. Key among the identified defects were blockages, faulty cold water systems, cracks damage, leakages, faulty electrical systems, etc. Buys and le Roux (2013) sought to assess the perceptions of built-environment stakeholders on the causes and types of defects in the South African housing construction industry. The study revealed that cracks (in floors, walls and beams), dampness, roof problems, plumbing leakages, detachment, structural instability, etc. were among the types identified with buildings. In Malaysia, Suffian (2013) sought to discuss some common maintenance problems and defects of buildings. His study revealed that water proofing issues that lead to water penetration into the buildings, cracks, soil settlements and stains on walls of buildings were among some of the defects identified with the buildings. Mydin *et al*. (2014) sought to identify common building defects associated with some school buildings in Malaysia. Defects such as peeling of paints, dampness, surface discolouration, timber decay, cracks, roof leakages, etc. were identified with the school buildings. Olanrewaju (2012) also sought to assess the user perspectives of defects associated with university buildings in Tronoh, Malaysia. The study revealed that a total of 20 out of 32 defects were found to be very critical to the building users. Faulty electrical systems, faulty air conditioning system and roof damages were the defects that required urgent maintenance. Ming and Mydin (2012) tried to analyze defects identified on different types of walling systems in Penang, Malaysia. Their study revealed that diagonal cracks on external walls, detachment of paints from walls, dampness, surface stains, among others were common in the buildings. From the review of literature, it is very clear that a number of studies have been conducted worldwide, most especially in Malaysia, on defects in buildings. These studies, most of which are current point to the urgent need which researchers have given to the problem.

In Ghana very little studies have been carried out in this area, especially when it comes to government buildings. Many of the government buildings are built under strict supervision. However, much attention is not paid to the aspect of maintenance after the buildings are occupied. In many instances, building maintenance is perceived as paying attention to the electrical and mechanical systems with little or no emphasis on the structural elements. The Ghana Cocoa Board (Cocobod) Regional Office building in Kumasi is one of such government buildings which has been left to deteriorate, and it formed the case for this study.

**Investigating defects in buildings**

One of the important stages in the conservation of buildings is the condition investigation which assists in identifying suitable methods to control defects and preserve the building (Johar *et al.,* 2013). According to Ahmad (2004), building condition investigation or dilapidation survey is very significant in the preservation of buildings. The aim of any building condition survey is to provide adequate information necessary for appropriate repair works to be carried out on the building (Johar *et al*., 2013; Ahmad, 2004). The procedures involved in any building condition survey include identifying the defects, the causes of the defects, and recommending remedial measures to control the defects (Glover, 2003). Dilapidation survey used in defects investigation is also a combination of investigation and documentation of damages to buildings, and the description of repairs and maintenance works to be conducted on the building (Johar *et al*., 2013; Ramly, 2007). According to the Royal Institute of Chartered Surveyors, RICS, (2009), dilapidation survey requires skills and expertise in diagnosing defects. The investigator should have in-depth knowledge of the types and causes of defects in buildings, and a basic understanding of how buildings are constructed (Johar *et al*., 2013). Such surveys should be carried out by specialized trained assessors with several years of experience in building surveying. Generally, there are four main processes involved in a building condition survey. These processes involve the preliminary survey/site or visual inspection, the specialist (non-destructive inspection), the detailed (destructive inspection) and the dilapidation report (laboratory assessment study) (Johar *et al.,* 2013; Johar, 2012, Burkinshaw and Parrett, 2004; Ahmad, 2004). In this study, only the first two processes were used. This is because the building under consideration was actively being used and employing a more destructive approach could halt activities within it. This could create unforeseen circumstances and could affect productivity.

## MATERIALS AND METHODS

This study was conducted to identify and examine key defects associated with the Ghana Cocoa Board (Cocobod) Regional Office building in Kumasi. The study adopted a mixed research strategy and involved the use of on-site building observations and case studies. The investigation consisted of a single case study of the government building reported to be experiencing serious defects. Out of the many public buildings in Ghana, the Cocobod Regional Office building also known as the Cocobod Jubilee House in Kumasi was chosen following complaints from users and management about the deteriorating state of the building. With permission from the management of the building, the researchers decided to probe a little deeper into why unlike the other public buildings, lots of concerns were being raised about the condition of this particular edifice. Many cases could have been included in the study. However, literature reports that in an invasive inspection or for detailed building condition surveys, more can be learned about damages posed by defects in one inspection than in a hundred more cursory surveys (Burkinshaw and Parrett, 2004).

For this study, data was collected by the authors because a study of such nature is required to be carried out by people with the technical know-how (Johar *et al.,* 2013). The data was mainly obtained through a checklist and on-site building investigations. The checklist consisted of a single part and was designed to identify common defects associated with the building. These defects were sixteen in number, and were those that had been identified after a critical review of relevant literature (Buys and le Roux, 2013; Pan and Thomas, 2013; Suffian, 2013; Shittu *et al*., 2013; Olanrewaju, 2012; Ahzahar *et al.,* 2011; Wong *et al*., 2006; Ilozor *et al.,* 2004). The identification of the defects were carried out per floor. The building consisted of a basement and five floors. However for ease of analysis and classification, the researchers classified the basement as a floor. Hence there were six floors in all, and the researchers designed the checklist to cover all the floors. From the common defects, the researchers were able to identify the key defects with the use of the checklist.

The on-site building investigation was carried out to examine the key defects identified in the checklist. It was carried out using two out of the four main protocols to building condition surveys. These included the preliminary survey/site or visual inspection and the specialist (non-destructive inspection) (Johar *et al.,* 2013; Johar, 2012; Burkinshaw and Parrett, 2004; Ahmad, 2004). These were the only two protocols used because the building was still actively in use and management had no plans of remedying the defects at the earliest possible time. In order not to create any inconveniences for the users of the building, the researchers deemed the visual inspection and non-destructive inspection to be good in examining the key defects associated with the building. These two protocols provided adequate information which could be necessary for detailed destructive testing to be conducted later for appropriate remedies to be applied to the building.

The preliminary investigation was carried out through the observation of the surrounding area, checking of the defective zones and visually predicting the causes of the defects based on the symptoms identified. Furthermore, examinations of the exterior of the building from street level and from higher access (roofing, rain water gutters, etc.) were carried out for any obvious defects. Also the interior parts of the building were examined to determine areas affected. The non-destructive inspection included the use of instruments and test equipment like the PCE-MMK1 moisture meter, especially for areas that were prone to dampness.

Data from the checklist was analyzed by simple counts. The defects were ranked based on their severity. From the authors' own construct, a defect was classified as severe, if it was present in four to six of the floors and that defect required urgent measures to be put in place to rectify it. Where a defect was not severe, it was present in less than four floors, with no urgency required.

## RESULTS AND DISCUSSION

### The building details

The building is oriented in the north-eastern and south-western directions which is good in warm humid countries like Ghana. The front faces the south-western, the left faces the north-western, the back faces the north-eastern and the right faces the south-eastern. It is located within the Central Business District of Kumasi. The building is five storey with a basement facility. It has two (2) lifts which convey people to various floors at different elevations in the building. It has four (4) number staircases for vertical movements between the floors. The building is connected to the national electricity grid for electricity supply. A standby plant has been provided to cater for power failure. Potable water from the Ghana Water Company Limited is also provided and serves the entire building. The walls of the building are constructed with sandcrete blocks and rendered with cement and sand mortar with emulsion paint finish on the internal surfaces and an emulsion paint and mosaic wall tiles on the external façade. The structure rests on pad foundations.

Figure 1a: Southern (left) and South Western (right) views of the building

Figure 1b: Western (left) and North-Western (right) views of the building

Figure 1c: Northern (left) and Eastern (right) views of the building

The floors are made of concrete with terrazzo finish and with tiles on the wet areas. Hardwood timber skirting boards are used at the bases of the internal walls. The ceilings are of plywood boarding and the roofs are made of aluminium sheets and reinforced concrete slabs with parapet wall. Glazed windows in aluminium frames are used and the doors are of hardwood flush doors fixed in hardwood frames. The compound is paved in concrete.

**Key defects associated with the building**

The checklist was used to identify the key defects associated with the building. The classification of the defects were based on all the six floors of the building. As already stated, a defect was classified as severe, if it was present in four to six of the floors and that defect required urgent measures to be put in place to rectify it. Where a defect was not severe, it was present in less than four floors, with no urgency required. Table 1 presents the results of the defects associated with the floors of the building. The results showed that peeling of paints, leakages in ceilings, staining/discolouration of walls, dampness in walls and floors, electrical defects, defective rain water goods and collapsed drains and cracked walls are the eight key defects associated with the building. These defects appeared in rooms located in four or more floors and were classified as severe.

On the other hand, clogged water closet, collapsed drains, damaged walls and floor tiles, algae and mould growth, and faulty doors were considered as the five least severe defects associated with the building. These defects appeared in rooms located in less than four floors and were classified as not severe.

Table 1: Ranking of defects associated with the building

| DEFECTS | Basement | First Floor | Second Floor | Third Floor | Fourth Floor | Fifth Floor | Number of Appearance(s) | Rank of Defect | Severity of defect |
|---|---|---|---|---|---|---|---|---|---|
| Peeling of paints | √ | √ | √ | √ | √ | √ | 6 | 1st | Severe |
| Leakages in ceilings | × | √ | √ | √ | √ | √ | 5 | 5th | Severe |
| Staining/discolouring of walls | √ | √ | √ | √ | √ | √ | 6 | 2nd | Severe |
| Dampness in walls and floors | √ | √ | √ | √ | √ | √ | 6 | 3rd | Severe |
| Damaged roofs, rain water goods, etc. | N.A. | √ | √ | √ | √ | √ | 5 | 6th | Severe |
| Electrical Defects | × | × | √ | √ | √ | √ | 4 | 7th | Severe |
| Lift failure | N.A. | × | × | × | × | × | 0 | 14th | Not severe |
| Cracked walls | √ | √ | √ | √ | √ | √ | 6 | 4th | Severe |
| Spalling and cracking of concrete | × | × | × | √ | √ | √ | 3 | 9th | Not severe |
| Blocked drains | × | × | × | √ | √ | √ | 3 | 10th | Not severe |
| Damaged windows | × | × | × | × | × | × | 0 | 12th | Not severe |
| Cracking and debonding of wall and floor tiles | × | × | × | √ | √ | √ | 3 | 8th | Severe |
| Clogged water closet | × | × | × | × | × | × | 0 | 13th | Not severe |
| Damaged walls and floors tiles | × | × | × | × | × | × | 0 | 15th | Not severe |
| Algae and mould growth | × | × | × | √ | √ | √ | 3 | 11th | Not severe |
| Faulty doors | × | × | × | × | × | × | 0 | 16th | Not severe |

Note:
√ means that the defect is present
× means that the defect is absent
N.A. means that the defect is non-applicable to the particular floor.

## Examining the key defects identified

On examining the key defects identified, the two-stage approach to building condition surveys was adopted. The results from the investigation are discussed under the following sub themes to include:

### *Peeling of paints*

Peeling of paints was identified as one of the key defects associated with the building. A critical examination of the building revealed that the elements, especially external elements of the building were consistently exposed to sunlight, rain, wind, etc. This could be a possible reason why most of the elements were affected by this defect. The defect could also have been caused by moisture penetration through the walls of the building. When water seeps through the substrate due to improper application of water proofing membranes around pipe penetrations, joints and walls in shower and bath areas, this problem can easily occur (Chew and Da Silva, 2003). In Figure 2a, it can be seen that the original colour of the building was a shade of pink, but on direct exposure to the elements of the weather, the walls had been stained and the paints had peeled off.

Figure 2a: Peeling of paint resulting from the direct exposure of the building to sunlight, wind and rain

Figure 2b is also a photograph taken from the on-site inspection of the building. It shows that the action of moisture in the wall of the building had peeled off the paint on that part of the building. This peeling of the paint had resulted in the surface discolouration of the wall, revealing the surface rendering. This defect usually occurs on facades, mainly on plastered walls, columns and other areas which are exposed to excessive rain and dampness (Ahmad, 2004). As a result of the constant wind, rain and sunlight received on the exposed parts of the building under investigation, those parts had been severely affected.

Figure 2b: Peeling of paint resulting from the action of moisture in the walls of the building

***Leakages in ceiling***

Leakages in ceilings was also identified in the rooms located in five of the floors of the building. According to Chew and De Silva (2003), leakages in ceilings are normally caused by discontinuities of the ceiling or slab, inadequate provision/treatment of movement joints, waterproofing and interfaces. Most of the times the discontinuities in the ceilings are due to pipe penetrations and joints (either expansion or contraction joints or both) (Chew and De Silva, 2003). The on- site inspection of the building revealed that the leakages in the ceilings resulted from a combination of failed flashings, damaged damp proof layers on top of the roof slab, damaged roofing sheets, leaking pipes, among others.

Figure 3a: Signs of ceiling leakages inside the building

***Staining/discolouring of walls***

Staining was also identified as one of the key defects associated with the building. Staining is very common on tiled walls and floors in wet areas (Chew and De Silva, 2003) and has been identified as a defect very common among buildings worldwide (Mydin *et al.,* 2014; Suffian, 2013; Buys and le Roux, 2013; Ming and Mydin, 2012).

The on-site inspection of the building revealed that the surface discoloration appeared in brownish, blackish and yellowish colours. The problem was very prevalent all around the external and some internal walls of the building. The stains and discolouration of the building were found to be associated with the presence of dampness and other biological attacks. This finding corroborates literature. In a similar study by Suffian (2013), most building facades in Malaysia were identified with stains associated with water run marks, growth of algae, fungus, etc. According to Ahmad (2004), fungal stains or mould occur in buildings when there is moisture in those buildings.

Figure 4 Stains and discolouring of walls

***Dampness***

Dampness, the penetration of water through the walls and certain elements of a building was identified as one of the defects severely associated with the building. This problem is very dangerous because it is one of the most damaging defects that can occur, whether a building is old or of recent construction (Hetreed, 2008; Burkinshaw and Parrett, 2004).

Figure 5a: Dampness resulting from water leakages and below ground water sources

A critical examination of the damp areas of the building with the moisture meter revealed that the walls were severely affected. The examination further revealed that the dampness that resulted in the building was as a result of water penetration in the form of leakages (Figure 5a). These leakages occurred on the first to the six floors. The dampness on the external wall of the basement was due to rising damp. This type of dampness was associated with symptoms such as surface efflorescence, horizontal tidemarks, etc.

The problem is very dangerous because it can damage brick/block work by saturating it, cause decay and break up of mortar joints, fungal attack in timber and corrosion in iron and steel as well as stained wall surfaces (Trotman *et al*., 2004). The problem in the building really needs urgent attention as research has shown that dampness is the most frequent and main problem in buildings, and contributes more than 50% of all known building failures, especially if it affects the structural parts of a building (Halim *et al.,* 2012). If it is allowed to stay in the building, the affected elements will deteriorate and with time the building will collapse.

Figure 5b: Dampness resulting from leakages and water penetration

***Electrical defects***

Electrical defects were among the key defects associated with the building. These defects were confirmed through the on-site inspection.


Figure 6: Faulty electrical fittings

The inspection revealed that most of the electrical fittings were faulty. For those which were functioning, they were so close to the damp areas such that occupants or users could be electrocuted.

***Cracked walls***

External walls may be harmful to a building if they are structurally unsound (Ahmad, 2004). Vertical or diagonal cracks in walls are common symptoms of structural instability. Cracks were identified on all the walls on every floor. These cracks were non-structural and did not pose any serious threat to the building. Different types of cracks such as vertical, horizontal, diagonal and hairlines were visually observed (Figure 7). Because these cracks were non-structural, their impacts could be neglected. However, the presence of cracks on all the walls on every floor within the building surveyed called for a major cause of concern. These cracks could have resulted from poor workmanship, weak materials joints, etc.

Figure 7: Diagonal (left) and horizontal (right) cracks on the interior walls of the building

***Damaged roofs, rainwater goods, etc.***

Damages to roof, rainwater goods, etc. were also amongst the key defects associated with the building. Roof is an important element of a building. It protects the interior from the external weather like rain, sunlight and wind (Mydin *et al.,* 2014; Pheng and Wee, 2001).

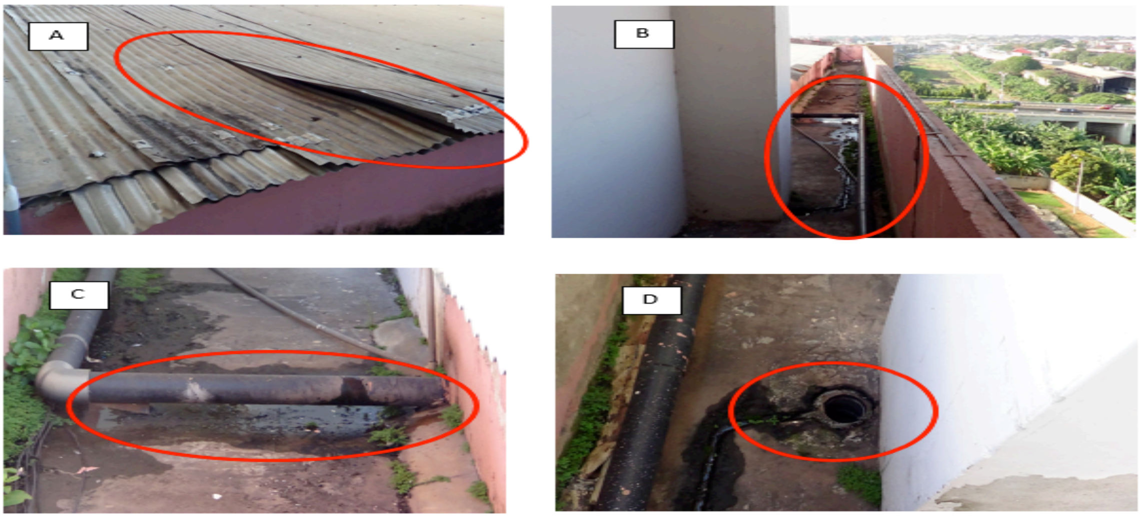


Figure 8: Slipped roofing sheets (A), leaking drainage pipes (B and C), Discontinuous discharge pipe (D)

The on-site inspection carried out on the building revealed that the roof was made up of corrugated aluminium sheets and concrete. The inspection revealed that several defects were associated with the roof. These included blocked gutters, leaking down pipes, leaking roofs, slipping roofing sheets, among others. These problems allowed water to penetrate the building and caused significant damages to the building and its interior.

**CONCLUSION**

The study sought to identify and examine key defects associated with the Ghana Cocoa Board (Cocobod) Regional Office building in Kumasi. This objective was achieved through a checklist and on-site building inspections. The checklist helped to identify the key defects, whereas the on-site building inspections assisted in examining the key defects identified. The findings from the study revealed that the Ashanti Regional Cocobod building is very sick and needs immediate attention. From the outside, the building looks healthy. However, on entering the building, it can be seen that every room suffers from one defect or the other. The findings further revealed that peeling of paints, leakages in ceiling, staining/discolouration of walls, dampness in walls and floors, electrical defects, defective rain water goods and collapsed drains and cracked walls were the key defects associated with the building. The on-site inspection carried out confirmed the severity of these defects, and revealed that the building was in a deplorable state. Even though this study may not indicate the entire scenario of the deplorable states of many government buildings, it tries to explore some common defects affecting one of such buildings, which could serve as an example to others. The findings from this study provides the platform for all stakeholders involved to come together and fight the deteriorating states of government buildings in the country.

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