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Consumer complaints about food packaging

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Today, the public's perception of food packaging is primarily negative, which is mostly triggered by factors such as the use of (fossil) resources, waste generation, and (marine) littering. Accordingly, the (re)design of packaging is focusing in particular on environmental sustainability (e.g., recyclability). However, it seems that in parallel, consumer experience and satisfaction continue to decline, which is reflected in numerous online complaints about packaging. Building on related European food and packaging legislation, dissatisfaction, and consumer complaint behavior (CCB) literature, this study aims to analyze online consumer complaints and identify underlying causes using the Netnography method. Over 250 complaints were collected, categorized, and evaluated based on images shared online, and as a result 12 design categories were identified that triggered significant dissatisfaction among consumers. These include food packaging that implies a higher quality or quantity of products through text-based information, design elements such as graphics, certain packaging sizes, windows, and sleeves as well as the seemingly excessive use of packaging material. The subsequent discussion shows that the consumer perspective and the legal framework have many points in common and that a different realization of the already existing requirements can avoid dissatisfaction in many cases. As a result, this study provides stakeholders from research, development, and politics with an important basis for significantly increasing consumer satisfaction along with the ecological (re)design of packaging.

KEYWORDS

packaging, design, consumer, complaint, dissatisfaction, netnography, communication

1. Introduction

1.1. Improvement of packaging designs

In the scientific literature, it is well established that food packaging fulfills essential functions such as containment, protection, communication, and convenience and thus allows food to be provided in the desired quality and quantity on the (inter)national market. Although packaging is indispensable and, in many cases, prevents negative environmental impacts by preventing or reducing food losses and waste, it is currently at the center of public and political debates. The major background to this is that packaging is related to severe environmental challenges such as the use of (fossil) resources and often poor end-of-life management, resulting in ever growing packaging waste streams or (marine) littering (Robertson, 2009, 2013; Verghese et al., 2012; European Commission, 2022a).

Against this background, stakeholders along the food supply chain including producers, fillers, retail, and policy makers desperately strive for more sustainable packaging options.

This is reflected in ever stricter goals, metrics, regulations, and directives, such as significantly increasing recycled content in packaging applications as well as the recycling rates in the European Union (European Parliament, Council of the European Union, 1994; Vergheese et al., 2012; European Commission, 2022a).

While these urgently needed developments are very much to be welcomed, they also add to the complexity of packaging design, which can be already regarded as a balancing act between different (legal) requirements (e.g., food and packaging quality and safety, labeling, design, processability, and costs). In addition, there is a wide range of expectations from stakeholders, such as retailers and consumers (Envirowise, 2008; Robertson, 2009, 2013; Vergheese et al., 2012; Singh et al., 2017). While the former can communicate these directly and explicitly to its supplier, the latter group faces obstacles. Reasons for this are, for example, the great diversity of the group, the various accompanying personal perceptions, as well as the collected and condensed transmission of information back to responsible stakeholders. This holds enormous potential for tension in this group, which already considers packaging to be environmentally harmful or unnecessary (European Parliament, Council of the European Union, 2006b; European Union, 2012; Otto et al., 2021).

It is therefore particularly important to better understand consumers and to take their perceptions into account when (re) designing packaging. This is also highlighted in recent European Union publications, some of which aim to empower consumers and strengthen their understanding and role in driving forward future-relevant issues such as waste prevention and circular economy (European Parliament, Council of the European Union, 2006b; European Commission, 2020, 2022a).

1.2. Consumer dissatisfaction and complaints

For this purpose, it is necessary to take a closer look at the background of consumer complaint intentions and behavior (CCB). Usually, the origin (necessary condition) for consumer complaints is dissatisfaction (Boote, 1998; Arora and Chakraborty, 2020), which is a dominant research area across multiple disciplines (Li et al., 2020). The variety of the used theoretical approaches such as research traditions, taxonomies, and classifications, shows the diversity of the topic [see for example (Boote, 1998) for theories, (Palací et al., 2019) for different approaches, and (Arora and Chakraborty, 2020) for a summary of existing definitions]. The widely accepted disconfirmation of expectations theory explains consumer (dis)satisfaction as emerging from the comparison between *a priori* expectations and *a posteriori* perceived performance of a product or service (Oliver, 1977), and usually a negative disconfirmation results in dissatisfaction (Oliver, 1980). It should be noted that dissatisfaction (the feeling of being deceived or cheated), can have different dimensions, and the term “deceived,” for example, can span from regulatory versus behavioral or objective versus subjective deception (Armstrong et al., 1980; Xie and Boush, 2011; Germelmann and Held, 2014). Regarding packaging related dissatisfaction, some of the observed trigger factors can be the need to unpack small items from huge packaging solutions, broken seals, spillage during opening, the accumulation of multiple waste pieces or packaging layers as well as “everything but easy-to-open” packaging. In addition, factors like misleading communication

and price changes can be named (European Union, 2012; Statista GmbH, 2022).

One of the reaction styles to dissatisfaction is complaining. There were many traditional attempts to classify the various types of CCB (see classifications by Singh, 1988 or Hirschman, 1970), among which four types are often discussed: exit, voice, negative word-of-mouth (WOM), and third-party action. Unfortunately, the traditional taxonomies fail to reflect current technological and behavioral changes, therefore have been expanded (Boote, 1998; Ferguson and Johnston, 2011), or even regarded as outdated with the rise of the Internet (Lee and Cude, 2012). With the availability of the Internet as a complaint channel, comments can easily become public: consumers now complain not just to their close network, but to millions of other consumers (“one-to-many” communication) rapidly (Berry et al., 2014) and negative WOM cannot be considered consumers’ private complaining behavior anymore. Online platforms are equally useful for consumers and brands: platforms make it easier for consumers to quickly express their (negative) opinions, therefore have emerged as important forums for consumer voicing (Bach and Kim, 2012), but are also important information sources for brands to improve their product (service) quality. However not handling those comments properly can also harm a brand’s reputation.

Therefore, in accordance with the above, online complaints (or in other words public negative WOM or badmouthing without contacting the brand) has been viewed as a part of CCB, and are interpreted here as a consumer’s response to dissatisfaction (including situations where one might have felt misled or deceived but is not limited to such situations) regarding the food purchase and consumption experience (Istanbulluoglu et al., 2017), and includes any reason why a consumer did not rate specific food packaging as satisfying.

1.3. Packaging-related dissatisfaction and complaints

Analyzing available literature regarding packaging design, it quickly becomes clear that there is an abundance of marketing-relevant publications, recommendations for technical design aspects (e.g., design for recycling), and consumer perception *per se* (Regattieri et al., 2012; Steenis et al., 2017; European Commission, 2018; FH Campus Wien and Circular Analytics TK GmbH, 2021). However, the topic of consumer perception in combination with (dis)satisfaction and related complaints, seems to be left out of the discussion. This might stand in relation to the different strategies of complaint handling along the supply chain or consumers complaint behavior (European Union, 2012).

However, some exceptions in literature exist, which analyze packaging designs in relation to dissatisfaction, such as for their potential to mislead or deceive. For instance, Germelmann and Held (2014) investigated the identification of deceptive food packaging by consumers based on different designs. For this purpose, consumers’ expectations gathered in questionnaires were compared after visual inspection and product tasting. It turned out that in addition to text-based information, graphics can also be a source of deception (Germelmann and Held, 2014). Furthermore, Weinrich et al. (2018) placed filling heights and the use of graphics (serving suggestions) at the center of their research. Here, the targeted variation of

front-of-pack information on product ingredients and the assessment of appropriate fill heights showed the following: neither modified text-based information next to graphics (serving suggestions) nor text-based information on technically necessary fill heights did significantly influence the perception of overpackaging (Weinrich et al., 2018). In the same context, Wilkins et al. (2016) analyzed how deceptive packaging, including downsizing and air and slack filling, are experienced and processed by consumers. For this purpose, the researchers used images of different filling quantities to trigger reactions of the test persons and showed possible negative consequences for manufacturers if they apply practices of filling quantity reduction that are common today (Wilkins et al., 2016). Beyond that, digitized analytical methods, such as eye-tracking, opened the possibility of answering more specific consumer perception questions. An example is Clement et al. (2017), who focused on potentially misleading elements (Clement et al., 2017). Last but not least, some authors research on opening of packaging as well as related injuries and, thus, related dissatisfaction of consumers (Caner and Pascall, 2010).

1.4. Legal perspectives

Picking up on terms such as “misleading elements” and “overpackaging” and turning to the legal perspective of food and packaging in the European Union, it becomes clear that a strong legal basis already exists. For example, the regulation (EC) No 178/2002 (general food law) states that food products have to be safe and that they shall not mislead consumers (European Parliament, Council of the European Union, 2002). Further, the directive 94/62/EC on packaging and packaging waste, defines that packaging volume and weight should be limited to the minimum adequate amount (European Parliament, Council of the European Union, 1994).

However, reality shows that there is a large gap between these intentions and consumer perception. In this relation, a briefing paper on Misleading Packaging Practices was published in 2012, addressing the question of whether specific legislation on the issue is needed. There, misleading packaging was described as a practice letting consumers think that “...there is a greater quantity of the product, than is actually the case, that the product is of a better quality, or that the product possesses certain other characteristics...” (European Union, 2012). Along with this, absent or wrongly indicated prices, packaging sizes, wrongful or misleading information through design, and packaging design imitations were mentioned as problematic and conflicting packaging examples from various member states were discussed in its annex (European Union, 2012). It was summarized that packaging solutions must be evaluated case by case and investigations of consumers attitudes or behavior were recommended (European Union, 2012).

Next to that, the briefing paper provides a definition of misleading packaging, namely “...misleading packaging is any kind of product packaging including, e.g., packaging size, form or design that notwithstanding a cursory examination deceives or is likely to deceive the average consumer, particularly as to the quantity or the quality, but also other main characteristics of the product and related to the product, taking into account as well comparisons of the product in its current state to previous packaging and to competitors’ packaging, and which causes or is likely to cause the average consumer to make a transactional decision that he would not have taken otherwise.” (European Union,

2012). Finally, existing directives were discussed. This included the Directive 2005/29/EC concerning unfair business-to-consumer commercial practices in the internal market (European Parliament, Council of the European Union, 2005), the Directive 2006/114/EC concerning misleading and comparative advertising (European Parliament, Council of the European Union, 2006a) as well as Directive 98/6/EC on consumer protection in the indication of the prices of products offered to consumers (European Parliament, Council of the European Union, 1998). The conclusion then suggested certain amendments of the directives, the creation of, *inter alia*, shared databases and European Standards (European Union, 2012).

Building upon this briefing paper, the Commission Notice—Guidance on the interpretation and application of Directive 2005/29/EC discusses misleading commercial practices using practical examples. This includes specific product characteristics such as “...availability, benefits, risks, execution, composition, accessories, after sale customer assistance and complaint handling, method and date of manufacture or provision, delivery, fitness for purpose, usage, quantity, specification, geographical or commercial origin or the results to be expected from its use, or the results and material features of tests or checks carried out on the product...” (European Parliament, Council of the European Union, 2005).

1.5. Research need and aim

While around a decade ago, a large proportion of consumer agencies dismissed the topic of misleading packaging as rather unimportant (European Union, 2012) and statements such as “...that misleading packaging practices do only have one negative consequence for consumers which is their disappointment...” (European Union, 2012) could be found, this perspective now seems outdated as a result of the developments and conditions described above. Accordingly, the trend is toward developing sustainable and at the same time consumer-oriented packaging solutions (Verghese et al., 2012; European Commission, 2020, 2022a).

To support this transition, the present study examines options for (re)designing food packaging from a new perspective—namely the combination of consumer research with the evaluation of online complaints. This can be regarded as an enabler to reflect on consumer experiences that finally led to public online complaints. Although it is difficult to collect data on initial consumer expectations (Wilkins et al., 2016) one can still investigate the complaint behavior and therefore extrapolate what would have been expected packaging-wise. Although it is clear that not every complaint, wherever it occurs (e.g., purchase, consumption), can be understood from a scientific or technological point of view, analyzing and dealing with this topic can nevertheless contribute to continuously improving packaging (Robertson, 2009, 2013; Verghese et al., 2012). Hence, the tension between expectations from producers and consumers as well as negative feedback outcomes (e.g., company losses) can be addressed, and at best, decreased. In addition, new knowledge about, for example, the handling of packaging by consumers could be created (e.g., collection, pre-sorting, and recycling). Therefore, the aim of the present study is to answer the following research questions (RQs):

- RQ1. Which topics dominate publicly available online complaints about food packaging?
- RQ2. Which food categories are particularly affected?

RQ3. Which measures can be taken to avoid similar complaints in the future?

As a result, this study provides stakeholders from research, development, and politics with an important basis for significantly increasing consumer satisfaction along with the ecological (re)design of packaging.

2. Materials and methods

Since the World Wide Web (Internet) is a popular and practical means of communication, one can find an almost infinite amount of data here today. This includes images, thoughts, feelings as well as complaints shared and discussed by consumers. In order to gain a deeper insight into complaints related to food packaging, the present qualitative study employed a method that has already been used to explore similar questions in the past—namely Netnography (Festila and Chrysochou, 2018; Dörnyei, 2020). This method by Kozinets (2002) is referenced as “...ethnography on the Internet...” (Kozinets, 2002) and represents an applied research method based on the observation of online channels. In this context, the formulation of research questions as well as the identification and understanding of online channels and their participants can be seen as a starting point. Then, the points collection and analysis (“recontextualization”) are performed. All in all, Netnography can be considered a realistic, unobtrusive, time-efficient and inexpensive research method that allows researchers to gain insights into consumers’ opinions in an inconspicuous manner (Kozinets, 2002). Accordingly, the method is used as a tool to diagnose, evaluate and understand acceptance and attractiveness of packaging solutions. Further, and in comparison, to consumer surveys, the method delivers a high quantity of responses within a short time, even with a low budget. A drawback exists, however, in the richness of the description. Nevertheless, Netnography has been shown to facilitate the creation of (hidden) taxonomies and categories as demonstrated in a previous packaging-related research (Dörnyei and Gyulavári, 2016).

In the present research, the Netnography method as described by Kozinets (2002) was applied as follows:

First, publicly shared pictures of dissatisfactory food packaging solutions were identified as the “...focused and research question relevant segment...” that provided sufficient “...detailed or descriptively rich data...” (Kozinets, 2002) for the following data collection and analysis. The justification of using pictures beside text-based information is that pictures provide a more objective base for the complaint, allowing researchers to understand the complaint in various dimensions and categorize complaints into redesign for packaging developers. The search was then carried out independently by a group of researchers with the help of the Google search engine. English was set as the main search language and the keywords included combinations of: bad packaging, bad food packaging, bad packaging examples, evil packaging, deceptive packaging, dishonest packaging, and unnecessary packaging. Please note that the word “complaint” was not among the search terms, because when consumers complain, they do not use this word, but rather the unsatisfactory end result, such as “unnecessary packaging.” Furthermore, there was no restriction regarding the origin (country) of the data.

Overall, the nature of the researcher’s participation was passive. Hence, they did not participate in online communication, but rather observed the found cases. The online postings were understood as intentionally public content and permissions to use the data to identify contextual complaints were not requested. The question of whether online data is ethical was therefore omitted (compare Kozinets, 2002). Further, none of the accessible data on individuals (usernames etc.) were processed.

The resulting pictures as well as information on keywords used, weblinks, access dates, and product descriptions were collected in a shared online spreadsheet. Websites that summarized individual pictures (secondary sources), mostly from posts on social media channels, proved helpful in this search ($n=21$, see Annex A) and redirected to primary sources. Data collection took place between summer and autumn 2021, until a theoretical saturation was reached. Subsequently, pictures referring to non-food products were excluded and duplicates were deleted. The final dataset included a total of 250 pictures and thus represents a snapshot of online consumer complaints about food packaging (see Annex B for descriptions).

In a next step, the present qualitative research included manual coding of the dataset. First, six researchers contextualized and described the pictures independently. In cases where the picture alone was not sufficient (e.g., packaging size or color), the corresponding complaint text was used for support. Then, the image descriptions (words, sentences) were clustered until individual, easily distinguishable and, as far as possible, non-overlapping categories emerged. In this context, it should be mentioned that most cases could be assigned to a specific category. However, about 10 % were assigned to a maximum of two categories. The overlap was considered insignificant as no quantitative categorization was aimed at.

Afterwards, a lead scientist and two further researchers developed descriptions for the categories in an iterative process. In addition, the cases found were assigned to specific food categories using the Guidance document describing the food categories in Part E of Annex II to Regulation (EC) No 1333/2008 on Food Additives (European Commission, 2017a). As there was no category for compound foodstuff (e.g., prepared meals), this was added by the authors (referred to as $n. 0$). This enabled a rough quantitative evaluation by product category (see Annex B).

3. Results and discussion

3.1. Categorization of complaints

Based on the data set, a total of 12 complaint categories were recontextualized, respectively, identified, which allow us to answer the first research question (RQ 1), namely which topics dominate publicly available online complaints about food packaging (see Table 1). Interestingly, it can be clearly seen that communication, a basic function of packaging, is the most pressing issue for consumer complaints. This basic function usually allows legally required (e.g., labeling), necessary (e.g., bar codes), or voluntary (e.g., certificates) information to be transferred as well as marketing (e.g., brand image; Robertson, 2013). Specific examples for complaints are explicit text-based or graphical information. In contrast to communication, the other basic functions of packaging, namely containment, protection, and convenience (Robertson, 2013), were subordinated topics of the

TABLE 1 *Recontextualized* online complaints.

Complaint category
I. Unclear, hard-to-read, or incorrect text-based information about ingredients, manufacturing processes or origins
II. Unclear, hard-to-read, or incorrect text-based information about product size or pieces
III. Relabeling
IV. Too much information
V. Unesthetic or uncommon design
VI. Graphics implying certain ingredients, (ingredient) amounts or manufacturing processes
VII. Unclear or beautifying colors and color schemes
VIII. Hiding or showing specific parts through, e.g., windows or sleeves
IX. Closures and sealings
X. Expensive packaging solutions
XI. Packaging sizes, formats, or waste amounts versus product sizes
XII. Unnecessary use of packaging or a certain selected packaging material

complaints. In contrast, the sustainability of packaging was, as expected, another focus of the complaints. The dissatisfaction of the consumers was particularly evident in the areas of packaging size, packaging format as well as waste generated in relation to product quantity or size. These are all points that primarily refer to the efficiency and recyclability of packaging. Two of four key factors in the design of sustainable packaging. The other two, namely the effectiveness and safety of packaging (Vergheze et al., 2012), were only of minor importance in the present study. Last but not least, consumers also criticize the use of packaging *per se*. This was particularly the case with high-convenience products. Especially in the last point, the authors suspect that in some cases it was the exaggerated degree of convenience (e.g., peeled bananas), and not the packaging, that triggered the complaint. In summary, it can be said that communication and sustainability are the most important drivers of consumer complaints.

The closer analysis of the collected data set provides an overview of the complaint categories per food category and allows us to answer the second research question (RQ 2), namely which food categories are particularly affected (see Table 2). Here it quickly becomes apparent that the food groups fruits and vegetables ($n=59$), confectionary ($n=44$), and bakery wares ($n=26$) most frequently cause consumer complaints. Other categories such as beverages, dairy products, and analogs as well as cereal and cereal products are behind. The fewest complaints were found in the category sugars, syrups, honey, and table-top sweeteners ($n=1$). These results are in line with the literature, where fruit packaging is mentioned among the top consumer concerns (especially overpackaging; IPSOS Mori, 2008; Vergheze et al., 2012; Bovensiepen et al., 2018). Furthermore, confectionery packaging is largely known for excessive packaging design. This can be explained by their hedonistic function and use as gift articles (Robertson, 2013; Wolf, 2016).

In the following, research question 3 (RQ 3), namely the question of possible solutions to avoid such consumer complaints in the future, will be addressed and answered. For this purpose, results emerging from RQ 1 and RQ 2 are examined in more detail. This includes: category description, cause identification, and prevention approaches. The latter point in particular is discussed against the background of

the relevant specialist literature and European legislation. This can serve as a basis for future research and action to increase consumer satisfaction with food packaging.

3.2. Outcomes and mitigation measures

3.2.1. Text-based complaints

Text-based information is an important part of communication and therefore a basic packaging function (Robertson, 2009). It can be discussed in the context of on-pack as well as accompanying information like advertisements, the latter however, is out of the scope of this work. At the stage of purchase and consumption, multiple requirements exist for giving (e.g., mandatory) information about food products. According to Regulation (EU) No 1169/2011, its purpose is to allow “...consumers to identify and make appropriate use of a food and to make choices that suit their individual dietary needs.” (European Parliament, Council of the European Union, 2006b). With unclear, hard-to-read or simply incorrect text-based information, this purpose is hardly attainable. Overall, text-based elements and their design on packaging can have a strong influence on the purchasing decision in the cases studied. They implicate various expectations and were seen to have a high potential for dissatisfaction if unclear, hard-to-read, incorrect, or similar.

3.2.1.1. Unclear, hard-to-read, or incorrect text-based information about ingredients, manufacturing processes or origins

In the category of mostly qualitative text-based complaints, it was found that consumers discussed multiple dissatisfactory scenarios of packaging design they came across. Text-based on-pack information, which should make it clearer for consumers to assess the product characteristics, was shown to cause dissatisfaction with food packaging. Most often, the following issues were mentioned:

- hard-to-read ingredients in cases where more valuable ingredients were easier to read than less valuable ones;
- unclear/misleading information about manufacturing methods and origins;
- unclear/misleading or incorrect information about nutrients or focus groups (such as claiming to include or be free from certain ingredients, being natural, for kids or similar);
- highlighting favorable nutrient contents that can only be reached by combinations with other products;
- unclear information about percentages of value ingredients; and
- unclear or misleading product names.

Interestingly, sustainability issues were not found in this context, although environmental claims pose a rising issue discussed on the European level (European Commission, 2005).

Starting with the mentioned cases about hard-to-read information, one can stress that the legibility of text-based information is regulated in (EU) No 1169/2011, *inter alia* in terms of font size, colors, and contrasts etc. This helps in questions of uncertainty of packaging design, also with objected to accentuations of value ingredients (quantitative ingredient declaration). Another issue found online is the unclear information about origins and manufacturing. Both aspects can also be found in (EU) No 1169/2011 (Article 7), as

TABLE 2 Complaint categories in food categories (database containing $n=250$ products)*.

		Complaint categories											
		Unclear, hard-to-read, or incorrect text-based information about ingredients, manufacturing processes or origins	Unclear, hard-to-read, or incorrect text-based information about product size or pieces	Relabeling	Too much information	Unesthetic, uncommon design	Graphics implying certain ingredients or (ingredient) amounts or manufacturing processes	Unclear or beautifying colors and color schemes	Hiding or showing specific parts through, e.g., windows or sleeves	Closures and sealing	Expensive packaging solutions	Packaging size, format, or waste amount versus product size	Unnecessary use of packaging or a certain selected packaging material
Product categories	0. Compound foodstuff ($n=21$)		3				1		10	1		5	1
	1. Dairy products and analogs ($n=16$)	1					2		4	1		12	
	2. Fats and oils and fat and oil emulsions ($n=3$)	1						1				1	
	3. Edible ices ($n=3$)									1		2	
	4. Fruits and vegetables ($n=59$)	1	1					1				10	47
	5. Confectionery ($n=44$)		2				2		8	2	1	34	
	6. Cereal and cereal products ($n=13$)	1	3					1	3			9	1
	7. Bakery wares ($n=26$)	3		1		1	5		2			14	
	8. Meat ($n=12$)	1					1		4			8	
	9. Fish and fishery products ($n=5$)								4			1	
	10. Eggs and egg products ($n=5$)											5	5
	11. Sugars, syrups, honey, and table-top sweeteners ($n=1$)	1											
	12. Salts, spices, soups, sauces, salads, and protein products ($n=10$)		1			1		1	1	1		6	
	13. Foods intended for particular nutritional uses ($n=2$)	1			1	1							
	14. Beverages ($n=20$)	8	1		1		1		1	2		8	1
15. Ready-to-eat savories and snacks ($n=10$)		2				1		1			7		

*Some food products cover more than one category. Therefore, given numbers do not sum up to $n=250$.

“...information shall not be misleading...as to its...country of origin or place of provenance, method of manufacture or production;” (European Parliament, Council of the European Union, 2006b). For text-based statements from the collected sample that deal with complaints about on-pack communication like “free-from...” or information about specific nutrients, regulation (EC) No 1924/2006 on nutrition and health claims made on foods gives potential guidance. Also focus groups are contextually discussed therein (e.g., kids; European Parliament, Council of the European Union, 2022).

Overall, “Food information shall be accurate, clear and easy to understand for the consumer...” (European Parliament, Council of the European Union, 2006b), which was, reflecting the consumers’ perspectives, not achieved in the online cases. In the worst case, one could argue that incorrect information can undermine “...the protection of consumers’ health and the safe use of a food.” (European Parliament, Council of the European Union, 2006b) as it might be the case with unclear information about ingredients. Comparing this information to the perspectives mentioned in European Union (2012), consumers most likely would have taken transactional product choices in the discussed cases if information would have been clear to them. Considering legislative prerequisites, text-based information must be checked thoroughly before bringing a specific product to the market. To respect different perceptions of consumers, one could even trial the clarity of implicit and explicit text-based information, in the sense of how consumers understand the given information via packaging (compare, e.g., Weinrich et al., 2018). Particularly, the effects of phrases that somehow might indicate that products are made for certain groups, for example more vulnerable ones must be thoroughly evaluated before applied as on-pack communication. Directive 2005/29/EC (Annex I) concerning unfair business-to-consumer commercial practices too touches upon this topic and gives guidance applicable to packaging design (European Parliament, Council of the European Union, 2005).

3.2.1.2. Unclear, hard-to-read or incorrect text-based information about product size or pieces

Like above, this category deals with complaints about text-based information, but quantity related. In the collected cases, unclear information about packaging- and product sizes was criticized. Frequently, complaints were made that certain product sizes were indicated larger or smaller than previous or comparable products. In addition, cases were criticized where the packaging was enlarged and/or the filling quantity was reduced, especially when measures were taken to cover this up. Overall, consumer confusion due to general or generic statements about size or size changes could be shown and statements about products being (extra) large, medium or small or of a specific size for sharing was shown to dissatisfy consumers, as it does not necessarily meet their expectations. Furthermore, complaints discussing incorrect information about the number of contained pieces were found.

Relating to amounts, giving the net quantity of a food in units of volume (e.g., liquids) or mass is one of the basic mandatory indications that is stated in Regulation (EU) No 1169/2011. Some exceptions are listed in its Annex IX, for example in cases where food products are normally sold by number, given that these are visible or indicated via labeling (Annex IX 1c). However, generally speaking, it is stated that *i.a.* the information about quantity shall not mislead (European

Parliament, Council of the European Union, 2006b). Therefore, one can discuss if a verbal description rating sizes of products as being big, large or similar should better be avoided.

The topic of shrinking products (downsizing, “grocery shrink ray”; Robertson, 2013) and changing or not changing the packaging’s appearance is an exceptional perspective in this category. It is not only about what is said, but also about what is not clearly communicated. Currently (2022), this topic is becoming more pressing looking at increasing product prices (Statista GmbH, 2022). It was already addressed in 2012 and discussed that this practice might not be fully covered by given frameworks and thus could be regarded as a misleading practice (e.g., p. 13, 41, and 96; European Union, 2012). If product shrinkage is found to be necessary for whatever reason, enlarging the packaging size or adding buzzwords like *big* or *large* to distract from changes is unacceptable. It should rather be clearly indicated. Consumers are found to be more vulnerable in such situations: they do not always check the product’s weight and do not expect such price increases (Singh et al., 2017; European Parliament, Council of the European Union, 2022).

3.2.1.3. Relabeling

Another issue that arises in the context of text-based information is relabeling. Consumer complaints were primarily about relabeling of products to communicate a different shelf-life than apparently originally intended (replacement or over-sticking of label).

Providing correct information via labeling of products is essential in the supply chain (e.g., 178/2022; European Parliament, Council of the European Union, 2002), e.g., for the traceability in case of necessary recalls (e.g., Rapid Alert System for Food and Feed; European Commission, 2022b). For some scenarios, relabeling can be necessary, for example in cases of imported goods to align with national law (QMFI, 2021). Regulation (EU) No 1169/2011 deals with changing information about food: “...Food business operators, within the businesses under their control, shall not modify the information accompanying a food if such modification would mislead the final consumer or otherwise reduce the level of consumer protection and the possibilities for the final consumer to make informed choices. Food business operators are responsible for any changes they make to food information accompanying a food...” (European Parliament, Council of the European Union, 2006b). Cases of shelf-life relabeled products and communication about these can be found online (Ruhr Nachrichten, 2021).

To avoid dissatisfied consumers in cases of necessary relabeling, open communication should help. As it is generally not forbidden to sell expired products (except for products with a use-by-date) this fact can be communicated at the point of sale (Verbraucherzentrale NRW eV, 2021). Instead of (only) relabeling products by over-sticking labels with new ones that are easily detachable, an explanatory second label that does not hide the previous could at best avoid confusion. Consumers seemed to be especially irritated in the cases in which they found different shelf-life labeling without explanation.

3.2.2. Text- and graphic-based complaints

Under text- and graphic-based complaints, two categories are discussed. Both deal with consumer complaints that refer to either way of communication and were found to be dissatisfactory packaging practices.

3.2.2.1. Too much information

This category offers another perspective that packaging design needs to take into account, namely that too much information can also make it difficult for consumers to understand product features and decide on a product. Although communication about products is crucial through food packaging (compare above categories and [European Parliament, Council of the European Union, 2006b](#)), it can also annoy, challenge, and even overwhelm consumers ([Kalnikaite et al., 2013](#)). In the present study, the issue of too much information referred especially to the food categories of bakery wares and beverages. Here, intended amusing slogans about ingredients were criticized by consumers.

Packaging design must therefore take into account that many consumers base their product choices on only a few cues and may ignore others when making quick decisions, e.g., at retail. Often, even the price is the sole and leading decisive criterion. Other decisive criteria are, for example, nutritional information (“health”) and brand/packaging ([Kalnikaite et al., 2013](#)). Therefore, if additional, optional information (such as non-standard nutritional information) is presented, it may interfere with the assessment of more important cues ([Hawley et al., 2013](#)). Based on this, the need and extent of these optional, text- and graphic-based information should be evaluated case-by-case. This was also shown by [Hawley et al. \(2013\)](#) who conducted research on labeling types and consumer understanding.

3.2.2.2. Unesthetic, uncommon design

Whether packaging is esthetic or not is a very subjective rating. What one might find appealing or appropriate is unattractive or inappropriate for another person. This category of unesthetic, uncommon design was added as a complaint category to carry out the discussion of what people are design-wise used to and what they claimed to subjectively dislike. The online found cases focused on uncommon, irritating designs and communication. Examples *inter alia* dealt with the use of widely known non-food packaging formats for food products and vice versa (e.g., personal care products).

Packaging allows the recognition of certain products, *i.a.* for an easy product selection ([Robertson, 2013](#)). If designs are out of well-known schemes, one can get attention for products, but also irritate consumers as the analyzed data shows. This might probably have negative effects, if, e.g., non-food products are packaged in food-like packaging (which was also found in the online complaints but was rated as out of scope of this study). Besides that, such examples are also present in product recalls and can be found online in the reporting system ([European Commission, 2022c](#)). However, this shows overall that packaging design induces expectations and that design of (food) packaging out of expected schemes can be critical in every-day life. If one reflects the different packaging designs in existing food environments, a basic understanding of what consumers might find (un)common or (un)esthetic for product groups in certain regions, can be derived and might help to avoid irritations. This is also interesting in considering color schemes (compare complaints about colors in category VII). Reflecting at this point again, e.g., Regulation (EU) No 1169/2011 ([European Parliament, Council of the European Union, 2006b](#)), discussing in chapter III, article 7, that also “... (b) the presentation of foods, in particular their shape, appearance or packaging...” should be “...accurate, clear and easy to understand...” packaging that is found to be uncommon (therefore not easy to understand) should be rethought.

3.2.3. Graphic-based complaints

Graphics can be seen as part of the basic communication function in packaging design ([Robertson, 2013](#)). Symbols like pictograms as well as pictures/images can provide multiple information, implicitly and explicitly ([Robertson, 2013](#); [Dörnyei et al., 2022](#)). A unique graphic design via decoration is regarded as important in packaging communication, *i.a.* for a product’s identity or differentiation ([Ampuero and Vila, 2006](#); [Robertson, 2013](#)). The printing of packaging and packaging elements is common for various products at different packaging (*i.e.*, primary, secondary, and tertiary) and supply chain levels ([Robertson, 2013](#)). A multitude of decoration options like printing processes (e.g., letterpress, flexography, flexo process, gravure, intaglio, offset and digital ink-jet, or electrophotography) allows specific design depending on materials, and even product protection (e.g., light protection; [Campbell-Platt, 2009](#); [Robertson, 2013](#)).

3.2.3.1. Graphics implying certain ingredients or (ingredient) amounts or manufacturing processes

The collected sample that was categorized under graphics that induced dissatisfaction includes complaints about the disuse of certain depicted ingredients, depicted amounts of used ingredients, and the number of depicted pieces, product origins and manufacturing processes. Consumers who were dissatisfied, mostly thought of higher amounts of value ingredients, they expected different product decoration, fillings or toppings (e.g., confectionary and bakery wares) or product shapes, more pieces than actually present or hand-made or national production, where it was neither hand-made nor a produced good from an indicated provenance.

In this regard, Regulation (EU) No 1169/2011 gives again guidance, as it also deals with the use of graphics on food packaging ([European Parliament, Council of the European Union, 2006b](#)). The principle of Quantitative Ingredients Declaration (QUID) sets certain rules for graphics on packaging and defines cases in which ingredients have to be quantified, which meets most of the issues addressed by consumers: “...The indication of the quantity of an ingredient or category of ingredients used in the manufacture or preparation of a food shall be required where the ingredient or category of ingredients concerned: ... (b) is emphasized on the labeling in words, pictures or graphics;” (2. Obligation to indicate QUID, 5.). QUID applies *inter alia* “(ii) where pictorial representation is used to emphasize selectively one or more ingredients...;” or “...(iii) where an ingredient is emphasized by an image evoking its origin...” (2. Obligation to indicate QUID, 11.). Exceptions exist for cases like serving suggestions, representations of all food ingredients and preparation instructions ([European Commission, 2017b](#)). Although QUID in relation to packaging design is probably not a general rule for the use of graphics, but rather a rule for the declarations if one uses graphics, it can help the consumer to better understand the composition of the food product and be properly informed about value ingredients. To avoid dissatisfaction, one could apply trials with different designs before marketing. The evaluation of certain packaging designs, similarly to [Germelmann and Held \(2014\)](#) who studied different tea packages, can show if a mismatch between expectations and product characteristics exists. If this is the case, the exchange of the causal cues seems appropriate.

3.2.4. Complaints about graphics and material use

The following two categories deal with complaints that were related to both, graphical as well as structural elements of material use. The “blurred” visual impression of products through mostly colored packaging material and the use of packaging elements like windows or sleeves is in focus. Both can be seen as aspects in the sense of the communication function, but are also related to product protection (e.g., protecting from light through the use of colors or opaque packaging and giving on the other hand insight to a product’s appearance; [Campbell-Platt, 2009](#); [Robertson, 2013](#)). Furthermore, the perceived ecological sustainability was discussed online in the collected cases.

3.2.4.1. Unclear or beautifying colors and color schemes

Complaints in this category dealt mainly with packaging intensifying the colors of products (film wrap) and confusing or alike color schemes for different products of the same brands or in between brands, against the consumers’ intuitions or expectations. Interestingly, complaints about ecological sustainability in the context of color use were not found in the online sources.

Addressing consumer issues with colors, packaging designers should have in mind what people associate with certain colors and that it is a way to distinguish between products and product groups as well as to evaluate quality criteria. While black for example, might suggest elegance and higher prices, white is seen as a color for “reasonably priced” products ([Ampuero and Vila, 2006](#)). Next to that, color also transports information, for example about the quality and freshness of meat or the ripening of fruits and vegetables ([Robertson, 2009](#); [Robertson, 2013](#)). Even specific taste expectations are related to colors ([DLG eV, 2017](#)). In packaging design, one must further consider that the expectations for product properties based on colors can vary between regions. [Ampuero and Vila \(2006\)](#) for example discussed that “patriotic products” were associated with the color red of the national flag (Spain) in their study. Even studies about colors in packaging design, dealing with issues of global acceptability of products can be found ([Aslam, 2006](#)). Also [Germelmann and Held \(2014\)](#) used different color schemes in their evaluation of tea packaging to trial the detection of deceptive packaging.

If it comes to packaging that gives unclear information by colors about, for example, the usage (like product group specific packaging colors), the food products properties (such as freshness) or if it beautifies/intensifies the products’ very own color, and consumers can get irritated and dissatisfied. If products are hard to distinguish from others or if used colors distort the selection at the point-of-sale in ways like covering quality related criteria, consumers can have hard times making informed choices. This goes against the goal of providing food information if one reflects on one hand the discussed perspectives from Regulation (EU) No 1169/2011 and the definition of misleading packaging on the other hand ([European Parliament, Council of the European Union, 2006b](#); [European Union, 2012](#)).

3.2.4.2. Hiding or showing specific parts through, e.g., windows or sleeves

The use of packaging elements like windows and sleeves has different functions in food packaging and was a cause for dissatisfaction. Whereas windows mostly provide sight of the actual product’s appearance, sleeves can be used for labeling purposes, to

decorate areas, stabilize specific packaging types like thin-walled cups or even combine multiple consumption units (such as in dairy products). With the use of sleeves, the access to and visibility of areas behind potentially is restricted and might need interaction by opening or removal.

These circumstances were part of multiple complaints about, e.g., cardboard boxes with and without trays, cups, trays with cardboard or plastic sleeves as well as partly transparent flexible film packaging. Dissatisfaction about the actual product amount or the overall ratio of value ingredients were in most cases the addressed issues, also in combination with the amount of packaging material used. Hidden levels of filling heights with windows on the lower part of the packaging solution or sleeves or labels on the upper part were frequently found. Specific sizes of outer packaging combined with a partial sight to the product but hollow structures or unused space in inner levels, invisible until consumption, were found too. The presentation of value ingredients (for example toppings on various products) through transparent areas like windows was a source of dissatisfaction, if the rest of the product did not look alike.

Taking away the consumers’ possibility to analyze filling amount versus packaging size besides obligatory weight information, makes it hardly possible to decide at the point-of-sale if product-to-packaging ratios are found appropriate or not. Although some requirements might induce the need for hollow spaces or certain headspace in packaging, for example, to mechanically or chemically protect products ([Robertson, 2013](#)), several products were criticized that seemingly took advantage of this argument and parallel placed products in visible areas behind windows or hid empty rooms behind sleeves or labels. As this overall increases the use of packaging material, the ecological sustainability in the light of material efficiency can be and also was questioned by the consumers. Hiding or showing of specific product parts induces certain expectations about its composition. If these are not met after unpacking, dissatisfaction is likely, and redesign should be considered. One can come back to the General Food Law, reflecting that “...the ... presentation of food ..., including their ... packaging, the packaging materials used, the manner in which they are arranged and the setting in which they are displayed... shall not mislead consumers.” ([European Parliament, Council of the European Union, 2002](#)). Qualitative aspects like the presentation of certain, maybe decisive or value ingredients should therefore not show specific parts if the rest of the product contains less of the same ingredients. Furthermore, hollow packaging parts and or unused spaces should be avoided if these are not intended for protective needs. If the product’s properties induce such necessities, this fact should be clearly communicated to avoid expectations of higher product quantities. Overall, the efficiency of solutions, where windows and sleeves potentially hide unused packaging space should be analyzed in detail to meet 94/62/EC, Annex II, saying that “...packaging volume and weight be limited to the minimum adequate amount to maintain ... safety, hygiene and acceptance for the packed product and for the consumer” ([European Parliament, Council of the European Union, 1994](#)).

3.2.5. Complaints about material use

This section contains four categories of complaints that could be connected to qualitative and quantitative issues of material use. The complaints deal one more time with the basic function of communication, as well as the functions of protection, containment,

and convenience. In the online collected cases, discussions concerning the ecological sustainability of the products were frequently found as well.

3.2.5.1. Closures and sealing

In the online complaints, different issues with closures and sealings were discussed. Mostly these referred to detached seals or reclosures and unpractical or hard-to-open solutions. More detailed, the cases dealt with detached seals from plastic films on metal trays, detached seals in single tea bags and flow-packs, detached reclosure in pouches, hard-to-open rigid lids on boxes and shrink film to secure screwcaps, spillage through opening and incorrectly attached spouts on beverage cartons. Hence, in the collected cases the proper containment of the products and secondly, product protection were not met, which was linked to spillage and potential hygiene problems. Packaging intended for reclosure that was not further actually re-closable, was related to convenience (e.g., “*apportionment function*,” “*convenience of use*”; Robertson, 2009) and similarly to product protection (such as for dry, powdery products that could not be reclosed, and probably taking up water). Hard-to-open packaging solutions, on one hand hindering the safe opening for the operating person (the need of scissors), and on the other hand, causing spillage during apportionment, were found as well.

The (effective) closure of packaging solutions is an important factor providing product protection, proper containment, convenience and, by avoiding food waste, supporting sustainability (Robertson, 2009). Reflecting Robertson (2013), the closure and sealing function have different main goals: effective seals, opening and resealing as well as tamper evidence. Furthermore, four types of closures are distinguished: “*Closure to retain internal pressure*,” “*contain and protect contents*,” “*maintain vacuum inside container*,” and “*to secure contents inside container*” (Robertson, 2013). Next to this perspective, various sealing types and sealing techniques exist (Robertson, 2013).

In this category, dissatisfaction and redesign are related to the material selection as well as applied closures and sealing systems. To ensure the enduring functioning of closures and sealing, packaging testing like shock testing, vibration testing, compression testing, and atmospheric testing (for example temperature and humidity) can be run to understand the impacts of handling along the supply chain (Singh et al., 2017). If these shortcomings had been detected at an earlier stage, a great number of the cases collected online could have been possibly prevented. Furthermore, packaging that was found to be hard-to-open by consumers could have been avoided too. For example, peel tests, tear growth tests, and tests about sealed-seam strength can be applied to detect the mentioned situations (ZwickRoell GmbH and Co. KG, 2022). Caner and Pascall (2010) investigated aspects of this category, as they analyzed the openability of 10 packaging types and even the related risks for injuries. Legal perspectives about closure and sealings could be looked at from the perspective of safe food (European Parliament, Council of the European Union, 2002): Ineffective seals can pose multiple hygienic risks.

3.2.5.2. Expensive packaging solutions

In this category dealing with expensive packaging solutions, consumers were dissatisfied with available identical food products, when the price per kilogram product showed big differences between

packaging solutions (for example rectangular versus irregularly shaped boxes). The price per kilogram product was in one solution less than half the price of a comparable second one.

Overall, the costs of packaging are a part of everyday purchases of fast-moving consumer goods and include for example the material costs, cost for handling and labor, storage, disposal, reuse, and other positions. While it is easy to understand that certain packaging solutions can be more costly than others, e.g., if they involve enhanced packaging technology or induce for example higher disposal costs, also the use of specific formats is a matter of costs, reflecting less efficient transportation (Verghese and Lewis, 2007; Verghese et al., 2012). The material choice that goes hand in hand with protection, the types and sizes of the containments, the packaging elements allowing convenience and the design for communication purposes, are all part of these costs (Verghese and Lewis, 2007; Robertson, 2009; Verghese et al., 2012). Comparing available products in retail, the packaging costs, for example, in limited editions or products with gift functions can be higher than in comparable products with conventional packaging solutions (Robertson, 2013; Dörnyei, 2020). The higher costs can be incurred at any step in the supply chain, whenever efficiency or effectiveness is impaired in an aspect (transportation reflecting stacking, folding etc.; Verghese and Lewis, 2007; Verghese et al., 2012).

To avoid dissatisfaction about costs, communication seems to be key. The advantages of the more expensive packaging solution must be clearly communicated. If not, consumers cannot see the point in paying higher product prices per kilogram of the same product with packaging variations, as the data shows. The willingness to pay for visible benefits is higher if consumers are properly informed, for example in the context of morality and ecological benefits of products (Thøgersen, 1996; Robertson, 2013). Reusability of packaging could be such a benefit, reflecting that this behavior is generally given for some packaging solutions: Caner and Pascall (2010) for example, analyzed convenience functions (specifically opening) of different packaging solutions. Consumers were asked if they had reused packaging after emptying the main product, depending on the packaging types. The reuse of plastic and glass bottles/jars was reported by approximately 22 and 37% of the study's participants (Caner and Pascall, 2010).

3.2.5.3. Packaging size, format, or waste amount versus product size

This category mostly describes complaints about situations in which consumers found that the packaging solutions were inefficient and wasteful compared to the contained product. On one hand, people were dissatisfied about perceived overpackaging/wasteful packaging in the light of environmental problems and secondly, they felt tricked by slack filling/ half-full packages. Many examples criticized had large packaging solutions as outer layers, often with inner layers that used very little of the possible space provided (likewise to category VIII dealing with specifically showing or hiding product characteristics). Furthermore, single packaged units of products were discussed by consumers.

Packaging sizes and formats vary depending on products and producing companies. While packaging must be effective, it is also necessary to be efficient. The latter can be evaluated through the ratio between product and packaging that describes their weight relation (Verghese et al., 2012). Although science agrees that there

is an optimal point of packaging between material use and product protection (product waste; compare for example graphic depictions like “The Innventia AB Model”), the food environment in retail offers manifold products within food categories with seemingly lavish or efficient packaging solutions (Dörnyei et al., 2022). Referring to the consumer’s impression about wasteful packaging and looking at slack filling, the European Briefing Paper, 2012 discusses it as misleading if non-functional (European Union, 2012).

However, whether the considered cases are ecologically unsustainable, depends on multiple aspects, potentially including aspects overseen by consumers. Life cycle assessment (LCA) is a broadly accepted approach to analyze such cases (Vergheze et al., 2012). Next to that, shelf-life and stress tests can help to determine how much packaging material is necessary to provide, e.g., a barrier for product protection (Robertson, 2009, 2013), dealing with the question of adequate amounts of packaging material (Annex II of Directive 94/62/EC; European Parliament, Council of the European Union, 1994). Touching upon this topic, one can add that it can currently be found online that in public consultations of the initiative on “Reducing packaging waste—review of rules,” Article 9 of 94/62/EC (European Parliament, Council of the European Union, 1994; Essential requirements) is asked to prospectively include the issue of overpackaging (European Commission, 2022d). The issue of dissatisfaction with sizes and waste amounts is also pressing in e-commerce, looking at the cases. That frustration free e-commerce packaging is worked out, was already reported in 2012 (Vergheze et al., 2012).

Concerning the complaints about wasteful packaging in combination with small product amounts, like in multipacks, the question of realistic consumption/portion sizes can give guidance to avoid absurdly small units and unnecessary packaging waste. In many settings, consumers probably eat more than one cheese slice (such as 25 g each) and multiple instead of single cookies (such as 7 g each) at once. While smaller consumption units allow on one side the prevention of food waste, the packaging waste amounts can be higher (Ecoplus, BOKU, denkstatt, OFI, 2020; Dörnyei et al., 2022).

3.2.5.4. Unnecessary use of packaging or a certain selected packaging material

Food packaging is frequently discussed under the perspective of environmental sustainability and consumers have the opinion that for many product categories, packaging, mostly plastic packaging, is unnecessary (Vergheze et al., 2012; Robertson, 2013). In online complaints about specific products, this impression was strong in certain categories, mostly fruits and vegetables. It very often dealt with flexible film wraps, partly in combination with expanded trays [for example expanded polystyrene (PS)]. Furthermore, the unpacking of foods like fruits and vegetables from natural protective layers like peels or shells and repacking it into non-biodegradable counterparts/conventional plastic packaging was criticized multiple times (such as for coconuts, citrus fruits etc.), this was also true for eggs. Prepared products with higher convenience levels like pre-cut pieces and their need for more sophisticated packaging were often discussed and likewise reasons for consumers being dissatisfied. Next to that, the wrapping of single fruits and vegetables that can on one hand easily be sold in bulk due to their relatively small sizes and, furthermore, amounts that do not match realistic consumption behavior, were a

basis for complaints (single potatoes, single berries etc.). Furthermore, one could find criticism referring to specific material selections, like the use of PS trays.

In the mentioned cases, avoidance of higher convenience levels as well as informative messages can be discussed as options to bridge the gap between expectation and technological needs of products. Single initiatives in retail already try to follow such educational strategies and one can partly find messages about the packaging itself on the products (Dörnyei et al., 2022). Overall, this is a category where consumption patterns (like avoidance) could make a difference, probably at most concerning high-convenience products that might use elaborate packaging solutions, resource intensive production and different packaging waste amounts compared to alternative products that are neither pre-cut, nor peeled, boiled or differently prepared. However, one can find that the sales of convenience products rose over the last years and this product type is said to be trending (Vergheze et al., 2012; Agrarmarkt Austria Marketing GesmbH, 2022). Redesign in some of the cases in this category is hard to reach, as technically, pre-cuts etc. need protective packaging, for example, against unfavorable color changes (Robertson, 2013).

3.3. Overall impression and future steps

Collecting and analyzing the complaints about packaging that consumers shared online; a deepened understanding of packaging practices that dissatisfy consumers could be developed. Its inclusion in redesign processes seems important to improve the situation. Comparing the issues that consumers mentioned against packaging perspectives from selected European law, one can sum up that a multitude of rules exist that designers could have applied differently to better satisfy consumers. One could even state provokingly, that most of the issues would not have arisen if packaging was designed according to a strict interpretation of these rules. Some discussed perspectives certainly leave room for interpretation (for example, how much is an adequate use of material), but designers should try to find the most suitable way possible of unmistakably presenting products via packaging (which is also discussed in (Vergheze et al., 2012) for the context of sustainability marketing), as, in the long term, repercussions can be expected (Wilkins et al., 2016), except perhaps from the most loyal consumers that might stay although dissatisfied (Boote, 1998).

If there is any chance that consumers might feel played with based on packaging design, the goals of optimizing packaging for sustainability could get undermined, as neglecting packaging could be an outcome parallel to such situations. If it is not repercussions on consumption patterns at purchase like brand rejections, the impression of packaging being unnecessary already has its effects on sustainable consumption, for example, if it is left out according to consumers’ wishes enlarging for some products the food waste problem in supply chains, if providing non-regional, non-seasonal products. As far as science (via LCA) can evaluate the sustainability of products at this point, it is ecologically beneficial for many products to package them, in contrast to leaving them unpackaged (Ecoplus, BOKU, denkstatt, OFI, 2020).

Regarding limitations, one must mention that the data collection only provides a snapshot of online complaints, and that the available data is expanding daily. Furthermore, recitations of pictures on various websites, starting, e.g., from a single post in social media, were

often not tracked down to their original sources. The picture of the specific case was the starting point for the recontextualization of the complaint. The accompanying text, if available, might have changed from website to website. Overall, the recontextualization of the data is a potential source of interpretation bias, as it is related to the researchers' interpretation. Whether or not one can "trust" the pictures is also a question that could be discussed. The analysis might have included cases that were "set up."

Considering the comparison with perspectives from European food or packaging law, one gets the impression that these, before marketing the products, could actually have prevented most of the found complaints. What is true from a theoretical approach, is practically not the case, as it must be mentioned that the national origin of the complaints goes beyond Europe. It was not a goal to detect the actual area where the product was marketed (or if it was legally correct). This means that various other legislative perspectives were probably relevant for specific cases. However, consumers were dissatisfied independent of existing law, which implies the need to redesign the mentioned solutions in any case. Furthermore, these selected documents are obviously not all possible (EU) publications one could compare the sample with, but in doing so, all issues found could be addressed and discussed.

Redesign is often mentioned as a potential future step to improve the situation of the overall negative perception of packaging and specifically the found complaints. It is highly recommended for packaging designers, for the sake of progress to a more sustainable consumption, not to exploit/take advantage of possible different interpretations of existing legislative perspectives on packaging design. Moreover, marketing and product development must work together closely, avoiding solely marketing-driven designs. Reflecting the complaints, consumers are sensitive to various packaging practices that are experienced as dissatisfactory, even if these practices meet legal requirements. Packaging designers, who, similarly, like consumers, seek a more sustainable future of products, should take these experiences into consideration and avoid these to the best of their knowledge (and respect sustainability impacts of packaging solutions). Very often, inefficiency was objected to and similarly seen in the researchers' evaluation of the complaints. There is (still) a need to catch up on design improvements for ecological sustainability and, in many cases, implicit and explicit communication. To further allow an overview of cases, which are found inappropriate by consumers, the idea of a shared database (European Union, 2012) could help to keep packaging designers updated with the most recent concerns of consumers and packaging design that did not meet their expectations. This would bring clarification in a topic that seems currently neglected in the technical-centered debate about packaging redesign. If this is, however, not possible, based on the impression that the complaints are widespread, connected to many different brands, product categories and dealt with out of the public eye, it is at least highly encouraged for packaging designers, to undertake regular online searches in channels that reflect consumer experiences toward their own or similar product designs. This can help packaging designers to get important feedback, which would, in the worst case, not find its way back to the designer otherwise. Overall, it is considered beneficial, if social sciences and humanities find their place in this discussion, as the consumers' wishes, and consumption patterns have already shown to have enough weight to change packaging

design (such as the preference for paper or unpackaged goods with potentially conflicting food waste occurrence). Currently, however, this perspective seems not to be used for improving packaging design for sustainability, but rather heating the conflict in which producers and consumers think to know it better.

4. Conclusion

As food packaging is a driver for, on one hand, purchase decisions and, on the other hand, a hot topic in sustainability, its design must be examined from various perspectives. Redesign is a pressing issue for food producers and retailers, and is in the middle of its realization, reflecting, e.g., time-bound recycling goals in the European Union. Up to now, consumers seem to be dissatisfied with packaging and their experiences and expectations should have a place in the redesign process, as it is part of their daily consumption. The collection of consumer complaints about packaging and their categorization into 12 areas of potential redesign foci, allowed the development of a deepened understanding about what consumers dislike about food packaging today and therefore prospectively could be improved. Fruit and vegetable packaging as well as confectionary packaging were often found in discussions about dissatisfactory packaging. The aspect of packaging sizes, formats and waste versus product amounts and sizes was an issue represented in almost all product groups. European law related to food and packaging offers manifold perspectives that, provocatively said, could have avoided the discussed, negative experiences with packaging, if applied differently in packaging design. Further steps to improve the situation around dissatisfactory packaging could incorporate existing ideas, *i.a.* to establish and make use of specific databases. This could be in the form of company internal databases or even a centralized (European) database for complaints about packaging (European Union, 2012). Hence, packaging designers could more easily respect consumers' wishes and include these, to the best of their knowledge, into the design process. To support these developments, it will also be necessary to significantly increase research activities with regard to consumer perception in combination with (dis)satisfaction and related complaints. However, this should not only be done from the perspective of social sciences and humanities but also include, for example, those of food science and technology, packaging technology, material sciences and sustainability science and economics. This will ensure that sustainability is addressed in all its dimensions.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#); further inquiries can be directed to the corresponding author/s.

Author contributions

A-SB, KD, and VK: conceptualization and writing—review and editing. A-SB and KD: writing—original draft preparation. KD and

VK: supervision. VK: project administration and funding acquisition. All authors contributed to the article and approved the submitted version.

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References

- Agrarmarkt Austria Marketing GesmbH (2022). Marktentwicklung. Roll AMA-Produkte. Available at: <https://amainfo.at/konsumenten/marktinfo/marktinformationen/rollama-infografiken> (Accessed August 13, 2022).
- Ampuero, O., and Vila, N. (2006). Consumer perceptions of product packaging. *J. Consum. Mark.* 23, 100–112. doi: 10.1108/07363760610655032
- Armstrong, G. M., Gurol, M. N., and Russ, F. A. (1980). Defining and measuring deception in advertising a review and evaluation. *Curr. Issues Res. Advertis.* 3, 17–39.
- Arora, S. D., and Chakraborty, A. (2020). Legitimate and illegitimate consumer complaining behavior: a review and taxonomy. *J. Serv. Mark.* 34, 921–937. doi: 10.1108/JSM-12-2019-0490
- Aslam, M. M. (2006). Are you selling the right color? A cross-cultural review of color as a marketing cue. *J. Mark. Commun.* 12, 15–30. doi: 10.1080/13527260500247827
- Bach, S. B., and Kim, S. (2012). Online consumer complaint behaviors: the dynamics of service failures, consumers' word of mouth, and organization-consumer relationships. *Int. J. Strateg. Commun.* 6, 59–76. doi: 10.1080/1553118X.2011.634871
- Berry, R., Tanford, S., Montgomery, R., and Green, A. (2014). How we complain—the effect of personality on consumer complaint channels. *J. Hosp. Tour. Res.* 74–101. doi: 10.1177/1096348014550921
- Boote, J. (1998). Towards a comprehensive taxonomy and model of consumer complaining behavior. *J. Consum. Satisfact. Dissatisfact. Complain. Behav.* 11, 140–151.
- Bovensiepen, G., Fink, H., Schnück, P., Rumpff, S., and Raimund, S. Verpackungen im Fokus: Die Rolle von Circular Economy auf dem Weg zu mehr Nachhaltigkeit. PriceWaterhouseCoopers GmbH Wirtschaftsprüfungsgesellschaft. Frankfurt am Main, Germany (2018). Available at: <https://www.pwc.de/de/handel-und-konsumguter/pwc-studie-verpackungen-im-fokus-februar-2018-final.pdf> (Accessed August 09, 2022).
- Campbell-Platt, G. (Ed.) (2009). *Food Science and Technology*. Oxford, UK: John Wiley & Sons.
- Caner, C., and Pascall, M. A. (2010). Consumer complaints and accidents related to food packaging. *Packag. Technol. Sci.* 23, 413–422. doi: 10.1002/pts.908
- Clement, J., Smith, V., Zlatev, J., Gidlöf, K., and Van de Weijer, J. (2017). Assessing information on food packages. *Eur. J. Mark.* 51, 219–237. doi: 10.1108/EJM-09-2013-0509
- DLG eV Farben und ihre Einflüsse auf die sensorische Produktwahrnehmung. DLG-Expertenwissen. (2017) 3. Available at: https://www.dlg.org/fileadmin/downloads/lebensmittel/themen/publikationen/expertenwissen/lebensmittelsensorik/2017_3_Expertenwissen_SensorikFarbe.pdf (Accessed September 11, 2022).
- Dörnyei, K. R. (2020). Limited edition packaging: objectives, implementations and related marketing mix decisions of a scarcity product tactic. *J. Consum. Mark.* 37, 617–627. doi: 10.1108/JCM-03-2019-3105
- Dörnyei, K. R., Bauer, A. S., Krauter, V., and Herbes, C. (2022). (Not) communicating the environmental friendliness of food packaging to consumers—an attribute-and Cue-based concept and its application. *Foods*. 11:1371. doi: 10.3390/foods11091371
- Dörnyei, K. R., and Gyulavári, T. (2016). Why do not you read the label? – an integrated framework of consumer label information search. *Int. J. Consum. Stud.* 40, 92–100. doi: 10.1111/ijcs.12218
- Ecoplus, BOKU, denkstatt, OFI Lebensmittel – Verpackungen – Nachhaltigkeit: Ein Leitfaden für Verpackungshersteller, Lebensmittelverarbeiter, Handel, Politik & NGOs. Entstanden aus den Ergebnissen des Forschungsprojekts “STOP waste – SAVE food”. Wien (2020). <https://boku.ac.at/fileadmin/data/H03000/H81000/H81300/upload-files/Forschung/Lebensmittel/Leitfaden-Lebensmittel-Verpackungen-V1.pdf> (Accessed August 13, 2022).
- Envirowise (2008). *Packguide: A Guide to Packaging Eco-Design*. Didcot, Oxfordshire: Envirowise
- European Commission (2005). Directorate-General for Justice and consumers. Commission notice – guidance on the interpretation and application of directive 2005/29/EC of the European Parliament and of the council concerning unfair business-to-consumer commercial practices in the internal market (text with EEA relevance). Available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229\(05\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229(05)&from=EN) (Accessed September 11, 2022).
- European Commission Guidance document describing the food categories in part E of annex II to regulation (EC) no 1333/2008 on food additives. (2017a). Available at: https://ec.europa.eu/food/system/files/2017-09/fs_food-improvement-agents_guidance_1333-2008_annex-2.pdf (Accessed September 11, 2022).
- European Commission (2017b). Directorate-general for health and food safety. Commission Notice on the application of the principle of quantitative ingredients declaration (QUID). Available at: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52017XC1121%2801%29> (Accessed September 11, 2022).
- European Commission Secretariat-General: A European Strategy for Plastics in a Circular Economy. Brussels, Belgium. (2018). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516265440535&uri=COM:2018:28:FIN> (Accessed July 17, 2022).
- European Commission (2020). A new circular economy action plan: For a cleaner and more competitive Europe; European Commission: Brussels, Belgium. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN> (Accessed February 16, 2021).
- European Commission (2022a). Directorate-general for environment. Proposal for a revision of EU legislation on Packaging and Packaging Waste. Available at: https://environment.ec.europa.eu/publications/proposal-packaging-and-packaging-waste_en (Accessed December 7, 2022).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2023.1047451/full#supplementary-material>

- European Commission (2022b). Food safety. RASFF—food and feed safety alerts. Available at: https://food.ec.europa.eu/safety/rasff-food-and-feed-safety-alerts_en (Accessed August 09, 2022).
- European Commission (2022c). Safety gate: the EU rapid alert system for dangerous non-food products. Available at: <https://ec.europa.eu/safety-gate-alerts/screen/webReport> (Accessed August 12, 2022).
- European Commission (2022d). Reducing packaging waste – review of rules. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12263-Reducing-packaging-waste-review-of-rules_en (Accessed August 13, 2022).
- European Parliament, Council of the European Union (1994). European Parliament and council directive 94/62/EC of 20 December 1994 on packaging and packaging waste. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31994L0062> (Accessed July 17, 2022).
- European Parliament, Council of the European Union (1998). Directive 98/6/EC of the European Parliament and of the council of 16 February 1998 on consumer protection in the indication of the prices of products offered to consumers. Available at: <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A31998L0006> (Accessed September 11, 2022).
- European Parliament, Council of the European Union (2002). Regulation (EC) no 178/2002 of the European Parliament and of the council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European food safety authority and laying down procedures in matters of food safety. Available at: <https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=celex:32002R0178> (Accessed September 11, 2022).
- European Parliament, Council of the European Union (2005). Directive 2005/29/EC of the European Parliament and of the council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market and amending council directive 84/450/EEC, directives 97/7/EC, 98/27/EC and 2002/65/EC of the European Parliament and of the council and regulation (EC) no 2006/2004 of the European Parliament and of the council ('unfair commercial practices directive') (text with EEA relevance). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32005L0029> (Accessed September 11, 2022).
- European Parliament, Council of the European Union (2006a). Directive 2006/114/EC of the European Parliament and of the council of 12 December 2006 concerning misleading and comparative advertising (codified version; text with EEA relevance). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32006L0114&qid=1662893508532> (Accessed September 11, 2022).
- European Parliament, Council of the European Union (2006b). Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, amending Regulations (EC) No 1924/2006 and (EC) No 1925/2006 of the European Parliament and of the Council, and repealing Commission Directive 87/250/EEC, Council Directive 90/496/EEC, Commission Directive 1999/10/EC, Directive 2000/13/EC of the European Parliament and of the Council, Commission Directives 2002/67/EC and 2008/5/EC and Commission Regulation (EC) No 608/2004 Text with EEA relevance. Available at: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32011R1169> (Accessed July 17, 2022).
- European Parliament, Council of the European Union. (2022). Regulation (EC) no 1924/2006 of the European Parliament and of the council of 20 December 2006 on nutrition and health claims made on foods. Available at: <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:32006R1924> (Accessed September 11, 2022).
- European Union Directorate general for internal policies. Policy department a: scientific and economic policy. Internal market and consumer protection. Misleading packaging practices. Briefing paper. Brussels, Belgium. (2012). Available at: <https://www.europarl.europa.eu/document/activities/cont/201201/20120130ATT36566/20120130ATT36566EN.pdf> (Accessed July 17, 2022).
- Ferguson, J. L., and Johnston, W. J. (2011). Customer response to dissatisfaction: a synthesis of literature and conceptual framework. *Ind. Mark. Manag.* 40, 118–127. doi: 10.1016/j.indmarman.2010.05.002
- Festila, A., and Chrysochou, P. (2018). Implicit communication of food product healthfulness through package design: a content analysis. *J. Consum. Behav.* 17, 461–476. doi: 10.1002/cb.1732
- FH Campus Wien and Circular Analytics TK GmbH Circular Packaging Design Guideline. Empfehlungen für die Gestaltung recyclinggerechter Verpackungen. Version 4. (2021). Available at: https://www.fh-campuswien.ac.at/fileadmin/redakteure/Forschung/FH-Campus-Wien_Circular-Packaging-Design-Guideline_V04_DE.pdf (Accessed August 09, 2022).
- Germelmann, C. C., and Held, J. (2014). Deceived or not deceived: how food consumers perceive deception. *Adv. Consum. Res.* 42, 313–317.
- Hawley, K. L., Roberto, C. A., Bragg, M. A., Liu, P. J., Schwartz, M. B., and Brownell, K. D. (2013). The science on front-of-package food labels. *Public Health Nutr.* 16, 430–439. doi: 10.1017/S1368890012000754
- Hirschman, A. O. (1970). *Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations and States*. Cambridge, MA: Harvard University Press
- IPSOS Mori (2008). Public attitudes to packaging 2008. Report to INCPEN and Valpak, London. Available at: <https://cdn.ymaws.com/www.productstewardship.us/resource/resmgr/imported/PublicAttitudetoPackaging2008.pdf> (Accessed September 11, 2022).
- Istanbulluoglu, D., Leek, S., and Szmigin, I. T. (2017). Beyond exit and voice: developing an integrated taxonomy of consumer complaining behavior. *Eur. J. Mark.* 51, 1109–1128. doi: 10.1108/EJM-04-2016-0204
- Kalnaitė, V., Bird, J., and Rogers, Y. (2013). Decision-making in the aisles: informing, overwhelming or nudging supermarket shoppers? *Pers. Ubiquit. Comput.* 17, 1247–1259. doi: 10.1007/s00779-012-0589-z
- Kozinets, R. V. (2002). The field behind the screen: using netnography for marketing research in online communities. *J. Mark. Res.* 39, 61–72. doi: 10.1509/Jmkr.39.1.61.18935
- Lee, S., and Cude, B. J. (2012). Consumer complaint channel choice in online and offline purchases. *Int. J. Consum. Stud.* 36, 90–96. doi: 10.1111/j.1470-6431.2010.00992.x
- Li, H., Liu, Y., Tan, C. W., and Hu, F. (2020). Comprehending customer satisfaction with hotels: data analysis of consumer-generated reviews. *Int. J. Contemp. Hosp. Manag.* 32, 1713–1735. doi: 10.1108/IJCHM-06-2019-0581
- Oliver, R. L. (1977). Effect of expectation and disconfirmation on postexposure product evaluations: an alternative interpretation. *J. Appl. Psychol.* 62, 480–486. doi: 10.1037/0021-9010.62.4.480
- Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *J. Mark. Res.* 17, 460–469. doi: 10.1177/002224378001700405
- Otto, S., Strenger, M., Maier-Nöth, A., and Schmid, M. (2021). Food packaging and sustainability—consumer perception vs. correlated scientific facts: a review. *J. Clean. Prod.* 298:126733. doi: 10.1016/j.jclepro.2021.126733
- Palaci, F., Salcedo, A., and Topa, G. (2019). Cognitive and affective antecedents of consumers' satisfaction: a systematic review of two research approaches. *Sustain. For.* 11:431. doi: 10.3390/su11020431
- QMFI Weiher I. Lebensmittelkennzeichnung von Importen. (2021). Available at: <https://qmfi.de/lebensmittelkennzeichnung-von-importen/> (Accessed August 09, 2022).
- Regattieri, A., Santarelli, G., and Olsson, A. "The customers' perception of primary packaging: a comparison between Italian and Swedish situations." in *Proceedings of the 18th IAPRI World Packaging Conference*. (2012) 110–119.
- Robertson, G. L. (Ed.) (2009). *Food Packaging and Shelf Life: A Practical Guide*. Boca Raton, FL, USA: CRC Press.
- Robertson, G. L. (2013). *Food Packaging: Principles and Practice*. 3rd Edn. Boca Raton, FL, USA: CRC Press.
- Ruhr Nachrichten Brauereien verlängern nachträglich das Mindesthaltbarkeitsdatum. (2021). Available at: <https://www.ruhrnachrichten.de/regionales/brauereien-verlaengern-nachtraeglich-das-mindesthaltbarkeitsdatum-w1616069-2000200094/> (Accessed August 09, 2022).
- Singh, J. (1988). Consumer complaint intentions and behavior: definitional and taxonomical issues. *J. Mark.* 52, 93–107. doi: 10.1177/002224298805200108
- Singh, P., Wani, A. A., and Langowski, H. C. (eds.). *Food Packaging Materials: Testing & Quality Assurance*. Boca Raton, FL, USA: CRC Press Taylor & Francis Group (2017)
- Statista GmbH (2022). Zusammensetzung des durchschnittlichen Warenkorb privater Haushalte in Österreich im Jahr 2022. Available at: [https://de.statista.com/statistik/daten/studie/697382/umfrage/zusammensetzung-des-warenkorb-privater-haushalte-in-oesterreich/#:~:text=Was%20ist%20der%20Warenkorb%3F,zw%3B%61f%20Ausgabenbereiche%20\(Hauptgruppen\)%20unterteilt](https://de.statista.com/statistik/daten/studie/697382/umfrage/zusammensetzung-des-warenkorb-privater-haushalte-in-oesterreich/#:~:text=Was%20ist%20der%20Warenkorb%3F,zw%3B%61f%20Ausgabenbereiche%20(Hauptgruppen)%20unterteilt) (Accessed July 17, 2022).
- Steenis, N. D., Van Herpen, E., Van Der Lans, I. A., Ligthart, T. N., and Van Trijp, H. C. (2017). Consumer response to packaging design: the role of packaging materials and graphics in sustainability perceptions and product evaluations. *J. Clean. Prod.* 162, 286–298. doi: 10.1016/j.jclepro.2017.06.036
- Thøgersen, J. (1996). Recycling and morality. A critical review of the literature. *Environ. Behav.* 28, 536–558. doi: 10.1177/0013916596284006
- Verbraucherzentrale NRW eV Mindesthaltbarkeitsdatum (MHD) ist nicht gleich Verbrauchsdatum. (2021). (Accessed September 11, 2022).
- Vergheze, K., and Lewis, H. (2007). Environmental innovation in industrial packaging: a supply chain approach. *Int. J. Prod. Res.* 45, 4381–4401. doi: 10.1080/00207540701450211
- Vergheze, K., Lewis, H., and Fitzpatrick, L. (eds.). *Packaging for Sustainability*. London Limited: Springer-Verlag (2012)
- Weinrich, R., Overbeck, C., Zuehlsdorf, A., and Spiller, A. (2018). Deceptive packaging and missing ingredients: on the effect of qualifying packaging information. *Ernährungs Umschau*. 65, 120–125. doi: 10.4455/eu.2018.028
- Wilkins, S., Beckenuyte, C., and Butt, M. M. (2016). Consumers' behavioral intentions after experiencing deception or cognitive dissonance caused by deceptive packaging, package downsizing or slack filling. *Eur. J. Mark.* 50, 213–235. doi: 10.1108/EJM-01-2014-0036
- Wolf, B. *Confectionery and Sugar-Based Foods. Reference Module in Food Science*. Amsterdam, The Netherlands: Elsevier (2016).
- Xie, G. X., and Boush, D. M. (2011). How susceptible are consumers to material and advertising claims? A retrospective look at the experimental research literature. *Mark. Rev.* 11, 293–314. doi: 10.1362/146934711X589480
- ZwickRoell GmbH and Co. KG. (2022). Testing of packaging. Available at: <https://www.zwickroell.com/industries/food-packaging/testing-of-packaging/> (Accessed September 11, 2022).