



A Global Outlook on Sustainable Plant Acquisition: A Review of Scholarly Works

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Abstract

In today's horticultural landscape, plant acquisition is under scrutiny due to sustainability concerns and the desire to enhance the consumer experience. This study employs a qualitative literature review methodology spanning 2019 to 2023, using the Scopus database and Harzing's Publish or Perish tool to ensure article relevance and timeliness. Employing keywords like "plant buying," "plant purchase," "plant shop," "buying plant," "plant shopping," "plant procurement," and "purchasing plants," the search yielded 42 articles, with 10 selected for their relevance, reputable sources, and empirical or theoretical contributions. This research explores two key aspects: the variation in plant purchasing behaviors among different countries and the role of technology in shaping plant acquisition in the digital era. Across nations, disparities in plant purchasing behaviors emerge, shaped by cultural norms, economic conditions, and technological advancements. Technological innovations like garden design apps, QR codes, and cloud-based solutions streamline the plant acquisition process, enhancing garden planning, information accessibility, and supply chain management, promoting efficiency and sustainability in horticulture.

Keywords: Plant purchase, Purchase behavior, Horticulture, Literature review, Scopus

Introduction

In the dynamic realm of horticulture today, the process of acquiring plants has garnered significant attention and scrutiny (Perdue, 2021). The increasing focus on sustainability and enhancing the consumer experience has propelled the study of the factors that influence decisions surrounding plant purchases into the forefront (Gabellini & Scaramuzzi, 2022). This heightened interest in the plant market is a result of several converging factors, including a growing environmental consciousness (Marvuglia et al., 2022), shifting consumer preferences (Knuth et al., 2023), and the recognition that the horticultural trade is not only a source of joy but also a potential conduit for ecological and economic challenges (Juma et al., 2019).

Consumers are now more inclined than ever to align their plant acquisitions with eco-friendly and sustainable principles (Tiwari, 2023). They seek products that not only elevate their surroundings but also minimize adverse impacts on the environment (Khan et al., 2020). In parallel, businesses operating in the horticultural sector are acknowledging the significance of catering to these evolving preferences (Knuth et al., 2023). They aim to optimize the consumer experience (Sulistyowati & Husda, 2023), encompassing various facets such as facilitating access to plant information (Nasir, Al-Qaraawi, & Sadik Croock, 2020), ensuring product quality (Nasir, Croock, et al., 2020), and mitigating potential risks associated with plant purchases (Behe & Fry, 2020).

This transformation in consumer behavior and industry practices underscores the necessity for an extensive exploration of sustainable practices in plant acquisition (Owen et al., 2019). Such an endeavor is crucial not only for unraveling the complexities of consumer choices (Knuth et al., 2023) but also for guiding businesses and policymakers in nurturing a more sustainable and gratifying ecosystem for acquiring plants (Caneva et al., 2020). In light of these considerations, this literature review is committed to delving into the core research questions essential for comprehending and promoting sustainable practices in this vibrant and evolving landscape.

Based on the aforementioned context, our research has formulated two pivotal research questions:

RQ 1: How does research on plant purchasing behaviors differ across various countries?

RQ 2: In the digital era, how does technology facilitate the process of acquiring plants?

Literature Review

Plant-Buying Habits

Research conducted by Dunn et al. (2020) reveals that plant sources indeed vary, encompassing options such as garden centers, Do It Yourself (DIY) /hardware stores, and supermarkets, which are frequently favored. Additionally, existing seed stocks and nurseries see consistent use, maintaining high rankings for the quantity obtained with minimal frequency fluctuation. Conversely, less conventional sources like mail order and horticultural events are seldom selected. When making decisions about plant sources, key factors influencing these choices include stock quality, cost, and variety. Factors associated with plant health, such as the cleanliness of premises, biosecurity measures, and plant origin, carry less significance. Notably, provenance emerges as the least influential factor when selecting individual plants, with appearance, suitability for the planting site, and cost taking precedence. Regarding guidance for plant purchases, individuals frequently turn to friends, family, and neighbors, seek advice online, or consult with sellers. Conversely, media, gardening shows, national associations, and local clubs/associations are less commonly tapped sources for advice.

Plant Shop Information System Based on QR Codes

The Plant Shop Information System based on Quick Response (QR) codes represents a digital revolution in the realm of plant retail (Nasir, Al-Qaraawi, & Sadik Croock, 2020). It operates on a simple yet effective premise: each plant or product in the shop is assigned a unique QR code, which customers can scan using their smartphones. Upon scanning, a world of plant-related information is at their fingertips. This includes details about the plant's name, species, care requirements, and more. Price and availability are also conveniently displayed, allowing customers to make well-informed choices. Some systems even facilitate direct purchases through the app or website, making checkout a breeze. For retailers, this system offers benefits beyond customer engagement, as it assists in inventory management by tracking sales and updating stock levels in real-time. Ultimately, the Plant Shop Information System based on QR codes enhances the overall shopping experience, blending the physical and digital worlds for both customers and retailers alike.

Research Method

This study employs a descriptive qualitative literature review methodology, a type of review that assesses the existing literature's status in relation to a specific research question, topic, or concept (Xiao & Watson, 2019). Researchers used a literature review approach to conduct a comprehensive investigation into the factors influencing plant purchases. This involved an extensive search across academic databases, research journals, and reputable publications related to plant acquisition.

The search was limited to studies published within the last five years (2019-2023) and was executed using both the Scopus database and Harzing's Publish or Perish tool on September 28, 2023, ensuring the timeliness and relevance of the findings. The literature review encompassed a variety of papers from the Scopus database, employing keywords such as "plant buying" (4 papers), "plant purchase" (10 papers), "plant shop" (13 papers), "buying plant" (3 papers), "plant shopping" (4 papers), "plant procurement" (5 papers), and "purchasing plants" (3 papers). Out of a total of 42 papers initially identified, 21 were deemed relevant and included, while 21 papers, including duplicates, book chapters, conference papers, conference reviews, data papers, and unrelated research studies, were excluded. Following a thorough full-text screening process, 10 articles were ultimately included, while 14 were excluded, as visually represented in Fig. 1. The selection of these 10 articles was based on a rigorous assessment of their content, relevance to the research question, and their contribution to the understanding of factors influencing plant purchases. These chosen articles underwent a thorough examination, including a comprehensive analysis of their methodologies, findings, and the quality of their research.

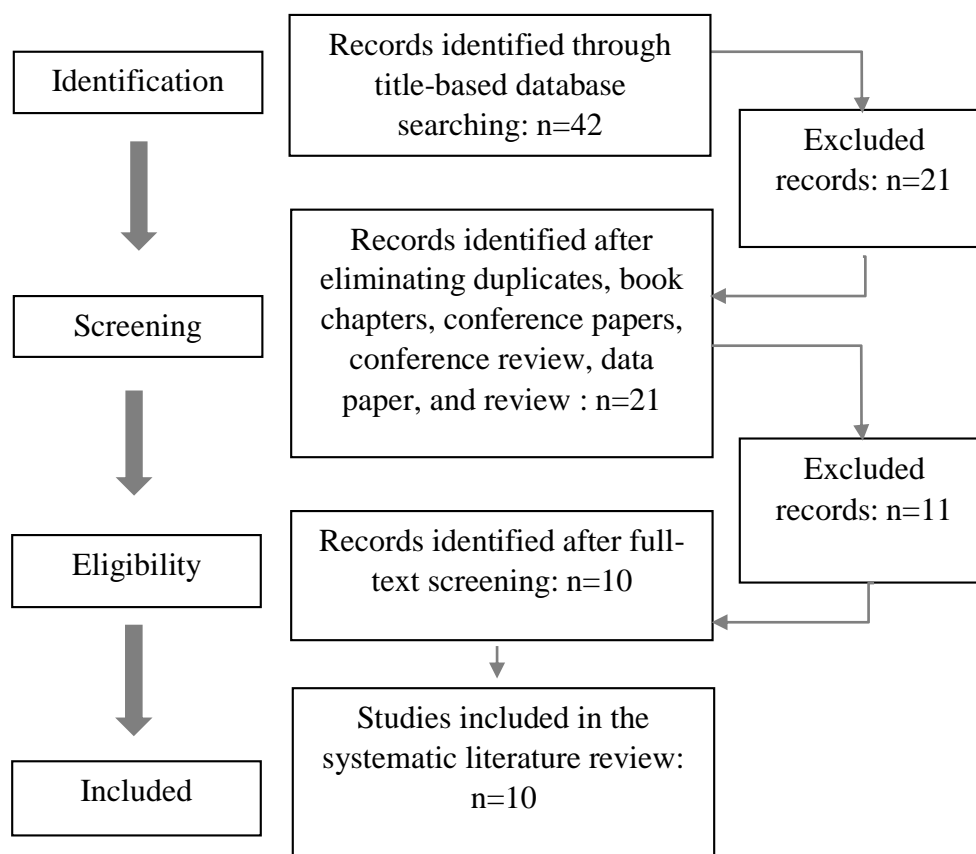


Figure 1. Literature Review Method

Result/Findings

The studies by Kim et al. (2019), Nasir, Al-Qaraawi, & Croock (2020); Nasir, Croock, et al. (2020), and Nasir, Al-Qaraawi, & Sadik Croock (2020) all revolve around the utilization of QR technology and mobile applications to enhance the plant purchasing experience. Kim et al. (2019) propose a comprehensive garden design app that covers planning, purchasing, and maintenance, using a freemium business model rooted in 4R marketing strategies. Their aim is to improve user experiences and encourage purchases by providing garden information and location-based services.

On the other hand, Nasir, Croock, et al. (2020) introduce a QR-based information system in plant shopping centers, ensuring efficient data management, fault detection, and recovery across local servers. This system includes multilingual plant offers in text and image formats, enhancing information access. Additionally, Nasir, Al-Qaraawi, & Sadik Croock (2020) employ QR tags on farm plants to enable easy scanning and access to detailed plant information via a web app, streamlining registration and sales services.

Lin et al. (2019) conducted a research study in China, specifically targeting the e-commerce-based plant industry. This industry holds a distinctive position among e-commerce sectors due to the unique characteristics of its products, such as a high susceptibility to damage and death. Consequently, its operational and logistical demands are notably stringent. Lin and his team sought to address a pressing issue faced by e-commerce plant shops – the effective

management of excess warehouse storage. Through a detailed case study involving a company referred to as Enterprise A, they employed sales volume data analysis, entropy, and the technique for order preference by similarity to an ideal solution to construct a decision-making model. Their research culminated in the proposal of an innovative cloud-based warehousing optimization plan tailored to the specific requirements of e-commerce-based plant shops. This plan serves as a valuable resource for industry decision-makers grappling with the complexities of managing excess warehouse storage while navigating the unique challenges posed by the digitization of the plant industry within the context of e-commerce.

The studies by Knuth et al., (2023) and Knuth et al. (2021) delve into plant purchasing behavior. Knuth et al. (2023) highlight the significant influence of plant benefits on purchasing behavior, with consumers showing diverse plant preferences. They also identify various retail destinations frequented by consumers, demonstrating a broad reach. In contrast, (Knuth et al., 2021) emphasize the impact of perceived prices on purchasing consistency, suggesting that external cues may play a more significant role than intrinsic factors.

Dunn et al. (2020) explore the significant societal impact of the horticultural trade, which plays a crucial role in the national economy but is also susceptible to the introduction and spread of plant pests and diseases. These threats pose risks to both horticultural stakeholders and the broader ecological and economic landscape. To address this issue, the study delves into the plant-buying habits of UK consumers and their receptiveness to a horticultural sector accreditation scheme, rooted in robust biosecurity practices. By surveying 1,500 members of the UK's plant-buying public, the research investigates factors such as awareness of pests and diseases, the importance of biosecurity in purchasing decisions, and consumer interest in accredited products, including plants. The findings reveal limited awareness of plant pests and diseases among consumers and a tendency to prioritize "quality" over biosecurity when selecting plants. While there is apparent support for the ideals of a horticultural accreditation scheme, consumers express concerns about potential cost increases associated with accreditation. This research underscores the need for dedicated efforts to raise public awareness and garner support for initiatives aimed at safeguarding the environment from pests and diseases within the horticultural trade.

Finally, Behe & Fry (2020) investigate the role of money-back guarantees in mitigating perceived risk associated with plant purchases, shedding light on the dynamics of consumer risk perception in the context of live products like plants. The study, based on responses from 504 US residents who had made live plant purchases, demonstrates that as the length of the money-back guarantees increases, perceived risk decreases. Notably, perceived risk is higher among men compared to women and decreases with higher income levels. Additionally, consumers who are more engaged with the product, possess expertise, experience delight, express repurchase intentions, and have feelings of regret exhibit higher levels of perceived risk. The research identifies specific price points and money-back guarantees lengths at which perceived risk reduction is most significant, highlighting the quantitative evidence of how money-back guarantees effectively reduce perceived risk. This evidence underscores the potential benefits of using and communicating money-back guarantees to enhance purchases, boost customer retention, and improve profitability in the plant retail industry.

The result of the literature review is as shown in Table 1.

Table 1
Studies on Plant Purchases in the Scopus Database (2019-2023)

Authors	Location	Scope	Findings
Kim et al. (2019)	Korea	Mobile Applications for Planning and Purchasing	The proposal includes a comprehensive garden design app flowchart, encompassing planning, purchasing, and maintenance, along with a freemium business model rooted in 4R marketing strategies. Its goal is to improve user experiences through graphics, garden information, and location-based services, facilitating connections between consumers and garden product vendors to encourage purchases.
Nasir, Croock, et al. (2020)	Iraq	QR-Based Plant Shopping System	The QR-based information system in the plant shopping center seamlessly manages data across local servers in various shops, automatically detecting and recovering from faults, ensuring comprehensive information storage and synchronization, and has been rigorously tested for efficiency and fault tolerance in information retrieval and management, encompassing sales, customer, and admin data as well as multilingual plant offers in text and image formats.
Nasir, Al-Qaraawi, & Sadik Croock (2020)	Iraq	QR-Based Information Systems	The system utilizes QR tags on each farm plant, enabling visitors to scan them with their mobile cameras, send the data to the server via a web app, and receive detailed plant information, while also providing registration and sales services, with successful testing confirming its efficiency across different case studies.
(Nasir, Al-Qaraawi, & Croock (2020)	Iraq	Plant Shopping Center QR Guide	The QR-based system in plant shopping centers, comprising mobile and server components, serves as a digital guide for visitors, offering detailed information about displayed seedlings through QR codes. Each branch connects to the main server via a private network, containing multilingual text and image data for all plants and branches. This application streamlines customer movement, enables electronic billing, and has been efficiently tested across various case studies for information and sales management.

Lin et al. (2019)	China	Cloud-Based Solutions for Warehousing	In the e-commerce-based plant industry, which grapples with unique product vulnerability challenges, Lin et al.'s 2019 research aims to streamline excess warehouse storage. This research commences with sales data analysis for predictive forecasting, incorporates decision-making models employing entropy and preference techniques, and ultimately recommends a cloud-based solution, emphasizing the significance of market awareness and optimized warehousing.
Knuth et al. (2023)	USA	Diverse Retail Channels in the USA	Clear group distinctions emphasized plant benefits' significant impact on purchasing behavior. Consumers preferred various retail destinations, including home improvement stores, independent garden centers, supermarkets, online platforms, mass merchandisers, and catalog sales, highlighting a wide consumer reach. Survey participants showed diverse plant preferences, favoring vegetables, annuals, herbs, flowering shrubs, foliage plants, and perennials.
Knuth et al. (2021)	USA	Diverse Retail Channels in the USA	Inconsistent purchasing is more likely at higher perceived prices than bargain prices. Few demographic differences exist among consistent and inconsistent plant buyers, suggesting external cues may influence consistency more than intrinsic cues.
Dunn et al. (2020)	UK	Biosecurity Monitoring and Traceability	Explored the feasibility of a UK horticultural accreditation scheme to address plant trade-related pests and diseases. Found limited consumer awareness and low biosecurity prioritization in purchasing decisions, alongside concerns about potential cost hikes. Emphasized the necessity for enhanced public awareness and support to safeguard the environment from these threats.
Behe & Fry (2020)	USA	Guarantee Duration & Perceptions	As money-back guarantee durations increased, risk perception decreased, with men generally perceiving higher risks than women, and those with higher income levels perceiving lower risk; furthermore, individuals deeply engaged with the product, possessing expertise, satisfaction, repurchase intent, and feelings of regret tended to have a heightened perception of risk.

Behe et al. (2022)	USA	Plant Purchase Benefits	Millennials benefited most socially from plant purchases, followed by educational, physiological, and psychological gains, with Gen Z experiencing more educational and physiological benefits than Baby Boomers. Plants served as a common online social interest, especially for Millennials and Gen Z, with Gen Z facing higher boredom and food insecurity levels. Plant buyers had better food security, especially those purchasing edible or food-producing plants, emphasizing the importance of food security, boredom relief, and social connections in consumer communication.
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RQ 1: How does research on plant purchasing behaviors differ across various countries?

Examining research on plant purchasing behavior is crucial for optimizing and improving the plant acquisition process. Studies conducted in different countries provide valuable insights into the various factors that impact the overall plant buying experience. These insights can be classified into several key areas:

United States: Diverse Preferences and Retail Choices

Research on plant purchasing behaviors varies across countries, reflecting distinct consumer preferences and concerns in different regions. In the USA, (Knuth et al., 2023) found that plant preferences significantly influence purchasing behavior, with consumers showing a wide range of preferences for various types of plants. Consumers in the USA also favor diverse retail destinations for plant acquisition, including home improvement stores, independent garden centers, supermarkets, online platforms, mass merchandisers, and catalog sales. This diversity in preferences and retail choices highlights the heterogeneous nature of plant purchasing behaviors in the country.

Price Perception in the USA

In another study by (Knuth et al., 2021) in the USA, the impact of perceived plant prices on purchasing behavior was explored. The research revealed that inconsistent purchasing is more likely to occur when plants are perceived to have higher prices, as opposed to bargain prices. Interestingly, few demographic differences were observed between consistent and inconsistent plant buyers, suggesting that external cues, such as price perception, may play a more substantial role in influencing purchasing consistency than intrinsic factors.

United Kingdom: Limited Biosecurity Awareness

Moving to the UK, (Dunn et al., 2020) conducted research on plant purchasing behavior related to plant pests and diseases. The study focused on the feasibility of a horticultural accreditation scheme to address these concerns. Findings indicated limited consumer awareness and low prioritization of biosecurity in purchasing decisions, along with concerns about potential cost increases. This research underscores the need for enhanced public awareness and support to protect the environment from the threats posed by plant trade-related pests and diseases.

Perception of Risk in the USA

Shifting the focus back to the USA, Behe & Fry (2020) investigated the perception of risk in plant purchasing behavior. Their study revealed that as money-back guarantee durations increased, the perception of risk decreased among plant buyers. Additionally, the research found that men generally perceived higher risks than women, and individuals with higher income levels tended to perceive lower risk. Those deeply engaged with the product, possessing expertise, satisfaction, repurchase intent, and feelings of regret, tended to have a heightened perception of risk, suggesting the multifaceted nature of risk perception in plant acquisition.

Demographics of Plant Purchasing in the USA

Lastly, (Behe et al., 2022) delved into the demographics of plant purchasing behavior in the USA. Their research highlighted that Millennials benefited most socially from plant purchases, followed by educational, physiological, and psychological gains. Gen Z, on the other hand, experienced more educational and physiological benefits than Baby Boomers. Plants also served as a common online social interest, particularly for Millennials and Gen Z. Gen Z faced higher levels of boredom and food insecurity, emphasizing the importance of food security, boredom relief, and social connections in plant buying decisions.

These studies collectively demonstrate that research on plant purchasing behaviors differs across countries and regions, reflecting unique cultural, economic, and demographic factors that influence consumer choices and concerns related to plants.

RQ 2: In the digital era, how does technology facilitate the process of acquiring plants?

In the digital era, technology plays a pivotal role in facilitating the process of acquiring plants. Research from various countries highlights how technological innovations streamline and enhance the plant acquisition experience. These advancements can be categorized into several key areas:

Mobile Applications for Planning and Purchasing

In Korea, (Kim et al., 2019) introduced a comprehensive garden design app that assists users in planning, purchasing, and maintaining their gardens. This mobile application leverages technology to provide a user-friendly interface enriched with graphics, garden information, and

location-based services. By connecting consumers with garden product vendors, it encourages plant purchases, demonstrating how mobile apps simplify the plant acquisition process.

QR-Based Information Systems

Iraq's research, as presented by (Nasir, Croock, et al., 2020), introduces QR-based information systems that efficiently manage plant data across various shops. These systems automatically detect and recover from faults, ensuring comprehensive information storage and synchronization. They encompass sales, customer, and administrative data, offering multilingual plant offers in text and image formats. QR tags on farm plants allow visitors to access detailed plant information and streamline registration and sales services. This technology-driven approach demonstrates how QR codes and web applications simplify the acquisition process by providing instant access to plant information and facilitating transactions.

Cloud-Based Solutions for Warehousing

In China, (Lin et al., 2019) address the challenges of excess warehouse storage in the e-commerce-based plant industry. Their research employs technology in the form of cloud-based solutions, combining sales data analysis, decision-making models, and predictive forecasting. This digital approach optimizes warehouse management, emphasizing market awareness and efficient inventory control. It showcases how technology can enhance logistics and supply chain management, making the acquisition of plants more efficient and cost-effective.

Diverse Retail Channels in the USA

Research in the USA, such as (Knuth et al., 2023) and (Knuth et al., 2021), highlights consumer preferences and behaviors in the plant purchasing process. Although not directly focused on technology, these findings emphasize the significance of digital platforms. Online platforms, supermarkets, and catalog sales are among the preferred retail destinations, underscoring the role of digital channels in plant acquisition. This demonstrates how technology, through e-commerce and online platforms, facilitates access to a wide range of plant options, catering to diverse consumer preferences.

Biosecurity Monitoring and Traceability

In the UK, (Dunn et al., 2020) explored the feasibility of a horticultural accreditation scheme to address plant trade-related pests and diseases. While not centered on technology, this study highlights the importance of digital tools, such as information databases and traceability systems, in monitoring and safeguarding plant health. Technology-enabled solutions are essential for identifying and mitigating biosecurity risks in the digital era.

The research findings demonstrate several technological innovations that enhance the plant purchasing experience. In Korea, (Kim et al., 2019) proposed a garden design app that

employs technology to assist users in planning, purchasing, and maintaining their gardens. In Iraq, (Nasir, Croock, et al., 2020) introduced QR-based information systems, which leverage technology to seamlessly manage plant information and enhance information retrieval and management. Furthermore, the system utilizes QR tags on farm plants to enable easy access to detailed plant information and streamline registration and sales processes (Nasir, Al-Qaraawi, & Sadik Croock, 2020). In China, (Lin et al., 2019) recommended a cloud-based solution to optimize warehouse storage, emphasizing the role of technology in logistics and supply chain management. These examples illustrate how technology, including mobile apps, QR codes, and cloud-based solutions, contributes to a more efficient and user-friendly plant acquisition process in the digital era.

Conclusion

In the ever-evolving horticultural realm, where sustainability and consumer experience are paramount, this comprehensive literature review provides valuable insights into the complex world of plant acquisition. Employing a qualitative literature review methodology spanning 2019 to 2023, researchers harnessed the Scopus database and Harzing's Publish or Perish tool to ensure the selection of pertinent and up-to-date articles. This study explored two critical facets of plant procurement: the diversification of plant purchasing behaviors across different countries, influenced by cultural norms, economic conditions, and technological advances, and the transformative role of technology in the digital age, where innovations like mobile apps, QR codes, and cloud-based solutions streamline the acquisition process, fostering efficiency and sustainability in horticulture. As sustainability and consumer preferences continue to mold the landscape of plant acquisition, this research serves as a vital resource for businesses, policymakers, and scholars aiming to navigate and contribute to this dynamic ecosystem.

Declaration of conflicting interest

The researchers state that there are no conflicts of interest in connection with the conduct of this research.

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