International Journal of Construction Engineering and Management 2017, 6(5): 215-220
DOI: 10.5923/j.ijcem.20170605.04

Awareness, Attitudes and Perception of Green Building Practices and Principles in the Zambian Construction Industry

Mutinta Sichali*, Luke John Banda

University of Zambia, Department of Environmental Health, Lusaka, Zambia

Abstract Awareness of green buildings technology is essential if practitioners in the building industry are to contribute in reducing negative impacts of building on the environment. Green building demonstration projects have been used as a way of sharing this knowledge to both practitioners as well as communities. Different strategies have been employed to share green building technology, however there is little research to demonstrate awareness attained from green building sites in Zambia. There are very few green buildings under construction and these few buildings could be a source of awareness. Understanding the level of awareness, perceptions and attitudes of artisans, communities and professionals on green building practices provides a good baseline on which to disseminate information on green building technology. This paper investigates the level of awareness, attitudes and perceptions of green building practices amongst participants in a green buildings housing project in North-Western and Lusaka provinces of Zambia. A qualitative descriptive cross sectional study was used and all the people who were directly involved in the project were interviewed. The findings suggest that the ones who had participated in other sustainability projects showed greater awareness than those who did not. The professionals had attained the knowledge from workshops, media, green building demonstration houses and institutions of higher learning while the artisans had attained it from previous project on renewable energy. Only two (2) community members showed great awareness which they attained from reading and watching documentaries on national television. The results suggest that professionals who were stationed on site demonstrated greater awareness than the artisans who spent an equal amount of time on the same project. The professionals showed the highest positive perception and attitude on the Likert scale. All the groups agreed that green building materials could only be affordable if they were locally produced. The study concluded that there are various ways of training practitioners on green building practices and no one method is sufficient. The sufficiency of the training depends on whether participants were made aware on the knowledge was being imparted. This should done at the beginning of the project. The demonstration houses showed that they could be a reliable source of training. Based on what the community said publications can be a good source of knowledge. For the professions, knowledge was acquired from university. This knowledge influenced their level of awareness and perceptions. The artisans who had worked on previous green building projects had gained knowledge. However knowledge gained was dependent on education levels. Training in green building practices should therefore be introduced in institutions of higher learning and trade schools.

Keywords Green building practices, Energy efficiency, Sustainable construction

1. Introduction

The Zambian construction industry is one of the fastest growing industries in the Sub- Saharan region and the construction sector contributes 27.5 percent of the Gross Domestic Product (GDP) of which the building industry is a part (Zambia invest. Magazine, 2014). Globally Buildings are responsible for 30 percent of all greenhouse gas emissions, 65 percent of waste output, 70 percent of electrical consumption and 12 percent of water consumption (National Energy Balance, 2009). Buildings which are not built in a green way can affect the health, safety, comfort and productivity of the occupants (Singh et al., 2010). Green building practices emerged after a United Nations conference held in Stockholm in 1972. The aim was to mitigate the impact of human activities on the environment and to improve the building construction process (Diana and Victor, 2012). Sustainable buildings can be a showcase to educate people about environmental issues, possible solutions, partnerships, creativity, and opportunities for reducing environmental impacts in our everyday lives (Diana and Victor, 2012). Green building, or sustainable design, is the practice of increasing the

* Corresponding author:
mutintamsichali@gmail.com (Mutinta Sichali)
Published online at http://journal.sapub.org/ijcem

efficiency with which buildings and their sites use energy, water and materials, and of reducing impacts on human health and the environment for the entire lifecycle of a building (Abimbola, 2014). Knowledge or awareness as these words will be used interchangeably in this paper is the amount of information from participants on positive or negative environmental impact of buildings.

2. Research Methodology

This was a descriptive cross sectional study and it used a qualitative method design. The research type was adopted from two similar studies by Usman and Khamidi, "Determining the Level of Green Building Public Awareness" and "Green Buildings: Analysis of State of Knowledge," (2012) by Diana and Victor (2012). The studies carried out surveys to investigate the level of awareness about green buildings.

Table 1. Category of the participants of the study

	participants	number	percentage of participants
2	artisans	11	34%
3	non professionals	7	22%
4	planners	2	6%
5	contractors	2	6%
6	foremen	3	9%
7	project managers	2	6%
8	arch.	2	6%
9	clerk of works	1	3%
10	engineers	1	3%
11	quantity surveyors	1	3%
12		**32**	

Table 1 above shows who the participants were and all the 32 participants who were available were interviewed. The largest number of participants were the professionals followed by the artisans and the community was the least. The community was represented by the Lumwana community business association. These were either suppliers of building materials or they participated in the building construction as bricklayers although they were not included in the category of artisans. The bricklayers were not included with the artisans because they did not have the basic qualification of artisans. The main research instrument used was a well-structured questionnaire containing both closed and open ended questions. The data gathered was measured on a Likert Scale and analysed qualitatively.

The questionnaire had four sections as follows:

a. Part A: respondent's background.
b. Part B: the awareness on green building technology; where the participants were asked to define green building technology, to identify the green building materials and how the technology was applied on the projects.
c. Part C: the perception ; they were asked open ended questions whether they agreed with green building practices and asked to explain their answers.
d. Part D: the attitude; the Likert scale was used to see their level of agreement or disagreement to the green building practices.

3. Data Analysis

The measure of green building awareness in this paper was based on rankings created on a Likert scale, A four (4) point awareness scale was used (1< very low, 2< low, 3< medium, 4< high). This type of ranking was based on a similar study that was done by Nazirah Z. et al. (2014). The data was generated from the awareness ranking scale that was created and mean scores were calculated for all participants grouping. The American LEED system was used as scoring chart. The following were the themes from which the questions were drawn:

a) Sustainable site planning
b) Safeguarding water and water efficiency
c) Energy efficiency, renewable energy and lower greenhouse gas emissions
d) Conservation and the reuse of materials and resources, and improved health and indoor environmental quality.

The attitudes and perceptions were explored using a thematic analytical technique, where the themes were developed using categories based on participants' responses and the resulting data (Fossey et al., 2002). The perceptions and attitudes helped explain the results that were seen in the awareness scale and these were measured on a Likert scale. The perceptions and the attitudes were scaled with 1- 5, with 1= strongly agree and 5=strongly disagree. A strong perception where it was expected meant a good attitude. The mean average was found for each group to see which group of participants had a good attitude and perception on green building technology.

Table 2 presents summary results for socio-demographic variables of the study participants. The majority of the respondents were professional males (n=12, 60%). The largest number of females were artisans (n=8, 66%). The majority of the professionals (n=8, 73%) were aged between 21 to 30 years whereas (n=2, 18%) of the artisan were aged between 21 to 30 years and only (n=1, 9%) of the community members were in that age group. More than half of the professionals (n=6, 60%) had 0 to 5 years working experience, while the artisans with 0 to 5 years of experience were (n=4, 40%) and there were none of the community members with 0 to 5 years working experience.

Figure 1 and 2 represents the average awareness scale for professionals and artisans respectively. The findings suggest that Architects have the highest level of awareness at 3.7 followed by project managers and clerk of work at 3.5, Quantity surveyors at 3.3. Similarly, planners and engineers had medium level of awareness, whereas contractors were the lowest. When asked where the different professionals had acquired their knowledge from. Architects had prior

knowledge from the University. They also had been involved in a previous green building project. The clerk of works also showed high level of awareness due to his experience on the green building demonstration site. The quantity surveyor showed medium level of awareness and this could be due to the fact that he had been involved in a previous green building project.

Table 2. Socio-demographic variables of the study participants

	Community		Professional		Artisans	
	Count	Percent	Count	Percent	Count	Percent
Gender						
Male	5	25.0%	12	60.0%	3	15.0%
Female	2	17.0%	2	17.0%	8	66.0%
Age group						
21-30	1	9.0%	8	73.0%	2	18.0%
31-40	1	10.0%	3	30.0%	6	60.0%
More than 40	5	45.4%	3	27.3%	3	27.3%
Education level						
Primary level	1	17.0%	0	0.0%	5	83.0%
Secondary level	3	33.5%	2	22.0%	4	44.5%
Tertiary	3	18.0%	12	70.0%	2	12.0%
Occupation						
Architect	0	0.0%	2	14.0%	0	0.0%
Quantity surveyor	0	0.0%	1	7.0%	0	0.0%
Clerk of Works	0	0.0%	1	7.0%	0	0.0%
Project Managers	0	0.0%	2	14.0	0	0.0%
Engineer	0	0.0%	1	7.0%	0	0.0%
Foremen	0	0.0%	0	0.0%	2	18.0%
Bricklayer	2	29.0%	0	0.0%	7	64.0%
business man	5	71.0%	0	0.0%	0	0.0%
Contractor	0	0.0%	2	14.0%	0	0.0%
Planner	0	0.0%	2	14.0%	0	0.0%
Carpenters	0	0.0%	0	0.0%	1	18.0%
Electricians	0	0.0%	0	0.0%	1	18.0%
Years of experience						
0-5	0	0.0%	6	60.0%	4	40.0%
6-10	5	36.0%	5	36.0%	4	29.0%
11-15	1	33.3%	1	33.3%	1	33.3%
16-20	0	0.0%	2	67.0%	1	33.0%
21-30	1	50.0%	0	0.0%	1	50.0%

Figure 1. Awareness level for the professionals

However some studies have shown that awareness had been gained from personal interest (Ameh et al., 2007). Amongst the planners the levels of awareness also differed when the study further inquired it was found that the one who was more aware had more years of experience and had attended courses on green building technology. As seen from figure 1 the contractors were at the lower end of the scale despite having spent more time on the green building project. Other studies show that the contractors' involvement is limited in the influence of green building practices but they can play a major role in recycling and reusing construction debris, limiting the use of hazardous materials and protecting vegetation (Buys and Hurbissoon, 2011).

In similar studies awareness of the professionals' practitioners in construction industry was 48 percent and, 30.6 percent respectively (Nadzirah and Carmen, 2015; Ntshwene et al., 2014), these were lower than the results in this study which found the awareness of the professionals to be much higher. The average community awareness was low at (22 percent), however two community members showed greater awareness during the focus group discussion.

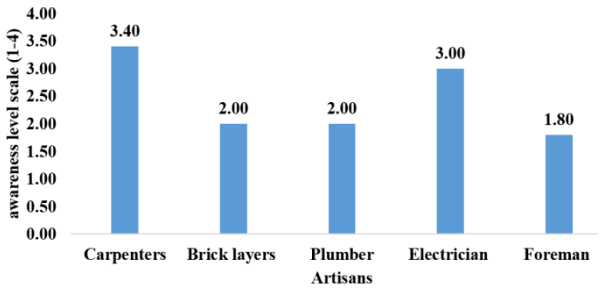

Figure 2. Awareness level for the artisans

The most knowledgeable in the artisan's group were the carpenters (3.5 out of 4) followed by the electricians (3 out of 4). It was observed that those who had high awareness had a tertiary education and had been involved in a previous green building training. From the results it can be suggested that a high education may encourage interest in green building technology. This is in line with Samari1 et al., (2013) who showed a significant correlation between professional awareness and education level.

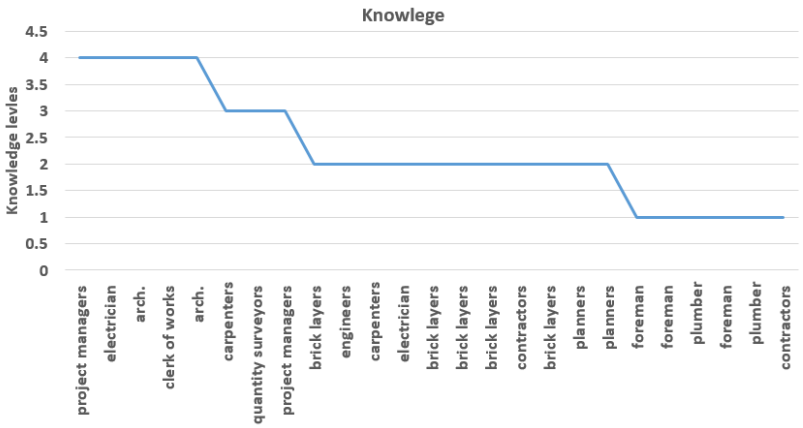

Figure 3. Awareness level for all the participants

When the awareness of the professionals and the artisans was combined as shown in figure 3, there was a downward trend of knowledge from the professionals to the artisans. It was however observed that the average levels of knowledge were the same amongst artisan. The level of knowledge amongst the foreman was lower than that of the artisans. It was noted that the foremen despite having spent more time on the demonstration site did not show comparatively high level of awareness. This could be attributed to the lack of training and awareness given to them before and during the construction process. It was observed that among the professionals and artisans their awareness as individuals also differed. An example of this is seen on the graph where one project manager had awareness of 4 and the other had 3. The one with 3 had less experience and had not been trained on green building practices. This was also the case with the contractors and electricians. The ones who had higher knowledge had attended workshops on green building practices.

Awareness of green building practices depends on the understanding of the individuals' actions, quest for knowledge and absolute involvement and commitment to the principles (Abolore, 2012). The professionals despite having less years of experience seemed to show greater awareness compared to the artisans who had spent an equal amount of time on the demonstration site. When the professionals were asked where they had attained the awareness on green buildings as seen from figure 4 below the highest source was from the demonstration houses. Which shows that demonstration houses can be a good sources of knowledge on green buildings. The other sources were training and media which had an equal distribution.

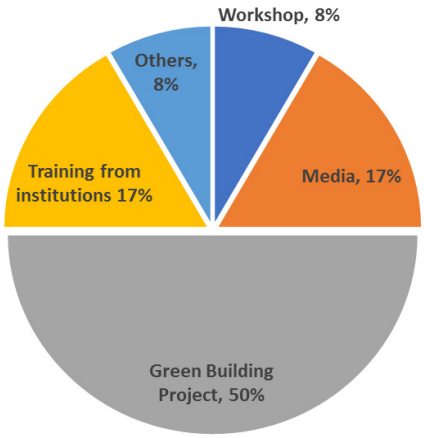

Figure 4. Sources of awareness on Green Buildings

Although the highest sources of knowledge were the demonstration houses other sources were also significant and can be applied to teach on green building practices. Others studies have shown that awareness was obtained from building regulations, personal research and formal training (Ntshwene et al., 2014), while another study showed that it was obtained from internet, through magazines and Newspapers and through their real estate agent (Usman and Mohd, 2012). In Zambia green building practices have not been incorporated into the building bye laws and if these regulations were available possibly more professionals would access this information and be better equipped.

3.1. The Perception and Attitudes

The perception scales ranged from strongly disagree to strongly agree (5 point Likert scale). On the left side of figure 5, were questions that were asked in the questionnaire and the scale for each group presented. On average, the community and artisans disagreed that the maintenance cost of green buildings compared to conventional buildings is high. Professionals also disagreed but this was further explained that the maintenance cost on green buildings depended on the source of the building materials and the use of materials found within a local setting. Moreover, practically all three — the community, artisans and professionals agreed, with a mean score of about 4, that the benefits of using green building designs are greater compared to conventional ones. Further, only professionals strongly agreed (mean score of about 5) that rain water can be collected and used for domestic purposes whereas artisans only agreed (mean score of 3.7) and some community members were not sure (mean score of 2.8). The three grouping agreed that green building having sufficient natural lighting, each of the three groups sampled agreed.

The community perception on the efficient use of energy in green buildings was low. This could be due to their low awareness of what energy efficiency meant. However the professionals were aware. There was a disparity in the community answers in that even though they disagreed that green buildings were energy efficient they strongly agreed that green buildings have better internal air quality and sufficient natural lighting. The participants were asked if rain water and grey water from the bath tub and sink could be reused for bathing and gardening respectively. All the professionals agreed that rainwater could be reused but the artisan's perception over the use of grey water was negative (1.2 out of 6) while the community had the highest perception (3.5 out of 6). All the participants agreed that there were more benefits from using green building practices in buildings than conventional ones.

When asked whether the materials were accessible and affordable all the groups were positive. When asked whether the green buildings concept was adopted from developed countries, they all strongly disagreed. The architects explained that if local materials were not used and foreign based materials were introduced then it would be a foreign concept. When asked if they would recommend green building technology all the participants agreed with a mean score of 4.5. When asked whether the demo houses were a good way of learning green building technology 80 percent agreed, while 10 percent thought workshops were the best and 10 percent thought a combination of workshops and demo houses would be the best way to learn.

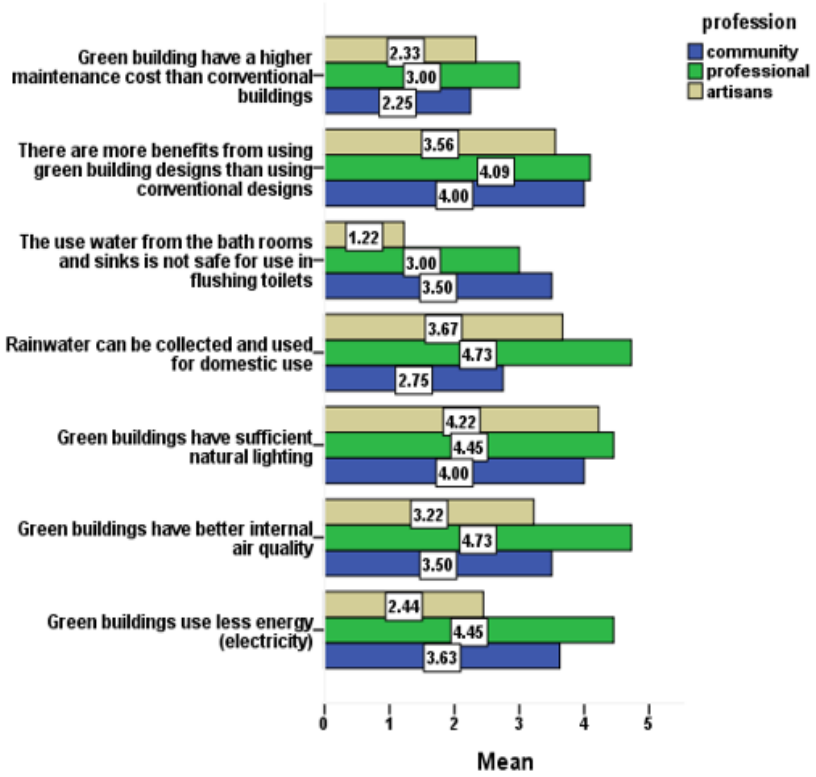

Figure 5. Perception of green buildings technology

4. Conclusions

The study concludes that even though the awareness levels among the artisans and the community were low their attitude and perception of green buildings practices was positive. There is need to increase awareness among all the participants and information should be made more available to all players in the construction industry and communities. The demonstration houses showed that they can be a reliable source of training. Prior knowledge gained from publications was a good source. The few who gained awareness had gained it through literature.

The professional's knowledge attained from University or Collaged had influenced their level of awareness and produced a good perception. The artisans who had worked on previous green building projects had gained knowledge but this depended on the level of education. Training in green building practices should therefore be introduced in institutions of higher learning and trade schools. The professionals felt that the introduction of green building practices in the building bye laws will institutionalise these practices. The demonstration houses aroused a lot of curiosity in the communities where they have been built and the introduction of green building technology was a welcome strategy. The actors in the building industry should be used as catalysts in the promotion of green building technology. More education is therefore required for the artisans and this should be by means of practical demonstration and not just theory. The professionals can go through continuous professional development, workshops and involving them in green buildings demonstration projects. The community could have community based education programmes where green building practices are demonstrated.

ACKNOWLEDGEMENTS

The author would like to acknowledge the University of Zambia, School of Public Health for the time given to carry out this study. Special thanks goes to the Journal club members at Sacore and the staff members of the department of Environmental Health. Further thanks go to the Lumwana community business association, Larfage Zambia and Kalumbila Housing Corporation where the study was carried out.

Limitations

Carrying out a study of this nature on participants who had different educational levels put a limit to the study. The study is not representative of the whole construction industry and more cases of green buildings projects should have been included in the study to make definite conclusions. There will be need for further research on a bigger study population.

REFERENCES

[1] E. Abuamer and M. Boolaky, "Consumer Be-havior towards Green Building: A Study in Abu Dhabi," International Journal of Business Administration, Vol.6, No.3; 2015 http://ijba.sciedupress.com, 2015.

[2] O. Abimbola, "Examination of Green Building Drivers in the South African Construction Industry," Economics versus Ecology, Department of Construction Economics and Management, University of Cape Town, Published: 9 September 2014, ISSN 2071-1050 (available online www.mdpi.com/journal/sustainability [accessed on 22/03/2017]).

[3] A.A. Abolore, "Comparative Study of Environmental Sustainability in Building Construction in Nigeria and Malaysia." Journal of Emerging Trends in Economics and Management Science, 3 (6): 951-961 Adegbile, M.B. (2013). (Available online http://jetems.scholarlinkresearch.com [accessed on 22/04/2017]).

[4] O.J. Ameh, S.J. Isijiola, & F.O. Achi, "Assessment of the Sustainability of Public Buildings in Lagos Nigeria." Construction Research Journal, 1(1): 46- 54.2007.

[5] B.P.C. Kwong, Quantifying the Benefits of Sustainable Buildings. AACE International Transactions (2004): 1-3). Washington DC: AACE International.

[6] F. Buys, and R. Hurbissoon, Green buildings: A Mauritian built environment stakeholders' perspective. Acta Struct, pg.18, 81–101.2011.

[7] C. Choi, "Removing Market Barriers to Green Development: Principles and Action Projects to Promote Widespread Adoption of Green Development Practices." JOSRE, 1(1), 107-138. 2009.

[8] National Energy Balance (BEN) 2009: Baseline Year 2008, 2010, available at: http://ben.epe.gov.br, accessed on: 18/06/17.

[9] O. Diana and Y. Victor. "Green Buildings: Analysis of State of Knowledge," International Journal of Construction Engineering and Management; 1(3): 27-32 (available online http://article.sapub.org. [Accessed on 01/-06/2017]) 2012.

[10] Z. Nadzirah and T. Carmen, M. Yee "An Insight of Sustainable Development- A Study among Construction Professional in Malaysia," International Journal of Current Research and Academic Review, January-201, pp. 56-64, 2015.

[11] C. Joseph, "What Are the Benefits of Going Green for a Business? online: http://www.smallbusiness.chron.com/ (accessed on 23 May 2017). 2013.

[12] N. Keneilwe, A. Emmanuel, Essah and J.D. Timothy "Investigating the level of awareness of building assessment tools in the construction industry of Botswana School of Construction Management and Engineering," University of Reading, P O Box 219, Reading, RG6 6AW, UK [accessed 20 May 2017] 2012.

[13] S. Milad , G. Nariman, E. Reza et al. "The Investigation of the Barriers in Developing Green Building in Malaysia," Modern Applied Science journal, Vol. 7, No. 2; 2013, ISSN 1913-1844 E-ISSN 1913-1852, Published by Canadian Centre of Science and Education (2013).

[14] K. Tshwane, E. Essah, and T. Dixon, "Investigating the level of awareness of building assessment tools in the construction industry of Botswana." Annual ARCOM Conference, 1-3 Sept 2014, Portsmouth, U.K., pp. 23-32. Available at http://centaur.reading.ac.uk, 2014.

[15] A. Singh, M. Syal, C. Sue, and S. Korkmaz, "Effects of Green Buildings on Employee Health and Productivity," American Public Health Association, 15-20 August 2011, USA.

[16] A. Usman and K. Mohd, "Determined the Level of Green Building Public Awareness: Application and Strategies," Conference Paper, University of Reading Malaysia, Available: https://www.researchgate.net/publication [accessed on 01/-05/2017] 2012.

[17] WS Atkins Consultants, Sustainable Construction: Company Indicator. CIRIA C563. London: CIRIA, 2001.

[18] Zambian Investment Magazine (2014) "Fiscal Decentralisation in Zambia." Available online at http://www.zambian-economist.com/2014/07/fiscal-decentralisation-inzambia.html, 2014 [accessed 17 August 2015].