INVESTIGATING GENERATION ZS' PERCEPTION OF GREEN HOME AND GREEN HOME FEATURES

by

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Dedicated to my family

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LIST OF ABBREVIATIONS

AEC – Architecture, Engineering and Construction

DIT – Dual Inheritance Theory

EIA – Environmental Information Administration

EE – Energy Efficient

GenZ – Generation Z

GH – Green Home

GHF – Green Home Feature

IEQ – Indoor Environmental Quality

LEED – Leadership in Energy and Environmental Design

NAHB – National Association of Home Builders

NAR – National Association of Realtors

NMT – Normative Motivation Theory

RE – Renewable Energy

SM – Sustainable Material

TRA – Theory of Reasoned Action

TPB – Theory of Planned Behavior

USGBC – United States Green Building Council

WE – Water Efficient

ABSTRACT

In recent years, there has been an increase in environmental awareness in the United States leading to steady growth in environmentally conscious consumerism. These changes have come in response to issues such as the energy crisis, climate change, exponential population growth, and rapid urbanization. This fact is further supported by environmental campaigns and the green movement. Looking to the future of green home marketing, understanding the green consumer behavior of Generation Z (GenZ) is important for environmental and business reasons. The purpose of this research is to better understand the perception of GenZ on Green Homes (GHs). The study uses the lenses of dual inheritance and normative motivation theory to explain the influence of benefits and norms related to environmentalism and sustainability on GenZ consumers' green behavior. This study seeks to evaluate 1) GenZ's preferences related to Green Home Features (GHFs), 3) the extent of the influence of certain barriers on the adoption of GHFs, and 3) the types of motivation (intrinsic, instrumental and non-normative) influencing GenZ towards green home consumerism. Data was collected using an online survey questionnaire exclusively at Purdue University during March – April of 2021. One hundred sixteen GenZ participants responded to the survey. The findings show that these GenZ consumers prefer a certain type of GHFs over others. Additionally, based on descriptive tests of GHFs, energy-related features were the most prized features, while the least preferred was water-efficient features. Descriptive tests on barriers suggest that GenZ consumers perceive the lack of choice in selecting GHFs in their homes to be a top barrier, followed by a lack of information and the perceived effort to analyze GHFs. Inferential tests for the same indicated that GenZ consumers perceive these barriers differently. Lastly, for GenZ consumers, intrinsic and non-normative motivations significantly affect their willingness to buy GHs. The findings concur with previous studies on green consumer behavior, yet they provide a new benchmark for understanding GenZ consumer behavior on GHs and an updated view of what GHFs they prefer. This research can be used by home marketers and policy makers to study future home trends, attract more potential homeowners to GHs, and help create a sustainable environment for future generations.

CHAPTER 1. INTRODUCTION

1.1. Introduction

“Sustainability” is a term that is widely used in different fields, including academia, business, and public administration. According to the Brundtland Report (1987), the concept of "sustainable development" can be defined as: "… development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The global acceptance of sustainability has occurred because the escalating population and overusing of resources created devastating issues like poverty and climate change affecting millions of people (United Nations, 2020). Owing to the global crisis due to limited resources, the United Nations recognized the need to have sustainable development. In 2015 they took the initiative to form the Sustainable Development Goals, 17 in number, urging all their partner countries to take initiatives and necessary actions to meet the 2030 Agenda for Sustainable Development (United Nations, 2021). Some of these goals relate directly to the construction industry: ensuring affordable and clean energy, sustainable industrialization, and creating sustainable cities (United Nations, 2021).

Being a highly developed country and one of United Nations (UN) founding members, the United States (U.S.) has also recognized sustainability as an important aspect of development. One important action undertaken by the U.S. towards sustainable development was creating the National Environment Policy Act (EPA) of 1969. The EPA was established primarily to address the growing environmental issues arising from rapid development. To widely promote sustainability, the EPA has committed to the Greening EPA mission, promoting green practices in buildings (U.S. EPA, 2020). Under this mission, the design and construction of projects promoting energy efficiency, water conservation, and green buildings are encouraged (U.S.EPA, 2021).

Apart from the greener EPA mission, some other initiatives were also undertaken by the U.S. to encourage sustainable development in the construction industry. These include (a) green building rating systems, (b) policies that promote renewable energy, like Renewable Portfolio Standards (RPS), and (c) green incentives to promote sustainable development in the building sector, and (d) Building codes and standards supporting sustainability, such as the International Energy Conservation Code and ASHRAE standard 189.1 (standard for the design of a high-performance green building) (Delmas & Montes-Sancho, 2011; Doan et al., 2017; U.S. EPA, 2017).

These initiatives respond to environmental issues like global warming, pollution, resource depletion, and environmental degradation (Delmas & Montes-Sancho, 2011; Erten, Korkmaz, Syal, & Potbhare, 2009).

According to the Global Status Report, "Buildings and construction together account for 36% of global final energy use and 39% of energy-related carbon dioxide (CO2) emissions when upstream power generation is included" (Abergel, Dean, & Dulac, 2017, p. 6). Since carbon dioxide is considered to be one of the primary Green House Gases (GHG), the Intergovernmental Panel on Climate Change (IPCC) argues that increasing the concentration of GHG's in the earth's atmosphere causes a rise in global temperature (Solomon et al., 2007). The U.S. took many initiatives as mentioned above to reduce the carbon footprint from the construction sector.

Since it is believed that if the global temperature rise exceeds 3.6^0 F, it may result in a climate crisis putting more than a million people at risk with detrimental social, health, and economic impact (Coyle & Simmons, 2014). As of 2020 according to NASA global climate change (2020), the earth's global temperature has already risen by 1.8^0 F over pre-industrial levels, so curbing and reducing the carbon footprint is considered to be very significant.

On the other hand, the Non-governmental International Panel on Climate Change (NIPCC) argues against the IPCC's perception of global warming, arguing that rising global temperature is a natural phenomenon (Singer, 2008). But since the IPCC reports are based on scientific assessments (IPCC, 2017), and the majority of scientists (over 75%) believe that global warming is caused by human activities and an increase in Green House Gas (GHG) (Liu, Vedlitz, Stoutenborough, & Robinson, 2015). It is popularly accepted that reducing GHG emissions sources would be the first step towards global warming mitigation.

As such, since building and construction alone account for more than one-third of the U.S carbon emissions. Therefore, the U.S construction sector could offer a potential opportunity to reduce carbon footprint significantly to reach the UN sustainable goals. Some effective ways to reduce carbon footprint in housing sector are by constructing green homes (GHs) or using green home features (GHFs) such as energy and water-efficient appliances, sustainable or local building materials that have a low carbon footprint, and renewable energy generators (e.g., solar panels) (C. M. Jones & Kammen, 2011; Tan, 2014).

Moreover, the growing population over the last decade and the increasing housing demand in the U.S. (USHMC, 2020) present a good opportunity for developers in the U.S. to construct green buildings. Accordingly, understanding how consumers perceive the concept of "green" in their homes is an important issue. Prior studies in consumer science have found that consumer behavior is greatly influenced by personal beliefs, values, social environments and perceived gains (Moser, 2015; Peattie, 2010). At the same time, from a psychological point of view, social movements and cultures also greatly influence people's opinions, emotions, and behavior. For example, the reliance on social media ratings and reviews on goods and services, recommendations from friends through social networking applications, online shopping, and the availability of new information such as price, style, offers etc., have completely changed the nature of shopping (Xliema, 2019). Dietz et.al (2015) point out that environmental movements have the potential to greatly influence the masses by letting their voices be heard, leading to a reduction in human impact on the environment. These authors also comment on the extent of the effectiveness of these movements when it comes to action, and their findings suggest that the U.S. states that more effectively supported environmentalism by improving policies and regulation, and have support from the community performed better in reducing their carbon footprints (Dietz et al., 2015).

With the increasing popularity of sustainability and government encouragement of the green movement, going green is becoming a trend among businesses around the world (Tan, 2014; White, Hardisty, & Habib, 2019). The Going Green movement refers to leaders and employees adopting sustainable and environmentally friendly practices (Parletta, 2019; Tzschentke, Kirk, & Lynch, 2008). This Going Green movement also influences employee environmental consciousness, shown by recycling plastic, cardboard, fitting energy saving and water saving devices. Additionally, businesses adopting green practices and the green products becoming more available has resulted in increasing green lifestyle adoption among individuals (Lorenzen, 2012). Findings from the Lorenzen (2012) studies suggest that individual adoption of green lifestyle often involves conscious use of resources and can include using cloth bags, organic products, light-emmitting diode (LED) or compact fluorescent (CFL) lights, and energy star appliances. Along similar lines, when households strive to reduce their negative environmental impacts through lifestyle changes such as using environmentally safe products and resource-efficient products, this also can be referred to as going green.

Although green attitudes about housing are increasing, actual behavior towards housing is not becoming any greener. EIA data on energy consumption clearly shows that the residential end use sector's energy consumption increased by 2% from 2020 to 2021 (U.S. EIA, 2021a). The reasons for this may include an increase in the population and higher standards of living or due to increased stay at homes due to COVID. Another reason may be a passive approach to sustainable solutions by home builders (Kwok, Wong, & Kuan, 2014) due to lack of demand from consumers to adopt green home practices beyond what standards mandate (Dodge Data & Analytics, 2020). This creates an attitude-behavior gap (Peattie, 2010): while consumer attitudes show an increasing emphasis on environmental concerns, this concern does not seem to be reflected in consumer behavior. On the other hand, many empirical studies on green consumer behavior have found that consumer purchasing intention behavior is directly linked to attitudes, beliefs, values, motivations, and barriers (Kanchanapibul, Lacka, Wang, & Chan, 2014; Moser, 2015). Studies also suggest that consumer attitudes and preferences change across generations (Hervé & Mullet, 2009). The fashion, music, technology, and lifestyle industries constantly update their styles to keep up with what consumers prefer. Examples of consumer trends in the 2000s include the move from skinny jeans to comfortable boyfriend jeans (Sowray & Murray, 2021) and the move from going out to shop to shopping from home. In relation to the green movement, there has been a shift from the eco-status of opting-in to the eco-shame of opting out, otherwise known as green consumer pressure. This shift is due to affordable, widespread sustainable alternatives in the market (Trend Watching, 2020). A McKinsey survey investigating the consumer behavior of new generations in Brazil (GenZ: born between 1997-2012) reveals that their behaviors (explained in chapter 2) stem from a larger philosophical search for truth (Francis & Hoefel, 2018).

The upcoming generation entering the housing market is Generation Z (GenZ). GenZ makes up nearly 20% of the total population of the U.S. (Duffin, 2020; US Census Bureau, 2021), making them a force to reckon with as potential home consumers. According to the National Association of Realtors (NAR), home buyer and seller generation trends indicate that 88% of first time home buyers fall between the ages of 22 and 29 years (NAR, 2020). This means that many GenZ consumers will be approaching that average age range in the next five years. As behavior is linked with consumer attitudes, values, preferences (Kanchanapibul, Lacka, Wang, & Chan, 2014; Moser, 2015), understanding GenZ's consumer characteristics is essential if home marketers are to understand and appeal to the purchasing intentions of the next generation of home buyers.

To this effect, the present study investigates the preferences and motivations (positive and negative) of GenZ consumers towards GH and GHFs, specifically among U.S. university students. In this current study, the researcher investigates the motivations and barriers that drive GenZ's GH purchasing intentions and identifies the types of GHFs that GenZ consumers desire to have in their homes.

1.2. Problem Statement

With the nation's rapid economic development and urbanization, Americans are becoming more aware of the environment and the hazardous impacts of human activities (Alwitt & Pitts, 1996). Studies show that currently the consumer trend is shifting towards responsible consumerism in many sectors, including residential construction sectors (Chan & Lau, 2002; Danziger, 2019; Moser, 2015; Tan, 2014; Uddin & Khan, 2016). There has been an increase in the number of households sympathizing with the concept of environmentally friendly homes, a gap still exists between attitudes and purchasing intentions (Moser, 2015; Tan, 2014). That is, consumer concern about the environment fails to translate into an intention to purchase GHs or GHFs (Peattie, 2010). Having a positive attitude towards environmentally friendly products can stimulate sustainable consumption behavior (Peattie, 2010). Still, some empirical studies have found that consumer attitudes and values may or may not translate into actual purchasing intentions and this depends on the extent of commitment to environmental values (Morwitz, Steckel, & Gupta, 2007; Park & Lin, 2020; Stern, 1999). This is called the attitude-intention gap.

Prior research on consumer behavior patterns has been based on behavior predictors such as attitude, value, environmental concern, perceived benefit, and social norms (Joshi & Rahman, 2015; Peattie, 2010; Uddin & Khan, 2016; Zhang, Chen, Wu, Zhang, & Song, 2018). But the effects of barriers and the mediating motivations shown by behavior predictors has not been explored thoroughly and remain largely absent in green home marketing literature (Gilal et al., 2020). Webb (2008) argues that an adequate way of understanding environmentally conscious consumption is to analyze consumers' purchasing choices in terms of motivations for their behaviors.

However, consumer purchasing choices change from generation to generation, and so do attitudes and beliefs (Hervé & Mullet, 2009; Houkes, 2012). Francis and Hoefel (2018) agree that the context in which a generation emerges shapes that generation's behavior and consumption

concept. Prior research studies used behavior control variables to identify consumer purchasing intentions (Lee, 2008; Promotosh & Sajedul, 2011; Tan, 2014). But these studies did not consider the implications of cultural change and age or the influences of negative factors like bad experiences, changing moods, or fears related to purchasing behaviors (LaMorte, 2019; Peattie, 2010).

Thus, the effect of these factors on consumer purchasing intention in the context of GH is still unclear (Joshi & Rahman, 2015; Zhang et al., 2018).

Accordingly, the research presented here offers an extended perspective on GenZ consumers' green home purchasing intentions by factoring in negative feelings or barriers and important motivations identified by dual inheritance theory (DIT) and Normative Motivation Theory (NMT). The research also explores whether there is a difference in preference of GHFs types by GenZ consumers, compared to other consumers. Thus, this research's primary purpose is to add knowledge to the existing body of literature on GH consumer behavior, especially the consumer behavior of GenZ. In addition, the research can help inform the needs and wants of future homebuyers in the United States.

1.3. Scope

The project scope involves a quantitative study of the GenZ consumers' preferences, perceived benefits and barriers, and motivations to buy GH and GHFs. This research shortlists eleven GHFs based on existing academic literature and market reports, which are then used to investigate the GenZ consumers' preference for GHFs. In addition, this study investigates whether there is any difference in preference among the types of GHFs based on the GenZ consumers' choices from the specified list of GHFs present in this research. The GHFs are categorized based on the type of resources they conserve, such as energy and water. Furthermore, this study investigates the effect of motivation types on the GenZ consumers' willingness to purchase GH and analyzes the GenZ consumers' perceived barriers to adopting GHFs.

The GH and GHFs considered in this study are in the context of single-family houses. The analysis will be based on online survey responses. The selected sample will represent a diverse population within a university setting.

1.4. Significance

The findings of this research study will explain the influence of motivations and barriers on GenZ's intentions to purchase the GHs and GHFs they desire to own.

1.4.1. Contribution to Business Practice

One of the primary challenges and motivations for every business is meeting evolving consumer needs by understanding the factors that influence consumers' purchasing intentions (Kanchanapibul et al., 2014; Vazifehdoust, Taleghani, Esmaeilpour, Nazari, & Khadang, 2013). With the consumer market shifting more towards environment-conscious consumerism, there has been an increase in consumer demand for sustainable products/services, healthier foods and lifestyle choices, and environmentally friendly transport choices. This has caused a significant change in consumer behavior over time (Jang, Kim, & Bonn, 2011; Kanchanapibul et al., 2014). In light of these facts, the present study seeks to expand the understanding of GenZ purchasing behavior in the United States related to GH and GHFs. Survey findings provide insights that can inform business practices by providing a snapshot into what the future of homes in the U.S. will look like, given that GenZ will most likely be buying homes ten years from now. These findings will help businesses to re-evaluate their market strategies and develop promotional ideas that cater to GenZ consumers. This is because consumers' motives, beliefs, intentions, and values ultimately determine the success or failure of products and services (Zelezny & Schultz, 2000).

1.4.2. Contribution to Environment Sustainability

Some of the major factors contributing to environmental degradation are the overuse of resources and GHG emissions. Previous studies have found that the building sector has a lot of potential in reducing GHG emissions (Lazzaroni & Bianchi Porro, 2003). It also has been established that green homes have significant potential for reducing resource consumption and environmental impact compared to conventional homes (Abergel et al., 2017). The findings of this research study will help reveal both positive and negative factors influencing GenZ's purchasing intention related to GH and GHFs. It will aid businesses in understanding the demands of the market and enable policymakers to evaluate better and promote means of achieving sustainability.

1.5. Research Questions

1) What types of Green Home Features (GHF) would Generation Z (GenZ) consumers like to have in their homes?
   - What are the most desired GHFs among the identified GHFs in the study, as perceived by the GenZ consumers?
   - Do GenZ consumers prefer certain types of GHFs (e.g.: energy efficient, water efficient, sustainable material, IEQ, Renewable) over others?
2) What barriers and motivational factors influence GenZ consumers' decisions to own or buy Green Home (GH) and/or GHF?
   - Which type of motivations wields the most influence over GenZ consumers' willingness to purchase GH and/or GHFs?
   - Which barriers have the greatest influence on GenZ consumers' willingness to purchase GH and/or GHFs?

1.6. Definitions

Green Homes: "A green home incorporates strategies in design and construction that increase energy, water and resource efficiency, improve indoor environmental quality, and minimize environmental impacts on the site"(Dodge Data & Analytics, 2020, p. 1).

Conventional home: Conventional homes, or stick-built homes, are homes that are built on-site using common techniques. These homes are designed and constructed to simply meet the minimum required Building Code standards (Evans & Evans, 2007, p. 126).

Sustainability: Sustainability means meeting the present needs of humans without compromising the ability to meet the needs of future generation (WCED, 1987, p. 24).

Generation Z (GenZ) : Anyone born between 1997 and 2012 is considered a member of GenZ (Dimock, 2019)

Consumer behavior: "Study of how people or organizations behave when obtaining, using, and deposing of products (and services)" (Kumra, 2007, p. 2).

Green Consumerism: Green consumerism is the consumer's conscious consumption of products and services that are not harmful to the environment. (Prothero, 1990)

1.7. Assumptions

Following are the assumptions that establish the basis of this study:

- The respondents are willing to participate in the survey voluntarily and without any incentives.
- The respondents answer the survey questions truthfully without any bias.
- The respondents are able to understand the survey questions and interpret the utilized scale.
- The respondents are representative of the older Generation Z population (born between 1996 and 2002).
- The generated online survey is compatible with the respondents' devices.

1.8. Limitations

The limitations of this study are:

- The green features identified in the study are limited to green features currently existing in the residential sector or proposed by 2020.
- The study intends to explore GenZ consumers' intentions to buy GH or GHFs in general rather than focusing on a particular GHF.
- The findings cannot be generalized globally, as characteristics like culture, values, geographical conditions, etc., may influence the purchasing intentions of consumers.
- The GHFs used to study the GenZ consumers' choices of GHFs are limited in this study to 16.
- The survey used to conduct the research will only be available online, so only respondents with devices and internet access will be able to answer.

1.9. Delimitations

Following are the delimitations of this study:

- The respondents are identified within the university setting in the U.S.
- The study focuses only on consumer motivations and barriers towards GH/ GHFs purchasing intention.
- The study will not factor in the ethnicity or social status of the respondents.
- The study will not address the influence of social-economic status on green consumer purchasing behavior.
- The barriers identified in this study are limited to information and choice problems.
- The study focuses only on single-family green homes.

1.10. Summary

This chapter outlines the research study by providing a brief of the study's purpose and objective, along with its context. The researcher identifies the study's boundaries by discussing scope, research questions, assumptions, limitations, and delimitations. The chapter also offers a literature review providing in-depth discussion of relevant research related to green consumerism, consumer behavior, GenZ consumers, and consumer behavior factors.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

"Green" and "sustainability" are common terms in the Architecture Engineering and Construction (AEC) industry, which has a long history of considering environmental impacts (Erten, Korkmaz, Syal, & Potbhare, 2009; World Commission on Environment and Development, 1987). In fact, in ancient vernacular architecture, most of the buildings, and homes, in particular, are sustainable due to passive design and construction using local materials such as straw bale, mud, stone, and cob (Zhai & Previtali, 2010). Nowadays, green and sustainable homes are lower in number than conventional homes (Jones & Laquidara-Carr, 2018), though homeowners' interest in GHs has been slowly increasing (WBCSD, 2008). To get a clear idea of GH marketing trends, it is crucial to understand homeowner consumer behavior. This chapter overviews Green Homes reviews the literature on green consumerism, discusses theories of consumer behavior, introduces popular GHFs on the market, and explains the variables influencing consumer GH purchasing intentions. Essentially, this chapter discusses the underlying concepts and factors related to the research study.

2.2 The Methodology of Conducting the Review

For conducting the literature review on GHs, GenZ consumers and their behavior, variables influencing GH purchasing intentions in consumers were developed by consulting databases including the Engineering Village, Sage, Scopus, and ProQuest. The references used for the review include highly-ranked peer-reviewed journal articles, conference proceedings, theses, and dissertations. A variety of sources on GHFs—including web-based articles, magazine articles, home industry reports, and organization survey statistics—are consulted to show the current body of knowledge on the green home consumerism industry. Figure 1 depicts the research's key concepts and their relationships, representing the literature review through a Venn diagram. The union of all the Venn circles represents the objective of the research study.

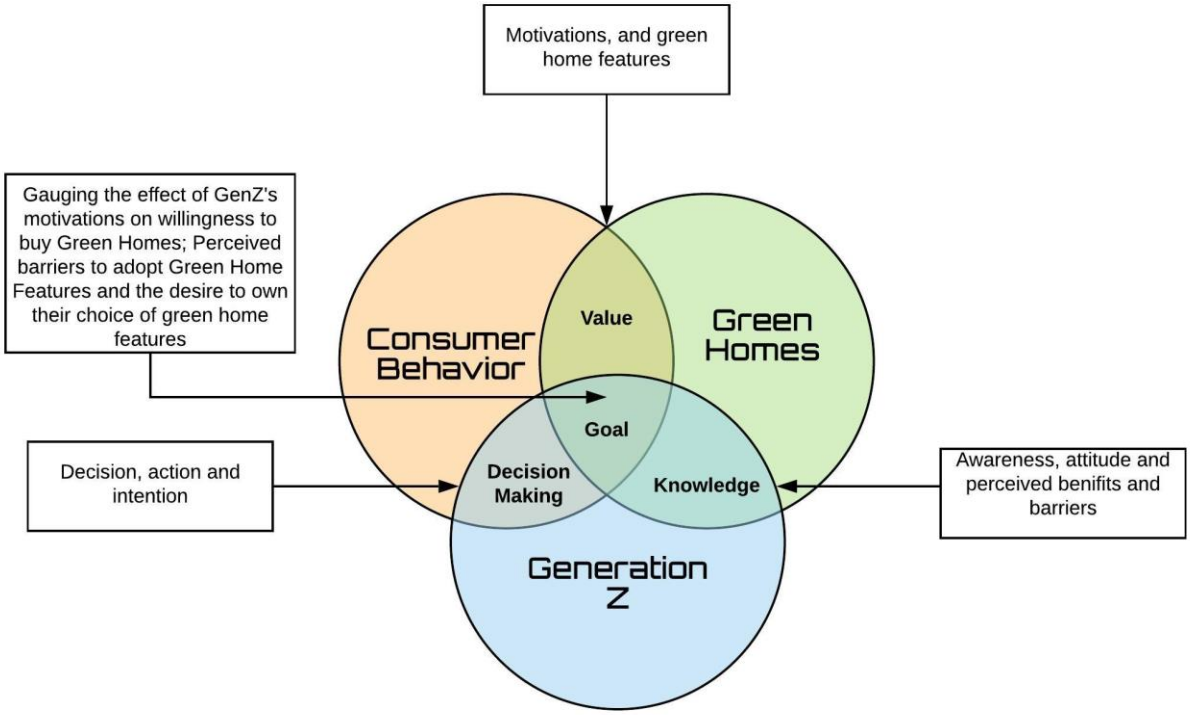

Figure 1 Key concepts and their relationships

2.3 Green Homes

The U.S. OPEC oil embargo in 1973 caused significant destruction of the environment and created a spike in energy costs, capturing public attention and giving rise to the environmental movement, which protests environmental damage due to human action (Cassidy, 2003). To commemorate the protesters' efforts, 'Earth Day' celebrations have been held since April 1970. In recent years, different organizations have used Earth Day to increase awareness of environmental issues. The day also is used as a pledge day to fight global warming (Mathur, 2015).

Becoming a global movement over time, the environmental movement has gained momentum and significantly affected law and society in the U.S. and around the world (Coglianese, 2001). Environmental awareness campaigns, the establishment of pro-environment groups, celebrations of Earth Day and World Environment Day, and the creation of environmental education programs have increased awareness of the environment. Issues like water shortage and environmental degradation have become virtually common knowledge among the public, and Gen Z in particular (Moser, 2015).

Today's consumers even realize that their purchasing behavior could have a large effect on the environment (Vazifehdoust et al., 2013). The extent to which individuals put effort into conscious consumerism depends on how much they support environmental consumerism, the belief that environmental degradation can threaten personal values, and that individual actions can directly or indirectly protect the environment (Stern, 1999). Some individuals who embrace environmental consumerism and consciously act to achieve minimal negative environmental impact identify themselves as pro-environmentalists, and this behavior is known as pro-environmentalism or pro-environmental behavior (Moser, 2015). Pro-environmentalists consider sustainability to be an ethical obligation influencing their consumption patterns. Many companies such as H&M, Levi, Starbucks, and Eco-roots promote sustainability to show their commitment to the environment and create a sustainable brand image (Sachs, 2020; Welch-Rhea, 2018). Since pro-environmentalism is seen as an appealing norm in society, many people buy products from brands that align with their values (Moser, 2015). In addition, the government has created certain environmentally friendly policies and incentives, such as the EPA and green incentives for sustainable buildings, to promote environmentally responsible behavior among people and organizations (Stern, 1999).

In light of the energy crisis, and since building and construction alone account for more than one-third of the nation's carbon emissions, the American Institute of Architects (AIA) in the U.S. created an energy task force to find creative approaches to saving energy in buildings (Cassidy, 2003). In the mid-1980s, a green building coalition came together in the U.S to discuss how to make buildings more environmentally sustainable. Over the next few years, several eminent professionals embarked on a journey to transform the nation's construction industry and founded an organization in 1993 called the U.S. Green Building Council (USGBC). To further support and encourage green construction, USGBC created a green building rating system called Leadership in Energy and Environmental Design (LEED), paving firm roots for green building concepts (Chance, 2012). Additionally, to understand energy consumption in U.S. buildings, teams were formed to investigate the data on energy consumption by source and sector and develop energy-saving technologies like photovoltaics, passive architecture, and green technologies ("U.S. Energy Inf. Adm.," 2020). One such government body is the U.S. Energy Information Administration (EIA), which gathers, analyzes, and disseminates data on energy in buildings, and this data is used to create sound policies, improve marketing, and increase public awareness of energy and its

impact on the environment. The Residential Energy Consumption Survey (RECS) is one survey conducted by the EIA to study energy characteristics of housing units, including household demographics and their usage patterns (U.S. EIA, 2020b). The first RECS survey was conducted in 1978 and its latest fourteenth iteration was conducted in 2015. The RECS is conducted across the U.S., and information from the survey is used to shape energy standards and policies related to buildings in the U.S. (U.S. EIA, 2020a). The 2015 RECS survey found that the most common type of fuel for household space heating is natural gas, followed by electricity, and the survey also revealed that there has been a slight increase in renewable sources of energy for household energy consumption (U.S. Energy Information Administration, 2018). But for a residence to be considered truly sustainable or green, the residence must have, in addition to lower energy consumption, a good indoor environmental quality (IEQ), use of environmentally low-impact materials, and a sustainable construction process (Reeder, 2019).

To officially recognize a building as a green building, third-party certification is necessary. The USGBC provides green certifications for buildings by awarding a LEED certificate for complying with sustainability standards. For a building to be LEED-certified, the project should earn minimum credits in 7 categories: (1) Site Selection, (2) Energy and Atmosphere, (3) Water Efficiency, (4) Materials and Resources, (5) IEQ, (6) Regional Priority, and (7) Innovation in Design (Reeder, 2019). More than 1.6 million residential units, including single and multi-family homes, have currently participated in the LEED program across the world, out of which 480,000 residences are LEED-certified and 1.1 million are currently in the process of getting certified (Long, 2019). But these are not all the green homes, since in different parts of the world, such as Singapore, India, Australia and Europe, there are other green building standards and certifications.

Despite long interest in sustainability within the AEC sector (WCED, 1987), the general need for more sustainable building and green homes is becoming even more critical due to increasing resource consumption and negative building impact on the environment (Mgbemene, Nnaji, & Nwozor, 2016).

With the increasing need for green building practices, authorities and organizations worldwide recognize the importance of initiating “environment sustainability” practices in construction (Lorenzen, 2012). In the US, popular green building certification systems include the LEED program and the WELL Building Standard, Living Building Certification, and Energy Star (Vierra, 2019). These third-party certification programs rate the level of sustainability for buildings.

A study conducted by the USGBC found that LEED-rated buildings perform better than conventional buildings, saving 30% to 97% of resources by reducing energy, carbon, water, and waste in buildings (Alpin Limited, 2017). One category of LEED certification is LEED for Residential Design and Construction. These homes save at least 15% in energy and 20% in water compared to conventional homes (USGBC, 2020). Though there are currently more than 1.6 million residences participating in LEED across the world (USGBC, 2020), there is still a need for more sustainable homes to address ever growing environmental challenges (Jones & Laquidara-Carr, 2018).

2.4 Consumerism

Consumption is an omnipresent activity in a person's life. The type of consumption is closely related to a person's lifestyle, where "lifestyle" captures not just a person's common practices and behaviors but also her sense of individuality and self-expression (Featherstone, 1987). According to Featherstone (1987), an individual's preferences in clothing, accessories, home, leisure pastimes, etc., can all be considered as indicators of consumer lifestyle.

2.4.1 Generation Z Consumer

Generation Z (GenZ), also known as the Post-Millennials, is the new generation born in 1997-2012 (Parker & Igielnik, 2020). Older members of GenZ are now between the ages of 18 and 24, and in 2020, GenZ made up nearly 20% of the U.S. population of 330 million (Duffin, 2020; U.S. Census Bureau, 2020). This generation has been exposed to the digital world since early in life, and they are more tech-savvy, educated, and community-oriented than previous generations (Su, Tsai, Chen, & Lv, 2019). According to Francis & Hoefel (2018), the characteristics of GenZ are "undefined ID, communaholic, dialoguer, realistic." That is to say, they try to create their own identities through exploring and experimenting, they are not bound to stereotypical thinking, and they are vocal about their opinions. Compared to other generations, GenZ is more knowledgeable about environmental issues, tends to be more concerned about the environment, and considers pro-environmentalism an appealing social norm (Kanchanapibul et al., 2014; Parker & Igielnik, 2020; Whitmarsh & O'Neill, 2010). As consumers, GenZ individuals tend to research products and their brand values before buying, and they like goods that are

customizable, unique, easy to search/buy, recommended by friends, family, and online reviews, and have ethical brand value and low environmental impact (Francis & Hoefel, 2018; NRF, 2018). To gain a competitive edge in the market, a company targeting GenZ consumers must know what motivates them to buy goods and services.

2.4.2 Green Consumerism

Many people embrace green consumerism out of a sense of environmental responsibility and due to influences from popular views about social and economic sustainability (Peattie, 2010). With authorities implementing sustainable development policies, marketplaces are pressured to provide environmentally sustainable aspects of products and services (Chowdhury & Samuel, 2014). To understand green consumerism trends, one needs to understand consumer behavior. There are many theories of consumer behavior, but they do not properly or fully represent the role of social norms in consumer psychology. More specifically, they do not properly identify the role norms play in motivating consumers to prefer green products and services to less green alternatives. Since the environmental movement is fundamentally a normative movement that values green behavior specifically on the grounds that it is the right way to act, the motivations involved in forming green preferences are, fundamentally, normative motivations, or motivations to follow norms. Accordingly, it is necessary to supplement existing theories of consumer behavior with theories that adequately represent the normative motivations driving green consumerism. For this reason, the present study uses Dual Inheritance Theory (DIT), which explains the evolution of norm psychology in humans, and Normative Motivation Theory (NMT) to identify what motivates GenZ consumers to purchase or not purchase GHs and GHFs.

2.4.3 Consumer Behavior

2.4.3.1 Theory of Reasoned Action (TRA)

According to Ajzen and Fishbein (1980), intentions toward purchasing behaviors is not random. Instead, they go through a thought process before purchasing. According to the TRA (1975), consumer behavior is driven by two conceptually distinct belief sets: 1) behavioral and 2) normative. The behavioral belief is assumed to be rooted in the personal nature of an individual. For instance, if one plans to be fit, she will exercise regularly, hence this factor is considered as an individual's attitude towards performing a behavior. By contrast, the underlying influence of normative beliefs depends on the individual's subjective norms, or personal beliefs about which forms of behavior are right or wrong (H. Ajzen & Fishbein, 1980).

Hence, Fishbein and Ajzen (1975) show that when an individual displays a level of steady intention between the time of consideration and the behavior, this intention can be translated into action. For example, if a consumer believes in sustainability, feels concerned about the environment, and is looking for a new home, he/she is likely to purchase GHs and GHFs.

2.4.3.2 Theory of Planned Behavior (TPB)

TRA assumes that behavior is under voluntary control, which is not the case in reality, as behavior may change based on a person's perception of ease or difficulty of performing a behavior (Ajzen, 1991). The Theory of Planned Behavior (TPB) was created to justify TRA's limitation and deal with incomplete volitional control in peoples' behavior (Ajzen, 1991). For example, imagine that two homeowners of similar backgrounds believe in sustainability, and both come across an ad for a drip irrigation system for home gardens. Still, only one of the homeowners purchases it, because the other is living in an apartment complex without a garden. Here the situation acts as an obstacle, though the intention is the same. Similarly, for a consumer to buy a GH or GHFs, the attitude is important, but situational factors matter as well. According to Azjen:

> Attitudes toward the behavior, subjective norms with respect to the behavior, and perceived control over the behavior are usually found to predict behavioral intentions with a high degree of accuracy. In turn, these intentions, in combination with perceived behavioral control, can account for a considerable proportion of variance in behavior. (I. Ajzen, 1991, p. 206)

TPB attempts to understand the link between the consumer's attitude, beliefs, influence from family and media, perceived behavior (behavior control factors), and behaviors by understanding the psychology of their behavioral intention (I. Ajzen, 1991). One major limitation of TPB, for present purposes, is that it does not consider a full view of norm psychology. While it appeals to subjective norms, this concept cannot clarify what exactly motivates individuals to follow norms. More specifically, it does not distinguish the intrinsic motivation to do the right thing *just because it is right* from instrumental motivations to do the right thing in order to attain social rewards or avoid social punishment from others who are expected to enforce the relevant norms. Another major limitation of TPB is that it does not consider how past experiences, like loyalty towards a brand, or the influence of time across generations, affect an individual's purchasing behaviors (LaMorte, 2019). To address these short-comings from TPB, DIT also is adopted in this research.

2.4.3.3 Dual Inheritance Theory

Dual inheritance theory (DIT) is a theoretical framework that explains human evolution in terms of two distinct mechanisms of inheritance: genetic inheritance through DNA and cultural inheritance through social learning (Henrich & McElreath, 2012; O'Brien & Bentley, 2017; Rindos et al., 1985). According to Houkes (2012), culture is anything from etiquette rules, policies, laws, languages, religious beliefs, technologies, and scientific theories to skills where one learns information from other individuals; in other words, culture is something that can be inherited from social learning. Psychological traits acquired through social learning are called 'cultural traits,' and the transmission of cultural traits from generation to generation is similar to genetic replication (Henrich & Boyd, 2002; Houkes, 2012). As a result of these two distinct streams of inheritance, this research concludes that Darwinian selection occurs in two dimensions at once and that these two selection processes interact causally in a dynamic process called gene-culture coevolution (Davis, Hennes, & Raymond, 2018; Henrich, 2016; Henrich & McElreath, 2012).

An important consequence of this coevolutionary process is the genetic evolution of what Davis et al. (2018) refer to as the norm system within the human mind. Once genetic selection had first created sophisticated capacities for social learning in humans, it became possible for cultural selection to favor certain norms, or socially learned standards and rules specifying what is right and wrong within a given culture (Boyd & Richerson, 2005). As a result, cultural selection eventually created a social environment filled with stable norms. But along with norms comes the

enforcement of norms, as individuals use whatever forms of punishment and reward they have available to coerce others into doing what they think is right (Henrich & McElreath, 2012). These rewards and punishments created powerful genetic selection pressures: individuals whose innate psychology was well suited to the task of gaining social approval and avoiding social punishment would have higher genetic fitness than individuals whose psychology was poorly suited to this task. Thus, a culturally evolved social environment led to the genetic evolution of a norm system, or a system of genetic adaptations for identifying, following and enforcing cultural norms (Boyd & Richerson, 2005; Henrich & McElreath, 2012).

Included within the norm system are the two different types of normative motivations described above: intrinsic motivations to do the right thing and instrumental motivations to avoid the punishments and gain the rewards of norm enforcement (Henrich & McElreath, 2012). And just as these two types of motivation apply to any other type of norm, such as norms against lying or stealing, they also apply to norms of environmentalism and sustainability. To genuinely believe that protecting the environment is the right thing to do, and to be motivated to protect the environment *because* it is the right thing to do, is to be intrinsically motivated follow norms of environmentalism. By contrast, to be motivated to protect the environment simply in order to receive a tax subsidy or to avoid being fined for violating regulations of the EPA is to be instrumentally motivated to follow norms of environmentalism.

For this study, we investigate the consumer's motivation to purchase GH or GHFs through the lens of the DIT description of the norm psychology or norm system.

2.4.3.4 Normative Motivation

For the current study, the researcher distinguished green home purchasing motivations based on whether the motivations are influenced by norms of environmentalism and sustainability (normative motivations) or by self-interested and personal gains in terms of money and health (non-normative motivation) (Davis et al., 2018). Normative motivations, then, were divided into intrinsic (personal) motivations and instrumental (extrinsic, external, or social) motivations. As the name suggests, motivation originating in personal beliefs, values, and attitudes is called intrinsic motivation. By contrast, a motivation that comes from external factors like acceptance from family and friends, influence from social trends, or following laws can be categorized as instrumental motivation.

Consumer theory explains that the various stages consumers move through before they decide on purchasing, using or disposing of a good or service make up the consumer decision-making process (Stankevich, 2017). Stankevich (2017) argues that the first stage of the decision-making process is need recognition: Why and what motivates the consumer to buy this product? Since the motivations of the green consumerism ultimately depend on the norms of environmentalism and sustainability, these norms dictate the relevant needs in the consumer decision-making process. This underscores the importance of understanding consumer decision-making's intrinsic and instrumental motivations when buying a GH or GHFs.

Additionally, non-normative motivations such as economic benefits and perceived health benefits also influence individual decision-making (Tan, 2014). For example, if a person wished to purchase a light bulb and had two options with similar prices, that person will decide to buy one of them based on factors like energy consumption or effects on the eye. Similarly, if a shopper wishes to purchase a shirt and sees a deal to buy one and get another 50% off, that shopper may be influenced to buy a different shirt than the one originally intended. Neither of these cases involve normative views about what is right and wrong, but nonetheless they reveal that non-normative motivations of self-interest are clearly important when analyzing consumer behavior based on motivations.

The current research focuses on variables influencing consumer need to buy GH or GHFs in terms of different types of normative (intrinsic, instrumental) motivations or non-normative motivations. Other variables include the situational barriers that consumers perceive in regards to purchasing GH or GHFs, which also affect need recognition. In terms of the example given above, a person who has no garden at all is unlikely to recognize a need for a drip irrigation system.

2.5 Variables

This research's variables are identified based on the literature review of journals, scholarly articles and reports, dissertations, and authorized articles on webpages. The keywords used to filter the search are: *consumer behavior*, *green consumerism*, *green home*, *green home features*, *the theory of consumer behavior (TPB, DIT)*, and *decision-making*. The variables are broadly classified into three types: demographic variables; motivations & situational barriers; and GHFs.

2.5.1 Demographic Factors

A significant body of literature has been published on age, which is considered as a demographic factor. Many studies have found that age can impact consumer behavior (Hervé & Mullet, 2009), and studies found that young people are more open to new and innovative ideas and technologies (Lee, 2008; Zhang et al., 2018).

Further studies have found that consumer behavior also varies with gender (Mitchell & Walsh, 2004), as women and men have different attitudes, desires, motivations, and preferences (Meinzen-Dick, Kovarik, & Quisumbing, 2014). Since DIT is directly related to motivations, the research investigates consumer behavior in terms of gender.

Another important factor is education. Education can influence decision-making behavior in people. Education can help from problem recognition to the evaluation of need (Moogan, Baron, & Harris, 1999; Peattie, 2010), making education one of the influencing factors of consumer behavior. For this research, the population is U.S. students, so the bias generated from varying knowledge levels across the sample is reduced.

As this study focuses on the role of cultural norms, identifying the consumer's geographical origin is necessary since different locations have different cultural values and views. In addition to regional variation, culture also varies as a function of differences between rural and urban locations. Hence, the demographic factors considered in this study are:

- Age
- Gender
- Education
- Geographic place of origin
- The environment of upbringing (urban, sub-urban or rural)

2.5.2 Motivations and Barriers

Many empirical studies have emphasized that environmental awareness and knowledge have a positive effect on green consumption behavior (Nguyen, Lobo, & Nguyen, 2018; Peattie, 2010; Tan, 2014; Zhang et al., 2018), though other studies have added that increasing consumer knowledge has only a small effect on consumer purchasing intention (Jackson et al., 2005) and may even sometimes confuse or overwhelm consumers (Moisander, 2007). To investigate the

effectiveness of knowledge on green home purchasing behavior, a lack of knowledge is considered as a barrier. That is, if the data on a product is not easily accessible, it may negatively affect a consumer's intention to buy that product. Lack of information on products and lack of consumer awareness of products were perceived as significant barriers in the NAHB survey and NAR report (Dodge Data & Analytics, 2020; NAR, 2020). Since GenZ consumers rely heavily on the internet to gather, compare and analyze information before making a judgment, the researcher investigates to what extent they perceive lack of information to be a significant barrier hindering their willingness to buy GH (Francis & Hoefel, 2018; NRF, 2018).

According to Francis & Hoefel (2018), GenZ consumer's try to create their own identities by finding true meaning themselves through exploration and experimentation (Francis & Hoefel, 2018). With that being said, a lack of choice can limit their ability to explore and find what truly resonates with their identity. A study by Tan et. al. (2016) and the findings from the NAHB (2020) suggest that the lack of choice and availability of green products created a barrier to GenZ consumers' willingness to buy GH. Similarly, most of the features are selected by builders or architects, limiting the freedom to choose for the GenZ consumer. Thus, the second barrier the current study considers is lack of choice.

Since GenZ is a more educated generation, and since it is part of their nature to seek information before making any decision to purchase a service, the ease of accessing information can play a vital role in influencing their decision process (Francis & Hoefel, 2018; Tan, Johnstone, & Yang, 2016). According to the Trend Watching report (2020), GenZ consumers are accustomed to getting services with less effort due to the digital evolution. In other words, if they have to make an effort to gather data, this could become a barrier. Since construction is a fragmented industry with a lack of ready information on GH, the final barrier the current research considers is lack of time (perceived effort) to gather and analyze GH information.

With knowledge, opinion or attitude is created. Attitude is directly linked to intuitive and emotional factors, influencing individual behavior (Carrus, Passafaro, & Bonnes, 2008). For example, if a person had a negative attitude towards the service of a particular restaurant, then he/she would be reluctant to dine again at that restaurant. In other words, attitude can influence an individual's process of decision-making. Environment attitude is said to be an amalgamation of beliefs and values an individual feels about environmentally related activities or issues (Schultz, Shriver, Tabanico, & Khazian, 2004). As attitude is considered one of the factors for consumer

behavior (Ajzen, 1991), environmental attitude plays an important role in green consumerism and subsequently towards GH's purchasing behavior. In addition, environmental concern originates from people's awareness of environmental issues (Fransson & Gørling, 1999) that can influence purchasing behavior. In this research, environmental attitude, concern, and belief are considered important items under the environmental motivation category.

The attitudes, beliefs, and moral values of consumers are important factors to consider, as they are directly linked to intuitive and emotional factors (Carrus et al., 2008). Additionally, according to the study on consumer behavior based on TPB, the consumer's attitude towards a product/service influences their decision-making process while considering buying the service (Ajzen, 1991). Thus, as intrinsic motivation is based on personal emotions like values and attitudes, understanding an individual's stance on sustainability/GHs can be valuable in ascertaining their motivations to own a GH or GHFs. For this research, consumers' feelings, moral values, and beliefs related to GH and GHF are considered important items under the intrinsic motivation category.

According to Azjen (1991), media, the opinions of friends and family, and social norms such as policies, laws, and standards are significant influencers when it comes to consumer purchasing intention behavior. For instance, a consumer decides to buy toothpaste. Out of the plethora of options, he/she is familiar with two products through advertisements and ads. Familiarity and knowledge gained from media influences the consumer towards choosing one of the two. Furthermore, say a family member is partial towards a particular flavor of toothpaste, and one of the two is of that flavor. The consumer is more likely to buy the toothpaste with the familiar flavor. In other words, an individual's decision to purchase can be significantly influenced by contextual traits and instrumental motivations from media or from family and friend's recommendations (Peattie, 2010). Researchers have found that in some cases, these actions are performed just to get acceptance or avoid disappointment from society or family/friends (Houkes, 2012; Moser, 2015; Peattie, 2010).

Many prior studies also have concluded that social norms can influence consumer decision-making, and that an individual's action is influenced by socially acceptable practices and actions that are perceived to be morally right in society (Jackson et al., 2005; Moser, 2015). Also, studies on consumer behavior have stated that a person's consumption activities reflect their social relationships and their obligations towards family and friends, community, and/or social networks

(Gilal et al., 2020; Jackson et al., 2005; Moser, 2015; Peattie, 2010). With sustainable products becoming more affordable, buying them is not a prestige issue anymore, but opting out could be perceived as a shameful act (Trend Watching, 2020). Thus, for this research, family, friends, and neighbors as well as social standing—including reputation and avoiding guilt—are considered important items under instrumental (extrinsic or contextual) motivation.

Empirical evidence has found that green-rated properties have considerably higher market value and sale value than conventional homes (Moser, 2015). Harney (2012) pointed to a study involving homes sold in California that revealed that green certified homes sold for 9% more than homes without a certification. These results can be attributed to the perceived benefits obtained from GH such as enhanced livability, better energy performance, lower utility bills, and increase value of the GH (Tan, 2014; Zhang et al., 2018). All the factors mentioned above affect perceived purchasing intention to some degree. As Lee (2008) stated in his study, having a more complete perception of green product consumers allows sellers to take varying actions that encourage the consumer to buy. Thus, for this research, property value, incentives, heathier living conditions and lower utility bills are considered important items under non-normative motivation, as social norms or rules do not influence them.

In Tan's (2014) study on the motivation of homeowners to buy GH, four motivations were identified namely a) financial benefit, b)healthy and sustainable environment, c) energy efficiency, and d) livability significantly influenced consumers' decisions to purchase GHs. Tan (2014) defined these motivations based on objective measures, meaning something that is quantifiable, like presence of financial incentives, absence of negative environmental impact, or quantities of attributes like reduced energy bills, distance to workplace. Additionally, all of these motivations were broadly classed as non-normative motivations. For the current study, the researcher measures GenZ consumer behavior towards green homes based on both subjective (perception, attitude, feeling) and objective measures (measurable benefit). To expand further, the feeling of perceived responsibility towards the environment, feeling of acceptance from family and society and avoidance of guilt are examples of subjective measures in the current study. Some of the examples of objective measures in the current study are low utility bills, increase in house value, and healthier indoor environmental quality. To crystallize it further the non-normative motivations in the current study aligns with the combined motivations from the Tan's study.

The study done by Gilal et al. (2019) found that consumers' green behavior was influenced by four types of motivation: *intrinsic, identified, introjected and external motivation*. In Gilal et al. (2019) study, motivations related to an individual's passion, loyalty or inherent interest were considered intrinsic motivations, for example: loyalty to a brand. The identified motivation was related to the regulation or knowledge of the importance of the action, for example: intend to buy a product after learning the benefits of obtaining it. The motivation to buy GHFs to avoid shame or guilt was defined as introjected motivation. The external motivations were more about the need to get a reward or avoid punishment. The findings of Gilal et al. (2019) suggest that external and intrinsic motivations had the most influence on green consumer behavior, followed by introjected and identified motivation. It is to be noted that the definition of types of motivations in Gilal et.al. is different from the current study, meaning the intrinsic in the Gilal's study is different from the intrinsic in the current study. At the same time this study focuses on many of the same phenomena that the current study is studying just with using different labels and categories. To be more precise, the intrinsic in the current study is more about the individual's perception of whether they believe buying GHs/GHFs is the right thing to do to reduce the negative impact on environment, which is different from the Gilal's intrinsic motivation. The instrumental motivation in the current study is the partial combination of introjected (avoidance of guilt, being accepted) and external motivation (incentives from the government). The non-normative motivation in the current study is the partial combination of identified (purchasing products based on the perceived benefits – health, house value) and external motivation (reduced utility bills). Since the motivations are close enough, the researcher compares the overall results from Gilal et al.(2019) with current research findings to determine whether differences in culture and attitude due to geographical local have any effect on the nature of the results.

The items considered as part of non-normative motivation to own a GH are increased house value, lower utility bills, and enhanced livability. The literature review of the variables is shown in Table 1.

Table 1 Literature review of variables

Category Type	Variable	(Tan, 2014)	(Peattie, 2010)	(L. Zhang et al., 2018)	(Tan et al., 2016)	(Gilal et al., 2020)	(Dodge Data & Analytics, 2020)
Demographic	Age	x	x	x	x	x	x
	Gender	x	x	x	x	x	x
	Education level	x	x	x	x	x	x
	Location	x		x			
	Growing environment		x		x		
Green Home Features	Energy efficient features	x					x
	Water efficient features	x					x
	Indoor environmental quality	x					x
	Materials	x					x
	Renewable energy	x					x
Awareness	Labels ‘green’ and ‘sustainable’ homes	x	x	x		x	x
	Green Home Features (GHFs)		x	x		x	x
	Green building certification program		x	x			x
Motivation	Intrinsic motivation	x	x	x	x	x	x
	Instrumental motivation		x	x	x	x	x
	Non-normative motivation	x	x	x	x	x	x
Barriers	Knowledge		x		x		x
	Patience		x		x		
	Choice		x		x		x
Response	Willingness to pay for green premiums		x	x	x		x

2.5.3 Green Home Features

Green Home Features are elements or systems in a home building. For a building feature to be a GHF, it should do one or more of the following: be energy-efficient; conserve resources; produce renewable energy; enhance IEQ; and/or have lower environmental impact (Alias, Sin, & Aziz, 2010; Li & Froese, 2017). The top GHFs for the present study (see Table 2) were identified using survey reports from the U.S. home industry, including the National Association of Home Builders (NAHB), RECS, and the National Association of Realtors® (NAR) (Dodge Data & Analytics, 2020; *REALTORS® & Sustainability Report*, 2019; "Residential Energy Consumption Survey (RECS)," 2020). The following surveys were used:

- The Residential Energy Consumption Survey (RECS), administered quadrennially by the EIA. The objective of the RECS is to understand household characteristics, consumption and expenditure patterns. A nationwide survey was conducted through interviews and web and mail forms ("Residential Energy Consumption Survey (RECS)," n.d.). These findings are used to identify energy-related GHFs.
- The survey conducted by NAR about the AEC industry's sustainability issues. Participants were members of the NAR, and their views are summarized in the Realtors® & Sustainability Report, conducted in March 2018 (NAR, 2020). These survey results were used to study several different GHFs.
- U.S. home builders have formed an association called the National Association of Home Builders (NAHB). Since 2006, NAHB, along with Dodge Data & Analytics, has surveyed home builders' views about green homes, including drivers and obstacles influencing decision making, benefits, most widely used features, level of green activity, and also about the costs and benefits of building green (Dodge Data & Analytics, 2020).

These survey results were used to identify the most popular GHFs. In the Green Single family and multifamily home survey (2020), home builders who were members of the NAHB were asked which type of green products they preferred. Energy-efficient systems were ranked first, followed by water-conserving systems and renewable energy systems. Interestingly, material and resource conserving products were given least priority (Dodge Data & Analytics, 2020). In the same survey (2020), when home builders were questioned about the type of green practices they used, most of

them selected energy efficient systems followed by IEQ. This may be because the benefits from energy-efficient systems can be quantified through utility bills, though the same cannot be said of the IEQ. In some cases, the absence of IEQ can be apparent, as it may make the occupants uncomfortable, so even when the homeowners are not concerned about IEQ the builders still give importance to them. While water efficiency and material resource efficiency were ranked 3rd and 4th as the most common practices that the home builders implement in their projects, renewable energy was not considered a green feature in its own right, probably because it was included green site or under energy efficiency. This may be due to the initial high cost for installation (Dodge Data & Analytics, 2020). In sum, the NAHB survey (2020) concluded the following about the most widely used GHFs:

- Among energy efficient products, LED lights and energy efficient appliances were at the top, followed by HVAC systems like heat pumps. Water and energy conservation products like tankless water heaters also were popular.
- Among water-conserving products, conservative plumbing systems were much more widely used than drought-tolerant landscaping (xeriscaping), drip irrigation, rain water and grey water systems.
- Material-conserving resources, recycled materials, and reclaimed materials were popular, while renewable materials were less widely used.
- In relation to IEQ, builders use low Volatile Organic Compound (VOC) material in 54% of their projects.
- Solar energy was the most popular type of renewable system, but it was only used in 8% of projects.

The NABH (2020) survey was more or less consistent with the NAR Report (NAR, 2020) in terms of preferred GHFs. In the NAR (2020) report, energy and water conservation (low utility bills), efficient lighting, water efficient irrigation and renewable energy systems were some of the features that the home owners preferred to have in their homes.

The findings from the 2015 RECS survey (2020), which deals with energy consumption in households, showed that apart from popular energy-efficient features like LED lights and energy efficient appliances, features like heat pumps and tankless water heating systems also significantly contributed to conserving energy in residences, though not many households use them. The low

use of heat pump systems for space heating and tankless water heating systems might be due to a lack of awareness of these products. The current study will investigate this lack of awareness.

Based on the findings from the reports discussed above, the present study will consider the following as green home features.

- Energy-Efficient Products/Systems
    - Energy Efficient Lighting (such as LED lighting)
    - Energy Efficient Appliances (such as Energy Star rated dish washer, laundry-unit, fridge having)
    - Heat Pump
    - Energy Star Rated Doors and Windows
    - Tankless Water Heater
- Products/Systems Impacting IEQ
    - Smart Thermostat
    - Low VOC materials
- Water Conserving Products/Systems
    - Dual Flush Toilets
    - Low-Flow Faucets and Showerheads
    - Rain Water Harvesting
    - Grey Water System
    - Water Efficient Landscaping
- Renewable Energy Systems
    - Solar Panels
- Materials and Resource Conserving Products/Systems
    - Eco friendly building materials
    - Recycled or Reclaimed Wood

The classification of the GHFs was based mainly on the LEED categories: Energy; Water Efficiency; Materials and Resources; and IEQ (Reeder, 2019). In the current research, energy was further classified into, first, efficient energy-related features that can reduce energy consumption and, second, features based on the generation of energy. The literature review of the GHFs appears in Table 2.

Table 2 Literature review of Green Home Featuers (GHF)

GHF Category	Type of GHF	(NAR, 2020)	(Dodge Data & Analytics, 2020)	(U.S. EIA, 2021b)
Water Efficient Features	Rain water harvesting		x	
	Grey water recycling		x	
	Xeriscaping	x	x	
	Water efficient irrigation	x	x	
	Dual-flush toilets		x	
	Low-flow faucets and shower-head		x	
	Tankless water heater system		x	x
Energy Efficient Features	Energy efficient lights	x	x	x
	Energy efficient doors and windows	x	x	x
	Energy efficient appliances	x	x	x
	Heat pumps (a type of heating and cooling system)		x	x
Indoor Environmental Quality	Non-toxic paint and carpet materials	x	x	
	Smart Thermostat	x	x	x
Materials	Eco friendly building materials (rammed earth, bamboo, mass timber)		x	
	Recycled or Reclaimed home products		x	
Renewable Energy	Solar Panels	x	x	x

2.5.3.1 Water Conserving Products/Systems

According to the water shortage projection model showing population growth and climate change, the U.S. may not meet water demand in five decades (Brown, Mahat, & Ramirez, 2019). With impending water shortage, some U.S. states like California, Georgia, and New York already have made new standards on water efficiency mandatory, such as using fixtures like low-flow faucets. Some other measures to conserve water and effectively use water in residences are rainwater harvesting, greywater recycling, and water-efficient landscaping.

- *Low-Flow Faucets & Shower Heads.* The WaterSense program created by EPA is in charge of testing and labeling plumbing fixtures. The plumbing fixtures approved by WaterSense are more efficient compared to traditional plumbing fixtures. Many states in the U.S. have made stringent rules on the maximum allowed flow rates for plumbing fixtures, but these standards are yet to become mandatory nationwide in U.S ("Water-Efficient Plumbing Fixtures," n.d.). Some effective water-conserving or water-efficient features include low-flow faucets (from 2.2 GPM to 1.5 GPM) and showerheads (flow rate from 2.5 GPM to 2.0 GPM) ("How to Design a Water Efficient Home," 2020).
- *Dual Flush Toilets.* Another conservative water fixture is dual flush toilets, which include two separate flush options for liquid waste and solid waste flushing. This type of dual flush toilet effectively consumes less water per flush on an average amounting to 1.28 gallons per flush, compared to conventional toilets, which often use 1.6 gallons per flush ("How to Design a Water Efficient Home," 2020; Scerbo, 2019).
- *Rain Water Harvesting.* Rainwater harvesting is an alternative method to offset freshwater usage, according to the Federal Energy Management Program (FEMP) (2020). In this system, rainwater is collected through roof surfaces and gutters and then diverted to a storage system, where it is filtered, stored, and treated (Department of Energy, 2020). This stored water is then pumped back into the water system to use as an alternative for freshwater needs.
- *Grey Water System.* The wastewater from washing machines, showers, and bathroom sinks are known as greywater. In the greywater system, the greywater is collected, treated, and redirected to irrigation purposes or flushing toilets (Al-Jayyousi, 2003; Department of Energy, 2021). In residences, the majority of water (50%-80%) falls

under greywater, and thus the greywater system reduces the requirement for fresh water by a significant amount (Al-Jayyousi, 2003). Though not all states in the U.S allow this system, it is still seen as an efficient water conserving feature (Allen, 2015).

2.5.3.2 Energy-Efficient Products/Systems

GHFs can play a significant role in reducing fuel consumption and the resulting carbon emission, whether directly or indirectly. The growing demand for energy coupled with the limited supply leading to higher energy prices has resulted in increasing exploitation of resources and a greater effect on global climate change (U.S. Environment Protection Agency, 2006). In response, the U.S. government has come up with the National Action Plan for Energy Efficiency, whose goal is to commit to energy-efficiency through utility regulators, partner organizations, and programs like ENERGY STAR® (U.S. Environment Protection Agency, 2006). According to the RECS, Realtors® & Sustainability Report, ENERGY STAR®, and NABH report, some of the popular GHFs that contribute to reduced utility bills are:

- *Tankless Water Heaters.* Tankless water heaters are instantaneous water heaters that provide hot water only when needed. Doing this saves energy, as there is no energy loss associated with storing hot water (Department of Energy, 2021). The higher life expectancy of tankless water heaters (20 years) is another advantage when compared to the conventional storage water heater (10-15 years). In this way, a tankless water heater qualifies as a GHF (Department of Energy, 2021).
- *Energy Efficient Lighting.* Lighting consumes around 10% of total residential electricity, according to the RECS. Energy-efficient lightbulbs, such as Energy Star-rated lighting, in comparision with traditional incandescent light bulbs LED lighting, and compact fluorescent lamps (CFLs), uses energy less than 25% - 80% (Department of Energy, n.d.). Homeowners also considered this feature in NAHB and NAR surveys to be an important feature.
- *Energy Efficient Appliances.* According to the NAR (2020) survey on sustainable homes, energy-efficient appliances and lighting are also notably popular among home buyers. A popular metric used to measure appliances' energy efficiency is the ENERGY STAR rating, which provides certification of a product's efficiency. The

U.S. government also made amendments to the Energy Policy and Conservation Act of 1975 (EPCA), requiring building appliances to have minimum efficiency standards (Hampton, Okpala, Perez-Reyes, Roycroft, & Sowards, 2017). To facilitate enforcement of this law, the Environment Protection Agency (EPA) coordinated with the ENERGY STAR program to develop test procedures and verification of the appliances (Hampton et al., 2017). Some popular products recognized as the most efficient by ENERGY STAR in 2020 are washing machines, refrigerators and freezers, dishwashers, and dryers (ENERGY STAR, 2020b).

- *ENERGY STAR rated Windows and Doors.* ENERGY STAR certified windows and doors are considered to be one of the most efficient energy-saving measures and can lower household energy bills by 12% nationwide (ENERGY STAR, 2020a). According to the NAR report (NAR, 2020), having durable doors and windows with good insulation was considered by clients to be one of the important features.
- *Heat Pumps.* In the U.S., the average end-user energy consumption for space heating and air conditioning is around 50% of total household consumption. So, having an energy-efficient HVAC system can significantly reduce the energy use and utility bills and at the same time improve the comfort of the occupants (Martin, 2020). Some examples of energy-efficient HVAC systems are the standard split heat pump, the mini-split heat system, and the geothermal heat pump (Martin, 2020). Though heat pumps are energy efficient, they are not widely used, according to RECS 2015 survey data (U.S. EIA, 2021b). The current study investigates whether GenZ consumers are familiar with heat pumps to better understand the low use of heat pumps within this population.

2.5.3.3 Products/Systems Impacting IEQ

Indoor Environmental Quality (IEQ) refers to the indoor building condition, including temperature, humidity, ventilation, views, air quality, and acoustic conditions (NIOSH, 2013). These factors of IEQ influence the occupant's health and wellbeing, so it is important to have a better quality of IEQ (NIOSH, 2013).

- *Smart Thermostats.* The Smart Thermostat is a smart home appliance that has a built-in SmartSensor that can automatically sense and adjust the room temperature to be more comfortable for the occupants, based on occupancy level. Some even have inbuilt motion sensors that determine the occupancy and automatically adjust, turn off, or turn on the temperature without any manual adjustments (Zeifman, Roth, & Urban, 2017). These smart thermostats help control and maintain the indoor temperature at a comfortable level for occupants and also avoids the excessive heating and cooling that cause energy losses (Zeifman et al., 2017). Thus, SmartThermostats improves IEQ for the occupant and also reduces heating and cooling loads, ultimately reducing utility bills and environmental impact. AJ Smith, vice president Global Pro Comfort Homes, has noted that

  > "Almost no homebuilders were doing much with that, and now you're seeing almost every new home builder having options for smart Wi-Fi thermostats, if not making it the standard (Taylor, 2018)."

- *Low VOC materials.* Materials that have a low content of volatile organic compounds (VOC) are called low VOC materials. VOCs are emitted in gaseous form from certain solids such as paints, solvents, wood preservatives, dry-cleaning clothing, etc. (US EPA, n.d.). If the accumulated VOCs from these home products are high in an indoor environment, it may cause health effects, including eye irritation, throat irritation, nausea, and allergic skin reactions (U.S. EPA, n.d.). So, for better IEQ, it is recommended to used products with low VOC content.

2.5.3.4 Materials

One of the latest revolutionary trends in the home market is that more consumers are inclined to shift towards healthier and more sustainable buildings. The green certified projects (LEED, ENERGY STAR, etc.) in the U.S. have seen growth from 16% to 32% from 2016 to 2018, and they are expected to grow further, according to World Green Building Trends 2018 (Jones & Laquidara-Carr, 2018). In most green certification programs, credits are given for materials having low environmental impact. Thus, eco-building materials and reused or reclaimed furniture have a lower life cycle carbon footprint (Lee, Trcka, & Hensen, 2011) Using green or recycled materials is one of the ways to earn credits for green certification easily.

- *Eco building materials.* Rammed Earth, Bamboo, Straw Bale, Tesla Solar Tiles, Mass Timber are some of the examples of the eco-building materials.
- *Reclaimed or reused furniture*: Using second-hand furniture and new furniture made from existing or old furniture. This reduces the need to manufacture new materials and reduces waste to landfill from building demolition activities.

2.5.3.5 Renewable Energy Systems

- *Solar Panels:* Solar panels harness energy from the sun. This harnessed power is considered clean and renewable energy. Some of the most significant benefits of harnessing solar energy are reduced electricity bills, low maintenance costs, and sustainability in nature (Vourvoulias, 2020). However, this feature is not suitable for all houses because installation costs are high and the amount of energy harnessed depends on the house's orientation and location (Abanda, Manjia, Enongene, Tah, & Pettang, 2016). The 2015 RECS survey revealed that though the use of solar energy in residences remains low, there was a slight increase compared to the 2012 RECS data (U.S. EIA, 2021b).

Since most of these results were from homeowners who already own a home or from builders, this study examines if there is a gap in understanding whether Gen Z consumers feel the same importance about GHFs in their future homes.

2.6 Summary

Overall, this chapter discussed the existing literature on the topic, including that of factors influencing the GenZ consumer's purchasing intention of Green Homes, and identified popular and efficient Green Home Features. The next chapter will discuss the methodology and research framework of the study.

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Introduction

This chapter details the methodology used in this study and addresses the research questions. It includes an overview of the research, research typology, data collection methods, variables for analysis, research instruments, population and sample, data analysis methods and pilot data analysis.

3.2 Study Objective

This study's objective is to examine the GH purchasing intentions of GenZ consumers as potential homeowners. To achieve the objective, the researcher determines GenZ consumers' choices of GHFs and their desire to own these GHFs. The researcher also investigated the factors (positive and negative) influencing GenZ consumers' decisions to buy a GH or GHFs in connection with motivations and situational barriers. This current study is divided into two parts: 1) The first part investigates the GenZ consumer's familiarity with GHFs and seeks to understand which GHFs are preferred and why; and 2) The second part investigates perceived barriers to adopting GHFs. Finally, to investigate how the types of motivations effect the GenZ consumers' willingness to buy GHs. Understanding these factors helps marketers translate the need for GHFs into demand (Peattie, 2010). This study also provides a better understanding of the GenZ consumer's attitude toward Green Homes and their features as a way of more fully accounting for current trends in green homebuilding.

3.3 Research Type and Design

The researcher adopted a quantitative design approach to identify the GenZ consumer's choice of GHFs and investigate the influence of variables on GH purchasing decisions. Another reason the researcher chose the quantitative approach was to evaluate the statistical significance of the relationship between the study variables and draw conclusions by examining the study sample's responses.

Quantitative research can be divided into two types, namely, inferential and descriptive. The former tests the alternate hypotheses against a threshold, while the latter simply describes the

sample distribution or demography (Lowhorn, 2007). Descriptive quantitative research provides the general overview of a sample by identifying frequency, central tendency and data distribution (Sekaran, 2016). For this research, the researcher uses both inferential and descriptive statistical analysis through a quantitative research approach. Prior studies on research approaches found that, unlike the qualitative approach (collecting and analyzing non-numeric data through interviews, observation of human behavior, and so on), the quantitative approach reduces subjective bias from the researcher's interpretation and helps increase objectivity (Hara, 1995). But the quantitative approach assumes that respondents will understand the questions as they were intended by the researcher (Slevitch, 2011). Because of this, and to maintain the objectivity of the study, the researcher used the quantitative approach. The researcher took measures to eliminate or minimize threats to the validity and reliability of the survey questionnaire by conducting face validity and pilot analysis to get feedback on the clarity of the questions and the logical flow and format of the survey.

3.4 Adopted Model and Theoretical Framework

The model deployed for this research is adapted from the works of Tan (2014) and Gilal et al. (2020). The model was modified to test GenZ consumers' GH purchasing behavior based on DIT and NMT, two theoretical frameworks that help explain motivations involved in forming preferences about environmentalism and sustainability (Henrich & McElreath, 2012; O'Brien & Bentley, 2017; Rindos et al., 1985).

In the study conducted by Tan (2014), the consumer behavior of owning a green home was measured based on home owners' motivations to own green homes in terms of incentives, energy efficiency, livability and sustainable and healthy environment. Tan also found that consumer satisfaction with GHFs changes based on the consumer's choice of GHFs. Though the study conducted by Tan (2014) gives great insight into green consumer behavior in owning a GH, it does not address – 1) how green consumer behavior changes over time based on an individual's attitude and values (generations), 2) cultural influences on consumer behavior through friends and family (feeling of reward or avoidance of disapproval) and, 3) perceived influence of barriers on consumer purchasing intention.

The study conducted by Gilal et al. (2020) uses self-determination theory to address cultural influence in addition to motivation (derived from personal and social norms/ standards) on green

consumer behavior. Self-determination theory explains motivation and behavior based on an individual's differences in motivational orientation, contextual or social influence, and interpersonal perception (Hagger & Chatzisarantis, 2008). The limitations of the Gilal et al. study are, 1) since the consumer behavior study is done in a Pakistani context, the results may not be valid in a U.S. context, 2) the study represents only millennials and not GenZ (Moller, Buscemi, McFadden, Hedeker, & Spring, 2014). A modified theoretical model for this research is shown in Figure 2.

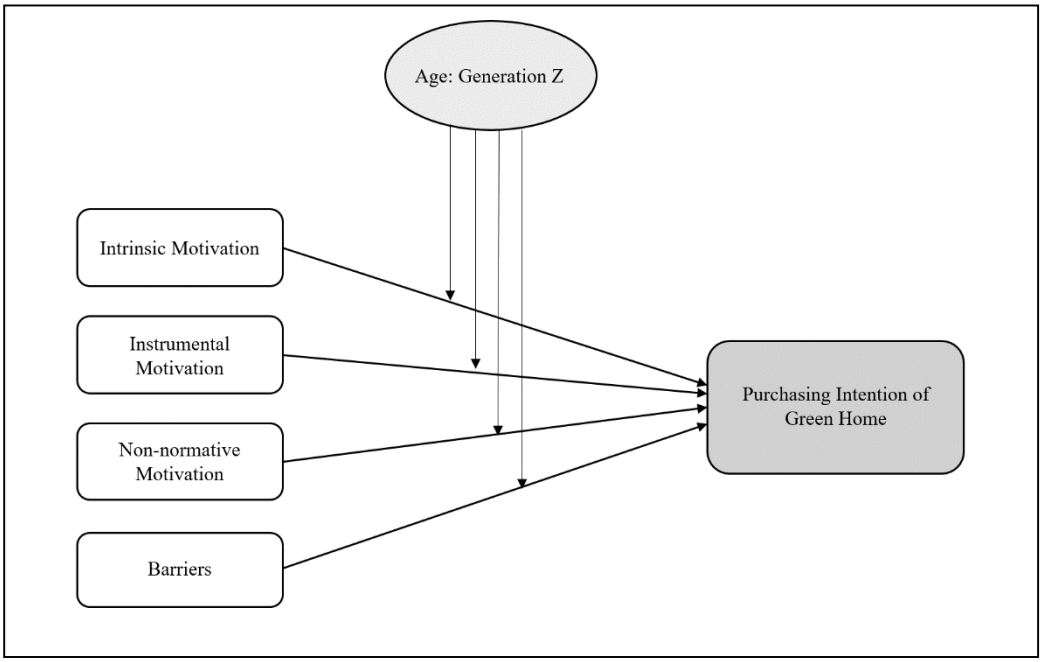

Figure 2 Theoretical model modified from Gilal et al. (2020)

The current research addresses green consumer behavior by 1) investigating the consumer's satisfaction with GHFs and 2) investigating the consumer's motivation (normative and non-normative motivation) to purchase GH and/or GHFs. The underlying theory used to conduct this research is the dual-inheritance theory. The research limited the study population to U.S. students of a certain age to address age and culture's influence on consumer behavior, thus reducing biases related to age and culture on consumer behavior.

This study's primary goal was to use DIT theory to assess the GenZ consumer's preferences and purchasing behaviors related to GH and/or GHF. A survey questionnaire tool was used to address the research questions. The survey design is similar to Tan (2014) and Gilal et al. (2020).

The questions were modified to make them relevant to GenZ consumer behavior and to address the influence of motivations, choices, benefits, and purchasing behavior barriers based on dual inheritance theory. The proposed conceptual framework is shown in Figure 3.

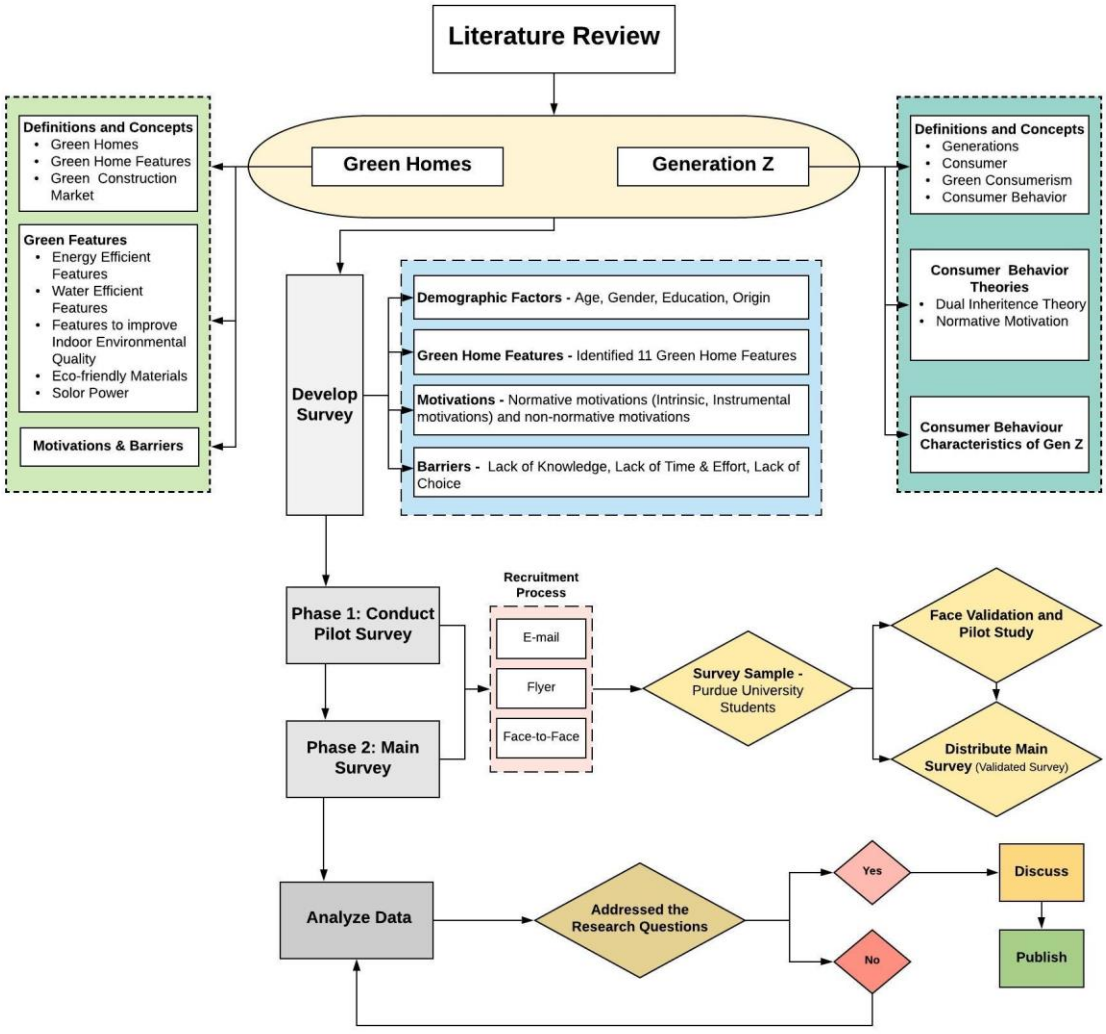

Figure 3 Proposed Conceptual Framework

The steps delineated in the proposed framework included the following steps:

- Literature review –selected variables and GHFs
- Developed a survey
- Conducted face validation with 3 students. Asked them whether the survey's language was unclear or whether there were any questions they didn't understand.

- Programmatically developed the survey based on respondents' feedback. Adjusted wording and revised the flow of the online survey.
- Phase 1 (Pilot study): Collected sample data from more than 30 responders from the study population. This data was later used for power analysis and to run statistical tests.
- Phase 2 (Conducted main survey): Distributed the survey through flyers, e-mail, face-to-face recruitment, and snowball sampling.
- The data was collected and analyzed.

3.5 Research Questions

The research questions that guided this study, as pointed in Chapter 1, are:

1) What types of Green Home Features (GHF) would Generation Z (GenZ) consumers like to have in their homes?
    - What are the most desired GHFs among the identified GHFs in the study, as perceived by the GenZ consumers?
    - Do GenZ consumers prefer certain types of GHFs (e.g.: energy efficient, water efficient, sustainable material, IEQ, Renewable) over others?
2) What barriers and motivational factors influence GenZ consumers' decisions to own or buy Green Home (GH) and/or GHF?
    - Which type of motivations wields the most influence over GenZ consumers' willingness to purchase GH and/or GHFs?
    - Which barriers have the greatest influence on GenZ consumers' willingness to purchase GH and/or GHFs?

3.6 Variables and Constructs

The proposed model, Figure 3, illustrated factors like normative and non-normative motivations and barriers that contribute towards the decision-making process for green consumer purchasing of GH and GHFs. These proposed factors are categorical, meaning that they take limited possible values and are divided or grouped based on their characteristics (Frost, n.d.). The categories have no intrinsic order.

For the current research, the researcher was mainly interested in analyzing Gen Z's perception, with Gen Z defined as individuals between the ages of 18 and 24 years old, as of 2021. Additionally, the researcher compared data from non-GenZ responses to gain a broader perspective of college students' perceptions of green homes (only GenZ responses are included in analysis related to the primary research questions). An overview of variables used to answer the research questions is shown in Table 3.

Table 3 Variables

Variables	Explanatory Variables and their levels	Response Variables
Green Home Features	Energy efficient features	
	Water efficient features	
	Indoor environmental quality	
	Materials	
	Renewable energy	
Motivation type	Normative motivation - Intrinsic & Instrumental motivation	
	Non-normative motivation	
Barriers	Knowledge	
	Patience	
	Choice	
Green consumer purchasing behavior		Willingness to buy Green Home (GH)

3.7 Instrumentation

An online survey questionnaire was developed by the researcher based on the literature review. The researcher chose an online survey because internet-based surveys are considered to be effective, cost effective, and convenient compared to paper-based surveys (Fricker & Schonlau, 2002).

All of the GHFs mentioned in the questionnaire were extracted from literature, such as the NABH (2020) and NAR (*REALTORS® & Sustainability Report*, 2019) reports and studies including Tan (2014) and Hlad (2009). To identify motivations for green home consumer behavior, the researcher extracted information from previous studies on green consumerism and green home consumerism including Tan (2014), Moser (2015), and Gilal et al. (2020). These were modified based on the DIT and NMT.

This questionnaire collected GenZ students' choices related to GHFs on a 5-point Likert Scale, with "1 = Not at all interested" and "5 = Extremely interested." The willingness to buy GHs as well as barriers and motivational factors affecting willingness to buy GHs and GHFs, also were measured on a 5-point Likert scale with "1 = Strongly disagree" and "5 = strongly agree." Demographic data also was collected. The researcher used the results from the survey to analyze how various factors influence the purchasing intentions of college students (respondents).

The researcher obtained IRB exemptions prior to collecting data. The IRB number for this study was IRB-2020-1414 (see appendix A).

3.7.1 Modification in instrumentation – Prior to Phase 1

Prior to the Phase 1 data collection for pilot analysis, the survey was face validated by three students at Purdue University – Main campus. The researcher approached these three students in one of the university's Construction Management labs, then explained the study and asked them to give feedback on the survey based on

- Clarity of the language
- Easy navigation – layout and style of the survey
- Whether the questions were relatable to the topic of GHs.

Based on the students' feedback and from the committee members who work as professors at Purdue University, the researcher made some minor modifications to the survey:

- Added a brief definition for the term ‘Xeriscaping,’ as Participant 1 said, “Define ‘Xeriscaping.’ Because people might not know the term, but like the feature or have heard of it.” Participant 2 gave similar feedback.
- Changed the wording of some of the questions to make them more precise since all three respondents felt that these questions were vague and could be easily misinterpreted.
- Changed the question format and labelled the scale within the question as well as above the items to make the document clearer to the respondents. Participants 2 and 3 felt that some of the labels were overlapping, which confused them a little.
- Based on advice from committee members, the smart thermostat and low-flow faucets and showerhead were removed since, in recent years, they have become standard installation features in new homes.

Beyond these improvements, all the respondents agreed that the logical flow in the survey was good and that the questions clearly related to the researcher’s topic of study.

3.7.2 Modification in instrumentation – Post Phase 1

After survey modifications were made in response to the face validation stage, the modified survey was released to collect data for Phase 1: pilot analysis. A total of 44 responses were collected. Pilot data was analyzed based on:

- Rate of completion – considered response rate of the survey as well as the percentage that finished the survey and the percentage that dropped from the survey. The researcher also analyzed possible reasons for participants dropping out of the survey.
- Statistical tests were conducted to confirm that the data could satisfy the proposed testing methods’ assumptions.

Based on pilot analysis feedback, the survey was adjusted before conducting Phase 2 - main survey study. The adjustments made to increase the response rate and procure the required data were as follows (detailed explanation can be found in section 4.2 pilot analysis):

- Changed 7-point Likert scale to 5-point Likert scale
- The year of birth question was modified from a drop-down format to a multiple-choice format with age group options.

- GHFs, including Xeriscaping and energy-efficient doors and windows were removed.
- The question asking respondents to 'Select the GHFs you had in your previous home(s)' was removed
- The demographic question related to level of education was moved to the end of the survey
- The levels of the 5-point Likert scale were explained

The final version of the questionnaire can be found in Appendix A. For the final instrumentation, a Likert scale (1 to 5) was used to gauge the variation in the measure of these variables towards the response variable. This was done to reduce the survey's cognition complexity of the survey. The research questionnaire in Phase 2 was divided into three main blocks:

(1) Demographic Data: This data was collected to identify whether the respondents represented the target population and determine any major variance in response due to a respondent's characteristics. The researcher split demographic data (Block 1) into two parts and moved part b with the secondary demographic data to the end of the survey as the questions were prioritized based on their importance in the study:
    (i) Block 1 (a)
        1. Age
    (ii) Block 1 (b) (moved to the end of the survey)
        1. Gender
        2. Education Level
        3. Country/Continent with which the participant identified
        4. Type of environment in which the participant was raised

(2) Green Home and Green home features: This block was created to measure respondents' awareness of and familiarity with GH and Green Home Features (GHFs). The questions posed were:
    (i) What do you think of the terms green and sustainable homes?
    (ii) Which of these GHFs would you be interested in purchasing? Likert scale of 1 to 5 (not at all interested to extremely interested)
    (iii) Do you wish to have 3rd party green certification?

(3) Consumer Behavior: This section focused on determining the general perception of GH and the purchasing intentions of respondents. The questions posed related to attitudes, motivations, and barriers with regards to willingness to buy GH. These questions were:

(i) Rate the statements on a Likert scale of 1 to 5 (strongly disagree to strongly agree) – motivations

(ii) Rate the barriers on a Likert scale of 1 to 5 (strongly disagree to strongly agree)

(iii) Willingness to buy GH on a Likert scale of 1 to 5 (strongly disagree to strongly agree)

(iv) Willingness pay for green premium (1 to 100 % above the base price of a home)

3.8 Research Setting

The research was conducted electronically at Purdue University-Main Campus, situated within West Lafayette, Indiana. This large, land-grant midwestern university offers more than 200 majors affiliated with 12 colleges or schools. Existing departments at Purdue include agriculture, engineering and technology, sports, law, management, science and research, liberal arts, and so on, and on the medical science side, the major departments are healthcare pharmacy and veterinary medicine ("Majors at Purdue," n.d.). Approximately 46,114 students are enrolled at Purdue's West Lafayette campus for fall 2020, and this includes 35,122 undergraduates and 10,057 graduate students(Oates, 2020). Due to COVID, many classes were held online through Fall 2020 and Spring 2021, which limited access to face-to-face recruitment by the researcher.

3.9 Data Collection Methods

The data was collected through an online platform called Qualtrics. The recruitment was based on voluntary responses and this recruitment process was slightly different for each phase. In Phase 1, the methods used to recruit respondents included distributing flyers, recruiting face-to-face, and snow ball sampling. For Phase 2, recruitment methods included distributing flyers, recruiting face-to-face, and sending e-mails (used the Institutional Data Analytics + Assessment, or IDA+A, service offered by Purdue Office of Provost to send a university wide survey request to students enrolled at Purdue's Main Campus and also to Purdue student organizations). The

researcher also sent survey requests through Purdue student social media groups (WhatsApp and Group me) from the researcher's contact list. This was done to reach respondents more effectively.

The sampling method for selecting students enrolled at Purdue University was Stratified Random Sampling. The IDA+A service had already categorized students based on their level of education (undergraduate year and graduate level) and selected a total of 3,000 students.

For face-to-face recruitment, the researcher approached respondents (students) directly on the Purdue campus and asked them to participate in the survey. Flyers (Figure 3) and copies of the QR code were distributed and shown to respondents, which enabled them to access the survey through their personal phones/iPads/computers by scanning the QR code or entering the survey link. If the researcher did not receive enough responses, the researcher would email faculty and request them to forward the survey to their students.

Figure 4 Survey Flyer

This study's data collection was conducted in two phases. In the pilot study, or Phase 1, a sample of less than 45 responses was collected, as a sample size of 30 is considered reasonable for a pilot study, according to Duval (1993). For both phases (pilot and main survey), responses were

collected through the voluntary response and snowball sampling methods. The ideal sample size for Phase 2, or the main survey, was determined through a power analysis of Phase 1's pilot data.

Due to COVID, there was a delay in collecting the data. Phase 1 data collection started in Jan 2021 and was closed in Feb 2021. The data collection for Phase 2 started in the middle of March 2021 and was closed in the middle of April 2021.

3.10 Population and Sampling Procedure

The population considered for this research study was students enrolled in universities located in the U.S. The sample for this study consisted of students enrolled at Purdue's West Lafayette campus during fall 20' and spring 21.' According to Moore (2017), a sample is a subset of a population that the researcher studies in order to gather information. Since the research wanted to learn about GenZ consumer behavior, the target age group was 18 to 23 years. According to the Pew Research Center, Generation Z consists of people born in or after 1997, meaning that older GenZ individuals are between 18 and 24 years (Dimock, 2019). This age range includes mostly undergraduate students. It also includes graduate students and students in other certification courses who are enrolled in any department or major at Purdue University. For the present study, the sample was limited to students 18 years or older to compare attitudes between GenZ (18 to 23 years) and non-GenZ students (24 or older).

As discussed previously in section 3.9, the main study's sample size was determined by conducting a power analysis for the Phase 1 pilot study data. Power analysis can be used to determine the minimum size a sample can be to gain meaningful data toward the study's hypothesis (Zhang & Yuan, 2018). Based on the findings, a G*Power package was used to run the power calculation. To test hypothesis 1, a repeated measure of ANOVA was used. To get a power of 80% at a 0.05 significance level with an effect size of 0.50, the sample size for the main survey was determined to be 15 responses. According to Cohen's classification of effect size, 0.5 was considered to be medium, meaning it has a noticeable magnitude of difference. For the hypothesis 2, a Freidman test was used. This revealed that to get a power of 80% at a 0.05 significance using the partial eta value 0.31 from the pilot data, the required response was 17. For Phase 2, the main survey, the researcher received 116 GenZ responses, out of which 45 responses were valid to test hypothesis 1 and 115 responses were valid to test hypothesis 2, thus meeting the required minimum sample size.

3.11 Data Analysis Procedure

Descriptive and inferential statistical procedures were conducted for the analysis of the data using a software tool called Statistical Package for the Social Sciences (SPSS).

The researcher used descriptive statistics to get an overview of the following sample distribution based on:

- Gender – (female, male)
- Education level – (freshman, sophomore, junior, senior, and graduate-level)
- Environment/ culture, the participant, grew in – (geographical location; urban, suburban and rural)
- Comparison of labels ‘green’ and ‘sustainable’ homes
- Opinion on the third-party green building rating system
- Preference of GHFs
- Motivations
- Barriers
- Willingness to buy GH
- Willingness to pay for green premiums

For the inferential analysis, three different measures were used: repeated measures of ANOVA; Friedman Test; and Multi-nominal logistic regression. These different measures were used to test the hypothesis and ultimately to answer the main questions of this study, as shown in Table 4 below.

Table 4 Research Questions and Tests

Research Question	Descriptive Statistics	Inferential Statistics	Hypothesis
Choice of GHFs	GHFs - mean, SD		
Preference of GHF types	Types of GHFs (mean, SD of aggregates)	Repeated measures of ANOVA	1
Perceived hindrance of barriers	Barriers - mean, SD	Friedman Test	2
Motivation and willingness to buy GH	Motivation - mean, SD	Multi-nominal logistic regression	3
Additional Tests			
Unawareness of GHFs and willingness to buy GH	Unknown GHF - frequency	Mann-Whitney U Test	

3.11.1 Choice of Green Home Features (Hypothesis 1)

To test whether GenZ consumers prefer certain types of GHFs over others, an inferential statistic method called repeated measure of ANOVA was used.

Only data from respondents in the GenZ category who were familiar with all the features was used to perform this test (meaning the researcher filtered the responses that selected 'I don't about this feature'). This method was adopted because the researcher wanted to investigate the mean score differences among the five types or categories of GHFs (see Table 4) (Bettany-Saltikov & Whittaker, 2014; Laerd Statistics, 2018). This method is also called within-subjects ANOVA as it measures the levels (type of GHFs like energy efficiency, water efficiency, IEQ, etc.) used in the same sample. Another reason for using this test was because it satisfied the following assumptions:

- Tests of differences within one independent variable (GHF) with more than two levels (5 types of GHFs)
- Measure of data using Likert scale (parametric measure)

The repeated ANOVA test was performed to test the following hypothesis at the $\alpha=0.05$:

Hypothesis$_0$ 1 = *There is no significant difference between the type of green home features preferred by GenZ consumers.*

Hypothesis$_a$ 1 = *There is a significant difference between the type of green home features preferred by GenZ consumers.*

To test this hypothesis, the mean scores of the GHFs falling under the same type were combined and averaged. The averages of the five types of GHFs were then used as input values for repeated measures of ANOVA to determine whether the GenZ consumers prefer certain types of GHF over others. The researcher checked the following assumptions: a) normality (normal distribution) and b) sphericity (equivalent to homogeneity of variances).

For the repeated measures of ANOVA, the variables used were the types of GHFs, and their values were the mean of the scores of the GHFs under each type. For instance, for the variable material, the value was the mean of the Likert scores of eco-friendly material and recycled or reclaimed home products. The type of GHF and GHFs under that type are shown in table 5.

Table 5 Classification of GHFs

Type of GHF	GHF
Water Efficient Features	Rain water harvesting
	Grey water recycling
	Water efficient irrigation
	Dual-flush toilets and low-flow faucets/shower-heads
Energy Efficient Features	Tankless water heater system
	Energy efficient appliances
	Heat pumps (a type of heating and cooling system)
IEQ	Low VOC paint and carpet materials (VOC - Volatile Organic Compounds)
Material	Eco friendly building materials (rammed earth, bamboo, mass timber)
	Recycled or Reclaimed home products
Renewable Energy	Solar Panels

The researcher tested if knowing or not knowing at least one of the GHFs affects the individual's willingness to buy a GH. To do so, a Mann-Whitney U Test was used. The responses for GHFs were divided into '0' and '1', where the former meant a respondent was familiar with all the features, while the latter meant the respondent was not familiar with at least one of the

features. In this test, the dependent variable is the willingness to buy GH, measured at the ordinal level. Since the data were not distributed normally, the data fit this test.

3.11.2 Barriers to buying GHFs (Hypothesis 2)

The Friedman test was conducted to address the second part of the second research question. This part of the question measured which barrier presented a greater hindrance to GenZ consumers and negatively affected their willingness to buy GH or GHF. Though the analysis testing the desirable type of GHF was similar to this one, in this case, the repeated measure of ANOVA could not be used. This was because the data for the GHF type was continuous in nature, while the data relating to barriers was ordinal and non-parametric in nature. So, the Friedman test was used because it is considered to be an alternative to the repeated measures of ANOVA (one-way) for non-parametric data (Laerd Statistics, n.d.). This test also was chosen because the data met the following assumptions of a Friedman test (Laerd Statistics, n.d.):

- One group multiple measure (Same sample measured 3 different barrier types)
- The sample was a random sample from the population
- The data was measured at ordinal level (5-point Likert scale)

After the Friedman test was conducted at $\alpha=0.05$, a post hoc test called the Wilcoxon signed-rank test was conducted to understand whether the barriers were significantly different from one another, with the barriers identified as information, effort, and choice. The output was to rank the barriers based on the GenZ consumers' perceived hindrances to the willingness to buy GH. The Friedman test performed was used to test the following hypothesis at the $\alpha=0.05$:

Hypothesis$_0$ 2: *There is no significant difference between the type of barrier perceived as a hindrance to willingness to buy green homes by GenZ Consumers.*

Hypothesis$_a$ 2: *There is a significant difference between the type of barrier perceived as a hindrance to willingness to buy green homes by GenZ consumers.*

The 0.05 significance was divided by 3 because the researcher used 3 comparisons (between 3 types of barriers) using Wilcoxon tests ($\alpha=0.05/3 = 0.017$). The process of the test was depicted in the image below:

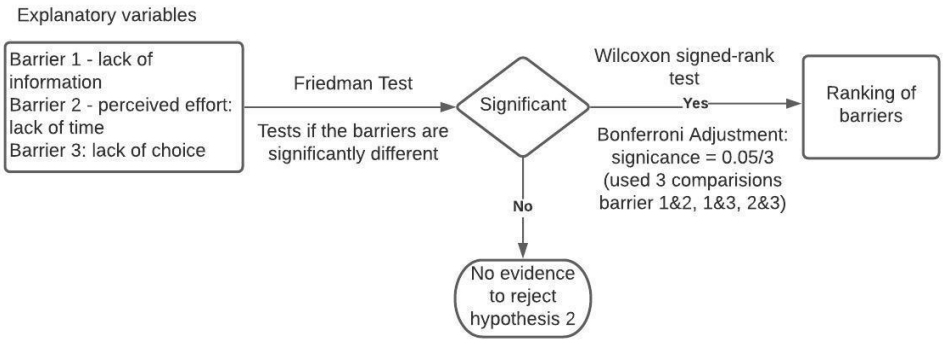

Figure 5 Testing process of hypothesis 2

3.11.3 Motivations to buy GH (Hypothesis 3)

To evaluate motivations' influence on GenZ's willingness to buy green homes or green home features (research question 2 part 1), this study used multi-nomial logistic regression analysis with willingness to buy GH as a nominal dependent variable and motivation type (intrinsic, instrumental and non-normative motivation) as independent variables. This was because the willingness to buy GH was nominal while the motivation types were continuous in nature. Some of the assumptions that the data needed to satisfy to conduct this test were:

- Dependent variable (willingness to buy GH) should be measured at nominal level
- Independent variable (intrinsic, instrumental and non-normative motivation) should be either continuous, ordinal or nominal
- All the observations should be independent of each other
- No multicollinearity, meaning the type of motivations should not be correlated to each other
- Needs linear relationship between type of motivation with the logit transformation of willingness to buy GH
- Presence of no outliers

For hypothesis 3, the difference between the type of motivation with the willingness to buy GH was tested at a α=0.05.

Hypothesis$_0$ 3: *There is no significant difference in the association of type of motivation with the Generation Z consumer's willingness to buy green homes*

Hypothesis$_a$ 3: *There is a significant difference in the association of type of motivation with the Generation Z consumer's willingness to buy green homes*

For hypothesis 3, the multi-nominal logistic regression of motivation type with the willingness to buy GH was calculated to determine which type of motivation has more significant influence on willingness to buy green homes. The values of the motivations types were the mean aggregates of the statements' means related to each specific motivation type (see Table 6). The pseudo R^2 value and the parameter estimates were used to interpret the results.

Table 5 Type of motivation and their statements

Explanatory Variable	Levels	Statements
Normative Motivation	Intrinsic Motivation	I should probably be doing more to prevent climate change.
		I feel personally responsible for keeping the environment healthy.
		One reason why I'd like to buy a green home is simply because I want to be a good person and contribute to next generations' sustainable future
		I aspire to conserve and reduce water and energy consumption in households because I believe in sustainability
	Instrumental Motivation	My friends and family would be proud of me for investing in green features for my home.
		One good thing about green home features is that you don't have to worry about disapproval from your neighbors.
		I'd like my home to have at least some green features, because I don't want people to think I don't care about the environment.
		Green home features provide valuable tax benefits and other incentives
Non-normative motivation	Non-normative motivation	Green home features are important because they increase the value of the home.
		Green homes is a good choice for me because they reduce utility bills (LEED certified homes save 30-60 % on utility bills)
		I'd buy green home because it creates a healthier living environment
		I'd buy green home because it gives better standard of living quality/experience

3.12 Phase 1 – Pilot Analysis

As mentioned previously, the researcher performed a pilot study for Phase 1 before the Phase 2 final data collection. The findings from the pilot are detailed in the following subsections.

3.12.1 Pilot Study Results

Using face to face recruitment and snowball sampling of students on the Purdue Campus, the researcher invited respondents to take the online survey. Recruitment was done from the end of January to the middle of February 2021. A total response of 44 was received. Of these 44 responses, eleven were blank or incomplete, out of which eight dropping out after the second question about the level of education and two dropping out after question three. This means that the number of usable responses came to 33. Out of the 33 responses, only 21 were valid for analysis, since 10 out of the 33 did not respond to year of birth and two others responded with 'prefer not to say,' making it difficult for the researcher to identify the generation the respondents belonged to. So for analysis the total valid response rate was less than 50% (n = 21). The researcher evaluated Cronbach's alpha for all the Likert scale items to check the reliability of the survey, and the $\alpha = .875$, which indicates high reliability and that the questions relate to each other.

The low response rate for the year of birth may have been due to the drop-down question format, so the format was changed to multiple choice in the main survey.

Even with low responses, the collected data allowed for preliminary analysis to evaluate the feasibility of the online survey for the final data collection and to determine the required power to validate the proposed hypothesis. A good balance between GenZ ($n_1 = 12$) and non-GenZ ($n_2 = 9$) was obtained (Figure 6 shows the distribution of respondents' age groups). Not all these respondents answered all the questions, which will be discussed in this section.

The demographic characteristics of the final valid respondents, combining both Gen Z and non-GenZ ($n_1+n_2 = 21$), was 38% males (n = 8), 57% females (n = 12), and the rest preferred not to reveal their gender (n = 1).

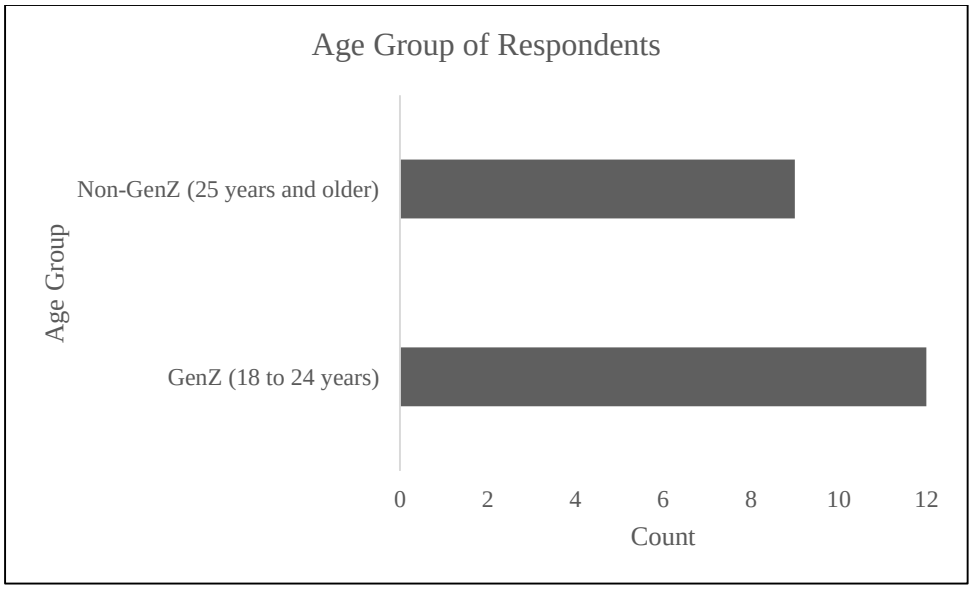

Figure 6 Distribution of Age (n = 21): Phase 1

In this sample, graduate students are in the majority at 61.9% (n = 13), with the rest consisting of undergraduates (n = 6, from freshmen to seniors) and respondents who selected other (n = 2).

To understand more about the cultural backgrounds of the respondents, the researcher investigated the growing environment. Most of the respondents came from urban or sub-urban regions and hailed from either the United States (57%, n = 12) or Asia (38%, n = 8). Table 7 summarizes the distribution of the respondents' environmental upbringings.

Table 6 Pilot - Distribution of Cultural Environment of the Respondents: Phase 1

	Age Group of Respondents		
Growing Environment	GenZ (n_1=12)	Non-GenZ (n_2=9)	Total %
Urban	3	3	29%
Sub-Urban	7	4	52%
Rural	2	2	19%

Although in the AEC industry the terms “green” and “sustainability” often are used interchangeably (Doan et al., 2017), they actually mean different things (Yanarella, Levine, & Lancaster, 2009). While “green” mean environmental improvement, "sustainability" means holistic improvement of the environment, economy and society as a whole (Yanarella et al., 2009). So, it was interesting to learn that most respondents (67%) seemed to understand that the two terms are different (see Table 8). Out of the 21 respondents, 14 (66.7%) believed that having a third-party evaluation was important or interesting to learn.

Table 7 terms “green” vs “sustainable” homes: Phase 1

	Age Group of Respondents		
"green" vs "sustainable" homes	GenZ (n_1=12)	Non-GenZ (n_2=9)	Total (in %)
They are same	1	6	33%
Sustainable homes are more environmentally friendly than green homes	6	2	38%
Green homes are more environmentally friendly than sustainable homes	5	1	29%

Table 8 Unknown GHFs: Phase 1

Green Home Feature (n = 21)	**I don’t know about this feature**
Xeriscaping (low water landscape style)	8
Dual-flush toilets	6
Grey water recycling	5
Tankless water heater system	5
Low VOC paint and carpet materials (VOC - Volatile Organic Compounds)	5
Water efficient irrigation	1

As for the GHFs, a significant number of respondents were not familiar with all the listed GHFs. Out of the valid response rate, only (n = 10) 45.5% were familiar with all the GHFs. Some possible causes for this might be low awareness or unfamiliarity with the technical terms of these GHFs. Table 9 shows the GHFs the respondents are not familiar with.

To understand their level of awareness and experience with the GHFs, the researcher also asked the respondents to identify the GHFs that have been present in past houses (see Table 10). It could be inferred that though some of the features like low VOC were present in their homes (housing standards), many may have been unaware of them. So, this question was removed from the main survey as it may not produce the intended results. Additionally, features like energy efficient doors and windows and xeriscaping were removed from the main survey. Since the intent of xeriscaping was simply to learn whether respondents perceived low water irrigation to be appealing, the language about water efficiency and irrigation may have been unfamiliar.

Table 9 GHFs present in the previous homes: Phase 1

Green Home Feature	**Features present in my previous homes**	
	GenZ (n1=12)	Non-GenZ (n2=9)
Rain water harvesting	2	5
Grey water recycling	1	0
Water efficient irrigation	0	3
Dual-flush toilets	2	3
Tankless water heater system	3	1
Energy efficient doors and windows	3	1
Energy efficient appliances	5	3
Heat pumps (a type of heating and cooling system)	2	1
Low VOC paint and carpet materials (VOC - Volatile Organic Compounds)	2	1
Eco friendly building materials (rammed earth, bamboo, mass timber)	1	1
Recycled or Reclaimed home products	2	1
Solar Panels	3	5

To evaluate the respondents' perceptions of the relative importance of different types of GHFs, only responses indicating familiarity with all the listed GHFs were considered (n_1 = 5

(GenZ), $n_2 = 5$ (non-GenZ)). This was done to eliminate bias of knowledge. Descriptive statistics were run to calculate the mean and standard deviation of different types of GHFs and understand the GenZ respondents' overall preferences (see Table 11). It was interesting to know other than sustainable features, the means of importance of GHFs was more for Non-GenZ than GenZ respondents. As Table 11 shows, it could be summarized that overall respondents favor energy related features, while water efficient features and sustainable materials are less favored.

Table 10 Type of GHFs: Phase 1

Variable	**Respondents: GenZ($n_1 = 5$)**		**Respondents: Non-GenZ($n_2 = 5$)**	
	Mean[a]	Standard Deviation	Mean[a]	Standard Deviation
Water efficient features	4.520	2.109	5.160	0.993
IEQ features	5.000	2.549	5.200	2.683
Sustainable Materials	5.300	1.109	4.100	1.781
Energy efficient features	5.600	1.606	6.100	0.821
Renewable Energy	5.800	1.303	5.800	0.836

[a] for a 7-point Likert -type scale from 1= I don't care about this feature at all to 7 = This is extremely important feature to me

In order to measure the internal consistency of the GHFs as Likert items, the researcher calculated the Chronbach's alpha. The number obtained ($\alpha = 0.832$) is above the threshold (0.70), making the GHF items internally consistent.

Due to the low response, inferential tests were not run on the pilot data because the power for the data was less than 80%. So, the researcher performed a descriptive statistic to analyze which types of barriers and motivations were considered to be obstacles and drivers by the pilot-phase respondents (refer to Figure 6). From the figure, it could be suggested that, firstly, non-GenZ individuals are either more motivated or have perceived barriers when it comes to GH decision-making, as most of their means are above 4 (mean =4, meaning its slightly important to me). Secondly, while intrinsic motivations are perceived to be significant drivers for Non-GenZ, the non-normative motivations are more significant for GenZ respondents.

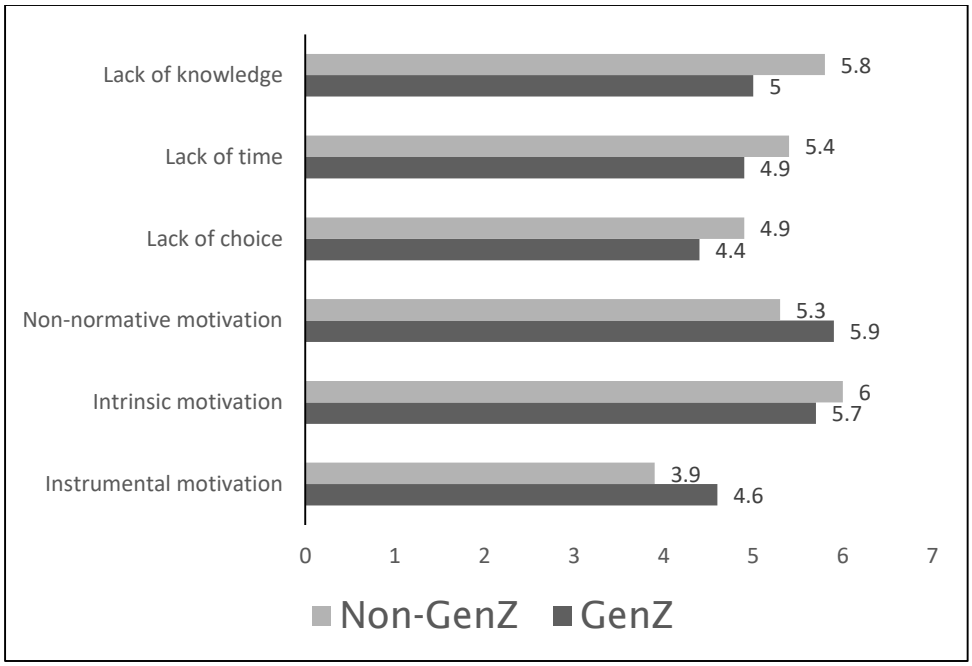

Figure 7 Means of Motivations and Barriers (n=21) : Phase 1

Overall, the descriptive analysis of the Phase 1 (pilot) data suggested that Non-GenZ individuals were more willing to buy GHs compared to GenZ respondents (refer to Figure 7). Additionally, on a scale of 7, GenZ respondents' mean score was 5.6 and Non-GenZ respondents' mean score was 6.3 for their willingness to buy GHs (see Figure 8). And on an average all the respondents were willing to pay 28.7% more for green premiums than standard conventional homes. It should be noted that the pilot study was conducted to understand the clarity of the survey and investigate if the respondents are interpreting the questions as intended. The non-GenZ data should not be used for generalization as the data received was limited to make any concrete inferences and the current study is on GenZ respondents. With that said, more data needs to be collected and inferential statistics need to be performed to come to any conclusions.

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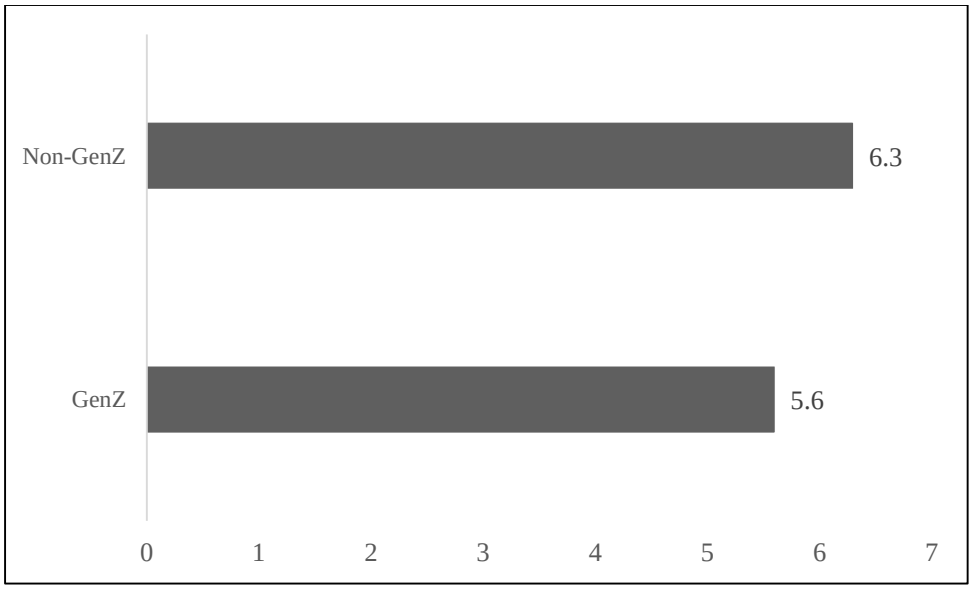

Figure 8 Willingness to buy GHs (n= 21) : Phase 1

3.13 Summary

In conclusion, this chapter outlined the research methodology used to carry out this research, including the conceptual framework, instrumentation, data collection, and analysis methods. After the data was obtained from the online questionnaire, the data was analyzed through the SPSS. The next chapter deals with the data analysis of the main survey and the interpretation of the data.

CHAPTER 4. DATA COLLECTION & RESULTS

4.1 Introduction

This chapter deals with analyzing and evaluating the data collected from Phase 2 (main survey) through the online survey. The results are presented in two parts. In part one, the descriptive data is presented, and in part two the data is analyzed using inferential statistics to tests the study's hypothesis.

4.2 Phase 2 – Online Survey Response Overview

Direct email invitations were sent to 3000 students enrolled at Purdue University –Main Campus as well as to 10 student organizations chosen by the researcher at the beginning of April 2021 from the student organization directory. The details of the study and the survey information also were forwarded to Purdue groups and students in the researcher's personal contact list. Apart from that, the researcher also recruited respondents in person and posted flyers in the labs of the KNOY building. The survey was closed on 13th April, 2021. As the researcher received enough responses (n > 32 GenZ responses who knew all the GHFs), no reminders emails or emails to faculty were sent. An internal consistency analysis was performed to assess the Likert scales items, with the result that $\alpha = 0.888$. This number is slightly higher than the coefficient found in the pilot analysis ($\alpha = 0.875$), meaning that the Likert scale items in the survey were constructed to measure the same concepts. The $\alpha > 0.80$ result also was acceptable, meaning that the attributable error in the test scores was low (Tavakol & Dennick, 2011).

The total number of respondents for the survey was 150. Out of these, 73 (48.7%) responses were from social media such as WhatsApp, and the rest were from emails (n = 72, 48%) and posters (n = 5, 3.3%) (see Table 12).

For the main descriptive and inferential analysis, three categories were not taken into account: surveys with less than 100% completion rate (11 surveys); Non-GenZ respondents (23 respondents); and responses that did not disclose age (0 responses). In other words, out of these 150 responses, only 139 respondents completed the survey, while the other 11 dropped the survey before going on to the third question. Out of these 139 respondents, the Non-GenZ sample

accounted for 23 responses. So, after eliminating the Non-GenZ sample, only the GenZ sample was considered for the analysis, meaning that n = 116. This sample is the final sample.

Table 11 Distribution Channel of the Main Survey

Distribution Channel	Frequency	Percent
Social media	73	48.7
E-mail	72	48.0
QR (poster)	5	3.3
Total	150	100.0

4.2.1 Descriptive Statistics - Demographics

Female (n = 65, 56%) representation in the responses was higher compared to males (n= 46, 39.7%), others (n = 3, 2.6%), and prefer not to say (n=2, 1.7%) (see Figure 9).

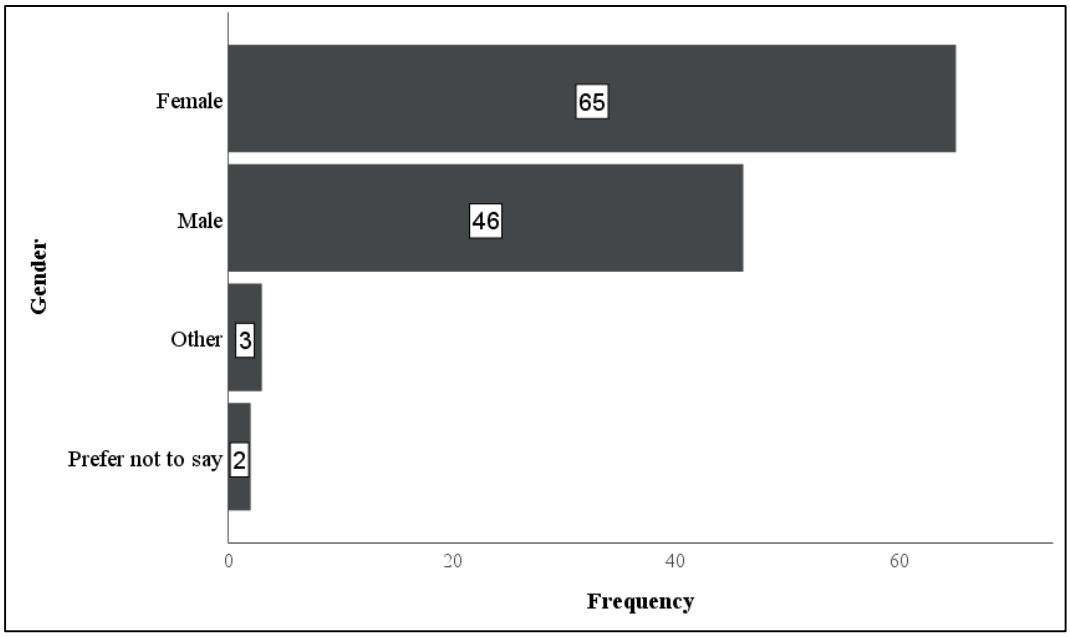

Figure 9 Gender Distribution (n=116)

Regional distribution was concentrated in the United States (n = 86, 74.1%), followed by Asia (n=27, 23.3%). There was one respondent from Africa (n= 1, 0.9%) and several from other parts of North America (n = 2, 1.7%), excluding the U.S. (see Table 13).

Table 12 Location

Location	Frequency	Percent
United States	86	74.1
Asia	27	23.3
North America outside United States	2	1.7
Africa	1	.9
Total	116	100.0

Figure 10, represents the growing environment of the respondents. It is observed that most of the respondents were from suburban areas (n = 69, 51.3%) followed by urban (n = 29, 26.7%) and rural areas (n=18, 14.7%).

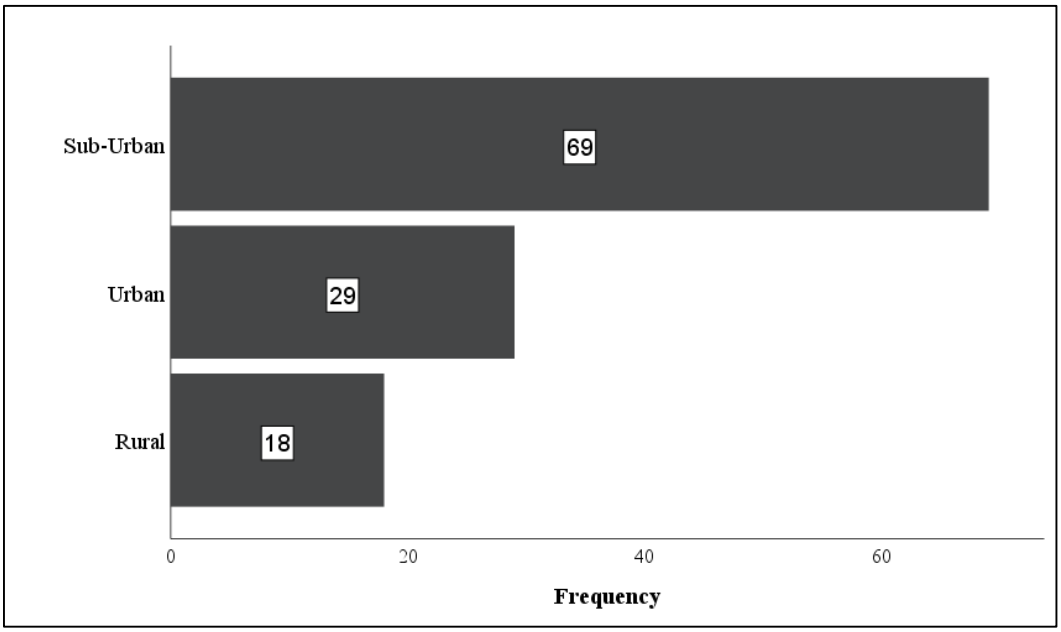

Figure 10 Growing Environment (n = 116)

Table 14 summarizes the level of education of the respondents who were enrolled at Purdue University. In case respondents were pursuing more than one major, they were asked to indicate

their highest levels of education along with their majors. Interestingly, 39 respondents (33.6%) were at the graduate level, 76 (65.5%) were undergraduates, and one reported as other (see Table 14 for more details).

Table 13 Level of Education

Education Level (n = 116)	Frequency	Percent
Graduate	39	33.6
Sophomore	21	18.1
Freshmen	19	16.4
Junior	19	16.4
Senior	17	14.7
Other	1	.9
Total	116	100.0

4.2.2 Descriptive Statistics – Green Homes and Green Home Features

The second part of the survey, "Green Homes and Green Home Features," asked respondents for their perceptions of the terms "green" and "sustainable" homes, as they often are used interchangeably in the construction industry. Interestingly, only 41 of the respondents (35.3%) believed that the two terms mean the same thing, with 38 respondents (32.8%) indicating that sustainable homes are more environmentally friendly and the other 37 respondents (31.9%) indicating otherwise (see Figure 11).

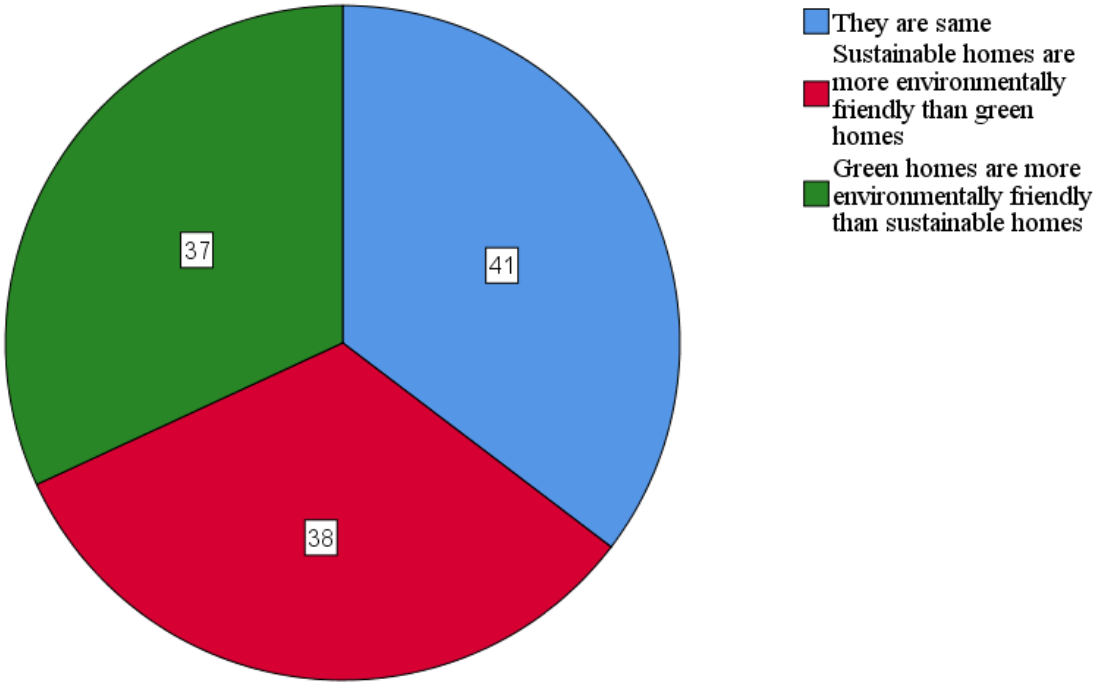

Figure 11 Labels “green” and “sustainable” (n=116)

To understand what type of GHFs the college students desire to own in a GH, the researcher asked a hypothetical question about which features the respondents would be interested in, if money was not an issue. In the same question, the researcher captured data on the features that respondents were unfamiliar with by providing an option to select ‘I don’t know about this feature’. The analysis on this question is divided into two parts. The first part investigates the features respondents were unfamiliar with. So all the responses with “I don’t know about this feature” were segregated and compiled into a table (see Table 14).

A large proportion of the respondents were unfamiliar with grey water recycling (n=44, 37.9%), followed by heat pump (n=36, 31%), tankless water heater system (n=30, 25.9%), and low VOC paint and carpet materials (n=17, 14.7%). By contrast, all the respondents were familiar with energy efficient appliances and the solar panels (see Table 15).

The second part of the analysis for the GHFs addressed which GHFs were most desired out of the responses who knew all the features. The researcher intended to learn which GHFs the respondents are interested to own in their homes. The respondents were asked to rate the features on a 5-point Likert scale with 1= Not at all interested; 2 = Somewhat interested; 3 = Moderately

interested; 4 = Very interested; 5 = Extremely interested. Analysis revealed that Energy efficient appliances (mean = 4.65, SD = .618) and Solar panels (mean = 4.44, SD = .893) are the most sought-after features, with minimum standard deviation relative to other features, while the the grey water recycling (mean = 3.58, SD = 1.177) and water efficient irrigation (mean = 3.58, SD = 1.097) are the least desired features (see Table 16).

Table 14 Unknown GHFs

Green Home Feature	**I don't know about this feature**	**Percent (%)**	**Valid number of responses**
Grey water recycling	44	37.9	115
Heat pumps (a type of heating and cooling system)	36	31	116
Tankless water heater system	30	25.9	116
Low VOC paint and carpet materials (VOC - Volatile Organic Compounds)	17	14.7	116
Water efficient irrigation	11	9.5	115
Rain water harvesting	5	4.3	116
Dual-flush toilets	4	3.4	116
Eco friendly building materials (rammed earth, bamboo, mass timber)	1	0.9	116
Recycled or Reclaimed home products	1	0.9	116
Energy efficient appliances	0	0	116
Solar Panels	0	0	116

Table 15 Level of interest in GHFs

	N					
	Valid	Missing	Mean[a]	Std. Deviation	Minimum	Maximum
Energy efficient appliances	45	0	4.60	.618	3	5
Solar Panels	45	0	4.44	.893	2	5
Heat pumps	45	0	4.04	.952	2	5
Dual-flush toilets and low-flow faucets/shower-heads	45	0	3.93	1.031	1	5
Low VOC paint and carpet materials	45	0	3.93	1.116	1	5
Eco friendly building materials	45	0	3.84	1.242	1	5
Rain water harvesting	45	0	3.80	1.100	1	5
Tankless water heater system	45	0	3.80	1.079	1	5
Recycled or Reclaimed home products	45	0	3.76	1.228	1	5
Grey water recycling	45	0	3.58	1.177	1	5
Water efficient irrigation	45	0	3.58	1.097	1	5

[a] for a 5-point Likert -type scale from 1= Not at all interested to 5 = Extremely interested

Table 16 Type of GHFs (Descriptive Statistics)

Type of GHFs	**N**	**Mean**	**Std. Deviation**
Renewable Energy (RE)	45	4.4444	.89330
Energy Efficient (EE)	45	4.1481	.69105
Indoor Environmental Quality (IEQ)	45	3.9333	1.11600
Sustainable Materials (SM)	45	3.8000	1.16483
Water Efficient (WE)	45	3.7222	.84984

[a] for a 5-point Likert -type scale from 1= Not at all interested to 5 = Extremely interested

All the means of the GHFs within the same type were combined and averaged to get the mean of that type of GHFs. The results suggested that renewable energy (RE) (mean = 4.4, SD =.89) and energy efficiency (EE) (mean = 4.2, SD =.69) were the most desired types of GHFs, while the water efficiency (WE) (mean = 3.7, SD =.85) was the least desired type of GHF (see Table 17 for more details).

The next question in the second part of the survey tested the college students' perceptions of third party certification programs for homes. Among 116 respondents, 17 respondents (14.7%) selected "it is extremely important to me, while 19 (16.4%) selected "It doesn't matter if I get a certificate or not," 15 (12.9%) selected "I don't know anything about certification programs" and a vast majority of 65 respondents (56%) selected "I think it's interesting and I would like to learn more about these certification programs" (see Figure 12 for graphical representation of data).

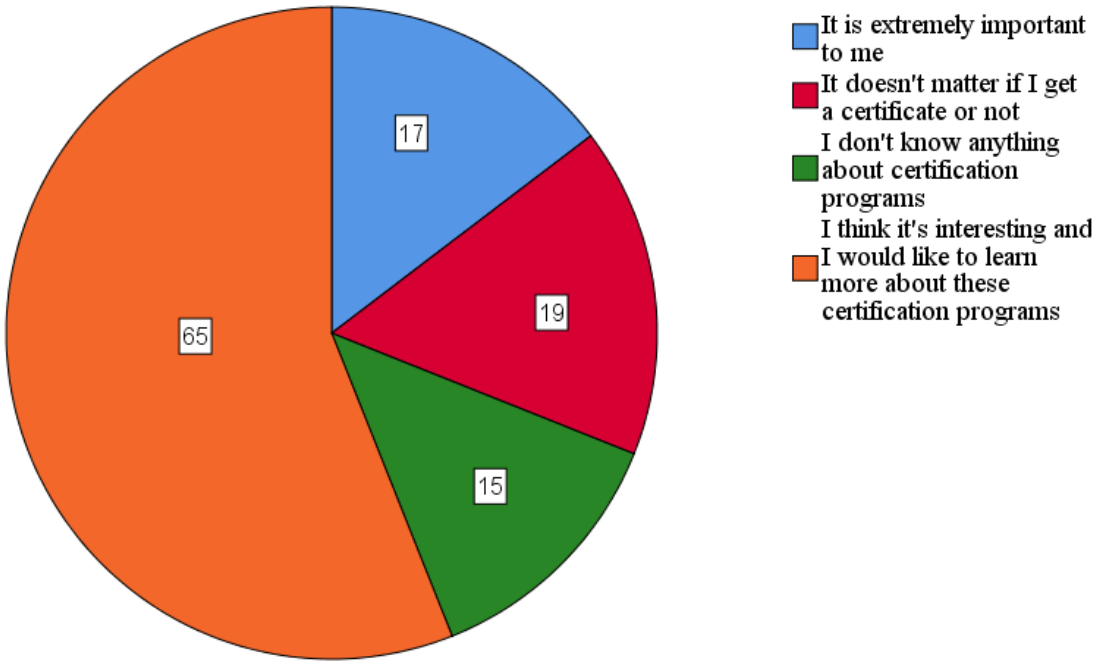

Figure 12 Third party green certification

4.2.3 Descriptive Statistics – Consumer Behavior

In the third part of the survey about "Consumer Behavior," the first question the researcher asked from the respondents was to rate 12 motivation statements on a 5-point Likert scale, from 1 = Strongly disagree to 5 = Strongly agree. These 12 motivation statements belonged to three types of motivations—intrinsic, instrumental and non-normative motivation—each with 4 statements. Intrinsic and instrumental motivation combine to form normative motivation.

Table 18 shows that the respondents believed that intrinsic motivations are most important (mean = 4.06, SD = .806), followed by non-normative motivations (mean = 4.03, SD = .702), though the level of agreement on the latter is slightly higher. Instrumental motivation (mean = 3.23, SD = .661) was the least valued among all the motivation types and also had a relatively lower standard deviation. Tables 19, 20, and 21 further breaks down the statistics for each statement about the different types of motivations. Among the intrinsic motivations, the GenZ respondents strongly believe (agree) that their small acts of conserving resources can contribute towards sustainability (mean = 4.22) at the same time, the perceived level of agreement on being personally responsible for keeping the environment healthy (mean = 3.85) was relatively low compared to the other statements (refer Table 19).

While the GenZ respondents' level of agreement on the influence of instrumental motivations are relatively low compared to the other motivational types. Among the instrumental motivation statements, the GenZ respondents somewhat disagree to the statement that their motivation to buy GHFs is related to upholding a good image (mean = 2.91) and in contrast they somewhat agree that their motivation to buy GHFs is related to appreciative feelings from family and friends (mean = 3.51) (refer Table 20).

Table 21, shows that among the non-normative motivations, GenZ respondents are more appreciative of GHs due to low utility bills (mean = 4.28).

Table 17 Types of Motivation

Motivation Type	N		Mean	Std. Deviation	Minimum	Maximum	Cronbach's Alpha
	Valid	Missing					
nonnormative	116	0	4.0323	.70212	1.50	5.00	.756
intrinsic	115	1	4.0630	.80626	1.00	5.00	.806
instrumental	115	1	3.2283	.66108	1.50	4.75	.553

Table 18 Intrinsic Motivations

Motivation Type	Statements	N		Mean[a]	Std. Deviation	Minimum	Maximum
		Valid	Missing				
Intrinsic Motivation	I aspire to conserve and reduce water and energy consumption in households because I believe in sustainability	116	0	4.22	.914	1	5
	I should probably be doing more to prevent climate change.	116	0	4.11	.976	1	5
	One reason why I'd like to buy a green home is simply because I want to be a good person and contribute to next generations' sustainable future	116	0	4.08	1.120	1	5
	I feel personally responsible for keeping the environment healthy	115	1	3.85	1.028	1	5
	Total	115	1	4.06	.81		

[a] for a 5-point Likert -type scale from 1= Strongly disagree to 5 = Strongly agree

Table 19 Instrumental Motivation

Motivation Type	Statements	N		Mean[a]	Std. Deviation	Minimum	Maximum
		Valid	Missing				
Instrumental Motivation	My friends and family would be proud of me for investing in green features for my home.	115	1	3.51	1.021	1	5
	Green home features provide valuable tax benefits and other incentives	116	0	3.44	.847	1	5
	One good thing about green home features is that you don't have to worry about disapproval from your neighbors.	116	0	3.06	.989	1	5
	I'd like my home to have at least some green features, because I don't want people to think I don't care about the environment.	116	0	2.91	1.161	1	5
	Total	115	1	3.23	.66		

[a] for a 5-point Likert -type scale from 1= Strongly disagree to 5 = Strongly agree

Table 20 Non- Normative Motivation

Motivation Type	Statements	N		Mean[a]	Std. Deviation	Minimum	Maximum
		Valid	Missing				
Non-Normative Motivation	Green homes is a good choice for me because they reduce utility bills (LEED certified homes save 30-60 % on utility bills)	116	0	4.28	.776	1	5
	I'd buy green home because it creates a healthier living environment	116	0	4.21	1.017	1	5
	I'd buy green home because it gives better standard of living quality/experience	116	0	4.00	.996	1	5
	Green home features are important because they increase the value of the home.	116	0	3.65	.887	1	5
	Total	116	0	4.03	.70		

[a] for a 5-point Likert -type scale from 1= Strongly disagree to 5 = Strongly agree

The next question in this third part of the survey related to perceived obstacles to adopting green features in the home. The researcher asked the respondents to rate three barrier statements namely lack of information, perceived effort and lack of choice on a 5 point Likert scale (1 = Strongly disagree to 5 = Strongly agree) which claims the degree to which these barriers acts as obstacles in adopting GHFs.

Table 21 Barriers

Barrier Type	N	Mean[a]	Std. Deviation	Minimum	Maximum
Lack of information on perceived benefits and savings	115	3.77	.983	1	5
Perceived Effort - lack of time and patience to analyze different features	115	3.57	1.018	1	5
Lack of choice - most of these features are decided by builders/ architects and we are given little or no choice	115	3.81	1.025	1	5

[a] for a 5-point Likert -type scale from 1= Strongly disagree to 5 = Strongly agree

Table 22 shows that among the respondents, lack of choice (mean = 3.81, SD = 1.025) was perceived to be the greatest barrier, and at the same time it had the largest std. deviation. Followed by that was lack of information (mean = 3.77, SD = .983). The respondents indicated that effort was the least important barrier (mean = 3.57, SD = 1.018).

The next two question in this third part of the survey were related to willingness to purchase a green home in the future and how much of a premium the college students were willing to pay. The researcher asked the respondents to rate their willingness to buy GH on a 5-point Likert scale, where 1 = Strongly disagree and 5 = Strongly agree. As for the premium, the researcher used a 0-100 slider, representing percentage of cost above the base price of a home the college students were willing to pay.

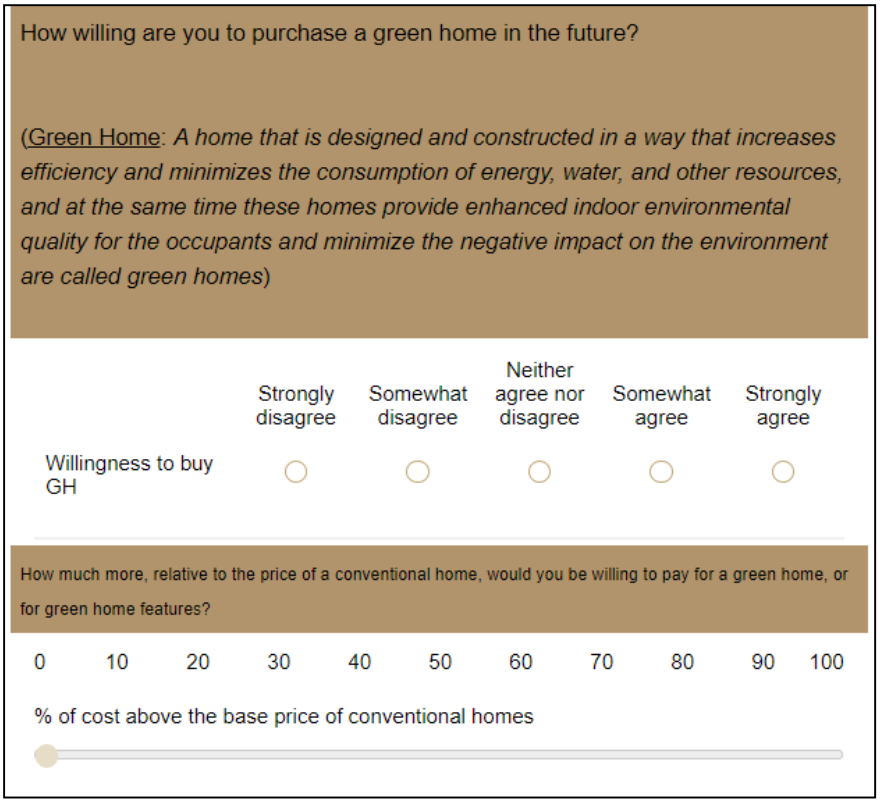

Figure 13 Survey Question – Willingness to buy GH and Green Premium

Table 23 indicates that among 115 respondents, the mean of the willingness to buy a GH was 4.23 with 0.773 standard deviation, and the mean for the green premium was 24.58% with a relatively higher standard deviation (n=113, SD= 16.34). Figure 13 shows how the questions on willingness to buy and pay the green premium were asked in the survey, along with what the researcher meant by GHs. A large chunk of the respondents (115) selected somewhat agree (n=56, 48.3%) and strongly agree (n= 45, 38.8%) when asked about willingness to buy a GH (see Figure 14).

Table 22 Willingness to buy GH and Green Premiums

	N					
	Valid	**Missing**	**Mean**	**Std. Deviation**	**Minimum**	**Maximum**
Willing to purchase a green home	115	1	4.23	.773	2	5
% of cost above the base price of conventional homes	113	3	24.5841	16.33725	.00	80.00

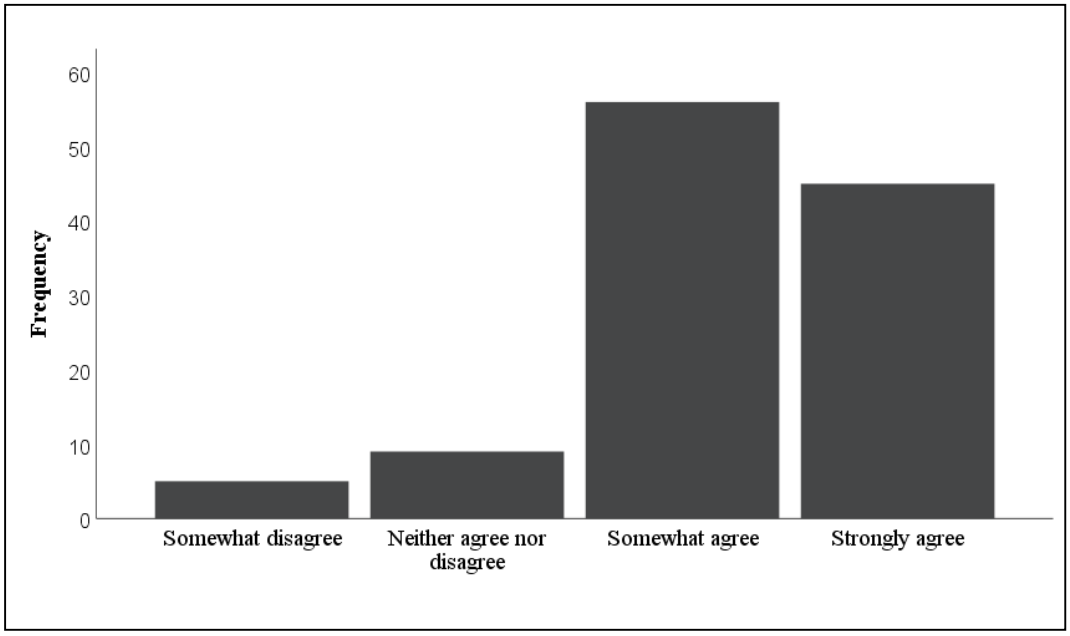

Figure 14 Willingness to buy GH (n = 115)

4.3 Phase 2 – Inferential Statistics

Inferential tests were performed on the data to address the research questions. The results of these tests are presented in the following subsections.

4.3.1 Green Home Features (GHFs)

Repeated Measures of ANOVA were performed to answer part two of research question 1. The actual power obtained for the data was .996 (> .8 assumed power). The data was tested and

all the assumptions for the use of repeated measures of ANOVA were checked and no issues were found. The following equation reflects the hypothesis for GenZ consumers' preference of GHFs:

Hypothesis$_0$ 1 = *There is no significant difference between the type of green home features preferred by GenZ consumers.*

The results from the tests within subject effects indicate that the p-value = 0.000 (at $\alpha = 0.05$), meaning that the means are not equal to each other and thus disproving the null hypothesis 1 (see Table 24).

For the five types of GHFs, a pairwise comparison post hoc test was conducted with this data using an adjusted p-value (Bonferroni correction = 0.05/20 = 0.0025). The results showed that respondents' desire for water-efficient features was significantly different from renewable energy features (see Table 25).

Figure 15 represents the marginal means graph of the type of GHFs. This data indicates that respondents showed interest in all the types of GHFs, some more than others.

Table 23 Hypothesis 1 (GHF) – Tests of within-subject effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power[a]
Type of GHFs	Sphericity Assumed	15.328	4	3.832	7.336	*.000*	.143	.996

a. Computed using alpha = .05

Table 24 Hypothesis 1 (GHF) – Pairwise Comparisons

(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
WE	EE	-.426	.123	.012	-.788	-.064
	IEQ	-.211	.130	1.000	-.594	.172
	SM	-.078	.133	1.000	-.471	.315
	RE	-.722	.139	*.000**	-1.133	-.311
EE	WE	.426	.123	.012	.064	.788
	IEQ	.215	.158	1.000	-.253	.683
	SM	.348	.170	.469	-.155	.851
	RE	-.296	.150	.550	-.740	.148
IEQ	WE	.211	.130	1.000	-.172	.594
	EE	-.215	.158	1.000	-.683	.253
	SM	.133	.163	1.000	-.349	.616
	RE	-.511	.184	.081	-1.056	.034
SM	WE	.078	.133	1.000	-.315	.471
	EE	-.348	.170	.469	-.851	.155
	IEQ	-.133	.163	1.000	-.616	.349
	RE	-.644	.162	.003	-1.123	-.166
RE	WE	.722	.139	*.000**	.311	1.133
	EE	.296	.150	.550	-.148	.740
	IEQ	.511	.184	.081	-.034	1.056
	SM	.644	.162	.003	.166	1.123

Based on estimated marginal means

*. The p-value is significant at the .0025 level.

b. Adjustment for multiple comparisons: Bonferroni (0.0025).

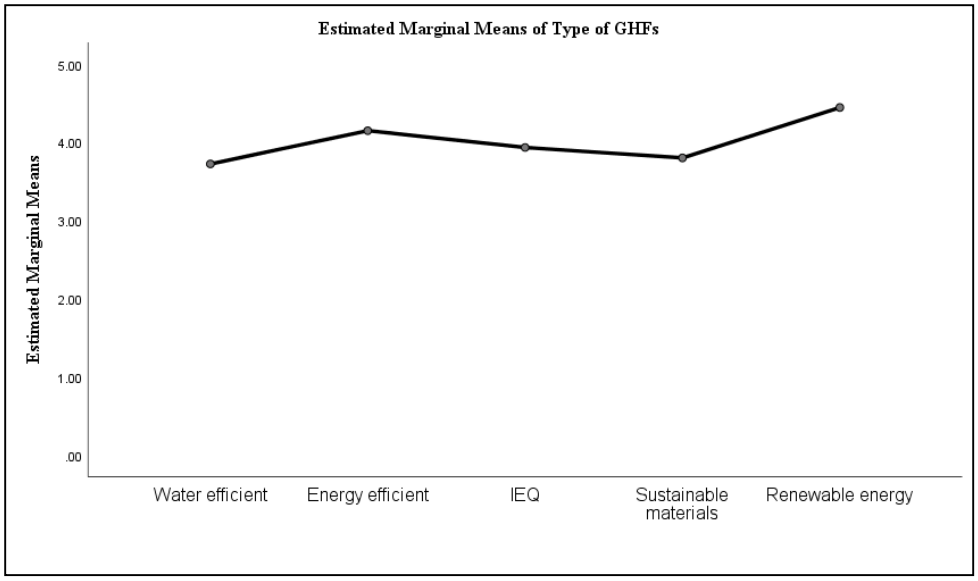

Figure 15 Means of types of GHFs

4.3.1.1 Awareness of GHFs and willigness to buy GHs

An additional test was conducted on the GHFs. This was to test if there exists a correlation between the GenZ consumer's awareness of GHFs to their willingness to buy GHs. In other words it was to test if the lack of awareness of GHFs affects the consumer's willingness to buy GHs. A Mann-Whitney U test was conducted at $\alpha = 0.05$. The results (refer Table 26) indicated that the willingness to buy GHs was higher for respondents who were familiar with all the GHFs (mean rank = 58.41) compared to the respondents who were not familiar with at least one of the features (mean rank = 57.75). However, the inferential test statistic was not significant (p-value = .909). suggesting that their lack of awareness does not significantly affect their willingness to buy a green home.

Table 25 Awareness of GHFs and Willingness to Buy GHs: Test Statistics[a]

	Willing to purchase a green home
Mann-Whitney U	1544.000
Wilcoxon W	4100.000
Z	-.114
Asymp. Sig. (2-tailed)	.909

a. Grouping Variable: awareness_GHF

4.3.2 Barriers

Friedman tests were performed on the second portion of research question 2. The normality assumptions were checked, and since the data was not normally distributed, it did not violate the normality assumption (p-value = .000, Shapiro-Wilk). Friedman test on hypothesis 2 regarding the GenZ consumers is presented in the following equation:

Hypothesis$_0$ 2: *There is no significant difference between the type of barrier perceived as a hindrance to willingness to buy green homes by GenZ Consumers.*

From the Friedman test mean rank (see Table 27), lack of choice (mean rank = 2.12) was identified as the greatest obstacle, followed by lack of information (mean rank = 2.03). Also, the test statistics indicate that the mean ranks of types of barriers are significantly different, with χ^2 = 6.834 (chi-square), p-value = 0.03 (at $\alpha = 0.05$) (see Table 28). As the Friedman test can only give overall differences, the researcher also performed Wilcoxon signed-rank tests on different combinations of barrier types to investigate which types of barriers are significantly different from others.

Table 26 Hypothesis 2 (Barriers) - Ranks

	Mean Rank
Lack of choice - most of these features are decided by builders/ architects and we are given little or no choice	2.12
Lack of information on perceived benefits and savings	2.03
Perceived Effort - lack of time and patience to analyze different features	1.85

Table 27 Hypothesis 2 (Barriers) – Test Statistics[a]

N	115
Chi-Square	6.834
df	2
Asymp. Sig.	.033

a. Friedman Test

Results from the Wilcoxon signed-rank tests with pair-wise comparison at $\alpha = 0.017$ ($\alpha = 0.05/3$: Bonferroni correction), indicate that differences are not significant (see table 29). It is noted that Bonferroni is a conservative adjustment for multiple tests.

Table 28 Hypothesis 2 (Barriers) – Wilcoxon Test Statistics[a]

	Lack of information Perceived Effort	Lack of information Lack of Choice	Perceived Effort Lack of Choice
Z	-1.886[b]	-.057[b]	-2.111[b]
Asymp. Sig. (2-tailed)	.059	.954	.035

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.

4.3.3 Motivation

Multinomial tests were performed on the first part of question 2. The multinomial test hypotheses for the GenZ consumers are presented in the following equation:

Hypothesis$_0$ 3: *There is no significant difference in the association of type of motivation related to Generation Z consumers' willingness to buy green homes*

Table 29 Hypothesis 3 (Motivation) – Collinearity Statistics

		Collinearity Statistics	
Model		Tolerance	VIF
1	(Constant)		
	intrinsic	.525	1.906
	instrumental	.655	1.526
	nonnormative	.517	1.936

To check the multi collinearity assumption among the independent variables, i.e. if the independent variables are inter-related, the researcher ran a simple collinearity diagnostic in SPSS. Since the variation inflation factor (VIF) values of independent variables (see Table 30) were in the range of 1 to 5, it can be said that although moderate correlation exists among the independent variables, this does not present a severe issue. Others assumptions like goodness-of-fit, model fitting for performing multinominal logistic regression test were checked and no severe violations were found.

The pseudo R square obtained is 0.47 from Nagelkerke, which is the adjusted value that compares the log likelihood of model with t and without the predictors.

Table 30 Hypothesis 3 (Motivation) – Likelihood Ratio Tests

	Model Fitting Criteria	Likelihood Ratio Tests		
Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	211.603	37.537	3	*.000*
intrinsic	189.182	15.115	3	*.002*
instrumental	174.521	.455	3	.929
nonnormative	183.392	9.325	3	*.025*

The test results at $\alpha = 0.05$ show that intrinsic (p-value = .002) and non-normative (p-value = .025) motivations have significant influences on the willingness to buy GH (see Table 31). However, instrumental motivation (p-value = .929) does not significantly influence the willingness to buy GH.

Table 32 summarizes the parameter estimates, meaning the coefficients of the model. In this table, B represents the coefficients, as shown below. Strongly agree values were treated as references for the outcome variables (from somewhat disagree to somewhat agree). As the respondents on the 5-point Likert scale selected a score of 2 (somewhat disagree) or above, the table showed only three sets (strongly agree, not shown as it is used as a reference measure).

Each set has an intercept and all the independent variables. The standard interpretation of the Set 1 data (Somewhat disagree relative to strongly agree) is as follows:

- Intercept: This is the multinomial logit estimate for somewhat disagree relative to strongly agree (to buy GHs) when the motivation types in the model are evaluated at zero (intercept = 15.385).
- Intrinsic: If a respondent were to increase his intrinsic score by one point, the multinomial log-odds of preferring somewhat disagree to strongly agree would be expected to decrease by 2.376 unit while holding all other variables in the model constant.

- Instrumental: If a respondent were to increase his instrumental score by one point, the multinomial log-odds of preferring somewhat disagree to strongly agree would be expected to decrease by .574 unit while holding all other variables in the model constant.
- Non-normative: If a respondent were to increase his instrumental score by one point, the multinomial log-odds of preferring somewhat disagree to strongly agree would be expected to decrease by 1.612 unit while holding all other variables in the model constant.

Table 31 Hypothesis 3 (Motivation) – Parameter Estimates

							95% Confidence Interval for Exp(B)	
Willing to purchase a green home[a]		B	Std. Error	df	Sig.	Exp(B)	Lower Bound	Upper Bound
Somewhat disagree	Intercept	15.385	3.864	1	.000			
	intrinsic	-2.376	.873	1	.007	.093	.017	.514
	instrumental	-.574	1.155	1	.619	.563	.059	5.417
	nonnormative	-1.612	1.198	1	.178	.199	.019	2.086
Neither agree nor disagree	Intercept	16.882	3.678	1	.000			
	intrinsic	-1.947	.809	1	.016	.143	.029	.697
	instrumental	.247	.984	1	.802	1.280	.186	8.809
	nonnormative	-3.008	1.135	1	.008	.049	.005	.457
Somewhat agree	Intercept	9.686	2.577	1	.000			
	intrinsic	-1.677	.504	1	.001	.187	.070	.502
	instrumental	-.075	.401	1	.852	.928	.423	2.036
	nonnormative	-.479	.487	1	.326	.619	.238	1.610

a. The reference category is: Strongly agree.

From the Table 33, at $\alpha = 0.05$, the intercept in set 1 was significant with p-value .000. This indicates the relation (positive) direction and shows that these intercept values differ from somewhat disagree to strongly agree. At $\alpha = 0.05$, intrinsic motivation was significant in set 1 having a p-value = .007. This means that for respondents with zero intercept instrumental and non-normative scores, there is a statistically significant difference between the likelihood of being classified as somewhat disagree or strongly agree. Other than the above mentioned, the only coefficients which were significant were the intercepts in sets 2 and 3 (p-value = .000, .000), intrinsic in sets 2 and 3 (p-value = .16, .001) and non-normative in set 2 (p-value = .008).

4.4 Summary

This chapter delineated the analysis of the data using several analysis techniques, including descriptive data analysis, repeated measures of ANOVA, the Freidman test, and multi-nominal logistic regression. As a result of multi-nominal logistic regression analysis, the respondents' willingness to buy a GH had a relation with intrinsic and non-normative motivations. It was also found that respondents had differences in their preferences of GHFs, and the perceived level of the hindrance of barriers to adopt GHFs were different. The contents of this chapter presented the data and discussed the findings of the study. The next chapter interprets the findings and presents the study's conclusion and future recommendations.

CHAPTER 5. SUMMARY, CONCLUSION AND FUTURE RECOMMENDATIONS

5.1 Introduction

This chapter discusses the results of the present study in light of previous literature and comments on the additional limitation discovered during the course of research. This chapter also explains this study's conclusions, shows how they contribute to a better understanding of GenZ consumers' current perceptions of Green Homes, and offers suggestions for future work.

5.2 Overall Discussion of Results

In this section, the researcher discusses the results obtained for each of the proposed research questions and compares these results with findings from previous literature.

5.2.1 Green Home Features

Environmental consciousness has become increasingly evident in recent years, as evidenced by the World Green Building Trends (2018) report, which states that green building activities continue to grow across the world and that one of the top triggers for this rise in green building is client demand. Now, consumers are starting to show an inclination towards GHFs and GHs, since the benefits of doing so include improved health and reduced resource consumption from utility bills (Noiseux & Hostetler, 2010). At the same time, previous literature on GHs indicates that this inclination towards green building practices is not all-encompassing, but that consumers prefer certain types of GHFs over others (*REALTORS® & Sustainability Report*, 2019; Tan, 2014). To investigate the preferences of GenZ consumers, this research scored eleven GHFs belonging to five types on a 5-point Likert scale. Based on the mean scores, the top GHFs selected by the GenZ consumers were Energy Efficient Appliances, Solar Panels, and Recycled or Reclaimed Home Products. The features Heat Pumps, Tankless Water Heater and Grey Water Recycling scored the least. Additionally, the current study shed light on which features were unfamiliar to respondents. Of these, Greywater recycling ranked as least familiar, followed by heat pumps and tankless water heaters. This lack of awareness about certain features should be acknowledged when interpreting consumer choice related to GHFs.

The lower desire for water-efficient features might also stem from GenZ consumers' lack of knowledge about these features and/or a lack of awareness about global water issues. In their study on water efficient washing machines, Fan et al. (2019) found that low environmental awareness and lack of knowledge about the products hindered consumers from purchasing these products. Zsoka and colleagues (2013) also found that the level of environmental knowledge and commitment is strongly correlated to green consumer behavior. At the same time, they acknowledged that it is difficult to define the correlation between environment education (as an individual factor) and consumer behavior. Peattie (2010) arguments also supports this finding, indicating that although environmental knowledge is considered to drive green consumer behavior, there is no substantial evidence to support this assumption. In his study, Peattie maintained that there is a difference between awareness of environmental problems and understanding of those problems. Understanding new information about the environment may prompt consumers to think differently about their consumption behavior. In the current study, the researcher found a correlation between awareness of green features and willingness to buy GHs. This study's connection between lack of awareness and willingness to buy is aligned with Peattie's argument that awareness does not necessarily lead to behavior change. Though there are studies on environmental awareness and green consumer behavior (Peattie, 2010; Zsoka et. al., 2013) , there is a lack of research on the awareness of GHFs and how that affects consumer behavior, making the findings of this present research useful.

This study's descriptive statistics on types of GHFs suggests that the GenZ consumers' most desired features were renewable energy features, followed by energy-efficient, IEQ, sustainable materials and water-efficient features. This is consistent with Tan's study, which shows that homeowners are most satisfied with features that can reduce energy use and are least satisfied with water-efficient features like rainwater harvesting and low-flow water fixtures (Tan, 2014). A similar finding appears in the NABH report: when builders were asked to select the most popular green attributes on their product selection lists, they reported that the energy-efficient attribute was ranked top, followed by non-toxic (IEQ) and then water efficiency (2020). However, the NAR report (2018) indicates that clients (potential homeowners) believe comfortable living space is more important than having renewable energy resources. The difference may be due to the fact that the NAR report focuses on the sustainability issues facing the industry, and the features included in the survey were the ones clients listed as important.

The inferential tests on the GHFs conducted in this study also indicated that GenZ consumers prefer certain types of GHFs over others. The follow-up tests confirmed that the preference for water efficient features was significantly different from that of energy-related features, and sustainable features were significantly different from renewable energy features. Thus, this research is consistent with findings from previous studies showing that consumers have different preferences of GHFs.

5.2.2 Barriers

As Peattie (2010) posits, green consumption behavior of consumers is influenced by many factors, and identifying these factors is important. Some types of barriers hinder the consumer's willingness to buy GHs, such as perceived effort, lack of knowledge, and lack of choice.

This study's results on barriers affecting green home feature (GHF) consumption indicate that respondents perceived differences among the three types of identified barriers – lack of information, perceived effort, and lack of choice. Interestingly, when post-hoc tests were conducted, the barriers were not significantly different from each other. As the descriptive statistical tests reveal, respondents somewhat agreed that barriers do in fact, hinder their adoption of GHFs, and they perceived the level of hindrance from these barriers to be nearly the same. Descriptive statistics show that the top barriers are lack of choice (Mean = 3.81) followed by lack of information (Mean = 3.77). This could be because GenZ consumers tend to be realistic, and their consumption characteristics tend to be uniquely tailored to their needs and ethics (Francis & Hoefel, 2018). The least perceived hindrance among the identified barriers is the perceived effort (3.57) necessary to analyze different features. The reason could be that GenZ consumers spend more time on digital platforms and are known to be digital natives (Francis & Hoefel, 2018). At the same time, effort still was recognized as a barrier. The reason might be due to the difficulty of gathering valid, trustworthy data, since information on green homes is scattered on the digital platform. This finding concurs with Tan et al.'s (2016) study, where the researchers concluded that consumers' intentions to buy energy-efficient products was influenced by lack of a trustworthy product information (benefits, savings, etc.) and this lack of information became a potential barrier. In the same study, the researchers found that another significant barrier to consumers' willingness to buy energy-efficient products was the idea that green products are too time-consuming or too hard to obtain (Tan et al., 2016). This implies that perceived effort is a significant barrier.

Similarly, the NABH (2020) findings indicated that among the obstacles for GHs, lack of home buyers' knowledge on GHs ranked 4th, while the availability of green products, the price premium, and the lack of consumer demand for GHs were among the top three. While the present research focuses on future and not current purchasing intention, it agrees with the NAHB (2020) findings that lack of choice is perceived to be a barrier affecting consumer purchasing of green homes and green home features. Also, the report shows that some clients prefer particular types of GHFs over others, and thus the researcher believes lack of choice could be a potential barrier as well.

Interestingly, Peattie (2010) suggests an opposing argument, indicating that having limited 'choice editing,' meaning restricting the choice of the consumers to a selected number of GHFs, is a potential way to attract more consumers towards the GH consumption path. The idea is that this approach solves the problem of information overload related to GHFs and reduces the perception of effort (Peattie 2010). This is an interesting argument worth exploring further to investigate how it might apply to GenZ consumers, especially since their consumption style is unique and tailored to their needs.

Since all the proposed barriers are situational barriers related to information needed to make a decision about GHFs, there is no significant difference among them. Nonetheless, according to this study, all three types of barriers were perceived to be distinct obstacles in the GenZ consumer's decision to adopt GHFs in their homes.

5.2.3 Motivations

The researcher used DIT and normative motivation theory to study the motivation to buy GH and GHFs. The descriptive statistics of the present research suggest that the top three motivations to buy GHs and install GHFs are reduced utility bills, followed by personal interest in contributing to environmental sustainability and a perception of health benefits.

In Tan's study (2010), the findings indicated that cost savings on electricity bills was the top motivation for homeowners to buy GHs, which concurs with the current findings. By contrast, certain motivations with low influence in Tan's study, including increased home value or rentals, healthy living experience, and perceived responsibility towards the community, were among some of the top motivations as perceived by the GenZ consumers. Though this may be the case, it should

be acknowledged that Tan's (2010) study focused on homeowners living in GHs while the current study studied GenZ consumers who are potential home buyers.

Based on the descriptive statistical tests of the motivations, motivations that have a low influence on GenZ consumers' willingness to buy GHs include avoiding shame and disapproval from neighbors. This concurs with the Gilal et al. (2019) findings, where introjected motivations (motivations to avoid feelings of shame or guilt) had a trivial influence over green consumer behavior. By contrast, Tan et al. (2016) argue that the green stigma from negative perceptions of an individual based on their green consumption behavior may create resistance towards green consumerism. This argument should be considered with caution, however, as the Tan et. al. (2016) study was a literature review and has not been tested with GenZ consumers.

From the tests conducted in this study, the types of motivations that most influenced the consumer's willingness to buy GHs were intrinsic motivations derived from an individual's environmental concern followed by non-normative motivations derived from perceived benefits and savings. The least influential motivation was instrumental motivation, derived from the influence of family, friends, and neighbors. In other words, these motivations come from avoiding feelings of guilt, shame, and disapproval from the community and maintaining a good image. This concurs to some degree with the results from the Gilal et al. study (2019), where introjected motivations had the least influence on green consumer behavior. With that said, the same study concluded that identified motivations (motivations related to the image) had more influence on green consumption behavior compared to intrinsic motivation. One reason for this could be that the study considered only the millennial generation and the division of motivations was different from the current study. Since attitudes and perspectives differ from generation to generation, the results might be expected to change.

Thus, based on the findings of the present study and on previous literature, it can be suggested that the type and extent of influence of certain motivations on willingness to buy GHs might change based on generation. The current study evaluated purchasing intention and not actual purchasing behavior. Therefore, further studies need to be conducted to investigate if, as GenZ consumers start to buy homes, their perceptions of GHs remain the same.

5.3 Limitations

Some of the limitations the researcher found during the course of this research were:

- *Phase 1 (Pilot):* The pilot survey received fewer responses than anticipated, and many of the respondents were non-GenZ. This limited the amount of analysis the researcher was able to perform on the pilot data.
- *Phase 2:* Since many respondents did not complete the survey in Phase 1, a 5-point Likert scale was used instead of the original 7-point scale to simplify the survey for the respondents. This resulted in a smaller spread of data than originally desired.
- *Phase 2:* The number of GHFs was reduced from sixteen to eleven in the final survey to reduce respondents' cognitive effort and increase the response rate. Thus, not all the originally identified features were included in the final survey.
- *Phase 2:* The number of valid responses obtained to evaluate differences in preference of green home features was greatly reduced because many respondents were not aware of certain features. Nonetheless, for the repeated measures of ANOVA and friedman test the actual power obtained was more than the anticipated power of > 0.8.

5.4 Conclusion

The present study contributes to green home consumption theory and practice in numerous ways. Though the body of research on green consumer behavior has been given considerable attention over the past few decades, little attention has been given to green consumption behavior in connection with motivations and preference of GHFs. Also, only a few studies have investigated GenZ consumer behavior in the GH context. Therefore, this research examined GenZ consumers' preferences of GHFs and identified the perceived barriers in adopting GHFs. Lastly, the researcher examined motivation and willingness to buy GHs through the lens of DIT and normative theory. The contributions made by this study are:

First, the present research describes the perceptions of GenZ consumers towards GHs and GHFs. It reveals that GenZ consumers show a positive attitude towards GHs. Though a large number of respondents did not know about third-party certifications, they were interested to learn

about them. Moreover, GenZ respondents seemed willing to pay green premiums on an average of 24.58% more than conventional homes, indicating their interest and positive attitude towards GHs.

Second, though current home builders incorporate green features, there is lack of attention given to which features are chosen and which types of green features consumers most desire to adopt in their homes. The present research fills this gap by investigating the extent to which GenZ consumers are interested in different types of GHFs and identifying the GHFs with which the consumers are unfamiliar. Based on the results, GenZ consumers are most interested in energy-related features and are least interested in water-related features. Greywater recycling, heat pumps and tankless water heater systems are the features that more than half of the GenZ respondents were unfamiliar with. Though many respondents were unaware of certain green home features, the present research did not find any significant impact of this lack of awareness on respondents' willingness to buy green homes. This is an interesting finding and requires further exploration. The researcher also found that there are differences among GenZ consumers in the types of GHFs they prefer.

Third, the present study elucidates the GenZ consumer's perceptions related to the importance of barriers in adopting GHFs. Based on the previous literature, the researcher identified three barriers that could affect the initial decision-making process of owing GHFs among GenZ consumers who are yet to go into the home market. In this present research, the descriptive survey results reveal that although the GenZ consumers do not perceive these barriers to be significant obstacles, they still agree that they might hinder their decisions to adopt GHFs to some degree (Mean between 3.5 to 4 on a 5-point agreement Likert Scale). Interestingly, the initial inference reveals that the barriers differ from each other, while the post hoc test with conservative Bonferroni adjustment reveals that the barriers were not significantly different from each other. Because of this, more research needs to be done to clarify which barriers show significant hindrance in adopting GHFs. By understanding these barriers, the marketers and policymakers can more effectively strategize and find solutions to help reduce the GenZ consumer's unfavorable perception of GHFs or GH.

Finally, the present study provides a new perspective on motivation and willingness to buy GHs through the lens of DIT and normative theory. The research reveals that non-normative motivation and intrinsic motivation significantly influence willingness to buy GHs among GenZ consumers. In other words, it can be concluded that norms are important, and in a specific way:

not so much through shame and guilt, but rather through internalization—coming to care personally about a norm (environmental and sustainability norms). That non-normative motivation matter isn't very surprising, since the received, background assumption is that GenZ people are just rational agents pursuing self-interest. What's interesting, against this background, is the finding that behavior it's not all about rational self-interest. When green norms matter, they do so because people internalize them, which means people are willing to pay personal costs—going against their own interests—to pursue these goals. Thus, this research extends previous literature by demonstrating how DIT and normative theory framework can be used to bridge the gap between the GenZ consumer's attitude and intention. The findings also suggest that purchasing intention can be encouraged by marketers and policymakers if they change the norms or improve motivational regulations.

5.5 Recommendations for Future Studies

This study on the GenZ consumer's perceptions of Green Homes and their features has provided some answers, but it also raises questions that are worth exploring through further research. Some suggestions that could improve our understanding of the GenZ consumer's perception of GHs and GHFs as well as encourage them to become more involved in green consumerism are as follows:

- *Easy Access to Information:* Study how tools to help easily access information on green homes and their products impact GenZ consumer purchasing intention of GHs.
- *Information on benefits and savings:* Study whether consumer knowledge and awareness of benefits and savings related to GHFs has an effect on consumer intention to purchase GHFs.
- *Development of motivational regulations in GH marketing domain:* Investigate whether studying end-users and changing motivation regulations could positively affect consumer behavior and reduce the attitude-intention gap.
- *Green Labelling:* Investigate whether there is an increase in purchasing intention among GenZ consumers for green labeled GHFs or GHs.
- *Green Advertising:* Investigate the effects on GenZ consumers' purchasing intentions when media or marketers promote a green lifestyle and environmental stewardship in connection with GHs and their features.

- *Trends: Longitudinal study of GenZ consumers' perceptions of GHs and GHFs:* A longitudinal study on how willingness to buy GHs and GHFs evolves over the years among GenZ consumers.
- *Trends: Study of the consumer's perception of GHs in connection with demographic factors:* Explore the influence of demographic factors (e.g., age, gender, background …) on GenZ's perception of green homes.
- *Investigate the gap between the self-reported green premium from the current study with the market green premiums rates:* Investigate and verify if the ongoing green premium rates in the market is anywhere closer to the percentage reported in this study.

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APPENDIX A: IRB APPROVAL

This Memo is Generated From the Purdue University Human Research Protection Program System, Cayuse IRB.

*****THIS LETTER IS BEING ISSUED DURING THE FACE TO FACE RESTRICTION ON HUMAN SUBJECTS RESEARCH STUDIES RELATED TO COVID-19. THIS DOCUMENT SERVES AS PROTOCOL APPROVAL FROM THE HRPP/IRB, BUT DOES NOT PERMIT FACE TO FACE RESEARCH UNTIL AN APPROVED UNIVERSITY COVID-19 RESEARCH SPACE SOP PERMITS RESEARCH OPERATIONS. ******

Date: March 31, 2021

PI: LUCIANA DE CRESCE EL DEBS

Re: Modification - IRB-2020-1414

Investigating the Generation Zs' Perspective of Green Homes and Green Home Features

The Purdue University Institutional Review Board has approved the modification for your study "*Investigating the Generation Zs' Perspective of Green Homes and Green Home Features*. " The Category for this Exemption is listed below. This study maintains a status of exempt and an administrative check-in date of October 25, 2023. The IRB must be notified when this study is closed. If a study closure request has not been initiated by this date, the HRPP will request study status update for the record.

Specific details about your modification approval appear below.

Decision: Exempt

Research Notes: NA

Category: Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

Findings:

Research Notes: Please follow Purdue University Guidance for enhanced PPE for close-up, person-to-person interactions in research for the face-to-face interviews.

Any modifications to the approved study must be submitted for review through Cayuse IRB. All approval letters and study documents are located within the Study Details in Cayuse IRB.

Sincerely,

Purdue University Human Research Protection Program/ Institutional Review Board
Login to Cayuse IRB

See Purdue HRPP/IRB Measures in Response to COVID-19 https://www.irb.purdue.edu/docs/IRB%20Covid-19%20Recommendations.pdf

APPENDIX B: SURVEY INSTRUMENT

Demographics

1) What is your age?
   - o 18-24 years old
   - o 25-40 years old
   - o 41 years or older
   - o Prefer not to say
2) What is your classification in college for your current major? If you are enrolled in two or more majors, choose the highest classification.
   - o Freshmen
   - o Sophomore
   - o Junior
   - o Senior
   - o Graduate
   - o Other ——————
3) Gender
   - o Male
   - o Female
   - o Prefer not to say
   - o Other
4) Originally from or which country/location do you most identify with culturally?
   - o United States
   - o North America outside the United States
   - o South America
   - o Europe
   - o Africa
   - o Asia
   - o Australia
   - o Carabian Islands
   - o Pacific Islands

- Others
- Prefer not to say

5) Choose the best option to describe the environment in which you grew up:
   - Urban (inside the interior of a major city)
   - Sub Urban (outside the interior of a major city, or inside a town or small city)
   - Rural (inside a small town, or outside of any town)

Green Home and Green Home Features

6) Suppose you were in the market to buy a house to live in for a long time, and you had enough money to comfortably afford the features listed below. Which features would you agree to buy? (Likert scale: Rate it between 1 to 5 where 1 = "Not at all interested", and 5 = "Extremely interested"; 6 – I don't know about this feature)
   - Rain water harvesting
   - Grey water recycling
   - Water efficient irrigation
   - Dual-flush toilets and low flow faucets/showers
   - Tankless water heater system
   - Energy efficient appliances
   - Heat pumps (a type of heating and cooling system)
   - Low VOC paint and carpet materials (VOC - Volatile Organic Compounds, includes chemical substance)
   - Eco friendly building materials (rammed earth, bamboo, mass timber)
   - Recycled or Reclaimed home products
   - Solar Panels

Perspective on GH

7) How do you compare the labels "green" and "sustainable" homes, as a homebuyer?
   - They are same
   - Sustainable homes are more environmentally friendly than green homes
   - Green homes are more environmentally friendly than sustainable homes

8) As a homebuyer, what is your opinion on having some kind of certification from a third-party program that evaluates how green or sustainable homes are (for example, LEED, Energy Star, WELL building, etc.)?

- It is extremely important to me
- It doesn't matter if I get a certificate or not
- I don't know anything about certification programs
- I think it's interesting, and I would like to learn more about these certification programs

Consumer Behavior

9) Please rate the degree to which you agree or disagree with the follow statements regarding the application of green principles to homes: (Likert scale 1 = strongly disagree to 5 = strongly agree)
   - I should probably be doing more to prevent climate change
   - I feel personally responsible for keeping the environment healthy.
   - A lot people make too big a deal about environmental issues.
   - Investing in green home features would make me feel better about myself.
   - One reason why I'd like green home features in my home is simply that I want to be a good person and contribute to sustainable environment
   - Even if it's costly, investing in green home features is important, because it's the right thing to do.
   - My friends and family would be proud of me for investing in green features for my home.
   - One good thing about green home features is that you don't have to worry about disapproval from your neighbors.
   - I'd like my home to have at least a few green features, because I don't want people to think I don't care about the environment.
   - Green home features are important because they increase the value of the home.
   - Green home features provide valuable tax benefits and other incentives
   - Green home features help by saving a lot of money on water and electricity bills
10) To what extent do you agree or disagree the following as significant obstacles that hinder your decision of adopting or installing the green features in your home?

    (Rate it between 1 to 5 where, 1 = "Strongly disagree ", and 5 = "Strongly agree")
   - Lack of information on perceived benefits and savings
   - Perceived Effort - lack of time and patience to analyze different features
   - Lack of choice - most of these features are decided by builders/ architects and we are given little or no choice

11) How willing are you to purchase a green home in the future? (5 point Likert scale where 1 = "Strongly disagree" and 5 = "Strongly agree")

(Green Home: A home that is designed and constructed in a way that increases efficiency and minimizes the consumption of energy, water, and other resources, and at the same time these homes provide enhanced indoor environmental quality for the occupants and minimize the negative impact on the environment are called green homes)

12) How much more are you willing to pay for green home or their features when compared to the cost of conventional or traditional homes?

- % of cost above the base price of conventional or traditional homes – 0 to 100 slider (intervals of 10)

APPENDIX C: FLYER