WILLINGNESS TO PAY FOR GREEN BUILDINGS IN GHANA: WHAT ARE THE INFLUENCING FACTORS?

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Abstract

Although green buildings have been found to be more life-cycle cost-effective than conventional buildings, the capital cost of building green remains greater than that of traditional alternatives, especially in the Ghanaian market. As such, for green buildings to gain proliferation in Ghana, adopters must be willing to bear a cost premium. This study tests Ghana's green building proliferation readiness by investigating Ghanaians' willingness to pay a green building cost premium. An online survey was administered and responded to by 1,227 participants, upon which statistical analysis, including ANOVA and correlation analyses, were conducted. 70.1% of respondents showed a willingness to pay a cost premium for green buildings, with 33.4% of respondents indicating a willingness to pay a premium of up to 5% the cost of a conventional alternative. Further analyses revealed statistically significant differences in willingness to pay for green buildings across Education levels, Income levels, Environmental Concern levels, and Green Building Awareness levels. However, no significant differences were found between different ages and genders.

Keywords: Sustainability, Green building, Willingness to Pay, Influencing Factors, Ghana

1.0 Introduction

Green Buildings according to the World Green Building Council (WGBC, 2022) are buildings that, in their design, construction or operation, reduce or eliminate negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings have been found to provide a myriad of environmental, economic, and social benefits including: a 25% increase in productivity (Ries *et al.*, 2006), a 30% decrease in energy consumption (Kats, 2003; Ries *et al.*, 2006), a 38% reduction in CO_2 emissions (Balaban and de Oliveira, 2017), a 29% increase in thermal comfort satisfaction (Elnaklah, Walker and Natarajan, 2021), and a lifecycle cost saving of over 10 times the additional cost of building green (Kats, 2003).

Due to these benefits, green building interest and adoption have been gaining momentum globally (Anzagira, Badu and Duah, 2019) as a remedy to the significant environmental harms of traditional buildings. This momentum is however found lacking in some parts of the globe (Wuni, Shen and Osei-Kyei, 2019), particularly in Sub-Saharan Africa where green building uptake remains sluggish and perfunctory (Addy *et al.*, 2020). Ghana, much like other Sub-Saharan countries, remains in the infancy stage of green building adoption (Darko *et al.*, 2017, 2018; Chan *et al.*, 2018; Darko and Chan, 2018; Anzagira, Badu and Duah, 2019; Guribie *et al.*, 2021). Across the country, there is minute government involvement in green building, leaving the mantle on private developers and individuals (Anzagira, Badu and Duah, 2019).

The lackadaisical green building uptake observed in Ghana and Africa at large is cause for concern as the continent will soon become an arena for unprecedented infrastructural development, stemming from the region's rapidly growing population (Komolafe, Oyewole and Kolawole, 2016; Oyewole and Komolafe, 2018). A failure to adopt sustainable building practices will only exacerbate the environmental impacts over time. It is therefore imperative that Ghana and other developing countries within the region widely adopt green building practices within the shortest possible time (Plessis, 2007; Oyewole and Komolafe, 2018).

Green building uptake in Ghana has however been hindered, more so than in the western world, by many factors, particularly the cost premium over conventional buildings (Chan *et al.*, 2018; Ako-adjei and Danso, 2019). Though these costs will be returned in surplus over the lifecycle of the building (Kats, 2003), relative to traditional alternatives, green buildings typically incur additional capital costs such as investment in research and development, and more efficient, but more expensive, construction systems (Ofek and Portnov, 2020).

For green buildings to gain ubiquitous traction, consumers' must be willing to pay these additional costs (Oyewole and Komolafe, 2018; Abraham and Gundimeda, 2020; Guribie *et al.*, 2021; Njo, Valentina and Basana, 2021). But are consumers willing to pay for green buildings? If they are, to what extent? And what factors influence their willingness?

To this end, this paper aims to assess individuals' willingness to pay (WTP) for green buildings in the Ghanaian real estate market and examines the factors affecting consumers' willingness to pay for green buildings. This study will be the first in Ghana, and part of the few in Africa to investigate consumers' willingness to pay for green buildings. The research is imperative to know whether there is a demand for green buildings as well as understand the dynamics of demand for green buildings which is crucial for the adoption of green buildings in Ghana.

2.0 Willingness to Pay for Green Buildings

The upfront cost of building green is amongst the most cited inhibitors of green building adoption (Dwaikat and Ali, 2016; Takuh, Adeyemi and Bello, 2021) across the extensively studied area of green building adoption drivers and inhibitors globally (Wuni, Shen and Osei-Kyei, 2019). In Ghana, previous studies have found barriers such as lack of government support (Darko *et al.*, 2018), lack of demand (Djokoto, Dadzie and Ohemeng-Ababio, 2014), and low sensitization (Guribie *et al.*, 2021) as the most significant hindrances to green building adoption. Additionally, Chan et al. (2018) and Ako-adjei and Danso (2019) found initial cost-related barriers as the most significant hindrance to green building adoption. Despite variances in what has been found as the most significant hindrance to green building adoption in Ghana, the upfront cost barrier has been found to be a significant hindrance both in Ghana (Djokoto, Dadzie and Ohemeng-Ababio, 2014; Opoku, Ayarkwa and Agyekum, 2019; Guribie *et al.*, 2021), and globally (Chan *et al.*, 2018).

The existence of a higher initial cost of green building construction over conventional alternatives, also referred to as green building cost premium (Dwaikat and Ali, 2016), green building cost surcharge (Hu and Skibniewski, 2021), or green premium (Kats, 2013), has been debated across the literature (Dwaikat and Ali, 2016; Hu and Skibniewski, 2021; Takuh, Abang and Akinyemi, 2021). After reviewing 17 empirical studies that investigated green building cost premiums, Dwaikat and Ali (2016) found no conclusive answer to the debate. They (Dwaikat and Ali, 2016) however pointed out that 90% of results revealed the existence of a green building premium within the range of 0.4%-21%, with very little evidence supporting the assertion that green buildings cost less than traditional alternatives. More recently, by

reviewing 36 studies, Hu and Skibniewski (2021) surveyed over 1,300 cases across 11 countries and confirmed the existence of a cost premium for building green. Their analysis revealed both a median and mean green building cost premium of 7%, which they recommended to be used as a green premium benchmark (Hu and Skibniewski, 2021).

In Ghana, though no research was found quantitatively investigating the cost premium of green buildings, the existence of a green building premium appears to be a widespread conception (Opoku, Ayarkwa and Agyekum, 2019). As Opoku, Ayarkwa and Agyekum (2019) put it, construction professionals with in-depth green building knowledge in Ghana are of the view that building green comes with a higher initial cost over conventional alternatives.

This cost premium, as reported by Opoku et al. (2019), results in developers' preference for traditional buildings over green alternatives. Developers however must consider the demand of the market (Njo, Valentina and Basana, 2021) and will only build green if they are confident that end-users have a preference for and are willing to bear the cost premium of green buildings (Oyewole and Komolafe, 2018; Abraham and Gundimeda, 2020; Guribie *et al.*, 2021; Njo, Valentina and Basana, 2021). Guribie et al. (2021), in their recent study of impediments to green building, concluded that the key to green building proliferation in the Ghanaian market is to have green building expansion driven by the demand of the end-users. But are Ghana's property end-users willing to pay for green buildings? If they are, to what extent?

This research found no empirical evidence measuring the Ghanaian market's willingness to pay for green buildings. There is however ample evidence of willingness to pay for green buildings from other countries. In Nigeria, Takuh, Adeyemi and Bello (2021) found medium-income earners willing to pay a 3.3% premium for green homes. In Indonesia, Njo, Valentina and Basana (2021) found 39.7% of respondents willing to pay a 6-15% premium, and 38.53% willing to pay a 5% premium. In Singapore, Heinzle, Boey Ying Yip and Low Yu Xing (2013) found buyers willing to pay a 3.78% premium for the certified award, and 7.98% for the platinum award of the Building Construction Authority Green Mark Scheme. In Israel, respondents to Portnov et al.'s (2018) survey indicated a willingness to pay a 7-10% premium.

2.1 Factors Influencing Willingness to Pay

Recently, there has been a high volume of research on factors affecting consumers' willingness to pay for green buildings (Oyewole, Komolafe and Gbadegesin, 2021). However, research on willingness to pay in developing countries and most especially in Africa is scant (Anzagira, Badu and Duah, 2019; Oyewole, Komolafe and Gbadegesin, 2021). In Ghana, no

study was found investigating the factors that influence willingness to pay for green buildings. This review found majority of the studies in this regard to have been conducted outside Africa, and to have evidenced several influencing factors including sociodemographic / socio economic factors, knowledge / awareness of green buildings, and the preferred green attributes / perceived benefits of green buildings.

Literature on the effect of gender on willingness to pay tends to be variable. Whilst some studies have found gender to be an influencing factor (Attaran and Celik, 2015; Khan, Thaheem and Ali, 2020), some others have not (He, Liu and Li, 2022). Even amongst studies that have found gender to be an influencing factor, it remains unclear which gender is more willing to pay. Attaran and Celik's (2015) study on students' environmental responsibility and their willingness to pay found females more willing to pay than males. They (Attaran and Celik, 2015) however associate this difference to their finding that females are more environmentally responsible than males. This is supported by the assertion of de Silva and Pownall (2014) that educated females put the greatest value on going green. Conversely, Khan, Thaheem and Ali (2020) recently found males more willing to pay for sustainable housing than their female counterparts; associating this occurrence to females being more risk averse and careful in their purchase decisions.

Similar to the effect of gender, the effect of age on willingness to pay seems unclear. Whilst some studies have found older respondents more willing to pay for green buildings than younger respondents (Khan, Thaheem and Ali, 2020; He, Liu and Li, 2022), some others have found no correlation (Rosner, Amitay and Perlman, 2022).

Income level has been found to have an insignificant influence on individuals' desire to go green (de Silva and Pownall, 2014). However, with regard to green buildings, Hu, Geertman and Hooimeijer (2014) revealed that the socio-economic status of homebuyers determines their purchasing power and thus their willingness to pay for green attributes, indicating that higher income earners are more prepared to pay for green buildings to improve their living comfort than lower income earners. In contrast, though agreeing to the existence of a correlation between income and willingness to pay, Khan, Thaheem and Ali (2020) posit that income level has a negative correlation with willingness to pay.

Studies seem to agree on the existence of a positive correlation between level of education and willingness to pay. Educated individuals were found to have a high willingness to pay for green buildings (de Silva and Pownall, 2014; Attaran and Celik, 2015). Khan, Thaheem and Ali

(2020) also find a positive correlation between level of education and willingness to pay for green buildings.

Attaran and Celik (2015) found a direct correlation between environmental concern and willingness to pay for green buildings. Tan and Goh (2018) add that consumers purchase intention is largely affected by psychological factors such as attitude towards environmental concern. Thus, as individuals' concern for the environment increases, their willingness to pay for green buildings increases (Attaran and Celik, 2015; He, Liu and Li, 2022). Also, people with high self-reported knowledge on environmental issues or environmentally aware behaviour were found to indicate a significantly higher tendency and/or willingness to pay for green buildings (Li *et al.*, 2014; Jang, Kim and Kim, 2018; Golbazi, Danaf and Aktas, 2020; He, Liu and Li, 2022; Rosner, Amitay and Perlman, 2022).

Ofek and Portnov (2020) revealed that in Israel, consumers more familiar with green building benefits are willing to pay 9.25% of green building price premium as opposed to 7.74% additional costs acceptable to consumers being less familiar with green building benefit; indicating that there exists a positive relationship between knowledge on green buildings and willingness to pay for green buildings (He, Liu and Li, 2022). The same conclusion was arrived at by Golbazi, Danaf and Aktas (2020) who found respondents with higher self-reported green building knowledge willing to pay significantly more for green buildings Oyewole and Komolafe (2018) assert that the promotion of green buildings and its benefits is of urgency for the successful growth of the green building industry. Njo et al. (2021) add that limited knowledge on green buildings contributes to individuals avoiding risks of purchasing or investing in green apartments. There is therefore the need to sensitize all stakeholders on the environmental benefits of green buildings especially in developing economies if its proliferation is to be achieved (Zhang *et al.*, 2016; Oyewole, Komolafe and Gbadegesin, 2021; Takuh, Adeyemi and Bello, 2021). Although all kinds of information can affect consumers' willingness to pay for green buildings, it was evinced that information on the economic benefits of green buildings has the highest influence on willingness to pay (He et al., 2022).

It is obvious that there is no concordance across the literature as to the significance of the identified factors. As Darko et al. (2018) put it, "green building is not the same across the globe". The significance of influencing factors is likely to differ across locations due to cultural, economic, and regulatory differences (Darko and Chan, 2018). This further highlights the cruciality and significance of a study investigating influencing factors specific to the Ghanaian market.

3.0 Methodology

This study adopted an exploratory mixed-methods research design to investigate the Ghanaian market's willingness to pay a green premium, and the factors that influence said willingness.

The research was undertaken by surveying 1,227 Ghanaians. The survey was designed and distributed online, using the *questionpro.com* platform, to as many willing respondents as possible. This distribution technique was adopted due to the large population size, geographical boundaries among expected respondents, its ability to increase survey distribution, and cost-effectiveness (Abidoye *et al.*, 2022).

The questionnaire began with an introduction, which detailed the purpose of the research and assured respondents of their anonymity and the confidentiality of their responses, followed by three main sections. The first section enquired background information on age group, gender, highest education level, and income level. The second section tested the respondents' knowledge of green buildings, their environmental concern levels, as well as their desire to occupy a green building. These were achieved by means of Likert scales. Respondents were asked to rate their environmental concern from *'I am Not at all concerned'* to *'I am Extremely Concerned'*. With regards to their knowledge of green buildings, respondents were required to rate their perceived level of knowledge on the subject from *'I have never heard of green buildings'* to *'I am an expert in green buildings'*. The desire to live in / occupy a green building was also tested by means of a 3-point Likert scale – *'Yes', 'Indifferent',* and *'No'*. The final section of the questionnaire was designed to gauge the willingness to pay a premium for green buildings over conventional alternatives. Respondents were asked to indicate how much premium they were willing to pay – from *'No premium'* to *'Above 25%'*. Finally, an open-ended question was included to allow respondents to share further thoughts on green building adoption in Ghana, and their ability to pay a green premium.

Prior to the distribution of the final survey, a pilot survey was undertaken to assess the clarity and suitability of the questionnaire. The questionnaire was distributed to 10 sample respondents who provided useful feedback, following which necessary changes and updates were made before the final survey.

The link to the final survey was distributed to target participants, reminders were regularly sent, and any concerns were promptly addressed. Overall, the survey was viewed by 1,872 and responded to by 1,227. However, 232 responses were incomplete and thus removed from the final sample. A final sample of 995 responses was deemed suitable for further analysis. Profiles of the respondents are presented in Table 1.

Table 1: Respondents' Profile

Variable	Scale	Frequency	Percentage
Age	Below 20	23	2.3%
	20 - 25	271	27.3%
	26 – 30	284	28.6%
	31 – 35	125	12.6%
	36 – 40	78	7.9%
	41 – 45	79	8.0%
	46 – 50	49	4.9%
	51 – 55	35	3.5%
	56 – 60	21	2.1%
	Above 60	27	2.7%
Gender	Male	576	60.3%
	Female	380	39.7%
Education Level	JHS	5	0.5%
	SHS	68	6.9%
	HND/BSc	608	61.4%
	Masters	265	26.7%
	PhD	45	4.5%
Monthly Income	No income	195	19.7%
	GH₵ 1 – GH₵ 1,499	173	17.5%
	GH₵ 1,500 – GH₵ 2,999	238	24.1%
	GH₵ 3,000 – GH₵ 4,499	136	13.8%
	GH₵ 4,500 – GH₵ 5,999	67	6.8%
	GH₵ 6,000 – GH₵ 7,499	53	5.4%
	GH₵ 7,500 – GH₵ 8,999	35	3.5%
	Above GH₵9,000	91	9.2%

Following collation of data and exclusion of incomplete responses, normality assumptions were checked to verify the validity of the data for further statistical analysis. Cronbach's test was adopted to estimate the internal consistency of the data and the reliability of the scales

adopted for the study. As established in literature (Attaran and Celik, 2015; Li, Long and Chen, 2018), a value range between 0.7 – 1 is acceptable, and our test returned a value of 0.842.

Several tests of association were performed to confirm the relationship between our variables. Adopting *'Willingness to pay a premium'* as the independent variable, correlation levels with all other variables were computed. Chi-square tests were also conducted to measure the relationship between our nominal variables *(Age, Gender, Education Level, Income Level, Environmental Concern Level, and Green Building Knowledge Level)* and the willingness to pay a premium for green buildings. Finally, ANOVA analyses were conducted to measure the variance within groups in an attempt to determine how different characteristics of our respondents influence their willingness to pay a premium for green buildings.

4.0 Results and Discussion

The biggest proportion of respondents (33.4%) was only willing to pay up to 5%, with the second largest group (29.9%) unwilling to pay any premium at all. These two groups make up more than half (63.3%) of the respondents. Furthermore, the average respondent was found willing to pay a green premium of up to 5%. Following a 7% green premium benchmark (Hu and Skibniewski, 2021), these results highlight a low willingness to pay for green buildings. Only 17.8% were willing to pay between 6% and 10%. Beyond this point, Ghanaians show limited interest in paying more for green buildings, with only 18.8% inclined to pay a green premium greater than 10% the cost of a conventional alternative. These statistics are presented in Figure 1.

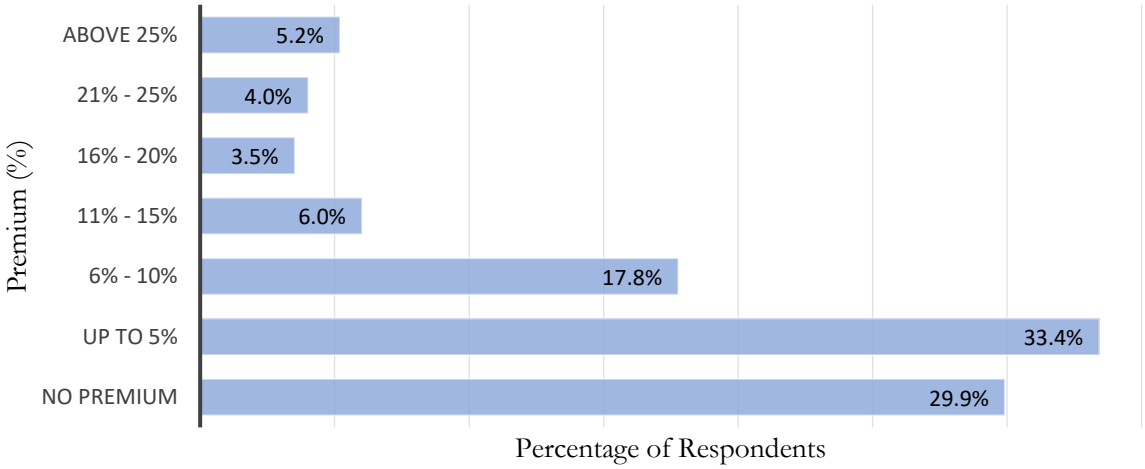

Figure 1: Willingness to Pay a Premium for Green Buildings

Levels of concern about climate change and the environment were generally favourable, with 98.09% of respondents expressing some concern, ranging *'slight'* to *'extreme'* (Figure 2). In the same vein, 75.47% expressed a preference for green buildings over conventional alternatives (Figure 3).

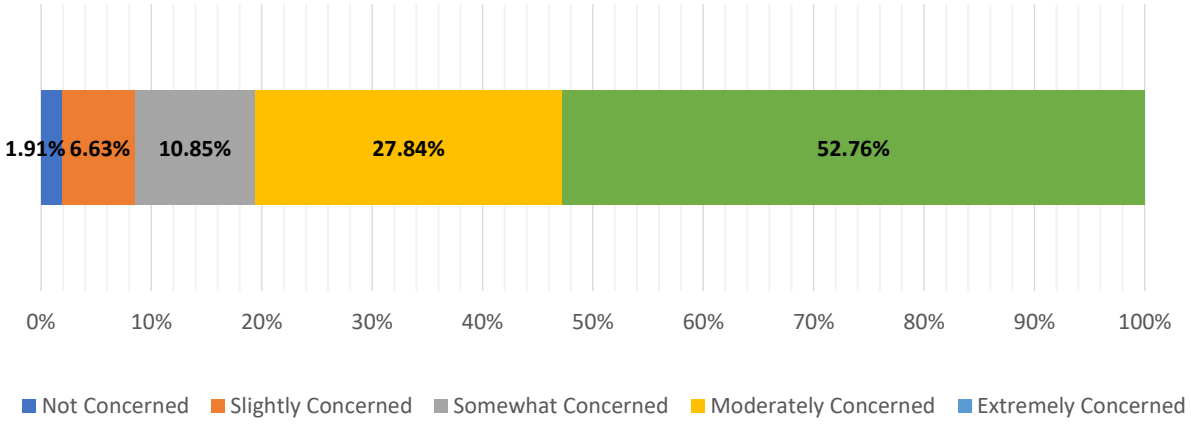

Figure 2: Environmental Concern Levels

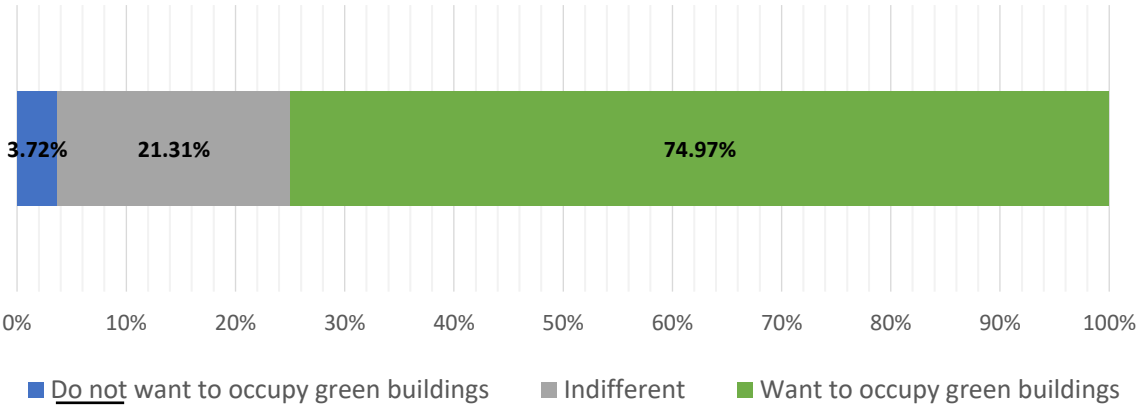

Figure 3: Desire to live in Green Buildings

Several tests of association were performed to confirm the relationship between our variables. Adopting *'Willingness to pay a premium'* as the independent variable, correlation levels with all other variables were computed. The results of our correlation analysis are presented in Table 2. The results showed that *'Knowledge of Green Buildings'* was the most highly correlated variable (0.286), significant at 5%. This is consistent with the findings of He, Liu and Li (2022) who found information contents to have the largest impact on green building purchase intention.

Table 2: Correlation Analysis results

Influencing Factor	Correlation with WTP
Knowledge of Green Buildings	0.286**
Income	0.195**
Environmental Concern	0.189**
Education Level	0.187**
Age	0.068*
Gender	-0.029

Note: This table presents level of correlation of all other variables with respondents' willingness to pay a premium for green buildings. ** denotes significance at 5% level, and * denotes significance at 10% level. *'Gender'* did not exhibit any statistically significant correlation with willingness to pay a premium.

Consistent with the literature (Hu, Geertman and Hooimeijer, 2014), Chi-square tests were also conducted to measure the relationship between our nominal variables *(Age, Gender, Education Level, Income Level, Environmental Concern Level, and Green Building Knowledge Level)* and the willingness to pay a premium for green buildings. The results of the Pearson Chi-square tests are presented in Table 3. The results support our initial predictions – *Education, Income, Concern for the Climate, and Knowledge of Green Buildings* all showed significant association with the willingness to pay a premium. Gender did not exhibit any significant association. This finding contrast those of Khan et al. (2020) who found correlations between the gender demographic and willingness to pay. Yet, the finding is in line with those of He, Liu and Li, (2022) and Rosner, Amitay and Perlman (2022) who found no significant correlation between willingness to pay and the demographics of age and gender.

Table 3: Chi-square Tests results

Variable	Value	df	Asymp. Sig.
Education	65.608	24	0.000
Income	85.210	42	0.000
Environmental Concern	92.009	24	0.000
Knowledge of Green Buildings	129.542	24	0.000
Gender	15.002	6	0.200
Age	58.155	54	0.325

Note: The results of Chi-square tests run to confirm the association between various variables and *'Willingness to Pay a premium'* are presented in the above table. A confidence level of 95% was adopted for these tests. As such, any variable with a significance level below 0.05 was deemed to exhibit statistically significant association with our dependent variable *'Willingness to Pay a premium'*.

ANOVA analyses were also conducted to measure the variance within groups in an attempt to determine how different characteristics of Ghanaians impact their willingness to pay a

premium for green buildings. Tests of homogeneity were run to confirm the suitability of ANOVA for further analysis, and the results were significant at 1% level for all variables. Rejecting the null hypothesis confirmed that there are significant differences in the willingness to pay a premium across the different groups. Consistent with previous tests of association (correlation and Chi-square), *'Age'*, and *'Gender'* did not exhibit any statistically significant variations on the willingness to pay. This suggests that the willingness to pay is not unduly affected by these characteristics (He, Liu and Li, 2022; Rosner, Amitay and Perlman, 2022), and they were excluded from further discussion.

4.1 Education Levels and Willingness to Pay a Green Premium

Significant variances were found between respondents with different levels of education and their willingness to pay a premium. No significant differences were found between JHS graduates and any other groups. Beyond this group, however, significant differences were confirmed between SHS graduates and the higher levels (HND/BSc, Masters, and PhD). No differences existed between Master's graduates and PhD holders, suggesting that Master's-level education is sufficient for an appreciation of the concept of green buildings as well as the willingness to pay for them. A key distinction between these two groups is that PhD holders are willing to pay a higher premium (between 11% – 15% on average) than their Master's counterparts (between 6% – 10% on average). This dynamic is most likely linked to the earning capacities of these two groups, as PhD holders ordinarily earn more than the average employee with a Master's degree. Future studies could explore the bi-directional relationship between education levels and earning capacities, as well as the moderating effects of earnings on the education-willingness to pay relationship.

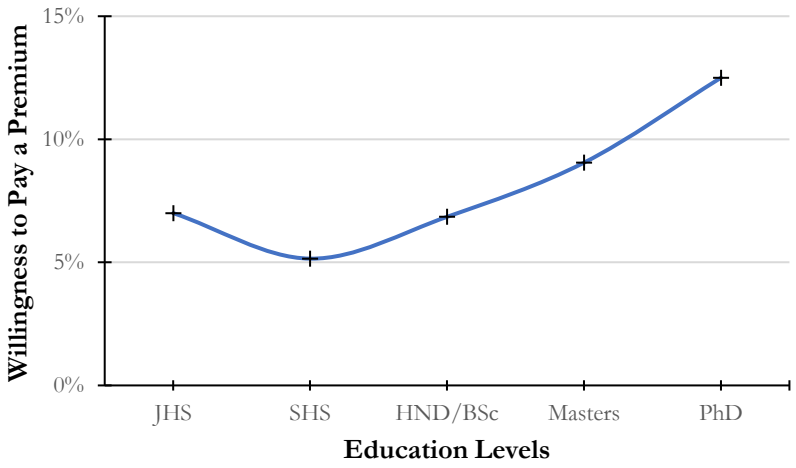

Figure 4: Means Plot: Education Levels and Willingness to Pay a Premium

4.2 Income Levels and Willingness to Pay a Green Premium

Consistent with the findings of Hu, Geertman and Hooimeijer (2014), who suggest that the wealthier are willing to pay a premium, our results indicate significant differences in the willingness to pay a premium across the different income levels. No significant variations were observed between those who earn no income up to those earning below GH₵6,000 per month. In these groups, the average respondent was willing to pay a premium in the range of 6% and 10%. Additionally, several of these respondents included comments citing their interest but an inability to pay a premium due to financial constraints. The average premium increased beyond the GH₵6,000 group, highlighting an increased willingness to pay a premium beyond a certain point on the economic scale. Earners above this point are generally willing to pay a little more for green buildings, perhaps highlighting improved affordability – these respondents are willing to pay premiums between 11% and 15% for green buildings. A few other respondents also implored the government to introduce incentives such as tax breaks and assisted housing finance for Ghanaians who opted for green buildings.

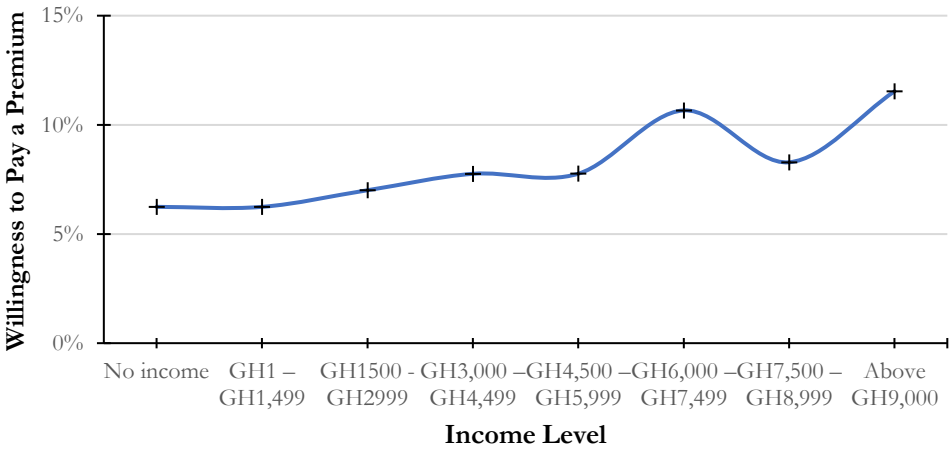

Figure 5: Means Plot: Income Levels and Willingness to Pay a Premium

4.3 Environmental Concern and Willingness to Pay a Green Premium

The impact of levels of environmental responsibility on the willingness to pay a premium for green buildings is well established in the extant literature (Attaran and Celik, 2015; He, Liu and Li, 2022). Our findings align with these expectations – the premiums respondents are willing to pay increase with the level of concern they have for climate change and the environment. This is shown in the Means plot in Figure 6. No significant variations are evident at lower levels of concern, the *unconcerned, somewhat and moderately unconcerned* are all willing to pay similar premiums (no more than 5%). The *more concerned* and *extremely*

concerned are willing to pay on average, premiums of 6% – 10%. The highest premiums match those extremely concerned about the environment, perhaps highlighting their appreciation of how urgent a switch to green buildings is for sustainability. Further comments reiterated some concerns about climate change and the preparedness of developing countries such as Ghana, but these cautionary comments still hinted at financial concerns and affordability ratios.

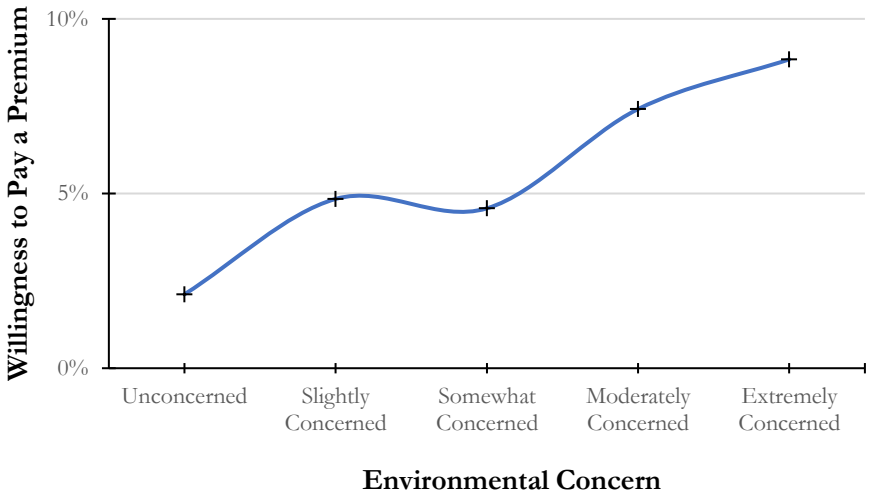

Figure 6: Means Plot: Environmental Concern and Willingness to Pay a Premium

4.4 *Green Building Knowledge and* Willingness to Pay a Green Premium

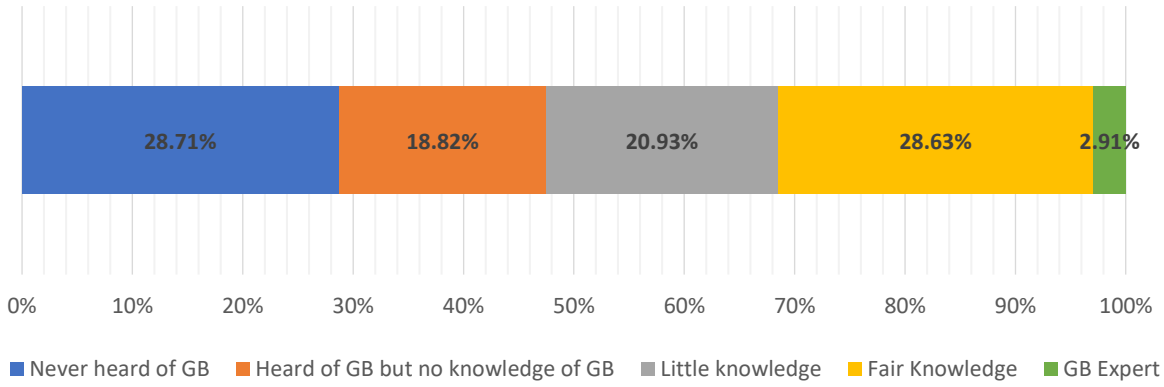

Figure 7: Green Building Knowledge Levels

Our initial hypothesis was that the level of green building knowledge heavily impacts the willingness to pay a premium for them based on the findings of (Oyewole and Komolafe, 2018; Golbazi, Danaf and Aktas, 2020; Ofek and Portnov, 2020; Njo, Valentina and Basana, 2021). The survey instrument posed a few questions to determine the level of knowledge the

average respondent has about green buildings as a concept. These questions indicate an interesting insight on the state of knowledge of green buildings among Ghanaians (Figure 7) – 28.71% have never heard of the term prior to the study while 18.82% have only come across the term but are not aware of its implications. A high proportion indicated a fair amount of knowledge about the concept (28.63%), but only 2.91% have expert-level knowledge.

The ANOVA analysis revealed significant differences as level of knowledge increased. Those who have never heard of green buildings and those who had only heard of the concept were fairly similar in terms of their willingness to pay a premium. On average, these respondents indicated a willingness to pay a premium of up to 5% for green buildings. The lack of variation between these two groups suggests that some level of understanding is required to impact willingness to pay a premium. Respondents in the final three categories *(little knowledge, fair amount of knowledge and expert knowledge)* were all willing to pay increasingly higher premiums as level of knowledge increased, indicating a strong positive relationship between these two variables. As shown in the Means Plot in Figure 8, experts were willing to pay the highest premiums: between 11% – 15% on average. This average (calculated mean of 3.714, corresponding to the 11% – 15% premium range) is the highest across all the variables considered in our study, further suggesting that knowledge levels are perhaps the most significant indicator of willingness to pay a premium for green buildings.

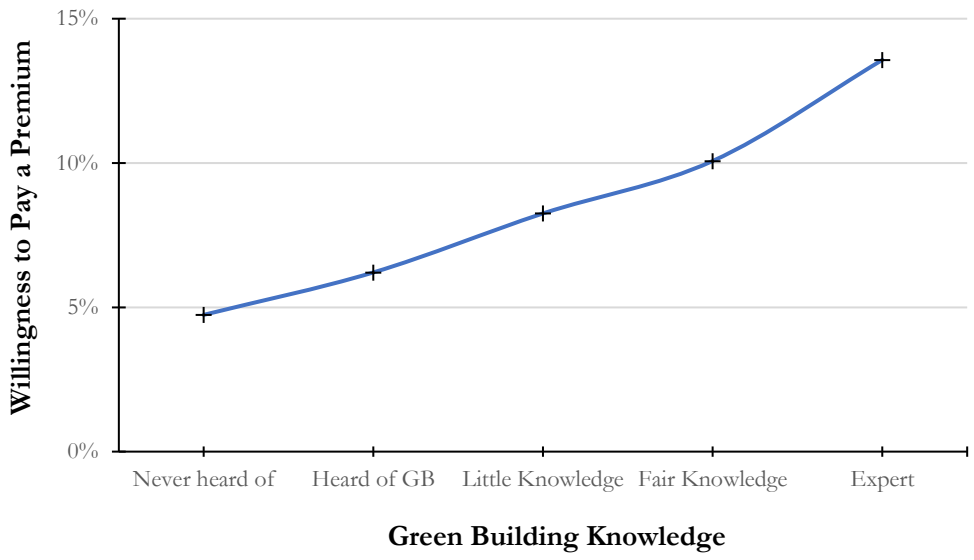

Figure 8: Means Plot: Green Building Knowledge and Willingness to Pay a Premium

5.0 Conclusion

Interest in green buildings has gained immense momentum across the globe over the last few decades due to their potential to significantly address climate change concerns posed by traditional buildings (Anzagira, Badu and Duah, 2019). Additionally, the proliferation of green buildings is necessary to achieve sustainable built environments by reducing the environmental impacts of building construction activities. While interest across the globe has undoubtedly increased, the adoption of green buildings has not been as universal. Particularly in developing countries such as Ghana, Addy et al. (2020) suggests that uptake remains limited. Attempts to explain these variations have been made, but with green buildings generally expected to command a cost premium on construction, end-users must be willing to pay a premium to build green, a change in attitude that will in turn, spur developers on (Njo, Valentina and Basana, 2021).

We surveyed 995 Ghanaian respondents to determine their willingness to pay (WTP) a premium for green buildings. Our survey instrument first collected background information on our participants, then gauged their knowledge of green buildings, as well as their willingness to pay a premium over conventional buildings. Following collation of these responses, we performed several tests of association and ANOVA analyses to address our primary research question – are Ghanaians willing to pay a premium for green buildings?

Our results revealed generally high levels of concern for the climate, with 98.09% showing some level of concern for the state of the environment. 74.97% also indicated a desire to live in green buildings, given its benefits. However, we found that knowledge of the concept does not match these concern and desire levels – 28.71% and 18.82% have never heard of or only heard of the concept, respectively.

Initial insights on WTP suggest that the biggest proportion (33.4%) are only willing to pay up to 5%, while 29.9% are not willing to pay any premium at all. Our correlation results also indicate that in order of strength, '*knowledge of green buildings', 'income levels', 'environmental concern', ''education level' and 'age'* are most correlated with WTP. We found significant variations across education levels, with the more educated willing to pay higher premiums. Income levels were also found to impact WTP, much like the findings of Hu, Geertman and Hooimeijer (2014). Our findings highlight steady increases in WTP as income levels rise, particularly for earners above GH₵6,000 per month. In contrast with lower levels of income who are willing to pay between 6% - 10% on average, the highest earners are willing

to pay between 11% and 15%. Environmental concern levels also exhibit a positive relationship with WTP, notably beyond the point just *somewhat concerned.* Respondents who were unconcerned, slightly concerned or somewhat concerned about the climate are only willing to pay up to 5% for green buildings, while those moderately or extremely concerned are willing to pay between 6% and 10%. These findings align with those of Attaran & Celik (2015) who suggested that environmental responsibility impacts WTP.

In response to calls for further sensitization efforts to boost the uptake of green buildings in developing countries such as Ghana (Anzagira, Badu and Duah, 2019), we found significant variances in WTP across knowledge levels. Respondents who had never heard of green buildings were not willing to pay beyond 5% over conventional buildings. As knowledge levels increased, WTP levels also increased, and those who identify as experts indicate a willingness to pay the highest premiums (between 11% and 15%). Much like Ofek and Portnov (2020), we conclude that knowledge levels heavily impact WTP a premium for green buildings, making this a key consideration in efforts to boost their adoption in Ghana.

No studies based in Ghana have attempted to gauge the willingness of the populace to pay a premium for green buildings, and how this willingness varies across different characteristics such as age, gender, income levels and education levels. To the best of our knowledge, this study represents the first attempt to address this gap by investigating the willingness of Ghanaians to pay a premium for green buildings. Based on our final sample of 995 respondents, we also computed significant differences in WTP due to differences in Income, knowledge levels, climate concern levels and benefit awareness. These findings offer a clear signpost for all stakeholders of green buildings and highlight that poor awareness levels have a detrimental impact on the WTP a premium, a fact that is stagnating their potential adoption. Additionally, these results should provide investors and developers some confidence in entering the green building space, knowing that there is a potential market for green buildings in Ghana, albeit under certain conditions.

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