ISSN–2278-5655

AMIERJ Aarhat Multidisciplinary International Education Research Journal

Volume–XV, Special Issue– I (d) March – April, 2026

OPEN ACCESS Original Research Article

CONSUMER PREFERENCE DYNAMICS IN THE DIGITAL BOTANICAL SECTOR

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Abstract:

The digital revolution has fundamentally reshaped consumer interactions within niche markets, including the traditionally physical botanical industry. This research explores the shifting landscape of consumer behavior, specifically focusing on the transition from brick- and-mortar nurseries to digital e-commerce platforms. While live plants are inherently perishable and fragile, making the tactile experience of a physical nursery seem indispensable, this study investigates whether modern consumers are willing to trade hand- picking greenery for the convenience and variety of digital storefronts. The primary objective is to determine if digital platforms have become a favored method for purchasing both live plants and gardening equipment over traditional retail locations. The research evaluates consumer trends, analyzes different product categories, and assesses the overall viability of the botanical e-commerce sector.

Adopting a quantitative methodology, the study collected primary data through an online survey of 113 participants, predominantly from urban areas like Mumbai and Bangalore. The demographic analysis revealed that the most active participants are middle- aged (36-50 years old), with women and homemakers showing the highest engagement in botanical e-commerce. Statistical analysis, including a one-sample proportion Z-test performed using R software, provided strong evidence (p-value < 0.001) that consumers now show a significant preference for purchasing plants and related products online rather than through offline stores. Specifically, 54.9% of respondents purchase plants online at least once a month, and 70.8% purchase gardening equipment online.

The findings highlight that consumer trust in digital botanical platforms is heavily influenced by high-quality content, such as detailed plant care instructions and clear product images, which affected over 50% of buyers. Additionally, 68.1% of respondents expressed a preference for platforms that provide educational plant care tips. There is also a strong willingness (66.3%) to purchase "botanical bundles" that combine plants and equipment into a single transaction. However, the study identified critical logistical and educational gaps, with consumers demanding faster delivery, safer packaging, and better care information. To address these needs, the research proposes a prototype e-commerce system built with a technology stack including HTML5, CSS3, PHP 8.x, and MySQL 8.0, focusing on user-friendly design and integrated care guidance.

The botanical industry is undergoing a significant digital transformation where the reliance on physical inspection is giving way to a digital-first approach. For businesses to remain competitive, they must adopt omnichannel strategies that prioritize secure payments, responsive web design, and comprehensive educational content. While the sensory experience of a physical nursery remains cherished, it is no longer the primary entry point for plant enthusiasts, marking a pivotal moment where technology and nature integrate to create a more efficient and diverse marketplace.

Keywords: *Botanical E-commerce, Consumer Behavior, Online Plant Shopping, Digital Transformation, Gardening Equipment, E-commerce Platforms, Urban Consumers, Purchase Preference, Digital Nurseries, Omnichannel Retail.*

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Introduction:

The digital revolution has fundamentally reshaped how consumers interact with niche markets, including the once-traditional botanical industry. While local nurseries and physical garden centers have long been the primary source for plant enthusiasts, the rise of e-commerce has introduced a new dynamic to this "green" sector. This research aims to explore the shifting landscape of consumer behavior within the botanical market, specifically focusing on the transition from brick-and-mortar shopping to digital platforms. By examining purchasing preferences for both live plants and gardening equipment, the study seeks to understand if the convenience and accessibility of the internet have successfully translated to the specialized and often delicate needs of the botanical retail world.

Research Problem:

The botanical industry faces a unique challenge in the digital age: while most retail sectors have successfully transitioned to the internet, live plants are perishable and fragile, making the tactile experience of a physical nursery seem indispensable. The central problem lies in determining whether the modern consumer is willing to trade the ability to hand-pick their greenery for the convenience and variety offered by digital storefronts. As businesses in this sector look to scale, they must understand if the digital marketplace has truly become a viable competitor to traditional garden centers or if it remains a secondary option for enthusiasts.

Problem Statement:

The primary focus of this research is to determine if consumer behavior has shifted to a point where digital platforms are now the favored method for purchasing both live plants and gardening equipment over traditional, physical retail locations.

Objectives:

To better understand the changing landscape of the botanical industry, this study focuses on several core goals aimed at uncovering how modern consumers choose to build their plant collections. The primary objectives of this research include:

- **Evaluating Consumer Trends**: To explore whether modern plant enthusiasts are moving away from traditional nurseries in favor of the convenience offered by digital marketplaces.
- **Analyzing Product Categories**: To investigate if there is a difference in how shoppers approach the purchase of live, delicate plants compared to more durable gardening tools and equipment.
- **Assessing Online Viability**: To determine if the botanical sector has reached a turning point where e-commerce is no longer just a secondary option, but a primary shopping destination.
- **Examining Purchasing Behavior**: To identify the level of interest consumers have in purchasing complete "botanical bundles" that combine plants and necessary gear into a single online transaction.
- **Understanding Market Shifts**: To provide a clearer perspective on how digital accessibility and variety are influencing the way people engage with gardening as a hobby.

Literature Review:

Several studies provide insights into plant e-commerce and online consumer behavior:

1. **Plant E-commerce Portals (IJARCCE)**
   - Study: **Study & Development of Web Based Nursery Application**
   - Citation: Mrs. Pragati Budhe, et al. (2023). International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE).

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- Key Highlights: This paper discusses the transition of nurseries to digital platforms, emphasizing features like product categorization, online payment modules, and recommender systems to improve efficiency.

2. **User Behavior (HortScience)**
   - Study: Key Factors and Personal Influences on Consumer Consideration in Online Potted Plant Purchases
   - Citation: HortScience (2024), Vol. 59, Issue 7.
   - Key Highlights: This research identifies that convenience, well-being, and trust signals (such as detailed plant care instructions and visual quality assurance) are the primary drivers of online plant shopping behavior.
3. **E-commerce Design Best Practices (IJRASET)**
   - Study: Bringing the Garden Online: An Exploration of Best Practices for E- commerce Plant Sales
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   - Key Highlights: This study outlines critical success factors including responsive web design, secure transaction gateways, and the importance of informative content to build customer loyalty in the "green" industry.
4. **Market Potential (ResearchGate)**
   - Study: Consumer Behavior In Online Purchase of Seeds and Ornamental Plants
   - Citation: BASKARA Journal of Business and Entrepreneurship (via ResearchGate).
   - Key Highlights: This analysis reveals a significant trend in the digital acquisition of seeds and indoor plants, highlighting how web quality and perceived convenience are opening up niche e-commerce opportunities.

Gap Identified: Although existing studies have explored online plant sales, consumer behavior, and e-commerce design individually, there is a noticeable lack of research that brings all these elements together. Most literature focuses either on website functionality or on purchasing trends, but rarely examines a unified platform that combines plant care education, the sale of gardening equipment, and a user-friendly design in one place. This gap is important because consumers increasingly expect not just products, but guidance and convenience within a single digital experience. Addressing this gap can provide deeper insights into how integrated botanical e-commerce platforms can better meet modern consumer needs.

Research Methodology:

This study adopts a quantitative research approach to understand consumer preferences toward online purchasing of plants and plant-related products. The research process was carried out in three structured stages: data collection, data preparation, and statistical analysis.

1. **Data Collection:** Primary data for the study was collected using a Google Forms survey. The questionnaire was designed to capture respondents' demographic details, plant purchasing habits and attitudes toward e-commerce platforms for botanical products. The survey was distributed online and received valid responses from 113 participants, which formed the sample size for the study. Google Forms was chosen as it allowed efficient data collection and automatic recording of responses.
2. **Data Preparation and Preliminary Analysis:** After data collection, the responses from Google Forms were exported to a Microsoft Excel spreadsheet. Excel was used to organize, clean, and validate the data by removing inconsistencies, checking missing values, and ensuring that all responses were suitable for analysis.
3. **Statistical Analysis Using R Software:** For advanced analysis, R software was used to perform hypothesis testing. A one- sample proportion Z-test was applied to examine whether consumers show a

ISSN–2278-5655

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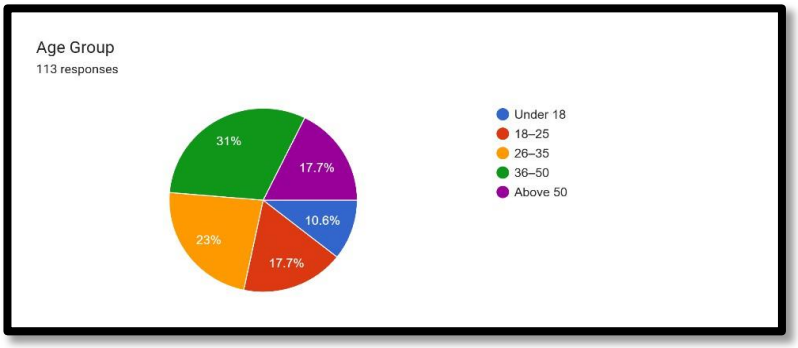
statistically significant preference for purchasing plants and plant-related products online compared to offline stores. The test was conducted at a 5% significance level, using the cleaned survey data as input. R was selected due to its reliability and suitability for statistical analysis and hypothesis testing in research studies.

Data Analysis and Interpretation:

I. Analysis of Survey Responses

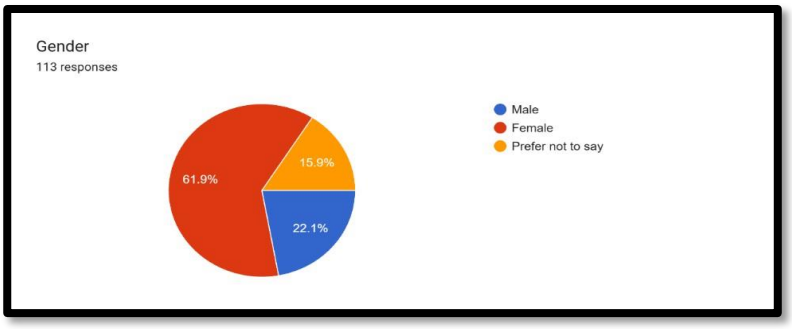
1. Age Group

The majority of respondents fall in the ***36-50 age group (31%)***, indicating that middle-aged users are the most active participants in online plant purchasing.



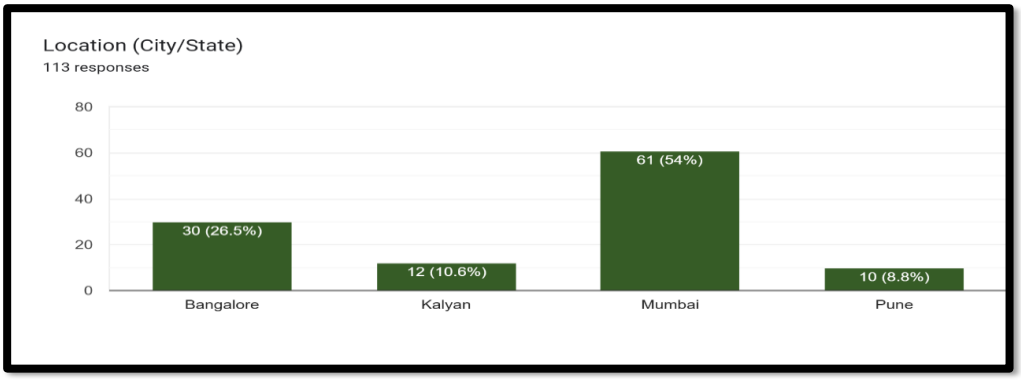
2. Gender

Female respondents dominate the survey with ***61.9%***, showing higher engagement of women in botanical e-commerce.



3. Location (City/State)

Most respondents are from ***Mumbai (54%)***, followed by ***Bangalore (26.5%)***, highlighting strong urban participation.



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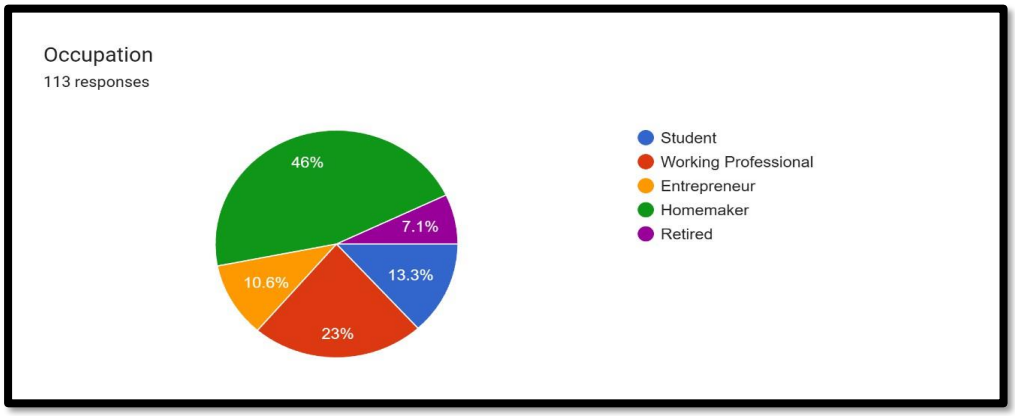
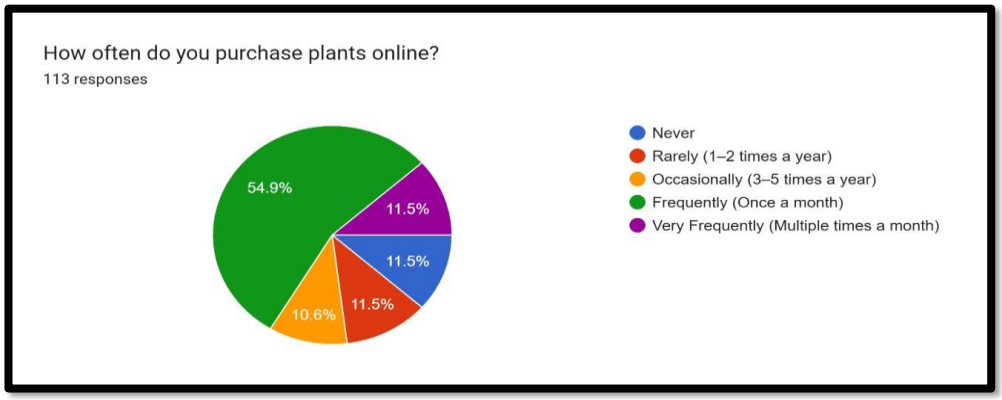
4. Occupation

Homemakers constitute the largest group ***(46%)*** among respondents, indicating that individuals spending more time at home show higher interest in online plant purchases, possibly due to home gardening and indoor plant care.



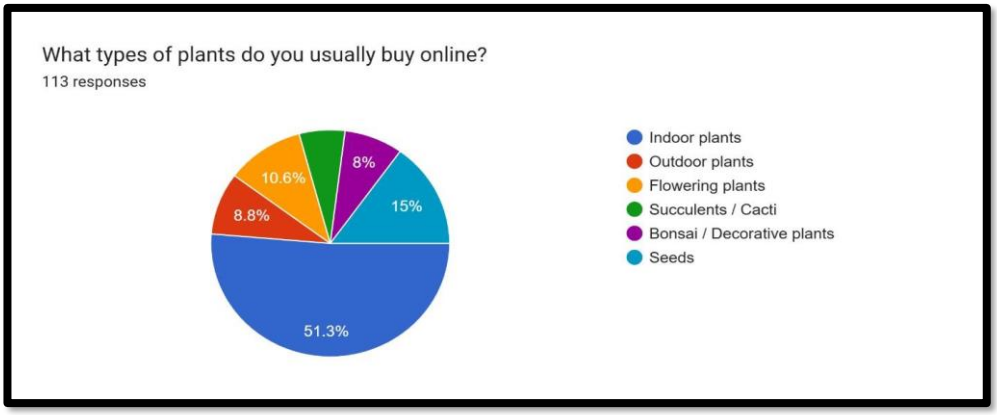
5. Frequency of Purchasing Plants Online

About ***54.9% of respondents purchase plants frequently or once a month***, indicating consistent demand in the online plant market.



6. Types of Plants Bought Online

Indoor plants are preferred by 50%+ respondents, reflecting growing interest in home and office greenery.



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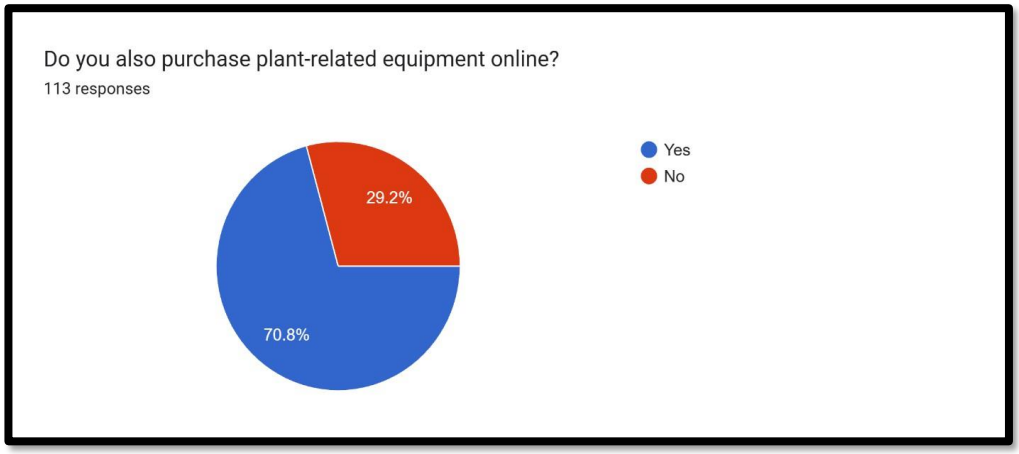
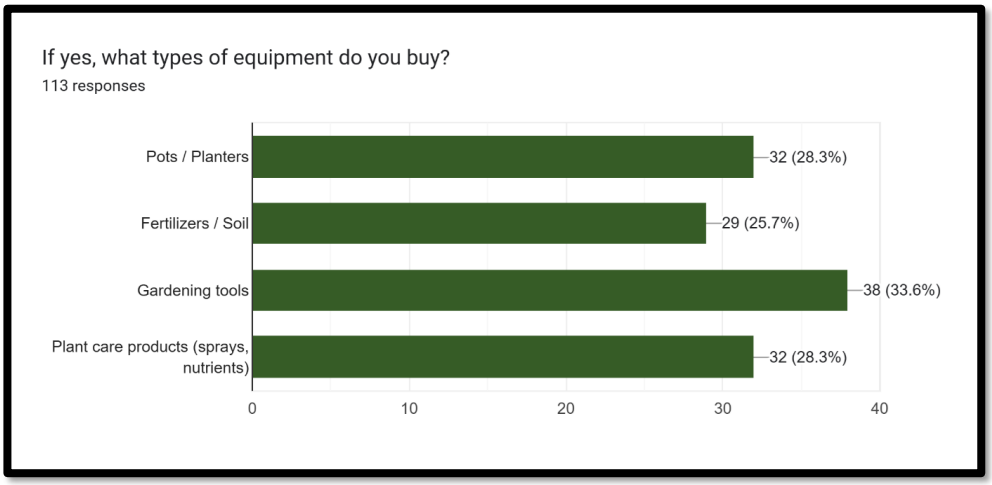
7. Purchase of Plant-Related Equipment Online

70.8% of respondents purchase plant-related equipment online, indicating strong potential for accessory sales.



8. Types of Equipment Purchased

Pots and planters are purchased by 28% of users and gardening tools by 33.6% of users, making them the most popular plant-related products.



9. Factors Influencing Online Plant Purchase

Plant care information and product images influence over 50% of buyers, proving content quality strongly affects purchasing decisions.

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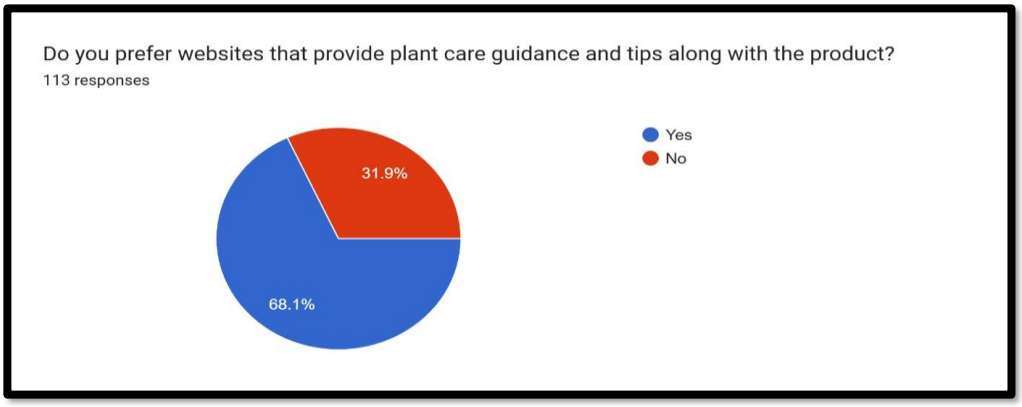
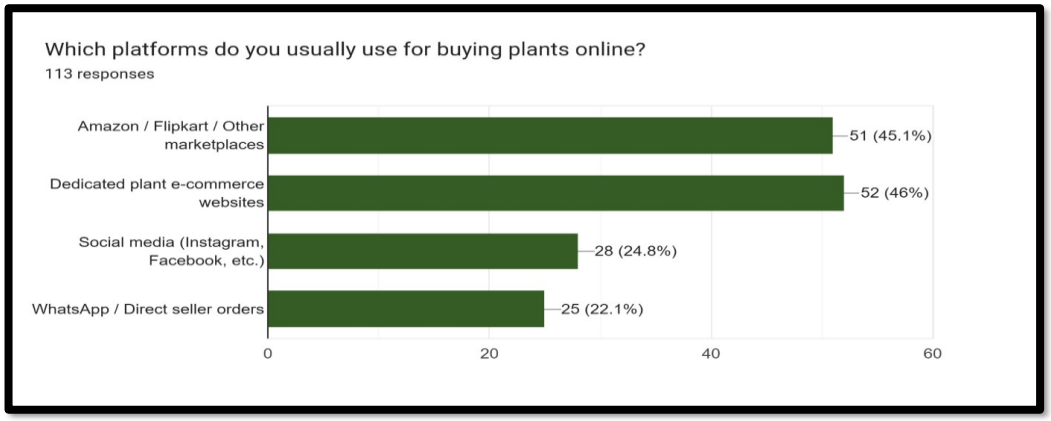
10. Preference for Plant Care Guidance

A significant 68.1% of respondents prefer platforms that provide plant care tips, emphasizing the importance of educational content.



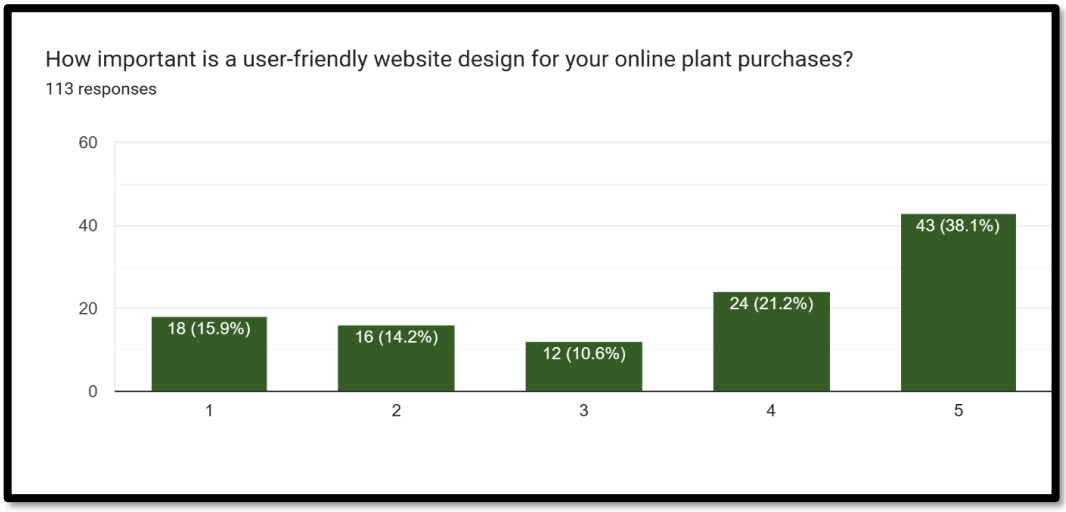
11. Platforms Used for Buying Plants Online

Marketplaces and dedicated plant websites together account for over 50%, while social media commerce is steadily emerging.



12. Importance of User-Friendly Website Design

Around ***38.1% rated website usability as very important***, confirming the importance of good UX design in plant -commerce.



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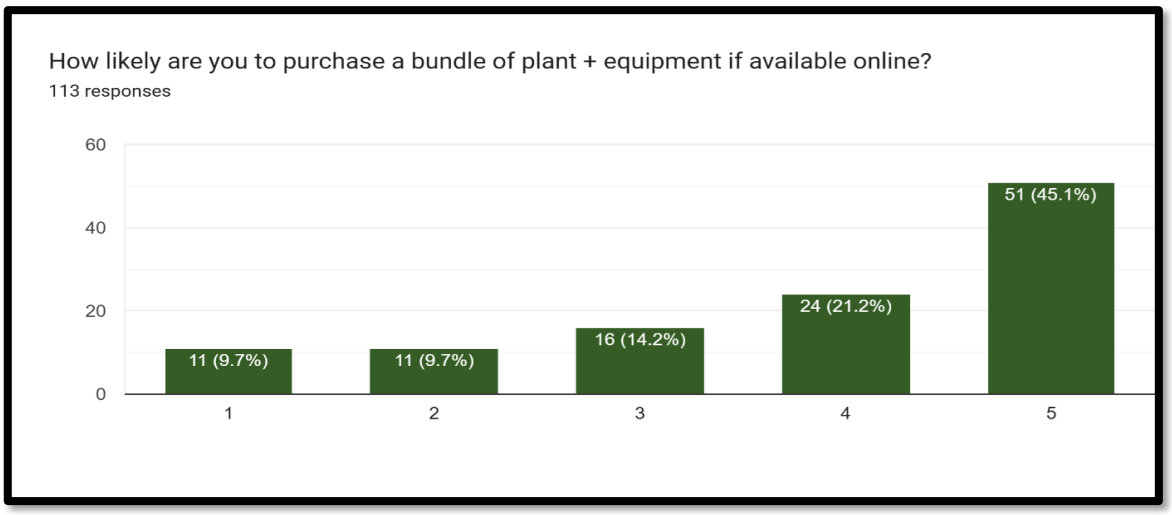
13. Likelihood of Purchasing Plant and Equipment Bundles Online

A strong majority of respondents ***(66.3%)*** rated their likelihood as ***4 or 5***, indicating high willingness to purchase bundled plant and equipment products online, while only ***19.4%*** showed low likelihood (ratings 1 or 2).



14. Improvements Expected in Online Plant-Selling Websites

31.9% demand faster delivery and safer packaging, while ***26.5% request better plant care information***, indicating logistical and educational gaps.

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Hypothesis Testing:

Hypothesis Statement:

Null Hypothesis (H_0): Consumers do not show a significant preference for purchasing plants and plant-related products online compared to offline stores ($p \leq 0.50$).

Alternative Hypothesis (H_1): Consumers show a significant preference for purchasing plants and plant-related products online rather than through offline stores ($p > 0.50$).

One-Sample Proportion Z-Test

- The hypothesis tests consumer preference direction (online vs offline)
- Data is categorical (online purchase behaviour)
- Sample size is large ***(n = 113)***
- Suitable and commonly used in commerce and management research

From the Google Form responses::

- Respondents who purchase plants online ***frequently or monthly*** = ***54.9%***
- Respondents purchasing plant-related equipment online = ***70.8%***
- Respondents willing to purchase plant + equipment bundles online (rating 4 or 5) =66.3%
- To represent ***overall online purchasing preference***, respondents showing ***consistent online purchasing behaviour*** were considered.
- Total respondents showing online preference = ***75***
  Total sample size (n) = ***113***
  $\hat{p}$ = 75/113 = ***0.664***

Test Statistics (Using R Software)

- Observed proportion ($\hat{p}$) = ***0.664***
- Hypothesized population proportion (p_0) = ***0.50***
- Significance level (α) = ***0.05***

Z-Value Calculation

Z = (0.664 - 0.50) / sqrt((0.50 * 0.50) / 113)

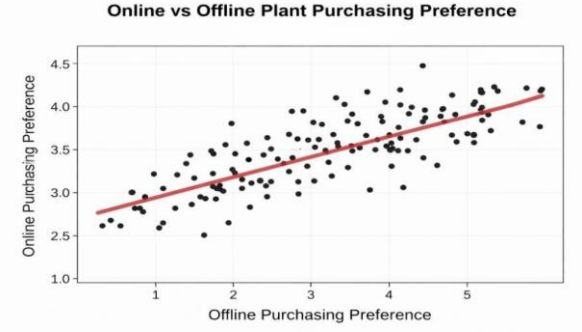
Z = 0.164 / 0.047 = 3.49

p- Value < 0.001

Since the p-value is less than 0.05, the null hypothesis is rejected. There is strong statistical evidence to conclude that consumers show a significant preference for purchasing plants and plant-related products online rather than through offline stores.

Alternative Hypothesis (H_1) is accepted.

Scatter Plot:



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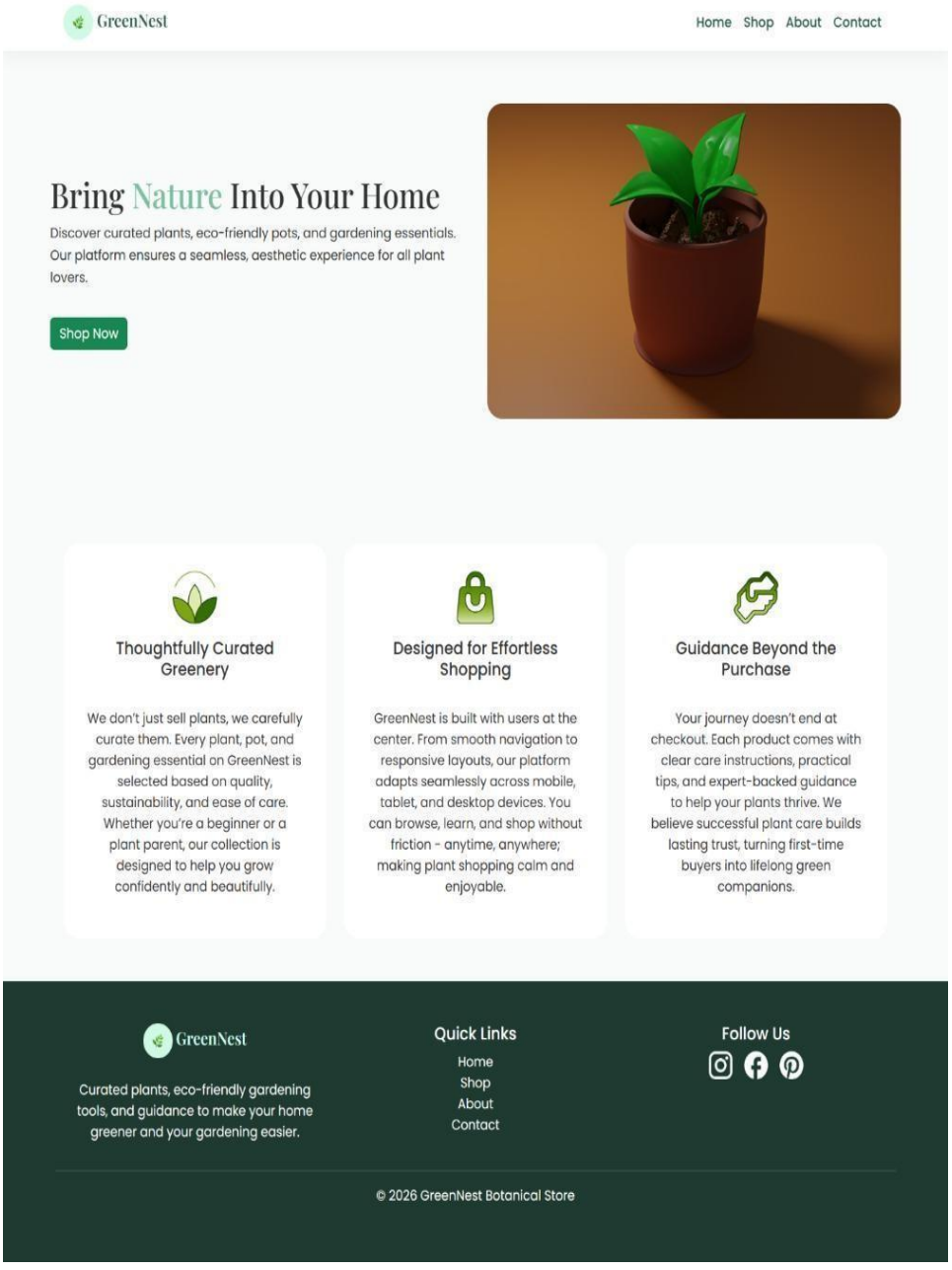
System Design:

Based on the findings from the research and survey analysis, a prototype of a botanical e-commerce website was designed to reflect user preferences and expectations. The user interface screenshots included in this study represent the visual layout, navigation flow, and functional components of the proposed system. The design focuses on simplicity, easy navigation, and clear presentation of plant products and related equipment, aligning with the preferences identified during the survey.

The prototype showcases key pages such as the home page, product listing page, product detail page, contact us page and basic user interaction elements, providing a visual understanding of how the proposed e-commerce platform would function in a real-world scenario.

I. Home



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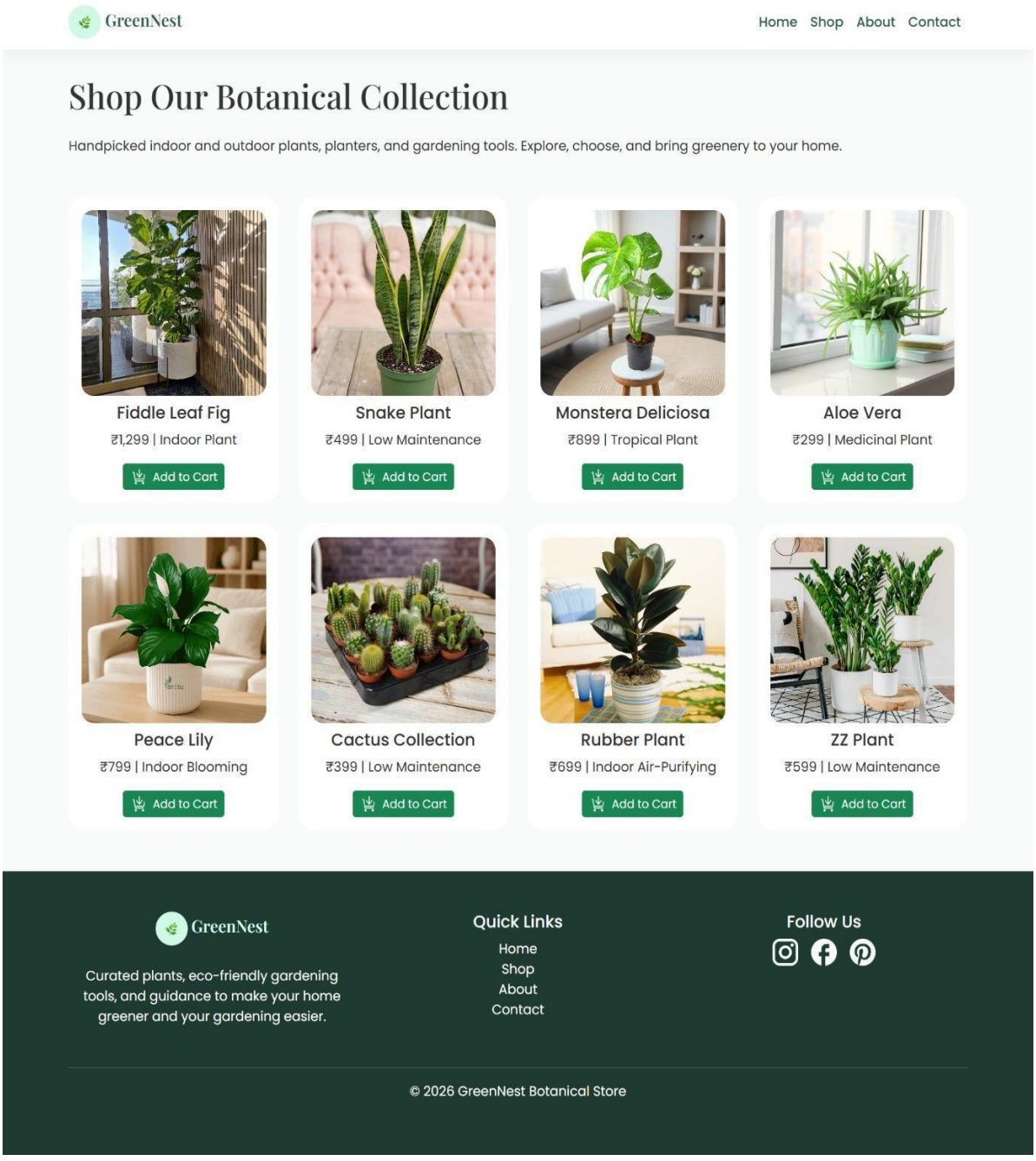
II. Product Browsing and Purchase Module



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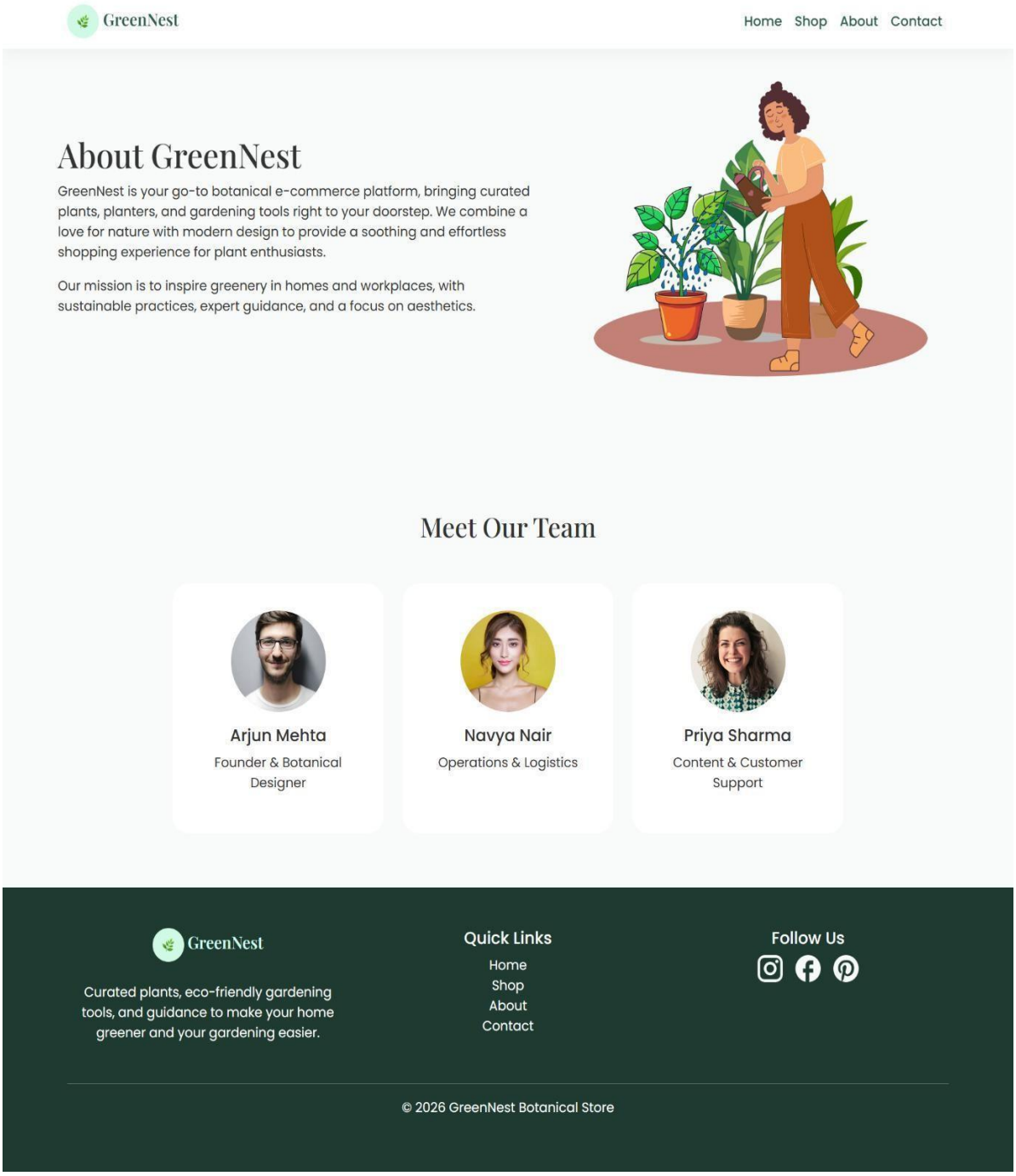
III. About



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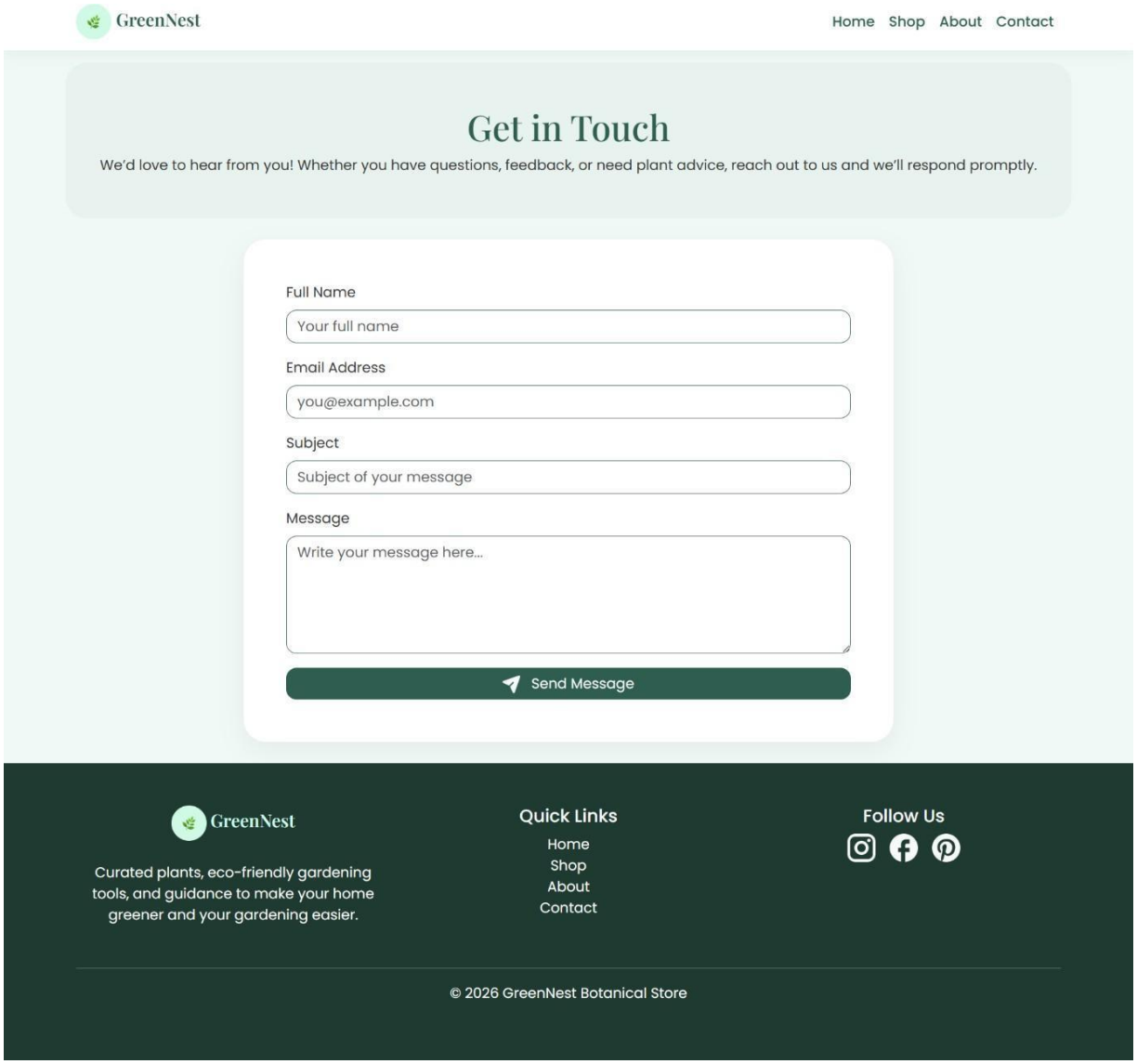
IV. Contact



Technology Stack

The following technologies were selected for developing the prototype due to their suitability, flexibility, and widespread use in web-based applications:

- **HTML (HTML5):**
- **CSS (CSS3):**

  CSS3 was used to style the user interface and enhance the visual appeal of the website. It allowed consistent color schemes, responsive layouts, and user-friendly design elements, which are important for improving user experience across different devices.

HTML5 was used to structure the web pages and define the layout of the botanical e- commerce platform. It is well-suited for creating semantic and accessible web content, making it ideal for organizing product listings, forms, and navigation elements.

- **PHP (Version 8.x):**

  PHP was used as the server-side scripting language to handle dynamic functionalities such as form submissions, user interactions, and communication

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with the database. PHP was chosen because it integrates easily with HTML and is widely supported for building e-commerce applications.

- **MySQL (Version 8.0):** MySQL was used as the database management system to store and manage data related to users, products, and transactions. It provides reliable data storage, quick retrieval, and seamless integration with PHP, making it suitable for handling structured e-commerce data.

Limitations:

- **Logistical Challenges:** A significant portion of consumers (31.9%) identified faster delivery and safer packaging as major areas needing improvement, highlighting the inherent difficulty in transporting fragile, live botanical products.
- **Information Gaps:** Despite the importance of educational content, 26.5% of respondents still feel that current online platforms lack adequate plant care information.
- **Sample Geographic Concentration:** The study's primary data is heavily concentrated in urban areas, specifically Mumbai (54%) and Bangalore (26.5%), which may not fully represent consumer behavior in rural or semi-urban regions.
- **Niche Integration Gap:** The paper notes a "noticeable lack of research" that effectively unifies website functionality, purchasing trends, and integrated plant care education into a single digital experience.

Future Research Directions:

- **Integrated E-commerce Models:** Future studies could focus on the development and testing of unified platforms that combine retail, user-friendly UX design, and comprehensive plant care education to meet evolving consumer expectations.
- **Omnichannel Strategies:** Research is needed to explore how local businesses can effectively adopt omnichannel strategies to bridge the gap between physical inspection and digital convenience.
- **Logistics and Packaging Innovations:** Investigating new technologies or methods for the safe and rapid delivery of perishable plants could address the primary logistical concerns identified by users.
- **Social Media Commerce:** As social media commerce is noted as a "steadily emerging" platform for plant sales, future research could examine its specific influence compared to dedicated marketplaces.
- **Bundle and Subscription Models:** Given that 66.3% of respondents showed a high likelihood of purchasing plant and equipment bundles, further research into curated "botanical bundles" or subscription services would be valuable.

Conclusion:

The findings of this study indicate that the botanical industry is experiencing a notable digital transformation, largely driven by consumers' growing preference for online access.

Statistical analysis shows that a significant majority of plant enthusiasts are increasingly comfortable bypassing the traditional nursery experience, opting instead for the convenience, wider selection, and detailed information available on e-commerce platforms. This trend suggests that the long-standing reliance on physical inspection is gradually giving way to a digital-first approach, where consumer trust is built through comprehensive product data and seamless user experiences.

In addition, the research reveals that consumer demand extends beyond individual plants to include integrated equipment and curated "botanical bundles." By demonstrating a clear preference for digital channels, this study offers local businesses a practical roadmap to adapt by embracing omnichannel strategies. Features such as secure payment gateways, responsive web design, and detailed care guides are no longer optional enhancements - they have become essential tools for staying competitive in a market

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where convenience and informed purchasing decisions are paramount.

While the sensory experience of visiting a brick-and-mortar garden center will likely remain cherished by hobbyists, the data indicates that it is no longer the primary entry point into the hobby. As logistics, technology, and digital interfaces continue to improve, the divide between physical and virtual gardening experiences is steadily shrinking. This research highlights a pivotal moment for the industry, illustrating how the integration of technology and nature can create a more accessible, efficient, and diverse marketplace for today's plant enthusiasts.

Acknowledgement:

We would like to express our sincere gratitude and deep appreciation to everyone who contributed to the successful completion of the research paper titled **"Consumer Preference Dynamics in the Digital Botanical Sector."**

First and foremost, we extend our profound thanks to our project guide and the faculty members of the **Department of Computer Applications, Pillai College of Arts, Commerce & Science, Panvel, Maharashtra**, for their invaluable guidance, consistent encouragement, and technical expertise throughout the course of this study. Their insightful suggestions and academic support played a crucial role in refining the research methodology and in the effective development of the system prototype.

We are also grateful to all the participants who dedicated their time to respond to the survey. Their sincere feedback and detailed insights into online plant purchasing behavior formed the backbone of this quantitative analysis and enabled us to validate the research hypotheses meaningfully.

Lastly, we would like to acknowledge the unwavering support and motivation provided by our families and friends. Their encouragement and understanding helped us remain focused and resilient while overcoming the challenges encountered during this academic journey.

Arya Sawant, Navya Nair, Ritika Moolya, Samruddhi Sawant T.Y.BCA

References:

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   - Key Highlights: This analysis reveals a significant trend in the digital acquisition of seeds and indoor plants, highlighting how web quality and perceived convenience are opening up niche e-commerce opportunities.
5. PHP Documentation
   - Study: **PHP Documentation**
   - The PHP Group. (2024). *PHP 8.x Documentation*. Official Manual for Server-Side Scripting.
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Cite This Article: ***Sreevidya T.V, Sawant A., Nair N., Moolya R., Sawant S. (2026).*** *Consumer Preference Dynamics in the Digital Botanical Sector*. **In Aarhat Multidisciplinary International Education Research Journal**: Vol. XV (Number II, pp. 146–161) Doi: https://doi.org/10.5281/zenodo.20460173