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MANAGEMENT | RESEARCH ARTICLE

Role of green and multisensory packaging in environmental sustainability: Evidence from FMCG sector of Pakistan

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Abstract: The primary purpose of this research is to explain the importance of a significant aspect of a sustainable environment: green packaging. Green packaging has been revealed to have an astounding effect on a sustainable environment. Misuse of carbon products negatively affects the environment and pollutes the surroundings to a great extent, for which one feasible solution is green packaging. The phenomenon has been investigated using two independent variables: green packaging and multi-sensory packaging. Consumer environmental knowledge has been used as a mediating variable, and consumer perception has been used as a moderating variable, whereas the dependent variable is ecological sustainability. Current research is quantitative, and data were collected from 302 FMCG customers through a Self-Administered questionnaire survey. The research approach was deductive, and the nature of the study was explanatory. AMOS software and the Structural Equation Modelling (SEM) technique have been used to test the proposed hypotheses. According to the study's findings, green packaging has a significant and positive effect on environmental sustainability, while multisensory packaging has a negative impact. Consumer perception positively moderates the relationship between green packaging and ecological sustainability. At the same time, consumer environmental knowledge had no mediating effect between green packaging, multi-sensory packaging, and ecological sustainability. This research fills the literature gap, as few studies exist on the relationship between green packaging and



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PUBLIC INTEREST STATEMENT

This paper has addressed the critical issue of today's world: environmental stability based on green packaging. Green packaging refers to using eco-friendly materials and design strategies to create packaging that minimizes negative impacts on the environment. On the contrary, packaging is multisensory in that it can be seen, touched, heard, and smelled, and it is mainly made of plastic, which is a leading cause of environmental damage. Environmental sustainability refers to maintaining ecological balance and protecting natural resources for future generations.

environmental sustainability. The mediating and moderating model has been tested for the first time in the FMCG sector of Pakistan. This study benefits manufacturers and marketers to know the importance of green packaging to enhance a sustainable environment. FMCG companies can use reusable and recyclable materials instead of substances like Plastic and Styrofoam for Packing, which is environmentally friendly and affordable for daily usage.

Subjects: Packaging; Consumer Psychology; Environmental Economics; Business, Management and Accounting

Keywords: environmental sustainability; green packaging; multisensory packaging; consumer environmental knowledge; consumer perception and sustainability

1. Introduction

Numerous scientists are observing escalating changes in global climate and environmental degradation, underscoring the rising significance of ecological sustainability. Unprecedentedly, human actions now possess the capability to alter the Earth's climatic conditions and biological diversity. Terms like "sustainability," "eco-friendliness," and "green initiatives" are now prominent catchphrases in both the business world and broader society (Wandosell et al., 2021). In the modern age, there's a growing recognition among individuals about the criticality of preserving the environment they inhabit. Over the past three decades, numerous nations have convened to deliberate on urgent solutions to counteract global climate change. The United Nations Framework Convention on Climate Change (UNFCCC) formulated a pivotal environmental treaty during the UN Conference on Environment and Development (UNCED), commonly referred to as the "Earth Summit." Held from June 3 to 14, 1992, in Rio de Janeiro, this summit aimed to mitigate detrimental human-induced climate shifts by maintaining equilibrium in atmospheric greenhouse gas concentrations (Xinzhang, 2012).

In recent years, there's been a heightened awareness among the public about the enduring impact of plastics and other non-biodegradable waste. As a result, the principle of environmental sustainability has become increasingly ingrained in daily life. This societal shift in attitude and perception has spurred numerous researchers to delve deeper into this domain. Various parameters have been explored in the context of environmental sustainability, seeking potential actions that society can take to diminish the adverse influences on our natural world. Hoornweg et al. (2013) raised an ecological concern, stating that the amount of waste generated in coming years is a significant problem.

Around the world, online shopping is a new trend. By observing the facts and figures of giant companies around the globe in 2020, Amazon Logistics shipped 4.2 billion packages, up from 1.9 billion in 2019. It currently accounts for 11% of all parcel shipments in the US, overtaking FedEx by 16% for the first time and trailing only the USPS (38%) and UPS (24%) (Rodrigue, 2020). Though these packages that fly around the world are convenient for us, they aren't always so for the environment, and that's how the main issues arise. Cardboard boxes have a low environmental impact and are less dangerous, while other materials, such as plastic packaging, are not biodegradable or recyclable. Facts show that packaging produces an enormous 77.9 tons of solid waste generated garbage annually, or close to 30% of all the waste. Over 65 percent of all home trash comprises packaging (Brizga et al., 2020).

Plastic packaging has been identified as one of the leading causes of environmental damage. In ecological sustainability, the main huddle that can be treated is using plastic packaging. According to data from 2016, France, Italy, and Germany each produced 190 kg of packaging garbage per resident (Леонов et al., 2019). This suggests that FMCG packaging makes up to 33 percent of all waste.

The immense daily use of plastic, combined with the billions of plastic debris polluting our oceans, lakes, and rivers and accumulating on land, goes beyond merely being an eyesore and poses a threat to flora and fauna. While numerous aspects can be explored to promote environmental sustainability, addressing the issue's root often presents a straightforward starting point for intervention (Rhein & Schmid, 2020). Green packaging, sometimes called sustainable packaging, uses components and manufacturing processes to lessen the energy requirements for production and the environmental impact of packaging.

Almost 13,000,000 tons of plastic are dumped into the ocean, and 500,000,000,000 plastic bags are used yearly. For the creation of plastic 17,000,000 barrels of oil are used annually. It has been estimated that 1,000,000 plastic bottles are bought every minute, and plastic kills 100,000 marine species annually. Plastic takes 100 years to decompose, and plastic particles have been identified in 90 % of bottled water and 83 % of tap water, whereas 50% of consumer plastics are only used once (Thompson et al., 2009a).

Eco-friendly packaging typically employs materials that can be recycled or reused rather than relying on plastics or Styrofoam. Conversely, sustainable manufacturing practices focus on minimizing energy consumption and reducing greenhouse gas emissions. Packaging is a fundamental component of any merchandise, and (Kuvykaitė et al., 2009) propose that to be considered sustainable, packaging must have four characteristics: clean, cyclic, effective, and efficient. Packaging will go to waste no matter what, so why not devise an alternative to this? Functional packaging protects the product and provides information to the consumer, while sustainable packaging uses the least energy and resources (Lupton, 2010).

Eco-friendly packaging is gaining traction due to its minimal environmental impact and role in waste reduction. In technologically progressive nations, consumers lean towards sustainable packaging, recognizing its environmental advantages and the subsequent improvement to their living standards. Yet, in countries with lesser development, like Pakistan, most remain uninformed about the virtues of green packaging and the environmental hazards posed by non-degradable materials like plastic (Galafassi et al., 2019). Further, Galafassi et al. (2019) observed that manufacturers who adopt eco-friendly packaging often resonate more with consumers, tapping into an emotional connection concerning environmental responsibility. This bond is further strengthened as producers highlight the adverse effects of environmental degradation, implicitly suggesting the consumers' role in it.

Beyond the environmental damage and hindrance to ecological sustainability, non-biodegradable packaging poses a significant health risk. It's imperative to initiate public awareness campaigns to educate people about the dangers of single-use plastic bags and promote eco-friendly substitutes like cotton tote bags, paper bags, and oxo-biodegradable bags. These alternatives safeguard the environment and foster a healthier living space for all (Tang et al., 2016). It is highly recommended that education about plastic pollution should be included in the curriculum (Dalu et al., 2020).

Everyday products, particularly fast-moving goods, significantly impact our environment due to their packaging. Such packaging inevitably carries societal implications. It's worth noting, as highlighted, that food packaging, in particular, generates substantial waste, much of which is challenging to recycle. Beyond its eco-friendly attributes, sustainable packaging also addresses broader societal health concerns. Lessening environmental health hazards plays a role in fostering a healthier community with robust immunity (Sustainable food packaging technology. 2021).

1.1. Green packaging and environmental sustainability

Plastic is a material often used for packaging and is usually composed of copolymers. It is commonly utilized in numerous products, including bottles of water, apparel, packaging materials, medical aid, technology, construction materials, etc (Tibbetts, 2015). In 2015, The Asian region is

believed to produce the highest amount of industrial waste, contributing to nearly half (49%) of global output. China is the most significant contributor, with 28% of the total, while North America and Europe follow at 19% each. While other regions might not significantly impact production, they play a role in waste generation. A potential solution to this looming environmental concern is adopting eco-friendly packaging. This approach prioritizes using reusable, biodegradable, or compostable materials for product containment and shipment and promotes recycling initiatives and methods that mitigate pollution during manufacturing (Luan et al., 2023).

According to Mellita et al. (2020), sustainable packaging should emphasize using renewable or recyclable materials. From sourcing to production, transportation, and reuse, the entire lifecycle of this packaging should harness sustainable energy. Beyond providing benefits to consumers, it should safeguard the health and well-being of the people and communities it impacts. Moreover, for such packaging to gain widespread adoption, it must be cost-effective and able to compete in the market. Essentially, green packaging manifests eco-conscious practices, utilizing resources to guarantee their continued availability for future generations. Similarly, Wong et al. (1996) concluded that consumers purchase eco-friendly products to benefit the environment. In research, there are a lot of different meanings of the word “sustainability”, and other researchers have defined it in different ways (Costanza & Patten, 1995). For this research, “sustainable” is defined as a process or system developed in a way that does not negatively impact the environment.

1.2. Investing in eco-friendly packaging

Individuals have been told for years to reduce, reuse, and recycle while making particular lifestyle adjustments to benefit the environment. While this has its implications, the acts of a few individuals will have little impact on environmental protection, at least when compared to the efforts of businesses.

As of June 2016, the Australian economy had 2,422,404 active trading enterprises, according to the Australian Bureau of Statistics. Across these two million businesses, waste is consistently produced, contributing to a substantial chunk of the nation’s total trash accumulation: several million tons! While this may seem like a small fraction, individual actions influence the environment. Without change, the necessary shift the world needs for genuine healing might remain unattainable. Merely adhering to governmental regulations isn’t sufficient for businesses; they must also uphold their environmental responsibilities. Should corporate actions harm the environment, nature will be left defenseless, with our precious resources left vulnerable to corporate exploitation. Regardless of a company’s size or the nature of its products or services, managing and mitigating its environmental footprint is imperative to prevent further harm (Paul et al., 2016).

1.3. Theoretical gaps and problem identification

The current study’s main objective is to determine how much green packaging contributes to environmental sustainability. Many developing countries are unaware of green packaging, which significantly hinders ecological sustainability (Fonseca et al., 2020). Sustainable packaging is a new concept that has received attention in recent years. Indeed, it is a critical issue that must be addressed to achieve environmental sustainability goals, with both social and economic implications.

Eco-friendly packaging may seem expensive upfront, but it can lead to significant savings in resource consumption. Using minimal materials and environmentally conscious packaging reduces the strain on our planet’s resources and helps preserve them for future generations. Over time, the importance of choosing sustainable packaging—often disposed of after a single use—will become more apparent to many, highlighting its role in promoting environmental health (Wandosell et al., 2021).

Almost 300 million tons of plastic are generated annually, but only a portion of that is recycled, according to the UN Environment Program (UNEP). Because of this, specific nations and groups are working to reduce plastic usage and better the environment, as much as some have even banned plastic bags and single-use plastics. Some retailers have also pledged to reduce the quantity of plastic they create as part of their environmental responsibilities (Tudu & Yadav, 2019).

Even when not discarded irresponsibly, plastic harms the environment due to the chemicals it emits during production. The environmental hazards stemming from these chemical releases into the air and water are increasingly alarming. Creatures across various habitats—land, freshwater, and marine have exhibited hormonal imbalances due to exposure to these pollutants. Worryingly, studies on lab animals reveal adverse effects at blood concentrations lower than what's typically observed in citizens of industrialized nations (Braun & Traore, 2015).

1.4. Problem statement

Pakistan, particularly in regions like Punjab and cities like Lahore, faces escalating challenges from plastic pollution. This environmental menace is just one of the multiple culprits intensifying air pollution in the area. Factors such as vehicular emissions, industrial contaminants, fossil fuel power stations, waste-to-energy processes, plastic degradation, and the extensive burning of coal in countless brick kilns throughout the province collectively exacerbate the issue (KhanSarah & Hassan, 2020).

An estimated 8 million tons of plastic garbage yearly floods the oceans. It is predicted that by 2050, plastic will eventually replace fish in the oceans. Simple plastic bags can decompose in up to 500 years, but plastic bottles can take up to 300 years. Unfortunately, plastics make up 65 percent of all trash in Pakistan; 55 billion plastic bags are used annually, and an annual increase of 15 percent is anticipated (Bhatti et al., 2021). With a manufacturing capacity of 624,200 metric tons per year and a growth rate of 15%, Pakistan's plastic industry contributes to 6.41 million tons of plastic waste and an estimated 55 billion plastic bags that pollute the environment annually. Excessive use of plastic has negatively influenced the environment by raising carbon emissions (Stanton et al., 2020).

In countries like Pakistan, the concept of recycling and waste disposal is entirely informal, and green packaging is not of much importance (Razaque et al., 2020). Consumers are unaware of sustainable packaging options, often placing their immediate requirements and affordability over environmental concerns. This research delves into the intricacies of eco-friendly packaging, examining the reasons that prompted the investigator's interest in this area, and proposes methods to enlighten and inform the consumer community (Warhurst, 2005). Moreover, Pakistan grapples with a significant challenge in South Asia: it has one of the region's most improperly managed plastic waste. According to Payne et al. (2019), plastic waste in Pakistan needs to be more managed, i.e., collected without categorization, recycling, or processing, and disposed of outside cities. The entire waste disposal is effectively a waste dumping system without any management. There needs to be a proper check and balance of the waste and proper disposal of plastic, causing a significant environmental threat.

Regarding achieving SDG 13 on Climate Action, Pakistan is one of the few countries recognized as "on track." This distinction can be attributed to the government's proactive approach in implementing many policies and initiatives aimed at environmental betterment and tackling climate change. Initiatives like Recharge Pakistan, Ten Billion Tree Tsunami, Clean and Green Pakistan, and the Protected Areas Initiative are just a few examples. However, despite these commendable efforts, Pakistan continues to be highly susceptible to the adverse impacts of climate change. The Global Climate Risk Index 2020 places Pakistan fifth among the nations with the greatest environmental vulnerability. The country suffered significant losses of USD 3.8 billion from 152 extreme weather events between 1999 and 2018. The health and economic aspects of Lahore are seriously threatened by the severe fog present today (Schöggel et al., 2020).

1.5. Research gaps

- (1) According to the discussion, the significant gap is that researchers still need to thoroughly evaluate green packaging and its influence on environmental sustainability.
- (2) As Bhatti et al. (2021) report that in South Asia, Pakistan has the most significant rate of untreated plastic, half of which is packaging plastic. The percentage of plastic garbage is significantly higher than in India, Sri Lanka, Bangladesh, and Iran. Companies in the fast-moving consumer goods industry need to be more accountable and recognize the role of packaging and its impact on environmental sustainability. They should be aware of various kinds of polyethylene and the alternatives available. As reports indicate, Pakistan consistently consumes between 55 and 112 billion packs. Single-use plastics block water sewerage, contaminate regular streams, and are highly unhealthy, and there is little discussion about their damaging effect on well-being and nature.
- (3) Regardless of these occasional limitations, lack of common knowledge of single-use plastics, absence of accessibility or comprehension of choices, high cost, and trouble implementing the policies all have made it difficult to eliminate the destructive material from our regular routines (Nielsen et al., 2019).
- (4) Being the civilization of the 21st century, consumers should be aware of the destruction plastic packaging is causing to the environment and climate. Everything is secure once the researchers try to study and propagate green and multisensory packaging (Svanes et al., 2010).
- (5) It is also designed to collect relevant data from the general public regarding their perceptions of environmental sustainability and the role of green packaging.

1.6. Objectives of the study

- (1) To investigate the effect of green and multisensory packaging on environmental sustainability.
- (2) To examine the mediating role of consumer environmental knowledge between green packaging, multisensory packaging, and ecological sustainability.
- (3) To analyze the moderating role of consumer perception between green packaging, multisensory packaging, and environmental sustainability.

2. Literature review

2.1. Supporting theories

2.1.1. Self-perception theory

Daryl (1967), in his study, states that Individuals' attitudes in one area of behavior often extend to other sites. For instance, if someone chooses to commute using eco-friendly modes, like cycling instead of driving, due to their environmental preservation attitudes (PA), they'll probably manifest environmentally conscious behaviors in other facets of their daily lives. Such patterns of behavior are evident within the broader society.

Self-perception theory offers a similar justification for emotions, arguing that people may deduce their feelings from how they act and move (Farley & Stasson, 2003). People's actions, body language, arousal state, and facial expressions shape their emotions and sentiments. Consequently, emotions often arise due to behaviors rather than being the precursor to them. This phenomenon is termed the "self-perception effect." It's exemplified when individuals frown or grin, corresponding to anger or happiness. This concept has previously been employed to study the correlation between buying habits and disposal patterns regarding beverage packaging in Germany (Van Birgelen et al., 2008). The study revealed a significant relationship between the two behaviors, implying that "a consumer who values ecological packaging during purchasing is also likely to value the proper disposal of used beverage packages".

2.1.2. Value-belief-norm theory

The Value Belief Norm (VBN) concept was first created by (Stern et al., 1999) to describe how human values influence behavior in an environmentalist context. According to this idea, connections among values, beliefs, social norms, and behaviors act as a chain of causation. “Value” describes “a guiding principle for any behavior based on desired trans-situational goals, which vary by relative importance”.

The VBN theory can be used to provide a thorough understanding of consumers’ pro-environmental behavior, particularly regarding environmental protection norms (Steg et al., 2005). The VBN theory proposes that the creation of ecological practices may be described by the interplay between values, beliefs, and norms. It combines the value concept of psychology, the activation theory of models, and the new environmental conceptual theory.

The adoption of eco-friendly packaging as a means of promoting environmental sustainability is complex. At first, consumers develop an understanding of environmental issues through their experiences with green packaging. This helps them appreciate its importance. As a result, they nurture a heightened sense of environmental duty and build confidence in sustainable brands. Gradually, they set their benchmarks for ecological conservation and grow more loyal to eco-conscious brands. According to the VBN (Values, Beliefs, and Norms) theory, a specific set of causal variables encourages the manifestation of green behaviors (Choi et al., 2015).

2.2. Environmental sustainability

Some human communities have long been ecologically responsible by formalizing systems of oppression, inequality, and class discrimination that would be repugnant to the majority of humanity today. In the second part of the 20th century, four major themes developed from the shared concerns and ambitions of the world’s populations: peace, freedom, development, and the environment (Wong et al., 1996).

Recently, environmental sustainability has emerged as a critical strategy for guiding the world’s social and economic transformation. To some extent, this is the need of the world to develop an environment that can be sustainable for future generations. Environment sustainability is the perception that the future should be better and healthier than the present (Wensing et al., 2020). The concept could be more innovative, but how it is acknowledged, reflected upon, fostered, and executed may be. Moreover, companies have shifted their attention from solely economic factors to include social and environmental concerns in the last decade (Camilleri, 2020).

The food sector, undeniably vast, has companies ardently striving for sustainability, a move with its own set of advantages and drawbacks. According to Zadek (2007), the food system intensifies issues such as global warming, waste, ecological degradation, and economic inequality, posing a significant challenge to sustainability. While many businesses have pivoted their operations to address the demands of the contemporary eco-conscious consumer, others have capitalized on the burgeoning “green market”. It can be concluded from the study of (Costanza et al., 2014) that the relationship between human beings is crucial for long-term development. Businesses are putting effort into overcoming this idea; they have a new task to restructure their strategies in response to opportunities for long-term sustainability (Thøgersen, 1999).

A United Nations report claims that 77 nations have banned plastic bags in some capacity, totally or in part. Thirty-two countries have even imposed a fee (or tariff) to reduce the use of plastic bags in Europe, even though plastic bag bans are most popular in Africa. One hundred seventy countries committed in 2020 to “substantially eliminate” their use of plastic by 2030. For instance, Kenya banned single-use plastic bags in 2017 and, starting in June 2020, prohibited tourists from carrying single-use plastics like water bottles and disposable plates into national parks, forests, beaches, and conservation zones. A similar ban on plastic food containers was implemented in Zimbabwe in 2017; offenders faced fines of \$30 to \$5,000 (Khan et al., 2020).

The United Kingdom taxed plastic bags in 2015 and outlawed the sale of products containing microplastics in 2018 (such as face washes and shower gels). Recently, a law in England forbade the sale of plastic cotton buds, stirrers, and straws (McNicholas & Cotton, 2019).

New York, California, and Hawaii are among the states that have prohibited single-use plastic bags, even though there is no federal prohibition. Single-use plastic goods such as straws, forks, knives, and cotton buds have been banned by the European Union in 2010 (Park et al., 2010). China outlawed non-biodegradable bags in all cities and municipalities, and restaurants were prohibited from using single-use straws. Instead of a proposed statewide ban on plastic bags, cups, and straws, India is asking states to enforce current regulations on storing, manufacturing, and using select single-use plastics (Thompson et al., 2009b).

It is a harsh reality that the stockpiling of non-biodegradables has resulted in increased plastic pollution in Pakistan (Ahmed & Sipra, 2020). Unfortunately, plastics make up 65 percent of all trash in Pakistan; 55 billion plastic bags are used annually, and an annual increase of 15 percent is anticipated (Pandey, 2015). Every country is coming up with innovative ideas, and Pakistan is doing its best to be a part where it can put some effort into degrading non-biodegradables (plastic). Pakistan joined the 128 nations that have banned single-use plastic (polythene) bags in 2019, yet implementation of the policy is still to be seen.

Another step Pakistan takes is the recognition of Extended Producer Responsibility (EPR) as a viable strategy for reducing plastic pollution. In this strategy, producers are given significant financial and physical responsibility for treating or disposing of post-consumer items under the EPR policy approach (Nizam et al., 2020).

2.3. Green packaging

The term “green packaging”, also termed as “sustainable packaging,” refers to methods of production that use less energy and less material to produce packaging (Wandosell et al., 2021). Green manufacturing approaches aim to reduce electricity consumption and curb greenhouse gas outputs. Packaging is pivotal in product presentation, irrespective of whether it’s food-related. A well-designed package protects its contents and acts as an informative and persuasive medium. The design and style of packaging can grab attention, serving as a bridge of communication between companies and their customers (Drašković et al., 2009).

It must, however, not only safeguard objects but also be advantageous to the environment due to new environmental protection guidelines. In the current scenario, packaging needs to support a variety of environmental objectives as well as basic product requirements. For some, four different marketing goals are achieved through the package. Apart from preserving and advertising the product, recycling simplifies, has a minor adverse environmental impact, and makes it easier for users to use the products (Perreault et al., 2014).

Eco-packaging should be designed with multiple objectives in mind. It ought to be advantageous for consumers and ensure the safety and health of individuals and communities during its entire lifecycle. Economic viability and market efficiency are also paramount. Ideally, the whole process—from sourcing to production, delivery, and recycling—should be powered by renewable energy. Such packaging should predominantly utilize renewable or recyclable resources, employ environmentally friendly production techniques and best practices, and be optimized to reduce waste, ensuring maximum efficiency in using materials and energy (Spence, 2021a). Mainly as a result of customers’ unrestricted access to information, packaging has increased dramatically in recent years. To put it another way, customers are aware of how packaging affects the environment and wastes resources, and therefore, seek out packaging that satisfies those needs (Singh & Pandey, 2018). From this perspective, eco-friendly packaging utilizing recycled materials, generating minimal waste, and being recyclable post-use is paramount for consumers. It’s suggested that buyers attribute more significant value to products encased in green materials. Yet, there’s limited

research delving into consumer sentiments regarding sustainable packaging. Understanding and considering consumer inclinations towards sustainably packaged products is essential (Maziriri & Liu, 2020).

A shift towards sustainable consumption is imperative for consumers to become more ecologically aware. This can be achieved by educating themselves about the environmental implications of their actions, reflecting on the consequences, or reorienting their perspectives on environmental issues and products. Factors such as individual characteristics, personality, and immediate environment significantly influence the behavior of an eco-conscious consumer. Generally, consumer views on sustainability align with traditional standpoints. This suggests that while consumers recognize environmentally friendly practices, their environmental concerns are often limited to specific behaviors (Prakash et al., 2019).

2.4. Multisensory packaging

Over recent years, product packaging has transformed. What was once merely seen as a protective measure is now regarded as an instrument for delivering a brand experience. Some describe packaging as the “enduring media” or the “last five seconds of marketing.” There’s a growing argument for incorporating the packaging into the traditional marketing mix—currently consisting of price, product, promotion, and place—suggesting it should stand as the fifth “P” due to its significant influence (Spence, 2021b).

The multisensory attributes of packaging play a pivotal role in the success of many, if not all, products within the vast food and beverage market. Consumption levels of these two sectors are notably high. Over the years, food and beverage packaging has transcended its essential role of mere product protection and calorie indication (Klimchuk & Krasovec, 2006). Often, packaging color is employed to convey specific product-related information or symbolism across diverse product categories. The multifaceted roles of multisensory packaging underscore the situational factors determining its relevance. Individual differences in flavor preferences and distinct color associations pose challenges for designers striving to adopt color palettes that convey the “right” message to varied consumer segments (Spence & Velasco, 2018).

Consequently, with packaging materials accounting for approximately 33% of environmental harm, many businesses are incorporating emerging trends and packaging variations into their offerings. Efforts are underway to bridge the gap between eco-friendly packaging and multisensory experiences. Research suggests that firms utilizing biodegradable materials for packaging garner favorable standing in the market (Loučanová et al., 2019). The multisensory nature of packaging means it’s not just visual—consumers can touch, hear, and smell it, and in some unique cases, even taste it, as with edible packaging. Given this context, experts in multisensory marketing are increasingly focusing on the multi-faceted attributes of packaging as tools to influence consumers’ browsing habits, expectations, interactions, usability, and perceptions of the product. A product’s success or downfall is often linked to its packaging’s visual elements, like color schemes, designs, or imagery. Though much research has delved into the implications and impact of packaging color, there’s a noticeable gap in studies related to its tactile, auditory, and olfactory facets (Petit et al., 2018). The visual aspect of multisensory packaging is arguably the most influential, presenting a mix of emotions and data. It’s imperative to convey essential product information on the package without overwhelming the limited space with excessive visuals. By challenging and exceeding market expectations, packaging designers can truly steer consumer perceptions (Spence & Wan, 2015).

2.5. Environmental concern

Pollution poses a grave threat to humans and wildlife globally, with air and water quality deteriorating rapidly. Vehicles emit vast amounts of exhaust, blanketing significant cities around the world. One of the primary contributors to escalating environmental degradation is the burgeoning global population. As the population rises, so does the volume of waste generated. In pursuit of a more convenient life, individuals have come to rely heavily on disposable items such as soda cans and

water bottles. However, the excessive accumulation of these items has resulted in a significant surge in plastic pollution, particularly in Pakistan (Daveray & Dutta, 2021).

Plastic, inherently laden with harmful chemicals, jeopardizes the ecosystem by contaminating the air, water, and soil. Its mounting prevalence has increasingly distressed the environment, posing challenges for wildlife and humans alike, leading to threats like plant extinction and endangerment of animal species. Gill et al. (2021) highlighted in their research the pervasive nature of plastic in the everyday lives of Pakistan's citizens. The country witnesses an alarming rate of plastic production and consumption. It's commonplace in Pakistan for people to carry purchases in plastic bags, eat with plastic utensils, and prefer plastic coolers over traditional mud pitchers. Plastic containers are frequently chosen to store spices and other commodities. Daily consumption of bottled water, the habit of protecting phones with plastic covers, and students carrying plastic geometry boxes to school all testify to this trend—even the snacks they purchase come in plastic packaging. Undoubtedly, plastic has woven itself into the very fabric of contemporary society.

Laroche et al. (2001), while researching consumer attitudes toward green products, analyzed that purchase behavior is positively associated with goods wrapped in environment-friendly packaging and negatively associated with goods packed in non-recyclable packaging. On the other hand, (2012) discovered a negative association between people's personal advantages and environmental benefits and concluded that people's interests and benefits still outweigh ecological benefits.

While examining the Asian market and understanding of green packaging (D'Souza et al., 2007), it was found that rising awareness of the environmental harm caused by conventional packaging in Indian society has led to a shift in the society's preference for eco-friendly packaging, which is why companies are now focusing more on producing environmentally packaging. Consumers' ethical sentiments and purchasing habits were found to have a favorable association. And people who hold altruistic values are more likely to help the environment. Hence, they favor eco-friendly packaging.

Manufacturers are encouraged to meticulously consider the after-use stage of packaging within each national context and adapt their packaging strategies accordingly. According to Mutsikiwa and Marumbwa (2013), educating consumers significantly influences their shopping habits; that is, when consumers are informed about the detrimental effects of standard packaging on the environment, they tend to favor more sustainable options.

Research points to a growing unease within the Asian market stemming from the rapid increase in waste production. Another model that has been explored previously takes into account various factors such as consumer attitudes, environmental consequences, the financial means of the consumer, and personal traits in the context of buying decisions related to environmentally friendly packaged goods. According to the Theory of Reasoned Action (TRA), a direct and positive link exists between consumers' intent to purchase and their propensity to choose green products (Neudecker et al., 2013). This model is frequently employed to predict consumer purchasing intentions and attitudes towards environmental preservation. Past studies suggest that consumers' purchasing preferences are shaped by their perceptions of eco-friendly packaged goods. Consumers who favor green-packaged products are reportedly more willing to spend on and procure such items, suggesting a heightened purchasing intention (Nancarrow et al., 1998).

2.6. Consumer perception

As per González et al. (2007), consumers from various income segments were studied to see what they wanted to buy. They identified a link between income and willingness to pay for better product attributes, i.e., the higher the payment, the greater the desire to spend on better product features. Magnier et al. (2016) concluded that higher-income people are more likely to buy environmentally friendly products, and their education also influences their decision to spend

money on green packaging. Recently, consumers have become more conscious of the adverse environmental effects of conventional packaging and choose green packaging.

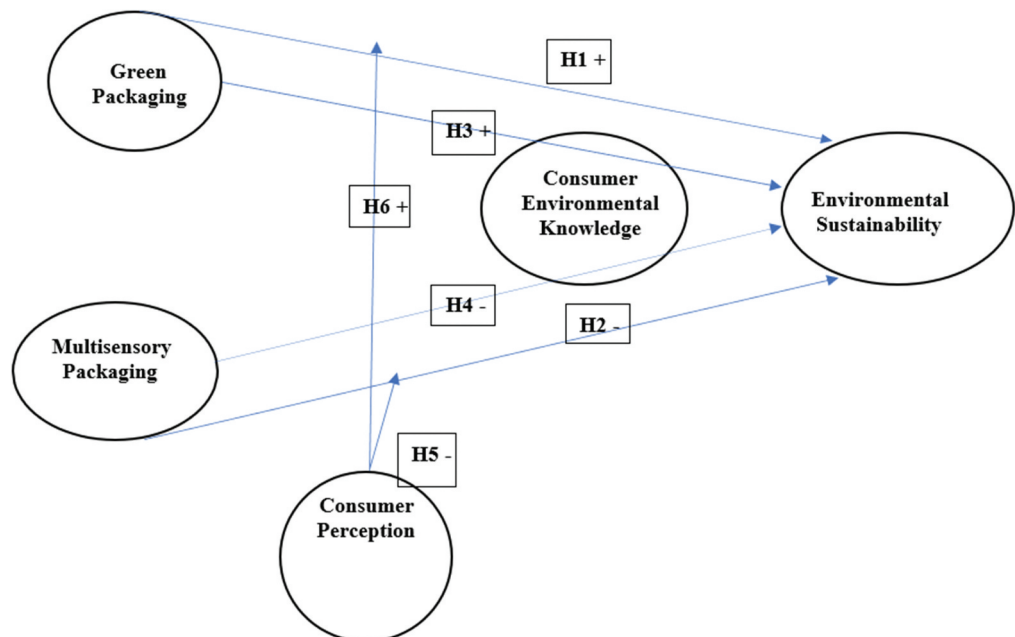
Consumers' willingness to pay is influenced by package pricing and quality. Thus, manufacturers should also emphasize these characteristics to encourage consumers to use green packaging. Consumers demand safe, convenient food and "organic" packaged in recyclable or reused materials. Innovative packaging can better balance these potentially competing goals than conventional packaging since it switches from an inactive to an aggressive mode. A collection of modern packaging technologies (in the food packaging industry) is referred to as "smart packaging" when they interact with the consumer and the product in a more enriching way while also being less destructive to the environment (Hao et al., 2019).

Similarly, the COVID-19 pandemic altered people's perceptions of sustainable packaging materials, forcing the entire value chain to respond quickly. In their recent study, Shukla et al. (2022) concluded that the COVID-19 epidemic has influenced customer behavior, including increased cost awareness, web purchasing across all categories, and buyer concern about safety, health, and sanitation. The consumer's perception of packaging has also shifted dramatically. Organizations and dealers in the fast-moving consumer goods (FMCG) business had assigned significant responsibilities to cost-effective packaging, and administrative offices were taking serious steps to address the problem.

Manufacturers should include the benefits of green packaging to raise knowledge about the positive impact on the environment and increase sales. A consumer always pays for what he expects and perceives from the product, so the perceived value has been defined as the value or worth of a product/service in the consumer's mind. Perceived value is crucial to a long-term consumer relationship and significantly influences consumer trust. As a result, it may be argued that consumers' perceptions of packaging have a beneficial impact on their product trust, which plays a vital role in buying (Fakharyan et al., 2014). Based on the above discussion following figure 1 is the theoretical framework.

2.7. Theoretical framework

Figure 1. Theoretical Framework.



2.7.1. Hypothesis of study

H1: Green packaging positively affects environmental sustainability.

H2: Multisensory packaging negatively affects environmental sustainability.

H3: Consumer environmental knowledge mediates the positive relationship between green packaging and ecological sustainability.

H4: Consumer environmental knowledge mediates the negative relationship between multisensory packaging and ecological sustainability.

H5: Consumer perception moderates the negative relationship between multisensory packaging and environmental sustainability.

H6: Consumer perception moderates the positive relationship between green packaging and environmental sustainability.

3. Research methodology

3.1. Research approach

The current study used a quantitative research technique and followed a positivist research strategy. The quantitative research methodology used the deductive approach, and the nature of the survey is explanatory.

3.2. Research design

This study employs a cross-sectional research design. The primary goal of this study is to investigate the cause-and-effect relationship between different variables, such as environment sustainability, multisensory packaging design, and green packaging, as well as the mediating variable, consumer perceptions, and the moderating variable, consumer environmental knowledge. The data for this study were gathered via a questionnaire survey at one moment. The questionnaire was written in English and designed to be easy to comprehend.

3.3. Sampling technique

The data were collected using a non-probability, purposive sampling technique. Only respondents familiar with green packaged goods and environmental sustainability were considered for this study.

3.4. Sample size

According to Ndesaulwa et al. (2017), to attain a confidence interval of 95% with a margin of error of 5%, a minimum sample size of 289 individuals would be required to be representative of the target population, and the sample size which researchers worked was 302 respondents. The actual population proportion must be determined with the necessary margin of error and level of confidence, and this is the minimal representative sample that must be used.

3.5. Unit of analysis & target population

The unit of analysis for the current research was individual, and the target population was the consumers of the FMCG sector residing in Lahore, Pakistan. For this study, the general public was selected to visit two significant malls, i.e., Emporium Mall and Packages Mall.

3.6. Measurement of scales

Table 1. Measures with Sources

Variables	Name of Measures	Number of Items	Sources
Independent Variable	Green Packaging	7	(Wandosell et al., 2021)
Independent Variable	Multisensory Packaging	7	(Spence, 2021b)
Dependent Variable	Environmental Sustainability	6	(Wensing et al., 2020)
Mediator	Consumer Environmental Knowledge	7	(D'Souza et al., 2007)
Moderator	Consumer Perception	7	(Hao et al., 2019)

4. Data analyses & results

4.1. Pre-testing

Pretesting is the research stage where survey questions are tested on participants from a particular community or study population to ascertain the validity and reliability of the survey instruments before they are broadly disseminated. Pretesting is frequently recognized as crucial to survey questionnaire design and improving data collection for value research. It uses several methods or approaches (Bryman & Bell, 2004). Content and face validity were examined in pre-testing by at least 20 participants, two of whom were regarded experts (Sabir et al., 2022). Twenty educators from the target audience were given the questionnaire, and some provided helpful pointers. Many question items were deleted from the questionnaire at this research stage. There were just 34 question items left to collect data from the target population. The survey seems ready for further testing after obtaining feedback from the pre-testing process and making the required changes.

4.2. Demographic analysis

4.2.1. Gender

The descriptive statistics for the frequencies test have been used to determine the gender categories of the respondents. The frequencies of females and males are listed in Table 2. There are 190 women among the general public respondents, while there are 112 males who responded. Table 1 indicates the sources of measurement of scales.

4.2.2. Age

The descriptive statistics for the frequencies test have been used to determine the respondents' age categories and have been divided into four groups. Table 3 clearly shows the frequencies of the age groups. Table 3 shows that there are 25 respondents whose age group was 30 or above 30 years, 149 respondents belonged to the age range of 21 to 24 years, 93 respondents aged between 25 to 29, and 35 respondents below 20.

4.2.3. Education

The descriptive statistics for the frequencies test have been used to determine the education level of the respondents. Researchers have chosen two significant education groups, whether the

Table 2. Descriptive statistics for Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
ValidMen	112	37.1	37.1	37.1
Women	190	62.9	62.9	100.0
Total	302	100.0	100.0	

Table 3. Descriptive statistics for age

		Frequency	Percent		Valid Percent	Cumulative Percent
Valid	Above 30	25	8.3		8.3	8.3
	21-24	149	49.3		49.3	57.6
	25-29	93	30.8		30.8	88.4
	Below 20	35		11.6	11.6	100.0
	Total	302		100.0	100.0	

Table 4. Descriptive statistics for education

		Frequency	Percent		Valid Percent	Cumulative Percent
Valid	Bachelor	218	72.2		72.2	72.2
	Master	84	27.8		27.8	100.0
	Total	302		100.0	100.0	

respondents have a bachelor's or belong to the group of people who have done a master's. Table 4 shows that 218 people belong to the bachelor's level of education group among the general public respondents, while 84 respondents have masters level education.

4.3. Hypotheses testing

Figure 2 depicts the model extracted through AMOS software to estimate the proposed structured model. Model estimation measures the model fitness and calculates the path lines' magnitude, direction, and significance. Comparative Fit Indices (CFI) test the model's fitness. CFI ranges from Zero to One. The calculated value of CFI close to one, such as 0.9 or above, indicates a perfect model (Sabir et al., 2021).

Table 5 depicts the beta coefficients and significance of paths. According to the result, all the independent variables (i.e., GP, MS, CP, and CEK) directly impact ES. However, GP and MS did not affect CEK (i.e., mediator). As the first condition of mediation is unmet, mediation cannot be run. Conversely, moderation shows that CP between MS and ES weakens the positive relationship.

As the mediation did not work, another model is run without the mediation; only GP, MS, and CP take as an independent exhibiting impact on ES (see Figure 2). Figure 3 shows the model without a mediator. The calculated value of CFI is 1.00 for the model in Figure 3, which indicates that the model is a perfect fit.

In Table 6, all the independent variables, i.e., GP, MS, and CP, show a positive and significant impact on ES. Moreover, results indicate that CP only moderates the relationship between MS and ES. The moderation also shows that CP weakens the relationship between MS and ES. Table 7 depicts the overall summary of results based on statistical analysis. moreover, it indicates the status of hypothesis either accepted or rejected.

5. Discussion & conclusion

5.1. Discussion of findings

The current study's findings bring interesting facts that significantly contribute to the existing literature. First, the H1 and H2 acceptance shows that green and multi-sensory packaging is essential for environmental sustainability. Also, rejecting H3 and H4 brings suggestions for

Figure 2. Estimated model.

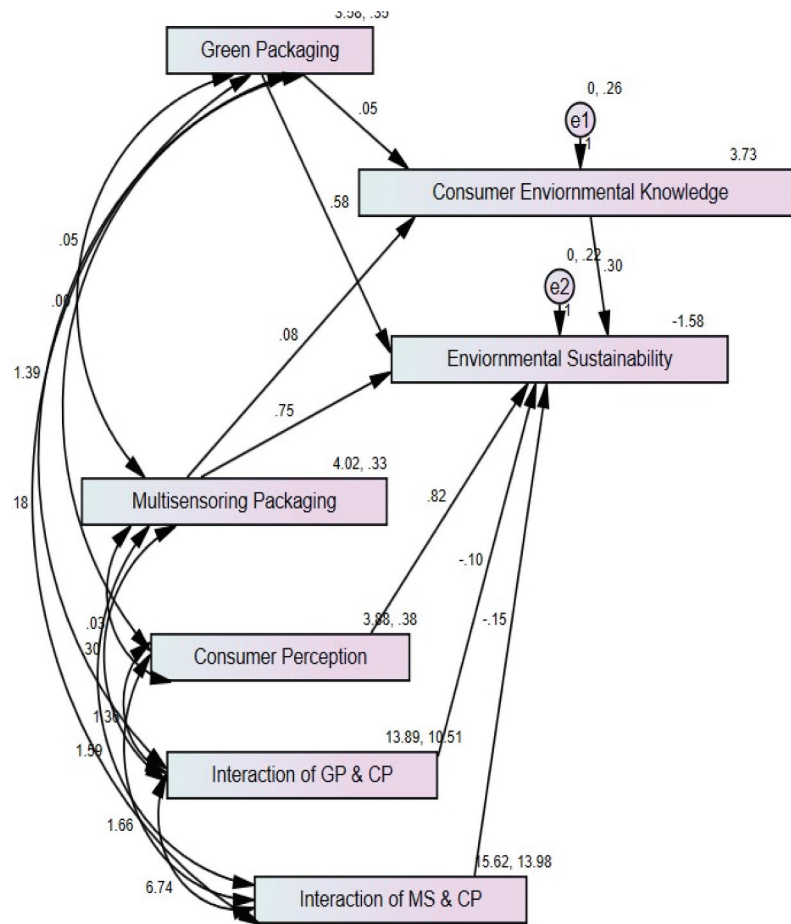


Table 5. Beta coefficients of path lines

	Beta Coefficient & Significance
CEK ← GP	0.050
CEK ← MS	0.083
ES ← GP	0.576*
ES ← MS	0.750*
ES ← CP	0.823**
ES ← INTERACTION OF GP*CP	-0.097
ES ← INTERACTION OF MS*CP	-0.152*
ES ← CEK	0.300**

**Significant at the level of 1% or 0.01.

*Significant at the level of 5% or 0.05.

researchers and managers. The acceptance of H5 indicates that consumer perception affects the linear relationship between multi-sensory packaging and environmental sustainability. At the same time, the rejection of H6 suggests that the linear relationship between green packaging and environmental sustainability did not need any other factor. The acceptance of H1 is aligned with the literature. However, the positive impact of multi-sensory packaging requires clarification. Literature suggests that multi-sensory packaging negatively impacts environmental sustainability, and findings show that green packaging positively impacts ecological sustainability.

Figure 3. Model extracted with-out mediator.

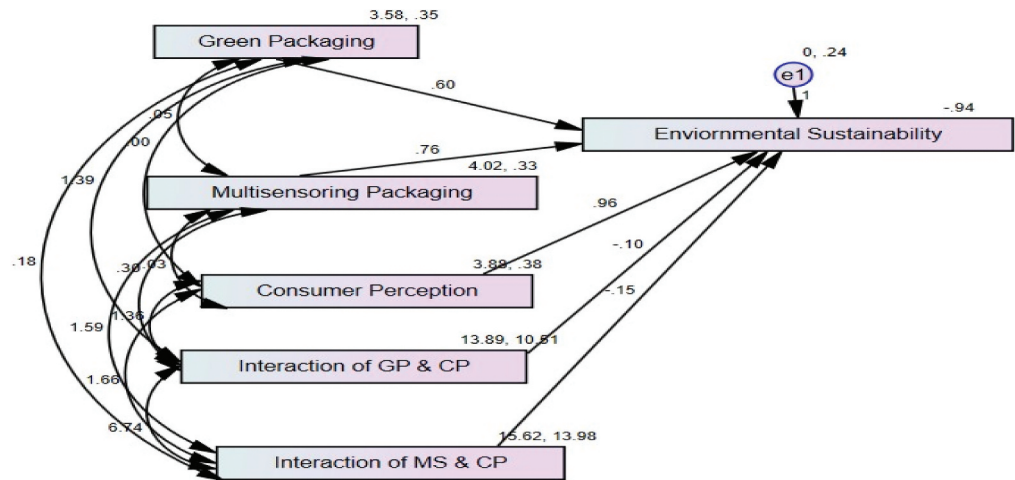


Table 6. Beta coefficients of path lines

	Beta Coefficient & Significance
ES←GP	.595*
ES←MS	.764*
ES←CP	.959**
ES←INTERACTION OF GP*CP	-.097
ES← INTERACTION OF MS*CP	-.152*

**Significant at the level of 1% or 0.01.

*Significant at the level of 5% or 0.05.

The development of many mass-market food and beverage goods, though certainly not all, benefit significantly from the product’s multisensory qualities (Hao et al., 2019). Almost 33% of all environmental harm is caused by packaging materials. Given the increasing environmental concerns and consumer awareness, many corporations aim to combine multisensory and green packaging. Organizations that use biodegradable materials for making multisensory packages have gained a positive standing in the business environment. Packaging is multisensory as it tends to be seen, contacted, heard, smelt, and, in certain conditions, even tasted by consumers (as in consumable Packaging). With this in mind, multisensory showcasing researchers and professionals are increasingly looking into multimodal packaging features as a tool for altering consumers’ search behaviors, assumptions, collaboration, ease of use, and impression of the item (Van Birgelen et al., 2008). Packaging is multisensory as it can be seen, contacted, heard, smelt, and, in specific conditions, tasted. Many items’ prosperity is not entirely set in stone by the visual highlights of packaging configuration (variety and plan or picture engraving). Even though the significance and effects of packaging tone have been extensively studied, experts emphasize the haptic (or physical), audible, and aromatic components of packaging design (Payne et al., 2019).

The visual part of multisensory packaging is the most significant because it shows a mix of sentiments and information. Concealing thoughts and splendor get energetic reactions, contingent upon the affiliations that every individual has fashioned considering their past. It’s vital to remember the essential data for the bundle, but at the same time, it’s necessary to try to keep the space manageable with designs (Camilleri, 2020). Packaging plan organizers can genuinely control client suspicions by conquering business area presumptions. Since the message is developed by the congruency among packaging and items, individuals focus on fragile merchandise in amazingly sensitive compartments. The negative impact of multi-sensory packaging on environmental sustainability has been observed in developed nations where individuals are highly

Table 7. Summary of Results

Sr.	Hypotheses	Status
H1	Green packaging positively affects environmental sustainability	Accepted
	Multisensory packaging negatively affects the environment.	
H2	sustainability	Accepted
	Consumer environmental knowledge mediates the positive relationship	
H3	between the green packaging and environmental sustainability	Rejected
	Consumer environmental knowledge mediates the negative relationship	
H4	between the multisensory packaging and ecological sustainability.	Rejected
	Consumer perception moderators the negative relationship between the	
H5	multisensory packaging and environmental sustainability	Accepted
	Consumer perception moderators the positive relationship between the	
H6	green packaging and environmental sustainability	Rejected

educated and aware of the sustainable environment (free from pollution, waste materials, and waste of natural). Individuals with knowledge about the sustainable climate are less likely to be attracted to fancy packaging such as color themes, style, and other things. However, product selection of sub-continent consumers is highly dependent on the fancy packaging appealing to the five senses. Most of the population in Pakistan needs to be more literate and recognize products/ brands/services through color schemes, styles, or symbols. The color or unique package design recorded in the consumer’s mind and influenced their perception might be another reason that multi-sensory packaging positively impacts environmental sustainability.

The findings also revealed that consumer environmental knowledge did not mediate (rejection of H3 and H4) the relationship between green packaging, multi-sensory packaging, and environmental sustainability.

In current research, the lack of mediation is due to the lack of direct impact of green packaging and multi-sensory packaging on consumer ecological knowledge. The insignificant mediation of consumer environmental knowledge indicates that there needs to be more than green and multi-sensory packaging to create consumer knowledge regarding an eco-friendly environment. Moreover, factors other than green and multisensory packaging might shape consumer environmental knowledge. In addition, individual literacy means one who can read and write their name in Pakistan. Individuals with higher education are limited in numbers and are aware of an eco-friendly environment and its consequences for the long-term sustainability of resources and the environment. The findings suggest that future researchers should explore other mediators with the same model.

In addition, the current study aimed to examine consumer perceptions (H5 and H6) moderating role in the relationship between green packaging, multi-sensory packaging, and environmental sustainability. Consumer perception refers to the individual understanding of choosing a particular

product/service/brand. Also, consumer perception measures the unique extent to which stimuli are used for memorizing and recognizing the product/service/brand.

Daverey and Dutta (2021) studied consumers from various income segments to see what they wanted to buy. A positive linear relationship between income and willingness to pay for better product attributes, i.e., the higher the payment, the greater the desire to spend on better product features. Tang et al. (2016) state that higher-income people are more likely to buy environmentally friendly products. He further asserted that education influences people's spending money on green packaging. Recently, consumers have become more conscious of the adverse environmental effects of conventional packaging and choose green packaging. Their examination indicates that most people will purchase from organizations that zeroed in on corporate social obligation. They presumed that bundle valuing and quality affect shoppers' ability to pay. Accordingly, makers should accentuate these attributes to urge customers to utilize green packaging (Wandosell et al., 2021).

Buyers request protected, helpful, and "natural" food bundled in recyclable or reused materials. By changing packaging from a dormant to a forceful mode, intelligent packaging is better ready to oblige these possibly clashing goals than conventional packaging. Savvy packaging alludes to an assortment of new packaging advances (in the food packaging area) that collaborate with the customer and the item in a more improved manner and are likewise less unsafe to the climate (Singh & Pandey, 2018).

Results show that consumer perception only moderates the relationship between multi-sensory packaging and environmental sustainability. The presence of consumer perception between the linear relationship of green packaging and environmental sustainability did not create any positive or negative effect. It shows that green packaging is a strong construct that only needs other factors to mediate or moderate the linear relationship with environmental sustainability. H2 shows that Multisensory Packaging hurts ecological sustainability. And that consumer perception is highly dependent on the education level of individual consumers, implying that consumers are prone to fancy packaging.

5.2. Conclusion

Academics, researchers, and practitioners are increasingly interested in green packaging, usually eco-friendly or sustainable. The current study investigated the direct and indirect effects of green and multi-sensory packaging on environmental sustainability by mediating consumer ecological knowledge. Results show that green and multi-sensory packaging directly affects environmental sustainability instead of indirectly through consumer ecological knowledge. Moreover, consumer perception is included in the proposed model to moderate the impact of green and multi-sensory packaging on environmental sustainability. Findings show that consumer perception negatively mediates the effect of multi-sensory packaging on ecological sustainability, which aligns with the literature. Future citizens who are managers and consumers with a high level of environmental awareness and knowledge are anticipated to impact the availability of eco-friendly products and consumption patterns as emerging countries move closer to becoming developed nations. Future generations will be more likely to buy green vehicles and help conserve, preserve, and protect the environment. This study demonstrates the positive benefits of environmental knowledge, awareness, attitude, buying intentions and actual purchases of green products.

5.3. Theoretical implications

The present study's findings have significant theoretical implications as they contribute to the literature in several ways. The theoretical contributions are discussed: first, the current research takes both aspects of packaging, i.e., green packaging and multi-sensory packaging, to discover environmental sustainability. Green packaging purposively serves ecological sustainability. However, it is essential to explore the role of multi-sensory packaging in establishing a sustainable environment that remains to be seen in the literature. Second, the current study considers consumer perception as a moderator between independent (i.e., GP and MS) and

dependent variables. The negative moderation of consumer perception of the relationship between MS and environmental sustainability confirms the existing literature's stance.

Also, it is suggested to identify other factors that strengthen the relationship between Multisensory Packaging and Ecological Sustainability. Thirdly, the present research used consumer environmental knowledge as a mediator. However, the findings reveal that both independent variables, i.e., green and multi-sensory packaging, need to create consumer ecological knowledge. The rejection of consumer environmental knowledge as a mediator in the relationship between green packaging, multi-sensory packaging, and environmental sustainability requires exploring other variables that move between the said paths. Also, there is a need to examine product packaging factors that may shape the consumer's environmental knowledge. Researchers should identify other factors that mediate the packaging factors and ecological sustainability.

5.4. Practical implications

The current study has several practical implications for marketing and strategic managers of the FMCG sector of Pakistan before developing a marketing plan. The following practical implications are as follows;

- (1) Pay special attention to the multi-sensory aspect of packaging. The multi-sensory packaging plays a role in creating ecological sustainability. Specifically, multinational companies should consider multi-sensory packaging to achieve environmental sustainability in sub-continent cultures and contexts.
- (2) Marketing plans to promote environmental sustainability should focus on shaping consumer perception of environmental sustainability.
- (3) Promotional activities should include a program to inform consumers and teach them about packaging aspects and how it will help obtain ecological sustainability.
- (4) Marketing managers should use multiple sources, such as social media and electronic media, to educate customers about how companies and brands create a sustainable ecological environment.

5.5. Limitations and future directions

Although, the current study has several theoretical and practical implications. Still, it is not free from limitations. The small sample size of 302 is the most critical limitation. The study is conducted at a particular time with a restricted budget; therefore, the diversity element in the sample size 302 is limited. However, future researchers with more time and considering participants from faraway locations solve this limitation. Second, the current study used a quantitative research design, which cannot measure participants' subjective evaluation and opinions. Therefore, future researchers should use mixed-method research.

Third, the current study only took two independent variables relevant to the packaging aspect (green and multi-sensory packaging). However, the latest literature review of green marketing suggests exploring the impact of green product certification on environmental sustainability. Future researchers may study green product certification's direct and indirect effects on ecological sustainability by mediating consumer environmental knowledge. Green Product Certification is a legislative solution for a sustainable environment. So, it will help to understand whether the availability of laws to implement an eco-friendly climate plays a role in environmental sustainability. Fourth, the current study uses one variable as a moderator. However, more than one variable can be used as a moderator. For instance, future researchers should examine the moderating role of consumer training programs/campaigns towards an eco-friendly environment between the proposed relationship of green product certification and consumer environmental knowledge. The moderation of consumer training programs highlights whether the social awareness programs strengthen the ties between legal solutions and individual ecological understanding. Also, consumer diversity in terms of culture and religion should be used as moderators between green product certification and consumer environmental knowledge.

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List of abbreviations

GP	Green Packaging
MS	Multisensory Packaging
CP	Consumer Perception
CEK	Consumer Environmental Knowledge
UNFCCC	United Nations Framework Convention on Climate Change
UNCED	United Nations Conference on Environment and Development
FMCG	Fast-Moving Consumer Goods
WWF-Pakistan	World Wide Fund for Nature- Pakistan
ERP	Extended Producer Responsibility
VBN	Value Belief Norm

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