Antecedents of marketing climate change adaption construction materials: Evidence from Ghana

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Abstract: Purpose: Climate Change affects all countries in the world. It impacts negatively on the living conditions of humankind, especially livelihood, temperature change, rainfall regime, and rise in tidal waves. Design/Methodology/Approach: The population in the real estate industry. A descriptive design was used, including questionnaires, to gather data. Since the study sought to examine the willingness to purchase accordingly, a logit regression model was used to predict the likelihood that the dependent variable willingness to pay (WTP) equals 1 (rather than 0). Findings: Income level, price of the products, respondent's age, gender, and availability of policies concerning eco-friendly products and identified associated health risks positively influence respondents' WTP. The study reveals that in the real estate sector of the Ghanaian economy, there is a positive WTP eco-friendly roofing product; hence, entrepreneurs and investors should take advantage of the urgency to reduce the impact of climate change in Ghana by investing in eco-friendly products for both the real estate and construction sectors of the economy. Recommendations: The results show that any eco-friendly roof material must raise consumer awareness about the effects of climate change and shape consumer perceptions.

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1. Introduction

Climate change, which includes seasonal changes over a long duration (Kudom-Agyemang, 2014 & Antwi, 2013), is mainly detrimental to tropical arid and semi-arid areas most vulnerable as sub-Saharan Africa. The various phenomena associated with climate change have negatively affected regions and the African continent. Limited resources and inequitable allocation of resources are some of the effects to be found. Both effects bring about stress-related problems that increase the probability of the adverse effects of climate change for towns all over the world, as De Sherbinin et al. (2007) observe. According to Henrichs, Krellenberg, and Fragkias (2013), climate change is the known system of continuous global change, and urbanization provides the context within which the climate changes as well as affects its potential consequences. Greenhouse emissions, a contributory factor to the climate change problem, are primarily produced in cities due to the concentration, size, and range of economic activities within the confines of the cities. In Ghana, changing flood risks threaten property in coastal real estate worth billions of dollars (Chandra, Zhang & Andrews, 2015). Guillaumont and Simonet (2011) also accept that a combination of higher temperatures and extreme weather events may create conditions unfavourable for real estate. Since the people directly affected by climate change will have to pay attention to new challenges (Müller & Weber, 2008), Ghana urgently has to address climate change concerns in development planning to reduce its effect on people. Sustainable strategies that can overcome the negative impacts are also required to efficiently deal with changed conditions (Müller & Weber, 2008).

Indeed, climate change negatively impacts the living conditions of humanity, in effect, the livelihood of people since it results in substantially higher temperatures (Organe consultative sur les changements climatiques (OcCC, 2002), the significant occurrence of floods coupled with its associated increase in the destruction of lives and property (IPCC, 2007). Nursey-Bray (2010) notes that irrespective of climate change's impact, crucial, tailored sectoral needs are not in place. According to Asante, Franklin, and Amuakwa-Mensah (2014), the impact of climate change includes temperature change, change in rainfall and rise in sea level, change in rainfall regime in favour of a long dry season, and disappearance of the rainy season. There are numerous explanations why Ghana should be concerned with low-carbon development planning (Würtenberger et al., 2011), particularly in the private sector. Effective market creation and commercialization of climate change products require immediate commitment from all stakeholders.

Moreover, numerous marketing studies involving consumers' willingness to pay have concentrated on agriculture and other sectors. Anifori, Owusu, and Owusu (2022), who worked on organic vegetables, preference for beef cuts, cassava bread, and pension schemes for poultry agribusiness workers, none of these studies have touched on marketing climate change adaption construction materials. Consequently, this study explores the consumer willingness to purchase eco-friendly roofing materials as well as examines the prospects and strategies of marketing innovative climate change products. This study also investigates the prospect and strategy of marketing innovative climate change products and examines the factors that affect the stakeholders' willingness to purchase these products. Specific Objectives of this study are: To estimate consumers' willingness to pay for eco-friendly roofing tiles (2) To determine consumers' perception of the effects of climate change (3) To examine the socio-economic factors that affect the marketing of climate change innovative products in the construction industry (4) To examine the factors that impede the marketing of innovative climate change products in the construction industry and (5) To determine the prospects and strategies required in marketing climate change products.

2. Theoretical framework

Climate innovation theory is based on a more liberal "Keynesian" interpretation of neoclassical economics, which advocates a limited role for government intervention (Morey et al., 2006). The theory posits that markets are reasonably efficient. However, in some way, they release public goods that do not meet the consumer's specific needs via price incentives. Put, neoclassical economic doctrines presume that the prices of goods can be used to bring about technological innovations. Despite the limited role of government concerning pricing, there is the need for an active role by the government to boost the morale of learning and to help upcoming institutions that

encourage innovation and the relationships between them, thereby encouraging new private and public partnerships (Atkinson & Hackler, 2010).

2.1. Climate change and innovation

According to Adger (2009), technology and learning capacity shape the ability to acclimatize but, more significantly, the ethics of caring for vulnerable individuals and places within the societal decision-making structures (Adger et al., 2009, p. 350). Therefore, governments and the private sector are leading in technological adaptations and innovations through research programs (Smit and Skinner, 2002). Ebi et al. (2005) suggest that technology plays an essential role in adapting to climate change through the provision of efficient innovations in cooling systems, desalination technologies, and some other forms of engineering solutions are the options that lead to improved outcomes and increased coping. The discomfort that climate change brings has led to the need to do things differently to reduce the effects of climate. Technological innovation is essential in the fight against climate change. Innovation leads to the introducing of new strategies or technologies or the revivals of technologies in response to new conditions imposed by climate change (Bass, 2005). Many technological responses to climate change are closely associated with a specific type of impact, such as higher temperatures or decreased rainfall (IPCC, 2007).

2.2. Climate change and the construction sector

The importance of providing sustainable and resilient public housing construction worldwide is that it is a convenient way to overcome the difficulties caused by climate change mitigation, adapt to the effects of climate change, and augment the housing supply (Martin et al., 2013). Providing sustainable and resilient public housing is essential because "designing, installing, and maintaining construction techniques within national public housing programs has the potential for allaying a portion of challenges posed by climate change" (Martin et al., 2013). Although Martin et al. (2013) believe that centrally administered public housing programs can generate newly constructed subsidized housing units in various forms, the agencies and bureaucracies involved lack the technical capacity and funding. They advocate for private sector participation since it has financing opportunities. Martin et al. (2013) explain that climate change impacts housing demand. Environmental analysts and advocates are also not conversant with the costs and bureaucracies of providing housing for people experiencing poverty. Martin et al. (2013) identify the technological solutions for addressing the challenges caused by climate change. They outline the following strategies that housing authorities can implement. These strategies include:

2.3. Reducing energy consumption in building construction

It reduces energy consumption in operating and maintaining housing through design, construction, systems, appliances, and occupant behaviour changes.

2.4. Mitigation technologies and innovation imperative

Morey et al. (2011) posit that mitigation is one of the most essential adaptation strategies; innovation is the only way to reduce costs and scale up the necessary climate technologies rapidly. They suggest that low-carbon technologies are essential for developing countries to reduce climate impact severity. Achieving the ambitious target of limiting global warming to 2°C above pre-industrial levels will require stopping carbon dioxide (CO_2) emissions growth in the next decade and then beginning a rapid emissions decline (IPCC, 2007).

Morey et al. (2011) identify the following examples of mitigation technologies:
- Improved renewable energy systems, such as low-cost solar.
- Carbon capture and sequestration for coal Green cement captures carbon dioxide in its production process.
- Low-carbon fuels such as direct solar fuels, biofuels from algae, and hydrogen produced from renewable sources.
- Electric vehicles and trains Improved energy storage.
- Superconducting, super-efficient electric motors.

2.5. Measurement of perception

The study also examined their perceptions of construction products to identify whether consumers in the construction sector will accept eco-friendly products. This becomes very important because it is acknowledged that an extensive range of factors affect consumer buying, and perception is one of the factors. The factors perceived quality, price, country of manufacture, and perceived risk affect consumer perception of a particular product.

2.6. Perceived price and value

It explains how a consumer perceives the price of a product. The product's price may be high or low from the consumer's perspective. This subsequently affects both purchase intention and purchase satisfaction of the consumer. For instance, Assael (2004) confirms that consumers' price perceptions are not very simple because their expectations influence them. Usually, their reference points include the previous prices, prices charged by other competitors, and the cost of goods sold.

On the other hand, the perceived value is a utility derived from using the product relative to its costs. Consequently, a consumer will be willing to pay premium prices if the product has higher brand equity. So, the choice of a brand is influenced by a perceived balance between the price of a good and its utilities (Lassar et al., 1995).

2.7. Perceived quality

It is the consumer's judgment regarding a product's total excellence or superiority (Zeithaml, 1988). On the other hand, Aaker (1991) holds that perceived quality is a customer's perception of the overall quality or superiority a product or service possesses relative to its intended use relative to its alternatives. On this basis, Angasa and Kinoti (2013) conclude that the perceived quality is the same as objective quality, product-based quality, or manufacturing quality but rather is the difference between the overall and undetected quality.

2.8. Country of origin/manufacture

This refers to where a product is made or comes from. There is a solid attachment to the product's country of origin (Parasuraman and Pisharodi, 1994). Consumers form a particular perception about products that originate from certain countries or firms. The perception formed is based on the prior perceptions that consumers have formed about the country's production (Roth & Romeo, 1992). According to Angasa and Kinoti (2013), since Schooler's (1965) seminal study, many other studies have acknowledged that consumers have different perceptions about products from some particular countries, affecting consumers' evaluation of the products manufactured in a particular country.

2.9.Product and market segmentation

Every company must devise strategies to boost the demand for its product to succeed in the market. Such a product should possess high quality so that the buyer's loyalty can be won through satisfaction (Seine, 1993). Moriarty and Reibstein (1986) believe that the market's most significant problem is categorizing the various heterogeneous groups of customers into homogeneous groups or segments with similar characteristics. Marketers over the years have attempted to categorize under geographic, demographic, psychographic, and behavioural variables. Demographic segmentation divides based on demographic variables. The demographic bases are age, gender, family size, family life cycle, income, occupation, education, religion, race, generation, social class, and nationality (Armstrong & Kotler, 2005). Demographic segmentation is often used in market segmentation because the variables are easy to identify and measure and provide an accessible description of the targeted customers.

3. Methodology

Method, participants, and procedure

In investigating the antecedents of adaptation to climate change technology and innovation, exploratory and descriptive research was undertaken. Qualitative and quantitative data collection

was applied for information and data collection. The study drew on qualitative descriptive methodology to investigate the research questions. The population for the study consisted of consumers in the construction industry. However, the targeted population was made of real estate professionals. To overcome the problem of time and cost, the real estate sector was limited to housing units in Spintex and Trassaco, Accra, Ghana. The enumerated housing units were drawn from the residential population in Spintex and Trassaco Estates. 150 housing units were enumerated from each area. The enumerated housing units were used as the sampling frame for the study. The systematic sampling procedure was used to select respondents for the survey from the sampling frame. It is a probability sampling method in which sampled members from a population are selected according to a random starting point and a fixed, periodic interval determined by the researcher. Primary data and questionnaire administration are the main data-gathering methods utilized in the study. These data were then analyzed using SPSS version 26.0 and Stata to run the probit regression model. Descriptive statistics such as frequencies, cross-tabulation, and percentage distributions were used to generate results on the educational backgrounds and ages of the participants.

4. Findings and discussion

The demographic profile of the respondents is presented in Table 4.1. This includes gender, number of houses, and uncompleted houses owned. The Table shows that 54 (36%) respondents are female, and 96 (64%) are male. The majority of the respondents interviewed from the real estate sector are male. Indeed, the gender of a person influences the person's willingness to purchase a product. For instance, Adebo and Ajewole (2012) found that willingness to pay for waste disposal was significantly affected by gender. The real estate sector cannot be an exception. Dong et al. (2003) found that men are more willing to pay for community base insurance schemes than women. The survey data shows that 5 (3.3%) of the respondents did not own any house. However, 131 (87.3%) respondents owned a house each, and 10 (3.3%) of the respondents owned more than one house. House ownership was deemed a critical criterion because such persons tend to purchase any housing product in the future. To determine the respondents' likelihood of purchasing a construction material shortly, respondents were asked if they had any uncompleted houses.

4.1. Consumer's perception of the effects of climate change

The perception of respondents about climate change is measured in terms of their understanding of its impact. The majority of respondents, 83 (55.3%), believed climate change would lead to reduced rainfall and overflow of rivers, decreasing the number of crops and livestock cultivated. Thirty-seven (24.7%) respondents think climate change does not seriously affect Ghana today. On the other hand, 30 (20%) of the respondents said they did not know the exact impact of climate change on rainfall patterns in the country. From the information gathered, it can be inferred that many consumers are aware of the negative impact of climate change on rainfall patterns. The second most serious problem caused by climate change is the increased frequency of severe weather events. 66 (44%) of the respondents consider the increased frequency of severe weather events a problem. Thirty-seven (24.7%) do not consider it a severe problem. Forty- seven (31.3%) said they did not know if it was a problem.

Respondents were also asked to indicate their perceptions regarding the effects of climate change on human health and activities. The results are also presented in Table 4.2. Most respondents, 100 (66.7%), believed that climatic change could provoke diseases caused by heat, such as heat stroke and heat exhaustion, and even lead to death. Thirty-two (21.3%) respondents think climate change does not seriously affect heat-related illnesses. On the other hand, 18(12%) respondents said they did not know the exact impact of climate change on the increase in heat-related illnesses. From the information gathered, it can be inferred that many consumers know climate change's negative impact concerning increased heat-related illnesses. The majority of respondents, 86 (57.3%), believed that climate change could reduce the availability of fresh food because of its impact on the farming and fishing industries, thus affecting general livelihood. Thirty-seven (24.7%) of the respondents think climate change does not seriously affect livelihood strategies in Ghana today.

On the other hand, 27 (18%) of the respondents said they did not know the exact impact of climate change on livelihood strategies in the country. From the information gathered, it can be inferred that many consumers are aware of the negative impact of climate change on livelihood strategies. Health consequences for survivors of natural disasters are a consequence of the impact of climate change on the weather. Among the many problems, respondents believed that health consequences for survivors of natural disasters are the most severe problems. Eighty-seven (58%) respondents consider it the most serious problem. Twenty-nine (19.3%) of the respondents do not

see the health consequences as the most serious. However, thirty-four (22.7%) of the respondents do not consider it the most severe problem.

Table 1: Respondents' perception of climate change and its effects on human health			
Variable	Category	Frequency	Percent
Reduced rainfall	Very serious	45	30
	Somewhat serious	38	25.3
	Not serious	37	24.7
	Don't know	30	20
Increased frequency of severe weather events	Very serious	57	38
	Somewhat serious	43	28.7
	Not serious	29	19.3
	Don't know	21	14
Increase in Heat-Related Illnesses	Very serious	60	40
	Somewhat serious	40	26.7
	Not serious	32	21.3
	Don't know	18	12
Loss or Reduction of Livelihood	Very serious	33	22
	Somewhat serious	53	35.3
	Not serious	37	24.7
	Don't know	27	18
Health consequences for survivors of natural disasters	Very Serious	49	32.7
	Somewhat Serious	38	25.3
	Not Serious	29	19.3
	Don't know	34	22.7

Source: Field Survey 2015

4.2. Consumers' willingness to pay for eco-friendly roofing tiles

The ability to penetrate a market will be determined by how popular the product is among the consuming public. Respondents were asked whether they had heard of the eco-friendly roof materials. Twenty-five percent of the respondents said there was nothing like that on the market. Fifty-two percent of the respondents said they do not know eco-friendly tiles. On the contrary, about 23% of the respondents believed eco-friendly products were on the market. The findings clearly show that not many people are aware of eco-friendly products.

Table 2: Purchase of another roof		
Response	Frequency	Percent
Yes	94	62.7
No	44	29.3
Not really	12	8
Total	150	100

Source: Field Survey, 2015

Table 2 shows the willingness of respondents to replace their present roof with an eco-friendly roof. The majority of respondents, 94 (62.7%), believed that they would want to change the roof of their house in the future. On the contrary, 44 (29.33%) of the respondents were not prepared to change the roof of their house. Twelve (8%) of the respondents were unsure if they wanted to change the roof of their houses in the future. The large number of respondents willing to change their roof in the future is probably due to increased and extensive national and international media coverage of climate change, its causes, and the appropriate response.

Many factors influence the decision to buy a product. Individuals were made to choose between two products based on the product's characteristics and quality to discover the factors influencing choice. It was discovered that the price of a product influenced the choice, thus affecting the willingness to pay for a product or exchange it for another one. In Table 3, the majority of the respondents, 120 (80%), said their decision to purchase non-eco-friendly products was primarily based on price. The price level ranges varied between alternatives to portray the perceived price fluctuations that each alternative product would have if and when priced in the market. According to Table 3, consumers prioritized prestige, necessity, and income less.

| Table 3: Factors that influenced purchase of roof		
Determinants	**Frequency**	**Percent**
Not interested	5	3.3
Price	120	80.0
Income	13	8.7
Prestige	8	5.3
Necessity	4	2.7
Total	150	100.0

Source: Field Survey, 2015

Respondents were asked to determine the likely factors affecting the country's marketing of eco-friendly products. Sixty-nine (46%) of the respondents identified lack of entrepreneurship as the main factor affecting the marketing of eco-friendly products. Thirty-five (23%) respondents identified a lack of policy to direct people to use eco-friendly products. Only 24 (16%) of the respondents believed that the product's pricing is why people are not into marketing the product. The information gathered showed that the lack of entrepreneurship spirit concerning risk-taking and initiatives and clear policy affects the marketing of eco-friendly products.

**Figure 1: Factors affecting the introduction of eco-friendly products**
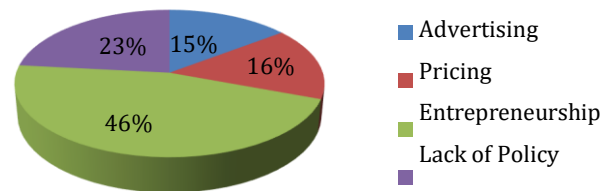
Source: Field Survey, 2015

Figure 2: Level of competition in the construction and real estate industry
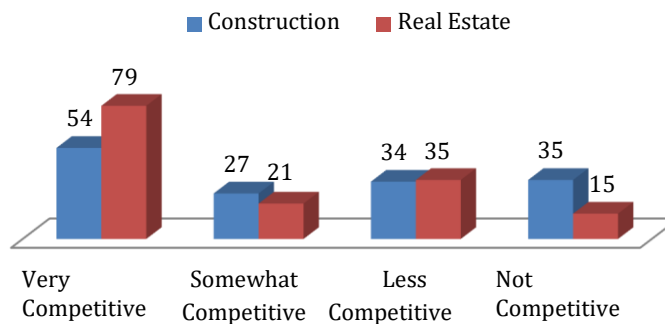
Source: Field Survey, 2015

Figure 2 examines the level of competition in both the construction and real estate sectors of the economy of Ghana. The level of competition will also tell how vibrant the market is for a particular product. Most (79 respondents) believed the real estate sector is more competitive than the entire construction sector. Again, 35 respondents also believed the construction sector is not competitive. In comparison, we conclude that the real estate sector is very competitive.

Figure 3: Effects of macroeconomic factors
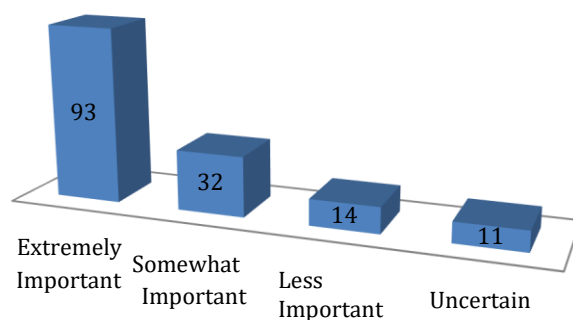
Source: Field Survey, 2015

Figure 3 shows the respondents' view on how macroeconomic conditions affect the marketing of eco-friendly products. Ninety-three respondents believed that macroeconomic factors are critical in marketing eco-friendly products. Also, 32 respondents believed that macroeconomic factors somewhat affect the marketing of the products. Only 14 respondents thought they were less critical in the decision to market eco-friendly products. Since eco-friendly products are not produced in the country, foreign exchange is required to import these products into the market. The Ghanaian Cedi's continuous depreciation will require huge capital to import such a product. Going by the majority decision from the survey, we can infer that the country's macroeconomic conditions significantly determine the direction of business and investment.

4.3. Determinants of willingness to pay for eco-friendly roof

Diagnostic results

Diagnostic statistics such as variance inflation factor (VIF) and Breusch-Pagan were performed to check the presence of multicollinearity and heteroscedasticity, respectively. The results are presented in Table 4. The results show that all the variables included in the probit regression have VIF less than 10, and the overall mean VIF was also less than 10. This suggests that multicollinearity is not present in the model.

Table 4: VIF and Heteroskedasticity		
Variable	**VIF**	**1/VIF**
Gender	1.29	0.777
Age	1.07	0.935
Number of houses owned	1.86	0.536
Rchoice	1.85	0.540
Basic education	1.19	0.841
Secondary education	2.04	0.489
Tertiary education	1.51	0.664
Household size	1.96	0.511
Policies	1.22	0.817
Income	1.12	0.895
Side effects	1.30	0.766
Gender	1.07	0.935
Mean	1.43	
Breusch Pagan test for heteroscedasticity		
Chi-square	3.07**	

Furthermore, the Breusch pagan test shows that the chi-square value (3.07) is statistically significant at a 5% level. This implies that heteroscedasticity is present in the model. A robust standard error estimation approach was employed to correct his issue.

Probit Regression Estimates of Willingness to Pay for Eco-Friendly Roofing Tiles Respondents were first of all forewarned that choosing between hypothetical elements could prove to be a daunting task. Thus, they were encouraged to be unhindered in their choices since people's opinion

concerning the amount to pay for environmentally friendly products was bound to differ. They were further told to be cautious of the budget constraint in the booklet. Including this section in the work is to get realistic estimates of premiums paid for each product (Kotchen & Reiling 1999). The probit regression model was employed to determine the factors influencing the respondents' willingness to pay for eco-friendly roofing tiles. The results indicate that the Wald Chi-square (355.85) is statistically significant at a 1% level, suggesting the explanatory variables included in the model jointly influence respondents' willingness to pay for eco-friendly roofing tiles. Among the variables in the probit model, the number of houses owned, R-choice, Education, household size, and income significantly influence consumers' willingness to pay for eco-friendly roofing tiles.

The coefficient of the number of houses owned had a significant positive effect on consumers' willingness to pay for eco-friendly roofing tiles. The result indicates that as consumers build more houses, their probability of buying eco-friendly roofing tiles increases by 0.284. The variable Rchoice significantly impacted the willingness to pay for eco-friendly roofing tiles at a 10% significant level. This implies that consumers who prefer eco-friendly roofing tiles are more likely to pay for them. Primary, secondary, and tertiary education variables tend to influence the willingness to pay for eco-friendly roofing tiles positively. The results indicate that more educated consumers are more willing to pay for eco-friendly roofing tiles than those without formal education. Educated people can read about climate change and its consequences on human health. The information they get tends to increase their preference for eco-friendly roofing tiles, which have a higher capacity to reduce the impact of high temperatures on human health. The coefficient of household size positively influences willingness to pay for eco-friendly roofing tiles and is significant at a 10% level, indicating that consumers with larger households have a higher probability of purchasing eco-friendly roofing tiles.

Income positively influences willingness to pay for eco-friendly roofing tiles and is significant at 10%. This indicates that higher-income consumers are more willing to pay for eco-friendly tiles. The findings resonate with the work of Batley, G., & Maher, W. (2001), who found a statistically significant positive correlation between the respondents' willingness to pay and income. The findings show that consumer preferences for eco-friendly roof tiles were related to specific characteristics regarding buying behavior. A higher willingness to buy was recorded for the 2000 to 5000 Ghana cedis income range. This result seems plausible since most of the people in the real estate residence are in the high-income group.

Table 5: Determinants of consumers' willingness to pay for eco-friendly roofing tiles					
Variable	Coefficient	Marginal effect	Robust standard error	z-value	Probability
Gender	0.082	0.024	0.471	0.18	0.861
Age	0.015	0.004	0.019	0.78	0.438
Number of houses owned	0.975**	0.284	0.536	1.82	0.069
Rchoice	0.355**	0.103	0.209	1.70	0.090
Basic education	4.957***	-1.444	0.736	6.74	0.000
Secondary education	5.166***	-1.505	0.800	6.46	0.000
Tertiary education	5.344***	-1.557	0.719	7.43	0.000
Household size	0.218**	0.063	0.131	1.66	0.097
Policies	-0.029	-0.008	0.139	-0.21	0.835
Income	0.000**	7.630	0.000	1.81	0.071
Side effects	0.174	0.051	0.151	1.15	0.249
Constant	1.062		1.958	0.54	0.587
Diagnostic statistic					
Wald chi-square	355.85***				
Pseudo R-square	0.2210				

5. Conclusion

The study reveals great potential for marketing eco-friendly products in the real estate rather than the construction sector. The real estate sector is more competitive than the construction sector. However, the prospects in the sector are hindered by the non-availability of clear policies for the marketing of eco-friendly products, the lack of entrepreneurial skills, and the prevailing macroeconomic conditions in the country. The significant determinants of WTP are respondents' income level, age, gender, and access to information (policies) about eco-friendly products and

associated health risks. On the other hand, the socio-economic factors that affect the individual's willingness to buy an eco-friendly product include the gender of the individual, age, and income level. Our results prove consumer preferences for certain eco-friendly roof tiles vary among consumer segments. The study revealed that consumers are very much aware of the effects of climate change on the environment and weather conditions. Consequently, the consumers may be willing to pay for an eco-friendly product.

There are plenty of opportunities for individuals who decide to go into the marketing of eco-friendly roof tiles. These include a significantly less exploited market, a competitive real estate market, and a vast population conscious of the health effects of climate change. Local producers should be encouraged to take advantage of natural resources all over the country for production. This way, their dependence on imported products would be reduced, and this would also minimize the cost of production. According to our findings, the health benefits of eco-friendly products play an essential role in consumers' buying decisions.

6. Recommendation

The results show that any eco-friendly roof material must raise consumer awareness about the effects of climate change and shape consumer perceptions. Government should certify individuals and organizations to invest in the marketing of environmentally friendly products. A vigorous campaign should be initiated to educate the public about the harmful effects of climate change. The campaign should explain what one can do to reduce the impact of climate change. Promotion campaigns should involve both private institutions and government. The campaign may synergize positively with the private sector businesses producing eco-friendly roofing materials.

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All authors declare no conflicts of interest in this paper.

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