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Green choices in the industry 5.0 ERA: An evidence from Egypt's organic food market

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Abstract

This study examines how environmental awareness, and personal factors influence organic food purchasing decisions among Egyptian consumers, framed within the context of Industry 5.0. It addresses a critical gap in understanding sustainable consumption behavior in emerging markets by evaluating both individual-level drivers and demographic variables. The current study is quantitative, relied on a structured questionnaire which was administered to 384 consumers across four Egyptian regions (Greater Cairo, Nile Delta, Upper Egypt, and Canal/Coastal), selected using stratified systematic sampling. The survey captured measures of environmental knowledge, personal motivations, and organic product choice. Data were analysed using SPSS v.26, applying reliability testing (Cronbach's $\alpha = 0.677–0.935$), correlation analysis, and multiple linear regression to test the proposed hypotheses. Personal factors, particularly health orientation and social influence, emerged as significant predictors of organic product choice, while environmental awareness, despite high mean scores, did not exert a direct behavioral effect. Education and place of residence significantly moderated consumer behavior, with urban and more educated consumers demonstrating greater intent to purchase organic products. Income did not exhibit a statistically significant influence, suggesting values-based rather than cost-driven decisions. This study presents a framework for green consumer behavior in Egypt, showing that personal factors outweigh environmental awareness. Two archetypes were identified: a tech-savvy urban group responsive to digital solutions and a traditional cohort influenced by community norms. The findings extend the Theory of Planned Behavior by emphasizing the roles of norms and access, with most consumers still in early awareness stages. This study makes three contributions: (1) provides empirical evidence of the awareness–behavior gap in the context of green consumption within a developing economy, (2) bridges behavioral science and Industry 5.0 principles by emphasizing consumer-centric and digitally enabled engagement strategies, and (3) offers practical guidance for segment-specific policymaking and marketing interventions to enhance organic food adoption through education, access, and trust-building.

Keywords: Environmental awareness, Green Marketing, Industry 5.0, Sustainable consumption, Organic food, Personal factors.

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1. Introduction

In recent years, global food systems have faced a convergence of critical challenges that threaten their sustainability and resilience, including climate change, rapid population growth, pandemics such as COVID-19, and armed conflicts like the on-going war in Ukraine, and economic shocks that disrupt global supply chains [1]. These challenges have exposed vulnerabilities in food security and accelerated the need for a transition toward sustainable and resilient food systems. This infection is to adopt central environmentally friendly consumption practices, especially the promotion and use of organic agricultural products. Bio -farming provides a permanent option for traditional agriculture by eliminating synthetic inputs by increasing soil, conservation of soil, conservation, and supporting moral production practices, and moral production practices [2, 3]. This approach aligns with the principles of Industry 5.0, which emphasizes human–machine collaboration, environmental sustainability, ethical innovation, and personalized customer experiences [4, 5].

Egypt has articulated a clear vision for sustainability, primarily embodied in Egypt Vision 2030, which emphasizes the integration of environmental dimensions into national economic and social development strategies. This vision aims to foster a green economy that supports sustainable growth while mitigating environmental degradation. A central pillar of this strategy is the promotion of green products, reflecting a shift toward sustainable patterns of production and consumption. Policy efforts include encouraging renewable energy adoption, expanding recycling systems, minimizing industrial and household waste, and supporting clean transportation initiatives, notably the expansion of electric mobility. In parallel, the government seeks to create an enabling regulatory and investment environment that incentivizes the private sector to embrace environmental and social responsibility standards, thereby contributing to the realization of the Sustainable Development Goals (SDGs).Within this framework, the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) serves as the principal global platform for negotiating climate action, including emission reductions and climate finance for developing nations. The 27th Conference of the Parties (COP27), hosted in Sharm El-Sheikh, Egypt, in 2022, marked a critical milestone in international climate governance. The conference emphasized a transition from pledges to implementation and introduced several key initiatives, such as the Just Energy Transition Partnership, financing mechanisms for loss and damage, and thematic programs on water, food security, sustainable agriculture, and low-emission transport. Through COP27, Egypt consolidated its role as both a regional and international actor in advancing climate dialogue and underscoring the balance between developmental imperatives and environmental stewardship.

Achieving food security and eradicating hunger remain central global priorities under the United Nations Sustainable Development Goals (SDGs). Goal 2, Zero Hunger, emphasizes ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture [6]. Despite significant progress in some regions, global challenges—such as climate change, rising food prices, supply chain disruptions, pandemics, and armed conflicts—continue to threaten the stability of food systems worldwide [1, 7]. These challenges have exposed vulnerabilities in food security and accelerated the need for sustainable and resilient food systems.

In this context, environmentally friendly production practices, particularly organic agriculture, have emerged as viable solutions. Bio-farming reduces reliance on synthetic inputs, enhances soil conservation, and promotes ethical production practices [3]. Such approaches align with Industry 5.0 principles, which emphasize human–machine collaboration, environmental sustainability, ethical innovation, and personalized consumer experiences [5].

Egypt plays a pivotal role in advancing food security while supporting climate action. Nationally, the country implements 41 SDG 2-related projects, with a total investment of USD 486.048 million, targeting malnutrition reduction, smallholder support, enhanced agricultural productivity, and resilient food systems [8]. Complementing these efforts, SDG 13 – Climate Action—through 84 projects valued at USD 365 million—aims to strengthen climate resilience, including technical assistance in agribusiness and compliance with food safety standards [9]. Initiatives such as SEKEM's carbon farming pilot and the adoption of climate-smart agriculture reflect Egypt's efforts to integrate domestic agricultural practices with global climate commitments [10, 11].

Egypt's agricultural sector remains vital to the economy, contributing 11.5% to GDP and employing over one-fifth of the labor force in 2019 [12]. However, challenges such as water scarcity, heat stress, soil erosion, pesticide misuse, and limited adoption of sustainable practices persist [13, 14]. While development projects have strengthened horticultural value chains and post-harvest practices, the biological food market in Egypt remains underdeveloped, highlighting the need to align consumer behavior with sustainable production and environmental awareness.

Consumer behavior plays a central role in shaping green and organic markets, particularly in emerging economies. Environmental awareness—which encompasses knowledge, attitudes, and behavioral ability—is essential for encouraging environmentally responsible choices [15-18]. Personal factors, including gender, education, income, family influence, and social networks, also significantly affect consumption patterns, especially in collectivist cultures like Egypt [19-22]. Higher environmental knowledge is associated with stronger green consumption behavior and a preference for organic products. Theoretical frameworks such as the Theory of Planned Behavior (TPB), Stakeholder Theory, and Institutional Theory offer insights into how attitudes, social norms, regulatory pressures, and perceived control shape both consumer and organizational behaviors [23-25]. Despite growing research on environmental awareness and consumer behavior, empirical studies on Egyptian consumers remain limited. Cultural, social, and infrastructure factors create a unique market context, and there is a need to investigate how demographic variables, family influence, and personal factors interact with environmental knowledge to shape organic food choices.

Despite progress, Egypt still faces several gaps that align directly with the research focus on green choices. First, while awareness of organic food and sustainability is growing, consumer knowledge remains uneven, and affordability is a barrier. Building a culture of informed, resilient consumption is essential [13]. Second, companies need to adopt transparent green marketing practices, integrating sustainability into branding and production to build trust with consumers and compete in international markets. Third, scaling up organic farming and climate-smart agriculture requires wider access to technology, training, and financial incentives for farmers, particularly in rural communities. Fourth, achieving SDG 2's target of correcting distortions in global agricultural trade will require Egypt to position itself more competitively in organic exports while reducing reliance on subsidized inputs and traditional farming systems [26]. Finally, to fully embrace Industry 5.0, Egypt must enhance digital infrastructure, support innovation ecosystems, and integrate AI, IoT, and blockchain solutions in agri-food systems while ensuring inclusivity and human-centric approaches.

Thus, Egypt provides new evidence of how emerging markets navigate the transition toward sustainable consumption and production in the Industry 5.0 era. Studying Egypt's organic food market highlights both local dynamics—consumer awareness, rural development, and sustainable agriculture—and global implications—trade, climate commitments, and resilience in food systems. This dual perspective reinforces Egypt's significance as a case study for advancing theory and practice on green choices and sustainability in developing economies.

A compelling example of green products emerges from the food industry, particularly in the case of organic and sustainably produced food items. Unlike conventionally farmed alternatives, these products are cultivated without chemical fertilizers, synthetic pesticides, or genetically modified inputs, which helps mitigate the harmful ecological effects of intensive agriculture. At the same time, they foster biodiversity, enhance soil quality, and strengthen ecosystem resilience. Many green food initiatives also emphasize local sourcing and fair-trade practices, which reduce carbon emissions through shorter supply chains while improving the livelihoods of local farmers and supporting rural communities. From the consumer's perspective, green food products offer safer and healthier alternatives while providing the additional benefit of aligning everyday choices with environmental and ethical values. The growing adoption of such products reflects a lifestyle shift toward more sustainable consumption patterns. For institutions and businesses, green food products generate both strategic and reputational benefits. Companies adopting sustainable food production and distribution models are able to differentiate themselves in competitive markets, appeal to environmentally conscious consumers, and strengthen long-term brand loyalty. They also enhance their compliance with global sustainability frameworks and reporting standards (e.g., ESG and GRI), which improves their ability to attract socially responsible investors. Furthermore, a critical complement to sustainable food is the adoption of eco-friendly packaging solutions. By replacing conventional plastics with recyclable, compostable, or biodegradable alternatives, companies not only reduce waste and pollution but also demonstrate genuine commitment to the principles of a circular economy. This fosters stronger consumer trust and provides opportunities for market expansion in regions with stricter environmental regulations. However, despite these advantages, challenges remain. Organic farming and green packaging technologies often entail higher production and distribution costs, resulting in premium prices that can limit consumer accessibility. There are also barriers related to supply chain scalability, technological readiness, and public awareness of the long-term benefits of green consumption. Nevertheless, advancements in sustainable technologies, government incentives, and a steady rise in eco-conscious consumer behavior continue to ease these challenges. Collectively, green food products and eco-friendly packaging are not only reshaping the dynamics of the food sector but also playing a pivotal role in accelerating progress toward the global sustainable development agenda.

In summary, Egypt represents a dual challenge and opportunity: advancing national food security while fostering environmentally sustainable consumption patterns in line with Industry 5.0 principles. Understanding the relationship between environmental awareness and personal factors in shaping consumer behaviour is critical for promoting organic consumption and developing data-driven strategies. Therefore, this study examines how environmental knowledge, individual characteristics, and family influence affect consumer decisions toward organic food in Egypt, offering new evidence from the era of Industry 5.0.

2. Literature review

This study draws upon three classical theories—Stakeholder Theory, Institutional Theory, and the Theory of Planned Behaviour (TPB)—to examine the relationships between environmentalism, personal factors, and consumer behaviour in Egypt's organic food sector within the context of Industry 5.0. Stakeholder Theory provides a lens for understanding how external factors, such as consumers, environmental NGOs, government regulators, and local communities, influence organizational behaviour, compelling firms to adopt environmentally responsible practices due to rising public concern and sustainability expectations [25, 27]. Complementing it, institutional theory explains why companies are in line with social

conferences, industry norms and government rules, which emphasize maintaining legitimacy, emphasizing that firms are bound to work socially, with institutional pressures, often with institutional pressures, the demands of the relatives [24, 25, 28]. TPB contributes by clarifying psychological motivations behind green procurement that approach, subjective criteria, and perceived behaviour control size intentions and behaviour [29]. In Egypt, this structure helps explain that demographic and individual factors like family effects, income, and education influence environmental consumption. By integrating these approaches, the study provides a wide understanding of how environmental awareness, individual determinants and institutional forces jointly affect the consumer's choice in the Egyptian organic food market.

2.1. Organic Products and Industry 5.0

Organic products are produced using ecological farming methods that avoid synthetic inputs such as chemical fertilizers, pesticides, and genetically modified organisms, emphasizing environmental protection and soil health [30]. These practices include crop rotation, manure, organic fertilization, and organic insect controls to maintain ecological balance and reduce pollution [29].

The adoption of organic products reflects a broader shift in consumer preferences toward sustainability and health consciousness. Compared to conventionally produced foods, organic products are perceived as safer and healthier, often associated with higher levels of vitamins and minerals, such as vitamin C [31, 32]. Growing concern over the environmental and health impacts of industrial agriculture has significantly contributed to the rising demand for organic alternatives.

This consumption trend aligns with promoted values in Industry 5.0 and Industry 6.0, which emphasize permanent production, renewable energy, bionics, and moral innovation [4, 5]. In this context, organic consumption not only represents a health-oriented lifestyle but also a commitment to ecological responsibility and conscious life. The distinctiveness of organic products is often positioned on these characteristics—contributing to their environmental benefits, moral production methods, and personal welfare [33]**.**

2.2. Environmental Awareness

Environmental awareness is a complex and evolving concept that encompasses an individual's understanding, concern, and readiness to act on issues related to the environment and sustainability. It encompasses cognitive knowledge and motivational capacity, both of which are essential for developing pro-environmental attitudes and making sustainable consumer choices [15].

Fundamentally, environmental awareness consists of multiple components, with knowledge being a central element. According to Hirose [34]; Mccann, et al. [35] and Olgyaiova [36] environmental knowledge is organized into three domains: system knowledge, which involves factual understanding of environmental systems such as pollution, biodiversity, and climate change; action-related knowledge, which encompasses procedural understanding of environmentally friendly practices like recycling and purchasing organic products; and effectiveness knowledge, which reflects comprehension of the relative impact of such actions. Individuals' grasp of these knowledge domains influences their understanding of how personal actions affect the environment and has been empirically linked to pro-environmental behavior [25, 28, 37].

Beyond cognitive knowledge, environmental awareness also includes motivational, behavioral, and conceptual dimensions. According to Olgyaiova [36] environmental awareness develops through four stages: Stage 1 depends mainly on health-related concerns; Stage 2 shows environmental law and shared responsibility; Stage 3 shifts from curative to preventive approaches; and Stage 4 reflects overall awareness beyond human concerns.

Knowledge supports awareness and behavior. Mccann, et al. [35] highlight system, action-related, and effectiveness knowledge as keys to environmental decision-making. Hsiao, et al. [28] suggest that informed consumers are more likely to engage in green procurement. Increased environmental knowledge also enhances the willingness to pay for environmentally friendly products [38] and ecological experiences strengthen environmental self-efficacy and curiosity [17]. Thus, environmental knowledge supports environmental values and sustainable consumer behavior.

According to Hertell, et al. [15] environmental awareness can be designed as a combination of knowledge, skills, and motivation. Similarly, Pongracz [16] enhanced this perspective by incorporating the ability and desire to function sustainably; environmental consciousness is formally designed as a grassroots concept. These ideas underline that awareness is not purely intellectual but also deeply associated with action-oriented capabilities.

Olgyaiova [36]; Sengupta, et al. [17] and Tsinopoulos, et al. [25] emphasize that environmental awareness is subjective and evolves over time. Personal experiences, cultural narratives, and increased exposure to ecological information influence how individuals perceive environmental issues. This affects the way they internalize environmental risks and translate them into thoughtful purchasing decisions—strengthening the idea that awareness is not fixed, but shaped by social and informational references.

In this study, environmental awareness is not treated as a static or discrete attitude. Instead, it is a composite psychological construct integrating emotional concern, factual knowledge, and perceived efficacy—all of which contribute to consumers' choices, particularly in adopting organic products. The industry also aligns with Industry 5.0 principles, where informed, strong consumers actively participate in sustainable market transitions driven by technology, morality, and human-focused innovation.

2.3. Personal Factors

Individual factors form a multidimensional construct incorporating characteristics that significantly affect consumer behavior, especially in relation to environmentally friendly or organic products. These factors operate across three primary domains: biological, psychological, and sociocultural [39]. The biological dimension includes attributes such as age and health status, which directly affect environmental sensitivity and lifestyle choices. As individuals age, psychological changes—including coping with loss, role transitions, and heightened health consciousness—can further influence preference for organic alternatives [32].

The psychological dimension involves internal states such as self-esteem, personal motivation, and autonomy. Secure emotional foundations, often fostered through early family bonds, particularly parent–child relationships, cultivate openness to pro-environmental behaviors [21]. Motivation derived from health considerations, ethical values, or social approval plays a crucial role in guiding green consumption.

The sociocultural dimension encompasses education level, cultural values, and family structures. In collectivist societies, family influence is particularly salient; parents act as primary agents of value transmission, with familial interactions shaping attitudes toward environmental responsibility and consumption norms. Consequently, the family—through both immediate interactions and broader social modeling—serves as a key conduit through which personal values are translated into behavioral intentions [40, 41].

When one person acts to change the behavior of another in some intended manner, influence occurs [42]. Thus, influence can be applied to purchase decisions when children affect, in one way or another, their parents' consumption behavior. According to McNeal [43] children's purchasing power and money can be direct or indirect, relating to parental purchases that the child initiates or influences. The study of Wang, et al. [44] stated that perceived influence occurs when one family member believes that another member has affected a purchase decision [45].

Collectively, these domains demonstrate that personal factors are not isolated traits, but rather the interplay of individual experience, social environment, and developmental context. In the context of organic product adoption, these factors affect how consumers interpret environmental messages, assess product credibility, and ultimately make purchasing decisions.

2.4. Consumer Choice

Consumer choice refers to the procedures by which individuals choose goods and services that align with their personal needs, values, and goals. In terms of organic product consumption, consumer behavior is often conceptualized through a rational five-step decision-making model: problem recognition, information search, evaluation of options, purchase, and post-purchase behavior [46, 47].

This process is affected by internal and external factors, including social impact, perceived product gains, personal motivation, and environmental knowledge [30]. Consumers evaluate their options using criteria such as price, quality, brand reputation, and environmental characteristics to reach informed purchasing decisions [15, 30, 38, 48-54].

The depth of consumer evaluation and decision-making varies with context. Routine procurement is often habitual, while organic products—usually considered more expensive and value-laden—require more complex cognitive assessment [17, 40, 47] with brands influenced by selective perception and previous experiences [27]. Environmental knowledge further enhances preference for green products; for instance, awareness of ecological issues positively affects choices related to green electronics Hassan and Nor [41] and environmental concern increases young consumers' likelihood of choosing organic products [49, 55].

Nonetheless, a knowledge–behavior gap remains, as high awareness does not always translate into action. Social and familial influences also play a critical role: peer and family guidance—through persuasion, competition, and information sharing—shapes green purchasing behavior [19, 20, 56, 57] with familial values particularly influential in collectivist societies [21]. Finally, consumers evaluate a "bundle of attributes" including health benefits, cost, certification labels, and sustainability claims [58] with assessments influenced by factors such as brand trust, credibility, and environmental effectiveness [46].

In the context of green consumption, consumer choice extends beyond practicality, incorporating ethical and ecological considerations. Accordingly, in this study, the term consumer choice refers specifically to the processes through which individuals select or avoid organic products based on their personal preferences and degree of environmental awareness.

Hypothetical development of Environmental Awareness and personal factors to Consumer Decision-Making in Green and Organic Markets

Environmental awareness exerts a strong influence on consumer choices for green products [41]. Classic consumer behavior models identify five stages in decision-making [47] which are shaped by both tangible and intangible product attributes [48] including brand image, environmental claims, production methods, and perceived sustainability. Consumers increasingly consider ecological impacts when evaluating products, reflecting a shift toward more informed and conscious purchasing behavior [29, 31, 35, 59] demonstrate that environmental awareness significantly affects young consumers' decisions, who tend to prioritize eco-friendly options when knowledgeable about environmental issues.

Family dynamics play a pivotal role in shaping consumption patterns. Children, for instance, can influence household decisions, particularly regarding organic and environmentally friendly products [57, 60]. Social interactions, shared values, and family communication contribute to embedding sustainable practices within daily consumption, underscoring that eco-friendly behavior is not solely an individual choice but also socially and culturally mediated. Sustainable consumption and pro-environmental behavior are further shaped by personal factors—including biological, psychological, and sociocultural

characteristics—as well as interpersonal dynamics and value formation within the family. The concept of the "green family" emphasizes how parenting style, communication, and emotional support influence environmental responsibility; conflictual family environments reduce ecological accountability [56] whereas consistent parental attention supports healthy psychological adjustment [60]. Quality parent–child relationships foster young people's readiness to adopt environmentally conscious behavior [20, 43].

Pimpa [22] identifies five familial influence dimensions—financial, informational, persuasive, expectational, and competitive—that enhance environmental awareness and sustainable consumption, particularly in collectivist societies [21]. Social influence also plays a critical role; family members can shape purchasing behavior, with children influencing parental purchases through financial knowledge and perceived influence [42].

Despite extensive literature on environmental awareness and personal influence on consumer choices, several research gaps remain. While Olgyaiova [36] four-stage model offers a comprehensive framework, empirical validation across diverse cultural contexts, such as Egypt, is limited. The progression of Egyptian consumers through these awareness stages and its impact on consumption choices remains underexplored [36]. Moreover, although studies acknowledge the role of family and peers [19] few examine how demographic variables—such as education, marital status, and income—influence environmental behavior in developing countries. While environmental concern is widespread, socio-economic status may moderate the relationship between awareness and behavior.

Consumer behavior models [61] often assume rational decision-making, overlooking the influence of emotions, cultural norms, and perceived behavioral control. Consequently, individuals who express environmental concern may not always translate this into action due to structural or psychological barriers, a phenomenon known as the "attitude–behavior gap." Additionally, the interaction between environmental awareness and product attributes—such as price, brand reputation, and certification—remains insufficiently analysed. Consumer beliefs and perceptions are subject to distortion, selective retention, and brand bias [27, 48] complicating inferences about environmentally motivated purchases.

Another limitation is the generalized portrayal of consumers. Although [16] notes that environmental knowledge affects choices, the level and nature of this knowledge vary across demographic segments. Without segmenting consumers by knowledge, values, or behavioural intentions, interventions to promote green products may be ineffective. Finally, the global trend toward organic food [30] underscores the need to understand local perceptions of organic certification and sustainability, as Egyptian consumers' trust in and interpretation of these labels may differ, influencing their purchasing decisions.

Thus the researcher hypothesizes the following hypotheses as shown in Figure 1:

H_1: Environmental awareness has a significant effect on consumer choices of organic products.

H_2: Personal factors have significant effect on consumer choices of organic products.

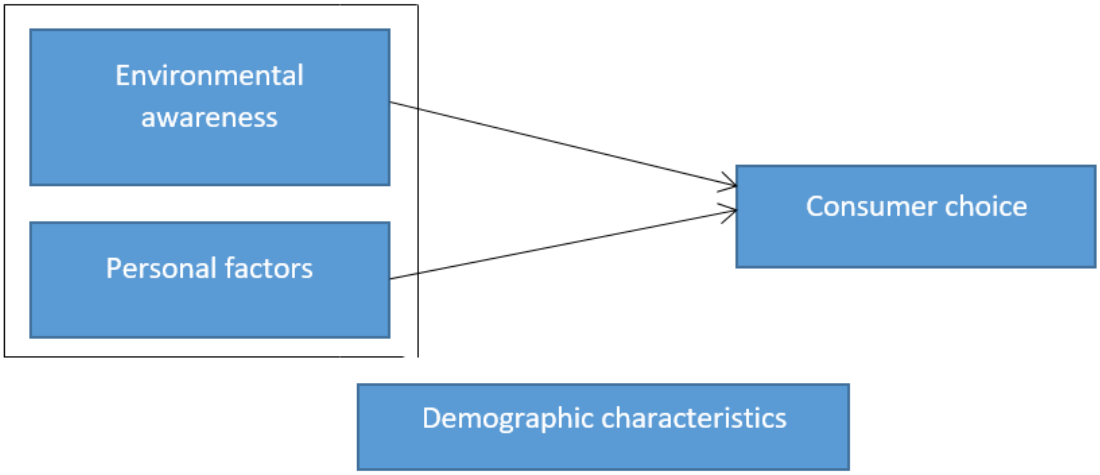

Figure 1.
Mapping the conceptual domain of Environmental and Personal factors on Consumer Choice of organic products in Era of Industry 5.0.

3. Methodology

3.1. Research Context

Egypt holds a unique and strategic position in the global sustainability landscape due to its rich civilizational heritage, diverse population of more than 105 million, and pivotal geographic location bridging Africa, the Middle East, and Europe. This demographic scale, coupled with diversity in income levels, cultural backgrounds, and consumption patterns, creates both opportunities and challenges for advancing sustainable consumption and awareness of green products. Historically, Egypt's civilization has emphasized the sustainable use of land and water resources along the Nile, reinforcing the importance of safeguarding natural resources for future generations. Today, the country is not only vulnerable to the impacts of climate change but also well-positioned to lead regional green transitions. Recognizing this duality, Egyptian political leadership has adopted strategies to integrate sustainability into both domestic and international agendas. These include embedding sustainability considerations in trade and investment agreements with partners such as the European Union and Germany, launching national initiatives like the "Go Green" campaign, and advancing renewable energy

projects under the NWFE program. At the same time, domestic strategies focus on aligning policies with global standards, strengthening local producers through capacity -building, and raising consumer awareness to encourage eco-friendly practices. Collectively, these efforts highlight Egypt's role as both a beneficiary of global green cooperation and a regional leader capable of steering the transition toward sustainable development.

Egypt represents a compelling case study for exploring green choices in the era of Industry 5.0 due to its unique intersection of demographic, economic, and environmental factors. With a population exceeding 110 million and a rapidly growing middle class, Egypt faces increasing pressure to balance food security with sustainability [12]**.** Agriculture contributes more than 11% to GDP and employs over 20% of the labor force, yet the sector continues to grapple with resource scarcity, climate change vulnerabilities, and limited adoption of sustainable technologies [14]**.** These dynamics create both urgent challenges and unique opportunities for advancing sustainable consumption and production, particularly in the organic food market.

Furthermore, Egypt has been an active player in global sustainability dialogues, hosting COP27 in 2022 and integrating agriculture into its National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs) [62]**.** Initiatives such as SEKEM's carbon farming and FAO-supported horticultural value chain projects illustrate Egypt's growing experimentation with climate-smart and organic agriculture [11, 62]**.** Against this backdrop, Egypt offers fertile ground for analysing how Industry 5.0—centered on human-centric, sustainable, and resilient production—can reshape consumer behaviour and corporate strategies in the food sector [1, 5]**.**

Egyptian government institutions have increasingly formalized policies, laws, and partnerships to promote green products and sustainable agriculture. For instance, the Olgyaiova [36] empowers the Central Laboratory of Organic Agriculture (under the Ministry of Agriculture) and the National Food Safety Authority to regulate organic farming, reduce reliance on synthetic inputs, conserve biodiversity, and improve the quality of organic exports [63]**.** Building on this, the Ministry of Agriculture signed a protocol with the Egyptian Centre of Organic Agriculture (ECOA) to establish a unified database of certified organic farms and harmonize training and certification processes [64]**.**

Meanwhile, the Ministry of Environment has launched several initiatives to green industries and consumer products. The Green Sustainable Industry (GSI) Program supports industries in adopting circular economy practices, reducing greenhouse gas emissions, and enhancing compliance with environmental standards [65]**.** Additionally, the Ministry issued guidelines for a Green Label for Plastic Products under Waste Law No. 202/2020, encouraging companies to integrate recycled or biodegradable materials in packaging and production [66]**.** At the national level, Egypt's Vision 2030 integrates sustainability as a core principle: by 2025, 50% of government-funded projects must be "green," with a target of 100% by 2030 [67]**.**

These efforts are reinforced by long-term strategies, such as the National Climate Change Strategy 2050 and the Integrated Sustainable Energy Strategy 2035, which aim to diversify energy sources, promote sustainable agriculture, and integrate environmental sustainability into Egypt's development agenda [68]**.** Furthermore, the "Go Green" Initiative, launched by the Ministry of Environment, raises consumer awareness of sustainable consumption through campaigns on waste reduction, energy conservation, and reduced plastic use[69]**.**

Together, these official policies and partnerships provide a solid institutional foundation for Egypt's transition toward sustainable production and consumption, enhancing consumer awareness and corporate responsibility while positioning the country as a regional leader in green markets [7, 26, 67]**.**

3.2. Research Design

This study employs a quantitative, hypothesis-driven methodology using a structured questionnaire survey to examine the influence of environmental and personal factors on consumer choices regarding organic products in Egypt. The research design is grounded in the positivist paradigm, which emphasizes objectivity, measurability, and generalizability [42] thereby facilitating statistical analysis and supporting the testing of causal relationships among latent constructs.

The study was conducted across both urban and rural regions in Egypt, where the organic food market is emerging but increasingly prominent. Egypt's demographic diversity, coupled with growing environmental awareness, provides a meaningful context for investigating green consumption, particularly within the framework of Industry 5.0, which emphasizes human-centric innovation, digital sustainability, and ethical consumption.

Data were collected from major national retail chains offering organic products, including Carrefour, Metro, Awlad Ragab, and Hyper One. These outlets were selected for their accessibility, demographic reach, and consistent availability of eco-labeled goods, enabling the inclusion of both technologically adept urban consumers and traditional rural shoppers.

A multi-stage stratified systematic sampling technique was employed to ensure representation across Egypt's four major regions (Greater Cairo, Nile Delta, Upper Egypt, and Canal/Coastal areas), with further stratification by urban and rural residence. Within each cluster, systematic sampling was conducted by selecting every third to fifth shopper at the targeted outlets, as detailed in Table 1. This approach supports the demographic segmentation strategy used to test H3.

The target population consisted of Egyptian consumers familiar with or exposed to organic products. The sample size of 384 was calculated based on a 95% confidence level and a 5% margin of error [43] and was proportionally distributed across regional strata to ensure diversity in gender, age, education, income, and marital status.

Table 1.
Sample Size Distribution (Total N = 384).

Region	Urban (n)	Rural (n)	Total
Greater Cairo	80	20	100
Nile Delta	60	30	90
Upper Egypt	50	40	90
Canal/Coastal Area	70	34	104
Total	260	124	384

Participation was voluntary and anonymous. All respondents gave verbal informed consent after being informed about the study's purpose, confidentiality policy, and non-identifiability. All procedures adhered to ethical research standards. Data were collected using a structured, self-administered questionnaire, developed based on validated constructs from previous studies (e.g., [55]). The instrument consisted of four sections: (1) **Environmental Awareness and Knowledge**, encompassing system knowledge, action-related knowledge, and effectiveness knowledge; (2) **Personal Factors**, including self-efficacy, health motivation, and social influence; (3) **Consumer Choice**, measured through behavioral intention, actual purchase behavior, and willingness to pay for organic products; and (4) **Demographics**, capturing age, gender, education, income, marital status, and place of residence. All items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), chosen for cultural appropriateness and to mitigate central tendency bias.

The questionnaire was reviewed by four marketing faculty experts and refined following a pilot test with 30 respondents. Revisions focused on improving item clarity, removing culturally ambiguous questions, and ensuring internal consistency. To operationalize alignment with Industry 5.0, age was used as a proxy to differentiate tech-savvy consumers (typically younger and digitally inclined) from traditional consumers (older and less digitally engaged), consistent with literature linking age to digital behavior, sustainability values, and openness to technology-mediated consumption ([29]).

Fieldwork was conducted from March to May 2023 through in-person interviews administered by trained researchers. Each interview lasted 10–15 minutes, allowing respondents to seek real-time clarification and enhancing data accuracy.

Data were analysed using SPSS Version 26, employing a series of statistical procedures to ensure robustness and validity. Reliability was assessed through Cronbach's alpha, indicating high internal consistency with $\alpha = 0.935$ for environmental factors, 0.677–0.810 for personal factors, and $\alpha = 0.795$ for consumer choice, thus confirming acceptable reliability thresholds. Face and content validity were established through expert review and pretesting. Descriptive statistics, including frequencies, means, and percentages, were used to summarize sample characteristics and item distributions. Pearson correlation analysis examined the relationships between key latent constructs. Multiple linear regression analyses were conducted to test hypotheses: H1 assessed the combined predictive effect of environmental and personal factors on consumer choices, while H2 examined the independent influence of each factor on consumer decisions. Finally, Mann-Whitney and Kruskal-Wallis tests were applied to test H3, exploring differences in the effects of environmental and personal factors on consumer choices across demographic variables such as income, education, and residence.

This methodology enabled comprehensive testing of the conceptual model and provided robust insights into segmented green consumption behaviours in the Egyptian market within the context of Industry 5.0.

3.3. Reliability and Validity Testing

Before analysing the data, the researchers tested the reliability and validity of the questionnaire using two main methods:

3.3.1. Face Validity Evaluation

The questionnaire was initially reviewed and refined using the face validity method as recommended by Cedefop [70]. The items were revised based on expert feedback, and the instrument was pre-tested with 10 participants from the study population. Based on this pilot test, some adjustments were made to ensure clarity and comprehensiveness of the statements.

3.3.2. Cronbach's Alpha Reliability

To test the internal consistency of the measurement scales, Cronbach's Alpha was computed for each dimension using SPSS V.26. The reliability coefficients for the dimensions of variable X (A and B) ranged from 0.677 to 0.810, which are within the acceptable threshold ($\alpha > 0.6$). For the overall variable X, the reliability reached 0.935, and for Y, it was 0.795, indicating strong internal consistency across constructs.

3.4. Descriptive Statistics

The descriptive characteristics of the sample are summarized in Table 2.

Table 2.
Descriptive Statistics of the Respondents.

Residence	**Frequency**	**Percent**
Rural	370	46.7
Urban	422	53.3
Total	792	100.0
Income	Frequency	Percent
< 1000 EGP	220	27.8
1001 – 2000 EGP	296	37.4
> 2001 EGP	276	34.8
Total	792	100.0
Education	Frequency	Percent
Intermediate	276	34.8
University	446	56.3
Postgraduate	62	7.8
Below Intermediate	8	1.0
Total	792	100.0

3.5. Means and Standard Deviations

The means and standard deviations for the study variables are presented in Table 3.

Table 3.
Means and Standard Deviations of Variables.

		N	**Std. Deviation**	**Mean**
X		792	0.30337	3.5163
1	A	792	0.34997	3.3021
2	B	792	0.42093	4.0875
Y		792	0.38404	4.0313

It is evident that the mean values of the dimensions A and B in Table 3 exceed the midpoint of the Likert scale (3.41), indicating a tendency toward agreement among participants. Similarly, variable Y also shows a high mean (4.03), suggesting a positive perception by the respondents.

3.6. Hypotheses Testing

3.6.1. Hypothesis 1: Correlation Between X (A and B) and Y

To test the first hypothesis, Pearson correlation coefficients were computed.

Table 4.
Pearson Correlation Matrix Between X (A and B) and Y.

	X	**A**	**B**	**Y**
X	1			
A	0.930**	1		
B	0.580**	0.241**	1	
Y	0.389**	0.168**	0.656**	1

Note: * Statistically significant at a level of significance less than 0.05.
** Statistically significant at a level of significance below 0.01.
*** Statistically significant at a significance level less than 0.001

The results show statistically significant and positive correlations between the dimensions A and B of variable X and variable Y. These findings support the acceptance of the first hypothesis.

3.7. Hypothesis 2: The Impact of X (A and B) on Y – Regression Analysis

To test the second hypothesis, a stepwise multiple linear regression analysis was conducted. The results are shown in Table 5.

Table 5.
Multiple Regression Analysis of the Effect of X on Y.

Table (4) :Multiple regression analysis of the effect of independent variable dimensions X on Y

Independent variable	Standard rated parameters	T-test		F –test		Correlation coefficient R	The determination coefficient R^2
		Test statistic	The level of significance	Test statistic	The level of significance		
Constant	1.586	15.751	.000	595.444	0.000***	0.656	0.430
B	0.598	24.402	.000				

Note: * Statistically significant at a level of significance less than 0.05
** Statistically significant at a level of significance below 0.01
*** Statistically significant at a significance level less than 0.001

From Table 5 it is clear that:

Correlation coefficient (R) where the value of the correlation coefficient was (0. 656) with a significance level less than (0.001).

3.8. Coefficient of Determination (R^2)

The value of the coefficient of determination of the model (0.430), meaning that the independent variables explain (43%) of the change and variation that occurs in the dependent variable and that the rest of the changes occur as a result of random change in the model or other factors not included in the model.

3.9. The Significance of Each Independent Variable is Tested Separately:

By testing the T-test, we find that the independent significant variables included in the regression model are (B) at a significance level of less than (0.001). The model excludes the dimensions (A) as there is no significant impact.

To test the significance of the model as a whole, the F-test was used. We find that the value of the (F) test statistic for the model reached (595.444), which is a statistically significant level of significance less than (0.001), which means that the test's significance is higher. From the model it becomes clear that there is a high significant impact of the dimensions (B) on (Y).

From the regression hypothesis that the errors (the differences between the estimated value using the model and the actual value of the independent variable) are distributed in a standard normal distribution with an arithmetic mean (0) and a standard deviation (1), and this can be tested when drawing the frequency histogram of the standard errors of the regression model, as shown in Figure 2 and it is clear from this figure that the arithmetic mean is approximately equal to (0) and the standard deviation (0.996) is approximately equal to the integer one.

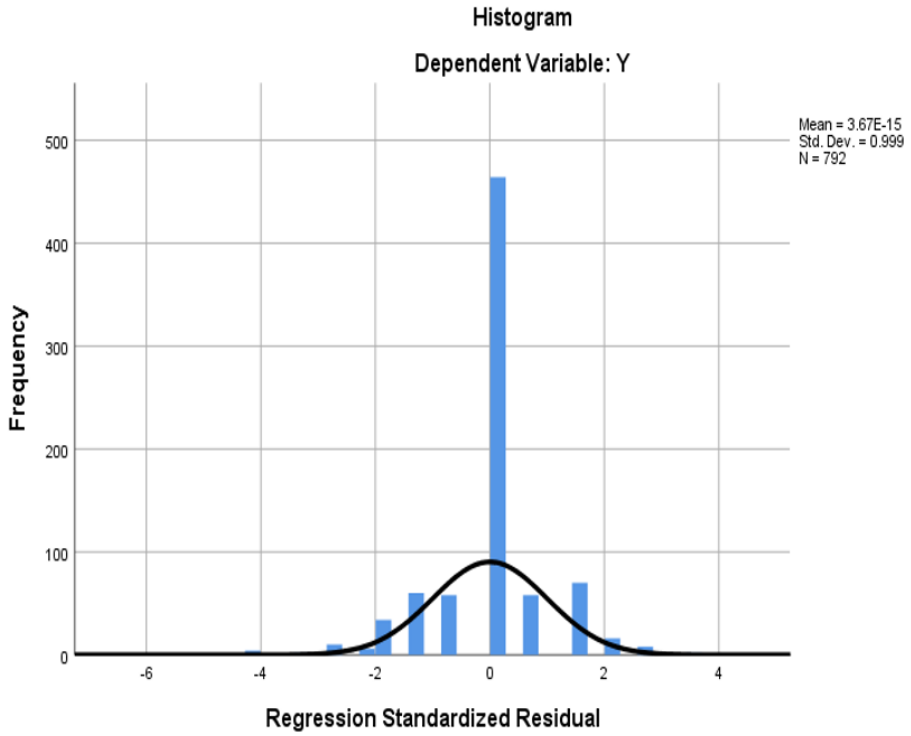

Figure 2.
Histogram of Standard Errors of the Linear Regression Model for the X Dimensions Most Affecting Y.

The moderation of the test is also evidenced by comparing the actual values of the dependent variable and the estimated value using the proposed regression model by drawing (p-p plot) by plotting the expected cumulative probability versus the actual probability. It is evident from Figure 3 that the comparison is very close to the same.

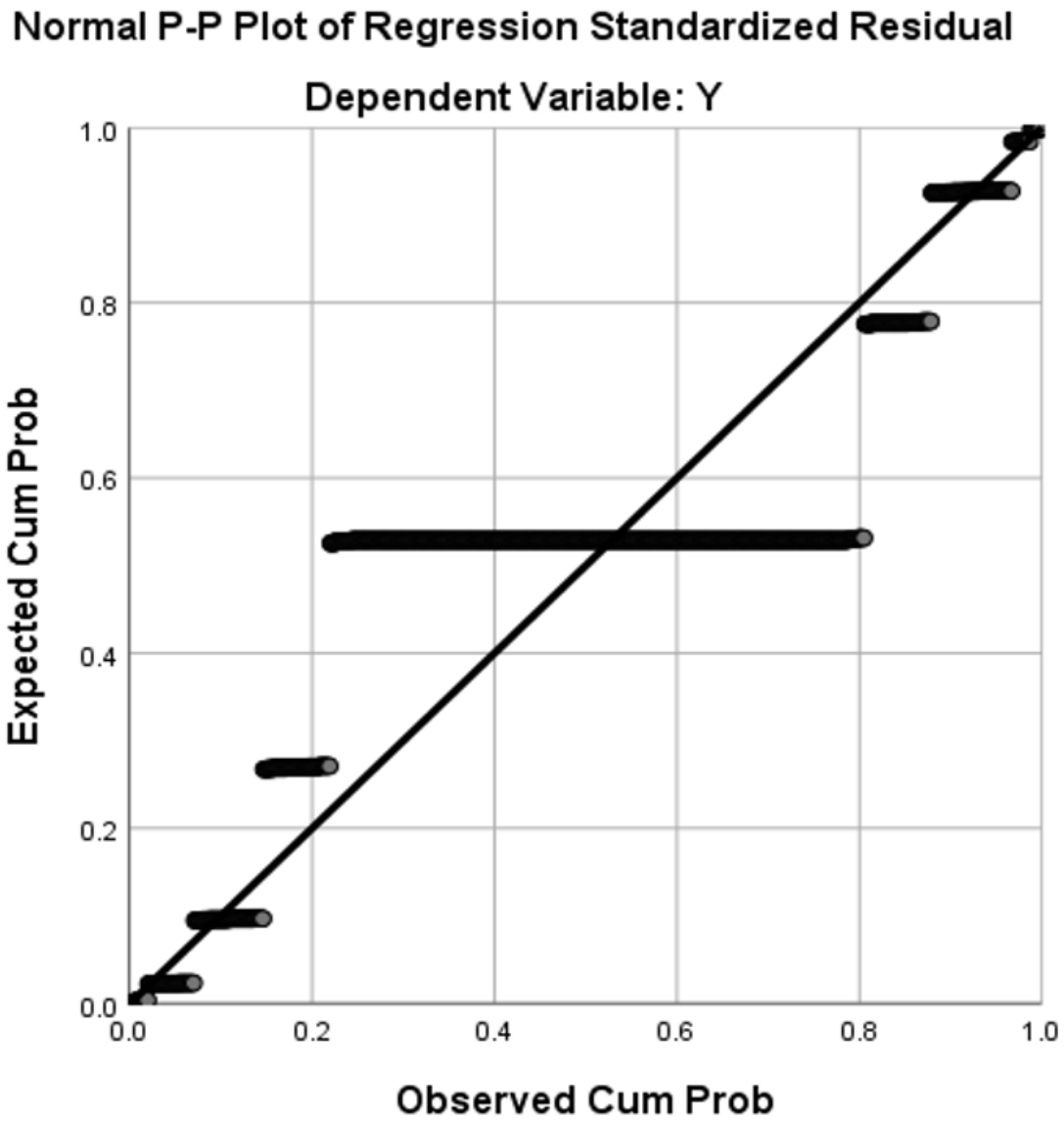

Figure 3.
p-p plot of the linear regression model for the X Dimensions Y.

The results of the regression analysis reveal the partial validity of the sub-hypothesis, which states: “There is a statistically significant effect of the dimensions of the independent variable, X on Y,” where there is a significant impact of the dimensions (B) The model excludes dimensions (A) as there is no significant impact on Y.

3.10. Hypothesis 3: Differences Based on Demographic Factors

3.10.1. By Residence – Mann-Whitney Test

Table 6.
Differences in Perception Based on Residence.

	Residence	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Sig
X	Rural	370	414.83	153487.00	71288.000	0.034
	Urban	422	380.43	160541.00		
	Total	792				
A	Rural	370	418.40	154807.00	69968.000	0.011
	Urban	422	377.30	159221.00		
	Total	792				
B	Rural	370	394.88	146107.00	77472.000	0.825
	Urban	422	397.92	167921.00		
	Total	792				
C	Rural	370	391.40	144817.00	76182.000	0.501
	Urban	422	400.97	169211.00		
	Total	792				

Table 6 demonstrates statistically significant differences in the perceptions of dimensions X (specifically A) and Y based on place of residence, thus supporting the hypothesis.

3.10.2. By Income – Kruskal-Wallis Test

Table 7.
Differences in Perception Based on Income.

	Income	N	Mean Rank	Kruskal-Wallis H	Sig.
X	< 1000	220	417.82	2.755	0.252
	1001 – 2000	296	385.59		
	> 2001	276	391.21		
	Total	792			
A	< 1000	220	416.37	2.517	0.284
	1001 – 2000	296	384.84		
	> 2001	276	393.17		
	Total	792			
B	< 1000	220	399.87	0.434	0.805
	1001 – 2000	296	390.66		
	> 2001	276	400.07		
	Total	792			
Y	< 1000	220	377.55	2.789	0.248
	1001 – 2000	296	405.55		
	> 2001	276	401.89		
	Total	792			

Table 7 shows no statistically significant differences based on income, and thus the hypothesis is rejected.

3.10.3. By Education – Kruskal-Wallis Test

Table 8.
Differences in Perception Based on Education.

	Education	N	Mean Rank	Kruskal-Wallis H	Sig.
X	Below Intermediate	276	358.29	33.741	0.000
	Intermediate	446	399.26		
	University	62	515.69		
	Postgraduate	8	637.25		
	Total	792			
A	Below Intermediate	276	339.07	57.986	0.000
	Intermediate	446	405.59		
	University	62	554.31		
	Postgraduate	8	648.50		
	Total	792			
B	Below Intermediate	276	433.28	20.688	0.000
	Intermediate	446	384.41		
	University	62	325.40		
	Postgraduate	8	352.50		
	Total	792			
C	Below Intermediate	276	436.06	20.648	0.000
	Intermediate	446	375.85		
	University	62	389.27		
	Postgraduate	8	239.00		
	Total	792			

Table 8 indicates statistically significant differences in perceptions across all variables depending on educational level, hence the hypothesis is accepted.

The study findings indicate that the research instrument demonstrated acceptable reliability and validity, supporting the robustness of the data collected. Participants generally exhibited positive attitudes toward the study variables and their respective dimensions. Pearson correlation analysis revealed statistically significant relationships between the independent and dependent variables, confirming the interconnectedness of the constructs. Regression analysis further showed that dimension B had a significant positive effect on Y, whereas dimension A did not exert a significant influence. Additionally, Mann-Whitney and Kruskal-Wallis tests indicated that specific demographic variables, namely residence and education, significantly affected participants' perceptions, while income was not found to have a discernible impact.

4. Discussion

This study investigated the relationship between environmental awareness, personal factors, and consumer choices regarding organic food in Egypt, guided by the frameworks of Industry 5.0 [5] the Theory of Planned Behavior (TPB**)** [23] Stakeholder Theory [25] and Institutional Theory [24]**.** Employing a structured quantitative approach with a sample of 384 consumers drawn from various Egyptian regions, the study examined the influence of two key independent dimensions—environmental factors (A) and personal factors (B)—on consumer choices (Y) related to organic products.

The findings indicate that personal factors (dimension B) exert a significant positive influence on consumer choice (Y), as confirmed through regression analysis. While environmental awareness (dimension A) was positively correlated with consumer choice, it did not demonstrate a statistically significant direct effect in the regression model. Demographic control variables revealed differential effects: education and residence significantly influenced perceptions and choices, whereas income did not. Overall, participants exhibited moderately high levels of awareness and positive attitudes, but behavioral action appeared more strongly driven by personal factors such as health motivation, family influence, and social norms. These results demonstrate that environmental awareness exerts a non-significant effect on consumer choice, while social dynamics, educational attainment, and access disparities emerge as the primary determinants of sustainable consumption patterns in emerging markets such as Egypt.

The results both align with and, in some instances, challenge existing literature on environmental knowledge, personal factors, and green consumer behavior. Consistent with prior research, personal factors were decisive in influencing consumer choices. Studies by Cramer and Foss [37] emphasize the influential role of family structure, peer networks, and social expectations in shaping individual behavior, particularly within collectivist societies such as Egypt. This aligns with the TPB construct of subjective norms as a critical determinant of behavior [5]**.** However, the finding that environmental awareness did not significantly predict organic food purchasing behavior contrasts with extensive research suggesting that higher levels of system, action-related, and effectiveness knowledge increase the likelihood of eco-friendly purchasing [71]**.** The researchers attributed this contrast to contextual limitations, including infrastructure constraints, limited trust in certification systems, and restricted access to organic products, which may help explain the observed gap between awareness and behavior in Egypt.

The demographic findings partially correspond with existing literature. The significant effect of education supports prior studies indicating that higher educational attainment enhances the ability to process and act upon sustainability-related information [31]**.** The urban-rural differences mirror findings by Nordin and Ruslan [29] who demonstrated that urban consumers, due to greater access and exposure, exhibit stronger intentions and behaviors regarding organic consumption. Conversely, the non-significant effect of income contrasts with earlier research [30, 48] that identifies affordability as a key barrier. In the Egyptian context, educated consumers appear to prioritize health, family well-being, and ethical responsibility over cost, reflecting a value-driven decision-making model.

The study's most notable divergence from existing literature lies in the non-significance of environmental awareness (dimension A) as a direct predictor of behavior. Several factors may explain this behavioral bottleneck. First, environmental knowledge may be incomplete, particularly regarding effectiveness knowledge, which limits motivation for behavior change. Second, the attitude–behavior gap persists: environmental concern does not consistently translate into action, especially in contexts with low institutional trust or weak regulatory systems. Third, social norms strongly influence behavior in collectivist cultures like Egypt, with family and peer expectations often guiding individual choices more than personal attitudes. Fourth, accessibility barriers—such as limited product availability, pricing concerns, and mistrust of certifications—further impede action. Finally, consumer segmentation by education shows that urban, highly educated individuals are more likely to integrate sustainability into their consumption, corresponding to Stage 3 of Olgyaiova [36] environmental awareness model, while rural and less educated individuals remain at Stage 2, characterized by externally motivated behaviour.

These variations from prior studies reflect structural, cultural, and demographic realities rather than theoretical inconsistencies, underscoring the importance of context-specific behavioral modeling in sustainability research. The findings also offer important theoretical and practical implications, particularly through the lens of Industry 5.0 [5] which emphasizes human-centric innovation and sustainability. The study identifies two primary Egyptian consumer archetypes: a tech-savvy, educated urban segment responsive to digital tools and eco-certifications, and a traditional segment influenced by family, community engagement, and storytelling. These insights suggest that environmental awareness is a multi-stage process, with most Egyptian consumers situated between Stage 2 and early Stage 3 of Olgyaiova [36] and only a small, highly educated subset approaching Stage 4, where eco-values are fully integrated into life choices. Consequently, segmented behavioral strategies are essential.

Finally, the study confirms the applicability of TPB [23] in emerging contexts, particularly when adapted to cultural conditions. In Egypt, subjective norms and perceived behavioral control, especially regarding accessibility, play a more decisive role than attitudes alone in shaping behavior. This underscores the need for culturally embedded extensions of TPB and integrated frameworks that also account for institutional [24] and stakeholder influences [25]**.**

5. Conclusion

This study provides an empirically grounded, culturally informed framework for understanding green consumer behavior in Egypt—an emerging organic market positioned for Industry 5.0 integration. The findings underscore the dominant influence of personal factors in shaping environmentally conscious behavior, while education and place of residence emerge as significant moderating variables. Notably, the results reveal a persistent behavioral inertia, indicating that environmental awareness alone is insufficient to drive sustainable consumption at scale.

Two distinct consumer archetypes have been identified: a tech-savvy, urban, educated segment inclined toward digital and individualized solutions, and a traditional, socially influenced cohort more responsive to community-based and family-driven approaches. These behavioral distinctions highlight the necessity of segmented marketing and policy strategies.

Theoretically, the study supports extensions of the Theory of Planned Behavior (TPB) within culturally embedded contexts, demonstrating that subjective norms and perceived behavioral control—especially access—may outweigh attitude in emerging economies. Furthermore, mapping Egyptian consumers onto [36] environmental awareness framework reveals that most are in early awareness stages, reinforcing the need for gradual and adaptive strategy design.

6. Contribution

This research contributes to the literature on sustainability by examining green food products and eco-friendly packaging as practical applications of the green paradigm at both the individual and institutional levels. On the consumer side, the study highlights how green food products promote healthier lifestyles, increase environmental awareness, and encourage sustainable consumption behaviors. On the organizational side, it emphasizes the strategic role of adopting sustainable production and packaging practices in enhancing corporate reputation, improving compliance with international sustainability standards, and fostering competitive advantage in increasingly eco-conscious markets. By integrating these perspectives, the research provides empirical insights into the dual impact of green products, underlining their significance not only as an environmental necessity but also as a driver of business innovation and market differentiation. Based on the findings of this study, it becomes evident that building public awareness regarding green products and sustainability, is a critical step toward fostering sustainable consumption behaviors. The results suggest that awareness campaigns should focus not only on the environmental benefits of green products but also on their long-term economic and social value to individuals and communities. Educational initiatives, community engagement programs, and targeted media campaigns can significantly enhance consumers' understanding of how their choices directly contribute to environmental protection and sustainable development. Furthermore, institutions and policymakers should collaborate to create incentives and supportive infrastructures that make sustainable products more accessible and attractive to the public. By linking awareness-building strategies to empirical evidence from this study, the research contributes to bridging the gap between theoretical

sustainability frameworks and practical consumer adoption, thereby supporting the broader agenda of sustainable development.

6.1. Theoretical and Practical Implications

To operationalize green behaviour and address the awareness–action gap, several policy and communication strategies are recommended. First, targeted education initiatives should combine behavioural modelling with informational campaigns, utilizing school programs, workplace workshops, and simulated sustainable practices to foster practical engagement. Second, localized outreach strategies are essential to accommodate consumer diversity: urban, educated consumers can be engaged through digital traceability tools, QR-code-enabled eco-labelling, eco-loyalty programs, and transparent platforms, whereas rural or less educated consumers benefit more from family- and community-based storytelling, oral campaigns, and visual materials that promote emotional and social resonance. Third, bridging the awareness-behaviour gap requires reframing green marketing to emphasize immediate personal and community benefits, such as child health, household wellbeing, and food safety, rather than abstract environmental appeals. Fourth, pricing strategies should be reassessed: since income did not significantly predict behaviour, approaches such as non-price value framing, product bundling, and building trust in eco-labels are likely to be more effective than simple discounting. Finally, strengthening institutional legitimacy is crucial, with governments and industry bodies enhancing certification transparency and enforcing labelling consistency to foster public trust in organic products.

6.2. Managerial Implications

The strategic importance of Egypt in the sustainability agenda has several managerial implications for policymakers, businesses, and industry stakeholders. First, the country's large and diverse consumer base creates opportunities for firms to design tailored awareness campaigns that address different cultural and income segments, thereby enhancing the adoption of green products [66]. Second, the government's integration of sustainability into trade agreements and national programs provides managers with a supportive policy environment that can be leveraged to secure funding, partnerships, and international recognition [26]. Third, initiatives such as the "Go Green" campaign and the NWFE renewable energy program highlight the importance of collaboration between the public and private sectors, encouraging firms to align their corporate strategies with national sustainability goals [7]. Finally, the dual challenges of population growth and climate vulnerability emphasize the need for managers to innovate in product design, supply chain management, and consumer engagement to ensure that sustainable practices are embedded across business operations [7]. Collectively, these implications position Egypt as a fertile ground for advancing sustainable consumption and provide a roadmap for firms to enhance competitiveness while contributing to national and global sustainability goals [26].

The findings of this study suggest that companies can significantly enhance customer engagement with environmentally friendly products by actively investing in awareness-building strategies. Managers should prioritize transparent eco-labeling and certification to increase consumer trust and facilitate informed decision-making [31]. Additionally, targeted educational campaigns—delivered through digital platforms, point-of-sale information, and community initiatives—can effectively communicate the long-term benefits of green products for both individuals and society [25]. Offering customer incentives such as loyalty programs, green rewards, or discounts on eco-friendly purchases further reinforces sustainable consumption behavior [55, 72]. By integrating these practices, managers not only contribute to environmental protection but also strengthen their organizations' competitive positioning, enhance corporate reputation, and build long-term customer loyalty in increasingly sustainability-driven markets [73].

Several donor-funded initiatives and national programs have significantly contributed to advancing sustainable development and promoting green products in Egypt. For instance, the European Investment Bank (EIB Global) and the European Union have allocated a €21 million grant to support cleaner industrial production, reduce carbon emissions, and foster circular economy practices within Egypt's industrial sector [67]. Similarly, the United Nations Development Programme (UNDP) has supported Egypt's Integrated National Financing Strategy (E-INFS), which mobilizes an estimated $14 billion annually toward aligning public and private financing with the Sustainable Development Goals [26]. Moreover, awareness campaigns such as the "Go Green" Initiative [69] and the "Reduce It" campaign—launched with support from UNIDO and the Government of Japan—have targeted millions of citizens through nationwide media and educational outreach, particularly focusing on reducing single-use plastics [65].

At the local level, the Central Laboratory for Organic Agriculture (CLOA), under the Ministry of Agriculture and Land Reclamation, plays a vital role in supporting sustainable food production. CLOA provides training and certification services for more than 300 organic farms annually, registers inputs such as bio-fertilizers, organic pesticides, and seeds, and conducts awareness programs for farmers and producers [63]. These efforts not only improve soil fertility and crop quality but also raise awareness of the environmental and health benefits of organic farming, thereby reinforcing the link between sustainability and consumer food choices [7].

Together, these donor-funded programs and national initiatives demonstrate a strong synergy between international and domestic stakeholders. They not only mitigate the negative externalities of global industries but also strengthen consumer trust, encourage eco-labeling, and expand the market for environmentally friendly food products [3]. Ultimately, this multi-level collaboration provides Egypt with a strategic pathway to enhance public awareness, stimulate demand for green products, and accelerate its transition toward a green economy [10].

6.3. Strategic Framework: Aligning Official Policies, Partnerships, and Consumer Behavior with Green Marketing in Egypt

Egypt's formal commitments—such as the Organic Agriculture Law, the Green Sustainable Industry Program, the Go Green Initiative, and Vision 2030—reflect its growing dedication to sustainability and the integration of global development goals. In particular, the alignment of SDG 2 (Zero Hunger) and SDG 13 (Climate Action) within agricultural and sustainability initiatives provides a foundation for developing strategies that bridge policy frameworks with consumer behavior in the era of Industry 5.0 [10] .

This strategic framework translates macro-level policies into micro-level actions, embedding green marketing and sustainability as central enablers that connect agricultural development, consumer choices, and climate-positive practices.

6.3.1. Policy–Consumer Alignment through Education and Awareness

Research Insight: Environmental awareness in Egypt is high but does not directly influence purchase behavior. Strategic Action: Ministries (Agriculture, Environment, and Education) should co-design targeted educational campaigns that move beyond awareness to focus on trust-building, product authenticity, and health benefits. Certification systems (e.g., Organic Label, Green Label) must be digitally accessible, with QR codes verifying authenticity in real time.

6.3.2. Health and Lifestyle Integration

Research Insight: Health orientation is the strongest predictor of organic purchasing. Strategic Action: Organic products should be positioned as a public health asset, linking them with national nutrition programs and campaigns to reduce non-communicable diseases. Partnerships with the Ministry of Health and the Food Safety Authority can integrate organic food into school meals, hospital nutrition plans, and awareness drives.

6.3.3. Social Influence and Community Engagement

Research Insight: Social influence significantly drives green choices. Strategic Action: Government and corporate partnerships should mobilize influencers, community leaders, and cooperatives to normalize organic consumption. The Ministry of Youth and Sports, alongside NGOs, can organize community-based organic food markets and digital campaigns showcasing sustainable role models.

6.3.4. Segment-Specific Access and Market Inclusion

Research Insight: Urban and educated consumers purchase more organic food; rural and less educated groups lag behind.

Strategic Action: Policies should bridge geographic and educational divides by:

- Expanding organic farmers' markets and cooperatives in Upper Egypt and Delta regions.
- Offering subsidies or incentives for small farmers converting to organic practices.
- Using digital platforms and Industry 5.0 smart supply chains to connect producers with consumers nationwide.

6.3.5. Trust, Certification, and Transparency

Research Insight: Awareness does not convert into behavior without trust in product authenticity. Strategic Action: The Ministry of Agriculture and Land Reclamation (MALR) should:

- Expand enforcement of the Organic Agriculture Law through strict monitoring.
- Launch a national digital organic registry accessible to consumers.
- Partner with blockchain-based traceability systems to ensure supply chain transparency.

6.3.6. Global Partnerships for Technology & Market Access

Research Insight: Industry 5.0 emphasizes human–technology collaboration and consumer-centric production.

Strategic Action: Egypt should leverage partnerships with the EU, FAO, and UNDP to:

- Integrate digital traceability in organic certification.
- Access global markets for Egyptian organic exports.
- Position Egypt as a regional hub for sustainable agriculture and organic trade in Africa and the Middle East.

6.4. Managerial Recommendations

6.4.1. Green Economy and Policy Level

At the macroeconomic level, policymakers and institutions must design strategies balancing food security with environmental sustainability. Investments in climate-smart agriculture, organic farming, and Industry 5.0 technologies can reduce greenhouse gas emissions, enhance efficiency, and improve resilience in agricultural value chains [7]. Embedding green marketing strategies can further strengthen consumer trust, enhance Egypt's agribusiness exports, and improve its international sustainability image.

Measurable outcomes may include:

- Reduction in agricultural carbon footprint (CO_2 equivalent).
- Increased share of organic and sustainably marketed products in exports.
- Growth in green financing for agricultural projects.
- Improved international image through green branding in agri-exports.

6.4.2. Organizational and Corporate Level

At the corporate level, firms and agribusinesses should embed green strategies across all departments—production, finance, accounting, and marketing—ensuring environmental impacts are considered in investment and budgetary decisions. Specific recommendations include:

- Product innovation & safety: Develop low-toxicity, eco-friendly products while minimizing microbial risks; adopt rigorous testing, component tracking, and certification protocols.
- Technology adoption: Leverage Industry 5.0 and digital tools for food safety monitoring and quality control.
- Green marketing integration: Apply the full green marketing mix (product, price, place, promotion), ensuring campaigns reflect cultural values, health consciousness, and eco-motivators.
- Sustainability metrics: Move beyond short-term profit to assess long-term environmental and social performance.

Measurable Outcomes:

- Growth of eco-labeled and organic products in the domestic market.
- Expansion of green agribusiness startups.
- Improved consumer trust through credible, transparent labeling and communication.

6.4.3. Individual and Consumer Level

At the microeconomic level, farmers, agribusinesses, and consumers each play a role. Farmers should adopt precision irrigation, renewable energy solutions, and organic inputs to balance productivity and sustainability. Agribusiness entrepreneurs can differentiate their businesses by leveraging green marketing, while consumers can be influenced through targeted sustainability campaigns encouraging healthier and eco-friendly choices.

Measurable outcomes may include:

- Increased adoption of climate-smart and organic practices.
- Higher income levels for rural farmers producing sustainable goods.
- Greater consumer demand for eco-friendly and health-conscious products.
- Increased participation in environmental education programs.

6.4.4. Strategic Roadmap for Egypt

Bringing together the macro, corporate, and consumer levels, Egypt should adopt an integrated green transition roadmap that aligns with its Vision 2030 and COP commitments. The roadmap must:

1. Policy Alignment: Ensure ministries of agriculture, environment, and trade collaborate on sustainability targets.
2. Public–Private Partnerships: Build partnerships with local and international investors to finance organic and green projects.
3. Cultural Integration: Leverage Egypt's rich cultural heritage, population diversity, and openness to global influences to foster acceptance of green products.
4. Knowledge & Awareness: Create national eco-literacy programs that educate consumers, empower farmers, and guide businesses toward sustainable choices.
5. Global Positioning: Position Egypt as a regional leader in green agriculture and organic exports, benefiting from its strategic location, agricultural capacity, and diverse consumer base.

6.4.5. Expected Long-Term Impact

- Egypt transitions toward a low-carbon, sustainable food system.
- Stronger international competitiveness in organic exports.
- Increased resilience of rural economies and food security.
- A culture of sustainability embedded at all levels of society.

Drawing on Egypt's Organic Agriculture Law No. 12/2020, the Sustainable Development Strategy Vision 2030, and the National Climate Change Strategy 2050, the roadmap should align ministries of agriculture, environment, and trade to jointly promote organic product standards, green marketing, and climate-resilient agriculture. The CLOA-ECOA partnership (2025) provides a model of institutional cooperation for certification, registry maintenance, and farmer training. Policies should mandate green criteria for all state-funded agricultural and export projects, integrate sustainability into national education and awareness programs, and set targets for registered organic farms, eco-branded exports, and agricultural emissions reductions consistent with NCCS benchmarks.

6.5. Managerial Recommendations

Green marketers and organic producers in Egypt are encouraged to adopt a multifaceted strategy that aligns consumer expectations with environmental responsibilities. In terms of product innovation and safety, firms should develop low-toxicity, eco-friendly products while minimizing microbial risks, implement rigorous testing, component tracking, and certification protocols, and leverage emerging technologies to enhance food safety monitoring and quality control. Public awareness and education initiatives should include seminars, conferences, environmental events, promotional campaigns highlighting corporate environmental roles, and the distribution of educational materials—both print and digital—to improve eco-literacy. Strategic green marketing requires the integration of the green marketing mix (product, price, place, promotion) with sensitivity to cultural values, considering both environmental motivators, such as a return to nature and health consciousness, and personal factors, including family size and peer influence, in campaign design. At the corporate

level, green strategies should be embedded across all departments, including production, finance, and accounting, with environmental impacts incorporated into investment and budgetary decisions, and sustainability metrics developed beyond short-term profit evaluations. Finally, effective consumer communication is essential, providing credible and accessible information, transparent claims, and clear labelling to guide eco-friendly purchasing decisions, enhance trust, and reduce scepticism.

6.6. Limitations and Future Research

While this study provides valuable insights into the relationship between environmental awareness, personal factors, and consumer behaviour in Egypt's organic food market, several limitations must be acknowledged. The research is contextually bounded to a single country and reflects a cross-sectional, single-point-in-time perspective, which may limit the generalizability of the findings. Additionally, although emotional and cultural dynamics were noted, they were not examined in depth, potentially overlooking important psychological and affective determinants of green behaviour. Future research is encouraged to extend the current model to other sectors, such as the medical or restaurant industries, and to adopt longitudinal designs that track changes in consumer behavior over time. Further studies should explore psychological and emotional influences on eco-friendly consumption, include a broader range of demographic variables such as age, gender, and household size, and test real-world interventions—such as label redesign, pricing strategies, or educational campaigns—to better bridge the awareness-action gap. Moreover, incorporating AI-based tools or digital behavior tracking could enhance the alignment of research with Industry 5.0 frameworks, providing more granular insights into consumer decision-making processes.

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