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Sustainable Construction Practices Challenges- A Stakeholders Perspective

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Abstract

Sustainable construction practices not only benefits government, environment and occupants but it secure the earth for future generations to come. Thus the paper discussing sustainable construction practices challenges in the construction industry of South Africa. Structured questionnaires were distributed to different construction companies and construction professionals. From the 75 questionnaires distributed, 60 were brought back and they were all valid and usable. Findings from the survey results obtained from the chosen respondents revealed that there is a lack of training in an organization regarding sustainable construction, lack of awareness of sustainable construction practices, lack of sustainable environmental materials, changes in material prices and escalations, lack of accessible guidance, lack of technical skills, resistance to change in adoption and material scarcity. The construction industry needs to promote and create more workshops on sustainable construction practices so that more stakeholders would be aware of its benefits and incentives should be provided to organization that are implementing sustainable construction. Furthermore, the implementation of construction principles can be achieved successfully if all the construction stakeholders participates from design to completion of the project with the assistance of knowledgeable project manager on sustainable construction practices. The study will contribute to the body of knowledge by increasing more awareness of SC to professionals in order to be implemented.

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Keywords: Challenges; Construction industry; Sustainable construction; sustainable construction practices (SCPs); construction industry; South Africa.

1. Introduction

According to the Green Building Council of South Africa (GBCSA)[1], sustainable construction practices are good for the environment including the occupants of the building. The main goal of sustainable construction are driven by four factors namely minimizing the impacts of construction materials on the earth, minimizing the impacts during the period when the building is occupied and making sure that the occupants have a favorable living experience, minimizing the impact of the construction when the building is being demolished [2]. Sustainable construction practices does not benefit government, environment and occupants only but it secures earth for future generations to come [3].

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2. Construction Industry

The construction industry provides us with good infrastructure [4]. However, the construction industry has a negative impact on the environment which should be taken into consideration. [5] stated that construction has a detrimental effect on the environment. Research has shown that the environmental impacts of construction activities are grave and must be minimized [6]. Infrastructure and the construction industry contribute to 60% of raw materials extracted globally [7]. Construction plays a vital role in providing infrastructure for society while having negative impact on the environment and resulting to the depletion of resources [8]. The materials used during construction contribute greatly to depletion of natural resources [9]. The processing of material requires energy and could result in waste generation, materials that are sourced elsewhere require transportation and this leads to an increased energy consumption, in a long term this will have an impact on the environment [10]. These impacts occur from the onsite phase, to operational phase of the building until the demolition phase of the building, all these cycles of a building have an impact on the environment [11].

3. Sustainability

Sustainability refers to three aspects which are ecological, economic and social wellbeing [8], it also governs decisions concerning building materials. The aim of sustainability is to preserve raw materials, while promoting the effective use of energy and water, and the prevention of environmental degradation caused by the infrastructures that are being constructed [12].

4. Sustainable Construction (SC)

[12], describes the concept of sustainable construction as the present needs being met without limiting resources for future generations. SC is concerned with making eco-efficient and environmentally friendly buildings, this can start from the decision of which transport and materials must be used that will minimize the impact on the environment [10]. Hence, there must be policies put in place for material selection [13]. According to [14] companies can save money and benefit the environment significantly by sourcing the materials locally and making few trips from the supplier. Moreover, this process can help decrease the emissions, also reduce the carbon foot print by considering environmentally friendly alternatives for materials. The principles of SC must be applied in all the construction stages until demolition as well as the management of the resultant waste [11]. Stakeholders and the client must take responsibility of their role in mitigating the problem encountered with traditional buildings and adapt to the sustainable construction practices while maximizing the economic benefits [15].

SC practices have great benefits for the environment [16], therefore, the concepts and technologies that have a function to achieve sustainability as well as yield great satisfactory results during and after construction are: Lean construction; Building information modelling (BIM); Construction ecology; Biomimicry; Value management; Ecological economics; Life cycle costing; Life cycle assessment; Industrial building system (IBS); Nanotechnology; Ecological footprint; Design for the environment.

5. Sustainable Construction Practices Challenges

Different countries and industries are looking for ways to reduce climate change, pollution and their impact on the world's ecology [17]. The implementation of sustainable construction has been unsuccessful in many countries due to the challenges that limit the successful implementation of SC. According to [16], the sustainable construction technologies are very expensive and costly due to the limitation of the components not being sold locally. The adoption of sustainable construction practices is client driven [18], a client with good knowledge of the benefits will encourage the use of the practices but due to lack of awareness clients do not have knowledge on some practices and decided to continue with traditional buildings.

The challenges that limit the implementation of sustainable construction practices are: The lack of training among construction stakeholders with regards to sustainable construction; The lack of participation from the government; The lack of knowledge regarding the legal aspects and regulations; The lack of understanding of sustainable practices by the client; The lack of financial and economic risks assessments in client organization; Lack of financial incentives; Resistant to change ;Misconceptions about sustainable construction practices; Lack of sustainable materials; Lack of public awareness. According to [11], the challenges of implementing some of the SC practices such as lean construction were: administrative view point, lack of legislation, lack of specialised angle and attitudinal perspective. Lack of knowledge on sustainable practices [16]. [19] observed negative perception as a challenge, therefore, better client perception will result in better understanding and demand of sustainable construction practices. SC can be introduced during the planning and design stage, engineers must have knowledge of SC as to minimize the environmental impact and incorporate sustainable construction [18]. Technologies like BIM are being used for planning and quality assurance procedures using software but barriers limiting the implementation are poor management and communication, the lack of availability of software, the lack of calibration and uniform procedures and the cost to implement such technologies [20; 17]

6. Research Methodology

6.1. Research area- Mpumalanga Province

Mpumalanga means the place of the rising sun and people are drawn to the province by its magnificent scenery, fauna and flora. The province is the second smallest province in South Africa yet it has fourth –largest economy. It's situated mainly on the high plateau grasslands of the middleveld. Mpumalanga has network of excellent roads and railway connections thus making it highly accessible [21]. The province is a tourism destination and it's a home, of over 4 million people, the principal languages are siSwati and isiZulu. The province is a summer-rainfall area divided by the escarpment into the Highveld region with cold frosty winter and lowveld region with mild winters and subtropical climate. Mpumalanga is the second largest citrus producing area in South Africa and is responsible for one third of the country's export in oranges. Mpumalanga is very rich in coal reserves. The province house the country three major power stations, of which are the largest in the southern hemisphere [21].

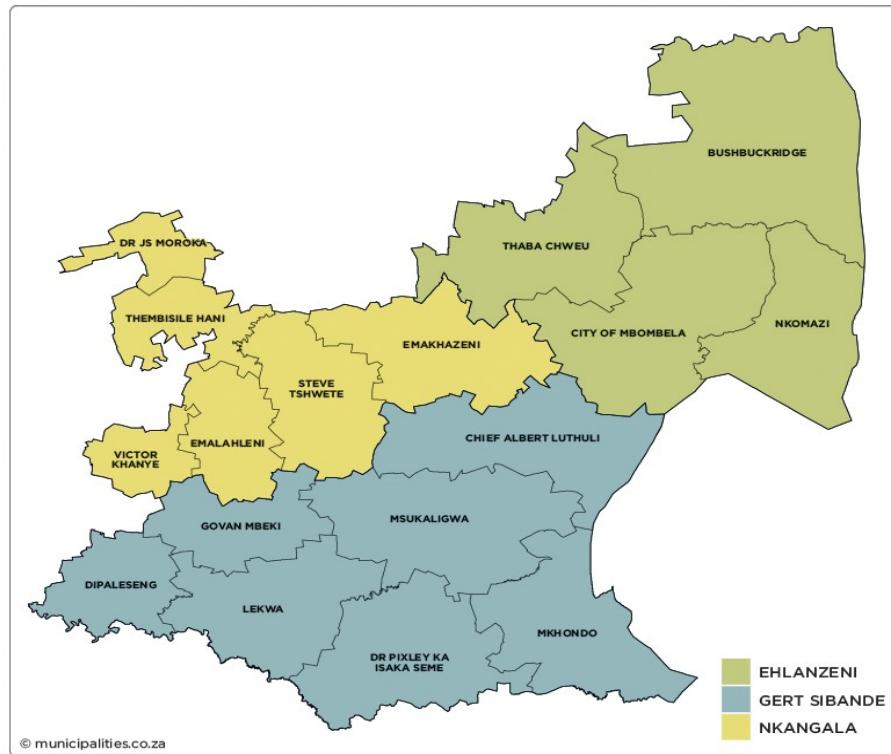


Figure 1: Mpumalanga map

6.2. Research area- Mpumalanga Province

Quantitative approach method was adopted to investigate a stakeholder's perspective on the challenges of implementing sustainable construction practices. The study was carried out in Mpumalanga Province of the Republic of South Africa. 75 Questionnaires were distributed and 60 were brought back which were all valid and usable. A well-structured questionnaire was distributed to different construction companies in the Mpumalanga Province, amongst construction professionals such as civil engineers, project managers, directors, quantity surveyors, construction managers and contractors who are register on the CIDB data base. The questionnaires were sent via e-mails, some were delivered to the known construction companies by the researcher and some were distributed during site clarification meetings of contractors and consultants bidders in Mpumalanga Province. The study was conducted from reliable scholarly sources such as articles, journals, books, publications, websites and site experience on the field.

6.3. Research area- Mpumalanga Province

5- point linkert scale was adopted for the study which gave a wider range of possible scores and increase statistical analyses that are available to the researcher. The first linkert scale read is on agreement form as follows:

- 1- Strongly Disagree (SD)
- 2- Disagree (D)
- 3- Neutral (N)
- 4- Agree (A)
- 5- Strongly Agree (SA)

The 5 point scales were transformed to mean item score abbreviated as (MIS).

6.4. Computation of the mean item score (mis)

The computation of the mean item score (MIS) was calculated from the total of all weighted responses and then relating it to the total responses on a particular aspect. The mean item score was adopted to rank the factors from highest to lowest. The Mean Item Score (MIS) is expressed and calculated for each item as follows:

$$\text{MIS} = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{\sum N}$$

Where;

- n₁ = number of respondents for strongly disagree
- n₂ = number of respondents for disagree
- n₃ = number of respondents for neutral
- n₄ = number of respondents for agree
- n₅ = number of respondents for strongly agree
- N = Total number of respondents

7. Findings

7.1. Challenges of sustainable construction practices

The challenges of implementing sustainable construction practices in the Mpumalanga province construction projects were identified as the lack of training in the organization which was ranked number one with (MIS=4.30 & STD=0.941); lack of awareness of sustainable construction practices was ranked second with (MIS=4.24 & STD=0.949); lack of environmentally sustainable materials and change in material prices and escalation were ranked third with (MIS=4.19 & STD=0.989 and 0.993 respectively); lack of accessible guidance was ranked fourth with (MIS=3.97 & STD=0.810); lack of technical skills was ranked fifth with (MIS=3.85 & STD= 0.998); resistance to change in adopting new practices was ranked sixth with (MIS=3.81 & STD=0.761); material scarcity and delay in decision making were ranked seventh with (MIS= 3.72 & STD=0.968 and 0.784 respectively); the price of implementing the practices and client worries profitability were ranked eight with (MIS=3.70 & STD=0.808 and 0.946 respectively); lack of incentives from the government was ranked ninth with (MIS= 3.69 & STD=0.838); lack of client demand was ranked tenth with (MIS=3.66 & STD=0.893); the fragmented nature of the industry was ranked eleventh with (MIS=3.56 & STD=0.981); lack of awareness of the benefits was ranked twelve with (MIS=3.54 & STD=0.815); potential time factor involved in implementation of new practices and lack of government support was ranked thirteen with (MIS=3.51 & STD=0.942 and 0.927 respectively); poor management and communication was ranked fourteen with (MIS=3.44 & STD=0.922); lack of awareness among professionals and human attitudes towards change was ranked fifteen with (MIS=3.41 & STD=0.818 & 0.922 respectively).

Table 1: Sustainable Construction Practices Challenges

Barriers	Mean	Standard deviation	Rank
Lack of training in the organization	4.30	0.941	1
Lack of awareness of sustainable construction practices	4.24	0.949	2
Lack of environmentally sustainable materials	4.19	0.989	3
Change in material prices and escalations	4.19	0.993	3
Lack of accessible guidance	3.97	0.810	4
Lack of technical skills	3.85	0.998	5
Resistance to change in adopting new practices	3.81	0.761	6
Material scarcity	3.72	0.968	7

Delay in decision making	3.72	0.784	7
The price of implementing the practices	3.70	0.808	8
Client worries profitability	3.70	0.946	8
Lack of incentives from the government	3.69	0.838	9
Lack of client demand	3.66	0.893	10
The fragmented nature of the industry	3.56	0.981	11
Lack of awareness of the benefits	3.54	0.815	12
Potential time factor involved in implementation of new practices	3.51	0.942	13
Lack of government support	3.51	0.927	13
Poor management and communication	3.44	0.922	14
Lack of awareness among professionals	3.41	0.818	15
Human attitudes towards change	3.41	0.922	15

8. Conclusion

Lack of training in an organisation, lack of awareness of sustainable construction practices, lack of environmental sustainable material, change in material prices and escalation, lack of accessible guidance were the top challenges of sustainable construction. Therefore, the government of South Africa is expected to conduct more workshops and training regarding SC to create more awareness among stakeholders. Since , in South Africa the adoption of sustainable construction practices is client driven its not a government mandate or a policy as yet, hence, the client must also attend such awareness training . Once the client has good knowledge of the benefits will encourage the use of the practices in their projects. Therefore, lack of awareness clients do not have knowledge on some practices and decided to continue with traditional buildings. It is recommended that contractors or companies who are already implementing the practices be encouraged through incentives or those construction material that promote sustainable construction be tax free and they must be readily available for the public to use.

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