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THE INFLUENCE OF INFORMATION ON RESIDENTS' GREEN HOUSING PURCHASING BEHAVIOR: DIFFERENT INFORMATION CONTENTS AND PROVIDERS

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Abstract. To promote consumers to buy green housing, the paper tries to find the effect of information on consumers' green housing purchasing behavior. It classifies the contents and providers of information and explores their different influences. The results show that: 1) Consumers' age and environmental protection attitude have a significant impact on their purchasing behavior, while consumers' gender and monthly income have no significant impact; 2) Consumers are more affected by information relating to the economy and indoor air quality. The detailed order of influence is as follows: information on loan at concessionary rates > cost saving in usage phase > indoor air quality > waste classification > investment benefit > carbon emission reduction > thermal comfort > acoustic environment > greening rate > luminous environment; 3) Consumers with higher environmental awareness care more about the information on living environment and carbon emission. Whereas, those with low awareness of environmental protection are more affected by information on economic benefits. 4) Regarding different information providers, the consumers are mostly impacted by the government, while the information from developers could induce limited effects. It could guide the government and developers to provide appropriate information to promote GH purchasing behavior.

Keywords: information, green housing, purchasing behavior, ordinal logistic regression.

Introduction

With the development of urbanization, the problems of energy shortage and environmental pollution are getting serious (Zhang et al., 2017). Under the circumstance, sustainable development has become a common target globally. As the world's largest energy consumer and contributor of CO_2 emissions, China has put forward the goal of carbon emission peak before 2030 and carbon neutrality before 2060 (Huo et al., 2021). Facing the situation, green building (GB) emerges as an effective way (Cheng et al., 2016; Mao et al., 2018). GB refers to the buildings that save energy, water, land, material and protect the environment (He et al., 2019). Various standards for GB have proliferated around the world, and most of them share the common opinion that GBs should mitigate significant influences on the environment, society, and economy (Patenaude & Plouffe, 2015). Green Housing (GH), as a branch of green building, can not only save national resources and energy (Ziogou et al., 2017) but also significantly improve the living quality of residents (Elnaklah et al., 2021; Pei et al., 2015). China has introduced a series of policies and laws to promote GHs since 2000. Such as the mandatory requirement that the housing projects of more than 100 thousand m^2 should get the GB certification (Sun et al., 2018; Yu et al., 2018). Moreover, according to the 14th five-year plan for GB development, all of the newly built building areas should be GB by 2025, and the energy conservation for new housings should increase by 30% compared to that in 2020.

However, the development of GH in China is slow that it only accounted for less than 0.4% of the total buildings in 2018 (He et al., 2018). One of the main reasons for the insufficient development of GH is the low purchasing willingness of consumers (Zhang et al., 2018b). Studies show that consumers are only willing to pay 5.09–9.96% of the incremental cost of GH (Li et al., 2014). From the perspective of cognitive psychology, their purchasing in-

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tention is the reaction to external information via the internal cognitive mechanism. Therefore, information is one of the leading factors affecting consumers' behavior (Neisser, 1967). GH-related information refers to the materials, news, signals, and stimuli that affect consumers' GH purchasing behavior. The information mainly reveals the costs and benefits of GHs (Delmas et al., 2013; Kikuchi-Uehara et al., 2016). For consumers, the cost information refers to the price and maintenance cost of GHs (Jia et al., 2019; Ofek & Portnov, 2020), while the benefits information refers to that on energy saving, water saving, living comfort, etc. (Elnaklah et al., 2021; MacNaughton et al., 2016). Sternthal and Craig (1982) show that different consumer experiences and information lead to different purchasing behavior. The information is especially important for new product like GH, whose benefits are gradually reflected in the usage process. Furthermore, some green qualities (e.g., sustainable material sourcing, construction waste diversion) are impossible to observe even after occupation, making GHs be credence goods. Consequently, consumers need to search the information from different channels to help them make purchasing decisions, such as from the developers, government, and other customers (Teng & Wang, 2015).

The paper tries to stimulate the GH purchasing behavior by providing effective information. It explores the main contents and providers of GH information, and finds the different effects of various information contents and providers. Besides, suggestions on appropriate information and channels are provided for developers and the government.

1. Literature review

Many studies have proved that different contents of GHs information could show a positive impact on consumers' purchasing behavior (Durdyev & Ihtiyar, 2020). Zhang et al. (2016) show that the residents' GHs purchasing intention is greatly enhanced (72.93 yuan/m^2) after receiving information on the living comfort of GH (Zhang et al., 2016). Moreover, compared with the information on energy and water saving, the information on ventilation, indoor environment, and waste treatment will be more effectively identified by residents and affect their behavior (Danlei & Yong, 2021). In addition, Zhang et al. (2016) found that the information on the government's tax and loan for GH have a significant impact on consumers' GH purchasing behavior, and the former has a more significant impact. Besides, the environmental benefit information of GHs mainly affects the behavior of environment-friendly consumers (Portnov et al., 2018).

In terms of information providers, consumers could receive information from various sources. One of the main sources of information is the developers. GH developers promote GH online and offline. Online promotion channels include TV and radio advertising; new media promotion, etc.; Offline information channels include project sales brochures; on-site explanations; etc. Developers stimulate consumers to buy GHs by emphasizing the benefit information of GHs such as energy conservation. Besides, developers also try to shape their environmental-friendly corporation image by publicizing green developing behaviors, to promote consumers' purchasing preferences. Except for developers, the government can also popularize GH information through official websites, new media, public lectures, etc. Moreover, studies show that information from other providers, such as other consumers who have bought GHs could also affect consumers' GH purchasing intention (Durdyev & Tokbolat, 2022). Feng et al. (2021) found that the comment of GH homebuyers has a positive effect on GH purchasing intention. Environmentally friendly consumers also prefer to consult the opinions of other GH users before making purchasing decisions (Darko & Chan, 2017).

To sum up, recent studies have confirmed that consumers' purchasing behavior will be affected by various contents of GH information and different providers. However, they did not make a comprehensive comparison of different information (Danlei & Yong, 2021; Zhang et al., 2016). Knowing the influence of different information helps to determine the focus of the information contents, and could promote the customer GH purchasing behavior more accurately and efficiently. Besides, whether the GH related information from different providers has different effects on consumers' purchasing behavior is still unknown. Therefore, it needs to analyze what is the most effective GH information content and provider for customers.

2. Information affecting residents' GH consumption behavior

As noted in Introduction, GHs information mainly reveals the costs and benefits of GHs. The cost information mainly refers to the price and maintenance cost, which is given by the developer and property management agency. Although the cost is crucial for customers, the cost information could be got directly without the issue of information asymmetry. Whereas, the benefits of GH are much more difficult to be realized by the customer, making the information on benefits more important. Since many studies have researched deeply on the impact of cost on consumer behavior (Liu et al., 2014; Ofek & Portnov, 2020), to make an in-depth study on GH information, this paper mainly concentrates on the information on GH benefits.

To clarify the specific information, the benefits of GH are summarized. Many studies showed that GHs have environmental benefits of energy conservation and emission reduction (Adam & Apaydin, 2016; Booth & Choudhary, 2013). MacNaughton et al. (2018) estimated energy savings in six countries, showing that GBs averted 33 MT of CO_2, 51 kt of SO_2, 38 kt of NO_x, and 10 kt of PM2.5 from entering the atmosphere (MacNaughton et al., 2018). Besides, GHs also produce significant benefits in improving indoor environment quality (Balaban & Puppim de Oliveira,

2017). Elnaklah et al. (2021) measured the thermal comfort satisfaction of GHs residents and showed it increased from 48% to 62%. Balaban and Puppim de Oliveira (2017) concluded through empirical analysis that GHs provide inhabitants with healthier living environments, such as improved thermal comfort and more natural ventilation and lighting. GHs also have a good acoustic environment. Zalejska-Jonsson (2019) found that residents of GHs were highly satisfied with the acoustic environment. In addition, GHs have superiority in the outdoor environment, including a better green landscape and waste management (Jiao et al., 2020; White & Gatersleben, 2011). Moreover, GHs have considerable economic benefits, such as cost-saving in the usage phase, investment benefit, and loan at concessionary rates (Dell'Anna & Bottero, 2021). Many studies have assessed the life-cycle cost of green building to determine whether the extra construction cost can be offset by economic or sustainability benefits, such as energy saving, less material waste, and water saving in the later stages of a building's life cycle (Chen et al., 2018). By investing in green projects, an internal rate of return was possible to achieve from the energy savings gained by green housings at a rate of approximately 12% (Taemthong & Chaisaard, 2019). Specifically, GHs residents benefited from a water bill reduction by 27% and the electricity expenditure saving by NT$ 8537.76 (Cheng et al., 2016; MacAskill et al., 2021). As to the investment benefit, it mainly reflects in the premium in rent or resale prices induced by the increasing market value (Zhang et al., 2018a). Deng and Wu (2014) found that Green Mark–certified properties in Singapore commanded a 9.9% premium in the resale market, while the initial transactions commanded a premium of only 4.4%. Chegut et al. (2014) showed that buildings with a green label in the UK rented for longer contracts and at a 28 percent rental premium. What is more, to stimulate the consumers to buy GH, the government stipulates that the interest rate of loans for GHs can be reduced by 0.5% and the maximum loan amount can be increased by 20%. To sum up, the benefits of GHs include not only direct energy conservation and emission reduction, but also non-intuitive benefits such as indoor environmental quality (IEQ) and residents' perception of health (Feng et al., 2021; Golbazi et al., 2020). Based on the residents' needs and the latest standards of Chinese's green building evaluation standard (2019 edition), the contents of information on benefits are divided into three categories (economy, living environment, and environmental protection) and 10 subcategories.

As to the information providers, it mainly includes developers, the government, and other GH users (Feng et al., 2021; Golbazi et al., 2020). The developers provide information directly through brochures, advertisements, and face-to-face introductions. The government provides information through public service advertisements, pilot projects, and website announcements of the GH evaluation. Besides, the customers could also refer to those who already purchased GHs. The providers and contents of information are shown in Figure 1.

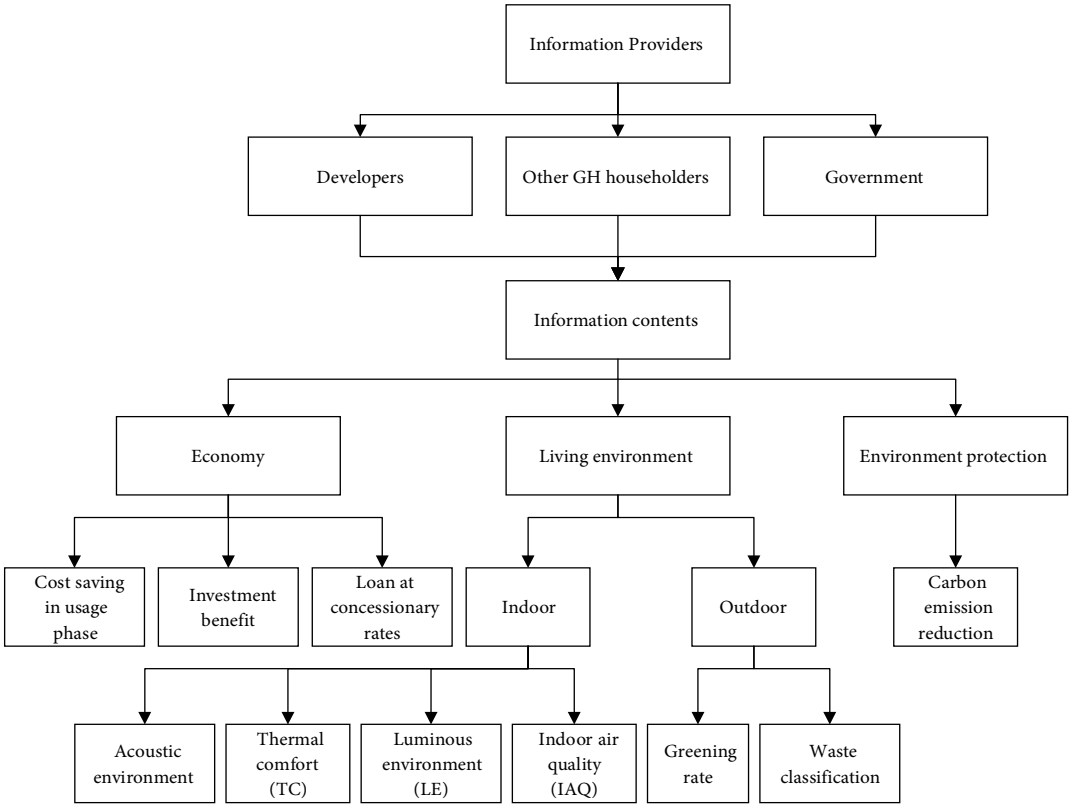

Figure 1. Providers and contents of the information

3. Method and data

3.1. Method

Since the dependent variable (purchasing intention improvement) is a categorical ordinal variable, which ranks from 1 (no increase) to 5 (maximum increase), the ordinal logistic regression is used. Ordinal logistic regression is a method developed for the situations where the response variable takes on ordered categorical values (Brant, 1990). It retains the inherent ordinality of the data, which imposes neither the loss of information inherent intreating an ordinal outcome as nominal or dichotomous, nor the unjustified quantification of category differences created when ordinal data is treated as continuous. Besides, the parameter that is estimated in the method is a type of odds ratio, and thus is recognizable and readily interpreted (Scott et al., 1997). Therefore, the method is chosen in this paper. The model is shown as follows:

$$\ln\left[\frac{p(y \le j \mid x)}{1-p(y \le j \mid x)}\right] = u_j - \left(\alpha + \sum_{k\ 1}^{k} \beta_k x_k\right), \tag{1}$$

where y is the residents' willingness improvement to buy GHs. X_k is a vector of independent variables, referring to different types of information. J is the grade of dependent variable y (j = 1, 2, ..., J), and the relationship between the values of dependent variables is (y = 1) < (y = 2) <...< (y = J). k indicates the number of information types, α is a constant term, β_k are the relevant coefficients, which differ across categories of X. u_j represents the dividing point between the grades of Y. If $y > u_{j-1}$ <, then $y = j$. For example, if $y \le u_1$, then y = 1; if $u_1 < y \le u_2$, then y = 2.

The way to determine the occurrence ratio of the ordinal logistic regression model is the accumulation of the occurrence probability of factors in the model. The formula for predicting the cumulative probability is as follows:

$$p(y \le j \mid x) = p(y^* \le u_j \mid x) = \frac{e_{u_j} - \left(\alpha + \sum_{k=1}^{k} \beta_k x_k\right)}{1 + e_{u_j} - \left(\alpha + \sum_{k=1}^{k} \beta_k x_k\right)}. \tag{2}$$

The dependent variables in this paper have five levels. Therefore, the model has four ordinal logistic regression functions:

$$\ln\left[\frac{p_1}{p_2+p_3+p_4+p_5}\right] = \alpha_{01} - \sum_{k=1}^{k} \beta_k x_k;$$

$$\ln\left[\frac{p_1+p_2}{p_3+p_4+p_5}\right] = \alpha_{02} - \sum_{k=1}^{k} \beta_k x_k;$$

$$\ln\left[\frac{p_1+p_2+p_3}{p_4+p_5}\right] = \alpha_{03} - \sum_{k=1}^{k} \beta_k x_k;$$

$$\ln\left[\frac{p_1+p_2+p_3+p_4}{p_5}\right] = \alpha_{04} - \sum_{k=1}^{k} \beta_k x_k. \tag{3}$$

p_1, p_2, p_3, p_4, and p_5 represent the probability of different levels of improvements in the purchasing intention of GH, respectively. It meets the requirement of $p_1 + p_2 + p_3 + p_4 + p_5 = 1$.

3.2. Data and sources

The data are gathered by an online questionnaire survey. The results of the model are influenced by the data surveyed. Therefore, to avoid biases, the questionnaire questionnaire is designed to be easy and clear to be understood, and the respondents should cover different types of people regarding their demographic backgrounds. The questionnaire includes three parts. First are the questions about the demographic background. Second are their opinions on environmental protection, knowledge about GHs, and initial willingness to buy GHs. The environment protection attitude is detected by asking "do you agree that everyone should participate in environmental protection?". The answers are as follows: very disagree, slightly disagree, uncertain, slightly agree, and very agree. Their knowledge about GHs is got by the question that "what do you know about GH?". The answers are: knowing nothing, having heard of it but not quite familiar, knowing a little, having basic knowledge, and having rich knowledge. Their initial willingness to buy GHs is gathered by asking "do you prefer to buy GHs?", and they could answer "very reluctant, slightly reluctant, uncertain, slightly prefer, and very prefer". The third part is about residents' purchasing possibility improvement after getting different GH information from different providers. At present, only a few residents have purchased GHs, making it difficult to obtain the existing behavior (He et al., 2019). Therefore, the paper uses the purchasing intention to predict the purchasing behavior (Dodds et al., 1991). The question is asking how much their purchasing intentions improve after receiving different contents of information, and how would they feel when the information is from different providers. The Likert five-level scale is used to describe the degree of purchasing intention improvement, which are no increase, slight increase, medium increase, large increase, and maximum increase. Before the full-scale survey, a pilot study was conducted to make the questions clear and easy to follow. 30 respondents were involved and it showed that they could understand and answer the questions easily. Finally, the questionnaire contained 17 questions and was released online from February to June 2021.

4. Results and discussion

4.1. Respondents' characteristics

270 questionnaires were gathered, and 236 of them were valid. The effective rate was 87.41%. The characteristics of respondents are shown in Table 1. Among the interviewees, 45.76% are men and 54.24% are women. The respondents aged 30–50 accounted for 57.21%. In terms of

income, the residents with a monthly income of more than 10000 RMB account for 33.1%, which is generally in line with China's income status. In terms of attitude towards environmental protection, 57.21% of the residents slightly or very agree that environmental protection is important, while 4.66% of them strongly disagree with the opinion. As to their knowledge about GHs, most of them (30.51%) have heard of it but are not quite familiar with it. Moreover, there are even 6.78% of the respondents knowing nothing about GHs, while only 9.75% of them indicate that they have rich knowledge. Therefore, it reveals an enormous need for disclosure and publicity of GH information. Besides, 36.02% of the respondents are uncertain about their willingness to buy GHs, and 22.88% of them are slightly reluctant to buy GHs.

Table 1. Basic characteristics of respondents

	Number	Percentage
Gender		
man	108	45.76%
woman	128	54.24%
Age		
under 19 years old	8	3.39%
19–30 years old	64	27.12%
31–40 years old	82	34.75%
41–50 years old	53	22.46%
over 50 years old	29	12.29%
Monthly income		
below 5000 RMB	67	28.39%
5001–10000 RMB	88	37.29%
10001–20000 RMB	59	25.00%
above 20000 RMB	22	9.32%
Environmental protection attitude		
very disagree	11	4.66%
slightly disagree	39	16.53%
uncertain	51	21.61%
slightly agree	69	29.24%
very agree	66	27.97%
Knowledge about GHs		
know nothing	16	6.78%
heard of it but not is quite familiar	72	30.51%
know a little	67	28.39%
have basic knowledge	58	24.58%
rich knowledge	23	9.75%
Initial willingness to buy GH		
very reluctant	11	4.66%
slightly reluctant	54	22.88%
uncertain	85	36.02%
slightly prefer	53	22.46%
very prefer	33	13.98%

4.2. Model test

After checking the result of residents' purchasing intention improvement, less than 16 of them chose "no increase" and a few of them chose "slight increase". To meet the requirements of the parallel line hypothesis, the "no increase" samples are removed, meanwhile the "slight increase" and "medium increase" are combined before data analysis. Finally, the purchasing intention improvement is divided into three levels: slight increase, medium increase, and large increase. And the residents of the three levels account for 36.07%, 37.02%, and 26.91%, respectively. It shows that consumer's willingness to buy GH has increased significantly after they know the relevant information about GH.

Before regression, multicollinearity is tested by a variance inflation factor (VIF). It can be seen in the Table 2 that the VIF values are lower than 5, which meets the requirements. Besides, the chi-squared score test for the proportional odds assumption is employed to see whether the main model assumption is violated or not. The score test of the proportional odds assumption is found insignificant at 5% level of significance with P-value of 0.149 and 0.120 for model l and model 2. Therefore, the data meet the proportional odds assumption and is suitable for ordinal logistic regression.

Table 2. Multicollinearity test results

Variable	Tolerance	VIF
Gender	0.956	1.046
Age	0.935	1.069
Monthly income	0.952	1.050
Environmental protection attitude	0.958	1.044
Information content	0.674	1.484
Information providers	0.674	1.485

4.3. Information impacts on consumer purchasing behavior

The improvement of customer's willingness to buy after the influence of GH information is shown in Figure 2. In general, most of the customers (about 73–98 persons) would largely increase their willingness to buy GH after knowing different information on GH benefits. In contrast, several of the customers (about 10–16 persons) would not increase their willingness after being provided with the information. In particular, the information on cost saving in the usage phase, which is related to economic benefits, could incur an extremely large increase in purchasing intents of 65 customers. In addition, the largest number of customers (98 persons) could be strongly promoted by the information on loan at concessionary rates, which is also related to economic benefits. Therefore, it is preliminarily found that influence of economy-related information is high.

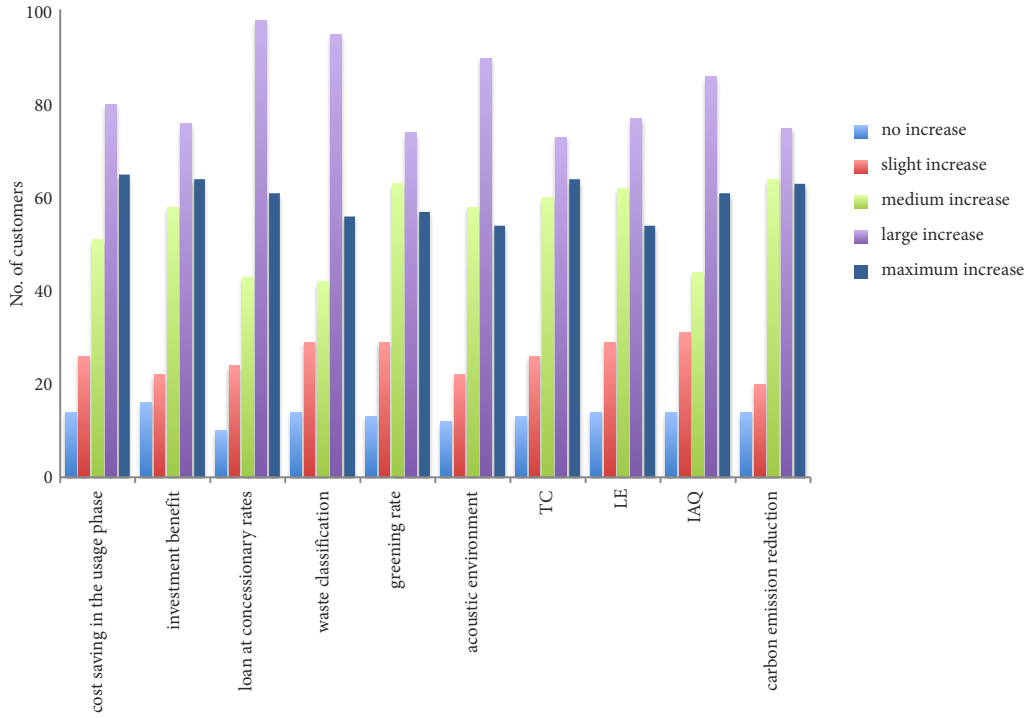

Figure 2. Improvement of willingness to buy GH after knowing different information

The detailed influence of demographic characteristics and information on GH purchasing intention is shown in Table 3.

For the basic information of consumers, in Model 1 and Model 2, the P values of gender and monthly income are greater than 0.05, indicating that their impacts on residents' purchasing intentions are not significant. It may be due to that in China, the housing purchasing decision is mainly made by the whole family members, thus the impact of gender is not significant. The insignificant monthly income may be because although the purchasing price of housing is high (average 9287 RMB/m^2) (Chenchen et al., 2021), the average premium of GH is only 523 RMB/m^2, which is relatively small compared with the total price. Therefore, a higher income has no significant relationship with the improvement in their intention to buy a greener housing. These results are consistent with the study of Li et al. (2018). In contrast, age and environmental protection attitude have significant impacts on residents' purchasing intention. Specifically, in Model 1, the odds ratio of age is 1.104, showing a positive relationship between age and purchasing intention improvement. It means that elderly customers are more likely to buy GHs. It is consistent with the study of Wong et al. (2020) that elderly people pay more attention to green environmental protection and health, which are the features of GHs. Besides, they also have a certain consumption ability to buy GH (Wong et al., 2020). In terms of the environmental protection opinion, it could find that in Model 1, the consumers with strong disagreement, slight disagreement, uncertain idea, and slight agreement on environment protection are 0.447, 0.406, 0.472, and 0.612 times that of consumers with strong agreement, respectively. This may be due to that one of the biggest features of GH is environmental friendliness. Therefore, customers willing to protect the environment are inclined to buy GHs (Mishal et al., 2017). Regarding the influence of the overall information, it could be seen from the regression coefficient and odds ratio in Table 3 that the information contents have the largest impacts on purchasing intention among all the factors. The coefficient of information contents is 1.112 and the odds ratio is 3.040. It means that the probability of GH purchasing intention will increase by 3.040 times for each increase in information contents provision. Abanda and Byers's (2016) research supports this view that the understanding of GHs information such as cost saving in the usage phase and living comfort can enhance residents' willingness to pay (Abanda & Byers, 2016).

As to the different contents of GH information, the P values of all kinds of information are less than 0.05, and the coefficients are positive, showing the significant effects of all information contents. However, the coefficient of various information is different, showing the different influence degrees. In general, two of the top three contents of information are related to economic benefits. Specifically, the information with the largest impact is on loans at concessionary rates, which could increase consumers' GH purchasing intention by 3.530 times. Besides, the information on cost saving in the usage phase ranks second. Customer with this information has 3.235 times higher intention to buy GHs. It shows the enormous influence of economic-related information. It consists with Luo's et al. (2017) study that the impacts of the economic information on consumers' willingness to buy GHs are stronger

Table 3. The influence of information on green housing purchasing intention

	Model 1				Model 2			
	Coefficient	OR	Std. Error	P	Coefficient	OR	Std. Error	P
Purchase intention								
medium	–0.909		0.141	0.000	0.204		0.192	0.289
maximum	0.693		0.140	0.000	1.809		0.195	0.000
Gender								
man	–0.047	0.954	0.072	0.511	–0.045	0.956	0.072	0.531
woman	0[a]	1.000	–	–	0[a]	1000	–	–
Age	0.099	1.104	0.035	0.005	0.100	1.105	0.035	0.004
Monthly income	–0.051	0.950	0.038	0.180	–0.051	0.950	0.038	0.182
Environmental protection attitude								
very disagree	–0.805	0.447	0.182	0.000	–0.807	0.446	0.182	0.000
slightly disagree	–0.902	0.406	0.114	0.000	–0.905	0.404	0.114	0.000
uncertain	–0.750	0.472	0.101	0.000	–0.753	0.471	0.101	0.000
slightly agree	–0.490	0.612	0.091	0.000	–0.493	0.611	0.092	0.000
very agree	0[a]	1.000	–	–	0[a]	1.000	–	–
Information								
With information	1.112	3.040	0.144	0.000				
Without information	0[a]	1.000	–	–				
Information providers								
government	0.678	1.969	0.187	0.000	0.678	1.970	0.187	0.000
other GHs householders	0.488	1.628	0.188	0.009	0.488	1.629	0.188	0.009
developers	0[a]	1.000	–	–	0[a]	1.000	–	–
Information contents								
• Economy								
cost saving in the usage phase					1.205	3.335	0.186	0.000
investment benefit					1.168	3.217	0.187	0.000
loan at concessionary rates					1.261	3.530	0.186	0.000
• Living environment								
waste classification					1.172	3.227	0.186	0.000
greening rate					0.944	2.570	0.187	0.000
acoustic environment					1.063	2.896	0.186	0.000
TC					1.093	2.982	0.186	0.000
LE					0.923	2.516	0.187	0.000
IAQ					1.178	3.247	0.186	0.000
• Environmental protection								
carbon emission reduction					1.109	3.030	0.187	0.000
Score test for the proportional odds assumption	Chi–square = 14.552 p–value = 0.149				Chi–square = 26.396 p–value = 0.120			
Goodness–of–fit test of overall model (Likelihood Ratio)	Chi–square = 184.156 p–value = 0.000 Pseudo R^2 = 0.103				Chi–square = 191.128 p–value = 0.000 Pseudo R^2 = 0.107			

Note: [a] represents the control group.

than IEQ and green energy for GHs (Luo et al., 2017). It is mainly because that in China, customers tend to be more sensitive to monetary factors, especially those are directly reflected at the purchasing stages (Zou et al., 2017). In contrast, other non-monetary benefits, such as improving living environment, are difficult to measure and could only be gained gradually in the process of living. Therefore, the influence of non-monetary information is generally weaker than monetary information. Unlike the first two information on economic benefits, the remaining economic-related information – investment benefit – only ranks fifth. It improves the GH purchasing intention by 3.235 times. The weaker influence of this information may be because the purchasing intention of most customers is

for living instead of for investment. They may live in the house for the whole life span without changing it. Thus, they are not affected that much by the information on the investment benefit of GHs. In addition, information on IAQ ranks third, which could effectively promote the GHs purchasing behavior by 3.247 times. It may due to the increasing concern about PM2.5 pollution and air quality in China (Liu et al., 2017). The improvement of consumers' environmental awareness and concern about living health has aroused their attention to the IAQ of housings. Besides, the information on waste classification ranks fourth. It may be due to the waste classification policy having improved residents' awareness of waste classification. The policy firstly started in Shanghai in 2019 and was carried out in other cities gradually. It forced the residents to classify garbage consciously, and residents would be fined if they classify it incorrectly. The sixth information is that on carbon emission reduction (3.03 times). This is related to national policy trends, especially the Chinese objectives of carbon emission peak by 2030 and carbon neutralization by 2060. The information coming next are TC (2.982), acoustic environment (2.896), and greening rate (2.570). This is mainly because that in China, after the fulfilment of basic living space, customers start to pay more attention to the living comfort and living environment gradually. While the information with the least impact is related to the luminous environment, which could only increase purchasing intention by 2.516 times. It may be because the recent building design pays much attention to daylighting. Buildings could generally meet the requirements of relevant design codes, and residents could generally satisfy with the luminous environment. Thus, this information has not as much effect as others.

In terms of GH information providers, the P values are less than 0.05, and the coefficients are positive. It indicates that the information provided by the government and other GH residents has larger impacts than that from developers. Specifically, the GH purchasing intention improvements are 1.970 and 1.629 times higher among the customers getting information from the government and other GH residents respectively, when compared with those getting information from developers. It is because consumers think the government provided information more authoritative (Feng et al., 2021; Wong et al., 2018), while they may doubt the authenticity of the information from developers. There are often information asymmetries between the GH developers and consumers, leading to the under-provision of difficult-to-observe building attributes (Matisoff et al., 2016). Builders have a better understanding of the construction process than consumers. In particular, building qualities like efficiency and indoor air quality are difficult to detect and verify before purchase or lease, which makes buildings akin to an experiential good, whereby the quality of the product cannot be observed until after consumption (Fuerst et al., 2014; Mason, 2013). Through the survey, it is found that developers usually take "green" as the selling point, while the actual effect is not as good as announced (Zhang et al., 2016). Therefore, consumers would worry about developers' exaggerative or false advertisements about greenness. In contrast, government-provided information can verify such difficult-to-observe improvements authoritatively (Wong et al., 2018). Besides, information from other GH residents is more reliable and likely to affect purchasing behavior, because GH residents have real experiences of usage and have no interesting relationship with other buyers. Moreover, consumers may also be influenced by the herd effect. Therefore, after knowing the information from customers buying GHs with good living experiences, they may also choose to buy GHs. This is consistent with the findings of Liu that when there are more numbers of GHs buyers, potential buyers would adjust their psychological activities due to group pressure, thus enhancing their willingness to purchase.

As regards the customer willingness to pay for GH after information influence, most of them (44.07%) are willing to pay 51–100 RMB/m^2 more for GH. Besides, about 24.15% of the customers intend to pay a premium of less than 50 RMB/m^2. Although there are 5.93% of them showing no premium after the information, there are still 13.56% of the respondents would like to pay more than 150 RMB premium for GH. However, compared with the average premium of GH (523 RMB/m^2), the customer's willingness to pay affected by information is still small. Therefore, it still needs to minimize the incremental price of GHs and stimulate the customer's willingness to pay by various methods, such as technology innovations and financial supports, as well as education.

4.4. Information impacts on customers with different environmental protection attitudes

Since consumers with different environmental attitudes may react differently to various information, we further dive them into two groups. Those who do not want to participate in or hold an uncertain opinion on environmental protection are defined as group one. Whereas, those who slightly or very agree with their responsibility of environmental protection are defined as group two. It makes group one and two consist of 101 and 135 respondents, respectively. Before the regression, the t-test is used to verify the difference between the two groups. The p-value of the t-test is 0.000, showing a significant difference between the two groups. The results of the information impacts on consumers from each group are shown in Table 4.

As seen in Table 4, there are differences in information impacts for people in the two groups. For those in the environmentally friendly group (model 4), the top three information affecting consumers are IQA, carbon emission reduction, and loan at concessionary rates, which could improve the purchasing intention by 1.853, 1.780 and 1.740 times, respectively. In contrast, those neglecting environmental protection (Model 3) are mostly affected by information on waste classification, loan at concessionary and cost saving in the usage phase, which improve the

Table 4. The influence of information on consumers with different environment protection attitudes

	Model 3 (group one)				Model 4 (group two)			
	Coefficient	OR	Std. Error	P	Coefficient	OR	Std. Error	P
Purchase intention								
medium	2.428		0.413	0.000	–0.008		0.280	0.976
Maximum	4.106		0.420	0.000	1.597		0.283	0.000
Gender								
man	–0.128	1.100	0.099	0.200	0.258	1.294	0.170	0.128
woman	0[a]	1.000	–	–	0[a]	1000	–	–
Age	0.099	1.104	0.058	0.018	0.082	1.085	0.046	0.073
Monthly income	–0.061	0.941	0.067	0.358	0.054	1.056	0.050	0.274
Information providers								
government	1.070	2.914	0.432	0.013	0.670	1.954	0.228	0.003
other GHs householders	0.995	2.705	0.433	0.022	0.424	1.528	0.228	0.063
developers	0[a]	1.000	–	–	0[a]	1.000	–	–
Information contents								
• Economy								
cost saving in the usage phase	1.904	6.716	0.404	0.000	0.410	1.507	0.232	0.077
investment benefit	1.729	5.634	0.404	0.000	0.505	1.657	0.232	0.030
loan at concessionary rates	1.911	6.758	0.403	0.000	0.554	1.740	0.231	0.016
• Living environment								
waste classification	1.946	7.004	0.403	0.000	0.386	1.471	0.232	0.097
greening rate	1.285	3.614	0.405	0.000	0.442	1.556	0.231	0.056
acoustic environment	1.447	4.250	0.403	0.000	0.533	1.703	0.232	0.022
TC	1.628	5.092	0.404	0.000	0.459	1.582	0.231	0.047
LE	1.568	4.799	0.404	0.000	0.221	1.248	0.232	0.341
IAQ	1.647	5.192	0.405	0.000	0.617	1.853	0.231	0.008
• Environmental protection								
carbon emission reduction	1.502	4.492	0.403	0.000	0.576	1.780	0.233	0.013
Score test for the proportional odds assumption	Chi–square = 20.533 p–value = 0.152				Chi–square =22.506 p–value = 0.105			
Goodness–of–fit test of overall model (Likelihood Ratio)	Chi–square = 199.499 p–value = 0.000 Pseudo R^2 = 0.152				Chi–square = 31.943 p–value = 0.007 Pseudo R^2 = 0.109			

Note: [a] represents the control group.

purchasing intention by 7.004, 6.758 and 6.713 times, respectively. Whereas, the information on carbon emission reduction only ranks 8th, which increase the purchasing intention of customer with low environmental protection awareness by 4.492 times. Therefore, consumers with high environmental awareness care more about the living environment and carbon emission. Whereas, those with no awareness of environmental protection focus more on the economic benefits.

Conclusions and implications

The paper generalized the contents and providers of GH information, which provides the basis for analysis on information effects regarding GH features. It applies ordinal logistic regression to calculate the information influence on customers' GH purchasing behaviors. Compared with current studies, the paper provides a deeper analysis and comparison on impacts of different information contents and providers. Moreover, it further analyzes the different reactions of various customers to information. It helps a better understanding on how information affects customers' GH purchasing behaviors and thus provides references for developers and governments to stimulate GH customers with different information.

Generally, the residents' awareness of environmental protection is not high, which hinders their GH purchasing behavior. Therefore, the government should improve public awareness of environmental protection through public-service announcements and regulations.

All kinds of information can effectively promote consumers' green housing purchasing behavior. However, the influence degree is different. Consumers are strongly affected by the information on economic benefits and IAQ

of GHs. Besides, environmentally friendly consumers are more affected by the information on living environment and carbon emission. Whereas, those with low awareness of environmental protection focus more on the economic benefits. Accordingly, the government and developers should strengthen GH information disclosure through various channels, and ensure the authenticity and readability of information. Moreover, the government could disclose more information on the economic benefits of GH by measuring the cost-saving of GH, and publicity the loan support for GH through banks and other channels. In addition, for air quality information, the government can regularly monitor and evaluate the air quality of GH, and disclose related information by the official information website or urge developers to publish the monitoring data. Besides, the government could also calculate and disclosure the carbon emission of buildings to attract consumers with the environmental protection responsibility.

Compared with developers, consumers trust more in the government and other green residential households. Therefore, the government could build a consumer information exchange platform to enable the consumer experience exchange to drive the GH purchasing behavior. In addition, developers should improve the product quality and conduct residential exhibitions regularly to improve the transparency of GH information. Besides, they could also gather and disclose the GH residents' feedback regularly to improve the GH quality as well as attract other residents.

In this paper, 236 customers were surveyed and analyzed to verify the validity of the GH information classification and the method proposed. However, it is worth noting that since the analysis is based on a limited number of respondents and is restricted to Chinese conditions and building characteristics, some results and implications cannot be used directly in other countries and specific areas. For example, in developed regions, consumers' reactions to monetary information might be weaker than to non-monetary. Since customers in developed countries are with strong purchasing abilities and they concern more about living environment (Kirby et al., 2023). Besides, for customers in tropical regions, they may be driven more by information on thermal comfort than other information due to the hot climate (Kumah et al., 2022). Although the study is based on the situation of China, the classification of information and the method proposed are applicable to all regions. Whereas, stimulating strategies should be proposed based on the results of field surveys according to the regionally climatic and economic characteristics. Moreover, since the study has a limitation that the data is from a limited number of respondents, in future studies large-scale questionnaires could be gathered to make a more reliable analysis, as well as find the market differences in different regions.

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