

Food Packaging Innovation as a Key Factor to Reduce Environmental Damage. Case study**Emballage Togo Start-up****Hamza Fatima Zohra****Khedim Amel**

The Higher School of Management–Algeria

The Higher School of Management–Algeria

f.hamza@esm-tlemcen.dzamelkhedim@yahoo.fr

LEREMA

LEREMA

Reçu le : 15/02/2023

Accepté le : 05/06/2023

Publié le : 30/06/2023

Abstract:

Packaging is an integral component of the product, offering both protection and value addition. However, growing public awareness is urging consumers to convert to environmentally packaging in order to avoid the negative effects of waste brought on by inconsiderate human conduct. The objective of this work is to shed light on sustainable packaging and its role in reducing environmental damage. This paper proves the interest of Algerian start-ups in the fight against waste by offering eco-friendly packaging. In the theoretical section, we have given a comprehensive definition of sustainable innovative packaging, which we assume is one of the possible solutions for reducing environmental damage. In the empirical section, we developed an interview guide that was introduced to a packaging producing company operating in Algeria under the name of "Emballage Togo" in order to figure out the role of innovative food packaging in reducing waste.

Keywords: Agri-food Sector; Packaging; Sustainable Development; Innovation; Environmental Damage.

Jel Classification Codes : Q15 ; O31 ; Q53 ; Q56

ملخص:

يُكمن للتغليف أهمية بالغة في توفير الحماية وتحقيق قيمة مضافة للمنتج كما انه يعتبر أداة ترويجية هامة في تسويق السلع، غير ان الوعي العام المتزايد بالضرر البيئي الناتج عن الصناعات المختلفة يحث المستهلكين على التحول إلى تغليف مستدام وصادق للبيئة من أجل تجنب الآثار السلبية للنفايات الناجمة عن السلوك البشري المتهور. الهدف من هذه الدراسة هو تسليط الضوء على التغليف المستدام ودوره في الحد من الأضرار البيئية. تثبت هذه الدراسة اهتمام الشركات الجزائرية الناشئة بمكافحة النفايات من خلال تقديم عبوات صديقة ومحافظة للبيئة. في القسم النظري، قدمنا تعريفاً شاملاً للتغليف المبتكر المستدام، والذي نفترض أنه أحد الحلول الممكنة للحد من الضرر البيئي. في القسم التطبيقي، قمنا بتطوير مجموعة من الاسئلة تم طرحها على شركة ناشئة لإنتاج عبوات التغليف تعمل في الجزائر تحت اسم «Emballage Togo» من أجل معرفة دور التغليف الغذائي المبتكر في تقليل النفايات.

الكلمات المفتاح: قطاع الأغذية الزراعية؛ التغليف؛ التنمية المستدامة؛ الابتكار؛ الضرر البيئي..

تصنيف JEL : Q15 ; O31 ; Q53 ; Q56

I. Introduction:

According to the United Nations, world population is expected to grow to 10 billion by the end of the century, yet earth size remains the same. The ongoing increase in human population can have a serious impact on Earth's ecosystems (Imhoff, Bounoua et al. 2004) through decisions made about consumers lifestyles, consumption and production activities, creating many environmental and social problems including food security.

Food sustainability and food security are complex systems feeling the world today and, in the future. Food sustainability considers factors such as health, environment, natural resources and their social and ecological footprint. Hence, factors to consider in order to ensure food sustainability include food security, the ability to feed the population all year round without compromising the ability to feed future generations; nutrition and health, the ability to deliver a healthy and nutritious diet; social justice, the ability to produce equal benefits for all and natural resources for positive environmental impact learning from nature and working within the limits of its ecosystems. Furthermore, one of the biggest challenges facing food sustainability is food wastage, which is considered as one of the many issues at the crossroads of climate action and social justice. Globally, over 800 million people are undernourished (Bruinsma 2017), while about 1.3 billion tons of food gets lost or wasted worldwide every year. In Algeria, and according to the UN, 3,918,529 tons of household food are wasted in 2020, approximately 91 kg per capita each year. Therefore, the need to create a sustainable food system which requires a wise and efficient sustainable food waste management, and that can also be through the efficient use of innovations related to waste reduction matter, including the role of packaging in preventing wastage and fighting against food spoilage at each link in the chain: production, processing, distribution, consumption.(KAMEL, BENKHEDDA et al.)

Thus, and in the aim of figuring out how the issue of food waste can be resolved through sustainable packaging innovation, our problematic will be around this main question: "Can packaging innovation contribute minimizing environmental damage?"

II. Food Industry:

Food industry plays a crucial role in public health, food safety, food security, social development, and nutrition. It has an essential and important part of nations economy. Health, sanitation and product quality are some of the major concerns in food industry.

2-1 Components of Food Industry:

Food industry, which is the operation of transforming livestock and cultivated plants into industrial food products, comprises of several components, mainly:

- Agriculture: That can be done through food, fiber, and feed production, including crop raising, livestock, and seafood.
- Food Processing: Is the process of making some food available all year round by transforming raw ingredients into marketable food products. The use of packaging can increase the food quality and extend its shelf life. (Brennan and Grandison 2012)
- Food Distribution: refers to "... the physical flows and storage of products from the final production point to the customer or end user" (Akkerman, Farahani et al. 2010)
- Regulation: local, regional, national, and international rules and regulations on food production distribution to ensure food quality, security, and safety.
- Financial Services: These include insurance and credit to facilitate food production and distribution. Insurance policies cover costly business disruptions commonly seen in the industry. Food accounting professionals work closely with all aspects of food industry to evaluate ideas and opportunities. (Sadiku, Musa et al. 2019)
- Research & Development: Research on any aspect of food industry produces relevant information about that sector. The food serving sector has the largest potential of research and development. Research reflections may be on factors influencing consumer behavior, customers' buying choices, formation of attitude, and opinions. Companies need to have a deep understanding of how consumers behave.
- Marketing: Marketing is the primary vehicle for promoting information about food. Food marketing describes any form of advertising used to promote the purchase and/or consumption of

a food or beverage. It can influence food behaviors by moderating sociocultural elements of the food environment.

2-2 Major Challenges in Food Industry:

For many years, solving food availability was the countries' biggest concern, by producing higher yields (Fresco and policy 2009) and providing adequate food for a growing world population (Buttriss 2013). However, food industry today is facing bigger issues and challenges due to population growth, natural resources scarcity, fluctuating food prices, moderations in consumer habits, climate change, and food loss and waste (Otlés, Despoudi et al. 2015).

The United Nations Food and Agriculture Organization estimates that globally, almost $\frac{1}{4}$ to $\frac{1}{3}$ of food produced in the world is wasted. In Algeria, the cost of food waste is estimated at more than 50 million Euros. (Zeng, Durif et al. 2021) In contrast, about 842 million people are food insecure and facing hunger worldwide. (Martin-Rios, Demen-Meier et al. 2018) Therefore, more efforts should be made to reduce the amount of food waste in order to sustain the world's limited resources and secure enough food to all humans. This can be possible through making end consumers aware of the need and importance to preserve resources, encouraging the creation of natural biological fast food chains that are not associated with bad and poor nutrition («Quick» and «Burger king») (CHIKHI and CHAIB 2020) or also by using new technologies through innovations such as intelligent packaging for example to prevent from food spoilage as an aim to sustainability (Williams, Wikström et al. 2012).

2-3 Innovation in Food Industry:

In innovation literature, the food industry is typically classified as a sector with low research intensity, accounting to one of the lowest R&D-to-sales ratios of any industrial sector. However, food innovations are recognized as an important instrument for companies belonging to the food industry in order to stand out from competitors and to satisfy consumer expectations.

Global warming, the carbon footprint, and society's future in general are all significantly influenced by how food production and consumption affect the environment. This function, which is being explored, informed about, and transmitted, impacts consumer demand and behavior for food. Additionally, it changes the offer and has an impact on food industry strategies. This environment calls for fresh developments and welcomes eco-design and eco-innovation.

In recent years, food manufacturers have accelerated the development of new products, by using new ingredients, processing and packaging techniques. Thus, food markets are increasingly characterized by competitive environments where relevant flows of innovative products, quality improvements and new technologies provide new consumption trends, food habits, market opportunities and firms' strategies.

III. The Concept of Sustainable Development:

Today, Sustainable Development is considered as an important aspect for economic, environmental and social growth of the modern world. It is increasingly regarded by academics, industry representatives and policy maker all over the globe (Silvestre and Țircă 2019).

3.1 The Definition of Sustainable Development:

The most cited definition of the term 'Sustainable Development' belongs to Brundtland Report (World Commission on Environment and Development), which was the first to articulate the idea of SD in late eighties and more specifically in 1987 (Johnston, Everard et al. 2007).

The Brundtland Report defined SD as bellow:

“... development that meets the needs of the present without compromising the ability of future generations to meet their needs”

Since the latest definition was released, the concept of SD has been looked at from the point of view of the society after being look at from and environmental angle. (Jabareen and sustainability 2008) Thus, there can be found a link between sustainability and preservation (Klauer and Ecology 1999) by introducing the concept of intergenerational equity as an important guiding principle. However, disagreements persist on the exact definition of the term SD. In most cases, definitions refer to maintaining human living stands, economic growth and the viability of natural resources and ecosystems overtime (Klauer and Ecology 1999).

3.2 Aspects of Sustainable Development:

Sustainable development is recognized through its three aspects: economic, environmental, and social (Harris 2000):

-Economic: Economic Sustainability refers to practices, mainly the production of goods and services, that support economic growth without making any negative impact on different aspects of the community such as social, environmental and cultural aspect. In other words, ES aims to preserving harmony between the economic activity of the man and natural environment (Tuziak 2010).

Economic Sustainability can be improved through the implication of the government by prohibiting nonsense land use and by planning, providing subsidies or tax breaks for green development. Financial support for Universities and research and development is also important for economic sustainability growth.

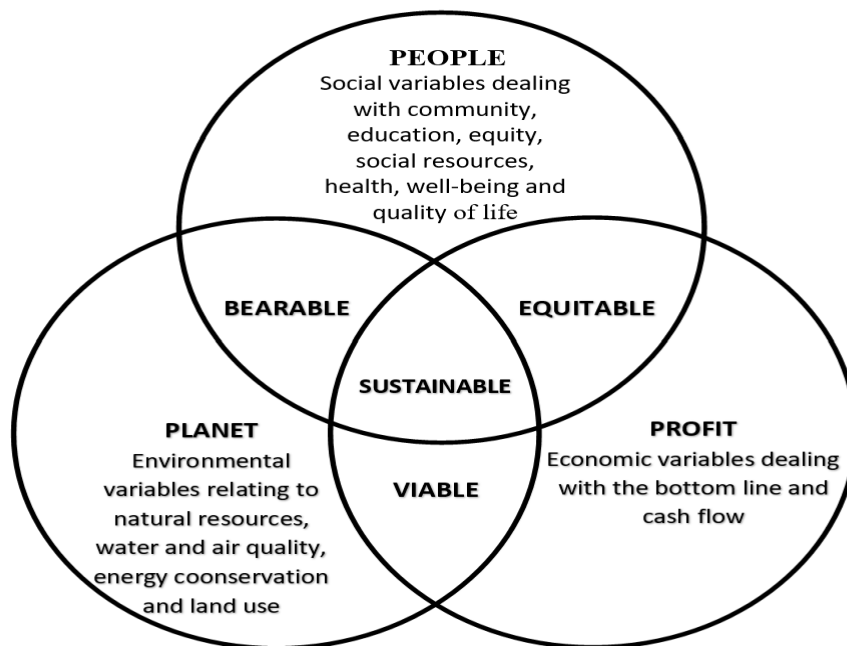
-Environmental: Environmental Sustainability refers to the responsibility of protecting global ecosystems and maintaining a stable resource base in order to improve the quality of human life without causing any harm the nature. According to (Goodland and systematics 1995), the scale (Population * Consumption Per Capita * Technology) of human economic subsystem should be limited within the carrying capacity and therefore sustainable.

Maintaining Environmental Sustainability involves proper management of natural resources as well as considering the importance of the environmental impacts of the outcome of the proposed development in decision making.

-Social: Many non-physical factors can be attributed to social framework such as: education; social justice; health, quality of life and well-being; social capital; community; safety; fair distribution of income; social order; social networks; social interaction; sense of community and belonging; employment; residential stability (vs. turnover); active community organizations; and cultural traditions (Eizenberg and Jabareen 2017). Furthermore, Social Sustainability is based on the idea that access to social resources should be the same or greater to the future generations as it is for the current generation.

The figure below shows the interaction between the three aspects and their importance, generating 03 other important pilers of stainability: viability, bearability and equiatbility.

Figure (1): The interaction between Sustainable Development aspects.



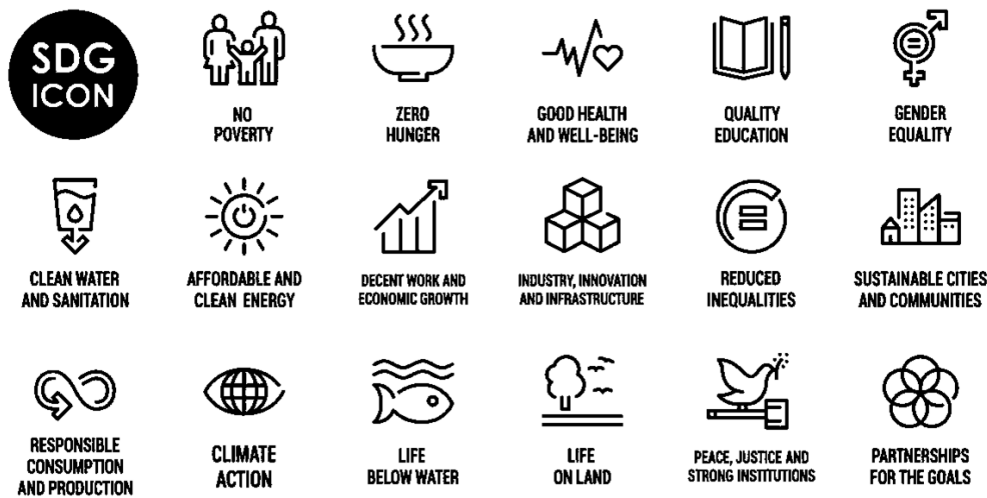
Source : <https://inletkeeper.org/2020/12/08/people-planet-and-profits-pillars-for-building-sustainable-equitable-food-systems/>

3.3 Sustainable Development Goals

In order to insure a better and sustainable future for all, the United Nations General Assembly released and approved, in 2015, 17 development goals (SDGs) with the aim of fostering the organizational operationalization and integration of sustainability as part of agenda 2030(Fonseca, Domingues et al. 2020).

According to the United Nations: “The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity.” The 17 SDGs cover all aspects of sustainability in all sectors of the society (Fleming, Wise et al. 2017).

Figure (2): The Sustainable Development Goals.



Source: <https://sdgs.un.org/goals>

IV. Sustainable Packaging:

Packaging has a crucial role in protecting a product, it can also contribute in ensuring food quality, facilitating transportation and logistics and enabling communication (Boz, Korhonen et al. 2020).

4.1 Definition of Sustainable Packaging:

Many definitions were attributed to sustainability, only two are related to packaging. The first definition is a result of a survey study supported by Sustainable Packaging Alliance (SPA) in Australia. The second definition is the fruit of Sustainable Packaging Coalition efforts (SPC) in the USA. (Boz, Korhonen et al. 2020)

SPA believes that to consider a packaging as sustainable packaging, four sustainability principles should be present (Sonneveld, James et al. 2005) Effectiveness, Efficiency, Cyclic and Safe as defined bellow in Table (1).

Table (1): SPA’s sustainable packaging definition

Packaging will support sustainable development if the following principles are met	
Principle	Levels at which the principle is applied
Effective: It adds real value to society by effectively containing and protecting products as they move through the supply chain and	Society

by supporting informed and responsible consumption.	
Efficient: Packaging systems are designed to use materials and energy as efficiently as possible throughout the product life cycle. This should include material and energy efficiency in interactions with associated support systems such as storage, transport and handling.	Packaging system
Cyclic: Packaging materials are cycled continuously through Packaging natural or (industrial) technical systems, minimizing material degradation and/or the use of upgrading additives.	Packaging material
Safe: Packaging components do not pose any risks to human health or ecosystems. When in doubt in precautionary principle applies.	Packaging component

Source: (Sonneveld, James et al. 2005).

According to SPC definition, packaging should meet eight sustainability principles to be considered as a sustainable packaging: (Boz, Korhonen et al. 2020)

- 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

4.2 Sustainable Packaging attributes and functions:

Sustainable Packaging is viewed as a combination of sustainable visual attributes (e.g. sustainable cues and biodegradable cues) and verbal attributes (e.g. sustainable cues and ecolabeling). (Zeng, Durif et al. 2021).

Thus, ecofriendly packaging can be categorized into three dimensions. Packaging materials which is associated with the biodegradability and recyclability of the product. Manufacturing technology associated with protection and conservation of the product in question, and finally market appeal which is related to visual presentation, functional performance and price (Seo, Ahn et al. 2016).

4.3 Consumer Perceptions of Sustainable Packaging:

Consumers play an important role in the determination of ecofriendly packaging success, and that can be through their purchase decision making (Shaikh, Yaqoob et al. 2021) promoted by the emergence of sustainable marketing through highlighting products considered to be more ecological and more respectful of the planet (Chikhi 2020).

Many studies have shown that both consumers and industrial manufacturers are increasingly aware of the environmental issues the world is facing (Nordin, Selke et al. 2010). However, they are not able to evaluate the environmental merits of materials in purchasing decisions (Herbes and Aspects 2021).

A study related to consumers behavior toward ecofriendly packaging, has mentioned that some consumers consider that sustainable packaging is less appealing and has lesser quality than conventional packaging because of its simplicity and lack of colors. They also consider that sustainable packaging is not aesthetically pleasing (biodegradable/paper based). (Seo, Ahn et al. 2016). Thus, managers should consider improving communicative packaging effectiveness through identifying the mechanisms by which consumers adopt or reject eco-designed packaging (Magnier, Crié et al. 2015).

V. The environmental impacts of packaging:

Packaging is heavily criticized for its negative effects on the environment, including the depletion of natural resources, the health risks associated with particular types of packaging, the difficulty in disposing of waste, and the fact that some containers are costly and misleading (Sehrawet & Kundu, 2007). Most of efforts concentrate on particular material or packaging properties that are thought to be more ecologically friendly. (Vendries et al., 2020).

The EU's packaging waste generation was expected to be 177.2 kilograms per person in 2020, with the highest amount generated in Croatia and Germany. The most prevalent forms of packaging waste in the EU are paper and cardboard (41.2%), plastic (19.5%) and metal (5.0%) (European Commission, 2020).

The packaging industry is the largest consumer of plastic polymers; 40% of plastic polymers globally were used in packaging manufacture in 2015. As a result, the global output of plastic garbage has increased (Pincelli, de Castilhos Júnior, Matias, & Rutkowski, 2021). Developed-country unmanaged plastic trash is beginning to reduce. But inefficient or no plastic waste management systems result in up to 90% of plastic garbage being improperly disposed of. As a result, medium and low-income nations have become the primary contributors of global plastic pollution (Ncube, Ude, Ogunmuyiwa, Zulkifli, & Beas, 2021).

In food industry, direct and indirect environmental impact of packaging is the impact caused by the influence that packaging has on the food product's life cycle. It includes the influence on the amount of food waste and the possibilities of recovering food waste. Packaging also affects transport efficiency in the food supply chain and consumer behavior affecting food transport, storage and preparation (Molina-Besch, Wikström, & Williams, 2019).

Judging a packaging made of paper as "excellent" just because it is biodegradable ignores the possibility that the food inside will have a very limited shelf life. Foods with a limited shelf life typically result in more waste, and an intelligent society would not embrace such a crude system of packaging classification (Robertson & Management, 1990).

VI. Innovation in Food Packaging as a tool to reduce waste:

The use of technology has impacted humankind's production patterns and lifestyles in so many ways and on so many levels, making life easy and comfortable. This technological revolution is characterized by new innovations that have a crucial role in solving everyday problems in a very short period of time. The application and diffusion of these new innovations can shape individuals' attitude and behavior causing an unexpected change in society.

Many innovations have been applied in food industry to create new sustainable solution for health, waste and other environmental issues. Sustainability problems in food industry are generally related to packaging and wastage. In most of times, packaging, which is considered as an integral part of the product, is thrown away right after using the product in question creating wastage. Hence, sustainable innovations nowadays, seek to get rid of this waste if not eliminate it, finding an ultimate solution to this serious problem.

As a solution, some inventors have created a technique enabling consumers to find out when their food is starting to spoil through the packaging (Intelligent Packaging) and subsequently eliminate waste (Russell and A 2014). They have the potential to transmit the conditions of the packed product. Their objective is to keep an eye on the state of food and inform customers. This can include details on a package's state and its contents, the date of manufacturing, or storage

circumstances. However, intelligent packaging technologies are still not widely available on the market. The reasons for this include the aforementioned shortcomings of the systems (extra expenses, dealer/brand owner acceptability, etc.). Nevertheless, the benefits of these systems should not be overlooked. More research and enhancement efforts must be carried out in order to reap their benefits and make them more widely available (Müller & Schmid, 2019).

Other innovations have been focusing on biodegradability aspect, by converting agri-food residues into innovative bio-packaging solutions, which considered as one of the most promising solution towards sustainability. (Guillard, Gaucel et al. 2018) Demand for biodegradable packaging is set to increase, partly because of improved properties and the decrease in its price. Policy and legislative changes, as well as world demand for food and energy resources, will play a major part in the development of this material (Shaikh, Yaqoob, & Aggarwal, 2021).

Food packaging design is also used as a solution for sustainability (Grönman, Soukka et al. 2013). Packaging designers can create a sustainable ecofriendly packaging through a unique innovative design to prevent from wastage and minimize the environmental impact of excess use of packaging. According to an estimate by ReFED (a national nonprofit dedicated to ending food loss and waste across the U.S), better package design may prevent six million metric tons of greenhouse gas emissions annually and redirect over a million tons of food waste. The net financial gain from solutions in this area would be \$4.13 billion. Manufacturers and merchants, however, might have had difficulty until recently understanding how to pursue these changes precisely. This technique is used by “Emballage To Go”, an Algerian startup specialized in food delivery packaging, and that we will analyze in the case study.

VII. “Emballage To Go” Startup:

“Emballage To Go” is an Algerian startup specialized in food delivery packaging. It was created in January 2019 in Dellys, Boumerdes with a total turnover of 81 123 128.88 DZD. The startup offers different types of food delivery packaging that provide protection for food during shipping but also act as a sales and marketing tool through their unique design as presented below:

1-Cake Box: “Emballage Togo” provides the Algerian market with cake boxes of different sizes and designs made of a healthy food safe carton that remain non-toxic throughout the life cycle.

2- FastFood Packaging: Different packaging for delivering pizza, burgers, tacos with different dimensions, all made out of a recyclable food paper which can reduce the use of toxic plastics and carbon footprint.

3- "Happiness Box": An ecofriendly packaging with two floors that contain multiple foods all in one which can subsequently reduce packaging and food waste. This innovative food packaging is registered at the Algerian National Institute of Industrial Property.

VIII. Research methodology:

In order to answer our paper's main question about sustainable innovative packaging and its contribution to reducing environmental damage, we have developed an interview guide, which was introduced to Mr. Hichem Merabet, the founder of "Emballage To Go." The questions were mainly about the food delivery packaging produced by the same startup and its relation to sustainability, as well as the role of packaging innovation in reducing environmental damage.

IX. Results and discussion:

According to the interview guide answers, the startup products are eco-friendly because they are made out of recyclable biodegradable food paper and have the ability to preserve taste and nutritional qualities while ensuring food safety.

"The Happiness Box" was created with a unique design; it includes two floors destined to clients who prefer more than one kind of food in the same delivery packaging. According to Mr. Hicham, the idea of offering such a service arose from market demand. The company has noticed that customers are always asking for packaging that can hold several food products at the same

time. The founder of the startup confirms that the main target of such innovation is generating less waste, lowering costs, and facilitating food delivery. Finally, "Emballage Togo" has used a new print style as part of its innovation, which helped the startup cover the Algerian market.

X. Conclusion:

Packaging is used mainly to highlight the product; it represents a major challenge for brands wishing to attract new customers. This silent salesman is considered an inseparable element of the product, which allows both protection and provides added value. However, collective awareness is pushing customers more and more to switch to sustainable, eco-friendly packaging in order to get rid of the harmful consequences of wastage caused by the irresponsible behavior of individuals. As a solution for sustainability, many companies have used innovative packaging ideas to minimize waste in the food industry. It can be through the use of renewable resources or recycled packaging materials, edible packaging, compostable and biodegradable plastic alternatives, or definitely by introducing technology in the making of the packaging, like in "Intelligent Packaging," which informs the consumer that the product is about to expire, thus avoiding spoilage. Some other companies, like "Emballage Togo," have used another technique, which is the packaging design, by using an innovative, unique print design that enables the packaging to hold different food products at once and avoid waste. Many techniques and innovations can be used, but the main goal is the same: avoiding or at least reducing waste and, consequently, the environmental impact of the excess use and waste of food products in the agri-food sector.

- Appendices:

Interview Guide questions:

Please answer the following questions:

- 1- Is your 'Happiness Box' packaging part of an eco-friendly packaging approach? If yes, how?
- 2- How did you come up with the idea of offering such packaging?
- 3- What is the purpose of such innovation?
- 4- Do you use a renewable raw material?
- 5- Does your packaging ensure the preservation of taste qualities? nutritional? and food safety?
- 6- Quel type d'innovation avez-vous utiliser dans la conception de votre emballage ?
What kind of innovation did you use in your packaging design?
- 7- Do you think that we can avoid waste in the agri-food sector, by using your packaging?
- 8- Is your production activity subject to specific rules?
- 9- Did this innovation help you positioning your company in the Algerian market?

Referrals and references:

- Boz, Z., Korhonen, V., & Koelsch Sand, C. (2020). Consumer considerations for the implementation of sustainable packaging: A review. *Sustainability*, 12(6), 2192.
- Buttriss, J. L. (2013). Food reformulation: the challenges to the food industry. *Proceedings of the Nutrition Society*, 72(1), 61-69.
- Chikhi, K., & , B. (2020). Marketing practices of fast-foods in Algeria. *French Journal of Economics and Management*, 1(3).
- Eizenberg, E., & Jabareen, Y. (2017). Social sustainability: A new conceptual framework. *Sustainability*, 9(1), 68.
- Fleming, A., Wise, R. M., Hansen, H., & Sams, L. (2017). The sustainable development goals: A case study. *Marine Policy*, 86, 94-103.
- Fonseca, L. M., Domingues, J. P., & Dima, A. M. (2020). Mapping the sustainable development goals relationships. *Sustainability*, 12(8), 3359.
- Fresco, L. O. (2009). Challenges for food system adaptation today and tomorrow. *Environmental science & policy*, 12(4), 378-385.
- Goodland, R. (1995). The concept of environmental sustainability. *Annual review of ecology and systematics*, 26(1), 1-24.
- Grönman, K., Soukka, R., Järvi - Kääriäinen, T., Katajajuuri, J. M., Kuisma, M., Koivupuro, H. K., ... & Linnanen, L. (2013). Framework for sustainable food packaging design. *Packaging Technology and Science*, 26(4), 187-200.
- Guillard, V., Gaucel, S., Fornaciari, C., Angellier-Coussy, H., Buche, P., & Gontard, N. (2018). The next generation of sustainable food packaging to preserve our environment in a circular economy context. *Frontiers in nutrition*, 5, 121.
- Harris, J. M. (2000). Basic principles of sustainable development. *Dimensions of Sustainable Development*, 21-41.
- Imhoff, M. L., Bounoua, L., Ricketts, T., Loucks, C., Harriss, R., & Lawrence, W. T. (2004). Global patterns in human consumption of net primary production. *Nature*, 429(6994), 870-873.
- Jabareen, Y. (2008). A new conceptual framework for sustainable development. *Environment, development and sustainability*, 10, 179-192.
- Johnston, P., Everard, M., Santillo, D., & Robèrt, K. H. (2007). Reclaiming the definition of sustainability. *Environmental science and pollution research international*, 14(1), 60-66.
- Klauer, B. (1999). Defining and achieving sustainable development. *The International Journal of Sustainable Development & World Ecology*, 6(2), 114-121.
- Molina-Besch, K., Wikström, F., & Williams, H. (2019). The environmental impact of packaging in food supply chains does life cycle assessment of food provide the full picture?. *The International Journal of Life Cycle Assessment*, 24, 37-50.
- Müller, P., & Schmid, M. (2019). Intelligent packaging in the food sector: A brief overview. *Foods*, 8(1), 16.
- Ncube, L. K., Ude, A. U., Ogunmuyiwa, E. N., Zulkifli, R., & Beas, I. N. (2021). An overview of plastic waste generation and management in food packaging industries. *Recycling*, 6(1), 12.
- Pincelli, I. P., de Castilhos Júnior, A. B., Matias, M. S., & Rutkowski, E. W. (2021). Post-consumer plastic packaging waste flow analysis for Brazil: The challenges moving towards a circular economy. *Waste Management*, 126, 781-790.
- Robertson, G. L. (1990). Good and bad packaging: who decides?. *International Journal of Physical Distribution & Logistics Management*, 20(8), 37-40.
- Sehrawet, M., & Kundu, S. C. (2007). Buying behaviour of rural and urban consumers in India: the impact of packaging. *International Journal of Consumer Studies*, 31(6), 630-638.
- Shaikh, S., Yaqoob, M., & Aggarwal, P. (2021). An overview of biodegradable packaging in food industry. *Current Research in Food Science*, 4, 503-520.
- Vendries, J., Sauer, B., Hawkins, T. R., Allaway, D., Canepa, P., Rivin, J., & Mistry, M. (2020). The significance of environmental attributes as indicators of the life cycle environmental impacts of packaging and food service ware. *Environmental Science & Technology*, 54(9), 5356-5364.