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## FOOD PACKAGING – NECESSARY FUNCTIONS TO ENSURE

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*Packaging plays a vital role in product production and distribution, ensuring protection, presentation, information, and promotion. Its design is influenced by the product's purpose and context. Functionality is determined by factors such as product lifespan, quality, and preservation needs. This study focuses on identifying and defining packaging, particularly in the food industry. It examines materials contributing to packaging sustainability. Promoting responsible practices in packaging enhances the sustainability of the food supply chain. This highlights the importance of considering various factors to ensure packaging meets consumer needs while minimizing environmental impact.*

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### INTRODUCTION

Packaging is an essential component in the production and distribution chain of products and plays a vital role in protecting, presenting, and promoting products. They represent the set of materials used to package, carry, and present a product [2], performing multiple functions, from protection against damage and maintenance of freshness to facilitating the handling and transmission of information to consumers. The diversity of materials from which packaging can be made, such as plastic, paper, metal, or wood [1], offers a wide range of options according to the specific needs of the products and the handling and transport requirements. Below is the classification of packaging by material, form, opening mode, sustainability, and durability.

Sustainability is not just about environmentally friendly materials. As many experts in the field argue, the sustainability of packaging is much more and that it must be analyzed and ensured in relation to products to be protected, taking into account all possible aspects specific to the use of the packaged product.

### PURPOSE

The purpose of this paper is to analyze the product life cycle and estimating the impact of the product on the environment. One of the sustainable strategies frequently approached is based on the applicability of the principles: Recycle, Reuse, Redu.



## RESULTS AND DISCUSSION

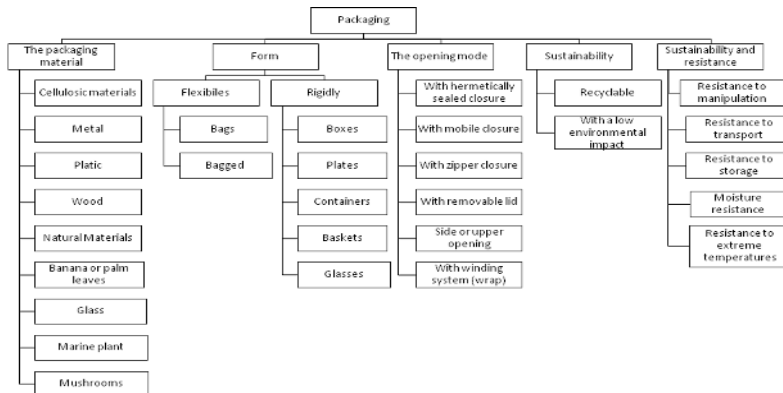


Fig. 1. Packaging classification

Functions are essential in the conceptual determination of packaging, with implications for the production, distribution, and consumption of products. The multispectral analysis of the packaging has led to the following functions:

1. *Protection of products.* Packaging protects products from damage, contamination, and mechanical stress during handling, transportation, and storage.

2. *Presentation of the product.* The packaging is designed to present the products in an attractive and visible way, attracting the attention of consumers and promoting sales.

Aesthetics. Packaging is often what catches the attention of users in training in the interest of seeing what is found beyond, convincing them to try it. Aesthetics suggests aspects of product stylistics and makes reference to product qualities. A new product is even more so because, before it is known by people, it must first be noted. The way it is packed plays a key role in this whole process.

3. *Culturally.* Culture exercises, through information communication, a systemic function that manifests itself on an individual, social, group, national, and even international scale [5].

4. *Educational.* The packaging is the result of the complex conscious, systematic, and organized activities carried out with the purpose of forming and developing the human personality in accordance with the level of development of society.

5. *Entertainment.* Packaging can create the right environment for relaxation and psychosensory comfort that induces the emotional well-being of the user. Funcțiile ambalajelor sunt esențiale în procesul de producție, distribuție și consum al produselor. Principalele funcții ale ambalajelor includ:

6. *Interactive.* Today, the packaging is no longer static; users expect it to involve them by actively participating in new dynamic, emotional, participatory discoveries.



7. *Of content.* The packaging ensures the content of the product in a specific space, preventing leakage or loss during handling and transportation.
8. *Informing.* Packaging provides essential product information such as expiration date, instructions for use, ingredients, and nutritional information, helping consumers make informed decisions.
9. *Facilitating manipulation.* The packaging is designed to facilitate the handling, opening, and use of the product, providing convenience and accessibility to consumers.
10. *Dosage of the product.* The dosed supply of food products is important both for the user, especially users with certain health problems that make it difficult to voluntarily dose the product from the package, and for some food products that have a longer life if their sealing is ensured.
11. *Promotion.* Packaging communicates brand identity and value, conveys marketing messages, and promotes consumer recognition and loyalty.
12. *Preservation of product qualities.* Packaging can help keep food fresh by protecting against air, light, and moisture that could accelerate spoilage.
13. *Retention of Shelf Life.* Some packaging is designed to extend the shelf life of products by using preservation technologies or modified atmospheres.
14. *Resistance to mechanical stress.* The ability of the packaging to withstand various stretching, bending, twisting, axial shearing, friction, etc.
15. *Transportation Insurance.* The packaging is designed to withstand the conditions of handling and transport, ensuring the integrity of the product during its journey to the consumer.
16. *Rationalization.* It refers to the efficient use of product packaging spaces, storage spaces, and commercial spaces where products are sold.
17. *Preservation of products.* Packaging that ensures the preservation of food taste, aroma, freshness, and texture, as well as from a chemical and microbiological point of view, while remaining suitable for human consumption.
18. *Barriers to the transfer of various substances.* The ability of the packaging not to allow various gases, fats, liquids, etc. to pass through them.
19. *Assurance of sealing.* The constructive solutions and the materials used ensure the sealing of the product through the packaging of various particles of substance, dust, dirt, etc.
20. *Resistance to thermal shocks.* The packaging is resistant to sudden and rapid temperature changes in the field of wide temperature gradients from different sources.
21. *Oxidation resistance.* The refractory capacity of packaging at high temperatures.
22. *Resistance to high and low temperatures.* The ability to keep its qualities intact in the conditions of the packaging in environments with high or very low temperatures.
23. *Microbial resistance.* Resistance to the action of different microbes.
24. *Ergonomics.* perceived and designed packaging whose shape and functionality are correlated with human anthropometric, physiological, psychological, and work characteristics.
25. *Economy.* Packaging developed in correlation with its predestination, motivating its efficiency and investment merit.



26. *Securing authenticity.* The ability of the packaging to provide credibility that the packaged product is authentic and made from quality raw materials according to authentic technologies.
27. *Harmlessness.* The ability of packaging not to affect the lives and health of users.
28. *Maintainability.* The potential of packaging to ensure its characteristics through all maintenance and repair activities.
29. *Warranty.* Packaging is designed in such a way as to assure users that they will maintain their properties as well as those of the products packed in them.
30. *Storage.* Consideration of the storage conditions of the packaged products refers to the environmental conditions, the possibilities of packaging in collective packaging, support surface, overlap, etc.
31. *Reduction of product waste.* Packaging is designed to minimize product losses during the production, handling, and distribution processes, contributing to supply chain efficiency.
32. *Commercial for sale.* The ability of the packaging to sell is presented with trends in graphic design, materials used, chromaticity, narrative, etc.
33. *Image identity (brand).* The function of expressing the manufacturer's image makes him stand out in the market compared to other manufacturers of the same type of products. The suggestive, distinctive element concerning the identity function is the trademark.
34. *Differentiation.* Packaging that stands out from the multitude of existing packaging on the shelves.
35. *Occasional.* Packaging developed for products based on the premises of special occasions.
36. *Creativity.* Packaging with creative elements that ensure its distinction in the market.
37. *Innovation.* Packaging with novelty elements that increase their multi-functionality but also improve the conditions for keeping products and their life span.
38. *Transformability.* The ability of packaging to transform from one product to another type of product. Example: packaging that can be transformed into a bag, table, diary, etc.
39. *Recycling.* The possibility of the packaging being recovered and subjected to processing with repeated inclusion in the daily life circuit according to the principles. The diverse and essential functions of packaging should contribute to supply chain efficiency and consumer satisfaction, playing a vital role in the success and sustainability of the food industry.
40. *Biodegradability.* Making packaging from organic materials that can decompose naturally under the influence of bacteria or other living organisms in a non-harmful way.
41. *Visual narrative.* Packaging that offers the user a visual story that involves them emotionally and memorably.
42. *Social status.* The ability of the packaging to suggest the quality class to which it is assigned.

The diverse and essential functions of packaging not only ensure the protection, presentation, and promotion of products but also contribute to the efficiency of the packaging value chain, from supply to consumer satisfaction, playing a vital role in the success and sustainability of the food industry.



Defining the functions of the packaging determines the raw materials used to obtain them. Their selection will be made according to the prioritization of the functions for each type of packaging dictated by the predestination of the products. For example, if the number one priority is protection against moisture and damage, materials such as plastic or metal, known for their resistance to water and mechanical stress, may be preferred. If the maximum sustainable approach is aimed for, biodegradable materials such as cellulose or wood could be selected in this regard.

The choice made in favor of certain types of materials will include an analysis of production costs, recyclability, legal aspects, and packaging aesthetics. Identifying the balance between functionality, sustainability, and economic efficiency in relation to the expectations and aspirations of users so that they are fulfilled as best as possible while minimizing the effects on the environment will ensure long-term sustainable solutions with significant impact.

In a world where environmental and sustainability concerns are growing, the choice of packaging materials is important.

In the following, a comparative analysis of packaging made from cellulosic, metal, plastic, and wood materials is presented, exploring their advantages, disadvantages, and impact on the environment (table 1). Each type of material is distinguished by its own unique characteristics, from the biodegradability and recyclability of cellulose to the durability and versatility of metals, plastic, and wood.

Table 1

**Comparison of materials used in fruit and vegetable packaging**

Material type 1	Advantages 2	Disadvantages 3
Cellulose	<ul style="list-style-type: none"><li>● Recycled and renewable materials.</li><li>● They are biodegradability and compostability.</li><li>● The potential to be used for food packaging, being safe and non-toxic.</li></ul>	<ul style="list-style-type: none"><li>● Resistance is limited to humidity and certain storage conditions.</li><li>● The production process may require significant water and energy resources.</li></ul>
Metal	<ul style="list-style-type: none"><li>● Sustainability and strength, ensuring high protection for products.</li><li>● Recyclable efficiently, without quality degradation.</li><li>● Potential for gas and light-tight packaging.</li></ul>	<ul style="list-style-type: none"><li>● The initial metal production process can be energy-intensive.</li><li>● The greater weight compared to other materials, affects transport costs.</li></ul>
Plastic	<ul style="list-style-type: none"><li>● Efficient in terms of production costs.</li><li>● According to training and versatility in design,</li><li>● Sustainability, and water resistance, providing effective protection.</li></ul>	<ul style="list-style-type: none"><li>● The dependence on non-renewable resources and difficulties in recycling.</li><li>● The slow degradation of plastic in the environment contributes to plastic pollution.</li></ul>
Wood	<ul style="list-style-type: none"><li>● Wood materials are biodegradable and can be recycled naturally.</li><li>● Aesthetic appeal and the potential to communicate sustainability.</li></ul>	<ul style="list-style-type: none"><li>● Variable hardness, influencing resistance to manipulation.</li><li>● Consumption of resources and impact on forests in cases of overuse.</li></ul>

Each type of material has unique characteristics and specific matches for the different needs of products and packaging processes. The effective choice of materials depends on considerations such as durability, environmental impact, costs and requirements for protection, and presentation of the product. Promoting



responsive and sustainable packaging practices can help reduce environmental impact and improve the sustainability of the manufacturing process.

### CONCLUSIONS

The growing expectations of the users determine the expansion of the functionality of the packaging. The diverse functions of food packaging, from protection and presentation to recycling and visual narrative, are important both for the field of reference to which it is attributed, such as the food field and for users as constituents of the correlational interdependence: user-environment-product. Packaging ensures product integrity, promotes sales, and contributes to consumer satisfaction. The choice of packaging materials must ensure multi-functionality, sustainability, and cost efficiency. In an environment where environmental concerns and user demands for transparency are increasingly emphasized, food packaging must satisfy multiple objectives while guaranteeing product safety and quality. An integrated approach to packaging functions is essential for the future success and sustainability of the food industry.

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### **ХАРЧОВА УПАКОВКА - НЕОБХІДНІ ФУНКЦІЇ ДЛЯ ЗАБЕЗПЕЧЕННЯ**

*Упаковка відіграє важливу роль у виробництві та розповсюдженні продукції, забезпечуючи захист, презентацію, інформацію та просування. Це дослідження фокусується на дослідженні упаковки в харчовій промисловості для забезпечення відповідності упаковки потребам споживачів при мінімізації впливу на навколишнє середовище.*

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**Ключові слова:** *упаковка харчових продуктів, види, функції, матеріали.*