Consumer Sustainability: A Study on Smart and Green Homes in Erode

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***Abstract*—Smart and green homes represent the integration of advanced technology and sustainable building practices to create energy-efficient, eco-friendly living environments. These homes incorporate features such as solar panels, smart meters, automated lighting, rainwater harvesting, and eco-conscious materials, enabling residents to reduce their carbon footprint and utility costs. By promoting responsible resource usage and offering enhanced comfort and security, smart and green homes play a vital role in addressing environmental concerns and urban sustainability. Despite the increasing awareness and adoption of smart and green homes, consumer sustainability perceptions remain varied and underexplored, especially in tier-two cities like Erode whereas there is limited empirical research assessing these dynamics in a localized context. In view of this point, this study focused on analyzing consumer sustainability in relation to smart and green homes in Erode. A descriptive research design was adopted, incorporating both primary and secondary data. The primary data were collected using a structured questionnaire targeting consumers who had adopted and maintained smart and green housing solutions. The questionnaire, designed on a 5-point Likert scale, measured key dimensions of sustainability. Secondary data were sourced from books, academic journals, research publications, and credible online materials. A random sampling method was used to select 134 respondents. The sample data were organized using MS-Excel and approaching tools statistical techniques namely percentage analysis, mean score, standard deviation and ANOVA to analyze the sample data with the help of SPSS version 26.0. It is justified that the consumers belong to female, 41-50 years age category, high level environmental awareness, energy-efficient preferences and those residing in independent houses display stronger sustainability orientation on smart and green homes.**

***Index Terms*—Smart Homes, Green Homes, Consumer Sustainability, Energy Efficiency, Environmental Awareness, Sustainable Preferences, Smart Technology.**

I. INTRODUCTION

Smart and green homes are modern residential buildings designed to promote both environmental sustainability and advanced technological convenience. A smart home uses connected technologies like the Internet of Things (IoT), smart thermostats, lighting systems, security devices, and voice-controlled appliances to enhance energy efficiency, comfort, and security. A green home, on the other hand, focuses on eco-friendly construction practices, renewable energy sources (such as solar panels), water conservation systems (like rainwater harvesting), and the use of sustainable materials (like bamboo and recycled concrete). When combined, smart and green homes aim to reduce energy and water usage, lower carbon emissions, and support sustainable living, all while providing a high-tech, comfortable living experience. These homes are increasingly favored by environmentally conscious consumers and are often supported by government incentives and regulations promoting green construction and smart city development. Consumer sustainability on smart and green homes reflects the awareness, preferences, and behavioral intentions of individuals towards adopting eco-friendly and energy-efficient living spaces. Increasing environmental consciousness and rising energy costs have shifted consumer preferences toward sustainable housing that incorporates smart technologies, renewable energy sources, and efficient resource management systems. Consumers now actively seek homes that reduce carbon footprints, conserve water, and optimize energy consumption through automation and renewable integration. These sustainable choices are also influenced by long-term financial savings, health benefits, and environmental responsibility. Moreover,

smart homes equipped with real-time monitoring systems help consumers make informed energy decisions and promote sustainable habits.

II. REVIEW OF LITERATURE

The researchers Kota et al. (2022) mentioned that Generation Z consumers are primarily motivated by intrinsic values, such as environmental concern and personal commitment to sustainability, when considering green homes. Further, non-normative motivations, including health benefits and future monetary returns, also influenced their preferences whereas instrumental motivations, like cost savings, had minimal impact on their purchase intentions. Moreover, barriers identified were lack of choice in green features, insufficient information, and the perceived complexity of evaluating such features but energy-efficient appliances and solar panels were the most well-known and preferred green home features. In case of Ferreira et al. (2023) measured that environmental awareness significantly moderates the adoption and recommendation of smart home technologies. Also, individuals with higher environmental awareness are more influenced by facilitating conditions and less by habitual behavior whereas their intention to recommend smart homes is less reliant on actual use behavior. The study of Puttamanjaiah et al. (2024) observed that awareness, accessibility, epistemic values, and technology adoption propensity significantly influence subjective norms, which in turn affect consumers' behavioral intentions and actual adoption of smart and sustainable building materials. However, challenges in adoption negatively impact these norms. Among all factors, awareness had the most substantial effect. Further, subjective norms also played a critical mediating role in driving adoption behavior through behavioral intention.

According to Rajendra and Mohanasundaram (2025) identified that civil engineers and architects significantly influence consumer adoption of smart and green building materials through education, marketing strategies and decision-making involvement. Additionally, income was found to be a moderating factor in consumer adoption. Also, environmental benefits were a major driver for adoption, while key barriers included high initial costs, limited availability, and regulatory complexity whereas a lack of standard certification systems further restricted adoption. The author Samarasinghe (2012) depicted that health consciousness is the most significant factor influencing Sri Lankan consumers' intentions to live in or purchase green homes. In contrast, environmental awareness, knowledge of green features, and comfort consciousness had minimal influence whereas socio-economic constraints and ingrained habits further limited green home adoption. Also, consumers from lower and middle-income groups showed greater motivation driven by health-related concerns while overexposure to green marketing without credibility also led to skepticism. The result of Strzelecki et al. (2024) confirmed that performance expectancy and personal innovativeness are determinants influencing the adoption of smart home technologies. In addition, smart homes significantly enhance sustainable consumption behaviors by improving resource efficiency in electricity, water, and gas management. Also, the integration of health, wellbeing, and environmental consciousness indicated a strong correlation between smart technology use and eco-friendly behavior. Moreover, smart homes contribute positively to the digital economy's sustainability objectives.

III. STATEMENT OF THE PROBLEM

The concept of smart and green homes has gained momentum due to growing environmental awareness, rising energy costs and the need for sustainable urban living in recent years. Consumers are increasingly inclined toward eco-friendly housing solutions that incorporate energy efficiency, smart technologies and sustainable materials. However, despite the increasing attention and policy support, there remains a significant gap in understanding consumer sustainability, how consumers perceive, adopt and sustain such housing choices over time. In regions like Erode, where urbanization is on the rise, there is limited empirical research examining the factors influencing consumer sustainability toward smart and green homes. Challenges such as affordability, lack of awareness, limited availability, and technological hesitance further complicate adoption. Hence, this study aimed to address these gaps by analyzing the demographic and behavioral factors influencing

consumer sustainability on smart and green homes in Erode.

Objectives of the study

- To explore the demographic profile of the selected consumers who adopted smart and green homes in Erode.
- To analyze the consumer sustainability on smart and green homes in the study area.

Hypothesis of the study

- There is no significant difference in mean consumer sustainability on smart and green homes with regard to their housing type.
- There is no significant difference in mean consumer sustainability on smart and green homes with regard to their environmental awareness.
- There is no significant difference in mean consumer sustainability on smart and green homes with regard to their sustainable preferences.

IV. RESEARCH METHODS

This study employed a descriptive research design to examine consumer sustainability on smart and green homes in Erode. Both primary and secondary data sources were utilized for comprehensive analysis. The target population comprised consumers who had adopted smart and green home solutions. The primary data were gathered through a structured questionnaire and the secondary data were sourced from credible references, including academic journals, books, published articles, and reputable online materials. This study collected respondents' demographic profiles and their sustainability adoption in smart and green homes with the help of 5-point Likert scale to evaluate various aspects of sustainability. A random sampling technique was applied to select the sample size of 134 respondents. Data entry was performed using MS Excel and statistical analysis was conducted through SPSS version 26.0, employing tools such as percentage analysis, mean score, standard deviation and ANOVA.

V. RESULT AND DISCUSSION

5.1 Demographic profile of the Respondents

The following analysis provides an overview of the demographic characteristics of consumers in Erode and their level of sustainability related to smart and green homes.

Table 1: Demographic Profile and Consumer Sustainability on Smart and Green Homes

No.	Variables Name	Number of Respondents	%	Mean	SD
1	Gender				
	• Male	78	58.2	3.71	0.51
	• Female	56	41.8	3.75	0.49
	Total	134	100.0		
2	Age				
	• Upto 30 Years	16	11.9	3.57	0.57
	• 31-40 Years	50	37.4	3.58	0.55
	• 41-50 Years	39	29.1	3.89	0.42
	• Above 50 Years	29	21.6	3.78	0.41
	Total	134	100.0		
3	Housing Type				
	• Independent House	85	63.4	3.80	0.43
	• Apartment	49	36.6	3.54	0.57
	Total	134	100.0		
4	Environmental Awareness				
	• Low	41	30.6	3.81	0.49
	• Medium	64	47.8	3.54	0.53
	• High	29	21.6	3.87	0.33
	Total	134	100.0		
5	Sustainable Preferences				
	• Energy Efficiency (Solar, LED, etc.)	32	23.9	3.89	0.50

No.	Variables Name	Number of Respondents	%	Mean	SD
	• Water Conservation (Rainwater Harvesting, Low-flow Fixtures)	61	45.5	3.84	0.53
	• Smart Technology (IoT, Smart meters)	25	18.7	3.85	0.35
	• Eco-Friendly Materials (Bamboo, Recycled concrete)	16	11.9	3.54	0.42
	Total	134	100.0		

- The above table observed that 58.2% of the respondents are male and 41.8% of the respondents are female.
- It is explored from the analysis that 11.9% of the respondents are belong to age segment of upto 30 years, 37.4% of the respondents are between 31–40 years of age group, 29.1% of the respondents are between 41–50 years and 21.6% of the respondents are above 50 years aged.
- The analysis assumed that 63.4% of the respondents live in independent houses while 36.6% live in apartments.
- It is mentioned from the analysis that 30.6% of the respondents have low level of environmental awareness, 47.8% have medium level of environmental awareness and 21.6% have high level of environmental awareness.
- The analysis justified that 23.9% of the respondents prefer energy efficiency (Solar, LED, etc.), 45.5% of the respondents prefer water conservation (Rainwater Harvesting, Low-flow Fixtures), 18.7% of the respondents prefer smart technology (IoT, Smart meters) and 11.9% of the respondents prefer eco-friendly materials (Bamboo, Recycled concrete).

5.2 Consumer sustainability on smart and green homes
The following table presents the consumer sustainability on smart and green homes in Erode. For this study, the researcher developed eight specific statements to assess various aspects of consumer sustainability, including preferences for eco-friendly materials, willingness to invest in energy-efficient technologies, environmental responsibility, and sustainable home features such as water conservation and smart systems. Each statement was measured using a 5-point Likert scale, and the responses were analyzed to understand the degree of consumer commitment towards sustainable living and their attitudes towards adopting green housing practices.

Table 2: Consumer Sustainability on Smart and Green Homes

S. No.	Dimensions of Consumer Sustainability	Mean	SD
1	I actively prefer homes that incorporate eco-friendly construction materials	3.77	1.00
2	I am willing to pay more for smart homes that reduce energy consumption	3.96	0.90
3	I make housing choices based on long-term environmental sustainability	3.58	1.12
4	I believe smart technologies in homes contribute to a sustainable lifestyle	3.81	1.01
5	I support green homes because they help reduce carbon footprint	3.93	0.92
6	I consider water-saving features essential in choosing a sustainable home	3.89	0.98
7	I practice sustainable behaviors in my home such as waste segregation and energy saving	3.14	1.08
8	I feel a sense of responsibility to adopt sustainable housing options	3.58	1.24

It could be observed from the above table that the Cronbach's Alpha value for the statements on consumer sustainability on smart and green homes is 0.895, confirming that the scale used is highly reliable and internally consistent for further statistical analysis. The highest mean score was recorded for the statement "I am willing to pay more for smart homes that reduce energy consumption" with a mean of 3.96 and a standard deviation of 0.90, followed by "I support green homes because they help reduce carbon footprint" (Mean = 3.93, SD = 0.92) whereas the lowest mean score was observed for "I practice sustainable behaviors in my home such as waste segregation and energy saving" with a mean of 3.14 and SD of 1.08.

Testing of Hypothesis (ANOVA)

5.3 Relationship between Independent Variables and Consumer Sustainability on Smart and Green Homes
This section investigates the relationship between the selected independent variables and consumer sustainability on smart and green homes in Erode. To examine this relationship, a hypothesis was formulated

and tested using the Analysis of Variance (ANOVA) technique.

Housing Type and Consumer Sustainability on Smart and Green Homes

H_0: There is no significant difference in mean consumer sustainability on smart and green homes with regard to their housing type.

Table 3: Housing Type and Consumer Sustainability on Smart and Green Homes

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	2.160	1	2.160	9.025	0.003*
Within Groups	31.589	132	0.239		
Total	33.748	133			

Note: * – Significant at 1% level

It is depicted from the above table that the 'p' value is 0.003, which is less than 0.01 therefore the null hypothesis is rejected. The analysis indicated that there is a significant difference in the mean consumer sustainability on smart and green homes with respect to their housing type. So, consumers residing in different housing types such as independent houses and apartments perceive sustainability on smart and green homes differently.

Environmental Awareness and Consumer Sustainability on Smart and Green Homes

H_0: There is no significant difference in mean consumer sustainability on smart and green homes with regard to their environmental awareness.

Table 4: Environmental Awareness and Consumer Sustainability on Smart and Green Homes

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	3.281	2	1.640	7.053	0.001*
Within Groups	30.467	131	0.233		
Total	33.748	133			

Note: * – Significant at 1% level

From the above table, it is surmised that the 'p' value is 0.001 which is less than 0.01 then the null hypothesis is rejected. The analysis confirmed that there is a significant difference in the mean consumer sustainability on smart and green homes with respect to their level of environmental awareness. Hence, consumers with varying degrees of environmental awareness like low, medium and high demonstrate different levels of adoption towards sustainable and smart housing practices.

Sustainable Preferences and Consumer Sustainability on Smart and Green Homes

H_0: There is no significant difference in mean consumer sustainability on smart and green homes with regard to their sustainable preferences.

Table 5: Sustainable Preferences and Consumer Sustainability on Smart and Green Homes

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	3.208	3	1.069	4.552	0.005*
Within Groups	30.540	130	0.235		
Total	33.748	133			

Note: * – Significant at 1% level

It is pointed out from the above table that the 'p' value is 0.005, which is less than 0.01 consequently the null hypothesis is rejected. The analysis proved that there is a statistically significant difference in consumer sustainability on smart and green homes based on their sustainable preferences. Therefore, it is assumed that respondents who prioritize different sustainability aspects such as energy efficiency, water conservation, smart technologies, or eco-friendly materials vary significantly in their overall adoption of smart and green homes.

VI. FINDINGS

- It is indicated from the analysis that male respondents are higher in number. The analysis measured that female respondents have a higher level (Mean = 3.75) of sustainability on smart and green homes than male respondents.

- It is inferred from the analysis that most respondents fall in the 31–40 years category. The analysis displayed that respondents in the 41–50 years age group have the highest level (Mean = 3.89) sustainability on smart and green homes.
- It is showed from the analysis that respondents from independent houses are the majority. It is evaluated from the study that respondents living in independent houses have a higher level of sustainability (Mean = 3.80) on smart and green homes compared to apartment dwellers.
- It is found from the analysis that most respondents have medium level of environmental awareness. However, the respondents with high level (Mean = 3.87) awareness on environmental indicated a greater sustainability perception on smart and green homes.
- It is identified from the analysis that the majority of respondents prefer water conservation methods. The analysis noticed that respondents preferring energy efficiency have the highest level (Mean = 3.89) of sustainability on smart and green homes.
- The mean score analysis illuminated that the highest mean score was recorded for the statement 'I am willing to pay more for smart homes that reduce energy consumption' with a mean of 3.96 whereas the lowest mean score was observed for "I practice sustainable behaviors in my home such as waste segregation and energy saving" with a mean of 3.14.
- From the ANOVA, it is displayed that there is a significant difference in the mean consumer sustainability on smart and green homes with respect to their housing type.
- It is mentioned from the 'F" test that there is a significant difference in the mean consumer sustainability on smart and green homes with respect to their level of environmental awareness.
- The result of ANOVA justified that there is a statistically significant difference in consumer sustainability on smart and green homes based on their sustainable preferences.

VII. SUGGESTIONS

- The analysis showed that female respondents show a higher sustainability level towards smart and green homes. Therefore, home developers and marketers can design targeted campaigns highlighting eco-friendly features that resonate more with women, such as health benefits, family well-being and household efficiency.
- From the study, it is revealed that the respondents aged 41–50 years indicated the highest sustainability levels on smart and green homes. Hence, awareness programs and promotional strategies for smart and green homes can be effectively tailored among the consumers of all the age group by emphasizing long-term investment benefits and environmental responsibility.
- It is mentioned from the findings that independent house residents show higher sustainability on smart and green homes. Therefore, home developers can promote individual green home projects or customization options in standalone units, focusing on autonomy in implementing sustainable solutions like solar panels or rainwater harvesting.
- This study indicated that the consumers with high environmental awareness exhibit greater sustainability orientation. So, increasing eco-awareness through educational campaigns, digital outreach and green certification programs may further boost adoption of smart and green homes.
- It is depicted that the respondents with preferences for energy efficiency display the highest sustainability levels. Hence, green home projects should prominently highlight energy-saving technologies such as solar energy, LED lighting, and smart meters in their design and promotion efforts.

VIII. CONCLUSION

The researchers aimed to analyse consumer sustainability on smart and green homes in Erode district. A favourable understanding towards smart and green homes reflects consumers' growing environmental awareness and preference for sustainable living. The study showed that there is a significant difference in mean consumer sustainability based on behavioural variables such as housing type, environmental awareness and sustainable preferences. Hence, it is revealed that home developers and policymakers should focus on promoting smart and green housing features through targeted awareness

programs, eco-friendly incentives and energy-efficient solutions. In addition, encouraging community participation and highlighting long-term environmental and financial benefits can further enhance adoption of sustainable housing practices in the region.

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