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The Importance of Packaging in Certified Organic Food: A Matter of Conscience

Rosana Carvalho Esteves

Abstract

Organic food production offers many advantages and is more environmentally friendly than conventional food. However, despite the certification guaranteeing organic management, soil and water preservation, and social well-being, it generally does not assess the type of packaging the food is sold in. The legislation of some countries, such as Brazil, does not require the use of biodegradable packaging. Thus, it is common to find organic food sold in plastic or styrofoam packaging, making it ecologically incorrect throughout its life cycle. This study demonstrates the importance of consumer awareness and how it can act in a global paradigm shift, demanding greater environmental responsibilities from those who produce the food. Also, the role of consumers, fulfilling their part as non-polluting agents, is essential for ecological well-being. A qualitative meta-analysis showed that, although green consumers are gradually increasing, they are still in the minority. For the time being, they are currently insufficient to generate significant changes in the production chain. Because of this, it is important that public, technological, and environmental institutions talk about these issues more and start calling for specific laws about the right way to use packaging, especially for certified organic foods.

Keywords: organic food, circular economy, packaging, sustainable packaging, waste; eco-friendly packaging, eco-friendly consumers; green polymers

1. Introduction

Organic food is not simply food that has been grown without the use of pesticides. It is a complex manufacturing system with production units that must be legalized and certified by a third party. Furthermore, each unit must implement sustainable management practices, which must be documented in the field notebook and approved and verified regularly by the certifying entity. In terms of epistemology, it must also ensure the social development of the productive area and rural community where it is inserted [1, 2].

An organic production system is guided and supported by four main pillars: soil preservation, water preservation, social well-being development, and environmental biodiversity promotion. Organic food production is much better for the environment.
than monocultures or systems that use a large number of pesticides. The essence of this system is to provide much more than just kilograms of food per hectare (kg/ha). While it ensures long-term environmental conservation and mitigates the effects of climate change, the purpose of organic production as established in the laws of several countries is to offer products free of genetically modified organisms (GMO) and intentional contaminants. Likewise, it must guarantee the preservation of the biological diversity of natural ecosystems as well as the restoration or increase in the life multiplicity of modified ecosystems [3].

In accordance with a standard definition, the soil, air, and water must be conserved and kept healthy, fruitful, and free of toxins during the entire process [4]. In Brazil and the European Community, the certification requirements established in the legislation are quite congruent and similar. However, specific parameters for the types of packaging that are used for the storage of organic foods are not included in these legislations. In the United States, there is a recommendation for biodegradable packaging.

2. General objective

The present study aimed to demonstrate the importance of consumer awareness and how it can act in a global paradigm shift demanding greater environmental responsibilities from those who produce the food, using meta-analysis qualitative for research. In addition, provide subsidies to regulatory bodies for the certification of organic products so that organic production is incorporated into the concept of a circular economy by adopting specific packaging requirements. This strategy is unheard of in Brazil.

2.1 Specific objectives

• Evaluate the issue of certification and the use of environmentally friendly packaging;

• To carry out a qualitative goal regarding trends in consumer behavior toward the packaging of food products in retail;

• List the types of biodegradable materials most commonly used in food packaging;

• Relate the circular economy with the production of organic foods.

3. Material and methods

In this study, an approach using the qualitative meta-analysis searching in the knowledge databases for research on the behavior of consumers of organic food in front of food packaging [5]. On the research bases, studies on ecologically correct packaging were also evaluated. Search base: Web of Science, ACM Digital Library, Cambridge Core, Journal Citation Reports, Scopus, Science Direct, Periodicos Capes (Brazil).

Note: Research carried out by the author using keywords: packaging; organic product packaging, sustainable packaging+organic food; organic food waste; biological food waste, and biological packaging concerns the packaging of organic products [6].
4. Regulation in developed and developing countries

Rules and regulatory requirements for products in general are the effects of certain programs that are established by governments. The creation of these programs is due to a set of actions, within the public policies established by the governments, in compliance with certain sectors for the well-being of civil society. They are also the main instruments that the government uses to promote integration between sectors, standardize production criteria, establish means of supervision and control, etc.

Regulations arise from specific technical meetings of certain committees formed by specialized technicians. These committees meet for a certain time to discuss, evaluate, and establish what requirements and criteria should be followed by stakeholders. In the case of Brazil, the requirements and regulations for organic production were established within a National Organic Production Program, specifically in the Special Commission. This commission was initially formed to propose standards for the certification of organic products [7]. Technicians and specialists from the Ministry of Agriculture, Livestock and Supply participated together with the Federal Government. As a result, law 10.831/2003 was published [8], considered the legal framework of Brazilian organic agriculture. Law 10.831/2003 set up a framework for each theme in organic agriculture. This framework is made up of decree ordinances and specific normative instructions.

In the same manner, the United States forms its normative framework within public policy programs, also established by technicians and experts [9]. In the European Community, each member country had its own regulations. It was then necessary to align the regulations of each member country and standardize them so that the free trade in products between the member countries would comply with a single regulation. Currently, the European Council governs and is responsible for the management of the national organic production program [10].

The main regulatory requirements that are part of the regulations for organic products are described in Table 1. To illustrate the developing countries, Brazilian legislation was used as a reference because Brazil is a country with increasing growth in organic production. For developed countries, the United States is considered a country that has very strict legislation and is the largest market for organic products in the world, followed by the European Community, represented here as well.

Analyzing Table 1, basically, the described requirements are quite similar and congruent. Brazilian legislation is analogous to European legislation, while American legislation is more discerning and stricter.

5. Organic seal of certification

For food to be labeled as organic, it must undergo a certification procedure supervised by a notified agency. The primary function of the notifying body is to ensure that the entire production system conforms to the regulatory bodies’ normative requirements. For example, the institutions in charge of regulating this type of agriculture are the USDA in the United States, the European Community Council in Europe, and the Ministry of Agriculture, Livestock [11], and Supply in Brazil. Once certified, the “organic” product must receive the certification seal of each country on its label, assuring the buyer of its legitimacy and dependability.
<table>
<thead>
<tr>
<th>Countries/requirements</th>
<th>Brazil</th>
<th>United States</th>
<th>European community</th>
</tr>
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| Definition              | Organic:  
  • Natural resources;  
  • Respecting cultural and social aspects;  
  • Biological, cultural and mechanical methods. | Organic or biological  
  Biological, cultural and mechanical methods. | Organic or biological or ecological  
  • Natural resources;  
  • Respecting cultural and social aspects;  
  • Biological, cultural and mechanical methods. |
| Seeds and seedlings     | Only organic seeds | About 3 years | 2–3 years |
| Conversion time         | 12–18 months according to kind of culture | | |
| Composting              | Use permitted provided approved by the certifying body | It follows strict and specific criteria for use | Use permitted provided approved by the certifying body |
| Seal of conformity      | Mandatory | | |
| Fertilization           | Natural methods such as: crop rotation, and promotion of soil microbial activity. Use of external substances only with natural agricultural inputs permitted by the certifiers | | |
| Pest control            | Natural methods and natural agricultural inputs permitted by the certifiers | | |
| Soil analysis to verify pesticide contamination | Only in case of suspicion by the regulator or certifiers | Performed periodically | Only in case of suspicion by the regulator or certifiers |
| Water                   | Conservation and chemical and biological control of irrigation water | | |
| Packaging for marketing | There are no requirements for materials used | It follows specific regulations, is recommended the use of biodegradable materials | There are no requirements for materials used |
| GMO                     | Forbidden use | | |
| Parallel production—organic and conventional in the same production unit | Allowed as long as the productive unit ensures full control so that it does not have cross-contamination. The certifier assesses the risk and approves the use of parallel production | | |
| Organic management plan (field or manual notebook) | mandatory use where all production practices, controls, inputs etc. are recorded | | |
| Product preservation    | The production unit shall ensure the integrity and traceability of the product throughout the production process to the point of sale | | |
| Bilateral equivalence between countries | Brazil and Chile | The United States and European Community | The European Community and the United States |

Table 1. Regulatory requirements for the organic foods for developed (references: USA and EU) and developing countries - adapt for Source [1].
These regulatory entities, which are country-specific, create the regulations and requirements that must be satisfied in order for the producer to ensure the conformity of his product. The certification procedure is a great technique for verifying and validating legal conformity. As each country has its own laws and certification processes, each country also has its own conformity seals.

Regrettably, unlike ISO standards (International Standard Organization), there is no single certification standard for all countries. As a result, each country has its own set of rules. The lack of regulatory equality makes free trade difficult, and those farmers who want to export their products, they have to pay the cost of certification in each country.

In the case of the United States and the European Union, there is already a bilateral agreement that allows certain products to be accepted. Except for Chile, the organic seal (Figure 1) for Brazil is not recognized in any other country.

In Brazil, all certified organic products sold in commercial establishments must have on their labels a seal that identifies compliance with current regulations (Figure 1). This requirement is included in the normative instruction of the Ministry of Agriculture, Livestock and Supply, IN 50/2009 [13].

In the United States, certification is based (Figure 2) on rules set by the USDA-NOP National Organic Program—Part. 205-311 [14]. In Brazil, products must also have the seal of conformity shown in Figure 1.

The member countries of the European Union also require labeling containing the seal of compliance, as decided by the European Council [10] - item 25 issued on 06/28/2007, and No. 889/2008 issued on 09/05/2008 and No. 834/2007 [15].

The European Council set out all the requirements for certification that are applicable to all member states. The Seal of Conformity, shown in Figure 3, is used in the whole European Union on products that are packaged for retail sale and on items that are imported from countries that are not part of the European Community. They must be certified in accordance with Community regulations.

Organic products are those that comply with the regulations attested by the certification bodies. Products processed with organic raw materials are recognized as organic if at least 95% of their content is composed of organic ingredients [16–18].

![Brazilian organic seal](image1.png)

**Figure 1.**
Brazilian organic seal [12].

![USDA organic seal](image2.png)

**Figure 2.**
USDA organic seal [14].
In the United States, the USDA-NOP National Organic Program - Part 205 classifies products as (a) “100% organic”, (b) “Organic”—with at least 95% organic ingredients, and (c) “made with organic ingredients”—composed at least of 70% organic ingredients, and maximum 30% from conventional agriculture [14].

Similarly, in Brazilian regulation, a product having composition from 70% to 95% as organic ingredients shall be labeled as a “product with organic ingredients”. In this case, it is not a normative requirement to report which ingredients are organic, but some producers prefer to explicitly put them on the label [18].

Although each country’s regulations establish specific rules for the use of seals, they are still not representative. This is because many consumers have difficulties recognizing these seals and what they exactly mean. Aggravated, most consumers are unaware of the regulatory requirements that food must meet to bear the seal of compliance.

This lack of consumer awareness stems from a lack of information and visibility of certification seals. One way to leverage this market would be the more effective participation of public authorities. In countries where the government has drastically influenced the adoption of public policies in this sector, organic production has grown and consequently, consumption has grown, as is the case in Ethiopia [19] and Australia [20]. In Ethiopia, the government took strong steps and gave subsidies to encourage the change of conventionally farmed land into organically farmed land.

Visibility and awareness actions will make the seals play an important role in the consumer’s choice of product at the time of purchase.

Another critical challenge is making consumers know how to associate the seal with all the difficulties that producers have to overcome to meet numerous regulatory requirements. It is not only about financial difficulties, but also that farmer have many difficulties in maintaining the integrity and seasonality of the crop, defeating diseases and pests, and using natural methods of control and combat. When a product arrives at retail with an organic seal on the label, it is an achievement for every producer, and this achievement, without a doubt, deserves to be recognized by consumers [21].

6. The importance of the consumer in the production chain

Conquering more and more consumers through the seal of compliance is a major challenge. In this context, Janssen and Hamm [21] demonstrated that there is often a lack of consumer knowledge about organic certification schemes. Most consumers are unaware that there are several types of seals and product labels, as well as that organic manufacturing, is subject to a control system.

Furthermore, customer evaluations of organic labeling systems are often subjective and, as a result, not supported by knowledge of what the seal of compliance means, and how it is earned by the producer. Therefore, it is important to ensure that consumers are aware of the regulatory requirements and the benefits of organic products. 

![European Community biological (organic) seal.](image)

Figure 3.
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actually means Janssen and Hamm [21]. Essoussi and Zahaf [22] show that only people who buy organic products regularly in North America know how to tell the difference between labels and what they mean.

The fact that natural products sold directly to the consumer, such as in street fairs, do not need to be labeled nor have the seal of conformity affixed to them, ends up contributing to their lack of knowledge [11, 23].

Along with the study by Janssen and Harm [21], the knowledge profile on labeling in the European Community was subpar and insufficient, and it also lacked objective consumer information. In the United States, the mark of conformity affixed to the food label distinguishes the product as organic and is easier for customers to recognize [22].

It is important to emphasize that different nations have different levels of confidence and trust in organic products. According to Sønderskov and Daugbjerg [24], label confidence is higher in areas where the state and government are actively involved and have a significant impact. For instance, there is a significant amount of trust placed on labels in Scandinavian nations [24–26]. Label trust is not as well-articulated in the UK and Brazil, where it is also fairly shaky [26].

The number of different types of labels and seals that exist on foods often confuses the consumer. There are organic or biological products, natural, denomination of controlled origin, fair trade, vegan, cruelty-free, HACCP—Hazard Analysis and Critical Control Point, Certified Humane, etc. [27]. Some are obtained voluntarily and others on a compulsory basis. Many of these seals are difficult for the consumer to understand. Customers in Brazil, for instance, still don't know how to tell the difference between organic and agroecological products [11].

Researchers should further investigate consumer behavior in relation to labels, seals, and certifications’ precise meanings. Due to a lack of knowledge about seals, it is extremely difficult for consumers to determine what an organic product actually is. Further action is required in order to address the issue of the consumer's unfamiliarity with the relevance of the seal of conformity. Ensuring the consumer's perception of identifying a seal, and understanding what exactly it means, can be a useful tool for improving the offer [28].

Ensuring consumer perception by identifying a seal and understanding exactly what it means can be a useful tool to improve the offer of organic products. Thus, valuing this cognitive perception will make the consumer to choose more organic foods than conventional foods in the purchase decision process [2]. In fact, retail chains and commercial establishments can adopt strategies and actions to promote products of this nature. Even educational campaigns. In the United States, for example, the number of establishments dedicated exclusively to organic products is growing. In Brazil, this reality is still far from happening [29]. Unfortunately, the consumer’s cognitive perception still associates the consumption of organic products with those of a more favored social class.

Another important point and rarely studied by the scientific community, given the lack of articles in the databases.

If the perception of the eventual consumer regarding the seal of conformity is already difficult, imagine his/her perception regarding the use of non-sustainable packaging. However, when addressing this issue to active consumers accustomed to consuming products of this nature, the issue of packaging needs to be discussed.

The benefits generated by the growing practice of consuming organic products are evident. Concern about the materials used to package these foods is still incipient, both among producers and consumers and among regulatory bodies. If organic production is so concerned with soil and water preservation, it is a counterpoint not to worry about disposing of plastics and Styrofoam in household waste.
In nearly every country, the demand for organic food has increased exponentially over the past several years. This is a result of people’s growing concern about their health and that of their families. Specifically, the COVID-19 pandemic has spurred the search for healthier foods [30]. In Brazil, according to the Brazilian Association of Supermarkets—ABRAS the market grew by an average of 30% in 2020 and the global market, 11.5% [31, 32], reaching 106 billion euros in 2019 [33].

Therefore, for this reason, the discussion of packaging by regulatory bodies is essential and fundamental. Boosting the use of innovative technologies in the search for biodegradable materials is essential.

6.1 Global trends in consumer behavior

Consumers are increasingly looking for the information they need to make their choices at the time of purchase as much as their individual needs for change and their environmental concerns. However, there is still a significant lack of understanding about what can and cannot be recycled. Therefore, the study conducted by Mintel [34] published in 2022, shows that the majority of consumers hold companies accountable for providing information clearly and objectively, as well as recycling and the impact of packaging materials on the environment.

The following data were taken from the Mintel report [34]:

a. 54% of consumers in China, say labeling that measures environmental impact using understandable quantifiers would inspire them to buy;

b. 65% of Canadian consumers approve their behavior can make a positive difference to the planet;

c. 52% in Germany think there is not sufficient information on how to correctly dispose of compostable food packaging;

d. 36% of Indians strongly agree that there is not good information available and how they could act to reduce household waste;

e. 36% of USA consumers made their choice because the packaging was more environmentally friendly than a product from another brand;

f. 55% of German consumers aged 35–44 do not trust organizations to be honest about their environmental impact;

g. 33% in Brazil don’t trust companies to be honest about their environmental impact;

h. 47% of USA consumers believe companies are responsible for increasing the amount of packaging that is recycled;

i. 42% of UK consumers believe companies can do more than governments to change the world;

j. 76% of Japanese consumers agree that it’s necessary for brands/companies to make big efforts to protect the environment.
This means that brands need to take advantage of the situation and promote smart labels and packaging by providing a positive carbon footprint of the products. As caring about the environment turns into doing the right thing, consumers will want to be in charge by getting clear information about products that fully meet their environmental values and about how to get rid of packaging in a responsible way.

Education and incentives to consumers to combat household waste packaging through communication activities and on-pack marketing are critical and companies’ responsibility. For many consumers, understanding the impact of their consumer choices is the first step in making positive changes. Consumers will require a clear and objective system printed on food packaging that demonstrates environmental responsibility for the product and provides comparable metrics to enable them to make clear and direct comparisons between products.

“Consumers, experiencing the environmental impact of their actions, are increasingly looking to make environmentally responsible choices that address concerns such as plastic pollution and climate change. Brands should aim to provide clear on-pack information that highlights understandable measures of the environmental impact of both the product and packaging.” [34]

7. The correct and incorrect points: the increase in consumption and discarded packaging

A consumer society symbolizes the twenty-first century. In recent years, the amount of domestic waste generated has increased dramatically and in an uncontrolled way.

Although the use of packaging protects food and prolongs its shelf life, it is also responsible for a substantial amount of household waste generated [35, 36]. Waste recycling is a matter of home education, and the less developed a country is, the less prevalent this habit is.

In addition, people often do not evaluate the type of packaging in which the food is stored at the time of purchase. This lack of perception and evaluation should be considered during the purchase process. In addition, it should also be the subject of discussions in the technical regulatory commissions. It is necessary to discuss the issue of the use of non-sustainable packaging in organic production. If specific rules are laid down for the use of biodegradable packaging, it is likely that farmers will initially need help. Educational guidance and subsidy policy actions helped producers in this transition.

In Brazilian regulations, certification criteria assess the management and production system. Ensuring traceability is a mandatory condition of control, describing the types of diseases and pests that attack the crop, as well as the measures to protect and combat them, is evaluated and authorized by the certifying body. It is also part of these requirements, the formalized labor and social issues, and within the laws. There are no requirements regarding the use of sustainable packaging, which is a counterpoint to the philosophy of environmental preservation [23]. Although the origins of organic food can be attributed in part to environmental concerns, there is no significant concern about the amount of household waste produced, particularly when it comes to packaging [37].

Commonly used materials such as non-biodegradable plastic packaging, Styrofoam, aluminum, and steel increase household trash on the globe and produce polluting, occasionally hazardous materials. That runs counter to one of the main
goals of organic farming, which is to save and preserve the environment. In addition to the package itself, the packaging-product system should be taken into account [35].

Based on this, Santos’ research [5] specifically set out to look into the variables influencing customers’ decision to buy organic goods in environmentally friendly packaging. The subjects of this study are residents of Portugal. The Theory of Planned Behavior was the basis for Santos’s research, and it was expanded to include things like how consumers think they know and how they feel about the environment [5]. A questionnaire was the research tool, and 311 responses from various consumer profiles were obtained. Because of this, even though perceived environmental concern and knowledge account for 26% of the variance in attitudes of organic consumers toward sustainable packaging, their effects on purchase intent were minimal [5].

Santos’ study emphasizes the significance of expanding our understanding of the correlation between preferences for organic foods and the selection of sustainable packaging. In the end, it raises questions about how, even though organic customers express environmental concerns and believe they are aware of environmental issues, more needs to be done to improve production systems as a whole and create a cleaner supply chain, particularly in relation to packaging [5].

Even if the scenario is less than ideal, advances in the food market, shifts in customer preferences, and a balance between food quality, protection, and environmental impact have all resulted in new packaging requirements over time. It can also be noted that, over the last few years, the use of ecological materials such as biodegradable plastics, for example, has been expanding more and more. But it is still insignificant and the cost is high when compared to regular plastic. Slowly, the industry’s use of non-biodegradable plastic is becoming less prevalent. This fact generates a degree of environmental optimism. Innovation in the food industry predicts more significant use of bioplastics, smart packaging, and “green” packaging in the coming years [38]. Active packages (AI) are those that, for instance, warn about the condition of the food and whether it is still safe for consumption. Sustainable or green packaging (SOGP) or Intelligent or smart packaging (IOSP) decreases carbon emissions [39].

Geueke et al. say that packaging should be looked at as a sustainable way to promote a circular economy because of how it affects the environment. This would help get rid of the “take-make-throw-away economy” of packaging, which is hurting many ecosystems [40].

The circular economy is a system that incorporates a production and consumption model that involves sharing, leasing, reusing, repairing, refurbishing, and recycling old materials and products for as long as possible, as stated by the European Parliament [41].

Therefore, extending the products’ life cycle as much as possible is the goal. In practice, the circular economy means cutting down on waste all along the manufacturing chain, even after the product has been used. As according to van Herpen et al. [42], “Wherever practicable, a product’s materials are preserved inside the economy when it reaches the end of its life.” These can be effectively used again and time again, adding to their value.

For the sake of the environment and ecosystems, the economic production model of the past, which involved taking, manufacturing, and discarding without giving anything back, must end. For this purpose, the circular economy is a crucial instrument for preventing and minimizing environmental harm caused by human activity [40, 41]. In this regard, organic production, whose pillars promote the preservation of biomes, and producer awareness, must consider the significance of employing
sustainable packaging within the circular economy, including the use of clean production techniques, recycled materials, and renewable energy sources.

As explained by Santos et al. [5], there has been a considerable increase in the number of scholars studying the relationship between food and packaging. In the study “Sustainable Packaging for Supply Chain Management (SPSC),” activists talked about how the packaging is handled, protected, and kept safe.

However, these studies are more directed to the use of new materials whose objective is food conservation and safety, without much focus on the degradation of these materials in nature.

There are not many policies governing the interaction between products and packaging in the food and beverage industry. What is evident is that there is more concern about how food deteriorates in storage than about the amount of waste that will be produced with the disposal of its packaging.

From the industry’s point of view, as it is a sector where innovation is increasingly present, the difficulty in adopting ecological packaging would not be as felt as in the case of small rural producers. Anyway, the reduction of domestic waste is a crucial issue for environmental preservation, and consequently, everyone should prioritize their choices. Changes are initially slow and laborious, but once awareness-raising actions are started, they become habits [36].

According to studies by LOHAS-Lifestyles of Health and Sustainability [43], the organic food and beverage market is expanding three to four times faster than that of non-organic products, according to studies by LOHAS. As a result, it has already aroused the interest of large manufacturers, who are looking for ways to increasingly exploit this market, preserving the brand’s hegemony by attracting a specific audience, the organic niche [36].

As Joseph Schumpeter’s theory of creative destruction says, which he highlights in this situation, markets are essentially a process of industrial mutation that continually revolutionizes the economic structure from within. Creative destruction refers to the continuous process of replacing obsolete production units with new ones as a result of product and process innovation [44].

With innovations in the industry, the use of smart packaging, the development of new ecological materials allied to changes in the population’s habits, and being increasingly ecologically conscious will bring the change that the planet so much needs.

8. Eco-packaging or sustainable packaging

The packaging used in food provides benefits to society in many respects. Furthermore, by 2020, it is estimated that the number of packaged goods sold globally will reach 3.844 billion [45]. This number of available products tends to grow strongly in the coming decades, being an essential indicator in generating jobs, industrial growth, and demand for new technologies.

The use of packaging allows the marketing sector to leverage the market of a given brand, favoring the differentiation between products. It also has the role of educating and informing the consumer while protecting food during production, transportation, and acquisition. On the other hand, disposal can have negative consequences if made of unsustainable material [42]. SPC believes that new technologies will be more present and more affordable in the future, with the development of smart and eco-friendly packaging. This is why the packaging industry is considered a fast-growing sector that incorporates new packaging design techniques and innovation [45].
Now, in the process of being considered ecological or green, you must follow certain criteria. According to Sustainable Packaging Coalition [46] sustainable packaging needs to be:

“A. Is beneficial, safe & healthy for individuals and communities throughout its life cycle
B. Meets market criteria for performance and cost
C. Is sourced, manufactured, transported, and recycled using renewable energy
D. Optimizes the use of renewable or recycled source materials
E. Is manufactured using clean production technologies and best practices
F. Is made from materials healthy throughout the life cycle
G. Is physically designed to optimize materials and energy
H. Is effectively recovered and utilized in biological and/or industrial closed loop cycles.”

To leverage the market for innovative and sustainable packaging, it is necessary to first study consumer behavior in order to identify the presence of ecological awareness at the time of purchase. This information is important for making an ecological map of how people treat the environment. According to Nguyen et al. [47], based on systematic reviews of 261 articles, the objective was to evaluate research on packaging ecodesign in the literature through three perspectives, positivism, interpretivism, and consumer transformative research. Nguyen apud Koenig-In Lewis et al. [47], an exploratory study of consumer behavioral assessment showed that purchase intention is significantly affected by consumer concerns about the environment. As people learn more about the environment, they end up wanting products that are better for them.

Nevertheless, it is logical that this sustainable behavior is quite vulnerable, that is, it is characterized by impotence and dependence. This is because it depends on particular situations, such as demographics, socioeconomics, and personal (age and gender). For consumers, these situations have a direct impact on their behavior [48]. Often, the lower the level of education or income power, the higher this vulnerability. The existing literature on research on Transformative consumer research (TCR) cited by Zeng et al. [48] is precisely the link between packaging and vulnerability. Some studies in the field of CRT have investigated the impacts of packaging innovation on vulnerable groups at risk, for example, older consumers or children, or even biological, psychological, and social factors. According to research conducted by Zeng et al. [48], there is a strong indication of a growing interest among researchers in topics related to sustainability and packaging innovation in the last 10 years. In relation to the CRT, the study points out three main topics addressed: consumer vulnerability, consumer health status, and sustainability.

With regard to the consumer of organic products, this vulnerability should be minimal considering that it is a niche market aimed at a consumer much more aware of the environment. There is little research on consumer perceptions of environmentally friendly packaging. In fact, environmentally friendly packaging has never been a clear concept in consumer behavior literature [48]. This point is corroborated by the fact that there are no metrics available in the databases consulted for this evaluation. Specific studies are needed to trace the behavior of consumers of organic products and their relationships in the face of the packaging used. These kinds of studies are very important for making producers aware of the right kinds of packaging to use.

8.1 Eco-friendly packaging—global trends

Some types of packaging, such as cardboard and glass, can even be considered sustainable as long as they are destined, after use, for recycling. However, they depend
on several factors. Users are not always educated to recycle garbage. Another factor that contributes to inadequate disposal is the absence of selective collection in some establishments, as well as the absence of effective educational campaigns. Cardboard, for example, could be used as compost in organic production.

With the lack of an adequate recycling process and environmental concerns, new materials have emerged that are considered eco-friendly or green packaging. Although the availability of propagation is still a faraway reality and it is not possible to trace a promising gift, the development of these new materials has grown significantly in the packaging sector. The market is expected to account for US $29.7 billion by 2026 [49]. Still being a more costly technology, bio-based polymers are 20–100% more expensive than plastics derived from petroleum polymers, which still makes them a little less accessible to the food industry [34].

Moreover, unfortunately, it is observed that most of the time there is no concern, whether from industry or producers, about providing food in packaging made of sustainable raw materials of low degradation time in nature. Moreover, unfortunately, it is observed that most of the time there is no concern, whether from industry or producers, about providing food in packaging made of sustainable raw materials of low degradation time in nature [50]. Generally, the concern of this sector is to have packaging that ensures a longer shelf life of food, conserves its integrity and allows a greater shelf-life.

On the other hand, there is optimism, the result of environmental concern and climate change caused by the growing generation of household waste. Because of this, some industries that make things are looking for new materials that are better for the environment and keep the quality of food the same as plastics. Ordinary plastics can take 450–1000 years to decompose, causing harm to the ecosystem and affecting fauna and flora. Biodegradable plastics decompose on average 60% in 180 days [47, 48]. For this reason, packaging made of polymers considered “green” is the current major trend in the packaging industry. They can be used in various sectors, not only in food but also automobiles and toys, for example [49]. Green polymers are sustainable polymers of plant origin that during their synthesis or processing have fewer impacts on the environment. They are polymers whose raw materials are not of fossil origin but of renewable matter such as corn, sugarcane, or cellulose. Recycling a ton of green polymer bottles can save up to 1.5 tons of CO₂ emissions. They can be recycled or reused, and even if discarded, they do not have a negative impact on the environment because they decompose with carbon-neutral emissions. As a denomination, these polymers are added to the word “green” after the citation of their nomenclature: PVC (polychloride vinyl) green, PP (polypropylene) green, PE (polyethylene) green [50].

Although they are environmentally correct, their production scale is still very small. This is because its cost is still expensive when compared to petroleum-processed polymers. Currently, the cost of biodegradable plastics varies from US$ 2/kg to US$ 2/kg as compared with that of traditional plastics, which is approximately, US$ 1/kg to US$ 2/kg [49, 51].

It comprises this range of packaging of bioplastics or biopolymers or green polymers, those also made from algae, mushrooms, shrimp shells, organic waste, fibers, and vegetable resins etc. [52].

8.2 The importance of packaging being sustainable

Consequently, the consumer of organic products plays a crucial role in this production chain, and their awareness of this role can encourage the shift in favor
of Schumpeter's theory of creative destruction. To create a circular economy, people need to use packaging that is good for the environment.

According to van Herpen et al., it has become standard practice in many supermarkets in Europe to sell products without plastic wrapping in the fruit and vegetable section. The removal of packaging at the time of purchase is a recent trend looked [42]. In countries like Brazil, this reality is still difficult to find.

van Herpen et al.’s research [42] looked at whether removing the primary packaging of fruits and vegetables would encourage more people to buy them. Plastic might seem to go against the idea of a sustainable environment, which is why this is a big deal for organic fruits and vegetables. Consistent with the study’s findings, the typical consumer prefers organic fruits and vegetables that are not packaged in plastic. However, the packaging is frequently associated with wastefulness and the “throw-away society” in the eyes of consumers.

Kafel et al. [35] evaluated the types of materials most commonly used in the European Community to package organic products. Table 2 shows the results obtained by Kafel et al. [35].

Even though the data indicates that plastic packaging is used a little more than cardboard packaging, 58.7% (Table 2) is quite significant. The results of the study by Kafel et al. [35] indicate the high use of plastic in the food industry.

In order to have a fully functioning circular economy, it is necessary to guarantee the preservation of soil and water throughout the production chain and the product’s life cycle. Additionally, the materials indicated in Table 2, Styrofoam is a common material widely used by Brazilian manufacturers (Figure 4). Figure 4 shows how organic products on store shelves are sold to customers.

Plastic, as seen in Table 2, is widely used and one of the agents responsible for the large amount of waste that remains in nature in the long term. It pollutes the soil, rivers, lakes, and oceans [54]. In addition, several animals lose their lives after consuming plastics found in nature waste by men. For this reason, consumers need to be increasingly informed and cautious when selecting products at the time of purchase. It is necessary to raise awareness of the way food is presented, and the kind of waste it will produce after consumption.

The use of plastic in the food sector is common, even for reasons of price, accessibility, and availability. Changing Kafel’s data is a crucial issue.

<table>
<thead>
<tr>
<th>Plastic packaging</th>
<th>Paper/paperboard</th>
<th>Glass</th>
<th>Multilayer laminate materials</th>
<th>Biodegradable materials</th>
<th>Metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>58.7%</td>
<td>47.8%</td>
<td>39.1%</td>
<td>23.9%</td>
<td>23.9%</td>
<td>8.6%</td>
</tr>
</tbody>
</table>

Table 2. Materials used for packaging of organic products [35].

Figure 4. Brazilian organic products at the supermarket—photo by National Institute of Technology—INT [53].
Finally, there is reason to believe that environmental preservation is gaining more supporters. More and more organic producers are realizing that the exponential rise in household trash is almost impossible to keep up with.


Undoubtedly, the packaging is essential to maintain the integrity of food, avoiding diseases and chemical contamination. Now, the food production system, whether organic management on farms or in the processing industry, needs to worry about going beyond maintaining food conservation. It is necessary to innovate, preventing these packages from becoming household waste with environmentally persistent materials, and in the long run, they will become part of the virtuous circle of the circular economy [55]. Among the potential solutions, the production of biodegradable polymers or bioplastics from agro-food or vegetable products will ensure that when discarded they return to the soil and, instead of polluting the land, they will function as nutrients. With regard to organic production, the use of packaging made of bioplastics would be ideal and perfect. It would ensure that the entire life cycle of the product would be in accordance with the circular economy, not generating pollutants, properly using natural resources, and prioritizing durable and renewable resources, as illustrated in Figure 5.

10. Conclusion

It is unacceptable, nowadays, to accept organic food being sold in non-biodegradable packaging, harmful to ecosystems. Maybe this situation would not change until the courts demand it and the government has to step in.

The fact is that there are consumers making a difference by being more demanding and defending environmental preservation. However, although they are gradually increasing and becoming representative groups, they are still a minority. They are not
enough to generate significant changes in the production chain. It is necessary that public, technological, and environmental institutions debate these issues more and more; they affect the food-packaging interaction with the environment.

Thus, it is important that the results of these debates generate informative and educational campaigns, in addition to pressuring the packaging industry to manufacture ecologically correct products, reducing the carbon footprint. Another important point in the present study is the fact that more in-depth research is needed on the role of the consumer in relation to conscious, behavioral, and ecological consumption. Lastly, to show that actions need to be taken right away, consumer society can no longer avoid taking responsibility.

On the other hand, while regulatory and standard-setting bodies are unaware of the importance of requiring organic food producers to use ecological packaging, the generation of domestic waste on the planet resulting from organic production, composed of aluminum, plastic, Styrofoam, and metal, has no end. Incorporating the mandatory use of biodegradable packaging into legislation and certification mechanisms is urgent and necessary. As organic production is based on the preservation of soil and water, it is not acceptable, therefore, its consumption generates polluting domestic waste. At the same time, the role of the consumer in this scenario is fundamental. Being more conscious at the time of purchase, adopting sustainable choice practices, recycling garbage, and demanding biodegradable packaging are necessary and fundamental changes in habits.

The qualitative meta-analysis carried out in this study showed that, although eco-consumers are gradually increasing and becoming a representative group, they are still a minority. For the time being, they are still not enough to generate significant changes in the production chain and to integrate organic production within the circular economy cycle. Therefore, it is necessary that public, technological, environmental institutions, associations, and cooperatives increasingly address these issues and begin to demand specific legislation for the proper use of packaging, especially for certified organic foods.

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