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An Objective Study on the Revolutionary Innovations Brought in By the Indian Food Packaging Market

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ABSTRACT

The Indian food packaging market has been undergoing constant change in the recent past with the change in the tastes and preferences of the consumers. The increasing cost of raw materials, supply chain insufficiencies and government restrictions regarding the packaging standards has added on to the turmoil of the food packers. The main focus of the marketers has been to provide quality food products and increased satisfaction of their products to its consumers. This article focuses on the paradigm shift in the nature of the products used for the packaging of food products. As agriculture is considered as the backbone of the Indian economy, India still boasts as the largest producer of milk, spices, pulses and vegetables. A major exporter of pulses like rice, wheat and other spices. The essence of the quality of the products are enhanced through the effective packaging ensuring its sustainability. This process has poised as a massive challenge in the Indian Food Industry, which has given way to novel innovations in its packaging ensuring the meeting of the demands of the domestic and international consumers. These challenges, such as regulatory controls and standardisation norms of the packaging by Government and technological limitations in the Indian food packaging sector aiming for safer, efficient and environmentally sustainable packaging solutions has been ably met by the Indian Packers by the introduction of Smart Packaging to the consumers. This article evaluates the functional properties, environmental impacts, economic implications, and the role of intelligent technologies in packaging smart. It also identifies key challenges and opportunities for large-scale adoption in the food industry.

Key Words: Environmentally sustainable products, Innovations, Smart packaging, Indian food products.

INTRODUCTION

Food Packaging is considered as a major influencing factor in the protection of the foods by retaining the essence of the quality until consumption. An effective food packaging sector is essential for diversifying and commercialising agriculture by extending the shelf life of the foods produce. By expanding the geographical limits for the agro-based products, the packers have not only increased the farmers' incomes but also created employment opportunities for a plenty of youngsters, thereby boosting the Indian Economy. They play a vital role in balancing the demand and supply chains. This is ensured by developing new packaging solutions that focuses on the market demands while coping with the growing environmental challenges.

Also, packaging is an essential means of communication with consumers, providing information about the product, such as ingredients, usage instructions, and expiration dates, and serving as a platform for marketing strategies. The increasing money spent on advertisement make the consumer to be aware of the latest brands in the market. The easy availability is to be ensured by proper distribution in almost all retail outlets, departmental stores and super markets. People can purchase their preferred brands from such shops. Thus, the Indian food marketers have ensured the proper marketing mix of the product, price, promotion and place to be offered with several benefits to the Indian consumers. The choice of the proper and suitable packaging enables to achieve the above objective of the modern marketer. Smart Packaging ensures to make a marketer smarter and trendy in the market.

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Traditional Packaging

Usually, cardboard, paper, glass and plastic have been predominantly used as food packaging materials. While cardboard and paper are recyclable, they face limitations regarding moisture and gas barriers, which are important for preserving many types of food. Whereas, plastic offers versatile properties such as lightness, strength, and flexibility, making it the standard material of choice for various packaging applications. However, the high stability of these materials also makes them resistant to natural degradation, leading to their accumulation and causing environmental problems.

Legal Environment

To strengthen the food processing ecosystem, the Ministry of Food Processing Industries has implemented key initiatives:

- **Mega Food Parks**: 41 Mega Food Parks with a combined processing capacity exceeding 4 million metric tonnes (MMT) have been approved, of which 24 are fully operational.
- **Agro-Processing Clusters**: 76 Agro-Processing Clusters, with a total capacity of over 2 MMT, have been sanctioned to enhance value addition at the farm level.
- **Cold Chain Infrastructure**: 400 Cold Chain Projects have been approved, adding over 35 MMT of storage and preservation capacity to reduce post-harvest losses.
- **Food Safety & Quality Assurance**: 209 food safety and quality assurance facilities have been established to ensure compliance with domestic and international food standards

In this dynamic scenario, it is necessary to analyze recent advancements and emerging trends in food packaging. Understanding these trends can guide future research and technological smart and assist policymakers and industries in making informed decisions which are fundamental for developing and implementing new packaging solutions that meet the demands of a global market in the food industry.

Innovative Packaging

Smart packaging and intelligent packaging are the innovations which has brought in a massive change in the food packaging sector. Smart packaging not only intends to attract the consumers but also has the ability to sense or measure an attribute of the product, the inner atmosphere of the package, or the shipping environment in order to maintain the quality of the product until consumption. Active packaging generally means having active functions beyond the inert passive containment and protection of the product. It is capable of carrying out intelligent functions (such as detecting, sensing, recording, tracing, communicating, and applying scientific logic) to facilitate decision making to extend shelf life, enhance safety, improve quality, provide information, and warn about possible problem This information can be communicated to users or can trigger active packaging functions. Programmable matter, smart materials, etc. can be employed in packages

Prominent Examples of Smart Packaging

Storing

Many products are packed in Zip-lock reusable covers which saves storage space. Some packages have closures or other dispensing systems that enable to change the contents from a liquid to an aerosol. These are used for products ranging from precision inhalers for medications to spray bottles of household cleaners.

Special packaging has been developed for shipping organs which keeps them alive during extended shipments. Edible films have been developed to allow consumers to eat the package along with the product. Packaging materials including silver nanoparticles have been shown to extend the shelf life of some foods

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Microwave proof packaging

Metallised films are used as a susceptor for cooking in microwave ovens. These increase the heating capacity and help make foods crisp and tasty. Plastic microwavable containers are also used for microwave cooking as well as serving.

Security

A variety of security printing methods, security holograms, and specialized labels are available to help confirm that the product in the package is not counterfeit.

- Bar codes have long been used with packaging to identify an item, facilitate routing, communicate locations, etc. there are many varieties of linear bar codes. Some are stacked to provide more information. Two dimensional Matrix codes can have a higher information density.

- QR Codes are used on packaging to provide additional information on the product with a scan through smartphone scanner. With digital printers, unit-level QR Codes can become the equivalent of a unique identifier or URL for each packaging, and enable other interactions with consumers such as providing specific information on product traceability or deploying loyalty These scan data generated can be used for active brand protection. A digital watermark or secure graphic can be inserted into the QR Code to make it copy-sensitive and let consumers authenticate products with a higher security level.

- Printed codes can be combined with security printing for expanded uses. For example, thermochroic ink can be used to activate, change, or deactivate a code based on the item's temperature history

The modern packaging of the food products is the utilization of the bio-based materials. bio-based packaging creates lightweight, durable, and flexible solutions that minimize waste, protect products during transit, and are easier to recycle or compost. These materials are valuable for food packaging in the food industry, as they offer significant potentiality to reduce the environmental impact associated with plastic waste. Their biodegradability and sustainability may help minimize pollution and carbon effluences, making them an attractive choice for brands committed to sustainability. These materials are also applied in food product packaging, where moisture protection and consumability of the product demand for eco-friendlier materials.

The smart packaging reflects the adoption of bio-based alternatives in food products enabling durability and efficiency in protecting them. These composites are formed by combining bio-based polymers with natural fibres, such as coconut, bamboo, and sisal fibres. The evolution of active packaging has led to the development of innovative solutions to extend the shelf life of perishable food products while maintaining their microbiological and sensory quality.

Objectives of Innovative Packaging

1. **Ensuring food safety and sustainability**

Novel packaging systems are aimed not only at ensuring food safety and traceability, but have also gained great importance for building more sustainable food chains, reducing food losses and waste, as well as the

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overall packaging environmental impact. In previous works, a recompilation of the latest research and development on bio-based packaging materials and composites form agri-food waste and by-product was conducted, with a special focus on materials properties and processing technologies for greener production

2. **Environmental impact**

To minimize the environmental impact of the packaging system, it is important to consider its capacity to contain, protect, and preserve the product as to extend its shelf-life and guarantee food safety, but it should also be adequately sized, easy-to-open and easy-to-empty, and with clearly accessible information to prevent food from being wasted. In addition, the packaging materials should meet the desired mechanical and barrier properties remaining as light-weighted as possible, food-safe, ideally reusable or recyclable, and disposed of with minimum to zero pollution.

3. **Economic Benefits**

The standards set in the size, design and material used for the packing ensures the economic production cost and recycling of the bio based packs saves the cost of packing.

4. **Ecological sustenance**

Facilitating recyclability has not only environmental and economic benefits, but also a social contribution, considering that dry waste sorting and selling constitute the income source for low-income workers in some countries.

5. **Logistics and Supply Management**

In addition, packaging design can considerably affect the logistics in transportation, handling, and storage throughout the supply chain Such decisions have direct implications in distribution times and product preservation. However, the best packaging systems depends on the frequency of reuse, transportation routes and distances, and end-of-life treatment

With advancement in technology and general awareness, the packaging sector in India is well poised as most of the raw materials for packaging are abundantly available in the country.

Moreover, the per capita spending has increased tremendously, leading to changing rural markets and a growing middle class who demand the best of products. Various upgraded technologies are being used in industry such as aseptic packaging, retort packaging and biodegradable packaging to enhance the life of food product. Moreover, the plastic packaging market is expanding rapidly registering a growth of 20-25 per cent per annum and is valued at 6.8 million tons while the paper packaging industry stands at 7.6 million tons. The packaging industry is all set to grow rapidly led by the increasing use of innovative packaging equipment and the rising flexible packaging market.

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In terms of packaging, the food packaging industry is one growth area that has seen the maximum number of innovations in terms of packaging and branding. Consumers want their food products to be hygienic, safe and at the same time to look attractive. When it comes to food packaging, MNCs have a very good ecosystem. They have a dedicated R&D house, which conducts various research-based experiments using the latest technologies, and are always innovating to ensure that the consumer is benefited. This development has led to healthy competition between our local manufacturers to deliver innovative products.

Packaging Process

- Unlike other products, hygienic aspect is more important for food products. The unpacked food is viable for spoilage and decay soon. Hence adequate care is to be taken to ensure the hygienic aspect. This is a predominant factor in the preference and purchase of packed food products by the consumers. Therefore, it is essential that a suitable material is used for packaging the food products. For this purpose, better ingredients should be checked so that the required quality will be maintained.

- Food labelling Standards give front-of-package health labelling which require more prominent labelling on food packaging. Require additional information on food labelling, such as recommended daily limit on added sugar consumption or caffeine consumption.

- It is also important that extra care is required before the food items are packed. The packaging should be good in the sense that the food packed is conducive for preservation and safety so that it is kept for long time without any problem.

- For any product, advertisement today is an essential activity to communicate and attract more consumers. Hence, it is vital for the manufacturers and retailers of packed food to go for wide advertisements in the right media to enlarge the market for their products.

- It is also essential that the products need lot of change and thus innovation is becoming necessary. Packaging is required to be more user friendly in order to considerably reduce wastages.

CONCLUSION

It is found from the study that consumers give preference more to quality of the packaging while buying packed food. Thereby, it is recommended to the manufactures of packed food introduce more and more new varieties of packaging which enhances the usability of the food products. Further for any product, it is necessary to know why customers buy and why they do not buy. This type of information will be more useful to the manufacturer and that they can get such information from effective marketing research. Hence, it is always important to find out various factors that influence the purchasing attitude of the consumers so that they may go for producing required varieties with improvement in the quality, taste, packaging etc., Further, it becomes obligatory on the part of manufacturers to explain to consumers as to why they should use the products and as to what benefit they will get, in an appropriate labelling. Innovative Packing will help manufactures to keep the existing customers more satisfied and to attract the new customers.

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