Assessment of Awareness Level of Green Building Concepts in Kigali Commercial Property Development

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Abstract

The construction industry is one of the main energy consumers and emitters of greenhouse gases (GHG), generating about 23-40% of the world's greenhouse gas emissions. Recently, the construction industry has performed poorly in terms of environmental protection. The construction sector in developing countries, including Rwanda, is characterized by excessive resource consumption, resulting in habitat loss, land degradation, air and water pollution. This has exacerbated the global warming crisis and led to the development of green buildings. The objectives of this study is to analyze the level of awareness of green building concepts by building construction players between 2013 and 2018 in Kigali; to examine to which extent the green building concepts have been adopted in the Kigali City by the construction industry and to identify the factor impeding the implementation of green building concepts with the aim of identifying appropriate strategies for implementing sustainably these concepts. The study was conducted using a questionnaire, interviews, and observations for green building concepts data collection. Data from survey questionnaire were assigned numerical values and analyzed quantitatively using mean item score and percentages. For closed ended questions, the data analysis involved the use of statistical program for social sciences and Microsoft office excel. The Data from interview schedules were transcribed, coded and categorized to facilitate the analysis of the information provided. It also reviewed secondary data from existing green building concepts documents, including journals and books. The study findings showed that 90.2% of the players in construction industry participated in the recently constructed commercial buildings in Kigali and were aware of the green building concepts and regulations. However, only 17.9% of the concepts were taken into account in building process. The findings reveal a lack of enforcement of sustainable building policies. Stakeholders in construction are unaware of green building concepts; didn't benefit neither empowerment not incentives from the government. This constitutes the biggest obstacles faced by practitioners in the adoption of green building concepts. Some strategies were recommended to promote uptake of the concepts including the development of sustainability checklist by local authority, availability of financial incentives like green loans, recognizing and certifying sustainable buildings as well as improved enforcement by local governments. The study concluded that administrative management and policies are needed to implement sustainable building concepts as well as introduction of incentives.

Keywords: Green buildings, Green Building concepts, Built environment and Sustainability

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1. Introduction

The building and construction sector play a significant role in development and welfare of population. However, how a building is designed, how it is constructed and place where it is located obviously affects the community, the users of the building and the environment (Choi, 2009). With the booming of construction, it was observed that, the industry performed poorly in terms of environmental protection (Ofori, 2012). Particularly in developing countries, excessive resource consumption has caused loss of habitats, land degradation, air and water pollution while the excessive use of energy by construction industry caused approximately 23 to 40 % of world's greenhouse gas emission (Gunnell, 2009). In addition, it is estimated that construction has consumed one-sixth of world's fresh water withdrawals, a quarter of its timber harvest and two-thirds of its material and energy flows (Stephen & Anthony, 2015). In terms of the impact of building on the environment, it is necessary to specify that the structure of the building affects areas beyond their immediate locations including watersheds, air quality, and transport patterns of communication among other things. Taking cognizance of those serious negative environmental challenges, a new concept of 'Green Buildings' came to the fore (Gunnell, 2009).

The concept of green building originated from the observation that the built environment can have profound impacts, both positive and negative, on the natural environment, as well as the people who inhabit buildings every day. Green building is an effort to amplify the positive and mitigate the negative of these effects throughout the entire life cycle of a building (Vince, 2007). Green building includes the planning, design, construction and operations of buildings with several central, foremost considerations: energy use, water use, indoor environmental quality, material section and the building's effects on its site (Kriss, 2014[1]). Green building - also called green construction or sustainable building – are attributed to use less energy, water and other natural resources compared to traditional buildings. Moreover, they reduce waste and provide a healthy living environment. In addition, they also have effective use of water, energy and efficient environmental protection (Bernstein & Mandyck, 2013). These buildings can use renewable energy and recycled materials to make effective use of the landscape, improve indoor quality and maintain health and comfort. This explains why in some countries, governments had already taken step to promote sustainable development through adoption and implementation of green technology (Bernstein & Mandyck, 2013). In this regards, estimates show that 51% of international firms, including engineers, architects, contractors, building consultants and building owners worldwide are focusing on sustainable design and construction and at least 60% of their projects were green by 2015, up from 28% in 2012 (Bernstein & Mandyck,2013).

Despite the growing awareness and adoption of green building worldwide, Africa seems to be lagging behind. Only South Africa has a Green Building Council (GBC). A gradual change is however being observed with Mauritius, Egypt and Morocco undertaking the process of building their councils (Habitat, 2010). The incentive to adopt green building is that the latter offers long-term business opportunity. In Rwanda the adoption of green building can contribute to reducing climate change and optimizing resources use through use of low carbon development and green technologies (Nash and Ngabitsinze, 2014). In this vein Rwanda has initiated collaboration with Singapore in 2016 to promote the development of green buildings and cities in Rwanda. Policy

[1] Kriss, J. (2014) https://www.usgbc.org/articles/what-green-building, consulted on 2nd June 2020

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documents conducing to green building development exists in Rwanda and include (among others): National Green Growth and Climate Resilience Strategy (2011), National Housing Policy (2015), Rwanda Building Control Regulations (2012) and Rwanda Environmental Policy (2003). The policies link green building to the use of locally mined and produced manufactured building materials such as compressed earth blocks; resource-saving technologies, low energy building standards and environmental protection measures. The government of Rwanda has realized the importance of safeguarding environment through sustainable building development as this has a significant impact on resource consumption and reduction of global warming (MININFRA, 2015). With enacted policies and regulations, the intention is to promote sustainability in the built environment and increase environmental awareness among professionals in design, planning, engineering and construction. While the number of projects developing commercial buildings has been increasing mainly in Kigali city, the development of unsustainable ones persists. So far, the strategy used by government agencies in charge of housing development and environment protection haven't yet put in place mechanisms for implementing the green building concepts. This explains the little progress made so far in adoption and implementation of green building concepts. The question is why commercial real estate developers do not adopt the concepts of green building and why these concepts are not yet commonly adopted. This research aims to assess awareness level of Green Building Concepts among Kigali commercial property developers, its benefits and challenges faced. The analysis will pertain to the level of awareness of green building concepts among key players in construction industry between 2013 and 2018; the challenges faced and the strategies to boost green building concept adoption and implementation.

2. Materials and Methods

2.1. Study area

This study took place in the City of Kigali where green buildings were identified. The City of Kigali is the capital of Rwanda and is located at Rwanda's geographical heart. Occupying an area of 730 km^2, the City is located at latitude $10^o58'$ S and a longitude $30^o07'$ E. The City of Kigali is composed of three Districts namely Gasabo, Kicukiro and Nyarugenge (Yao Brou, et al., 2024). Gasabo is the largest district by geographical area at 429.3km2, followed by Kicukiro (166.7km^2) and Nyarugenge (134km2). Due to rapid urbanisation and a growing population in Kigali City which is causing a high demand for housing (Uwayezu and de Vries, 2020), although Rwanda is the least responsible for climate change, the Rwandan government prioritized a model of economic development that is low-carbon and climate-resilient balancing environmental sustainability with economic growth. Rwanda's policy framework for the building and construction sector underscores the benefits of green/ sustainable buildings.

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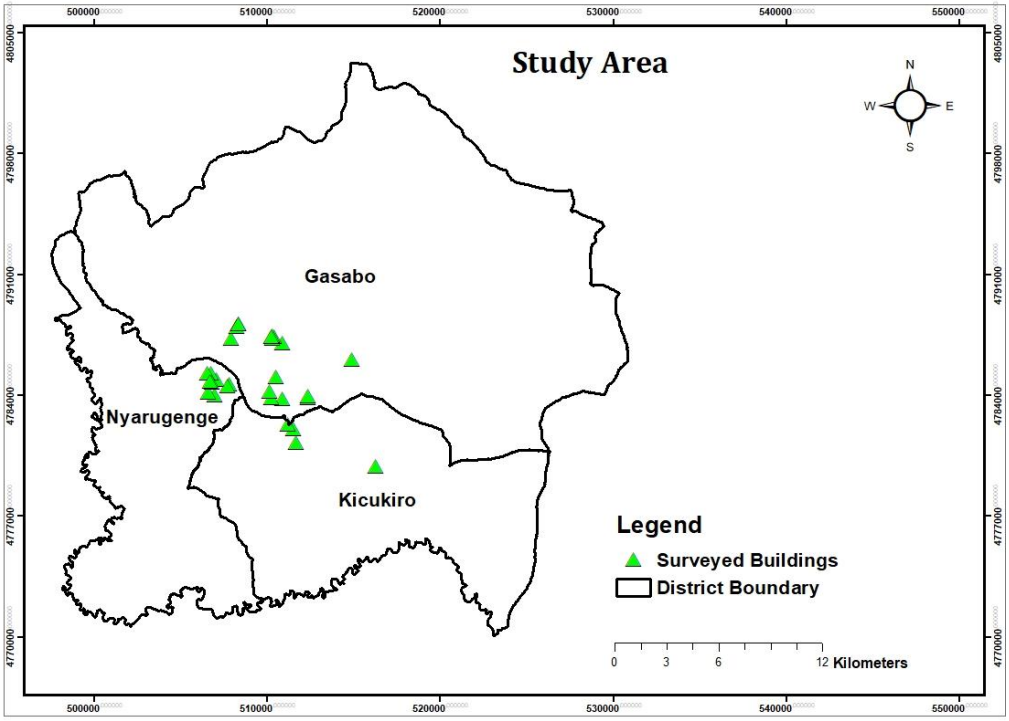
Figure 1: Study area and surveyed building in Kigali City



Source: Field Survey (2018)

2.2 Data collection

This study used the combination of field observations, quantitative and qualitative modes of enquiry. The respondents were drawn from individuals involved in the the design, construction and management of the buildings.

2.2.1 Questionnaire survey

The main objective of this study was to collect information status of green building concepts application on commercial buildings having at least 3 floors and above. The data from Kigali City One Stop Center revealed that the total number of buildings fulfilling the criteria is 44. These are commercial properties: hotels, supermarkets, apartments, offices and retail shops developed between 2013 and 2018. Taking this into consideration, it was decided to use the purposive sampling to determine the number of building to focus on in the research. Taking account of geographic distribution, 30 building were retained 16 in Gasabo, 5 in Kicukiro and 9 in Nyarugenge District. For each building, an Architect, a Quantity Surveyor, a Property Manager and an Engineer were incorporated on the list of respondents in the survey. This means that the total number of surveyed individuals is 120 including 30 Quantity Surveyors, 30 Architects, 30 Engineers, and 30 Property Managers respectively.

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Table 1: Socio-demographic variables of the study participants

	Count	Percent
Profession		
Architect	26	22.4
Quantity Surveyor	30	25.9
Property Manager	30	25.9
Engineer	30	25.9
Years of experience		
Below 5	26	22.4
6-10 years	37	31.9
11-15 years	21	18.1
16-20 years	17	14.7
Over 20 years	15	12.9

Source: Field Survey (2018)

Under the category of "Engineers", there were sub-categories of electrical, structural and mechanical engineers. The questionnaire prepared focused on five major elements of green building design namely sustainable sites, water conservation, energy, indoor environmental quality and conservation of materials to determine the degree of awareness. The information collected enabled to collect data on structure and sex ration, education levels, energy sources, energy use, water efficiency, sustainable construction materials and site selection among other parameters. This questionnaire was designed in the form of a likert scale with closed and open ended questions.

2.2.2 Semi-structured interviews

Data on awareness of green building concepts awareness were also obtained from semi structured interviews with construction industry stakeholders from different government and non-government institutions. Interview was conducted with one stakeholder from each of the following institutions: Kigali City One stop center, Ministry of Infrastructure (MININFRA), Rwanda Housing Authority (RHA), Rwanda Environmental Management Authority (REMA), President of Institute of Engineers, the executive secretary of Rwanda Green Building Organization (RwGBO) and President of Rwanda Institute of Architects (RIA). The interview was open ended and directed mainly to the experts at the level of assistant director and above.

2.2.3 Observations

According to Gerard Keegan (2009), the observation method is concerned with watching and analysis of observed behavior of the phenomena and people you visited. In this specific context, the inspection checklist was used as a tool for data gathering. It helped to define green construction with a range of variables from minimal to complete incorporation of the elements as well as the degree of adoption. The incorporation of five environmental categories was considered.

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2.2.4 Secondary data sources

This included information about green building concepts, both published and non-published information, past works from libraries and internet. Secondary information was used to have a strong background in green building concepts and their application.

1.2. Data processing and analysis

Data from survey questionnaire were assigned numerical values and analyzed quantitatively using mean item score and percentages. For closed ended questions, the data analysis involved the use of frequency count, percentages and ranking generated through the use of statistical program for social sciences (SPSS) version 16. SPSS and Microsoft office excel enabled to generate pie charts, histograms, tables and trend curves. The Data from interview schedules were transcribed, coded and categorized to facilitate the analysis of the information provided. The processing and analysis of data involved the sorting of data entailing ordering data from questionnaire and other field records for the purpose of subsequent processing and analysis. The data were numbered and arranged systematically. The quality control was checked with the analysis of the validity and feasibility of data collected using various selective criteria.

3. Results

The results include the awareness and incorporation of green building concepts (section 3.1); the adoption of green building concepts (section 3.2); factors impeding the implementation of green building concepts (section 3.3.) and the appropriate strategies to boost the implementation of green building concepts (section 3.4.).

3.1. Awareness and incorporation of green building concepts

To analyze the level of awareness of green building concepts by building construction players, the green building concepts were grouped into five environmental categories namely water efficiency and conservation, energy efficiency, choice of site, material and environmental quality. The practitioners were initially asked if they were aware of the green building concepts and whether they had incorporated them in their projects in the last 5 years (2013 – 2018). In terms of awareness of green building concepts by construction players, the responses from the surveyed practitioners indicate that the majority is aware of the green building concepts under the five environmental categories. The awareness in water efficiency is the highest with 98.3%; energy efficiency accounted for 96.6%; the use of sustainable site practices scored 94.8%, indoor environmental quality 81.9% whereas awareness on use of sustainable material was 79.3%. The overall average of awareness is 90.2%. This high level of awareness is a testimony that stakeholders in Rwanda construction industry knows that the safeguarding of the environment is a priority to secure for the sustainability of the building industry.

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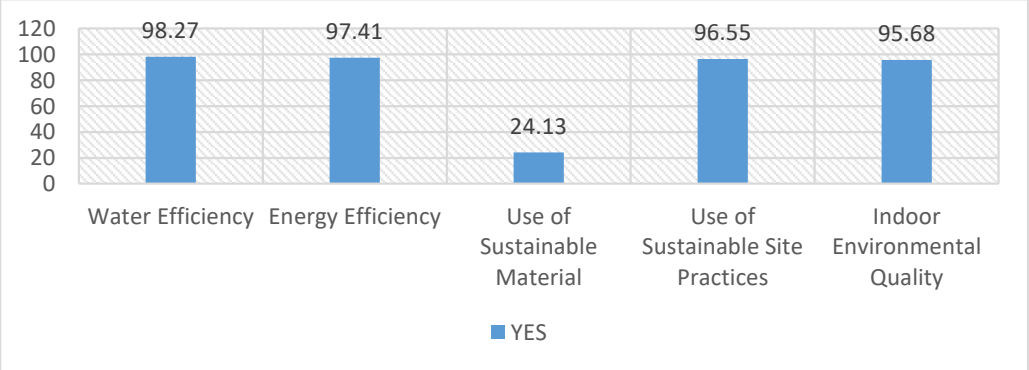
Figure 2: Awareness on the five environmental categories



Source: Field Survey (2018)

When it comes to the incorporation of green building concepts in commercial building projects, it was observed that that 100% of the consultants and practitioners in these commercial buildings had incorporated some of the concepts in the projects they were involved in during the last 5 years. This was further confirmed during interviews with the Executive Secretary of Rwanda Green Building Organization (RwGBO) and the Director of Kigali City One Stop Center who indicated that practitioners were aware and had incorporated the green building concepts in their commercial building projects. In addition, through observations, it appeared that various concepts such as rainwater harvesting, water efficient fixtures, use of renewable sources of energy, provision of adequate ventilation, thermal and sound control among others had been incorporated in some commercial buildings.

3.2 Application of green building concepts in the last 5 years

When trying to find out to which extent the five environmental categories (water efficiency and conservation, energy efficiency, choice of site, material and environmental quality) had been applied in the projects during the last 5 years, it was found that there has been varying levels of engagement in green activities in relation to the environmental categories.
It was revealed that a certain proportion of respondents (34.48 % for water; 8.6 % for energy; 39.65 % for sustainable site and 6.89 % for indoor environmental quality) have applied green building concepts to a great extent.

3.2.1 Incorporation of environmental categories

The study established that certain concepts in all the five environmental categories had been applied in the completed commercial buildings. Concepts in the category of water and energy efficiency had been applied with a score of 98.3% and 97.4% respectively. The use of sustainable site practices had been applied by 96.6% of respondents; Indoor environmental quality was applied by 95.7% of respondents. The explanation for high percentage might those stakeholders in construction industry is aware that improved indoor environmental quality can improve health conditions in the neighborhood of settlements. Only the use of sustainable material cored low (24.1%).

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3.2.2 Adoption of water efficiency

In terms of adoption of water efficiency, it was revealed that the concepts of water and conservation had been applied to a moderate extent of 51.7%. About 34.5% of respondents indicated that the concept was applied to a great extent; 8.6% was applied to a very great extent and only 5.2% was applied to a little extent. These results indicate that the level of incorporation of efficiency and conservation concept in the sampled buildings is high. It was observed that in the 30 sample buildings, only apartments had installed water sub meters. The reason is that the use of water sub meters had been incorporated only in apartments. Only tenants prefer to have their own water bills for purposes of monitoring and control than paying a fixed amount incorporated in service charge. Again, the study revealed that the use of rain water harvesting tanks had been incorporated to a very great extent by 37.1% of respondents; water recycling had been incorporated to a little extent by 50% of respondents; water efficient fixtures had been incorporated to moderate extent by 62.1% of respondents while the use of water sub meters had been incorporated to a little extent by 13.8% of respondents. Reduced city water for sewage had been incorporated to a little extent by 8.6% whereas water waste reduction had been incorporated to a little extent (22.4%). The great majority (91.4% of respondents) uses water-saving toilets, faucets and shower heads to reduce water bills from Water and Sanitation Corporation (WASAC). This was observed during inspections of the buildings and it was noted that Water-Efficient Plumbing had been used in 27 buildings.

3.2.3 Adoption of sustainable sites

The study revealed that the concept of sustainable site had been applied to a moderate extent by 46.6% of respondents; about 39.7% of the respondents had applied the concept to a great extent while about 7.8% did it to a little extent. Only 6% of respondents had applied the concept of sustainable site to a very great extent. The study indicates that the majority of respondents (48.2%) have applied site landscaping to a little extent and only 3.4% of respondents have applied the concept of preservation of existing vegetation. The interview specified that the developers want to maximize the site for perceived ‘higher returns’ and the developers found themselves with no open spaces to landscape nor to preserve existing vegetation. In relation to the management of storm water, this was incorporated to a little extent by 15.5% of respondents. Through the interview, it was observed that practitioners understood the benefits of managing rainwater (storm water) but indicated that successful affordable storm water management requires a long-term coordinated approach to integrate best practice as well as community and business engagement and education programs.

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Table 2: Extent of adoption of Sustainable sites

Choice of site	Not at all	Little	Moderate	Great	Very Great
Adherence to Local zoning requirements	0%	0%	6.0%	19.8%	74.1%
Preservation of existing vegetation.	96.6%	3.4%	0%	0%	0%
Site Landscaping	19.8%	48.3%	19.0%	12.9%	0%
Management of storm water	84.5%	15.5%	0%	0%	0%

Source: Field Survey (2018)

3.2.4 Adoption of energy efficiency

The study revealed that energy efficiency concepts had been generally applied to a little extent. Approximately, 63.8% of the respondents indicated that they had applied the concept to a little extent; 21.6 % to a moderate extent; 8.6 % to a great extent. Only 6 % of respondents affirm to have adopted this concept. The use of alternative sources of energy such as gas, charcoal, was applied to a little extent (50.86%). Cooking gas could possibly be preferred for reducing electricity bills while charcoal was preferred to prepare meat Skewers (brochettes). The use of solar energy was adopted to a moderate level by 63.8% of respondents.

The highest percentage of respondents (48.27%) adopted the energy conservation measures concept largely while only 3.4 % of respondents did not apply the concept. Generally, this concept was the most applied among others. Even though the study revealed the use of pre-paid cash power meters in the buildings to a great extent, it was noted that there was no particular metering on the equipment and other electronic devices in the buildings. The use of day lighting was applied to a moderate extent (38.7% of respondents).

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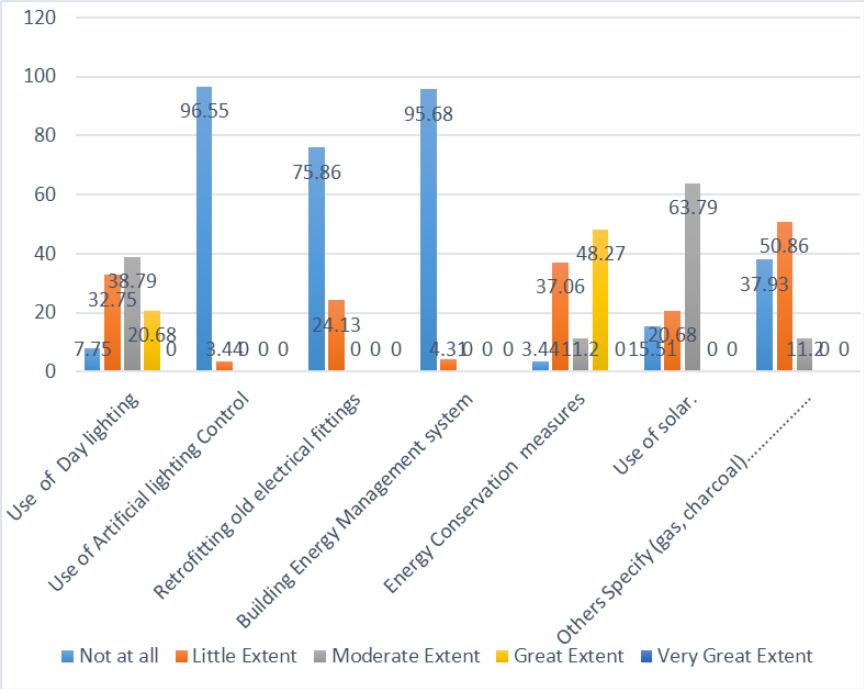
Figure 3: Extent of adoption of Energy Efficiency



Source: Field Survey (2018)

3.2.5 Adoption of sustainable materials

The study revealed that the concept of sustainable materials had been applied to a little extent (56.9 % of respondents); about 13.8% of respondents used sustainable materials to a moderate extent whereas 29.3% had not applied the concepts of sustainable construction materials. The results indicate that practitioners do not consider the use of sustainable materials in their projects as no respondent applied sustainable materials to a very great extent.

The study indicated that the use of materials with low environmental impact was the most incorporated concept under sustainable materials with a percentage of 44.8% of respondents followed by the use of local materials and components with a percentage of 12.9% of respondents. The use of materials that can be reused or recycled after the building life had been incorporated to the lowest level (7.7% of respondents).

3.2.6 Adoption of environmental quality practices

Six concepts under environmental quality which included ventilation to spaces, use of thermal control units, noise control, and provision of smoking areas, use of low emitting paints and use of low emitting finishes were considered in this study. It was revealed that the concept of environmental quality had been applied to a little extent (70.7% of the respondents); 22.4% of respondents used the concept to a moderate extent whereas 6.9% used it to a great extent. These results indicate that only concepts which had adverse effect like paint were adopted by the stakeholders at a great extent (31.03% of respondents). In the six concepts under environmental quality the study revealed that provision of smoking areas was the least applied concept as 84.4%

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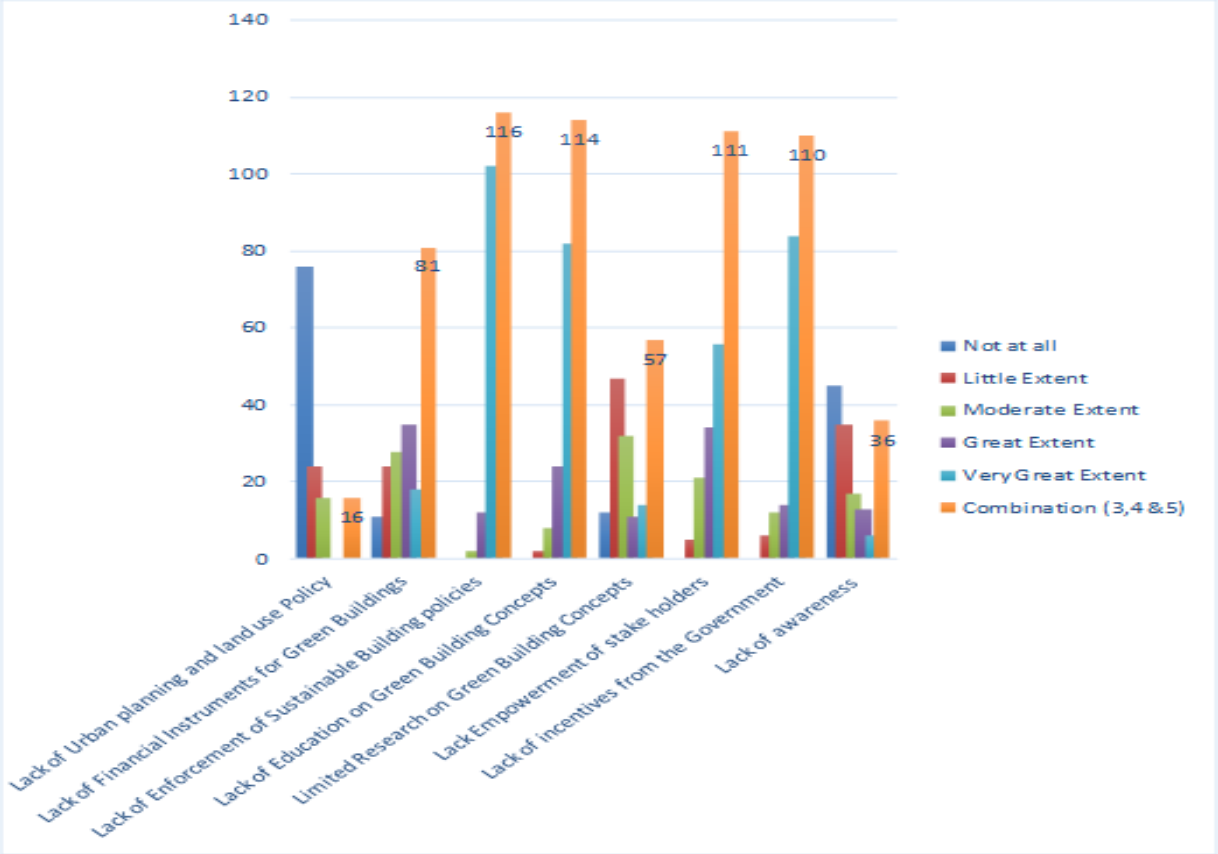
of respondents did not apply the concept whereas the use of low emitting paints and adhesive was incorporated the most with 31.03% of respondents having adopted the concept to a great extent.

3.3. Factors impeding the implementation of green building concepts

In order to determine the challenges faced by practitioners in adoption of green building concepts, respondents were asked to use a 5-point scale, with 1 being the lowest grade and 5 being the highest grade. From the figure above, it appears that the respondents strongly agreed that the lack of enforcement of sustainable building policies is a major challenge in the adoption of green building concepts as ranked first. The lack of education on green building concepts was ranked 2nd; the lack of empowerment of stakeholders was ranked 3rd; the lack of incentives from the government was ranked 4th; the lack of financial instruments for green buildings was ranked as number 5th; the limited research on green building concepts was ranked as number 6th, the lack of awareness was ranked as number 7th and the lack of urban planning and land use policy has least impact in the adoption of green building concepts and ranked number 8th.

Figure 4: Factors impeding the implementation of green building concepts.



Source: Field Survey (2018)

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3.4. The appropriate strategies for implementing green building concepts

The study revealed that the development of sustainability checklist by local authority was one of the fastest ways to promote uptake of green building concept as confirmed by 116 respondents. This strategy is followed by financial incentives like green loans (106 respondents). Other strategies for promoting uptake in order of priority included recognizing and certifying sustainable buildings (105 respondents), improved enforcement by local governments (104 respondents), strict enforceable urban land and planning policy (102 respondents), public awareness and campaign (98 respondents), education and training focusing on sustainability (89 respondents), introduction of mandatory building audit (88 respondents), promoting green procurement (81 respondents) and investment in green building related research (58 respondents).

4. Results Discussion

This section will discuss some important findings including the level of incorporation of each of the five environmental categories, the factors impeding the implementation of green building concepts and the appropriate strategies for implementing green building concepts.

4.1 Incorporation of the environmental categories

Water and energy efficiency had been applied mostly in the completed commercial buildings because of their daily usage in buildings which calls for monitoring besides the high bills associated with their provision as indicated during the interviews. This concept is followed by the use of sustainable site practices due to the requirement for commercial building projects to respect the Kigali City Master Plan. Construction industry players like architects, were advised to ensure that the plans they submit to the One Stop Centre on behalf of their clients, are up to the required standards. The incorporation of indoor environmental qualities can be justified by the fact that construction industry players are aware that improved indoor environmental quality has a positive impact on work performance and health. Due to the lack of awareness and knowledge on sustainability of construction materials by construction industry players the use of sustainable material is low. The interview indicated that, the lack of awareness and knowledge could be due to the lack of expressed interest from developers; the high cost of sustainable building materials and long payback periods from sustainable practices, which seems to suggest that construction companies are reluctant to invest in sustainable social, economic and environmental designs/projects in Rwanda.

4.2 Adoption of water efficiency and conservation concepts

The study findings indicate that the level of incorporation of water efficiency and conservation concepts in the sampled buildings is high. The reason behind is the steady progress made by the government of Rwanda in improving access to safe water and sanitation by strengthening efficient and productive investments, sustainable management of its water resources. The Government of Rwanda promotes the use of rainwater harvesting as a key output under water management policies. Another plausible reason is that the Ministry of Natural Resources (MINIRENA) and its partners made effort to develop rainwater harvesting through Rainwater Harvesting Project that aimed to improve livelihoods and to reduce surface runoff-overflow causing water erosion. For that, a National Rain Water Harvesting Strategy is in place while National Program is being

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developed. The limited incorporation of waste water treatment plants can be explained by the lack of space for retail shops and offices and high cost for construction and maintenance.

4.3 Adoption of sustainable sites

The findings on adoption of sustainable sites indicate that adherence to the Kigali City Master Plan requirements by site landscaping and preservation of existing vegetation and management of storm water are concepts considered either during design and construction or during occupation of commercial buildings. This contradicts the findings by Tessema, et al (2010) and Adebayo (2000). Adebayo (2000) believes that construction in many urban areas in Africa, occupy the entire site, completely ignoring the natural environment. The government of Rwanda through the Ministry of Natural Resources has made considerable efforts to encourage green growth and sustainable development. This is a positive response to green city requirements. On the other hand, the high incorporation of the concept of adherence to local zoning requirements was achieved due to efforts made by the city of Kigali in the implementation of Kigali City Master Plan 2013. The construction permit cannot be approved if the design has not been done in conformity with intended use for the particular zoning code.

4.4 Adoption of energy efficiency

The adoption of energy efficiency such as solar water heaters by all sampled hotels and apartment buildings is due to the introduction by the government of subsidies to keep some electricity consumers off the main grid in addition to offering tax exemptions. Solar power and water heaters are subdivided at 25 %. The findings that the use of alternative sources of energy is applied to a limited extent confirms previous studies that commercial buildings rarely use other alternative sources of energy other than electricity due to complex demand for cooling, heating and lighting (Brown, 2000). The large adoption of energy conservation measures concept as explained by Scott (2009) is motivated by the interest of individual tenants to monitor their consumption using pre-paid cash power meter.

4.5 Adoption of sustainable materials

The concepts under sustainable materials, which were considered in the study, included the use of local materials and components, use of recycled materials and the use of materials with low environmental impact. The incentive to incorporate materials with low impact stems from the implementation of environmental regulations such as Environmental impact assessment. On the other hand, the use of recycled material was limited in the commercial buildings corroborating the finding by Rode (2011). There is however an exception for a number of recyclable materials such as aluminum and timber that are commonly used.

4.6 Adoption of environmental quality practices

The adoption of environmental quality practices such as incorporation of smoking areas into buildings is an outcome to the implementation of the tobacco control law in line with the World

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Health Organization (WHO) framework. In general, practitioners avoid using products, which are harmful to users. They could lose out in the market with products that do not meet the standards.

4.7 The factors impeding the implementation of green building concepts.

The lack of enforcement of sustainable building policies is the biggest challenge in the adoption of green building concepts. This confirm the observation made by Anderson, Lyer and Huang (2004) that it is difficult to enforce sustainable building policies as enforcement requires satisfactory education and training of building inspection teams. According to the same Field Surveys, improved enforcement could be achieved through voluntary schemes and the use of incentives to overcome the challenge. In contradiction with the previous, findings by Tessema et al (2010) indicate that the biggest challenges facing developed and developing countries in promoting green buildings are inadequate urban planning. On the other hand, McGraw (2003) stipulates that the higher cost of green building work is seen as the biggest obstacle between current adoption and future growth and estimate that the second most important challenge is the lack of enforcement depending on the region. In the context of Rwanda, the inability and inefficiency of the institution in charge of construction activities have been observed through interviews.

5. Conclusion and Recommendation

This study looks at the real estate practitioners' awareness on green building concepts in Kigali commercial property development, despite the high awareness about green building concepts among the practitioners, the extent of adoption of the concepts in commercial buildings is limited. The findings demonstrated that there is need to develop guidelines and policies for enforcement of sustainable building concepts, education on green building concepts, empowerment of stakeholders and introduction of incentives from both local and national governments as the lack of these factors were found as important challenges practitioners faced in the adoption of the concepts. Consequently, the strategy would be to develop sustainability checklist by local authority, financial incentives like green loans, recognizing and certifying sustainable buildings as well as improved enforcement by local governments as found out in the adoption strategies. From the findings of this study, the noted recommendations are therefore made with a view of assessing the awareness level of Green Building Concepts in Kigali commercial property development and adoption of green building concepts in Kigali commercial property development. As per the study findings and conclusions of the objectives, the study shows that the level of adoption of green building concepts varied per each concept. The study therefore recommends the developers, practitioners and players in the built environment to translate awareness into practice through introduction of financial incentives like green loans. Practitioners need to explore and adopt concepts especially at project design stages and implementation phase. The government of Rwanda through one stop centers can also start requesting all developers to include some green building concepts in all of their future projects before providing building permits. In this way, clients and architects have no choice but to comply with the requirements. Players in the built environment should view green building as a system and incorporate the whole concepts together as opposed to adopting single concepts. MININFRA through One Stop Centers in collaboration with REMA should develop guidelines and policies for enforcement of sustainable building concepts and introduction of incentives for adoption of green building concepts. Education programs should be conducted in the private and public sectors to increase the knowledge on green concepts among the public and construction industry players. There should be collaboration with local universities,

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colleges to establish green building practices in their coursework's programs. The private sector should develop a green strategy and do not rely solely on the government. They need to prepare their own financial institutions such as banks that can provide more attractive credit for green development investors; provide green incentive programs and tax exemptions for construction companies and participants involved in green development. Due to the high initial capital cost, green investment is not always the first choice for investors. Incentive programs should be established and financial support provided to local manufacturers. The study also shows that the government should promote and encourage the use of local green materials. Local construction companies, suppliers or manufacturers will be more environmentally friendly if supported by the government. Moreover, incentive plans and tax exemptions should be published and made available to the public. In that way, the public knows that such a policy exists.

6. References

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