

## Possibilities of reducing the volume of plastic packaging for consumer chemicals

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*One of the most significant environmental problems currently addressed is an effort to reduce the volume of plastic used for packaging. Theoretically, the volume of plastic packaging can be reduced in a number of ways, but not all of them are practically applicable. So far, it is not yet clear which savings options for primary plastic packaging are suitable for consumer chemicals (detergents, washing and sanitary products). This article offers one of the possible approaches for such savings. It presents the results of primary qualitative research whose main objective was to reveal innovations of primary plastic packaging for consumer chemicals that would be feasible by the manufacturer and, at the same, appreciated by customers. The research reported herein was carried out in two consecutive stages. The first one was realized in a company which can be considered a typical producer of consumer chemicals focused on the identification of possibilities to save plastic waste from primary packaging from the manufacturer's point of view. In this research, the method of semi-structured interview was used; the main respondent being the process engineer of the company. The second stage was carried out with final consumers with a focus on revealing the main environmental requirements of the final customers for primary packaging for consumer chemicals. Data collection at this stage of the research was carried out using the group discussion method. The subsequent comparison of the results from both phases of the research enabled to identify suitable environmental innovations of primary plastic packaging, as well as barriers that will have to be overcome when implementing these innovations.*

**Keywords:** Sustainable packaging; Consumer chemicals; Plastic packaging waste

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## Introduction

Environmental protection is currently focused on reducing emissions, energy and water consumption, but also on reducing food and packaging waste [1]. The manufacturing sector is also trying to save the volume of packaging in which various products are marketed. Saving of packaging in companies is one of the key elements supporting the implementation of business strategies focused on efficiency and sustainability [2]. In order to increase the efficiency, manufacturers aim to reduce the volume of packaging in general; in terms of sustainability, it is of the utmost importance to reduce the volume of plastic packaging. This is usually a relatively big problem for manufacturers as plastics are widely used in the packaging industry. Packaging plastics are, in fact, very suitable as they are cheap and lightweight material with universal use [3]. The plastic packaging market has been the most widespread branch since the mass transition to disposable packaging [4].

On the other hand, plastic packaging waste strongly affects the environment. Large quantities of such packaging are released into the surrounding nature and only 14 percent of all plastic containers are being recycled after use [3]. Of the 8 million tons of plastic waste that enters the ocean annually [3], a significant part is plastic waste [4].

The enormous environmental problem of plastic packaging forces the manufacturers to change their customs. They are looking for ways to leave a convenient solution for increasing the sustainability of their products and the packaging in which are contained. For example, the management of Unilever has promised that, by 2025, all of its plastic packaging would be fully reusable, recyclable, or compostable in a commercially viable manner [3]. Achievement of these commitments will require a large degree of redesign and innovation [3].

The possibilities of packaging innovation (at all levels) for the sake of sustainability are also of interest in the academic sphere. García-Arca and Prado-Prado (2008) addressed this issue in the retail sector [5], having formulated a number of new approaches that could potentially lead to more ecologic ways in packaging, including:

- product innovations to change its weight, shape or size,
- changing the package size,
- changes in palletization, with or without changing the size of the primary packaging,
- changes in the number of units in the package,
- standardization of formats,
- reducing the number of references on the packaging,
- changes in the type or quality of material used,
- changes in graphic design,
- changes in the packaging process, and
- wider use of returnable packaging.

The approaches surveyed above apply to all levels of packaging, i.e. primary, secondary and tertiary. Concerning innovations in environmental packaging for consumer chemicals, Atkinson [6], Makower and Pike [7] and Dharmadhikari [8] have addressed this issue. While Atkinson [6] and Makower and Pike [7] state the possibility of saving plastic packaging through product concentration, Dharmadhikari [8] has focused on more environmentally friendly packaging materials.

Our previous qualitative research was also devoted to savings of plastic packaging for consumer chemicals. It revealed that these options for technical and technological innovation were identified for selected product (toilet cleaner) [9]:

- replacement of plastic with another material (including bioplastic),
- use of recycled plastic in the manufacture of packaging,
- increase of active ingredient content – production of concentrated product,
- change of product form (e.g. capsule),
- change of colour of the plastic packaging,
- introduction of plastic packaging reuse,
- application of packaging recycling, and
- introduction of a packaging-free system for sale of consumer chemicals.

However, customer needs and requirements must also be taken into account when innovating packaging for sustainability. They buy and use many products that are packaged in plastic [10] and increasingly value sustainable products, i.e. products with positive social and/or environmental attributes [11]. Statistics indicates an increasing number of such customers [9]. However, it is true that the environmental sustainability of products is not primary in their decision-making. First, they focus on the functionality of the product, and assess the environmental attributes of the product only subsequently [12]. Nevertheless, in making decisions to purchase a product, the environmental attributes can significantly influence one's decision. In fact, the consumers consider only a part of attributes of the purchased product or service, making decision mainly on the basis of comprehensive assessment of the value that brings something to them [12].

As for the environmental attributes of a product that customers evaluate, it can be a wide portfolio of aspects that relate to the product itself, its packaging, or other features of supply. However, knowing the environmental attributes that customers are considering is extremely important for manufacturers. If manufacturers intend to realize a successful innovation of primary packaging in order to save plastics, they must not only know these environmental requirements of customers but also take them into account. Since this link, the connection between customer's environmental requirements and the innovations of plastic packaging for consumer chemicals for the sake of sustainability, has not yet been addressed in the literature, the issue has become our concern.

Therefore, this paper deals with the possibilities of saving plastic packaging from the point of view of the consumer-chemicals manufacturer, as well as the environmental requirements of final consumers for packaging of these products. Our report presents the results of two-stage primary qualitative research carried out both in a company that represents typical manufacturer of consumer chemicals, and among the consumers. It confronts the results of both stages, emphasising that innovations of plastic packaging that are feasible by the manufacturer have some value for customers. The identification of these options, including the barriers to overcome when implementing such innovations, can be considered the main output of this scientific paper.

### **Goals of Research and Methodology**

The aim of the primary research was to identify the possibilities of saving plastic waste from packaging for consumer chemicals that are feasible from the producers' point of view and, at the same time, appreciated by final consumers. Two-stage qualitative research was carried out to achieve the objectives.

The first stage of the research was carried out in a chemical company that can be considered a typical representative of manufacturers of consumer chemicals (detergents, washing and sanitary products). The aim of this stage was to identify the possibilities of reducing the volume of plastic waste from primary packaging from the manufacturer's perspective. The data collection was realized by the method of semi-structured interview with the company's process engineer. Based on the content analysis discussed in the interview, 17 potentially feasible innovations were identified, including expected barriers associated with such implementation.

The second stage of the research was carried out with final consumers. The aim of this phase was to identify the main environmental requirements of final consumers for primary packaging of consumer chemicals. The data were collected using the group discussion method, which included 8 respondents. The criterion for the respondent's inclusion in the group discussion was both his/her active decision-making on the purchase of consumer chemicals and his/her active interest in environmental protection (i.e. the need or at least willingness to purchase eco-friendly products). A video was taken from the group discussion to capture all the statements and interactions of the participants. Based on the content analysis of the video recording, the main environmental requirements of final consumers for primary packaging for consumer chemicals were specified.

Comparison of the results from both phases of our research has allowed us to identify suitable innovations of primary environmentally friendly packaging, as well as the barriers and problems that will have to be overcome during their implementation.

## Results and discussion

The first stage of primary research has resulted in the identification of a broad portfolio of not only technical innovations, but also innovations in selected business processes that help reduce the volume of plastic waste from primary packaging from consumer chemicals. Unfortunately, it has also found that in almost all cases the identified innovation is associated with a significant barrier to its implementation in the enterprise. The results of this stage of research are shown in Table 1.

**Table 1** Possibilities and barriers to reduce the volume of plastic waste primary packaging from consumer chemicals in the manufacturer's perspective

Innovation	Barriers to innovation
Thinning of the plastic packaging	Only if the packaging has no supporting function
Replacement of plastic material with another type of material (bag in box)	High packaging costs, need to solve the method of dosing
Combination of materials to reduce plastic content - e.g. plastic and glass	Not identified
Replacement of material with higher transparency	Environmental benefits are negligible The volume of plastic used remains unchanged The innovation only facilitates recycling
Replacement of a part of the plastic packaging with another material - saving the lid of the plastic box	Not identified.
Reuse of plastic packaging through refilling (purchase of fillings)	Problem with maintaining the quality of the contents - for example, washing capsules may become wet or crushed
Change of the colour of the plastic packaging for easier recycling	Decreasing the appeal to the final consumer
Use recycled plastic in packaging production	25 percent or more recycled content in the packaging plastic significantly reduces the strength of the packaging Recycling companies are not able to supply recycled materials of sufficient quality to the market
Technological innovation in the packaging production - bubbling	Significant cost increase, uneconomical option with respect to production volumes
Increased concentration of consumer chemicals	Problem with products that the customers dispense themselves (threat of skin damage)

**Table 1** Possibilities and barriers to reduce the volume of plastic waste primary packaging from consumer chemicals in the manufacturer's perspective (continued)

Innovation	Barriers to Innovation
Change of the product form - 2in1, 3in1 products	Especially feasible for personal hygiene products, but the environmental benefits are low
Increased use of primary packaging (more content)	Unsuitable option for liquid consumer chemicals - threat of leakage of contents (both in packaging, retail and consumer)
Sales of products in larger packages	Expiration problem, the need to avoid wastage due to unused product
Change in the selling method - through package-free shops	The problem of ensuring the microbiological safety of the product Necessity of induced changes in packaging and distribution
Introduction of plastic packaging reuse	The company does not have facilities to wash and disinfect packaging that can be repeatedly filled; refilling is not yet technologically possible The problem is the collection of packaging Retailers are not interested in participating in the collection of packaging by manufacturer Reuse is uneconomical compared to the use of new packaging (costs of collection, washing, inspection, storage) There are induced environmental impacts on wastewater and wash water consumption
Subsequent use of packaging in the home - e.g. for cleaning and/or gardening	Not identified
Application of recycling	The company does not have a packaging return system or recycling system in place

The subsequent research phase led to the identification of environmental requirements of final consumers for packaging for consumer chemicals. Consumers require primary packaging to:

- contain a larger quantity of product (i.e. could be purchased a larger quantity at a time),
- be of a single type of packaging material,
- not be composed of inseparable layers of different packaging materials (e.g. outer plastic foil or inner lining), i.e. the packaging consists of only one layer of packaging material,
- contain only a low percentage of synthetic plastic,
- be made (or part thereof) of recycled plastic,
- be recyclable,
- be degradable,

- match the size of the contents (not packed with large amounts of air at the same time),
- not be coloured (not contain colour additives),
- not exist; i.e. the product could be purchased without packaging (e.g. in a packaging-free shop).

At the same time, other customer requirements have been identified that can influence the form of plastic packaging innovations for sustainability. These requirements include the request to concentrate the consumer chemicals. For customers, this product innovation means not only saving plastic packaging, but also reducing the amount of products that have to be used once. Finally, the above list of requirements includes environmentally-oriented information on packaging. Final customers prefer to include certificates and eco-labels on such a product packaging.

By comparing the manufacturer's views on possible variants of plastic packaging savings with that of the environmentally-oriented consumer, it was possible to identify innovations that are meaningless for manufacturers in terms of the increasing customer value. Customers will not appreciate:

- thinning of the plastic packaging,
- combination of materials in the production of packaging (a plastic combined with another material),
- changes in the colour and transparency of the packaging material,
- possibility to purchase the content for refilling the packages,
- 2-in-1 or 3-in-1 product variants, or
- take-back of plastic packaging for reuse.

The implementation barriers for these variants are less important. Indeed, the manufacturer should focus on the use of packaging made of a single, environmentally friendly material (degradable and recyclable). Also, the packaging should consist of only one layer. If it has to be made of plastic, it should contain a recyclable polymer. Products should be sold in concentrated form, in larger packages that would be highly utilized. Also suitable is the introduction of packaging-free sale of some consumer chemicals.

With innovations that customers will appreciate, it makes sense to particularly consider overcoming barriers to their implementation. Removal of such barriers means:

- ensuring that the product is correctly dispensed by the consumer,
- extending the shelf life of the product,
- providing recycled plastic for packaging (or buying packaging from a supplier offering a recycled plastic in packaging),
- ensuring a sufficient amount of funds for implementation of these and secondary innovations.

## Conclusions

The results of primary research and their discussions have shown that there are possibilities to save plastic used for packaging consumer chemicals. The identification of such possibilities can be inspiring, but applicable ways cannot be generalized for the time being as they are based only on qualitative research carried out in limited conditions – with one manufacturer and a certain group of final consumers.

In order to develop this knowledge and to obtain widely valid results, we assume a follow-up quantitative research. Again, it will be implemented in two phases, both with manufacturers and final consumers. Such a follow-up research with final consumers will focus on identifying the importance of environmental packaging requirements for consumer chemicals, as well as revealing appropriate classification features that would indicate differences in consumers' attitudes. The follow-up research at manufacturers of consumer chemicals will also concentrate on the mapping of the feasibility of the individual innovations and assessing the universal validity of barriers. It is expected that both these phases should significantly deepen our knowledge in the field of innovations of environmentally oriented packaging for consumer chemicals.

## References

- [1] Beitzel-Heineke E.F., Balta-Ozkan N., Reefke H.: The prospects of zero-packaging grocery stores to improve the social and environmental impacts of the food supply chain. *Journal of Cleaner Production* **140** (2017) 1528–1541.
- [2] García-Arca J., González-Portela Garrido A.T., Prado-Prado J.C.: “Packaging Logistics” for improving performance in supply chains: The role of meta-standards implementation. *Production* **26** (2016) 261–272.
- [3] MacArthur D.E.: Beyond plastic waste. *Science* **358** (2017) 843.
- [4] Geyer R., Jambeck J.R., Law K.L.: Production, use, and fate of all plastics ever made. *Science Advances* **3** (2017) e170078.
- [5] García-Arca J., Prado-Prado J.C.: Packaging design model from a supply chain approach. *Supply Chain Management: An International Journal* **13** (2008) 375–380.
- [6] Green Packaging: Waste not, want not.  
<https://www.inboundlogistics.com/cms/article/green-packaging-waste-not-want-not/>  
(accessed January 22, 2020).
- [7] Makower J., Pike C.: *Strategies for the green economy: Opportunities and challenges in the new world of business*. McGraw-Hill, New York 2009.
- [8] Dharmadhikari, S.: Eco-friendly packaging in supply chain. *The IUP Journal of Supply Chain Management* **9** (2012) 7–18.



- [9] Branská L., Paták M., Pecinová Z.: Innovation of customer chemicals packaging in concern of sustainability, in: Jedlička P., Marešová P., Firlej K., Soukal I. (Eds.): *Proceedings of the international scientific conference Hradec Economic Days 2020*. University of Hradec Králové, Faculty of Informatics and Management, Hradec Králové 2020, p. 61–67.
- [10] Taufik D., Reinders M.J., Molenveld K., Onwezen M.C.: The paradox between the environmental appeal of bio-based plastic packaging for consumers and their disposal behaviour. *Science of the Total Environment* **705** (2020) 1–10.
- [11] Luchs M.G., Naylor R.W., Irwin J.R., Raghunathan R.: The sustainability liability: Potential negative effects of ethicality on product preference. *Journal of Marketing* **74** (2010) 18–31.
- [12] Chen C.-C., Chen C.-W., Tung Y.-C.: Exploring the consumer behavior of intention to purchase green products in belt and road countries: An empirical analysis. *Sustainability* **10** (2018) 854–870.