

Promoting Sustainable Building Construction in Zambia

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Abstract: *Since the Earth Summit held in Brazil in 1992 when agenda 21 was formulated as the international blueprint for sustainable development, all sectors of society have been in the process of interpreting and pursuing sustainability and sustainable development within their specific contexts. However, the Zambian construction industry has not seen much of sustainable building construction principles being put into practice. Therefore, the objectives of this research were to: examine the current construction (building) practices in Zambia; explore the fundamental principles of sustainable construction practices; to identify the main challenges in implementing sustainable construction practices in the Zambian Construction Industry; and develop a framework and strategies that could be taken to promote sustainable construction in the Zambian Construction Industry. This study was conducted through a survey research design and made use of both qualitative and quantitative modes. A random sample of 35 commercial buildings of the 50 targeted were used for the study. The results indicated that, 14% of the respondents have excellent level of awareness on sustainable construction while 86% have a good level and the aim of achieving a sustainably built environment calls for excellency. Results on current construction practices indicate organization/firms putting more preference on (37%) the economic aspect of construction, while the professionals feel (51%) the environmental aspect should be the one prioritized. In conclusion, the status of sustainable construction in Zambia is still in its infancy. The lack of awareness/training is among the major barriers for sustainable construction practices. Besides the need for capacities, technologies and tools, ardent commitment by all players in the construction industry including the government and the public is required in order to achieve sustainable construction in the Zambian Construction Sector.*

Keywords: Sustainable Building Construction, Sustainable Development, Conceptual Framework

1. Introduction

The building and construction sector is of key importance to the development of Zambia and the well-being of its population. Zambia can fulfil the demand for a built environment that meets the needs of the Zambian people through the application of sustainable building and construction (SBC) concepts. The negative environmental impact of buildings on the environment has led to a demand for improved practice. The challenge of implementation of ecological principles to the entire construction projects lifecycle is as a result of such cry and it has been linked to the evolution of a relatively new and evolving concept termed “green building” – sustainable building and construction. Green building has been recognized as an essential practice for improving negative environmental outcomes of buildings. The building sector has been accounted to be responsible for about 25- 40% of energy usage, 30- 40% of material resources consumption, 30- 40% of waste production and 30-40% of greenhouse gases released to atmosphere globally (Umar and Khamidi, 2012). It is further revealed that about 30% of recently built or retrofitted buildings suffer from sick building syndrome which in turn exposes occupants to unhealthy environmental conditions. However, the imperative of environmental performance of building calls for systems that can assess the environmental impact of buildings.

Locally, the Zambia Green Jobs Programme (ZGJP) in collaboration with the National Council for Construction aim to provide technical and development assistance to enable Micro Small and Medium Scale Enterprise (MSMEs) to enhance competitiveness and sustainable business in the construction Industry (Zambia Green Jobs Programme, 2013). The combination of rapid population growth,

urbanization and economic development are putting the African continent at risk with regards to meeting the increasing demands for housing and urban planning (De Boeck, 2013). Although the construction industry could form the bedrock for possible solutions to the developmental challenges (Ebohon and Rwelamila, 2001), accounting for more than 29% of the Gross Domestic Product in Zambia (African Economic Outlook country note on Zambia, 2014) while growing, year-on-year, faster than the already rapidly expanding Zambian economy, their significant contributions to sustainability challenges in society and the biosphere as a whole have been little emphasized in Africa (Adebayo, 2002). The need to develop appropriate strategies and actions to make the construction activities in the region more sustainable is of great importance to society (Djokoto et al., 2014).

Construction industry plays a vital role towards achieving national and international strategies for social and economic development. It contributes towards increasing the GDP, stimulating growth of other industries and creating job opportunities as well as providing societies with facilities and infrastructure projects that meet their needs and fulfil their requirements but having a major impact on the environment because about 50% of the material resources for construction are taken from nature, 40% of energy consumption and 50% of total waste generated (Othman, 2010). The huge consumption of the resources by construction industry has called for sustainable construction in order to meet the present and future needs.

However, current sustainable construction practices are widely different depending on how the concept of sustainable construction is developed in various countries (Thipparat, 2011). The difference between the market

economies, transition economies and developing economies influences its implementation priorities. The mature economies pay attention to a sustainable building stock either by new construction or by refurbishment. In the transition economies the emphasis is on new developments reducing the housing shortage and improving their transportation networks. In the developing economies the social agenda (for example, job creation) is much higher on the agenda than environmental concerns (Thipparat, 2011). Therefore Zambia being a developing economy, with its built environment still developing, measures to promote and start implementing sustainable building construction practices in all manner of construction should be taken well in advance so that future generations are not 'suffocated'. The construction of commercial buildings has continued to grow within Zambia and unless appropriate measures are put in place, development of unsustainable buildings will not stop.

1.1. Sustainable construction

Sustainability is sometimes used interchangeably with green. Green or sustainable supply chain management is defined as the strategic, transparent, integration and achievement of an organization's social, environmental, and economic objectives in the systemic coordination of key inter-organizational business processes for improving the long-term performance of the organization/firm and its supply chain partners (Wu et al., 2012). Sustainable construction is the one in which the construction companies in today's competitive environment understand the needs of current generations and offer them efficient and effective solutions that achieve their objectives without compromising new generations from achieving their own needs (Othman, 2010). Bob Hansen in Dow Corning magazine stated that sustainable construction also aims at ensuring that buildings have long-term purpose even those that are built for one-time events.

Ultimately, the concerns of sustainable construction go beyond the serviceability of a building during its lifetime, but also the recycling of resources to reduce waste streams associated with demolition is also given an important consideration. Increasing energy efficiency for the life of the structure is also a key, as is minimizing waste in the construction of a building through recycling and design. The four principal attributes which construction sustainability depends on are social, economic, biophysical and technical (Xiao, 2005). In the light of achieving sustainable construction, Green Supply Chain Management (GSCM) has been adopted as an antidote (Ojo et al., 2012). Green supply chain management aims to maximize overall environmental profit by adopting a life cycle approach through product design, material selection, manufacturing, and sales and recovery, and therefore helps the organization/firm to realize its sustainable development and improvement (Shi et al., 2012). GSCM has become popular and notable concept in sustainable construction because it largely takes environmental elements into consideration.

The term 'sustainable construction' is generally used to describe a process which starts well before construction (in the planning and design stages) and continues after the

construction team have left the site (Hill and Bowen, 1997). According to the World Commission on the Environment and Development (WCED), sustainability is a form of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability design goes far beyond simply creating products that benefits consumer in terms of better air environment, cost savings and durability, rather effective sustainable design must illustrate a thorough understanding of a full systems approach of products in their environment and interaction, with other products, as well as the effect on many other factors. Sustainability should be viewed as a process and not just a goal that allow a broader evaluation over time of the environmental, economic and societal impacts of buildings products (Ojo et al., 2013). Viewing sustainability as a process is essential for green designs as specifiers are challenged to evaluate the full life cycle of products (Ojo et al., 2013).

The sustainability aspects in the built environment are generally concentrated on reducing the environmental footprint of buildings. Sustainable buildings are assessed by: (1) reduced production of greenhouse gas emissions (particularly carbon dioxide); (2) reduced use of natural resources, in particular, water, gas and electricity; (3) reduced waste production and increased recycling; (4) enhanced building occupant health, comfort, and safety; (5) production of renewable resources; (6) collection of water for potable and non-potable uses; and (7) recycling and treatment of sewage and waste water. Furthermore, sustainable construction can be qualified as a special case of sustainable development targeting the construction industry especially, whose role it is to develop, plan design, build, alter or maintain the built environment, including the building materials manufacturers and suppliers (Adebayo, 2002).

2. Methodology

This study was conducted through a survey research design and made use of both qualitative and quantitative modes of inquiries to investigate sustainable building construction practices in Zambia. The focus of the study was on the commercial buildings newly constructed between 2012 and 2017 within Zambia's Lusaka area which has experienced a steady rise in the number of commercial buildings. The primary data emanated from questionnaires directed to Architects, Engineers, Quantity Surveyors and Property Managers. Further primary data were obtained from semi structured interviews with policy makers in addition to observations made during inspections. Secondary data was collected through review of past work, journal articles, text books and from the internet. The questions were developed through the extensive literature review and the authors experiences within the industry.

A total of 50 buildings were identified for this study in Lusaka area but due to time and resource constraints, the study was restricted to a portion of the targeted population. It focused on 75% of the target population; Burns (2000) recommend a minimum sample of 30 items which were selected through simple random sampling. To maintain uniformity, premises that were sampled were limited to at

least two floors and above. This ensured that the composition of the accessible population had the same characteristics hence homogeneous. Questionnaires designed with closed and open-ended questions were directed to different respondents which included Architects, Engineers, Property Managers and Quantity Surveyors behind the sampled buildings. Further, enquiries were made from policy makers in the building industry particularly from the technical departments of the Government Republic of Zambia: Ministry of Lands and Natural Resources, Ministry of Local government and Housing, Ministry of Housing and Infrastructure Development, Ministry of Works and Supply and Ministry of Energy through direct or personal contact.

Data from questionnaires, observation checklist and interview schedules were coded to assist in analysis. Responses from closed ended questions were assigned numerical values and analyzed quantitatively using mean item score and percentages whereas the open-ended questions were analyzed qualitatively. For closed ended questions, the analysis involved the use of mean item score, frequency count and ranking generated through use of statistical program for social sciences (SSPS) version 25 to generate tables, pie charts, and weighted means. Microsoft office excel was also used to generate other charts and graphs for discussion.

To check on data validity, questionnaires were pretested on a sample that was similar to the actual sample intended for the study and the procedure for pretesting was identical to that which was used during the actual data collection. Further, limiting the sample population in a particular geographical zone (Lusaka) and zeroing in on commercial buildings of at least two floors and above, increased homogeneity and the level of data reliability. With valid and reliable data, the study could be replicated by other researchers within Zambia and in other countries. Conclusions are based on how respondents responded regarding environmental, social and economic merits of sustainable construction and the extent to which these aspects influence decision making within construction industry/contractor firms. By measuring current knowledge, attitudes and practices, recommendations are made which lead to the formulation of a framework that could be adopted to promote sustainable construction in the Zambian Construction Industry.

In all, fifty (50) questionnaires were distributed to various respondents selected for the study. Thirty-five (35) responses were retrieved for data analysis giving the response rate of 70% which indicate an unbiased and higher value of survey. Tables were used for representing descriptive result. The five-point Likert scale (1= not preferred and 5=most preferred) was used to calculate the mean score for each green building rating which was then used to determine its relative ranking in ascending order of agreement. Also, the Likert scale (1=strongly disagree and 5=strongly agree) was used to calculate the mean score for each benefit of green building rating systems which was then used to determine its relative ranking in ascending order of agreement. The averaging statistical analysis was also used to calculate straightforward totals, percentages and averages.

3. Results

Tabulation of Contextual data

Data for this study was collected from 35 respondents of whom 10 were Civil/Structural Engineers or Quantity Surveyors, 8 were Architects, 6 Construction Managers, and 1 was a Real Estate Practitioner. The distribution of role of the respondents 'organization in construction included 40 percent Client/ Client Representative, 28.6 percent contractors, 22.9 percent Consultancy, 5.7 percent Property Development, and 2.8 percent Academia. The bulk of the respondents had 5 to 10 years of experience, representing 54.2 percent of the sample. The proportion of respondents with more than 10 years of experience was reasonably high at 37.2 percent.

Table 1 shows the contextual data of the study sample.

Table 1: Tabulation of contextual sample data

		Frequency	Percentage
Professional Background	Architect	8	22.9
	Construction Manager	6	17
	Civil/Structural Engineer	10	28.6
	Quantity Surveyor	10	28.6
	Land Economist	1	2.9
	Total	35	100
Organizational Role	Contractor	10	28.6
	Consultancy	8	22.9
	Client/ Client Representative	14	40
	Regulatory Body	0	0
	Property Developer	2	5.7
	Academic/Lecturer	1	2.8
Total	35	100	
Work Experience	Less than 5 years	3	8.6
	5 to 10 years	19	54.2
	10 to 15 years	5	14.3
	15 to 20 years	8	22.9
	More than 20 years	0	0
Total	35	100	

Source: Authors (2017)

3.1 Awareness on sustainable building construction

The study revealed that respondents were aware of sustainable construction. All the respondents affirmed awareness to sustainable construction. When asked further about their understanding of sustainable construction, respondents answered in varied ways. There was, however, a general principle that permeated all the definitions. The three sustainability themes of economic, social and environmental stewardship were present in all definitions. All respondents exhibited a good understanding of sustainable construction. The level of awareness among respondents was good. Respondents had acquired knowledge through School, Books/Magazine, Colleagues, and the Internet.

3.2 Level of awareness in sustainable construction

From Figure 1 below, a probe to check the level of awareness in sustainable construction revealed that 30 (86%) of respondents had a good level of awareness with 5 (14%) being excellent.

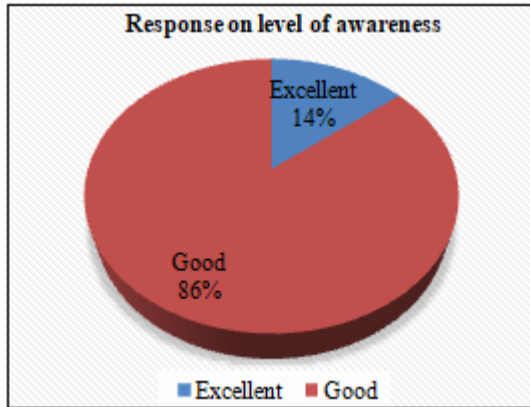


Figure 1: Level of awareness

3.3 Widespread Knowledge of Sustainable construction in Zambia

Respondents disagreed that there was widespread knowledge of sustainable construction. None of the respondents agreed to the statement that there is widespread knowledge of sustainable construction in Zambia. Knowledge among construction officials is good but not across other departments which are not directly involved with construction decisions.

3.4 Sustainable Construction Issues the Organizations Consider versus issues experts Most consider in their Operations

Table 2 of the results is divided in two parts, for the first part, the respondents were asked what their organizations/companies considered in their construction business and shows issues of energy wastage, deforestation and economic development of the society in their operations. However, economic development of the society was considered highest 25 (37%), followed by energy wastage 20 (30%) and deforestation 22 (33%).

Table 2: Sustainable construction issues considered by the organizations and the experts

Sustainable construction issues considered by organizations	Frequency	Percent
Energy wastage	20	30
Deforestation	22	33
Economic development of society	25	37
Total	67	100.0
Issues considered by experts		
Economic	10	25.6
Social	9	23.1
Environmental	20	51.3
Total	39	100

Source: Field research 2017

3.5 Sustainability Issues That Respondents Considered in Their Operations

Based on the second part of Table 2 above, environmental sustainability issues were given more prominence by the experts (respondents) than the others with 20 (51.3%) considerations – which is the ideal situation for the promotion of sustainable construction. Other issues like economic came second with 10 (25.6%) while social issues were considered the least with 9 (23.1%).

Tabulation of Primary sustainable construction concern in connection with operations

Table 3: Sustainable construction in connection with operations

Factors	Responses					RII		
	1	2	3	4	5	Weight	RII	Rank
Disposal of waste or by products	0	5	3	22	9	152	0.779	1st
How to save power or electricity	0	10	1	17	11	146	0.749	2nd
How to conserve water	0	8	15	8	8	133	0.682	4th
Safety at work place	0	7	4	21	7	145	0.744	3rd
How to stimulate local economy	0	0	26	11	2	132	0.677	5th
How to conserve wildlife	0	1	27	7	4	131	0.672	6th

Source: Authors Field Survey, 2017

Rank: [5-Strongly agree, 4-Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree]

This section assessed the primary issues which were considered by construction professionals in connection with their operations. It sought the agreement or disagreement of respondents to some key considerations in sustainable construction and considered which of the measures were considered most. Disposal of waste appeared to be the key issue considered most with a relative importance index (RII) of (0.779). The least considered issue was conservation of wild life with a relative importance index (RII) of (0.672). Furthermore, socio-economic issues had a low relative importance index (RII) of (0.677) in 5th place.

3.6 Challenges Affecting Sustainable Construction in Zambia

This section sought to measure the extent of agreement by respondents to the challenges of sustainable construction in the literature review. It aimed at establishing whether the construction industry professionals could identify with those challenges. Respondents identified with the following challenges (1) lack of public awareness, (2) lack of interest in the issue of sustainability, (3) poverty and perceived high cost of initial investment, (4) lack of research into sustainable construction, (5) lack of capacity of the construction sector, (6) little incentive for professional officers, (7) resistance to technology, (8) turbulent economic environment, and (9) lack of accurate data.

Table 4: Challenges affecting Sustainable construction in Zambia

Challenges	Responses					Relative Importance Index (RII)		
	1	2	3	4	5	Weight	RII	Rank
Lack of public awareness	0	0	0	128	35	163	0.836	1st
Lack of interest in the issues of sustainability	0	0	6	128	25	159	0.815	2nd
Poverty and perceived high cost of initial investment	0	2	3	128	25	158	0.810	3rd
Lack of research into sustainable construction	0	8	9	120	10	147	0.754	4th
Lack of capacity of the construction sector	0	12	6	112	15	145	0.744	5th
Little incentive for professional officers	0	6	27	108	0	141	0.723	6th
Resistance to technology	0	20	15	96	0	131	0.672	7th
Turbulent economic environment	0	48	15	40	0	103	0.528	8th
Lack of accurate data	0	52	12	36	0	100	0.513	9th

Source: Authors 2017

Rank: [5-Strongly agree, 4-Agree, 3-neutral, 2-Disagree, 1-Strongly Disagree]

According to the ranking above, the top three challenges of sustainable construction are Lack of public awareness, lack of interest in sustainability issues with poverty and perceived high cost of initial investment. Lack of public awareness was ranked highest and was identified by respondents as the major challenge in promoting sustainable construction. It was ranked 1st among the other challenges. They least identified with lack of accurate data as a challenge.

3.7 Measures Undertaken to Mitigate Challenges

Table 5: Measures against challenges

Response	Frequency	Percent
Education to adopt to situation	39	86.7
Vegetation reforestation	6	13.3
Total	45	100

Source: Authors 2017

Two key issues were dominant as measures taken by construction officials to mitigate the challenges of sustainable construction. These issues were education to adapt to situation and vegetation restoration. Most respondents undertook education to adapt to situation with 86.7% as a way of mitigating the challenges of sustainable construction, while Vegetation reforestation was also used with (13.3%). In other words, stakeholder sensitization was done mostly along with vegetation reclamation. This is to whip up public support, understanding and interest.

4. Discussion

Here, the following sub-headings will be discussed from the results of the study:

- a) The current construction (building) practices in Zambia.
- b) Main challenges in implementing sustainable construction practices in the Zambian Construction Industry.

4.1 The current construction (building) practices in Zambia

The Building and construction sector is of key importance to the development of Zambia and the well-being of its population. Zambia can fulfil the demand for a built environment that meets the needs of Zambian people through the application of sustainable building and construction (SBC) concepts. The results of this study indicate that, 86% of the respondents have a good level of

awareness on sustainable construction. The level of knowledge on sustainable construction is high and penetrating based on the findings above. This therefore gives a solid ground preparation for measures to improve on sustainable construction. The aim of achieving a sustainably built environment calls for excellency, to which, according to the finding on awareness only 14% meet that threshold. This means that, Officials dealing with construction have appreciable knowledge on sustainable construction but there is the need to do more for the translation of this knowledge into tangible sustainably constructed buildings. The results further indicate that, there is no widespread knowledge of sustainable construction in Zambia. Knowledge among construction officials is good but not across other departments which are not directly involved with construction decisions.

Construction companies attach a higher value on the economic gain that the building will have to society and neglect to consider if the needs of the present would not be compromising the ability of future generations to meet their own needs. From the results, 37% of construction organizations/companies considered economic development of the society as a priority when it came to sustainable construction matters. This was followed by deforestation 33%, and energy wastage 30%. This is true to the general belief that developing countries – Zambia inclusive – concentrate less on environmental sustainability issues but more on social and economic factors (Ojo et al., 2013). The construction industry is vital for the economic development of any society or nation (African Economic Outlook country note on Zambia, 2014). This according to sustainable construction does not mean, the construction industry most prioritize economic gains at the expense of the environment which is the bedrock of sustainability. The results indicated that 51.3% suggested environmental sustainability issues to be given more prominence when it came to sustainable construction.

The study further investigated the primary issues that were considered by the professionals in the construction industry in Lusaka in connection with their operations in order to have a full depiction of the current situation of sustainable building construction. From the results, the disposal of waste with a relative importance of 0.779 was considered as the most practised in sustainable construction while the least was conservation of wild life having a relative importance index of 0.672. This is a depiction that sustainable commercial building construction in Lusaka is above

relative importance index of above 0.5 but way less than 0.85 which is not good but not very poor/ bad at the same time. This is a clear indication of the potential and progression of the Zambian construction industry to fully go green.

4.2 Main challenges in implementing sustainable construction practices in the Zambian Construction Industry

The construction industry is complex in its nature because it comprises large numbers of parties as owners (clients), contractors, consultants, stakeholders, and regulators. Despite this complexity, the industry plays a major role in the development and achievement of society's goals. According to the results, lack of public awareness with a relative importance index of 0.836 was ranked highest and was identified by respondents as the major challenge in promoting sustainable construction. This was followed by a relative importance index of 0.815 for lack of interest in the issue of sustainability by all parties involved. The third challenge is poverty and perceived high cost of the initial investment for constructing a sustainable building, having a relative importance index of 0.810. These three mentioned challenges have a significantly high relative importance index and are the top impediments to sustainable building construction in Zambia. From the results the other major challenges of sustainable construction are: lack of research into sustainable construction; lack of capacity of the construction sector; little incentive for professional officers; resistance to technology; turbulent economic environment; and lack of accurate data.

The study further investigated what has been done to eradicate the above challenges and the first thing that the professionals in the construction industry – 87% of them – did was to get an education on sustainable construction in order for them to easily adapt to the 'new norm' of green construction. The statement, education on sustainable construction complements a number of fields such as environmental education, multicultural education, conservation education, global change education, ecological literacy education, as well as sustainable engineering in broad terms. This is a process that develops apprentice (student/learner) awareness, competence, attitudes and values, enabling them to be effectively involved in sustainable development at local, national and international levels, helping them to work towards a more equitable and sustainable future. In particular, it enables apprentices to integrate environmental considerations into economic

decision-making. For example, when one understands that buildings, not automobiles, emit most of the carbon dioxide (CO₂) in the United States and that the average house is 45% bigger now than it was 31 years ago (Montoya and Trethewey, 2009), they can begin to understand the role they play in environmental sustainability. In order to make such information accessible and relevant to students, it is imperative that academics in engineering, construction, education, and other disciplines heed the call for sustainable technologies, policies, and practices.

5. Conclusion

In conclusion, Construction Engineers make decisions that often have a critical impact on the environment and society. This enhanced ability to impact others makes sensitivity to ethical and social concerns a must in the construction engineering profession. Obviously, sustainable construction requires fresh knowledge and learning within the construction industry, because firm's innovativeness not only improves client's satisfaction, competitive advantage and profitability, but is also a vital procedure in sustainability adoption in an organization. The results of the study indicate that, there is a good level of awareness on sustainable construction but does not meet the excellency threshold which sustainable construction needs in order to thrive in the society. Economic development is prioritized over the environment and social aspects of sustainable construction when organizations implement construction projects. The professionals in the industry feel environmental aspects should be given priority when implementing construction projects if there is to be sustainable construction. Lack of awareness by the public on all matters to do with sustainable construction is the number one challenge in the implementation of sustainable building construction. The other challenge is lack of interest from all parties involved to make green construction a fully realized reality. There is potential and progression of the Zambian construction industry to fully go green. The framework that should be adopted when implementing construction projects has been formulated and is under the recommendation section.

6. Recommendation

A framework and strategies that could be taken to promote sustainable construction in the Zambian Construction Industry

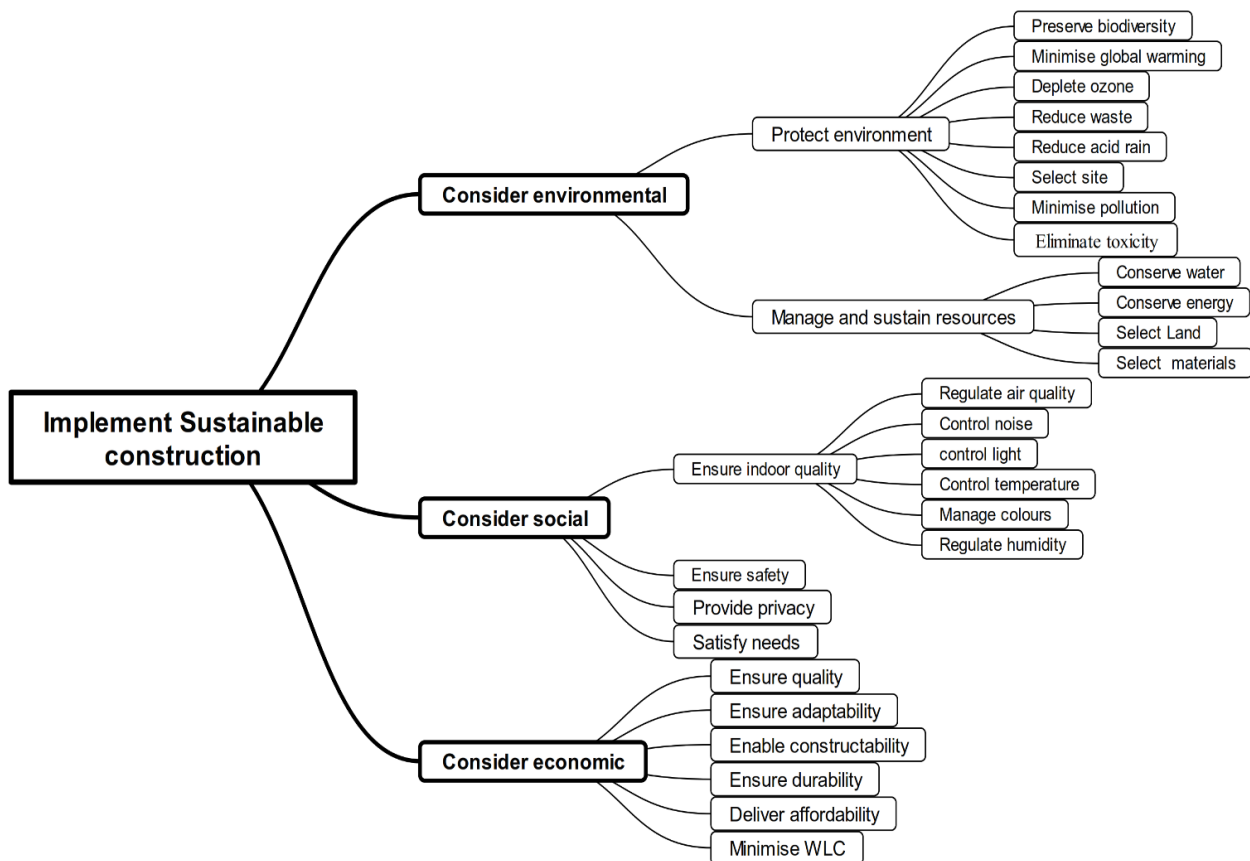


Figure 2: A framework that should be adopted when executing any construction

A sustainable construction action plan with well-defined targets and strategies such as reducing waste, carbon emissions, energy and water consumption, delivering social benefits through procurement should be put in place. This action plan will include various strategies and measures such as using sustainable materials, energy efficient technology, buying raw materials like timber from sustainable sources and the use of labor-based construction techniques which will create employment. This will encourage participation of local enterprises and achieve economic and social objectives of sustainable construction.

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