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ADVANCING SUSTAINABLE PACKAGING: A UNIFIED APPROACH INTEGRATING INDUSTRY, INNOVATION, AND CONSUMER

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Abstract

Conventionally, the primary focus of packaging was ensuring product safety, quality, and streamline the logistics. However, a recent study demonstrates that, there is an urgent need to adopt sustainable practices—advanced methodologies or frameworks to decrease the growing environmental burden of packaging waste. Several opportunities remain untouched to reduce waste and increase the use of renewable, biodegradable, and locally available materials. The packaging industry is at the intersection of environmental, social, and economic challenges, reflecting the global shift in global business frameworks towards sustainability, social equity.

Sustainability is the key factor where packaging industries are waiting for linear models of production and consumption. To address these challenges, this research proposes a collaborative framework uniting business, local craftsmen utilizing innovative materials, and customers. This approach aligns industry capabilities with consumer priorities, fostering cost-efficient and sustainable packaging solutions that support a circular economy.

This study presents a comprehensive approach to sustainable packaging design, encompassing packaging systems and packaged goods throughout the entire supply chain—from producers to end consumers. Designed as a "blueprint" for achieving more sustainable packaging solutions, the proposed methodology identifies critical attributes that contribute to sustainability from a 360-degree perspective. It integrates a variety of analytical methods to offer a solution that is both easily available and affordable. An industry's Expert survey was conducted to identify essential attributes using the Pareto 80/20 model, highlighting attributes that affect how sustainable packaging is perceived and used. One of the key attribute findings was that material should be accessible to reduce the overall cost of production. This approach encourages economic sustainability and raises the standard of life for craftsmen by reducing the total cost of materials and transportation costs.

In parallel, a customer study was carried out to find out what customers prioritize when it comes to affordable, easily available, and ecological packaging. This research offers practical insights to encourage businesses to adopt design features that support sustainability by balancing industry capabilities with consumer expectations. The findings emphasize the importance of leveraging local resources and expertise to create affordable, eco-friendly packaging solutions that align with consumer needs and contribute to a circular economy.

Keyword: Sustainable Packaging Design, Attributes, Industry, Local innovation, Customer

INTRODUCTION

Packaging has a key role to play in sustainable development. Developing sustainable packaging design (SPD) has always been a greater issue for the industry. Rising demands of goods are increasing the waste filling landfills, which is causing a major problem for the government to filter out. According to conservative estimates of the Central Pollution Control Board (CPCB), 60 major cities in the country generate around 25,940 tonnes of plastic waste every day. Out of all the waste collected in India, around 660,787.85 tonnes of plastic waste, only 60% has reportedly been recycled. Nearly 43% is packaging material and most are single-use plastic.

A long-lasting or sustainable business is a good business. Sustainability is a modern business strategy that takes into account social, environmental, and economic factors to ensure a company's long-term viability (K. Haanaes 2016) "What is the role of designers with their designs so that a business can be sustainable?" is the next question to be taken into consideration. Implementing the idea of sustainable development into the design is one duty that a competent designer might complete. A designer bears moral and ethical responsibility for the design and its effects (O. Diegel 2001; and D. Nemerson, J. Rosenbeck 2009).

The escalating environmental concerns surrounding packaging waste have become a defining issue of the 21st century (Sonneveld et al., 2005). It is prompting a global shift towards more sustainable practices in both production and consumption. The problem of packaging waste has attracted attention from researchers and practitioners lately due to growing awareness of plastic pollution's harm to the environment (Svanes, E et al., 2010). As a result, consumers, industries, and legislators are increasingly calling for solutions that can lessen the damaging effects of packing on the environment. One of the main areas of concentration among these solutions is sustainable packaging, particularly locally sourced, biodegradable, and renewable materials.

Using a cumulative frequency distribution analysis, this paper identifies eight essential design attributes for SPD: functionality, protection, adaptability, affordability, accessibility, reusable, energy efficient and durability. Another tool utilized in the process to find the customer liking is the Relative Importance Index (RII) is frequently used in research to rank and prioritise attributes, traits, or variables according to respondents' perceptions of their relative significance is the Relative significance Index (RII), also known as the Relative Relevance Index. It is extensively used in fields including sustainability studies, project management, and construction management. The mean RII of each attribute is then analysed based on the attribute categorisation in order to produce a SPD. The survey was taken into consideration by letting customer decide their prioritize on the scale on a Likert scale i.e., most needed, essential, desirable, neutral and not needed. The primary goal of this study is to conclude that the current SPD practice is adequate for creating SPD products in accordance with the definition of SPD and to add necessary features to enhance the sustainability practice in order to serve all user segments.

LITERATURE REVIEW

In today’s market, the importance of product packaging extends far beyond its traditional role of protecting the contents. It has become a key factor influencing consumer behaviour, brand

perception, and even environmental impact. According to the data offered by the Indian Institute of Packaging, the total packaging waste in India is around 32 million metric tons per year (Suyog D 2012). As sustainability increasingly becomes a key focus in packaging design, businesses are under mounting pressure to shift away from conventional, linear models of production and consumption, and adopt more sustainable, circular practices. Data suggests that Consumer are interested in investing in sustainable packaging design. They are aware that sustainable packaging design solutions contributes to conservation and environment awareness. As a result, packaging companies are now taking a different approach when it comes to product packaging (Singhal and Malik, 2018).

A study by Mekonnen et al. (2021) studied the effect of sustainable packaging on consumers' purchasing intentions. The study examined major constructs such as perceived benefits of sustainable packaging, concerns over sustainability, and the credibility of sustainability claims. In addition, packaging was shown to express the individuality and personality of consumers, and thus, play a significant role in the development of their image when they look for products that reflect their values (James & Kurian, 2021).
Gil-Saura et al. (2021) examined the impact of sustainable packaging on perceived value, customer satisfaction, and repurchase intentions in the e-commerce sector. They concluded that perceived value and customer satisfaction were the most critical factors driving consumers to repurchase, which is consistent with Lorek's (2015) conclusion on the contribution of sustainable practices to consumer loyalty. Similar to this, Norazah et al. (2020) analysed how green packaging features affect online buying behaviour. The authors assessed factors like ecolabeling, sustainable material acquisition, and recyclability on the purchase decision of a product through online channels.

The industry now views packaging not just as a protective layer for products but as a vital component of its sustainability strategy. Therefore, the need for recyclable, reusable and environmentally friendly packaging options is becoming a key driver of innovation in many sectors (Byggeth and Hochschorner, 2006; Beitzen-Heineke et al., 2015). The other business, the packaging sector is currently at the intersection of challenges related to sustainability, social justice, environmental protection, and economic growth, which defines the commercial and social framework of the early century (Underwood, R. L., 2003).

This research paper argues how the demand for sustainable packaging is increasing and how the use of such materials can resolve many issues of this nature. Its purpose is to delve into the broader context that locally accessible materials could replace existing non-recyclable packaging materials after giving a comprehensive review of environmental, economical, and sociological aspects of using such materials in packaging production. The aim of this project is to help the audience appreciate the fact that sustainable packaging is both innovative and functional in that it offers solutions that are beneficial to Industries, customers and the environment.

Mapping opportunities with locally available sustainable materials in India:

India promotes environmentally friendly building and manufacturing methods by providing a large variety of locally accessible sustainable materials that differ among its many states. Environmental, economic, and social considerations are all part of the push for sustainable practices, which encourages creative ways to improve products while maintaining authenticity (Kesaboyina et al., 2024). Various materials available have needed physical properties like robust, adaptable, and grows quickly, making it perfect for crafts and construction. In Rajasthan and Gujarat, mud is a cheap, energy-efficient building material that provides natural insulation. States like Kerala, Rajasthan, and Tamil Nadu are home to natural stones like granite, sandstone, and laterite, which offer long-lasting and thermally efficient building materials. Coconut shells and coir are recycled for building, insulation, and crafts in coastal regions like Kerala. Frequently utilized in Tamil Nadu and Rajasthan, terracotta tiles provide exceptional durability and heat regulation. When harvested responsibly, wood from forests that are sustainably managed—like Madhya Pradesh and Odisha's teak and sal is long-lasting and environmentally beneficial. Other biodegradable substitutes for synthetic materials in building, packaging, and energy use include jute, rice husk, and cow dung, which are found in West Bengal, Punjab, and rural areas. These materials are essential to India's sustainable development because they lessen their negative effects on the environment, boost rural economies, and conserve cultural heritage—all while using local resources.

India being one of the richest countries in heritage and traditional innovation can bring valuable knowledge of natural and sustainable materials, offering a unique opportunity to develop eco-friendly, locally sourced packaging material (Jain, R., & Thakkar, J. 2019). When integrated into business models, these materials not only provide a sustainable solution but also support the preservation of traditionally innovated materials, empowering craftsmen, and contributing to social equity. As, it was identified in the literature review customers feels encouraged for the opportunity to make more environmentally conscious purchasing decisions in a sustainability-driven market. With the help of available literature review and books, a list of locally available materials and crafts being practised has been prepared as shown in Table 1.

Table 1. Locally available material and craft associated with them

State	Craft Material	Associated Crafts
Jammu & Kashmir	Pashmina Wool, Willow Wood, Paper Mache	Pashmina Shawls, Basket Weaving, Decorative Boxes
Himachal Pradesh	Wool, Wood, Bamboo	Kullu Shawls, Wooden Carvings, Bamboo Basketry
Punjab	Phulkari Embroidery, Jute, Clay	Dupattas, Jute Bags, Terracotta Pottery

Uttarakhand	Rambaan Fiber, Aipan Art, Wood	Rugs, Aipan Paintings, Decorative Carvings
Rajasthan	Cotton, Natural Dyes, Lac, Leather	Block Printing, Lac Bangles, Mojaris
Uttar Pradesh	Brass, Marble, Chikankari Embroidery	Metalwork, Marble Sculptures, Embroidered Garments
Bihar	Silk, Bamboo, Madhubani Painting	Sarees, Bamboo Crafts, Madhubani Paintings
West Bengal	Jute, Clay, Kantha Embroidery	Jute Crafts, Pottery, Kantha Quilts
Assam	Cane, Bamboo, Silk	Weaving, Silk Sarees, Bamboo Furniture
Manipur	Cotton, Cane, Bamboo	Traditional Textiles, Cane Crafts, Bamboo Handicrafts
Meghalaya	Bamboo, Cane, Wood	Weaving, Cane Furniture, Wooden Carvings
Nagaland	Bamboo, Cane, Wood	Tribal Jewelry, Cane Handicrafts, Wooden Artifacts
Madhya Pradesh	Bell Metal, Cotton, Stone	Metal Sculptures, Chanderi Sarees, Stone Carvings
Gujarat	Cotton, Silk, Beads	Bandhani, Patola Sarees, Beaded Jewelry
Maharashtra	Cotton, Bamboo, Warli Art	Warli Paintings, Bamboo Handicrafts, Textile Weaving
Goa	Terracotta, Coconut Shells	Terracotta Pottery, Coconut Crafts
Karnataka	Sandalwood, Cotton, Mysore Silk	Sandalwood Carvings, Silk Sarees, Kasuti Embroidery
Kerala	Coconut Fiber, Coir, Banana Fiber	Coir Mats, Fiber Crafts, Kathakali Masks
Tamil Nadu	Silk, Cotton, Stone	Kanjivaram Sarees, Stone Carvings, Tanjore Paintings
Andhra Pradesh	Cotton, Silk, Kalamkari Art	Kalamkari Paintings, Ikat Weaving, Stone Sculptures
Telangana	Cotton, Silk, Bidriware	Bidriware Artifacts, Pochampally Sarees
Odisha	Brass, Terracotta, Palm Leaves	Dhokra Art, Palm Leaf Etching, Silver Filigree

Chhattisgarh	Iron, Brass, Bamboo	Bell Metal Craft, Tribal Textiles, Bamboo Baskets
Jharkhand	Lac, Bamboo, Jute	Lac Bangles, Jute Products

To cater to issue, this research proposes a framework that encourages collaboration across three key stakeholders: Packaging Industry, local craftsmen employed with local innovative materials, and consumers. The framework aims to harness the potential of the industry and Identifying sustainable packaging design attributes is indeed fundamental in creating a framework for environmentally responsible product development (Singh, R et at. 2020). These attributes serve as essential guidelines to ensure that packaging not only meets functional requirements but also aligns with sustainability aspect. Through this collaboration, businesses can reduce their environmental footprint while supporting local economies and promoting social responsibility.

Research Problem and Objectives

This research will examine consumer perceptions of sustainable packaging of locally produced sustainable packaging materials, focusing on various aspects like emotional aspect, material, functionality, product value, and environmental impact. Qualitative methods have been employed, including surveys, interviews to gather insights from consumers to understand what their preferences are. In conclusion, this study reflects on a greater collaboration between local communities, and businesses alike for customers. To benefit the rising environmental concerns which will help in designing of sustainable packaging solutions. Industries can play a pivotal role in fostering a more sustainable and socially responsible economy by integrating CSR initiatives into packaging strategies and promoting local craftsmanship.

The primary research question driving this paper is:

OBJ01: To examine the growing consumer demand for sustainable packaging: To understand the customer requirement and factors that influence their buying decisions for SPD.

OBJ02: To investigate the potential of various design attributes: Design attributes that can help in development of sustainable packaging with desired cost, and performance efficiency

OBJ03: To propose a possible solution for Packaging Design Industry: Analysing the challenges faced by the industry and suggesting a potential solution for utilizing the identified attributes.

METHODOLOGY

As various stakeholders collaborate to develop sustainable packaging designs, it is essential to consider the needs and preferences of users to create effective and sustainable packaging solutions. Finding the key characteristics of SPD that can be included in the early stages of the design process is the ultimate objective of this research. Three processes make up the procedure of determining the qualities (Figure 1), which are as follows:

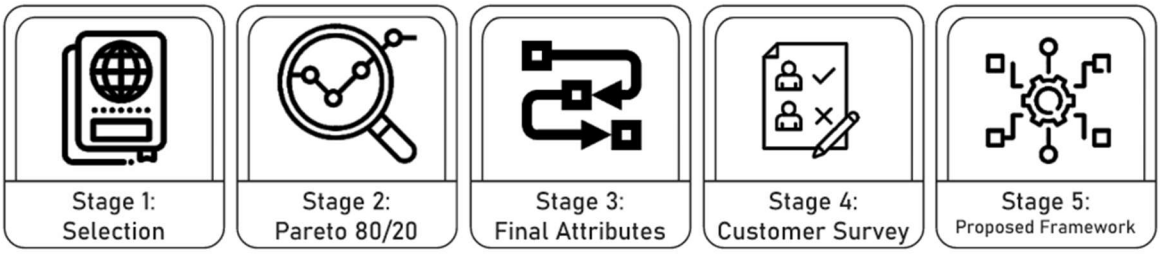

Figure 1. Methodology

Stage 1:

Selection of the Attributes: A list of attributes that are associated with the design and users were collected from the journals, books, internet, design magazines, product catalogues and market survey. To represent the design attributes based on tangible/in tangle outcomes and user characteristics, a list of over 100 words was identified and gathered for the study (e.g., functionality and usability extracted from tangible/in tangle outcomes i.e., product and product attachment/emotion is obtained from human experience. This step's goal was to investigate and develop design terminology in order to determine the necessary qualities. Simultaneously, removing any undesirable attributes that were not directly related to SPD was also completed. Identical words were eliminated. Words that were inappropriate for conveying SPD were left out, reducing the number of qualities to over ten. Thirty design professionals from academia and industry participated in this process, which required eliminating identical and inappropriate traits from the design language in order to uncover the key attributes.

Stage 2:

Utilizing Pareto 80/20 Method

Following the focus group session with the design specialists, the total number of 10 attributes were selected to be tested on Pareto method, where words are linked with the notion of SPD. With the assistance of 30 design professionals, a cumulative frequency distribution analysis was conducted to determine the key characteristics that are either directly or indirectly associated with SPD (Table 2). In statistics and data analytics, cumulative frequency is a crucial instrument that helps control the proportion of observations in our dataset that fall above or below a given value (Chakraborty, P 2012). Additionally, it is used for information extraction from the dataset, which includes forecasting, trend analysis, and decision-making. The cumulative frequency distribution was calculated using distinct attributes and the instances that go along with them. The following procedures were used to present the analysis table based on cumulative frequencies:

Table 2. Cumulative frequency distribution for selected attributes

S.No.	Attributes	Frequency	Cumulative Frequency	Percentage
1.	Accessible	35	35	21.60%
2.	Affordable	28	63	17.28%
3.	Energy Efficient	20	83	12.35%

4.	Protection	18	101	11.11%
5.	Durable	15	116	9.26%
6.	Reusable	12	128	7.41%
7.	Functional	10	138	6.17%
8.	Adaptable	10	148	6.17%
9.	Aesthetic	8	156	4.94%
10.	Informative	6	162	3.70%

Absolute frequencies for each design attribute were gathered from the design experts. These frequencies were then arranged in descending order. The cumulative frequency for each attribute was subsequently calculated. Finally, the percentage for each attribute was determined using the formula:

$$Percentage\ (\%) = \frac{cf}{\sum_{i=1}^{n} f_i} * 100$$

Where,

- cf = Cumulative frequency
- $\sum f_i$ = Sum of absolute frequencies
- n = Total number of attributes

The cumulative frequency distribution analysis was used to prioritise problem-solving and/or root-cause investigation while removing uncertainties associated with design attributes. As a result, the cumulative frequency distribution chart provides a ranking tool for relative frequency design attributes, allowing process improvement efforts to be arranged to extract the most efficient traits for SPD from others. The cumulative frequency distribution chart was used to illustrate the goal of using the cumulative frequency distribution analysis, which was to distinguish between the "trivial many" and the "vital attributes."

Stage 3:

Final Attributes:

The absolute frequency and cumulative frequency distribution of the 10 design attributes are displayed in Figure 2 and Table 1. The Authors developed an assessment criterion to these attributes after analysing the cumulative frequencies and the associated percentage. This rule indicates that "All the attributes lying within 80% are recognised to be the vital attributes contributing towards SPD."

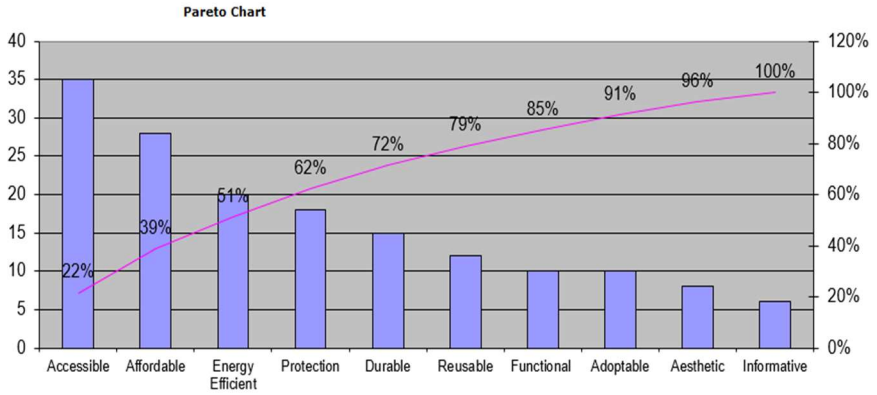

Figure 2. Cumulative frequency distribution

Analysis: In the cumulative frequency distribution analysis, this evaluation rule serves as a threshold, identifying which attributes are considered significant out of all those that fall over the specified threshold value. Consequently, 08 attributes were identified as having a substantial impact on SPD based on this assessment rule, as shown in figure 3:

Final Attributes
Accessible
Affordable
Energy Efficient
Protection
Durable
Reusable
Functional
Adaptable

Figure 3. Final Attributes for SPD

Stage 4:

Customer Survey: This is a complex field that encompasses human behaviours and biases during purchasing and post-consumption. That is the reason for a in-depth research on sustainable packaging has become increasingly prevalent, as consumer behaviour plays a pivotal role in shaping purchase intentions. A customer survey was conducted to understand how respondents perceive the importance of packaging attributes such as Accessible, Affordable, Energy Efficient, Durable, Protection, Reusable, Functional, and Adaptable**.** Total number of 65 Reponses were received. Using the Relative Importance Index (RII) as a statistical tool, the survey analysed customer ratings on a 5-point Likert scale ranging from "Most Needed" to "Not Needed." RII simplifies decision-making by quantifying the importance of each attribute, providing a

normalized score between 0 and 1. This score aggregates responses, where higher RII values indicate greater relative importance. By ranking the attributes based on their RII values, the survey identified the most critical features for customers, aiding in prioritizing these attributes in sustainable. Purpose of this stage to understand and identify an area for further work. The RII helps determine the relative importance of various factors by aggregating respondents' ratings. It simplifies decision-making by quantifying the significance of SPD attributes.

The formula for *RII* is: $$\boldsymbol{RII} = \frac{\sum W}{A \times N}$$

Where:

- $\boldsymbol{W}$ = Weight assigned to each factor by respondents (based on the rating scale)
- $\boldsymbol{A}$= Highest rating on the scale (e.g., if the scale is 1 to 5, A=5).
- $\boldsymbol{N}$ = Total number of respondents.

Table 3. Evaluated Relative Importance Index (RII) values of the customers.

Attribute	Sum of Weights (W)	Highest Rating (A)	Total Respondents (N)	RII	Rank
Accessible	575	5	65	0.89	1
Affordable	550	5	65	0.85	2
Protection	525	5	65	0.81	3
Reusable	500	5	65	0.77	4
Durable	475	5	65	0.73	5
Energy Efficient	450	5	65	0.69	6
Functional	425	5	65	0.65	7
Adaptable	400	5	65	0.62	8

The mean RII was computed from Table 3 in order to assess each of these attributes' relative relevance in relation to SPD. The mean RII for each of these characteristics is shown in Table 3.

- ***Accessible*** (RII = 0.89) is now ranked highest, reflecting its top priority as per your order.
- ***Affordable*** (RII = 0.85) follows, emphasizing the importance of cost-effectiveness.
- ***Adaptable*** (RII = 0.62) remains the least prioritized.

Stage 5:

Proposed Collaboration

India is rich in several various materials that have been used over centuries in the local crafts and construction be it bamboo or sisal fibre or terracotta or wood of various kinds and these materials can be well used as sustainable alternatives to the conventional packaging as they are readily available and economical too. For instance, bamboo is a fast-growing resource while terracotta and sisal fibre are completely organic and can be used for packaging without destroying nature which allows for better environmental practices. When such materials replace plastic covers, chances are that pollution and waste will not be as much as it could have been because of the use of more eco-friendly alternatives for the package solutions. Plus sourcing the materials from nearby only reduces the carbon emission from transportation further enhancing the sustainability of the packing.

By integrating Indian craft these materials can be further better promoted and can be made into finished products which can create a lot of opportunity and also allows these materials to be recycled properly. A country having diverse artisans creates ruins on so many fabrics which are unique and beautiful all at once. Not only the incorporation of these fabrics into new packages helps to sustain these old crafts, but it also creates a new competitive value for these products by giving them a unique twist which makes it suitable for the modern world. By fusing contemporary demands with traditional skill, incorporating these materials into contemporary packaging not only contributes to the preservation of these ancient crafts but also gives products a distinctive, marketable character. In addition to bolstering cultural legacy, this gives local craftspeople a reliable source of income, enhancing their standard of living and fostering economic growth in rural and impoverished areas.

Consumers, particularly in India and other emerging markets, are increasingly conscientious about the environmental impact of their purchases and seek out brands that prioritize sustainability**.** These locally available sustainable materials will provide consumers an environmentally responsible choice without compromising on quality or accessibility. From a business perspective, these materials offer a cost-effective substitute for imported packaging materials or traditional plastic. Because locally produced materials are more affordable, they are a viable choice for companies of all kinds, from big corporations to small producers, which helps the packaging, sector as a whole embrace them more widely.

Contextual understanding the Demand:

The Packaging sustainability concepts have co-evolved with the increasing incorporation of the principles of sustainable development at various levels within industrial and organizational platforms. Environmental impact of product packaging is of immense interest to package designers, package manufacturers as well as its users.
Where, Material plays a very important role in Packaging Design as it defines the protection value of the product inside. Figure 4 has requirements and issues that industry and customers faces often as identified in the literature review.

1. Industries hire designers to understand the user's perspective, design the information they want to communicate to consumers and the actual products and services they provide (Jeenusha, K. S., & Amritkumar, P. 2020)
2. Increasingly companies are becoming more environmentally conscious and want to project the image through their products as well as packaging

1. The users are also becoming environmentally conscious and focus on packaging as much as products. At the point-of-sale, product package can play a pivotal role in the consumer's purchase decision (attracts attention, communicates product information, and builds brand). Even after purchase, packaging can continue to influence consumption experience.' (Czinkota, M. R., & Ronkainen, I. A. 2009).

2. Cost is perceived to be the major barrier to applying sustainable packaging design in.

Figure 4. Requirements and issues that industry and customers

This research has focused on the important attributes to select a sustainable packaging material. Widely available in local region, encouraging the idea of *"vocal for local",* which could act as an intervention to shift consumers' behavior in an environmentally and socially beneficial way. The proposed work will also examine user's perception and evaluation of the sustainable package materials. In order to analyze the data from different points of view & stakeholders. The sustainable packaging design will also be solving other issues as mentioned in figure 4.

Motivation: The Importance of Packaging in the Context of the Trinity of Demand Centres

This shift is particularly relevant when considering the "trinity of demand centers," which highlights the convergence of consumer preferences, brand identity, and environmental consciousness. Customers consider the properties and functionality of a product, but also how it is presented to them, and as a consequence, packaging becomes one of the key components in their buying preference as well as the overall experience with a brand. Packaging is viewed as one of the basic needs of the modern-day business and not only performs the functions of protecting and preserving the product, aiding in distribution and promotion but has also become integral for sustainability. Even with the recent advances in sustainable packaging materials, there is still a need for further development (Ziynet B et at., 2020).

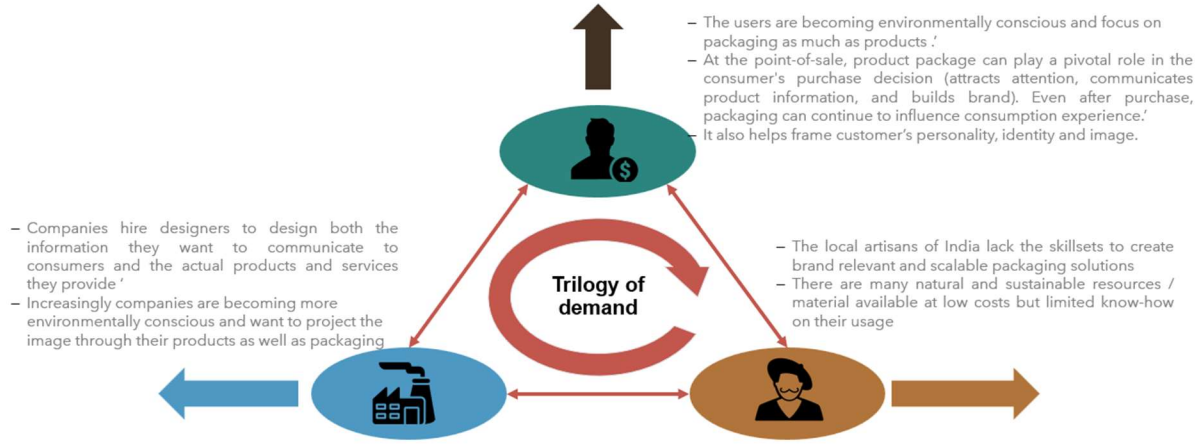

Figure 5. Understanding the demands of trinity

In today's competitive market, the significance of product packaging extends far beyond merely protecting the contents. These days, packing of product can no longer be meant only for protection of the products packed in. Rather, it is now an issue which has something to do with marketing,

with how the consumers, brands and the environment are concerned. The 'trinity of demand centres' refers to consumers, brands and the environment as in in Fig 5.

Understanding the Role of Packaging in Consumer Decision-Making

The study *"Impact of Eco-Friendly Products on Consumer Behaviour"* by Ms. Preeti Sehgal and Ms. Neha Singh from Chandigarh Business School provided significant insights that greatly contributed to our research (Singhal and Malik, 2018). This study aimed at understanding the relation that existed between the people's prosocial propensity, and their purchase of green products. The results that came in however showed that more consumers have been exposed to green products and thus bought them because focus is placed on more value than traditional products. At the point-of-sale (POS), packaging is the first point of contact between the consumer and the product. It may play a crucial part in the purchase decision by performing a number of primary functions.

• **Attracts attention**: Attractive and innovative packaging draws consumers to the product, especially in crowded retail environments. The visual appeal of packaging can often be the deciding factor when there are many competing products.

• **Information & communication**: Packaging conveys important information about the product, such as ingredients, instructions for use and product benefits. This helps consumers make informed decisions about their preferences and needs

.• **Creation of a brand identity**: Various colour combinations, logos, typography and images, packaging reinforces the brand identity. It allows consumers to connect emotionally with the brand, fostering loyalty and trust over time

.• **Packaging as a reflection of the customer's personality, identity and image:** consumers increasingly consider their purchasing decisions as a reflection of their identity. In this sense, packaging plays a crucial role in defining the customer's personality.

Customers look for products that match their values and self-image, and packaging often conveys a story that resonates with their aspirations. Even after purchase, the role of packaging does not stop. Packaging continues to influence the consumer experience, for example through user-friendliness, durability and aesthetic appeal during unboxing. The entire experience of un-boxing and interacting with the product packaging can deepen the consumer's relationship with the brand.

Methodology of Framework:

Innovative uses of locally accessible resources in packaging design can include recycled waste goods, biodegradable and even creative applications of natural fibres and agricultural waste. Because they may be grown, collected, or supplied in local region. These materials frequently have a smaller environmental impact due to reduced transportation-related energy use and emissions. Using local materials can also result in the development of distinctive packaging solutions that are suited to customer tastes. It will also give industry a edge who are dedicated to sustainability a major competitive advantage. By emphasizing the use of locally accessible materials and craftsmen, this approach offers a dual impact—environmental 1. Reducing waste

and promoting sustainability and 2. Social: Empowering local artisans and preserving traditional artisanship.

The framework designed is intended to develop synergies among SPD industry, locally available material, and consumers, fostering a innovative collaborative ecosystem. This framework will serve various communities working with unsung materials while displaying their craft skills. By doing so, it will contribute to the global transition toward more sustainable practices, ultimately improving their livelihoods. Moreover, for consumers, the framework aims to raise awareness about the environmental and social benefits of sustainable packaging, revitalizing demand for eco-friendly products. Mention below are the various stages of framework:

Framework Stages

Stage 1: Collaboration and Ideation

1. **Objective**: Align industry, craftsmen, and customer goals.
2. **Actions**:
    1. Industry organizes design workshops with craftsmen.
    2. Customers participate in surveys or focus groups to share packaging preferences.
    3. Identify locally available materials (e.g., bamboo, jute, palm leaves).

Stage 2: Material Sourcing and Skill Utilization

1. **Objective**: Efficiently use local resources for sustainable production.
2. **Actions**:
    1. Map regions for sustainable raw materials.
    2. Train craftsmen to adapt traditional techniques for packaging

Stage 3: P

1. **Objective**: Ensure quality & customer's demand.
2. **Actions**:
    1. Industry provides basic manufacturing tools & machinery for development
    2. Employ craftsmen to oversee and execute the artisanal aspects

Stage 4: M

3. **Objective**: Build awareness and value around sustainable packaging.
4. **Actions**:
    1. Highlight the material & sustainability aspects to promote authenticity.
    2. Engage customers with campaigns emphasizing their role in supporting eco-friendly initiatives.
    3. Conduct quality control checks and compliance assessments.

The use o ble packaging wer carbon emiss ocally available materials as not only boost their local economies but also produce packaging solutions that are more sustainable and affordable. Packaging Industry have interesting opportunity to meet consumer demand for sustainable alternatives and further their environmental sustainability goals by utilizing region-specific materials to create packaging.

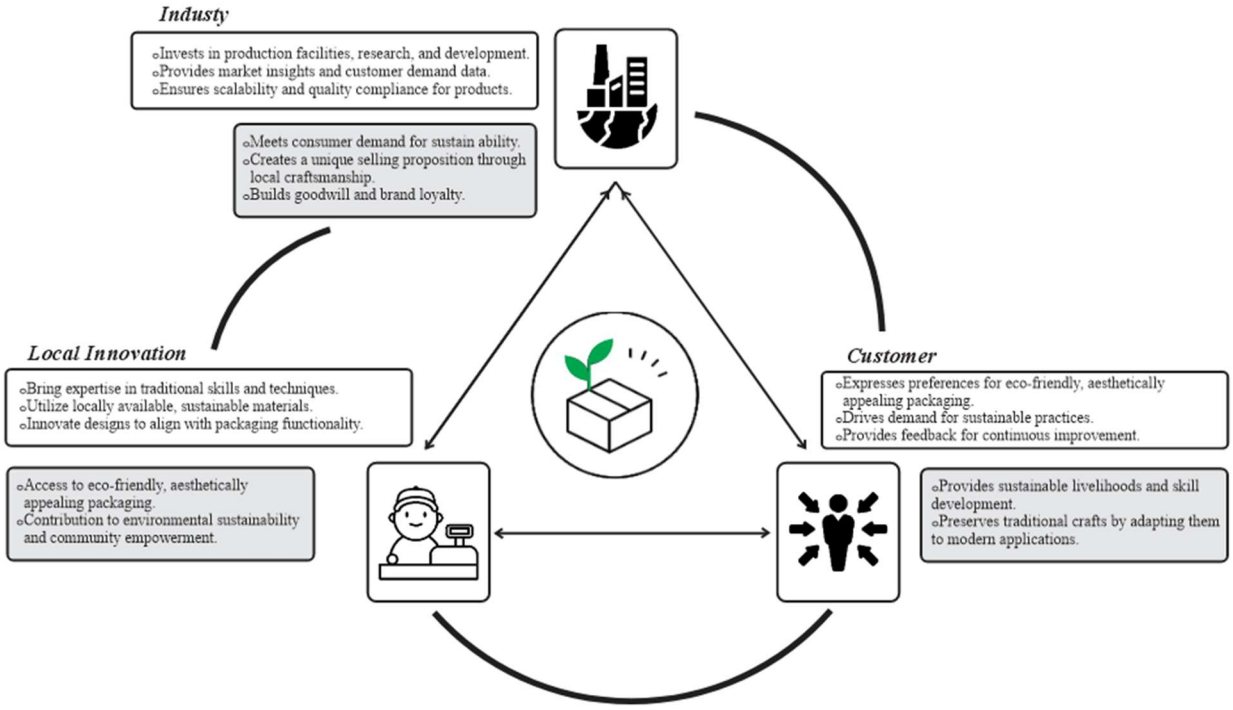

Figure 6. Flow of the methodology of framework

This framework emphasises on how industry, consumers and craftsmen working with locally resourced material, may work together to develop sustainable packaging in their area. The collaboration requires each stakeholder's distinct skills to guarantee sustainable and useful packaging that satisfies customer preferences. Each stakeholder will bring their own expertise to develop and encouraging SPD. Industry is essential because it provides infrastructure, investments, machines-tools and market information. Through efforts including material sourcing, craftsman training programs, and scalable production methods, it bridges the gap between traditional craftsmanship and contemporary production demands.
By knowledge of native designs and materials that can easily be sourced locally, craftsmen and craftswomen create sustainable, well-designed packaging. These packaging can meet up the industrial levels using all craftsmen skills so it remains useful and appropriate from the cultural perspective as well. Customers' interest for a greener approach leads to purchasing sustainable packaging. According to their preferences, this decision impacts the design; it forms feedback, which propels them in continued development.

Based on a trinity model discussed, the framework highlights "Material Sourcing" and "Training" between craftsmanship and industry, "Eco-Friendly Packaging" and "Aesthetic Design" between artisans and consumers, and "Feedback" and "Market Insights" between consumers and industry. The framework promotes environmental collaboration and community empowerment while guaranteeing sustainable practices, the preservation of traditional crafts, and the development of packaging that reflects contemporary consumer values.

DISCUSSION

In this research, accessibility and affordability have been found as the top most important attributes that customers look for in packaging. Customers increasingly value easy access to products or packaging solutions. Whether it is associated with their availability, convenience of packaging, or the access of environmentally friendly alternatives. This trend presents an unparalleled opportunity to study the design of sustainable packaging solutions from materials available locally, and, in the case of India, the opportunities appear much more vast. It will be very easy for them to come up with innovative packaging solutions that reflect a country's cultural tradition with regard to sustainability resources in India.

This study identified ways in which sustainable packaging techniques can be integrated with the spirit of Indian local innovations. The aim of adopting a sustainable viewpoint is to identify innovative strategies that balance cultural importance and ecological responsibility satisfying customer's need. As environmental consciousness becomes a central concern for both consumers and companies, packaging has emerged as a critical element in a brand's overall sustainability strategy. Companies now view packaging not as a vehicle that carries their product but instead as an effective tool to illustrate their environmental ethos. Using sustainably sourced materials and innovative packaging designs enables brands to project a very eco-friendly image, responding to the increasing number of conscientious consumers.

This collaboration between industry, craftsmen, and consumers' goals, this is the first stage that supports innovation. The industry takes up an initiative whereby they set up design workshops whereby the craftspeople can teach them. These workshops will ensure that the packaging solution is satisfactory to the customers. Furthermore, they bridge the gap that exists between craft and industrial requirements. At this point in time, finding locally available, sustainable sources of material such as bamboo, jute, or palm leaf is crucial. These materials allow for packaging that is culturally and environmentally relevant to the country. Then come the craftsmen, which are taught how to innovate their techniques to fit and meet industry standards while still maintaining and upholding their cultural identity. Art can represent a perfect harmony of tradition and modernity, showing the cultural aspect while remaining durable and useful. Environmental, economic, and social concerns all fall under the pressure to create sustainable practices, which means coming up with innovative ways to enhance products without losing their originality (Kesaboyina et al., 2024). The industries promote a sense of authenticity and belonging by emphasizing the story of local craftsmen and materials used in product branding.

Apart from this, in the light of demand centre trinity, consisting of consumer preference, brand identity, and environmental consciousness, it is a crucial touch-point between the brand and consumer in this line. In India, such opportunity through making SPD a new favourite by empowering local craftsmen and bringing self-sufficiency to sustainable packaging solutions would be rewarding. By utilizing natural resources and providing the appropriate training, companies can support a more sustainable future while strengthening their brand image and customer engagement.

CONCLUSION

In conclusion, the use of locally available materials for sustainable packaging design is a promising solution that effectively meets the growing consumer demand for eco-friendly alternatives while keeping the packaging accessible and affordable. Rising concerns over environmental degradation and plastic pollution have led consumers to seek products packaged using sustainable materials. India can tap into indigenous resources such as bamboo, sisal fibre, terracotta, and a wide variety of woods to develop sustainable packaging that is both environmental and economically friendly. Most of the locally sourced materials are biodegradable and compostable, though they can be found abundantly in the country, thereby making them accessible to manufacturers and consumers at large. This is not only a need for sustainability but also an affordable alternative to what exists as traditional packaging material, which will mean less cost burden on businesses.

Furthermore, the material is natural and will also help in supporting local crafts as well as maintaining the culture. India has a history of artisan communities who have a skilled workforce in handling sustainable materials that can be found in the environment. Using these materials for packaging could revive these age-old crafts that can provide artisans with sustainable livelihoods. This can have a transformative impact on rural economies, where many artisans live and work, by providing them with steady work and access to larger markets. The integration of traditional crafts into modern industries helps preserve cultural heritage while creating new economic opportunities for local communities, empowering artisans and fostering social development.

This study aims at identification of methods for combining environment-friendly packaging techniques with the spirit of Indian local innovations, through an examination of literature, design analysis, and case studies. Through an examination of the dynamic interaction between local available material and sustainable packaging in sustainable package design, this study looks into the adoption of the sustainable viewpoint to recognize some creative strategies that balance the importance of culture and responsibility for ecology.

The sustainability of these materials also contributes to India's broader environmental goals. Using local materials reduces the carbon footprint associated with transportation and imports of raw materials, following the global trend toward sustainability. Materials such as bamboo and sisal are renewable and do not contribute to environmental degradation, making them ideal alternatives to plastic packaging. In this way, India can reduce its environmental footprint while also becoming a model example of achieving sustainability in harmony with economic growth at a global level.

Global markets and modern production systems in manufacturing lead to standardization of material culture, the result of centralizing production with segmented processes. This mode of production favours efficiency over mass production and tends towards uniform products without regional peculiarities. In contrast, craft practices are deeply regional, involving holistic methods with context-specific knowledge, techniques that have cultural significance, and community-

oriented production processes. These artisanal practices conserve and express unique cultural identities while enhancing local economic resilience. This kind of localized, flexible, and responsive production is discussed here with regard to its relation to sustainability and its potential as an innovative and sustainable alternative for the future to conventional manufacturing. Although these materials have a strong potential connection with sustainability, research on the relationship between the two proposes exploration of how craft can better contribute to modern industries to develop SPD.

LIMITATION

While the proposal for using locally available materials for sustainable packaging in India holds great promise, there are several limitations that need to be considered. One of the key limitations is the scalability of utilizing locally accessible materials such as bamboo, sisal fibre, and terracotta on a large scale. While these materials are abundant in certain regions of India, they may not be uniformly available across the entire country. This uneven distribution can cause issues in sourcing consistent quantities and quality, which can influence the reliability and cost-effectiveness of production. Large-scale manufacturing may also require special infrastructure and processing techniques to transform these materials into packaging that will meet industry standards, thereby raising operational costs and limiting the feasibility of mass production. However, the use of locally sourced materials for sustainable packaging design comes with various advantages and lacks some benefits regarding scalability, material durability, availability of skilled labour, consumer acceptance, and overcoming barriers for compliance by rules. These constraints need to be considered so that these packaging solutions become widely used in India successfully.

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