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Perception of Construction Industry Practitioners on Success Factors for Green Building Technologies Adoption

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Abstract

Climate change resulting from global warming is fast becoming an important issue globally. Although there have been numerous empirical studies that have identified critical success factors for green building development. However, there is dearth of studies on success factors for the adoption of Green Building Technologies (GBT) as an integral part of green building development. This study is set to examine the success factors affecting the adoption of GBT as a component of green building development. A comprehensive literature review was conducted to identify success factors affecting GBT. This was followed by administration of questionnaires to industry practitioners engaged in the design and construction of buildings. The mean score (ms) and ranking of the success factors revealed five (5) most important factors as social awareness of GBT benefits (ms 4.0133), availability of social and natural environment condition to adopt GBT (ms 3.9867), availability of stable economic condition (ms 3.8933), demand and competitive advantage (ms 3.8533), and team members' technical background (ms 3.8533). Analysis of variance (ANOVA) was conducted to investigate the level of agreement in the perception of industry practitioners based on type of organisations, years of industry experience, academic qualification and professional background. ANOVA results shows that there is no general agreement in the perception of industry practitioners on the ranking of the success factors. In order to ensure adoption of green building technologies, industry stakeholders must ensure that there is incentive for clients to include cost of GBT in the project budget. Additionally, design professionals must be mandated to always incorporate same at the early stage of building projects. This study has contributed to the existing body of knowledge regarding success factors for the adoption of GBT which could guide in formulating policies for its implementation.

Keywords:

building projects; global warming; green building technology; practitioners; success factors;

1. Introduction

Global warming is one of the most important global environmental challenges threatening human survival, resulting from gas pollution, huge factory disposal, melting ice, polar bear in the verge of extinction, and descending agricultural land. Climate change has become an issue of concern from different climes over the last few decades and climate experts conclude that human beings are the major cause for this dangerous development (Nikyema & Blouin, 2020) . These experts are calling for immediate and practical solution to fight global warming and its remedial measures. However, the construction industry which has been considered as a resource-intensive industry is one of the major contributors to the broader problems and issues affecting the environment, including global warming, climate change, flood, draught, desertification, deforestation, acidification, loss of diversity, land pollution, and consumption of valuable resources such as fossil fuels and ozone depletion (Pearce, Ahn, & Global, 2012; EIA, 2014; Yong, Chan, Minjae, & Myung, 2016). As a result, the construction industry in the developed countries have begun to incorporate green building technologies as part of their national agenda to achieve a sustainable environment in order to avert this dangerous development threatening present generation and the generation unborn (Nikyema & Blouin, 2020).

The construction industry is responsible for almost 40% of energy consumption and accounts for up to 30% of total annual greenhouse gas emission globally (Darko and Albert, 2018). This negative impact of construction activities on the environment has led to the implementation of sustainable development within the construction sector nationwide. Sustainable development which has been dubbed ‘green construction’ according to the World Green Building Council (2018) Green building ‘is a building that, in its design, construction, or operation, reduces or eliminates negative impacts and can create positive impacts on our climate and natural environment’.

The existing literature on green building technology in developing countries (Darko, et al., 2017 ; Adeleke, Ayegbokiki, Buari, A, & Popoola, 2018; Nikyema & Blouin, 2020; Amuda-Yusuf, et al., 2020) almost focused entirely on evaluating the awareness, drivers and barriers for adopting GBT rather than identification and evaluation of critical success factors to enhance adoption. Although, the study of Darko et al., (2017) examined the strategies

for implementing green building technology within Ghanaian construction industry, the study revealed; more publicity through media, educational and training programs for key stakeholders, relevant institutional framework for effective GBTs implementation, research and development to strengthened GBTs, and “financial and market-based incentives as the top five strategies for implementing GBT in Ghana. In a similar development, Wang, et al., (2018) studied the key factors to green building technologies adoption in developing countries from the perspective of Chinese designers. The study indicates that the adoption motivation, the capability of GBTs, the knowledge structure and the defects of GBTs are the significant factors that affect designers’ adoption behaviors.

This study therefore aimed to diagnose the CSFs to implement green building technology, with the objective of evaluating and ranking the critical success factors to green building adoption as per Nigerian construction industry. Fundamentally, this study will not only fill the gap in knowledge concerning CSFs to green building adoption but would also serve as reference material for academics, practitioners and policy makers in taking appropriate measures to implement green building and consequently promote environmental sustainability. Additionally, findings from this study would also be relevant to international communities interested in promoting green building technology implementation and environmental sustainability in Nigeria.

2. Literature Review

2.1 Critical Success Factor

Pinto and Slevin, (1989) defined Critical Success Factors (CSFs) as the rules, procedure and environmental condition necessary for the implementation of a new projects. Morlhon, Pellerin, and Bourgault, (2014) describe CSF as essential elements needed for successful implementation of new system. Within the context of Building Information Modeling, Amuda-Yusuf. (2018) view CSF as drivers and enablers whose presence can cause success and their absence can cause failure in the adoption and implementation of building information modeling. In a similar development, Chileshe and Kikwasi, (2014) considered CSF with respect to risk assessment and management practice as driver or enablers for successful implementation of risk assessment and management practice in construction industry. Considering this, Gichoya, (2005) argued that drivers are factors that facilitate the successful implementation of IT project, while enablers are critical elements

present in society which facilitate the overcoming of potential barriers to ICT system implementation. Based on the aim and objectives of this current study, CSFs is considered as the drivers and enablers which are critical for the successful implementation and adoption of Green Building Technology in Nigerian construction industry.

2.2 Identification of Critical Success Factors

For the past few decades, critical success factors which explore the impact of system development have received special and continuous attention globally (Wang *et al.*, 2017; Bakaret *al.*, 2010) for this reason, CSFs have always been the focus of researchers on the promotion and development of green building, for instance, Morris *et al.*, (1998) and Martin and Scott, (2003) identified legislation policies and regulation as the critical success factors for implementing new system. The policies and regulations for promoting GBs have actually been proposed, and outstanding achievements have been made in some countries (Wang *et al.*, 2019). There are basically two types of legislation policy which have been identified in literatures as international legislation (such as the United nation framework convention on climate change) and national legislation which are usually peculiar (such as the implementation of site waste management plans). This implies that legislation imposed by the government on green building adoption will enhance the implementation by the stakeholders and construction professionals, for instance, at the International legislation level, legislation on the standard of building material to be imported can be put in place by the government and it must be in compliance with GBT, also at the National level, legislation on approval of buildings drawings can be laid down and the drawing must comply with the GBT before it is approved by appropriate authority irrespective of whether the form of title and usage. Similarly, Pitt, Tucker and Riley (2009) submitted that legislation policy and regulation is the most important success factors for the adoption of GBT, the reason been that any policy regulations set by the government will spelt out stakeholders' response and react to issues of GBT.

The study of Pitt *et al.*, (2009) revealed that the form of support lent to stakeholders for the adoption of GBT is termed as incentives, it could be given by government, financial institutions, International financial institutions such as European Union, International Monetary Fund, African Development Bank and others types of lending institution. The recent study of Chen, P.C, Chan, Owusu, and Gao, (2022) indicate that the roles of

stakeholders and government are vital in green building technology promotion and adoption. Institutions and lending organizations incentives has proven to be quite effective geared towards the adoption of GBT, it also serves as support to the stakeholders when procuring GBT items and motivates the stakeholders in executing job in compliance to GBT (Sayce *et al.*, 2007).

Additionally, Porter and Kramer, (2006) identified market demand and competitive advantage in as one of the major factors that enhance GBT adoption. Low or reduced demand for GBTs products affects company or cooperate organizations manufacturing or distributing such products. It can however lead to close down or suspension of all activities of the company producing it. Figge, Hahn, Schaltegger, and Wagner, (2002) affirmed that frequent demand can also bring about competitive advantage to the stakeholders, for example, a region where GBTs product is adopted frequently, it will lead to different companies coming up with that same product and this bring about competition in the market. The competition is however favorable to the stakeholders because of the cost of procuring materials when there are different manufacturers is lesser compared to the cost of procuring that same material if the manufacturers are few in the market.

In addition, GBT growth may have a dynamic impact on equilibrium prices and for a regular and frequent production of GBT products, there should be frequent demand of such product to enable the producer be in market and demand of GBT products greatly depend on the awareness of stakeholders on GBT.

One of the major challenges of GBT adoption is lack of awareness of and benefits. To improve the knowledge of stakeholders with regard to the benefits of the green building would better inform the general public and help to eliminate misperceptions (Mavi and Standing, 2018). Green building technology is technology driven and people tend to move or divert to the newest and latest technology in vogue. It is therefore important to create awareness on GBT as its adoption is still lagging in most developing countries with no exception to Nigeria.

Awareness can take several forms, but it should explain the benefits and functions people will derive by adopting it, with this, the stakeholders and the

client will develop interest in the adoption if the benefits is well spelt out and laid down. Although GBTs suffers rejection because of unforeseen costs, but this can be tackled by creating awareness to all stakeholders and clients by the government or its parastatals (Häkkinen & Belloni, 2011). Awareness can be in form of a seminar, a conference or a gathering involving all construction stakeholders in different regions by empowering them on the new normal should be adopted.

As mentioned by Häkkinen and Belloni, (2011) awareness is not limited to just describing the features of GBT but encompasses the benefits to be derived from its adoption, however, Bull, Chang, and Fleming, (2012) stated that one of the benefits for the adoption of GBT that need to be known to stakeholders, client and residents is the energy performance of building. The energy performance of building is the energy efficiency, that is, the extent to which energy consumption per square meter of floor area of the building measures up to the established energy consumption benchmark for that building under defined climatic condition. Energy performance or energy efficiency is not just about minimizing the amount of energy consumed in a residence nor is it limited to the measurement of energy consumed but, the ability to recycle and reuse energy generated within the home (Haas, et al., 2011). Therefore, awareness of the energy efficiency in buildings should also emphasize the renewal or recycle of energy or heat generated in the home.

The study of Gan, *et al.*, (2015) revealed that client, owner and end-users 'interest is a success factor for GBT adoption. The referenced authors further stated that the procurement of the built environment is driven by the requirement of the clients, owners and/or the end users. This implies the client which is one of the stakeholders is the determinant of the method or type of procurement to be adopted. Brennan and Cotgrave (2014) submitted that clients are the key determinant in the creation of GBT products, this will then be taken into consideration at procurement stage. A client that shows no interest in GBT is a disadvantage to other stakeholders as they cannot construct what is against the client specification.

Availability of Stable economic condition has also been considered as critical success factors for implementing new system. A stable economic condition or environment is an enabling environment, without a stable economic condition, it will be difficult to progress in the construction industry. Issa, Rankin, and Christian, (2010) reviewed that in most developing countries

like Nigeria, corruption have hampered development in all sectors including construction industry. The availability of GBT products such as solar system technology, green roof is hindered as a result of instability of the economic condition. In this regard, government therefore has a pivotal role to play in curbing various internal policy that disrupt the economic condition hindering the adoption of GBT in the country.

The study of Majdalani, Ajam, and Mezher (2006) considered availability of social and natural environment condition to adopt GBT as critical success factors for green building technology adoption. The referenced authors stated that enabling a foundation that defines opportunity to stimulate the adoption of GBT should be addressed through government policies and public actions. An enabling social and natural environment should be created and this will serve as a guiding principle for the government to develop policies and more actions amongst stakeholders potentially promote the adoption of green building within the construction industry includes the technological, institutional and value system enablers (Majdalani *et al.* 2006). The summary of success factors identified from literature review is as listed in Table 1.

Table 1: Summary of success factors for the adoption of green building technology

S/N	Success factors	Author(s)
1	Legislation Policy, and Regulations	(Pitt, et al.,2009; Morris <i>et al.</i> , 1998; Martin and Scott, 2003)
2	Incentive scheme	(Pitt et al., 2009; Sayce et al., 2007).
3	Markets: Demand and Competitive advantage	(Wagner et al., 2001; Figge et al., 2002; Porter and Kramer, 2006).
4	Awareness on green building technology	(Häkkinen and Belloni, 2011).
5	Flexible construction mode to adopt green building technology	(He dan, 2014; Huang Junpeng 2017)
6	Stakeholders' involvement	(Mavi and Standing, 2018).
7	Client, owner and end-users' interest	(Gan et al., 2015; Pitt et al. 2009; Brennan and Cotgrave, 2014)
8	Awareness of Energy Performance of Building	(Bull et al., 2012; Haas et al., 2011)
9	Awareness of financing institute to Energy performance contracting EPC	(Low <i>et al.</i> , 2014; Wang et al., 2017)
10	Availability of stable economic condition	(Issa <i>et al.</i> 2010)
11	Availability of social and natural environment condition to adopt GBT	(Majdalani <i>et al.</i> , 2006; Mavi and Standing, 2018)
12	Team members technical background	(Gan, <i>et al.</i> , (2015))

S/N	Success factors	Author(s)
13	social awareness of GBT benefits	(Majdalani <i>et al.</i> 2006; Gan, <i>et al.</i> , 2015)
14	Project scope clearly defined	(Low <i>et al.</i> , 2014; Shi <i>et al.</i> , 2012; Mavi and Standing, 2018)

3. Methodology

3.1 Data Collection

The study adopted questionnaire survey approach in its data collection. The fourteen (14) items used in the questionnaire to examine critical success factors for green building technology adoption were derived from extensive literature search. The items were measured on a 5-point Likert Scale ranging from 1= Not at all a success factor to 5 = Extreme success factor. The questionnaire was administered through a non-probabilistic (purposive) sampling technique on practicing professionals in the construction industry, that are registered with professional bodies in Ilorin, Kwara State, Nigeria. A total of 75 copies of questionnaire were purposively administered and retrieved for analysis.

3.2 Analytical Technique

The data was coded into excel sheet and later exported to SPSS for analysis. Mean rank analysis was conducted to identify critical success factors that influence adoption of green building technology among professionals in the construction industry. Furthermore, one-way analysis of variance (ANOVA) test was performed to examine how the different groups (professional background, level of education, years of experience) differ in their perception on the critical success factors identified .The choice of one-way ANOVA is based on the fact that the study is comparing means of more than two independent groups .

4. Results and Discussion

About 46.7% of respondents are Quantity Surveyor, 40% Engineer, 9.3% Architect and 4% project manager. In terms of educational qualification, 45.3% of the respondents obtained degree certificate (B.Sc./B.Tech), 44% obtained Masters ‘degree (M.Sc.), 6.7% obtained Higher National Diploma (HND) and 4% PhD. For professional qualifications, more than half (56%) are associate member, 28% probationer, 13.3% fellow while 2.7% obtained other professional qualifications. About 44% of respondents work with

contracting firms, 33.3% with consulting firms, 10.7% with client organizations, 9.3% academia and 2.7% work with other organizations. About half (49.3%) of respondents have between 11-15 years work experience, 37% have below 5 years experience, 9.3% have above 20 years experience and 4% between 16-20 years work experience.

The objective of this study is to identify the critical success factors that influence adoption of green building technology (GBT) among professionals in the construction industry. Therefore, 14 items factors (items) derived from existing literature were used in rating the opinion of respondents about GBT adoption. The mean score and ranking in Table 1 reveals, that 8 out of the 14 items, have mean score ≥ 3.8 . Among these 8 items are: *social awareness of GBT benefits* ($\mu = 4.0133, \pm .89281$) which ranked 1st, followed by *availability of social and natural environment condition to adopt GBT* ($\mu = 3.9867, \pm 1.09660$), *availability of stable economic condition* ($\mu = 3.8933, \pm 1.15751$), *markets: demand and competitive advantage* ($\mu = 3.8533, \pm 1.04872$), *team members' technical background* ($\mu = 3.8533, \pm 1.09906$), *awareness on green building technology* ($\mu = 3.8533 \pm 1.02263$), *client, owner and end-users interest* ($\mu = 3.8267, \pm 1.07015$) and *flexible construction mode to adopt green building technology* ($\mu = 3.8133, \pm 1.02263$).

Based on these results, it could be said that professionals in the construction industry, perceived social awareness of GBT benefits as one of the major factors that could aid the adoption of GBT in the study area. In diffusion of any new innovation or technology, awareness is vital, as people only shift/migrate to new technology, when they are well informed/aware of the benefits accruable from its adoption. Another factor that respondents perceived as an important factor for the adoption of GBT is stable economic condition. Without a stable economic environment, it may be difficult to make any progress in the construction industry. In most developing countries, including Nigeria, fragile economic policies have hampered development in all sectors. GBT is technology driven, and with poor economic environment, the required technologies such as solar system technology, green roof and wall technology are lacking most times in developing countries.

Markets, demand and competitive advantage was identified as another major factor that aids GBT adoption. When there is low demand for

some of the products that are used in GBT, the tendency is for firms or companies that engage in such production to cease producing. Take for instance, a firm which produces recycled building material or other energy efficient appliances may be forced to close down, if demand of such products is low.

Table 2: Mean score and rank of critical success factors for GBT adoption

Success Factors	Mean	Std. Deviation	Rank
Social Awareness of GBT benefits	4.0133	.89281	1st
Availability of social and natural environment condition to adopt GBT	3.9867	1.09660	2nd
Availability of Stable economic condition	3.8933	1.15751	3rd
Markets: Demand and Competitive advantage	3.8533	1.04872	3rd
Team members' technical background	3.8533	1.09906	3rd
Awareness on green building technology	3.8533	1.02263	3rd
Client, owner and end-users Interest	3.8267	1.07015	4th
Flexible Construction mode to adopt green building technology	3.8133	1.02263	5th
Legislation Policy, and Regulations	3.7867	1.05643	6th
Awareness of Energy Performance of Building	3.7733	.93828	6th
Incentive scheme	3.7733	1.00772	6th
Project scope clearly defined	3.7467	1.14010	7th
Stakeholders' involvement	3.7067	1.04975	7th
Awareness of financing institute to Energy Performance Contracting EPC	3.7067	1.08769	7th

Perception of critical success factors for GBT adoption by different

Professional groups

In the previous section, the mean score and rank in Table 2 as obtained for the various critical success factors for GBT adoption were examined. However, this section examines how the different professional groupings perceived the first 8 items identified as success factors for GBT adoption in the study area. Results in Table 3 indicate that respondents significantly differ in their perception about the influence markets: demand and competitive advantage has on GBT adoption ($F = 3.330$, $p<0.05$). A closer look at the mean score obtained for the different groups (Table 2), reveal that Engineers recorded highest mean (4.2333) while Project Managers recorded the least (2.6667). What this result

suggests is that Engineers perceived markets; demand and competitive advantage as critical success factor for GBT adoption in the study area, while project managers perceived it not to be a success factor. For the reaming factors, there is no significant difference among the professional groups ($p>0.05$), which suggests they all agreed that the factors are important for adoption of GBT.

Table 3 ANOVA results based on different professional background

		Mean	Std. Deviation	F	Sig
Social Awareness of GBT benefits	Architect	3.8571	.69007	.796	.500
	Engineer	4.2000	.88668		
	Quantity	3.9143	.91944		
	Surveyor				
	Project Manager	3.6667	1.15470		
Availability of social and natural environment condition to adopt GBT	Total	4.0133	.89281	1.727	.169
	Architect	4.2857	.48795		
	Engineer	4.0667	1.17248		
	Quantity	3.9714	1.07062		
	Surveyor				
Availability of Stable economic condition	Project Manager	2.6667	1.15470	1.625	.191
	Total	3.9867	1.09660		
	Architect	3.8571	.69007		
	Engineer	4.2333	1.13512		
	Quantity	3.6571	1.23533		
Markets: Demand and Competitive advantage	Surveyor			3.330	.024* *
	Project Manager	3.3333	.57735		
	Total	3.8933	1.15751		
	Architect	3.7143	.48795		
	Engineer	4.2333	1.10433		
Team members' technical background	Quantity	3.6571	.96841	1.410	.247
	Surveyor				
	Project Manager	2.6667	1.15470		
	Total	3.8533	1.04872		
	Architect	4.1429	.89974		
Awareness on green building	Engineer	3.9333	1.25762	2.067	.112
	Quantity	3.8286	.95442		
	Surveyor				
	Project Manager	2.6667	1.15470		
	Total	3.8533	1.09906		
	Architect	3.7143	.48795		
	Engineer	4.0000	1.08278		

		Mean	Std. Deviation	F	Sig
technology	Quantity	3.8286	.98476		
	Surveyor				
	Project Manager	3.0000	1.73205		
Client, owner and end-users Interest	Total	3.8533	1.02263	2.067	.112
	Architect	3.7143	.48795		
	Engineer	4.1000	1.09387		
	Quantity	3.7143	1.07297		
	Surveyor				
Flexible Construction mode to adopt green building technology	Project Manager	2.6667	1.15470	2.084	.110
	Total	3.8267	1.07015		
	Architect	4.1429	.89974		
	Engineer	4.0667	.98027		
	Quantity	3.6000	.97619		
	Surveyor				
	Project Manager	3.0000	1.73205		
	Total	3.8133	1.02263		

Note statistics is significant at 0.05**

The study went further to examine how respondents perceived these factors based on their years of working experience in the construction industry. Results (Table 4) indicate that out of the 8 identified critical success factors, respondents differed significantly on four factors (*social awareness of GBT benefits*, $F=3.905$, $p<0.05$, *availability of social and natural environment condition to adopt GBT*, $F=3.29$, $p<0.05$, *stable economic condition*, $F=15.776$, $p<0.05$, and *flexible construction mode to adopt green building technology*, $F=4.619$, $p<0.05$). The mean score value obtained by the different groups (Table 3) reveal that those respondents whose years of work experience ranged between 11-20, have mean score greater than 4, which suggests that they perceived social awareness of GBT benefits as a critical success factor for GBT adoption. Those whose years of work experience are below 5 years and those above 20 years have their score below 4, which means that they perceived social awareness of GBT benefits as somewhat a success factor for GBT adoption. Also, respondents whose years of work experience ranged between 11-20 years perceived stable economic condition as a success factor for GBT adoption while those with 20 years and above work experience stated otherwise (ie Not at all a success factor). Similarly, respondents whose work experience ranged between 11-16 years perceived flexible construction mode to adopt

green building technology as a success factor, while those below 5 years and above 20 years work perceived it as somewhat a factor.

Table 4 ANOVA results based on years of work experience

		Mean	Std. Deviation	F	Sig
Social Awareness of GBT benefits	Below 5 years	3.6429	.82616	3.905	.012**
	11-15years	4.3243	.74737		
	16-20years	4.3333	.57735		
	Above 20years	3.7143	1.38013		
	Total	4.0133	.89281		
Availability of social and natural environment condition to adopt GBT	Below 5 years	4.0714	1.05158	3.286	.026**
	11-15years	4.0811	1.08981		
	16-20years	4.6667	.57735		
	Above 20years	2.8571	.89974		
	Total	3.9867	1.09660		
Availability of Stable economic condition	Below 5 years	3.7143	.89679	15.776	.000**
	11-15years	4.4054	.89627		
	16-20years	4.0000	.00000		
	Above 20years	1.8571	1.21499		
	Total	3.8933	1.15751		
Markets: Demand and Competitive advantage	Below 5 years	3.8571	1.04401	2.626	.057
	11-15years	4.0270	.92756		
	16-20years	4.0000	.00000		
	Above 20years	2.8571	1.46385		
	Total	3.8533	1.04872		
Team members' technical background	Below 5 years	3.6429	.98936	2.545	.063
	11-15years	4.0811	1.18740		
	16-20years	4.6667	.57735		
	Above 20years	3.1429	.69007		
	Total	3.8533	1.09906		
Awareness on green building technology	Below 5 years	3.5714	1.10315	1.772	.160
	11-15years	4.0811	.89376		
	16-20years	4.3333	.57735		
	Above 20years	3.5714	1.27242		
	Total	3.8533	1.02263		
Client, owner and end-users Interest	Below 5 years	3.6786	1.15642	1.768	.161
	11-15years	4.0541	.88021		
	16-20years	4.0000	.00000		

Flexible Construction mode to adopt green building technology	Above 20years	3.1429	1.57359	4,619	.005**
	Total	3.8267	1.07015		
	Below 5 years	3.5714	.95950		
	11-15years	4.0541	.94122		
	16-20years	5.0000	.00000		
	Above 20years	3.0000	1.15470		
	Total	3.8133	1.02263		

Note statistics is significant at 0.05**

The perception of respondents about the identified success factors for GBT adoption was further examined, based on their organization. Results in Table 5 reveal that at 0.05 level of significance, respondents do not differ in their perception on any of the 8 items (ie success factors) ($p>0.05$). What this suggests is that respondents perceived the identified 8 factors as germane for GBT adoption in the study area. A closer look at the mean score obtained for each group shows that none scored less than 3.6.

Table 5 ANOVA results based on different organizations

		Mean	Std. Deviation	F	Sig
Social Awareness of GBT benefits	Client	3.7500	.70711	1.117	.355
	Consulting	3.8800	.92736		
	Contracting	4.0606	.96629		
	Academia	4.2857	.48795		
	Others	4.0000	.00000		
	Total	4.0133	.89281		
Availability of social and natural environment condition to adopt GBT	Client	3.6250	1.40789	1.881	.123
	Consulting	4.2000	.91287		
	Contracting	3.7273	1.17985		
	Academia	4.7143	.48795		
	Others	4.5000	.70711		
	Total	3.9867	1.09660		
Availability of Stable economic condition	Client	3.7500	.70711	.253	.907
	Consulting	3.8400	1.02794		
	Contracting	3.8788	1.43086		
	Academia	4.1429	.69007		
	Others	4.5000	.70711		
	Total	3.8933	1.15751		
Markets: Demand and	Client	3.6250	1.18773		

		Mean	Std. Deviation	F	Sig
Competitive advantage	Consulting	4.0000	.76376		
	Contracting	3.6970	1.21153		
	Academia	4.5714	.53452		
	Others	3.0000	1.41421		
	Total	3.8533	1.04872		
Team members' technical background	Client	3.6250	1.40789	1.183	.326
	Consulting	4.0000	.91287		
	Contracting	3.6364	1.19421		
	Academia	4.4286	.78680		
	Others	4.5000	.70711		
Awareness on green building technology	Total	3.8533	1.09906	.263	.901
	Client	3.7500	1.38873		
	Consulting	3.8000	1.00000		
	Contracting	3.8485	1.09320		
	Academia	4.0000	.00000		
Client, owner and end-users Interest	Others	4.5000	.70711	.877	.482
	Total	3.8533	1.02263		
	Client	3.8750	1.35620		
	Consulting	3.8000	1.00000		
	Contracting	3.6970	1.13150		
Flexible Construction mode to adopt green building technology	Academia	3.7429	.69007	1.197	.320
	Others	3.7000	.00000		
	Total	3.8267	1.07015		
	Client	3.2500	1.16496		
	Consulting	3.9600	.93452		
	Contracting	3.7273	1.09752		
	Academia	4.2857	.48795		
	Others	4.0000	1.41421		
	Total	3.8133	1.02263		

Note statistics is significant at 0.05**

Finally, the respondent's perception on the success factors was examined based on their educational qualifications. Results in Table 6 indicate that significant difference exists in the perception of respondents on two (2) factors (*social awareness of GBT benefits*, $F = 3.731$, $p < 0.05$ and *awareness on green building technology*, $F = 2.940$, $p < 0.05$). A closer look at the mean score obtained by the different educational groupings

(Table 5) reveal that those with PhD (4.6667) and M.Sc (4.2727) qualifications recorded higher mean than those with B.Sc/B.Tech (3.8235) and HND (3.2000). What this result suggests, is that respondents with higher educational qualifications (PhD and M.Sc) tended to perceive social awareness of GBT benefits as important factor while those with degree (B.Sc/B.Tech or HND) certificates perceived it as not too important. In other words, those with lower educational qualifications perceived the two (2) factors: *social awareness of GBT benefits* and *awareness on GBT technology* as not too important factors for GBT adoption in the study area.

Table 6 ANOVA results based on different educational qualifications

		Mean	Std. Deviation	F	Sig
Social Awareness of GBT benefits	PhD	4.6667	.57735	3.731	.015
	M.Sc	4.2727	.87581		
	B.Sc/B.Tech	3.8235	.83378		
	HND	3.2000	.83666		
	Total	4.0133	.89281		
Availability of social and natural environment condition to adopt GBT	PhD	4.3333	1.15470	.367	.777
	M.Sc	3.9394	1.11634		
	B.Sc/B.Tech	4.0588	1.04276		
	HND	3.6000	1.51658		
	Total	3.9867	1.09660		
Availability of Stable economic condition	PhD	4.0000	1.73205	.767	.516
	M.Sc	4.0303	1.33428		
	B.Sc/B.Tech	3.8529	.98880		
	HND	3.2000	.44721		
	Total	3.8933	1.15751		
Markets: Demand and Competitive advantage	PhD	4.6667	.57735	2.089	.109
	M.Sc	4.0000	1.14564		
	B.Sc/B.Tech	3.7647	.92307		
	HND	3.0000	1.00000		
	Total	3.8533	1.04872		
Team members' technical background	PhD	4.0000	.00000	.633	.596
	M.Sc	3.9091	1.20840		
	B.Sc/B.Tech	3.8824	1.03762		
	HND	3.2000	1.09545		
	Total	3.8533	1.09906		
Awareness on green building technology	PhD	4.6667	.57735	2.940	.039
	M.Sc	4.0909	1.07132		
	B.Sc/B.Tech	3.6765	.87803		
	HND	3.0000	1.22474		
	Total	3.8533	1.02263		
Client, owner and end-users Interest	PhD	4.0000	.00000	1.703	.174
	M.Sc	3.9091	1.12815		
	B.Sc/B.Tech	3.8824	1.03762		

		Mean	Std. Deviation	F	Sig
Flexible Construction mode to adopt green building technology	HND	2.8000	.83666	.725	.540
	Total	3.8267	1.07015		
	PhD	4.0000	.00000		
	M.Sc	3.9091	1.12815		
	B.Sc/B.Tech	3.7941	.84493		
	HND	3.2000	1.64317		
	Total	3.8133	1.02263		

Note Statistics is significant at 0.05**

5. Conclusion

Adoption of the concept of sustainable development is at the centre stage in the global construction industry. GBT is an integral part of green building that could aid adoption of sustainable development in the construction industry. However, several factors could aid the adoption of GBT in buildings. A comprehensive literature review was conducted in this study to identify success factors for the adoption of GBT. This was followed by administration of questionnaires to Architects, Quantity Surveyors, Builders, Engineers working in clients’, contracting and consulting types of organisations and out of a total of 14 success factors identified from literature. Mean score (ms) was adopted for the analysis of the result and ranking of the factors revealed five most important success factors which includes social awareness of GBT benefits (ms 4.0133), availability of social and natural environment condition to adopt GBT (ms 3.9867), availability of stable economic condition (ms 3.8933), demand and competitive advantage (ms 3.8533), and team members’ technical background (ms 3.8533). Analysis of variance (ANOVA) was conducted to investigate the level of agreement in the perception of industry practitioners based on type of organisations, years of industry experience, academic qualification and professional background. ANOVA results shows that there is no general agreement in the perception of industry practitioners on the ranking of the success factors. In order to ensure adoption of green building technologies, industry stakeholders must ensure that there is incentive for clients to include cost of GBT in the project budget. Additionally, design professionals must be mandated to always incorporate same at the early stage of building projects. This study has contributed to the existing body of knowledge regarding success factors for the adoption of GBT which could guide in formulating policies for its implementation.

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