International Journal of Construction Engineering and Management 2021, 10(3): 70-79
DOI: 10.5923/j.ijcem.20211003.02

Investigating Implementation Strategies towards Elimination of Structural Failure of Buildings in Uganda: A Case Study of Kampala City

Asingwire Myers*, Muhwezi Lawrence, Sengonzi Ruth

Department of Civil and Building Engineering, Kyambogo University, Kampala, Uganda

Abstract Buildings failure in Kampala City has occurred frequently, leading to increase in the spate of building collapse that has claimed the people's lives. Although different strategies to eliminate structural failure of buildings have been devised by KCCA (Kampala Capital City Authority), the challenge continues to affect different parts of the city, causes of which this study examined. Although the Government of Uganda through the Ministry of Lands, Housing and Urban Development (MLHUD) and KCCA has enacted guidelines for the construction industry, numerous buildings have still continued to succumb to failure, implying that the strategies to eliminate the structural failure of buildings as established by Government exist but are not being followed or enforced. The purpose of the study was to assess the causes of collapse of buildings in Kampala, to establish the impact of building failure to stakeholders, to assess the performance of the strategies designed by KCCA to mitigate the occurrence of structural failure of buildings and to develop a framework for mitigating and eliminating structural failure. The study adopted a case study research design employing the triangulation approach with both quantitative and qualitative approaches. The study population comprised of 200 respondents from the following bodies: UIPE (Uganda In statute of professional Engineers), ERB (Engineers Registration Board), MOWT (Ministry of Works and Transport), MLHUD (Ministry of Lands Housing and Urban Development), LC (Local Council) and KCCA members. The data collected were analyzed quantitatively using SPSS (Statistical Package for Social Scientist) Ver. 16. Qualitative data was further analyzed according to objectives. Findings were presented using frequencies and tables. The findings indicated that buildings without approved drawings was ranked 1st cause of building failure, on the impacts created by failure of structural buildings; failure to pay borrowed resources from financial institutions was ranked 1st by the respondents and findings the existing strategies to eliminate structural building failure revealed that planning ranked 1st. it was concluded that there is need for enhancement of coordination among the MDAs (Ministry Departments and Agencies) charged with planning and development of Kampala city, involvement of taskforces at Division level and increase in the outreach and sensitization of the population to report cases to concerned authorities.

Keywords Building failure, Strategies, Elimination of structural failure, Kampala City

1. Introduction

Since time immemorial, buildings have been factored as determinants of might of a city. According to [4], a building is a structure that serves as shelter for man and his activities. It can also denote a roofed and walled structure built for permanent use for man's living, working and storage. Through the centuries, buildings have been integral to the socio-economic development of humanity [22]. A building, once properly constructed is expected to be in use for a very long time [19].That said, to the ranking of the pace or state of development of any given city, the contribution of buildings does not yield the desired potentials where there are cases of failed projects as well as poor functional performance [22]. Carnage and mega losses resulting from the devastating consequences of building collapses have become a silent feature of present day cities worldwide. The occurrence of these sudden accidents has led to loss of lives, permanent and temporary injuries. In addition, it has caused loss of investments, jobs, and income [11].

Although [23], reports that in many locations around the world, building have collapsed due to terrorist attacks, gas leak explosions, earthquakes, and global environment changes, in Africa and in many developing countries, the causes are: weak foundations, substandard constructional materials, poor material mixing by construction workers, excessive load on strength of buildings, and poor testing of building strength [3]. African countries have also witnessed

* Corresponding author:
myersasingwire@gmail.com (Asingwire Myers)
Received: May 2, 2021; Accepted: May 21, 2021; Published: Jul. 26, 2021
Published online at http://journal.sapub.org/ijcem

building collapse although largely documented in media reports [6].

In Cameroon, [25] reported a number of building collapses between the period 2010 and 2014, which were caused by inadequate preliminary works, adoption of wrong foundations, low-quality sandcrete blocks, poor concrete mix ratio, and neglect of design and building approval procedures, among others [6]. These findings show that the underlying factors of building collapse in African countries are similar in many respects.

In East Africa, [16] remarked that collapsed buildings are a growing problem in East Africa, where many buildings in the region's major cities are under construction or renovation. For example, in Kenya, [21] remarked that construction teams often violate construction regulation resulting into collapse. Still in Kenya, [15]. revealed that most collapsed buildings were constructed with low-quality building materials by incompetent craftsmen due to a lack of political will to enforce existing building codes [15], In Uganda, the problem of structural failures has become a major blow to the planners and policy Faced with recurrence collapsing buildings, the government of Uganda has developed a regulatory framework to redress effects outlined above. For example, the Building Control Act No. 10 of (2013) spells out the proper strategies to be followed [13].

Findings in the Office of the Auditor General of Uganda OAG Report (2016) revealed that there is weakness in enforcement (OAG report, 2016). However, none of the studies has endeavored to come up with a framework for eliminating the problem of building failures in Kampala city. Against this backdrop, this research study has been carried out with the overarching aim of producing a framework capable of filling the existing gaps.

Kampala City has experienced more cases because of the high competition for space calling for the erection of high rise buildings, given its strategic location and grading as the only city in Uganda [6].

2. Literature Review

2.1. Main Causes of Structural Failure of Buildings

Structural failure is instigated when the materials in a building are stressed to its strength limit, thus causing fracture or excessive deformations which result into failure and collapse of buildings [8]. Collapse according to the Dictionary of Architecture and construction refers to mechanical failure. According to [13], Collapse is a state of complete failure, when the structure has literally given way and most members have caved-in, crumbled or buckled; the buildings can no longer stand as originally built. It can be seen, therefore, that collapse is extreme state of failure. The immediate and remote factors for structural failure of buildings are mainly categorized into two, natural and man-made [4].

2.2. Man-Made Factors

Man-made factors are human errors that occur before, during and after the construction of a building (Akinyemi et al., 2016; Alinaitwe & Ekolu, 2014; Amadi et. al., 2012). They include: poor design and construction, use of sub-standard and untested local materials, greedy and poor maintenance culture, foundation failure, and absence of site investigation and engagement of quacks/non-professionals.

2.2.1. Poor Design and Construction

Most collapsed buildings have also been linked to poor design and wrong construction methods. Architects and Structural Engineers that find themselves at the design stages should be careful to see that necessary variables are considered at this stage such as the nature of the soil, type and sizes of materials specified. Failure of most contractors to build according to specifications and plans often results to structural anomalies in buildings.

2.2.2. Use of Sub-Standard and Untested Local Materials

The use of sub-standard (inferior) material in building construction is one of the major causes of structural failure of buildings. A Study by Wright (2015) asserted that the use of substandard materials has caused failure of buildings. Substandard materials especially reinforcement bars, steel sections and cement can contribute immensely to failure of buildings. Wright further submitted that in some instances, when other substandard materials are or have been used, the stakes are high that failure of buildings can occur.

Hall (2016) posited that the use of low quality materials is one of the major causes of structural failure. Clients' over reliance on contractors for decision making instead of relying on consultants has caused failure of buildings. This is because most contractors are either their friends, relatives or recommended by friends. The result of this relationship is that clients rely more on the contractors for decision making than on the consultants. Poor mixing of concrete aggregate, poor quality steel reinforcement and use of sub-standard blocks from some block industries contribute their own factor to building collapse in Nigeria. Some of these constructional materials did not meet specified standard nor any quality control checks conducted on them before they are used for the construction. The frequent use of inferior and untested local building material leads to structural failures in buildings.

2.2.3. Greed and Poor Maintenance Culture

Greedy or get-rich-quick syndrome has its negative impact on the building industry. Take for instance, the case of a building that collapsed in Lagos in 2007, a building which was originally designed for a three storey but out of greediness, the owner decided to add extra two floors (Amadi et. al., 2012). This additional weight on the structure without due consideration of the foundation,

column and slab led to the collapse of the building (Oke et. al., 2009a). Adequate maintenance of building is necessary for the safety and durability of the structure. Poor management and maintenance in buildings leads to development of cracks on the walls, differential settlement and premature ageing of the structure. These deficiencies when not checked, could result to building failures.

2.2.4. Foundation Failure

All engineering works start with the foundation (Oloyede et. al., 2010). The purpose of a foundation is to transfer the load of structure to the ground without causing the ground to respond to uneven or excessive movement. Weak foundations of structures have caused structural failure of buildings (Kioko, 2014) as a firm foundation may cost almost half of the cost of the whole construction especially in swampy areas. Thus, a building structure can fail if founded on poor sub-soil, or if it is not uniformly loaded. In this line or argument, Johnson (2015) argues that if suitable foundation was not specified according to soil nature or due to soil erosion or earth movement under the foundation, then chances for building failures occurring are rife. Even on firm areas, a strong foundation is a must to ensure the strength of a building. Such load must be transferred in such a way that there will be no shear failure in the underlying soils. Many buildings have collapsed due to faulty foundation (Amadi et. al., 2012). Most of the foundations are designed without considering the soil type on which they rest upon. Therefore, it is vital that adequate soil investigation should be carried out before designing of foundation in-order to have a suitable design to suit the local geology of the area.

2.2.5. Absence of Site Investigation

According to Hornby (2001), investigation is defined as an examination or enquiry into something, especially a detailed one that is undertaken officially. Site investigation is therefore the act of undertaking an examination of site (a piece of land). This is a process whereby surveyors, geologists, architects, engineers, builders and other professionals obtain information for successful project attainment. There is need for site investigation because it is vital to the success of any construction project, because inadequate or absence of soil investigation can lead to very large construction cost over-runs. If site investigation is to be effective, it must be carried out in a systematic way using techniques that are relevant, reliable and cost effective. Lack of site investigation has always led to foundation failure which results in building failures. Site investigation helps to reveal the weak and soluble soil in the area.

2.2.6. Engagement of Quacks/Non-Professionals

Adebayo (2010), opined that efficiency in skill and experience is important in creating valuable workmanship in building construction. A number of professionals (stakeholders) exist in the building industry, but in most cases their services are not sought for due to one reason or the other, such professionals include: Architects, Quantity Surveyors, Land Surveyors, Builders/Contractors, Engineers (Structural, Civil, Mechanical, Electrical, and Geotechnical) (Amadi et. al., 2012). That said, Oloyede et. al. (2010) attributed causes of building failure to man's negligence in some vital areas in construction such as emphasizing soil investigation, incorporating design for extra loads, erecting stress shields from winds, use of substandard building materials, poor monitoring and overall poor workmanship. It has been observed that due to high cost of consultancy fees needed to engage the services of these professionals, most building proprietors prefer to cut cost by engaging the services of nonprofessionals (quacks) who lack the needed experience in construction sector. This is reflected in poor workmanship and low standard of.

2.3. Nature-Generated Causes of Structural Failure in Building Constructions

Natural factors that give rise to building collapse are subdivided into two groups: Geological phenomenon that causes building failures and geo-materials that lead to the collapse of building [4].

2.3.1. Geological Phenomenon

The possible geological phenomenon that causes building collapse is as follows: subsidence, erosion and flooding, earthquake, landslide, mud-flow and debris-flow, hurricane, typhoon and tsunami, faulting, rain-storm, thunder-storm and lightening.

2.3.2. Subsidence

Subsidence is the sinking/settling down of land resulting from natural shifts frequently causing structural damage to buildings. Subsidence is most common in areas that have weak soils.

2.3.3. Erosion and Flooding

Erosion is the scraping, scratching, grinding, and pulverizing of the earth's surface rock. Various agents of erosion which carve and shape the earth's natural surface rock includes running water, groundwater, gravity, moving ice, wind action, waves and current. Erosion can be of the following types: stream, wind, marine and glacial erosion [4]. Flooding is a natural process of busting of river banks or simply overflow beyond the river's bank. Most river flooding is a function of the amount and distribution of precipitation in the drainage basin, the rate at which precipitation are infiltrated into the soil. However, some floods result from rapid melting of ice, snow and dam failure. Urbanization without adequate provision for flood channels increases both the magnitude and frequency of flooding. Factors that determine the catastrophic nature (magnitude) of floods are: land-use on the floodplain, duration of flooding and sediment load. Whenever municipal and city authorities fail to draw a sound strategy for abating the occurrence of

both erosion and flood and most especially in in the design of construction sites, such buildings are prone to collapsing.

2.3.4. Earthquake

Earthquakes are series of shock vibration generated at the focus, within the earth crust or mantle. When earthquakes occur, they generate three main types of waves: L-waves, S-waves and P-waves. Earth quakes are caused by sudden movement within the earth crust or release of build-up stress and strain within the earth crust. It is interesting to note that earthquake does not occur everywhere, neither do they occur with equal intensity, rather its occurrence are concentrated along the long narrow load belt characterized by zones of crustal weakness and major fracture. Earthquakes constitute one of the natural factors leading to an increase in the spate of structural failures.

2.3.5. Landslide

Landslides constitute a serious natural hazard in many parts of the world, particularly in urban areas. Landslide refers to a rapid down-slope movement of soils as a coherent mass. Landslides and other ground failure are natural phenomena but are generally enhanced by human activity. Landslides on naturally sensitive slopes are sometimes averted by means of stabilizing structures or techniques thereby reducing the substantial damages (houses) and loss of life. It is the complex combination of sliding and flowage. Factors such as type of earth material, slope angle, climate, vegetation, water and time determines the magnitude of landslide in an area.

2.3.6. Hurricane, Typhoons and Tsunami

Hurricanes are tropical cyclones characterized by circulating winds of 100 km/hr or greater generated over an area of about 160 km in diameter. It is known as typhoon in the ocean. Tsunamis are seismic sea waves generated by submarine volcanic activity. It is characterized by very long wave length and moves rapidly in the open sea where it is known as tidal waves. Hurricane, Typhoons and Tsunami activities are catastrophic in nature and whenever it occurs, buildings and human lives are not spared. Globally they are among the causes of building collapse.

2.3.7. Impact of Building Structural Failure

Each collapse carries along with it tremendous effects that cannot be easily forgotten by any of its victims [9]. The consequences are usually in form of economic and social implications. These include: loss of human lives, injuries, economic waste in terms of loss of properties, investments, jobs, incomes, loss of trust, dignity and exasperation of crises among the stakeholders and environmental disaster [9].

The unprecedented occurrence of structural failures has a big toll on urban life. According to [22], the consequences of structural failures can take several forms ranging from material/structural damage and human injuries/fatalities to functional downtime and environmental impact. [14] asserts that municipal and city authorities should be quick in action to mitigate these challenges by ensuring that they develop a risk-based robustness framework within which consequence modeling is an important step in estimating risk, both in determining the robustness of a building and in assessing the benefit of possible robustness-improving measures. However, their findings and accompanied recommendations are very silent with regard to how the framework would work and how best it would be improved and upgraded to ensure that it becomes relevant over and again. This left a contextual gap for this study. Collapsed buildings where there are scores of deaths constitute a major challenge to the owners of the buildings in terms of compensations [4]. At times, even when there is no reported death but a big number of injuries, the costs related to injuries are also at times higher especially in instances where the building is already operation and housing many businesses. The costs cited by [7] could include pre-hospital emergency treatment, emergency department services, hospital physician and surgeon services provided to the causalities, visits to private physicians, rehabilitation costs and lost income following the injuries.

According to [17], quantification of the complete effects of any collapse is extremely difficult as there are so many factors involved, and these include emotional and subjective factors. Apart from the number of deaths that can often be truly identified, the rest of the effects are surrounded by so many uncertainties which make the analysis only approximate. Leaving aside the grossly quantifiable economic sums, the stress, trauma and shocks to the building owners may have some far-reaching effects upon others involved in one way or the other with the structure. Property worth millions has been damaged in African countries most especially due to failure of buildings. People invest for the purpose of making profit and/or personal uses and when it collapses, it discourages investors for further investment in property.

The collapsed property most time cannot be regained except such property has been insured, which most developers hardly do these days [9]. Earlier, a study by [9], revealed that the continued collapse of buildings in cities and other urban centers discourages many developers from investing in property development, most especially those who are new in the system. As a result of this, they may move into other investments e.g. stock and shares.

2.4. Existing Strategies against Structural Failure of Buildings

Examined contemporary issues around building collapse in major cities in Nigeria and their implications on its sustainable development [22]. Their study specifically assessed whether the approach to construction by industry stakeholders followed the basic principles of sustainable development. Results revealed that incidences of building collapse were prevalent among residential buildings of less than five floors high with major commercial centers worst affected by the under-performance of industry stakeholders.

They concluded that improved levels of conformance to and compliance with sustainable construction principles by construction industry stakeholders is required to abate building collapse and recommended an overhaul of planning and implementation policies (e.g., building codes, which set out minimum performance standards for design and construction works that are based on sustainable principles. Notably, they specified the need for revising the Building Code to incorporate sustainable construction. Also, as a matter of concern was their recommendation that bye-laws developed need to be developed for big constructions because of their strategic level of development and then lastly, the need for a coordinating thread between the governments (federal, state and local), through respective regulatory agencies to ensure that there is compliance with the set standards and clauses enshrined in the building and authorization plans respectively.

3. Methodology

The study employed a case study research design. A case study design is an empirical inquiry that investigates a phenomenon within its real-life context. Case studies are based on an in-depth investigation of a single individual, group or event to explore the causes of underlying principles [7]. The case study research was employed because it allows in-depth, multi-faceted explorations of complex issues in their real-life settings.

A quantitative approach was used to understand the perception of respondents in Kampala city towards the implementing strategies for eliminating building structural failure. The qualitative approach was employed to have more understanding of the phenomena under study.

A sample size of 137 respondents was determined from the table developed by Kreijer & Morgan where a known population of the selected respondents was 200. The respondents were drawn from a population of members from the UIPE, ERB, MOWT, MLHUD, LC and KCCA.

Simple random sampling technique was used to determine the respondents but also key informants were purposively identified. In order to determine the perception of different stakeholders, the study developed a self-administered questionnaire. This contained closed ended questions where the respondents were limited to a fixed set of responses with options to select and these responses were based on a five point likert scale. The decision to have more closed ended questions in the questionnaire was informed by [18] that close ended questions keep the respondent focused, weed out irrelevant and uncalled for responses and above all, increase the response rate This was the main tool used to collect the data from the target respondents. The interview was also adopted as a method for data collection partly due to its cost effectiveness and its strength of capturing empirical data in both informal and formal settings. The interview guide consisted of only open questions. The interview guide was used to obtain qualitative data from mainly the key informants.

Validity and reliability

Validity is the ability of the instrument to produce findings that are in agreement with theoretical or conceptual values. According to [5], validity refers to appropriateness of the instrument. Content validity measures the extent to which the content of the instrument corresponds to the content of the theoretical concept it is designed to measure. To obtain content validity index, inter judge was used with the help of three research consultants. Each of the judges provided his/ her opinion on a two point rating scale of Relevant (R) and Irrelevant (IR) to calculate the average Content Validity index (CVI). The items considered irrelevant were deleted or substituted with relevant ones. The formula used to calculate CVI was;

$$CVI = n/N$$

Where: n = number of items rated as relevant
N = Total number of items in the instrument
The CVI results are presented in Table 1.

Table 1. Validity Indices

Items	**Content Validity Index**
Causes of failure of structural buildings	0.866
Impact created by structural failure of buildings	0.725
Existing strategies	0.666
Average Validity indices	**0.725**

The CVIs for the questionnaire was valid at above 0.70, which is the benchmark in a survey [18] and average validity indices is 0.725 which is above 0.70. This implied that the questions in the tool were valid.

Reliability

Reliability for the interview guide was achieved with the help of the supervisor who read the question items and guided on the formulation of the questions. During data collection, the researcher ensured prolonged engagement and audit trails. Data collected was systematically checked, focus maintained and errors identified and corrected" [26]. On the other hand, the reliabilities of items in the questionnaire were tested using Cronbach Alpha (α) method provided by SPSS. Reliability for the items for the different constructs was attained at the benchmark of $\alpha = 0.70$ and above [27]. The Cronbach test results were as presented in Table 2.

Table 2. Reliability Indices

Items	**Cronbach alpha (α)**	**No of Qns**
Causes of failure of buildings	0.806	12
Impacts	0.713	12
Existing strategies	0.736	9
Average Reliability indices	**0.752**	

The alpha values for the questionnaire were all valid since they were above 0.70 because the average reliability indices is 0.752 way above required 0.70, which is the benchmark in

a survey [18]. This implied that the questions in the tool were consistent.

4. Results

The data was analyzed according to the research objectives i.e. to assess the causes of collapse of buildings in Kampala, to establish the impact of building failure to stakeholders in Kampala city, to assess the performance of the strategies designed by KCCA to mitigate the occurrence of structural failure of buildings in Kampala City and to develop a framework for mitigating and eliminating structural failure of buildings in Kampala City.

4.1. Causes of Structural Failure of Buildings in Kampala City

Objective one (1) assessed the causes of collapse of buildings in Kampala city. The respondents were requested to rate their opinion on the causes of structural failure and the responses were measured on the linkert scale of" D" represents the opinion of those that strongly disagreed and disagreed respectively; "NS" represents opinion of the respondents who were ambivalent or non-committal while "A" stands for those who agreed and strongly agreed to a given statement. Based on table 3, all the respondents agreed to all the statements that measured the causes of structural failure of buildings in Kampala city since the means values ranged between 3.01-5.00. Item 1 from Table 3 shows that majority of the respondents 80(83.3%) agreed that most of the buildings that have collapsed in the different parts of Kampala city have resulted from the failure of the building proprietors and their contracted companies to follow approved structural drawings as one of the cause of collapse of buildings in Kampala. While an insignificant number disagreed and showed ambivalence respectively; implying that over the time scope selected for the study, one of the prominent causes of structural failures has been caused by disregard for approved structural drawings. This finding was further substantiated by the key informants during interviews when they unanimously indicated that most of the causes of the recent spate of buildings that have collapsed and caused death of many people as well as damage to various properties have resulted from the alterations or total neglect of the plans approved by KCCA.

4.2. Impact Created by Structural Failure of Buildings

Table 4 shows that majority of the respondents, 80(83.3%) agreed that one of the most serious impacts of structural failure of buildings that have collapsed in Kampala city is financial crippling of the proprietors of the buildings as most of them augment their savings money with a portion of loans from the financial institutions operating in the city. This level of agreement is further confirmed by the mean value of 4.07, which implied a higher level of agreement by the majority of the respondents, meaning that when buildings collapse, there is a high possibility of the owners failing to meet their financial obligations with their bankers. While expressing their distress, majority of the key informants that if the vice of collapsing buildings is left unchecked, it may have a long term multiplier effect on the growth of investments in the real estate building sector in Kampala city. On Item 2, an equally big number of respondents, 79(82.3%) agreed to the statement that when there are cases of collapse of buildings, resources or property is lost. The loss of resources or damage to property cited by the respondents occurs in majorly three ways; Firstly, it may be lost or get damaged at the site itself when property worth millions is buried under rubble, it may also occur when the collapsed building was functional and housed numerous running businesses and parked cars and motorcycles, lastly, the loss of property occurs when the falling debris spills over to the neighbouring homesteads or even other business premises. The high value of mean (4.05) provided a confirmation that majority of the participants in the study rated the impact highly. This could be related to the aftermath when the owners of the collapsed buildings have to duly and fully compensate all the victims affected by the collapse of the buildings, culminating into a double loss.

4.3. Performance of the Strategies Laid to Address the Problem of Structural Failure of Buildings

Findings in Table 5 showed that the respondents agreed to all the statements that measured the effectiveness and performance of the strategies designed by the government and KCCA over time to address the causes of collapse of buildings in Kampala city. The validity of this assertion is reflected in the mean values that are above the 3.01 lower limit. From table 5, findings revealed that one of the strategies made by the management of KCCA was the choice of involving key stakeholders in planning for building construction sector in the city. Majority of the respondents 78 (81.3%) agreed to the statement. Together with the high mean value (4.23), the respondents greatly agreed that KCCA engages stakeholders in panning for the building sector. The truth of the matter is provided by the Strategic Plan 2014/2015- 2019/2020 which provides two slots in the administrative machinery of a representative from UIPE and USA (Uganda Society of Architects). However, through interviews with key informants, it was established that KCCA still does not have and or embrace a balanced representation as the current systems employed do not involve key stakeholders despite their foot print in the maze of construction activities in the city. A case in point is the Local Council 1 officials who serve as the watchdogs of the government and have more local presence in their designated areas. Equally too, are members from Uganda Building Workers union. These are charged with ensuring that the working conditions of workers at building sites are well catered for in terms of ergonomics and occupational safety among others. In sum, this strategy lacks the recipe of inclusiveness and sidelines the members "who" matter most such as the LC1 leader.

4.4. Framework to Existing Implementation Gaps

Research Objective four (4) set out to design a framework that will provide a means and basis upon which the recurrent building failures and collapse can be mitigated in the short run and eliminated or prevented in the long run. The assorted remedies suggested in the entire framework arise from the contributions and opinions of the respondents as well as the documented evidence accessed from the resource centres of Ministry of Lands, Housing and Urban Development, KCCA and Ministry in Charge of Kampala District. The framework advises the line ministries to train, monitor and offer advisory services to KCCA as well as extend logistical support to division construction management units (Reference Figure 1). In addition, the framework suggests that the ministry should pioneer the birth of a building technical committee containing all-inclusive teams like the division physical planners, UIPE representatives, ERB representatives and the representatives from the UNBWU (Uganda National Workers Union), UNABCEC (Uganda National Association of Building & Civil Engineering Contractors), USA (Uganda Society of Architects) and UNBS (Uganda National Bureau of Standards). The framework reminds KCCA to ensure that there is tight coordination with line ministries, in order to lay grounds for synergies and collective action, which strengthens the planning, tracking and monitoring systems for high rise constructions in all parts of Kampala. The framework encourages KCCA to empower the division construction management unit such that it is in position to validate the reports submitted by the In-progress and start-up buildings on a daily basis.

Table 3. Causes of structural failure of buildings

S/N	Cause of collapse	D	NS	A	Mean	Std	Rank
1	Buildings without approved drawings	7.3 (7)	9.4 (9)	83.3 (80)	4.19	1.089	1st
2	Using unqualified engineers	5.2 (5)	9.4 (9)	85.4 (82)	4.18	1.066	2nd
3	Lack of proper supervision by professionals	9.4 (9)	9.4 (9)	81.2 (78)	4.17	1.102	3rd
4	Complicated designs	9.4 (9)	5.2 (5)	85.4 (82)	4.16	1.060	4th
5	Lack of experienced contractors	24.0 (23)	13.5 (13)	62.5. (60)	3.96	0.946	5th
6	Illegal Alteration of Existing Buildings	11.4 (11)	16.7 (16)	71.8 (69)	3.76	1.023	6th
7	Use of substandard materials	21.9 (21)	15.6 (15)	62.5. (60)	3.72	1.211	7th
8	Corruption in the industry	15 (14)	14.6 (14)	60.4 (58)	3.43	1.185	8th
	Mean of Means				**3.76**		

Key for interpreting mean: 1.00-2.99= Disagreed, 3.00=Not sure, 3.01-5.00= Agreed

Table 4. Respondents' opinions on the impacts created by structural failure of buildings

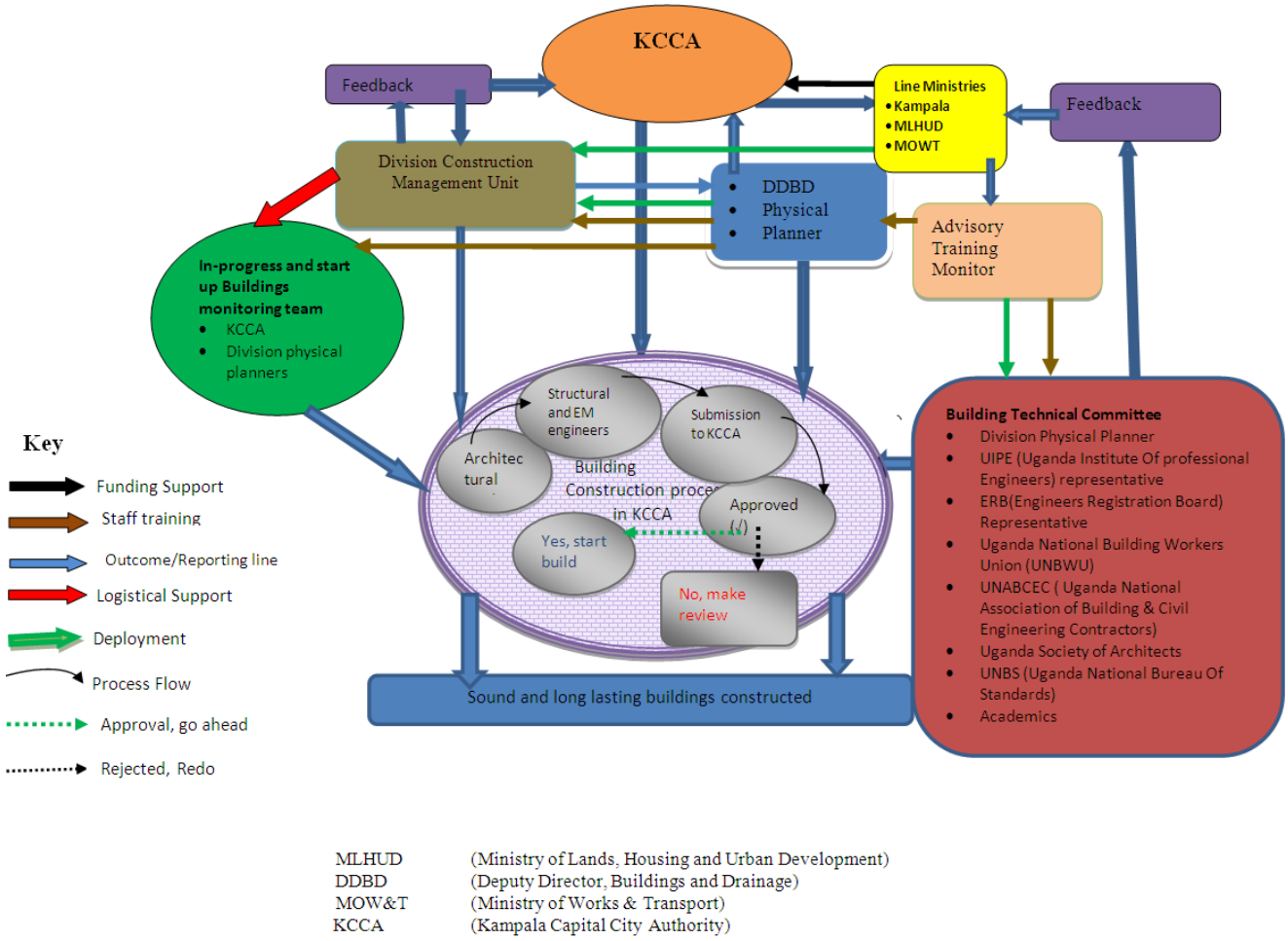
S/N	Impact created	D	NS	A	Mean	Std	Rank
1	Failure to pay borrowed resources from financial resources	7.3 (7)	9.4 (9)	83.4 (80)	4.07	0.943	1st
2	Loss of resources from the developer	7.3 (7)	10.4 (10)	83.3.0 (79)	4.05	0.944	2nd
3	Loss of revenue by Government	9.4 (9)	17.7 (17)	75 (72)	3.97	0.944	3rd
4	Effect on third parties	14.6 (14)	18.8 (18)	67.0 (64)	3.77	1.051	4th
5	Loss of property and Life	22.9 (22)	6.2 (6)	70.8 (68)	3.60	1.334	5th
6	Unemployment	25 (24)	14.6 (14)	60.4 (58)	3.51	1.422	6th
	Mean of means (MOM)				3.82		

Key for interpreting mean: 1.00-2.99= Disagreed, 3.00=Not sure, 3.01-5.00= Agreed
Source: Primary data (2019).

Table 5. Respondents' opinions on the performance of the strategies laid to avoid structural failure of buildings

S/N	Impact created	D	NS	A	Mean	Std	Rank
1	Stakeholder engagement in building development planning	10.4 (10)	8.3 (8)	81.3 (78)	4.23	0.957	1st
2	Emphasis on fluid communication between contracted firms and KCCA physical planning unit	6.3 (6)	10.0 (10)	83.3.0 (80)	4.11	0.905	2nd
3	Developed physical planning and development guidelines	7.3 (7)	12.5 (12)	80.2 (77)	3.96	0.917	3th
4	Creation of a supervision team	10.4 (10)	12.5 (12)	55.2 (53)	3.84	1.977	4th
5	Emphasis on use of experienced personnel	8.4 (4)	2.1 (2)	89.6 (86)	3.43	0.983	5th
	Mean of means (MOM)				3.91		

Key for interpreting mean: 1.00-2.99= Disagreed, 3.00=Not sure, 3.01-5.00= Agreed
Source: Primary data (2019).



MLHUD (Ministry of Lands, Housing and Urban Development)
DDBD (Deputy Director, Buildings and Drainage)
MOW&T (Ministry of Works & Transport)
KCCA (Kampala Capital City Authority)

Figure 1. Framework To Eliminate Structural Failure Of Buildings

5. Discussion of Findings

The findings are summarized in line with the objectives of the study which were to assess the causes of collapse of buildings in Kampala, to establish the impact of building failure to stakeholders in Kampala city, to assess the performance of the strategies designed by KCCA to mitigate the occurrence of structural failure of buildings in Kampala City and to develop a framework for mitigating and eliminating structural failure of buildings in Kampala City.

5.1. Causes of Structural Failure

Regarding the causes of collapse of buildings, the findings revealed that largely, a number of buildings were constructed

without approved drawings. This allowed room for deviations that hence provide antecedents for structural failures. In the same vein, majority of the respondents cited poor workmanship as one of the causes of structural failure of buildings in Kampala. Equally, low-grade construction materials are used on the sites as well as lack of professionalism that leads some construction companies to alter the approved construction plans. Together with the deployment of unqualified engineers by the site construction companies, there were high incidences of messing up the different processes involved in the construction of high rise buildings such as testing processes for the quality of concrete and beams, hence leading to eventual failure and consequently, collapse of the buildings.

5.2. Impacts of Building Failure

In the aftermath of collapse of buildings, life in and around the sites is prone to interruptions. Notably, the respondents revealed that collapsed buildings claim lives of people and lead to damage of property worth colossal sums of money. In addition, it also leads to injury of a score of people who sometimes become debilitated and infirm and pushed out of active income generating work with broken limbs and amputated legs and arms. Directly, this leads to loss of money in effecting compensations, meeting the hospital bills of those who have been injured while indirectly, the collapsed buildings paralyses traffic in a given area, lead to sudden cut off of utilities such as water, electricity and sewerage services. Collectively, these affect the quality and welfare of the dwellers in the neighborhoods negatively.

5.3. The Performance of the Strategies Designed by KCCA to Mitigate the Occurrence of Structural Failure of Buildings

Although a series of steps have been taken in form of strategies to thwart the challenge of structural failures in Kampala city, no viable remedies have so far yielded positive results. The most important factor downplaying the efforts is that the many supervision and planning institutions for Kampala city lack a united stand and operate single handedly. This has given rise to a couple of gaps that are exploited by the gullible public to engage in illicit construction activities that have continued to deal a blow to life in Kampala city especially in and around areas where deranges caused by collapsed buildings have been reported in the recent past.

6. Recommendations

There is a need for a multistage clearance and vetting of the construction projects in Kampala city. To make the clearance all binding, the study recommends the need for deploying certified professionals at every stage so that the initial construction stages are designed following the building code of Uganda and other internationally agreed building and construction standards.

The government and KCCA should endeavor to bring the local community people on board as a means of ensuring that whatever constructions are taking place in a given part of Kampala are in the orbit of the supervisory and monitoring teams from KCCA and the line ministries. This could best be done through forming a union of LC1 Chairpersons with a facilitated board so that these can assist in playing a stakeholder role of keeping the supervision and monitoring team informed about the progresses and any other side information on a given site in an area.

KCCA should work hand in hand with the professional bodies and construction and building unions in order to address the problem of deployment of non-professionals at sites of high rise buildings in the city. The professional bodies are necessary in this strategy as they will help to enforce standards by favouring only certified groups but again through competitive bidding processes.

The government through its quality assurance agency, UNBS should strengthen the monitoring and supervision of construction materials at import, manufacturing and selling points to ensure that only prequalified materials that meet the standards of high-rise buildings are certified and made public.

There is need for joint building quality expos and exhibitions in Uganda. These could be organized at regional level and publicized by urban authorities and line ministries in order to transmit critical information to the public about the requisite building standards and underlying processes. This could also involve the use of both electronic and print media to sensitize the public on advantages safe buildings.

There is need for periodic refresher courses on safe building planning and management practices for staff in the construction sector. Capacity building is necessary because it will enable the personnel in the construction industry to keep abreast with best practices in the management of buildings. To make the trainings comprehensive, the study recommends KCCA to integrate professionals from all relevant bodies concerned or related to building construction so that a full dose of necessary and relevant information is disseminated and fed to the concerned groups in the construction industry.

REFERENCES

[1] Akinyemi, A., Dare, G., Anthony, A. and Dabara, D.I., 2016, May. Building collapse in Nigeria: Issues and challenges. In *Conference of the International Journal of Arts & Sciences, CD-ROM* (Vol. 9, No. 01, pp. 99-108).

[2] Alinaitwe, H.M. and Ekolu, S., 2014, December. Failure of structure in East Africa with focus on the causes of failures in the construction phase. In *Construction Materials and Structures: Proceedings of the First International Conference on Construction Materials and Structures* (pp. 76-85). IOS Press.

[3] Fernandez, R.H.F., 2014. Strategies to reduce the risk of

building collapse in developing countries. Strategies.

[4] Amadi, A.N., Eze, C.J., Igwe, C.O., Okunlola, I.A. and Okoye, N.O., 2012. Architect's and Geologist's View on the Causes of Building Failures in Nigeria. *Moder Applied Science*, 6(6), p.31.

[5] Amin, M.E., 2005. Social science research: Conception, methodology and analysis. Makerere University.

[6] Asante, L.A. and Sasu, A., 2018. The challenge of reducing the incidence of building collapse in Ghana: analyzing the perspectives of building inspectors in Kumasi. *Sage open*, *8*(2), p.2158244018778109.

[7] Chuang, W.C. and Spence, S.M., 2017. A performance-based design framework for the integrated collapse and non-collapse assessment of wind excited buildings. *Engineering Structures*, *150*, pp.746-758.

[8] Deskin, K. 2018. Informed Conservation: Understanding historic buildings and their landscapes for conservation. English Heritage.

[9] Ede, A.N., 2013. Building collapse in Nigeria: The trend of casualties the last decade (2000-2010). *International Journal of Civil & Environmental Engineering*, *10*(6).

[10] Fernandez, R.H.F., 2014. Strategies to reduce the risk of building collapse in developing countries. *Strategies*.

[11] Ibrahim, R.B., 2013. Monumental effects of building collapse in Nigerian cities: The case of Lagos Island, Nigeria. *Basic Research Journal of Engineering Innovation*, *1*(2), pp.26-31.

[12] Janssens, V., O'Dwyer, D.W. and Chryssanthopoulos, M.K., 2012. Assessing the consequences of building failures. *Structural engineering international*, *22*(1), pp.99-104.

[13] Dimuna, K.O., 2010. Incessant incidents of building collapse in Nigeria: A challenge to stakeholders.

[14] Kakooza, F. 2017. Managing Road Reserves in Uganda: A Case of Kampala District. Unpublished Dissertation for Master of Public Infrastructure Management, Makerere University, Kampala.

[15] Kuta, J. and Nyaanga, D., 2014. Effect of quality of engineering materials on construction and quality of buildings: A case study of Nairobi, Kenya. *Prime Journal of Social Science*, *3*, pp.608-611.

[16] Muhumuza, R. (2013, July 22). Building collapses in Uganda, killing at least 4. Associated Press. Viewed 19 December 2019 <https://www.sandiegouniontribune.com /sdut-building-collapses-in-ugandakilling-at-least-4-2013jul22-story.html>.

[17] Obodoh, D., Amade, B., Obodoh, C. and Igwe, C., 2016. Assessment of the effects of building collapse risks on the stakeholders in the Nigerian built environment. *Nigerian Journal of Technology*, *38*(4), pp.822-831.

[18] Odiya, J.N., 2009. Scholarly writing: Research proposals and reports in APA or MLA publication style. *Kampala: Makerere University*.

[19] Oloyede, S.A., Omoogun, C.B. and Akinjare, O.A., 2010. Tackling causes of frequent building collapse in Nigeria. *Journal of Sustainable Development*, *3*(3), p.127.

[20] Osam, E. I. 2015, July 27. Of Ghana, collapsed buildings, knee jerk reaction, then forgetfulness. Citifmonline. Viewed 10 October 2019 <http://citifmonline.com/2015/07/27/of-ghana-collapsed-buildings-knee-jerk-reactions-then-forgetfulness/>.

[21] Wachira, M. 2015. Another city building collapses Daily Nation. Viewed 12 February 2020 https://www.nation.co.ke/counties/nairobi/Zimmerman-Building-Collapse/1954174-2789530-kfdf3t/index.html.

[22] Windapo, A.O. and Rotimi, J.O., 2012. Contemporary issues in building collapse and its implications for sustainable development. *Buildings*, *2*(3), pp.283-299.

[23] World Bank 2015. Building regulation for resilience: Managing risks for safer cities. Washington, DC: Author.

[24] Wright B F, (2015), Law of Health and Safety at Work, London - Sweet and Maxwell, Pg. 209 - 226).

[25] Tchamba, J.C. and Bikoko, T.G.L., 2016. Failure and Collapse of Building Structures in the Cities of Yaoundé and Douala, Cameroon from 2010 to 2014. Modern Applied Science, 10(1), p.23.

[26] Creswell, J.W. and Miller, D.L., 2000. Determining validity in qualitative inquiry. Theory into practice, 39(3), pp. 124-130.

[27] Rehman, S.U., Kyrillidou, M. and Hameed, I., 2017. Reliability and validity of a modified LibQUAL+® survey in Pakistan: An Urdu language experience. Malaysian Journal of Library & Information Science, 19(2).

Copyright © 2021 The Author(s). Published by Scientific & Academic Publishing
This work is licensed under the Creative Commons Attribution International License (CC BY). http://creativecommons.org/licenses/by/4.0/