

Adoption of Green Products for Climate Change Mitigation: Sustainable Pathways in Urban Chennai

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Abstract

Climate change presents a critical challenge for rapidly urbanizing cities such as Chennai, where rising temperatures, extreme weather events, and increasing pressure on natural resources threaten environmental and socio-economic sustainability. Green products, designed to minimize environmental impacts throughout their life cycle, offer a viable pathway for climate change mitigation and sustainable urban development. This study examines the adoption of green products among urban residents in Chennai using a structured survey of 60 respondents, supported by secondary data and case-based evidence. The findings reveal that government initiatives, corporate sustainability practices, and growing environmental awareness significantly influence adoption, while high costs, limited availability, and inadequate consumer knowledge remain major barriers. Statistical analysis using the Chi-square test confirms a significant association between age and awareness levels, as well as between educational qualification and adoption challenges. The study proposes policy-driven and market-based interventions to enhance green product adoption and emphasizes their role in achieving Sustainable Development Goals (SDG 11, SDG 12, and SDG 13).

Keywords: Green Products, Climate Change Mitigation, Sustainable Consumption, Urban Chennai, Consumer Awareness.

Introduction

Climate change has emerged as one of the most pressing global challenges, significantly affecting ecological balance, economic stability, and human well-being. Urban centres, particularly in developing countries, are disproportionately vulnerable due to high population density, energy-intensive lifestyles, and rapid infrastructure expansion. Chennai, a major metropolitan city located on India's southeastern coast, is increasingly exposed to climate-related hazards such as rising temperatures, erratic rainfall, urban flooding, water scarcity, and coastal erosion. Recent extreme events, notably the floods of 2015 and 2021, have resulted in substantial economic losses, disruption of essential services, and social dislocation. In addition, unplanned urbanization and escalating energy demand have intensified the urban heat island effect, accelerated resource depletion, and exacerbated environmental stress. These challenges highlight the urgent need to adopt sustainable consumption practices as an integral component of climate change mitigation strategies. Green products—defined as goods and services that minimize environmental harm throughout their production, usage, and disposal stages—play a critical role in reducing greenhouse gas emissions, conserving natural resources, and promoting circular economy principles. The adoption of such products aligns closely with the United

Nations Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Despite the implementation of policy initiatives such as the Chennai Smart City Mission and various incentives promoting energy-efficient appliances and renewable energy adoption, the uptake of green products remains uneven across consumer segments. Against this backdrop, the present study seeks to analyse consumer awareness, adoption behaviour, and the barriers to green product usage in urban Chennai, with the objective of providing actionable insights for policymakers, businesses, and civil society stakeholders.

Review of Literature

Several studies highlight increasing environmental awareness among urban populations. The Citizen Consumer and Civic Action Group (CAG) reported that over 90% of Chennai residents engage in energy-saving practices, while nearly 80% actively participate in waste reduction initiatives. Tamil Nadu's Greenhouse Gas Inventory and Pathways Report outlines a strategic roadmap toward achieving net-zero emissions by 2070, emphasizing renewable energy, sustainable urban planning, and energy efficiency.

Chennai's Climate Action Plan (CAP) targets carbon neutrality by 2050 through integrated urban planning and emission reduction strategies. Youth-led enterprises have also contributed to promoting eco-friendly products such as sustainable furniture and organic food.

Indrajit Ghosal et al. (2021) identified factors influencing online green product purchases, revealing that flexible payment options and product availability significantly impact consumer behaviour. Previous studies consistently emphasize that while awareness is rising, affordability and accessibility remain persistent constraints to widespread adoption.

Statement of the Problem

Despite increasing awareness of climate change, the adoption of green products in urban Chennai remains limited. High costs, insufficient product availability, and lack of reliable information discourage consumers from adopting eco-friendly alternatives. Understanding these challenges and their relationship with demographic factors is essential for developing effective strategies for sustainable urban development.

Objectives of the Study

- To analyse the level of awareness and utilization of green products among urban residents in Chennai.
- To identify the factors influencing consumer adoption of green products.
- To examine the barriers faced by consumers in adopting green products for climate change mitigation.

Research Methodology

The study adopts a mixed-method research design using both primary and secondary data. Primary data were collected through a structured questionnaire administered to 60 respondents selected using simple random sampling from different urban localities of Chennai. The survey assessed awareness, perceptions, and usage of green products. Secondary data were sourced

from journals, books, reports, and credible online sources. Data were analysed using SPSS, employing percentage analysis and Chi-square tests to examine associations between demographic variables and adoption behaviour.

Hypotheses

- H₁: There is a significant association between age and awareness of green products among urban residents in Chennai.
- H₂: There is a significant association between educational qualification and the challenges faced in adopting green products.

Data Analysis and Interpretation

Variable	Category	Frequency	Percentage
Gender	Male	28	47
	Female	32	53
Age Group	18–25 years	32	53
	26–33 years	5	9
	33–40 years	15	25
	Above 40 years	8	13
Educational Qualification	Higher Secondary / Diploma	7	12
	Undergraduate	39	65
	Postgraduate	14	23
Occupation	Student	26	43
	Private Employee	18	30
	Government Employee	8	13
	Self-employed	8	14
Monthly Income (₹)	Below 20,000	21	35
	20,001 – 40,000	19	32
	40,001 – 60,000	12	20
	Above 60,000	8	13
Type of Family	Nuclear	38	63
	Joint	22	37
Area of Residence	Central Chennai	24	40
	North Chennai	14	23
	South Chennai	22	37

Source: Computed

Interpretation of Demographic Profile

The demographic analysis provides valuable insights into the socio-economic characteristics of the respondents and their potential influence on the adoption of green products in urban Chennai.

- **Gender Composition:** The sample comprised 53% female and 47% male respondents, indicating a fairly balanced gender representation with a slight predominance of female participants. This suggests that women may be more willing to participate in studies related to sustainability and environmental responsibility. Previous studies have also indicated that female consumers often exhibit stronger pro-environmental attitudes and greater involvement in sustainable purchasing decisions, which may positively influence green product adoption.
- **Age Distribution:** A significant proportion of respondents (53%) belonged to the 18–25 age group, followed by 25% in the 33–40 age group. This concentration of younger respondents indicates that awareness and interest in environmental issues are more pronounced among youth. Younger consumers are generally more exposed to sustainability-related content through education and social media platforms, making them more receptive to green consumption practices. The relatively lower representation of older age groups suggests the need for targeted awareness initiatives aimed at middle-aged and senior populations.
- **Educational Qualification:** Educational attainment among respondents was relatively high, with 65% undergraduates and 23% postgraduates, while only 12% had completed higher secondary or diploma education. This distribution indicates that higher education plays a crucial role in shaping environmental awareness and responsible consumption behavior. Educated individuals are more likely to understand the long-term benefits of green products and climate change mitigation, which can positively influence their purchasing decisions.
- **Occupational Status:** Regarding occupation, 43% of the respondents were students, followed by 30% private sector employees, 13% government employees, and 14% self-employed individuals. The dominance of students highlights the growing environmental consciousness among the younger generation. Private and government sector employees represent economically active groups who can significantly contribute to sustainable consumption if affordability and availability barriers are addressed.
- **Monthly Income:** Income distribution reveals that 35% of respondents earned below ₹20,000 per month, while 32% earned between ₹20,001 and ₹40,000. Only 13% reported income above ₹60,000. This indicates that a majority of respondents belong to low- and middle-income groups. Income level plays a critical role in green product adoption, as eco-friendly products are often perceived as relatively expensive. The findings suggest that pricing strategies and government subsidies are essential to promote wider adoption among economically constrained consumers.
- **Type of Family:** The analysis shows that 63% of respondents belonged to nuclear families, while 37% lived in joint families. Nuclear families often have greater autonomy in purchasing decisions and are more inclined toward adopting new consumption patterns,

including green products. Joint families, on the other hand, may prioritize cost considerations over environmental concerns, which can influence adoption behaviour.

- **Area of Residence:** With respect to residential location, 40% of respondents resided in Central Chennai, followed by 37% in South Chennai and 23% in North Chennai. Central and South Chennai are relatively better developed in terms of retail infrastructure and access to eco-friendly products, which may facilitate higher awareness and usage. The lower representation from North Chennai highlights potential disparities in accessibility and calls for improved distribution networks across all urban regions.
- Overall, the demographic profile indicates that younger, educated, and economically active urban residents are more inclined toward awareness and potential adoption of green products. However, income constraints, residential disparities, and varying occupational backgrounds influence actual adoption behaviour. These findings underscore the importance of targeted policy interventions, affordability measures, and region-specific awareness programs to enhance green product adoption and support climate change mitigation efforts in urban Chennai.

Hypothesis Testing

Test No.	Hypothesis Tested	Chi-square Value (χ^2)	Degrees of Freedom	Table Value (5% level)	Result
Test I	Association between age and awareness of green products	18.07	9	16.91	Significant
Test II	Association between educational qualification and challenges in adopting green products	14.02	6	12.59	Significant

The Chi-square analysis was conducted to examine the relationship between selected demographic variables and consumer behavior towards green products in urban Chennai. The results provide statistically significant evidence regarding the factors influencing awareness and adoption challenges.

- **Test I: Association between Age and Awareness of Green Products:** The calculated Chi-square value for the association between age and awareness of green products is 18.07, which exceeds the table value of 16.91 at the 5% level of significance with 9 degrees of freedom. As the calculated value is greater than the critical value, the null hypothesis is rejected, and the alternative hypothesis is accepted.
- This result indicates a significant association between age and awareness of green products. The findings suggest that awareness levels vary across different age groups, with younger respondents exhibiting higher awareness compared to older age groups. This can be attributed to greater exposure of younger individuals to environmental education, digital media, and sustainability-oriented campaigns. The result highlights the importance of age-specific awareness programs, particularly targeting older populations to bridge the awareness gap.

- Test II: Association between Educational Qualification and Challenges in Adopting Green Products: In the second test, the calculated Chi-square value is 14.02, which is higher than the table value of 12.59 at the 5% level of significance with 6 degrees of freedom. Consequently, the null hypothesis is rejected, confirming a significant association between educational qualification and the challenges faced in adopting green products.
- This finding reveals that consumers with lower educational qualifications experience greater difficulties, such as lack of awareness, difficulty in usage, and challenges in accessing green products. In contrast, respondents with higher educational levels are better informed and more capable of understanding the benefits and usage of eco-friendly products. This underscores the role of education in facilitating informed and sustainable consumption behaviour.

The Chi-square test results collectively demonstrate that demographic factors significantly influence both awareness and adoption barriers related to green products. While younger and more educated consumers show higher awareness and fewer challenges, older and less-educated groups require targeted interventions. These findings emphasize the need for demographically tailored policy measures, educational initiatives, and marketing strategies to promote widespread adoption of green products and strengthen climate change mitigation efforts in urban Chennai.

Findings

- Younger respondents (18–25 years) demonstrated higher awareness of green products.
- Educational qualification significantly influenced the type and intensity of adoption challenges.
- Adoption levels remain moderate despite reasonable awareness, mainly due to cost and availability constraints.
- Female respondents showed slightly higher engagement in sustainable purchasing.
- Organic food products were the most commonly used green products.
- Social media emerged as the primary source of information on green products.

Suggestions

- Strengthen awareness campaigns through educational institutions, media, and community programs.
- Introduce financial incentives such as subsidies, tax benefits, and price support mechanisms.
- Improve product availability through retail and e-commerce expansion.
- Encourage collaboration between businesses, NGOs, and local authorities.
- Integrate sustainability education into academic curricula.
- Establish consumer feedback mechanisms to improve product design and accessibility.

Conclusion

The study underscores that demographic factors, particularly age and educational attainment, play a significant role in shaping awareness and adoption of green products among urban consumers in Chennai. Although awareness levels are steadily increasing, the translation of

awareness into actual adoption remains constrained by persistent economic and infrastructural barriers, including higher costs and limited product availability. Addressing these challenges necessitates coordinated policy interventions, strengthened supply chain mechanisms, and sustained consumer education initiatives.

Promoting the adoption of green products extends beyond environmental considerations; it represents a strategic pathway to enhancing urban resilience, improving public health outcomes, and fostering sustainable economic growth. By embedding green consumption practices within Chennai's broader climate action and urban development strategies, stakeholders can significantly accelerate long-term climate change mitigation efforts and contribute to the realization of sustainable urban transformation.

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