Investigating the level of awareness of building assessment tools in the construction industry of Botswana

INVESTIGATING THE LEVEL OF AWARENESS OF BUILDING ASSESSMENT TOOLS IN THE CONSTRUCTION INDUSTRY OF BOTSWANA

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Environmental building assessment tools have been developed to measure how well or poorly a building is performing, or likely to perform, against a declared set of criteria, or environmental considerations, in order to achieve sustainability principles. Knowledge of environmental building assessment tools is therefore important for successful design and construction of environmentally friendly buildings for countries. The purpose of the research is to investigate the knowledge and level of awareness of environmental building assessment tools among industry practitioners in Botswana. One hundred and seven paper-based questionnaires were delivered to industry practitioners, including architects, engineers, quantity surveyors, real estate developers and academics. Users were asked what they know about building assessment, whether they have used any building assessment tool in the past, and what they perceive as possible barriers to the implementation of environmental building assessment tools in Botswana. Sixty five were returned and statistical analysis, using IBM SPSS V19 software, was used for analysis. Almost 85 per cent of respondents indicate that they are extremely or moderately aware of environmental design. Furthermore, the results indicate that 32 per cent of respondents have gone through formal training, which suggests 'reasonable knowledge'. This however does not correspond with the use of the tools on the ground as 69 per cent of practitioners report never to have used any environmental building assessment tool in any project. The study highlights the need to develop an assessment tool for Botswana to enhance knowledge and further improve the level of awareness of environmental issues relating to building design and construction.

Keywords: Sustainability, Building Assessment Tools, Construction Industry, Botswana.

INTRODUCTION

Concerns about the negative impact of buildings on the environment have stimulated interest in the development and use of environmental building assessment tools. Environmental building assessment tools assess the impact of buildings on the environment such as CO2 emissions from the buildings energy use. Therefore the assessment tools improve knowledge and environmental performance of building stocks (Reed et al., 2011). During the building's stages of design, construction and use, environmental building assessment tools gather information and report on performance (Mateus and Bragança, 2011). The information is on performance of various attributes including resource usage, waste, pollution and energy and water efficiency. Accordingly environmental building assessment tools share the primary

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objective of stimulating the market demand for buildings with improved environmental performance (Lee and Burnett, 2006).

Knowledge of environmental building assessment tools and their assessment criteria is essential for their successful implementation. Goh and Rowlinson (2013) argue that training on environmental building assessment tools is essential to understand their contents. Hence, knowledge and awareness of green buildings practices and environmental building assessment tool's assessment criteria in particular is important (Todd et al., 2013). The tools however can improve users understanding of environmental design in buildings.

The purpose of this study is to investigate the level of knowledge and awareness of the role of environmental building assessment tools in the Botswana construction industry. To achieve this, the following objectives have been considered; to assess user's awareness on environmental design and the source of knowledge of such awareness, to develop an understanding of their knowledge of building assessment and design using environmental building assessment tools, to determine how users perceive the importance and use of environmental building assessment tools and finally investigate possible barriers as perceived by users or potential users. This was to establish the basis for potential use of an environmental building assessment tool by the users in Botswana. In the context of the paper, building assessment is carried out to assess a building's ability to demonstrate its contribution to sustainable development by providing greater satisfaction to users, enhance and better protecting the natural environment and be water and energy efficient. Environmental building assessment tools are used primarily for these purposes.

ENVIRONMENTAL BUILDING ASSESSMENT TOOLS

Environmental assessment of buildings measure how well or poorly a building is likely to perform, against a declared set of criteria or environmental considerations (Cole, 2005). They can be broadly classified as qualitative or quantitative tools (Reijnders and Roekel, 1999). Qualitative tools are based on auditing of buildings as a whole and putting a score to each investigated parameter resulting in one overall score of a building (Forsberg and von Malmborg, 2004). Scoring in this regard emphasizes different aspects of environmental performance (Reijnders and Roekel, 1999). Quantitative tools on the other hand use a physical life cycle approach, focusing on aspects of a building like energy, indoor environment, building materials etc.in a fragmented manner (Forsberg and von Malmborg, 2004) .Various qualitative environmental building assessment tools exists worldwide such as the UK Building Research Establishment Environmental Assessment Method (BREEAM),US Leadership in Energy and Environmental Design (LEED), Green Star Australia, Singapore Green Mark, SBTool, South African Sustainable Building Assessment Tool (SBAT) and Japanese Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), all of which are relevant to the country of design and use.

The use of environmental building assessment tools generally promotes sustainability in the built environment. Reed et al. (2011) argue that they improve sustainability knowledge in each country's building stock. Moreover Cole (2012) point out that the tools are instrumental in mainstreaming green building practices. Besides defining the attributes of green buildings in practice, Todd et al. (2013) argue that they promote market transformation. The tools have been used extensively in their countries of origin possibly to transform markets and improve green building practices. BREEAM

and LEED are regarded as market leaders and to date have certified over 250 000 buildings and 44 270 projects respectively in the UK and US (BRE, 2014, USGBC, 2013).

Despite these positive uses, there are perceived shortcomings of use of environmental building assessment tools. Reed et al. (2011) asserts that the use of environmental building assessment tools is a complex process crippled by bureaucracy, and consequently is prohibitively expensive. Moreover, they tend to be used as checklists for scoring points rather than promoting sustainability. The tools follow the specific country's building regulations and other guidelines like the quality standards (Haapio, 2012). As a result, performance requirements of the tools are different across countries. The different performance requirements could yield different performance results or attributes. Therefore there are different principles and concepts of building performance, which creates complications for those who want to invest in property in different markets (Dixon et al., 2008). In spite of the challenges, environmental building assessment tools are used actively in construction industries across the world.

BOTSWANA CONSTRUCTION INDUSTRY

Economic and Employment Contribution

Botswana has experienced a steady economic growth since independence in 1966. In June 2011 total workforce was estimated at 387,426 employees (CSO, 2012). Of these, 23,347 were employed in the construction industry. Since 2004 to 2011 the construction industry contribution to total employment has been more than 5%. The construction industry's contribution towards GDP has also been averaging 5% between the years 2004 and 2011.In 2011 the construction industry contributed about 7.4 billion Botswana Pula to the national economy (BOB, 2012) (1Botswana Pula=0.071 British Pound).

Size of the Industry

Firms that intend to undertake public works are required to register with the Botswana Public Procurement and Asset Disposal Board (PPADB). PPADB classify construction firms into different categories according to their financial and human resources, skills and experience relating to past or similar projects. The contractors are classed into classes OC, A, B, C, D and E. Class OC is the lowest and E is the highest for building works. At the time of the study there were 1767 construction firms registered in all classes (PPADB, 2013). Consultants on the other hand are not classified on any size but rather on speciality. They are registered as consulting firms who provide architectural, building engineering, project management, quantity surveying, electrical and mechanical engineering services. Likewise there were 193 such firms registered with the PPADB at the time of the study.

Environment Legislation

The Ministry of Environment, Wildlife and Tourism has the overall responsibility of formulating and implementing environmental legislation. The current legislations were not specifically formulated for the construction industry but there are some that have nonetheless been applicable to the industry. These include; Environmental Impact Assessment Act 2011Mines and Minerals Act 1977, Waste Management Act 1999, Atmospheric Pollution Prevention Act 1971 and National Monuments and Relics Act (DEA, 2013). The main legislation used for construction activities is the Environmental Impact Assessment Act.

METHODOLOGY

The study investigates the importance of knowledge and awareness of environmental building assessment tools by construction industry practitioners for successful implementation. A questionnaire survey was used in this study. The choice was made because questionnaires can be sent to many people who can fill them anonymously (Leedy and Ormrod, 2013). Furthermore they provide a reduced risk for bias due to the presence of the researcher, have wider coverage, and offer stable, consistent and uniform information with less variation (Sarantakos, 2005). The questionnaire comprised of four parts. Part one requested the profile of respondents. Part 2 was intended to ask respondents to rate their environmental awareness and the main source of that information. Part 3 asked respondents about their understanding of building assessment and its importance. Also they were asked about their knowledge of building design using environmental building assessment tools and the possible barriers to the implementation of environmental building assessment tools. Part 4 asked respondents about attributes that are important to assess environmental performance of buildings. All survey data was examined and analysed using IBM SPSS V19 software. A pilot study was conducted prior to the main study to test the suitability of the questionnaire

Forsberg and von Malmborg (2004) identified local authorities, architects, designers, consultants, building owners, investors and contractors as the main decision makers intended to use building assessment tools. It was the endeavour of the study to target those groups who have influence on the use of the assessment tools. Consequently in the study, groups of users including, building engineers, architects, construction/project managers, private developers, quantity surveyors, environmentalists, real estate developers, government employees and academics were purposively invited to complete the questionnaire. A total one hundred and seven questionnaires were distributed and sixty five were returned back as per Table 1.

Table 1: Summary of Respondents

Category	Respondents
Building Engineers	25
Architects	8
Quantity Surveyors	15
Construction/Project Manager	4
Private Developer	1
Government Employee	1
Researcher	1
University Lecturer	7
Others (Quality Controller)	3
Total	65

IBM SPSS V19 software was used for analysis and mostly data was analysed with descriptive statistics. The non-parametric Kruskal-Wallis test was conducted to determine whether there were statistically significant differences between users regarding knowledge of building design using environmental building assessment tools and their importance in design and construction. This was to determine whether

there was any bias in rating from any categorised group and how significant it was. The Kruskal-Wallis Test tests whether the distribution of ordinal variables is the same in three or more groups by comparing the sum ranks (Norusis, 2002). Testing was done at 5% significance level. The grouping variable was position in the organisation. The study reports preliminary findings on an on-going research.

RESULTS AND DISCUSSIONS

Environmental Awareness

Responses show that 30.6% of the respondents are extremely aware of environmental issues pertaining to building design and construction (Figure 1). Majority of respondents (58.1%) however report moderate awareness. The remaining 11.3% were somewhat and slightly aware. There was no respondent who responded that they were not aware. There were however three respondents who did not answer the question so it is probable that they were not aware as well or they just missed the question. The level of awareness from the results indicates that in theory users understands the concepts of environmental building assessment tools.

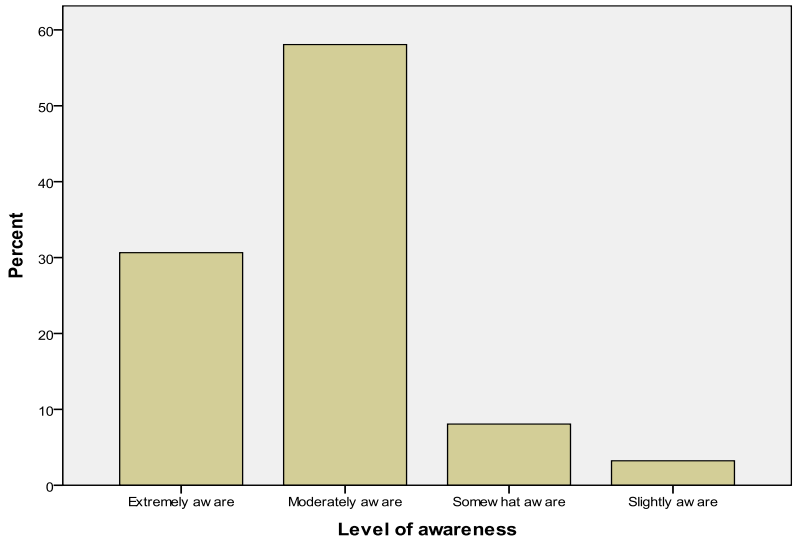

Figure 1: Level of Awareness

It was important to find where users get knowledge and awareness of environmental issues pertaining to building design and construction. As shown from Table 2, respondents reported the three main source of information as from building regulations, personal research and formal training. Formal training was reported in 32.3% of the cases which perhaps is indicative of reasonable knowledge. Building regulations was reported in 49.2% of the cases. This somehow suggests the building regulations include relevant information for environmental design and construction and perhaps could be relevant for use if an environmental building assessment tool could be introduced for use. Personal research at 36.9% of cases may suggest users have interest on environmental issues relating to building design and construction. The results points to interest of users on environmental issues related to building design and construction.

Table 2: Source of Information

Source of Information	Responses		Per cent of cases (%)
	N	Per cent (%)	
Formal Training	21	17.2	32.3
Building Regulations	32	26.2	49.2
Personal Research	24	19.7	36.9
Media Articles	18	14.8	27.7
Short Courses/Conferences/Seminars	10	8.2	15.4
Co-Workers	9	7.4	13.8
Clients	6	4.9	9.2
Other Sources	2	1.6	3.1
Total	122	100	187.7

Building Assessment

To appreciate the importance of using environmental building assessment tools, users have to understand what building assessment is. To assess the understanding of respondents regarding building assessment, respondents were asked "what they understood by the term building assessment and its importance to the construction industry?" The responses were varied and categorised into five themes including compliance to codes, feasibility study, building performance, quality assurance and environment protection. A combined 40% of responses mentioned that building assessment is primarily assessing the performance of buildings and protecting the environment as indicated in Figure 2.

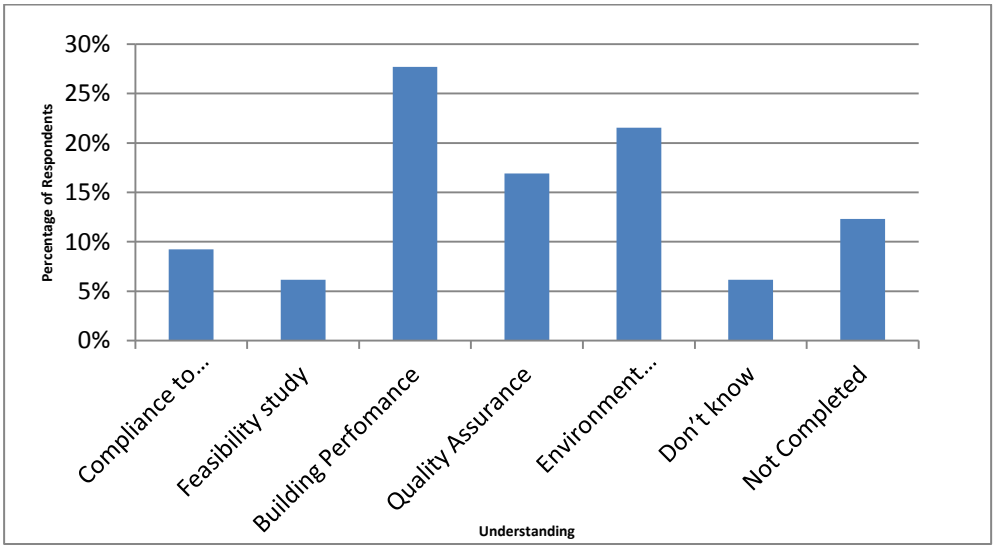

Figure 2: Users Understanding of Building Assessment

Most of the responses mentioned building assessment is monitoring the performance of buildings. Some of the excerpts from three users to illustrate this are recorded below:

Respondent 6: "It's about assessing the buildings in terms of the designs, environmental impacts as well as construction. It is important especially for quality assurance and environmental friendliness"

Respondent 2: “Building assessment is very broad but could mean checking for compliance to design codes and assessment for rating on standards e.g. LEED”

Respondent 16 “Enables the developer to determine materials used on the building and its effect on the environment”.

In the context of the paper building assessment is carried out to assess a building’s ability to demonstrate its contribution to sustainable development by providing greater satisfaction to users, enhance and better protecting the natural environment and be water and energy efficient. The responses from users indicate that they are aware of the rationale of building assessment and attribute it mostly to assessing the performance of a building in view of protecting the environment and satisfying stakeholders through quality assurance of the building.

Knowledge of Building Design Using Environmental Building Assessment Tools

To design adequately for the environment, designers need to have adequate knowledge of using environmental building assessment tools. From Table 3 69.8% of respondents reported sufficient to excellent knowledge of building design using environmental building assessment tools. 27% reported they have insufficient knowledge and 3.2% reported they did not know of building design using environmental building assessment tools. A Kruskal Wallis Test revealed no statistically significant difference in rating of knowledge of building design using environmental building assessment tools across the sampled groups, $\chi 2 = 6.765$, df =8, p=0.562.

Table 3: Knowledge of building design using assessment tools

Rating	Frequency	Valid %	Cumulative %
Excellent	6	9.5	9.5
Good	20	31.7	41.3
Sufficient	18	28.6	69.8
Insufficient	17	27.0	96.8
Do not Know	2	3.2	100.0

Test Statistics

Kruskal Wallis Test

$\chi 2 = 6.765$, df =8, p=0.562

Importance of Environmental Building Assessment Tools in Design and Construction of Buildings

In order to find the importance of environmental building assessment tools in design and construction of buildings, respondents were asked to rate on a scale of 1-5. One meant that environmental building assessment tools are not important and should not be a priority in design and construction while five meant that it was a priority. The results in Table 4 show that majority of the respondents believe that environmental building assessment tools are important in the design and construction of buildings. 68.9% of respondents rated 4 or 5 while the remaining 31.1% rated 3 or below. A Kruskal Wallis Test revealed no statistically significant difference in rating of importance of environmental building assessment tools in design and construction of buildings across the sampled groups, $\chi 2 = 8.280$, df =7, p=0.309.

Table 4: Importance of assessment tools in Design and Construction of Buildings

Rating	Frequency	Valid %	Cumulative %
1	4	6.6	6.6
2	4	6.6	13.1
3	11	18.0	31.1
4	22	36.1	67.2
5	20	32.8	100.0

Test Statistics

Kruskal Wallis Test

$\chi 2 = 8.280$, df =7, p=0.309

Use of Environmental Building Assessment Tools in past projects

Sixty nine per cent of respondents reported never to have used any environmental building assessment tools in past or present projects. This when compared with the level of awareness where more than eighty per cent have reported extreme or moderate awareness shows a gap between awareness (theoretically) and implementation. Environmental building assessment tools are used to measure environmental performance of buildings during design and construction. Therefore, adequate awareness and knowledge should perhaps translate into implementation.

Users reported awareness of existing environmental building assessment tools from elsewhere. BREEAM was reported in 21.5% of cases. This was followed by both LEED and Green Star Australia at 18.5% of cases each. The South African SBAT was only reported in 7.7% of cases. SBTool and CASBEE were reported in 6.2% and 1.5% of cases respectively. Majority of cases however points out that respondents are not aware of any environmental building assessment tool with 52.3% of cases reporting such. Knowledge of the environmental building assessment tools is likely from formal training and personal research.

Possible Barriers to Implementation of Environmental Building Assessment Tool

Successful implementation of environmental building assessment tools may sometimes be hindered by certain barriers. Consequently identification of those barriers is important for the successful implementation of environmental building assessment tools. Respondents were asked to state possible barriers to the implementation of environmental building assessment tools and Table 5 show the responses. Lack of knowledge and prohibitive costs were cited as the biggest possible barriers accounting for 33.8% and 30.8% of cases respectively. Lack of awareness at 24.6% of cases was cited at the third biggest barrier. A sizable number (20.0%) of cases were not completed.

Table 5: Barriers to Implementation of environmental building assessment tools

Barriers	Responses		Per cent of cases (%)
	N	Per cent (%)	
Lack of Knowledge	22	22.2	33.8
Corruption	5	5.1	7.7
Costs	20	20.2	30.8
Lack of Information	5	5.1	7.7
Lack of Resources	1	1.0	1.5
Lack of Standards/Legislation/Regulations	7	7.1	10.8
Lack of Technology/Technical Skills	4	4.0	6.2
Construction Industry Informal	1	1.0	1.5
Political/Government Support	5	5.1	7.7
Lack of Awareness/Ignorance	16	16.2	24.6
Not Completed	13	13.1	20.0
Total	99	100.0	152.3

CONCLUSIONS

The study has found that users deem environmental building assessment tools important for assessing environmental performance of buildings. The fact that no environmental assessment tool been developed in Botswana did not prevent users from acquiring knowledge through other means. Most of the users reported that they are aware of environmental issues related to building design through personal research building regulations and formal training. It is indicative of positive interest and likelihood for successful introduction of an environmental building assessment tool. This is in line with Goh and Rowlinson (2013) assertion that understanding and knowledge of environmental building assessment tools will lead to their use.

The Kruskal-Wallis Test conducted did not reveal any statistically significant differences between users regarding knowledge of building design using environmental building assessment tools and their importance in design and construction. All groups were in agreement in their rating to the statements, which shows no bias from any group. The results indicates that majority of users perceive environmental building assessment tools important in design and construction of buildings. In addition, most users have sufficient to excellent knowledge in building design using environment building assessment tools. Despite their knowledge, fewer users have used environmental building assessment tools in past projects. Therefore, there is limited practical experience using environmental building assessment tools.

Possible barriers for successful implementation however highlight the practical challenges of using environmental building assessment tools. It is not surprising therefore that lack of knowledge, lack of awareness and costs are deemed the biggest barriers. This is in line with previous studies, for example Reed et al. (2011) who argued for the prohibitive costs of using environmental building assessment tools.

Environmental building assessment tools have been found to transform green building practices (Todd et al., 2013). This perhaps presents a case for the development of such tool which will not only monitor and assess environmental performance, but transform green buildings practices. It could further enhance the knowledge and

awareness of users on environmental building design. To conclude, there is an indication that knowledge and awareness of users in Botswana is adequate for the introduction of an environmental building assessment tool. The assessment tool may further enhance that awareness and knowledge and may result in transformation of green building practices in the Botswana built environment. However, it has to be driven by Government since there is no competent body to drive it forward in contrast to other countries where there are Green Building Councils which can act in this capacity.

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