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EXECUTIVE SUMMARY OF THE THESIS

An Exploration of Environmentally Sustainable Packaging in Cosmetics: Analyzing Industry Adoptions and Investigating Market Potential for Innovative Solutions

TESI MAGISTRALE IN MANAGEMENT ENGINEERING – INGEGNERIA GESTIONALE

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1. Introduction

The pressing environmental crisis and the concurrent challenges in waste disposal have triggered a paradigm shift within the cosmetic industry, highlighting the significance of sustainable packaging. This transformation not only underscores the imperative for eco-friendly solutions but also represents for the cosmetic industries a pivotal moment to catch new opportunities of growth and innovation, also in response to consumers' growing concern and emphasis on sustainable packaging.

Against this backdrop, the aim of the thesis is to explore consumer response and preferences related to a selection of environmentally sustainable packaging innovations for cosmetics.

A review of existing literature was carried out to investigate the relationship between the cosmetics industry and environmentally sustainable packaging. The review of existing research has identified a theoretical gap: existing literature

primarily focuses on analyzing the technical and environmental properties of innovative substitute materials for cosmetics packaging, leaving a void in understanding consumer preferences toward such innovations. By contrast, this study employed a survey involving respondents to evaluate a selection of environmentally sustainable packaging solutions, identified by the analysis of both cosmetic industry and cross-industry real case studies. This approach allowed for a clear and effective understanding of customer preferences for the environmentally sustainable packaging innovations proposed. Therefore, the study seeks to answer the following question: (Q) Among the six presented solutions of innovative environmentally sustainable packaging for cosmetics, which are the most promising for the market?

Answering the research question, the study aims to give businesses concrete insights on customer preferences for the proposed cosmetic packaging innovations.

2. Theoretical Background

The present section examines the pivotal role of cosmetic product packaging concerning environmental sustainability, exploring strategies to reduce packaging's environmental impact by focusing on the use of biopolymers as promising alternatives to traditional plastics.

The widespread use of petroleum-based plastics has led to a dramatic increase in plastic waste production, prompting growing consumer awareness of its negative environmental impact and concerns about waste management and bioeconomy regulations. In response, biopolymers derived from biological sources have emerged as promising alternatives. However, despite thorough analysis in research and prototypes, these solutions have yet to be widely adopted by the cosmetic industry.

Among the examined biopolymers, PolyLactic Acid (PLA), derived from renewable resources such as sugarcane or cornstarch, demonstrated versatility in both rigid and flexible packaging. Despite its biodegradability and compostability, PLA might present challenges in terms of compatibility with specific cosmetic formulations. [1]

Polyhydroxyalkanoates (PHAs), derived from bacterial sources, emerged as another promising alternative. Although they may come with slightly higher costs than PLA, their biodegradability and skin compatibility make them attractive for cosmetic packaging. [1]

Materials like chitosan, derived from crustacean shells, and seaweed-based materials like alginate, carrageenan, and agar, have been considered for their antimicrobial properties and film-forming capabilities. However, while promising, these materials require further evaluation concerning durability and product integrity. [1] [2]

Moreover, materials like nanocellulose, derived from renewable resources and characterized by lightweight, biodegradability, and potential cost-effectiveness, showed great potential for both the food and cosmetic industries. [3]

Furthermore, also papaya, pomegranate peel powder, and aloe vera reveal as promising sustainable alternatives. Papaya's accessibility and potential cost-effectiveness make it an appealing option, while pomegranate peel powder's potential

for eco-conscious biofilms requires further assessment on costs and mechanical properties. Aloe vera, recognized for its antioxidant benefits in food coatings, presents promise for cosmetic packaging, though further specific research is needed for its applicability. These natural materials show potential for eco-friendly packaging, emphasizing the need for thorough evaluation before industry adoption. [4] [5]

The use of innovative biopolymers such as PLA, PHAs, and others examined represents significant progress toward sustainable packaging. However, their widespread implementation in the cosmetic industry requires further research and evaluations to ensure their suitability in meeting the specific requirements of cosmetic packaging.

The literature review provides an overview of the different eco-friendly biopolymer options applicable to cosmetic packaging, emphasizing the need for further research and specific testing to ensure the effectiveness and compatibility of these materials with the cosmetic industry's needs.

3. Case Studies: Cosmetic Companies' Sustainability Practices in Packaging & Cross-Industry Innovations

This section of the thesis examines how cosmetic companies are managing environmental sustainability in packaging by presenting various case studies. Out of twenty-four identified cases, six standout examples have been chosen for an in-depth analysis. These case studies highlight the industry's ongoing commitment to eco-friendly practices and serve as potential models for adopting solutions from adjacent industries within the cosmetic sector.

The identified case studies span from the cosmetics sector to packaging innovations from adjacent industries, showcasing the potential for adaptation within the cosmetics industry. These include:

- Refillable Aluminum Packaging: P&G Beauty and Unilever have introduced refill practices to reduce the use of virgin plastic.
- Refillable Plastic Packaging: NIVEA has implemented refill stations for shower gels.

- Refillable Biodegradable Packaging: NENDO, NEEK SKIN ORGANICS and Lush present biodegradable solutions to reduce waste.
- Single-use Biodegradable or Compostable Packaging: Axiology Beauty and L'Oréal propose compostable or easily recyclable packaging solutions.
- Recycled Material for Packaging: Beiersdorf uses recycled PET for products like NIVEA Fresh Blends.
- Material and Weight Reduction of Packaging: NIVEA developed a body lotion in a thinner and more flexible package, while Albéa presents a lightweight and reduced closure system.
- Eliminate the packaging: Lush shifts to naked product significantly reducing plastic waste
- Reduce the overpackaging: the locking system used in the food industry for jam jars eliminates the need for additional packaging, demonstrating a sustainable and practical approach in the cosmetic industry, inspired by the good practices of the food industry.

Out of these case studies carefully analyzed, six standout examples have been chosen for an in-depth subsequent analysis and the choice has been guided by three core principles: innovation, sustainability, and profitability. The six environmentally sustainable packaging innovations selected are: the “Dissolvable Shower Sachet”, the “Paper Hand Soap Dispenser”, the “Biodegradable Clamshell for Perfume”, the “Biodegradable Jar for Skincare Cream”, the “Jar with safety click-clack system for Skincare Cream” and the “Biodegradable seaweed capsules for Face serum”.

The “Dissolvable Shower Sachet” offers a unique approach to packaging shower gel, presented in sheets enclosed within dissolvable sachets. These sachets dissolve upon contact with water, ultimately reducing waste substantially compared to traditional alternatives.

The “Paper Hand Soap Dispenser” combines a recyclable paper carton with a reusable dispenser pump, effectively replacing single-use plastic soap dispensers.

The “Biodegradable Clamshell for Perfume” consists in a biodegradable outer packaging, which represents a notable departure from traditional solutions that involve cardboard boxes wrapped in plastic film.

In the realm of skincare, the “Biodegradable Jar for Skincare Cream” is a significant advancement. Crafted from a special compostable polymer called Vivomer, this jar decomposes entirely without leaving any harmful residues. This innovative material contributes to ecosystem enrichment when composted, marking a substantial stride in sustainable packaging solutions.

The “Jar with safety click-clack system for Skincare Cream” ensures product integrity without requiring additional packaging, enhancing convenience and eco-friendliness. Comprehensive product information is conveniently located directly on the jar, eliminating the need for extra packaging.

Lastly, the “Biodegradable Seaweed Capsules for Face Serum” consists in biodegradable capsules, made from seaweed which align with efforts to reduce plastic dependency. The selected solutions are reported in Table 1.





	Dissolvable Shower Sachet
	Paper Hand Soap Dispenser
	Biodegradable Clamshell for Perfume
	Biodegradable Jar for Skincare Cream
	Jar with safety click-clack system for Skincare Cream
	Biodegradable Seaweed Capsules for Face serum

Table 1 - Selected Sustainable Packaging Innovations for Cosmetics

These packaging solutions illustrate innovative and eco-conscious approaches across various product lines, aiming to reduce environmental impact while maintaining functionality and convenience for consumers.

4. Research Methodology

A survey was conducted to collect data regarding individuals' response and preferences towards the environmentally sustainable packaging innovations for cosmetics proposed, addressing the research question. The survey was developed both in Italian and English to target as many people as possible, then the results have been converged to be analyzed. The survey was launched in November 2023 and concluded after a two-week period. The survey was designed using Google Forms and shared through three distinct channels:

WhatsApp, Instagram and LinkedIn. The survey is composed by four sections: demographics, respondent clustering, importance and knowledge of sustainability in cosmetics packaging for the customer and evaluation of each environmentally sustainable packaging innovation proposal.

The first section aims at gathering all the demographic data necessary to learn more about respondents, including information about: gender, age and country of residence.

The second section aims at clustering respondents in: spending profiles (Luxury, Entry-level luxury, Premium and Mass) and then in purchase frequency profiles, according to their frequency of purchase of cosmetic products (Weekly + A couple of times a month, Once every two months and Two or three times a year).

The third section aims at collecting information about the importance and knowledge of sustainability in cosmetics packaging for respondents.

The fourth section aims at investigating the participant's response to the six environmentally sustainable packaging innovation proposals: the "Dissolvable Shower Sachet", the "Paper Hand Soap Dispenser", the "Biodegradable Clamshell for Perfume", the "Biodegradable Jar for Skincare Cream", the "Jar with safety click-clack system for Skincare Cream", the "Biodegradable seaweed capsules for Face serum". Firstly, for each packaging innovation proposed it's been investigated: respondent inclination to adopt the new solution over the traditional one; respondent price expectation for the new proposal, with respect to the traditional solution; respondent concerns about the use of the new proposal; respondent overall impression on the new proposal. Secondly, it's been evaluated respondents' inclination towards environmentally sustainable packaging innovations across various demographic segments, considering age groups, spending profiles, and purchase frequency profiles. Finally, the six proposed environmentally sustainable packaging innovations have been compared according to: the preferences expressed by the respondents (measured analysing the willingness-to-pay expressed by the respondent for each solution); the potential market success of each solution (measured combining the analysis of the willingness-to-pay expressed by the

respondent for each solution with the purchase frequency profile of the respondent).

5. Results and Discussion

The total number of answers collected is 223 (218 answering to the survey in Italian, 5 answering to the survey in English). The findings coming from the survey allow to provide a comprehensive response to the research question “*Q: Among the six presented solutions of innovative environmentally sustainable packaging for cosmetics, which are the most promising for the market?*”, where the potential market success has been measured combining the analysis of the willingness-to-pay expressed by the respondents for each packaging solution with the frequency of purchase of the respondents. Indeed, the analysis highlights the **"Biodegradable Jar for Skincare Cream"** as the most promising solution in terms of potential market success, followed closely by the **"Paper Hand Soap Dispenser"** and the **"Jar with safety click-clack system for Skincare Cream"**. These outcomes are further corroborated by a comparative analysis of participants' preferences for the six solutions presented. Notably, these solutions, besides being those with the highest potential for market success, also emerge as the favorites among respondents: the Biodegradable Jar for Skincare Cream stands out as the favorite among the others, followed closely by the "Jar with safety click-clack system for Skincare Cream" and the "Paper Hand Soap Dispenser". The results are reported in Table 2 and Table 3.

Packaging Innovation	Potential Market Success (expressed in score)
Biodegradable Jar for Skincare Cream	195,75
Paper Hand Soap Dispenser	178
Jar with safety click-clack system for Skincare Cream	176
Dissolvable Shower Sachet	169
Biodegradable Clamshell for Perfume	163,5
Biodegradable seaweed capsules for Face serum	161,25

Table 2 – Packaging Innovations in Comparison: Potential Market Success

Packaging Innovation	Respondents Preferences (expressed in score)
Biodegradable Jar for Skincare Cream	88
Jar with safety click-clack system for Skincare Cream	80,75
Paper Hand Soap Dispenser	79,5
Dissolvable Shower Sachet	75
Biodegradable Clamshell for Perfume	74,5
Biodegradable seaweed capsules for Face serum	71,5

Table 3 – Packaging Innovations in Comparison: Respondents Preferences

In light of these discoveries, various suggestions can be offered to cosmetic firms regarding the introduction in the market of the environmentally sustainable packaging innovations that resulted as the most promising in terms of market potential, namely the “Biodegradable Jar for Skincare Cream”, the “Paper Hand Soap Dispenser” and the “Jar with safety click-clack system for Skincare Cream”. In the conducted analysis, it was observed that most respondents expect to pay either an equal or higher price for the new solutions compared to traditional ones. Beyond pricing, the analysis of consumers' preemptive concerns for innovative solutions revealed that the “Paper Hand Soap Dispenser” raised considerable worries among participants regarding the resistance and the durability of the packaging. Clearly, although this solution has emerged as one of the favorites, it has also elicited consumer considerable concerns. Hence, it's advisable for companies to consider these expectations and apprehensions expressed by consumers to fully harness the market potential of these innovations. Lastly, the analysis of the results clearly showed that different age groups showed a more or less homogeneous interest in investing in eco-sustainable packaging solutions, with some age groups (36-45 and 18-25) exhibiting a higher inclination with respect to the other groups. Furthermore, “Luxury” profiles displayed the highest inclination among the different spending profiles. Regarding purchase frequency profiles, the different groups showed a more or less homogeneous interest in investing in eco-sustainable packaging solutions, with frequent buyers showing to be slightly less inclined to shift to these solutions. Based on these results,

companies should tailor their marketing strategies for innovative solutions by considering the preferences across various generations, distinct spending profiles, and diverse purchase frequency patterns among participants.

6. Conclusions

This thesis contributes to research in both the cosmetic industry and environmental sustainability domains. It explores consumer responses to six environmentally sustainable packaging innovations selected out of twenty-four real case studies identified, offering valuable insights for cosmetic companies seeking to market these innovative solutions effectively.

Through the analysis of the findings, significant insights have been acquired, leading to the identification of future developments and the recognition of certain limitations.

Indeed, given that the survey predominantly garnered responses from Italian participants, the findings might not directly apply to consumers in other nations. Subsequent research endeavors could concentrate on conducting analogous studies in different countries to explore commonalities or discrepancies, aiming for a more holistic comprehension of the subject matter.

Another limitation of the study concerns the analysis of case studies aimed at identifying innovations in sustainable packaging evaluated by the participants. While this analysis provides a current snapshot of the situation, it's crucial to consider that the landscape of innovations is in constant evolution. Future research could focus on emerging new solutions, thereby providing an updated and in-depth picture of progress in the realm of sustainable packaging.

Finally, considering that the solutions presented to the respondents reflect their current state without any rendering done to make these solutions visually appealing, respondents might have been negatively influenced in their responses. Future research endeavors could also delve into rendering to elicit more accurate consumer responses.

7. Bibliography

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