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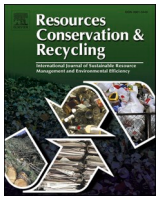

Consumers' sustainability-related perception of and willingness-to-pay for food packaging alternatives

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ABSTRACT

Research regarding consumers' perception of and willingness-to-pay for alternatives to conventional plastic packaging reveals an ambiguous picture. On one hand, consumers are said to be neither willing to change their consumption behavior nor to pay for alternatives. On the other hand, there is evidence that consumers have an increasing environmental awareness and a positive willingness-to-pay for packaging alternatives. The mixed-method study (Discrete Choice Experiment and qualitative free-text analysis) described in this paper, elucidates the role of consumers and analyzes both consumers' sustainability-related perception of and willingness-to-pay for alternative food packaging (unpackaged, paper, recycling plastic, bioplastic). Results demonstrate that consumers are willing to pay for packaging that they perceive to be sustainable and are not willing to pay for packaging that they perceive to be non-sustainable or about which they are uncertain. Considering the general disagreement on what kind of packaging actually is sustainable, these results raise the question: if neither theorists, nor companies, nor government agree on the sustainability of different types of packaging – how are consumers supposed to make correct assessments? Besides, results demonstrate that consumers are largely united in their general dissatisfaction with the current packaging situation, even though they are aware of the positive characteristics of single-use plastic packaging.

1. Introduction

It is well known that the global environmental pollution caused by plastic not only threatens ecosystems worldwide (Bergmann et al., 2019; Jambeck et al., 2015) but is also an increasing risk for human health (Wright and Kelly, 2017). One of the main causes of this pollution is the uncontrolled disposal of single-use plastic packaging (e.g., Schnurr et al., 2018). In Europe's case, the total demand for virgin plastic from the plastics processing industry was up to 50.7 million tons in 2019, nearly 40% of which can be attributed to the packaging industry (Plastics Europe, 2020). A great deal of this packaging is ascribed to the food industry, as most food items are in single-use plastic packaging (Marken and Hörisch, 2020).

Mitigation of the plastic crisis (caused by single-use plastic packaging, particularly food packaging) is in the focus of both political measures (e.g., Clayton et al., 2020; Nwafor and Walker, 2020) and food industry companies (Phelan et al., 2022). Considering political measures, the EU, for example, has banned certain single-use products like straws and plastic cutlery (European Commission, 2020), several countries around the world have already banned single-use plastic bags (e.g., Bezerra et al., 2021), and, for example, the Canadian government decided to classify manufactured plastic items as toxic due to their harmful effects on the environment (Walker, 2021). Companies have committed themselves to curb the flood of single-use plastic packaging and force a sustainable use of plastic both by signing global commitments and by implementing individual plastic-related commitments and actions (Phelan et al., 2022; Rhein and Sträter, 2021). Within the framework of these voluntary commitments, one of the frequently formulated goals addressing single-use plastic packaging is that of reduction. This term, however, has quite different interpretations, ranging from reduction of packaging itself (i.e., offering unpackaged goods) to reduction of plastic packaging (i.e., substitution of plastic with paper), reduction of conventional plastic made from crude oil (i.e., substitution of plastic by bioplastic), and reduction of virgin plastic in use (i.e., substitution of virgin plastic by recycled plastic) (Rhein and Sträter, 2021).

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Without question, all these endeavors to *reduce something* are valuable. However, none of the (non-) packaging and packaging materials can play out to its strength if there is no acceptance on the part of consumers. One of the key aspects that determines the market success or failure of a particular (non-) packaging is the consumers' willingness to buy and pay for alternatives to ordinary plastic packaging (Ketelsen et al., 2020), which is influenced by their perception of packaging characteristics, such as material, size, convenience, and eco-friendliness (Fernqvist et al., 2015). However, even though consumers play an important role in mitigating the plastic crisis (Rhein and Schmid, 2020), disagreement remains about whether consumers are willing to pay more for alternative packaging or for non-packaged products. On one hand, corporate experts frequently identify consumers as one of the main hindrances to the successful mitigation of the plastics crisis: relevant studies point to the fact that consumers are, for example, not willing to change their consumption behavior or pay more for alternatives (Gong et al., 2020; Ma et al., 2020). On the other hand, different consumer studies have already identified a willingness-to-pay (WTP) for sustainable packaging alternatives (Section 2). This ambiguity regarding the consumers' role points to the fact that further investigations are necessary. There is a need to know more about whether consumers want to accept personal responsibility even if this goes hand in hand with financial burdens. Gaining a deeper understanding of consumers' interests and preferences is crucial to support both companies and policy makers determining appropriate and efficient means of mitigating the problems with single-use plastic packaging (e.g., Hao et al., 2019).

This paper provides a holistic, in parts explorative analysis of consumer's attitudes towards and WTP for the most common alternatives to ordinary plastic packaging (unpackaged alternative, paper, recycling plastic, bio plastic) while accounting for the influences of different kinds of production and origin of the packaged product itself on their decisions. Using a mixed-method design consisting of a Discrete Choice Experiment (DCE) followed by closed and open questions regarding packaging per se and packaging alternatives, this paper provides answers to two different levels of questions. Based on the DCE and, thus, on a first level, the following questions are addressed:

1 Are consumers willing to pay more for plastic alternatives in comparison to ordinary plastic packaging and how do these WTP rates relate to each other?

Secondly, the survey questions allow to identify possible reasons for the results of the first level and, thus, address the following question:

2 Why are the reported WTP rates related to each other the way they are?

In total, the mixed method design enables generation of valuable insights into consumers' preferences for plastic packaging substitutes and, thus, gives direction for mitigation of single-use plastic pollution.

The paper is organized as follows: Section 2 provides an overview of related research. In Section 3 the experimental design and the data are described in more detail. Section 4 provides an explanation of the applied quantitative and qualitative methods. The results of both the model estimation and the qualitative analysis are presented in Section 5; the discussion of results is in Section 6.

2. Packaging alternatives and consumers' attitudes

In order to understand consumers' perception of alternatives to plastic packaging and their respective WTP, it is necessary to summarize the environmental characteristics of different packaging materials, before providing an overview on recent research regarding consumers' attitudes towards and WTP for plastic alternatives. In addition, as this paper accounts for influences of different kinds of production and origin of the product itself, insight regarding consumers' attitudes towards these attributes as well as the interrelation of these attributes and packaging are briefly summarized.

One of the most common substitutes for virgin plastic is recycled plastic material. In Europe alone, four million tons of plastic recyclates were used in the manufacture of new products in 2018, 24% alone for new packaging (PlasticsEurope, 2020). The objectives to increase the share of recycled materials in use and to ensure (100%) recyclability of plastic packaging in the future are the central elements of most companies' voluntary commitments (Rhein and Sträter, 2021). However, from a sustainability perspective, recycling material is associated with several problems: due to shortcomings of infrastructure and incorrect waste separation by consumers, among others, not everything that is recyclable is actually recycled (PlasticsEurope, 2020) and even if return and recycling rates were high, the recycling process itself is associated with losses of both material and quality. Thus, recycling is crucial – but is not sufficient to completely replace the use of virgin plastic (Geyer et al., 2015). From the (food) industry's perspective, it is to be considered, that recycling material is relatively expensive compared to using virgin plastic, particularly if crude oil prices are low (Milios et al., 2018).

Besides recycled plastic, so-called bioplastic is also gaining importance. Packaging material labeled as bioplastic is mostly derived from renewable resources (mostly plant material, e.g., corn) and, thus, is associated with different sustainability benefits, for example, reduction of greenhouse gas emission during production compared to fossil-based plastic. However, the special way in which they are produced does not automatically mean that bioplastics are biodegradable (Álvarez-Chávez et al., 2012; Philp et al., 2013): indeed, some types of bioplastic are biodegradable, and others are not, which is why this type of plastic commonly leads to similar environmental problems as conventional plastic if disposed incorrectly (Taufik et al., 2020). Bioplastics cannot automatically be considered sustainable for further reasons: the assessment of the sustainability of this material depends on the manufacturing process as well, for example, if the cultivation of the feedstock goes hand-in-hand with the use of pesticides, it is not environmentally friendly (Álvarez-Chávez et al., 2012). Moreover, in comparison with conventional plastic, bioplastics are also associated with economic challenges, such as higher production costs (Neves et al., 2020).

A long-known alternative to any kind of plastic packaging is paper, which is used in a wide range of packaging applications. Paper is generally based on renewable, biodegradable, and recyclable raw materials and is often perceived as an environmentally friendly material (Deshwal et al., 2019; Oloyede and Lignou, 2021). However, paper-based packaging is also associated with environmental concerns, particularly if it is only used once. Paper-based packaging consumes a lot of energy and water during the production process and due to chemicals and printing inks, several kinds of paper-based packaging are also associated with severe challenges regarding both biodegradability and recycling (Deshwal et al., 2019; Villanueva and Wenzel, 2007).

Finally, if food items are suitable, they can be sold unpackaged (Marken and Hörisch, 2020). Buying loose, unpackaged bulk products is a growing consumer trend (Louis et al., 2021). However, packaging protects food from spoilage, so in the case of unpackaged food, the debate continues about whether it is more important to reduce packaging or minimize the risk of food spoilage (Williams et al., 2012).

In summary, plastic as well as all its alternatives have their (ecological and economical) advantages and disadvantages. Even from a theoretical point of view, it is difficult to assess whether one packaging is (more or less) sustainable (than another): results vary with the evaluation-method in use (Sikdar, 2020).

Consumers' perception of different kinds of packaging. Considering consumers, it is to be noted that there is a general willingness to buy more sustainable packaging (e.g., Heidbreder et al., 2019; Rhein and Schmid, 2020) and unpackaged goods (van Herpen et al., 2016): it can be observed that the type of packaging material has not only an important influence on the purchase decision but also on the perception of product sustainability (Greenwood et al., 2021; Nguyen et al., 2020).

However, for consumers, it is even more difficult to assess what kind of packaging actually is sustainable. They often have concerns or lack ability and knowledge to pass sustainability-related judgement on different kinds of material (Ketelsen et al., 2020), like, for example, bioplastic (Dilkes-Hoffman et al., 2019; Mehta et al., 2021), which results in uncertainty (Ketelsen et al., 2020).[2] Thus, what consumers perceive as sustainable does not necessarily have to correspond to the results of life cycle assessments (e.g., Steenis et al., 2017).

Regarding the packaging alternatives relevant for this study, research agrees that consumers perceive virgin plastic as the most environmentally harmful material. From their point of view, and compared to virgin plastic, recycling material is perceived to be the more sustainable alternative (e.g., Lindh et al., 2016; Young, 2008). A somewhat similar picture emerges for bioplastic: the latter, and, in particular, biodegradable bioplastic, is perceived to be more environmentally friendly compared to virgin plastic – and compared to recycling plastic as well. However, consumers' knowledge regarding bioplastics is said to be quite limited and its (varying) characteristics are mostly unknown (Dilkes-Hoffman et al., 2019). Paper and wooden packaging, in contrast, is frequently associated with the least harm to the environment, compared to plastic (Fernqvist et al., 2015; Nguyen et al., 2020). Evidence on whether consumers prefer reusability or recyclability of packaging is mixed. Respective preferences differ from country to country (Herbes et al., 2018). Consumers' attitude regarding unpackaged alternatives is currently in flux: Prior to the COVID-19 pandemic, there was an increasing preference to avoid single-use plastic packaging (Walker et al., 2021) in favor of unpackaged goods (van Herpen et al., 2016); this trend seems to have reversed due to food-safety concerns (Kitz et al., 2021).

Consumers' WTP for different kinds of packaging. So far, consumers' WTP for packaging alternatives is either ascertained based on DCEs or by directly asking consumers within the context of survey studies. Relevant studies typically focus on ordinary, recycled and bio-based/biodegradable plastic. Using survey methodology, Walker et al. (2021), for example, figured out that 41.9 percent of their respondents would be "(…) willing to pay more for items containing biodegradable packaging" (Walker et al., 2021, p.5). Likewise based on survey data for the case of water bottles, Orset et al. (2017) found that the WTP for recycled or biodegradable plastic packaging varies with the amount of information provided. Also, considering water bottles as well as recycling and bioplastic, De Marchi et al. (2020) identify a DCE-based positive WTP for bioplastic and a preference for recycled as compared to virgin plastic. Besides a WTP for alternative packaging material, there is a certain WTP for the recyclability of packaging (Klaiman et al., 2016). Wensing et al. (2020) investigate the WTP for bioplastics with the particularity that they not only focus on the general WTP, but they additionally examine whether green nudges influence the WTP for bioplastics. They found that especially informative and normative nudges increase the WTP for tomatoes packaged in bioplastic.

In summary, numerous studies have already analyzed consumers' (sustainability-related) perception of packaging (Heidbreder et al., 2019), and other studies have determined respective WTP values. However, most of the comparisons that have been drawn so far only address a quite limited number of alternatives at one time (most frequent: different kinds of plastic packaging) and perception of and WTP for packaging alternatives are rarely combined with each other. Comprehensive studies that focus not only on different kinds of plastic but also on paper, unpackaged alternatives, or others are very rare (e.g., Friedrich, 2020; Otto et al., 2021). Thus, a holistic picture that allows an overall comparison of those packaging alternatives that are most common in everyday shopping situations is still missing. In addition, such a holistic picture must also account for further product characteristics that are linked to sustainability issues like mode of production and origin of the food product itself, as research shows that packaging and these characteristics are somehow interrelated. (e.g., Lindh et al., 2016). Therefore, it is necessary to briefly summary recent insights regarding consumers' preferences regarding these attributes.

Consumers' perception of different kinds of production and origin. There is a general agreement that the production process as well as the product origin affect consumers' purchasing decisions: consumers typically prefer locally- to globally-, and organically- to conventionally-produced food items (e.g., Thøgersen et al., 2019, Hinkes and Schulze-Ehlers, 2018; Pouta et al., 2010; Tait et al., 2019, Van Loo et al., 2011). Organic food is usually considered more sustainable compared to conventional as, for example, harmful pesticides are not allowed. Globally produced food is generally considered less sustainable compared to regional produce due to transnational transport that is associated with, for example, greenhouse-gas emissions (e.g., Götze and Brunner, 2020; Reisch et al., 2013). However, there is evidence that consumers do not always differentiate between production and origin issues and assume that locally produced food is automatically organic (Meas et al., 2014). In line with this, there seems to be a substitution relationship between these food characteristics: According to Thøgersen et al. (2017), for example, the influence that the origin has on the purchase decision decreases if the product is organic. Evidence regarding the interaction of packaging characteristics and origin or production, respectively, is rather rare. However, there are indications for a relationship between the importance of the perceived sustainability of the packaging and the production method of the product (Lindh et al., 2016; van Herpen et al., 2016) – so that it is reasonable to assume that these interrelations matter.

3. Experimental design

The experimental mixed-method design unifies DCE and survey questions (open and closed) regarding (alternatives to) plastic packaging. The DCE is intended to determine the WTP for plastic substitutes while accounting for differences in origin and production type of the food item. The DCE engages participants in a situation (Fig. 1), in which they have to choose between two bunches of grapes (each 500 gram) that differ in production, origin, packaging and price (Table 1). The survey part aims to gather information on consumers' perception of and knowledge regarding alternatives to ordinary plastic packaging.

DCEs are based on random utility theory (Thurstone, 1927; McFadden, 1973), i.e., they assume that, in choice situations, utility-maximizing individuals opt for the one alternative that generates the highest utility. Based on observed decisions, DCEs enable an estimation of preferences regarding specific attributes that, as a bundle, constitute an alternative. Success of DCEs depends on an appropriate design (Johnson et al., 2013; Lancsar and Louviere, 2008). Following Caussade et al. (2005), four design dimensions are particularly important:

1 *Number of choice sets*: There are two dimensions to the choice sets: the total number of choice sets (depending on the number of attributes and the experimental design) and the number of choice sets presented to each individual (depending on the response efficiency, i.e., measurement errors that arise from cognitive burden) (Johnson et al., 2013). Recommendations for the optimal number of choice sets per individual reach from 9 to 16 (Caussade et al., 2005; Clark et al., 2014): This study presented 9 choice sets per individual to avoid cognitive burden and to minimize the error term variance.
2 *Number and kind of alternatives*: As the completion rate declines more with an increase in the number of alternatives than with an increase in the number of choice sets (Louviere et al., 2013), we included two alternatives per choice set and decided against an opt-out option. The

[2] Uncertainties in the environmental perception of packaging can be reduced, for example, by appropriate labeling. By means of nudging, the awareness regarding sustainability of packaging can be increased and a higher WTP induced (Rokka & Uusitalo, 2008; Wensing et al., 2020).

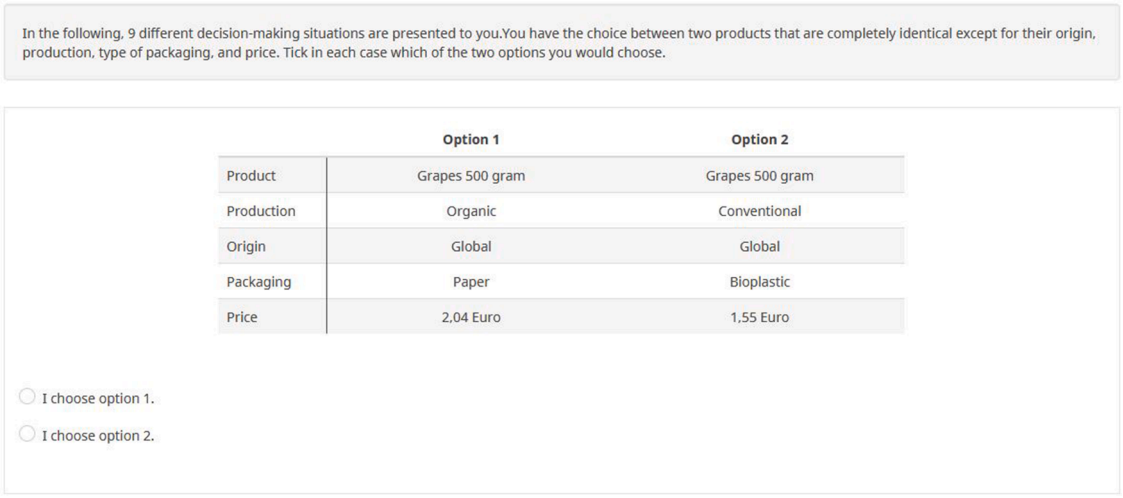

Fig. 1. Example of a choice set (authors' illustration).

Table 1
Attributes and levels.

Attribute	Levels	Description
Production	Conventional / Organic	describes the kind of production, which indicates if the product was produced organically or not. The attribute is defined as a factor. A conventional product is coded as 0 and an organic as 1.
Origin	Global / Regional	describes where the product was produced. Regional means a product from the immediate area. The attribute is defined as a factor. A global product is coded as 0 and a regional as 1.
Packaging	Plastic / Recycled Plastic / Bioplastic / Paper / Unpackaged	describes the different kind of packaging or its absence. The packaging varies from different types of plastic to paper. The attribute is defined as a factor. Each packaging alternative is coded as 1 if it appears and as 0 if it does not appear. Ordinary plastic is generally coded as zero since it is the benchmark packaging.
Price	1.08 / 1.55 / 2.04 / 2.52 / 2.99	describes the price of the product in Euro. The attribute is defined as a metric variable.

latter decision was, on one hand, based on our desire to bring our design as close to reality as possible (if a consumer has a specific food item on the shopping list, that would suggest a need to buy that particular product[3]). On the other hand, we are mainly interested in the relation between different WTP values. Even though excluding an opt-out alternative might inflate WTP values, their mutual relation is unaffected by the existence of an opt-out option (Veldwijk et al., 2014). Additionally, we used unlabeled alternatives[4] to avoid possible influences of brand names (Lancsar and Louviere, 2008; Kløjgaard et al., 2012).

3 *Number and kind of attributes*: Several studies point to the fact that an increase in the number of attributes leads to an increase in error term variance (Arentze et al., 2003; Caussade et al., 2005; DeShazo and Fermo, 2002) and a decrease in completion rates (Louviere et al., 2013). Moreover, too many attributes induce simplification strategies on the part of participants (i.e., ignoring, or aggregating attributes) due to cognitive constraints (Caussade et al., 2005).[5] We identified four relevant attributes: production, origin, packaging and price (Table 1, see also Section 2).

4 *Number and kind of attribute levels*: An increase in the number of levels leads to a higher variation of the error term, as more comparisons must be made and, thus, decisions are more complex. Furthermore, effects of attribute level ranges (narrow vs. wide) are to be considered (Wang and Li, 2002; Caussade et al., 2005; Lancsar and Louviere, 2008; Kløjgaard et al., 2012; Adamowicz et al., 1997). Thus, the use of qualitative research and pre-testing is as important as in the case of attributes to ensure that the most relevant levels are included (Maddala et al., 2003; Clark et al., 2014; Kløjgaard et al., 2012). The attribute levels, which are selected with respect to comprehensibility and relevance (Kløjgaard et al., 2012; see also Section 2) are described in the following (see also Table 1).

The determination of attributes and levels is based on the following considerations: The set of packaging alternatives covers those commonly used in Germany and, thus, corresponds to everyday shopping situations. As normally used in everyday language, the terms bio-based, biodegradable, and bio-based-and-degradable plastic were summarized under the umbrella term of bioplastic – leaving consumers with the same contextual uncertainty that they experience in everyday shopping situations. As the experiment aims to identify the consumers' WTP based on the individually-perceived sustainability of packaging, we did not provide any additional information regarding their environmental impact. The chosen prices reflect real offers from German supermarkets. The consideration of both production and origin of the product was intended to situate the experiment close to reality, making it possible to account for interaction effects (see Section 2). The differentiation between both

[3] There is also evidence that consumers often feel forced to buy the products as they are offered by supermarkets, because the supermarket/discounter does not offer the product (un-) packaged the way they prefer (Rhein and Schmid, 2020).

[4] In our case, "unlabeled" means that the grapes are simply grapes and do not carry a brand name.

[5] There is an area of tension between the risk of inducing cognitive overload and having too few relevant attributes: The most relevant attributes are to be included - omitting some attributes lead to misunderstanding (Lancsar and Louviere, 2008). Thus, all relevant attributes should be included but are to be formulated as clearly and precisely as possible (Kløjgaard et al., 2012). Attribute selection should be made by literature review or qualitative research, e.g., focus groups, interviews (Maddala et al., 2003; Lancsar and Louviere, 2008).

organically vs. conventionally produced as well as regionally vs. globally produced food items is common in German supermarkets and products are labeled accordingly.

The overall experimental design[6] satisfies the requirements of D-efficiency and, thus, can be used to create fractional factorial designs that enables an estimation of interaction effects in addition to main effects. The experimental design is created applying the function *dcreate* incorporated in Stata 15 (Hole, 2015). The experimental design contains 36 different choice tasks, which are divided into four questionnaires. Fig. 1 displays a choice set example of the survey. We decided against including graphical representations of the different alternatives as Veldwijk et al. (2015) emphasize that these may cause choice inconsistency and, thus, might lower the validity of attribute estimates. Moreover, a graphically recognizable distinction between ordinary, recycled and bioplastic would require the use of labels as these packaging alternatives are indistinguishable from each other without labels.

After a brief introduction, participants were offered nine different choice sets from each of which they had to choose between two options. In addition, participants were asked to respond to both socio-demographic questions and queries regarding plastic packaging in general, plastic substitutes and recycling rates. To get an indication of how informed participants are regarding recycling, they were asked to guess the percentage of plastic packaging that is recycled in Germany. To have additional information on the respondents' individual perception of the sustainability of different kinds of packaging, they were asked to rank-order respective alternatives. In addition, two open questions were asked to ascertain possible reasons for the WTP: in light of the general confusion regarding the characteristics of bioplastic (Dilkes-Hoffman et al., 2019), we asked participants what is – according to their knowledge – so special about bioplastic ("What do you think is special about bioplastic?").[7] The second open question focused on consumers' wishes regarding packaging in their everyday shopping ("Is there anything you would like to have in terms of packaging when you go shopping every day?"). This question was intended to identify aspects that may have remained hidden behind predefined response categories and choice sets. All these questions were placed after the DCE to avoid priming effects.

4. Methods

In accordance with the random utility framework (Thurstone, 1927; McFadden, 1973), the analysis of the DCE was done using a respective discrete choice model. It is assumed that each individual chooses the alternative that yields the highest individual utility (Bahamonde-Birke et al., 2017; McFadden, 1973). The utility of an individual i in alternative j and choice set t is:

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt}, \tag{1}$$

where V_{ijt} is a systematic term that contains a set of alternative-specific variables and vectors of the corresponding coefficients and ε_{ijt} is an independently identically extreme-value-type-1 error term. Since we have repeated measurements for each individual and, thus, dependencies between observations, a mixed logit model is used to specify the utility function as follows:

$$\begin{aligned} U_{ijt} = {} & \alpha\, PRICE + \beta_{1,i}\, PROD_{ijt} + \beta_{2,i}\, ORG_{ijt} + \beta_{3,i}\, REC_{ijt} + \beta_{4,i}\, BIOBAS_{ijt} + \beta_{5,i}\, PAP_{ijt} + \beta_{6,i}\, UNP_{ijt} + \\ & \gamma_1 \left(PROD_{ijt}\ x\ ORG_{ijt}\right) + \gamma_2 \left(PROD_{ijt}\ x\ REC_{ijt}\right) + \gamma_3 \left(PROD_{ijt}\ x\ BIOBAS_{ijt}\right) + \gamma_4 \left(PROD_{ijt}\ x\ PAP_{ijt}\right) + \\ & \gamma_5 \left(PROD_{ijt}\ x\ UNP_{ijt}\right) + \gamma_6 \left(ORG_{ijt}\ x\ REC_{ijt}\right) + \gamma_7 \left(ORG_{ijt}\ x\ BIOBAS_{ijt}\right) + \gamma_8 \left(ORG_{ijt}\ x\ PAP_{ijt}\right) + \\ & \gamma_9 \left(ORG_{ijt}\ x\ UNP_{ijt}\right), \end{aligned} \tag{2}$$

where α describes the mean coefficient of the *PRICE* variable (α is fixed). The production, origin and packaging variables are specified as normal distributed random parameters $\beta_{k,i}$. Therefore, not only can the mean coefficients be estimated but also the standard deviations. Correlations between the random parameters are allowed to consider heterogeneity (Train, 2009). In addition, two-way interaction terms are defined to account for possible relations between variables; interaction effects are represented by γ coefficients. The parameters are estimated using a simulated maximum likelihood with 100 draws of pseudo-random numbers.[8]

After estimating the utility function (Eq. (2)), we compute the WTP and the standard errors for each random parameter and individual. The WTP is defined as (Train, 2009):

$$WTP_i = -\frac{\beta_{k,i}}{\alpha}, \tag{3}$$

where $\beta_{k,i}$ are the coefficients of the random parameters and α is the fixed price coefficient. As a result, we get the average WTP for each individual and each random parameter and their corresponding standard errors, which are calculated per delta method. All calculations based on the mixed logit model are done using the software *R* version 4.1.0 and the package *gmnl* (Sarrias and Daziano, 2017).

Responses to free text questions are analyzed applying the qualitative, explorative GABEK® method (Software WinRelan®). GABEK® allows the connection, integration, systematization and management of verbalized knowledge and experiences of a (very) large number of individuals (Raich et al., 2014). The software-assisted method follows a stepwise procedure that ensures transparency and traceability of results: in the first step, the qualitative dataset is subdivided into *units of sense,* defined as an inherently coherent line of thought.[9] Each unit of sense is stored on a digital index card of the software WinRelan®. In a second step, key terms that represent the units' key message are identified by hand and noted down on the respective index card as well. Key terms that are located on one index card, i.e., representing the meaning of one line of thought, are associatively linked and can be recalled via network graphs (Zelger, 2000, 2019).

[6] The experimental design encompasses the combination of attribute levels to alternatives and the combination of alternatives to choice-sets (Lancsar and Louviere, 2008). Thereby, it must be ensured that implausible combinations are excluded, and that interaction effects and cognitive limitations of the respondents are considered (Johnson et al., 2013).

[7] We decided against asking for the other packaging alternatives because open-ended questions are said to increase the rate of item non-response (Miller and Lambert, 2014) – an effect that we wanted to avoid.

[8] The coefficients' estimates stabilize at 100 pseudo-random numbers.

[9] In the case of our data, each individual explanation of bioplastic and each individually formulated wish regarding packaging is defined as one unit of sense. This makes it possible to interpret the results not only from a content perspective but also quantitatively.

5. Results

5.1. Sample description

Data collection was done through an online survey (October 2020 to February 2021) in Germany.[10] Participants were recruited via mailing lists (snowball principle) from various organizations (e.g., universities, senior citizens academies) that do not have any kind of specific relationship to sustainability-related topics to avoid systematic biases within the sample. Participation was voluntarily and not monetarily incentivized. 296 participants took part, 254 completed the survey (completion rate ≈ 86%; 157 women, 94 men, 2 non-binary, 1 NA). Since the number of respondents of non-binary gender is too small for a meaningful representation, the two participants were randomly assigned to the gender male or female. This procedure is in accordance with the recommendations of the statistical offices in Germany (Statistische Ämter 2021). Both sexes have similar age distributions. The average ages are 29.6 for men (sd = 12.9) and 29.6 for women (sd = 13.1): the distributions do not show conspicuous patterns. Thus, the sample is, on average, of younger age than the general population in Germany (Statistisches Bundesamt, 2021b).

The majority of individuals in the sample are low-income earners (today): 53.6% of the participants have a net income of less than 1000 Euros and 18.3% have a net income between 2000 and 3000 Euros per month. The sample's average net income is below the German average, which is approximately 2000 Euro (Statistisches Bundesamt, 2021a). Most of the participants have a general certificate of education (GCE) on an advanced level (49.6%), 19% have completed an apprenticeship. Regarding the political orientation, the sample is rather 'green': 30.2% of the respondents favor the Green Party. With an average guess of 37.77%, the respondents are much more pessimistic about recycling rates than the official recycling figures indicate. In 2019, for example, around half of plastic packaging was recycled (Umweltbundesamt, 2019).[11]

In summary, it turns out that our sample is on average young, typically female, and (well-) educated. Due to the results regarding political orientation as well as the general underestimation of recycling rates, it can also be assumed that the sample is rather environmentally sensitive. We decided not to reweight the data but to interpret our results considering the given specialties, since the results could indicate a trend for coming decades (Section 6).

5.2. Quantitative results

The mixed-logit model (Eq. (2), Section 4) was estimated to determine the general preferences for price, organic, and regional products, as well as different packaging substitutes. The reference level is a conventionally produced item with the origin 'global' that is packed in ordinary plastic.

Main effects. Table 2 presents the estimated coefficients, standard errors and the corresponding 95% confidence intervals. All main effects except the bioplastic effect are significant. As expected, there is a negative price effect.[12] Both organic and regional products have positive effects, i.e., are preferred to conventionally produced and global products. Three of the packaging alternatives, recycled plastic, paper and unpackaged grapes, yield significantly higher utility than the reference-level alternative, which is reflected in the respective positive estimates. However, these coefficient's standard deviations are large and significant at a 5% level meaning that there is heterogeneity in the sample. We found an insignificant negative coefficient for bioplastic, implying that bioplastic is not preferred to the reference material at all.

Table 2
Mixed-logit regression results with choice as dependent variable.

	Estimate	Std. Error	95% Confidence interval
Mean coefficients			
Price	−1.83**	0.13	−2.09 −1.57
Organic	0.97**	0.30	0.38 – 1.55
Regional	1.80**	0.31	1.20 – 2.41
Bioplastic	−0.24	0.30	−0.82 – 0.34
Recycled Plastic	1.13**	0.26	0.62 – 1.64
Paper	0.88*	0.44	0.01 – 1.75
Unpackaged	2.44**	0.36	1.74 – 3.15
Organic*Regional	−0.54*	0.21	−0.95 – −0.14
Organic*Recycled Plastic	−0.36	0.30	−0.94 – 0.22
Organic*Paper	0.71	0.41	−0.09 – 1.50
Organic*Bioplastic	0.50	0.32	−0.13 – 1.13
Organic*Unpackaged	0.28	0.36	−0.43 – 1.00
Regional*Recycled Plastic	0.67*	0.32	0.03 – 1.31
Regional*Paper	1.24**	0.37	0.51 – 1.97
Regional*Bioplastic	1.28**	0.35	0.60 – 1.95
Regional*Unpackaged	0.42	0.32	−0.20 – 1.05
Standard deviations of the random parameters			
Sd.Organic	0.89**	0.19	0.52 – 1.25
Sd.Regional	2.06**	0.22	1.62 – 2.50
Sd.Bioplastic	0.58*	0.28	0.04 – 1.13
Sd.Recycled Plastic	0.85**	0.20	0.45 – 1.25
Sd.Paper	2.55**	0.38	1.81 – 3.29
Sd.Unpackaged	2.70**	0.33	2.05 – 3.35
AIC	2168.058		
Log Likelihood	−1047		
Numb. of observations	2252		

$^{**}p < 0.01$; $^{*}p < 0.05$.

Interaction effects. There is a negative interaction effect for organic and regional products that points to a substitution relation between these attributes. Besides the negative interaction effect of organic food and packaging made from recycling plastic, we found positive (significant and non-significant) interaction effects, for example, regarding regional food and recycled plastic. In the case of bioplastic, the determined interaction effects (both are positive) are particularly interesting as this kind of packaging material itself does not lead to an increase in utility.

Willingness-to-pay. Fig. 2 displays boxplots representing the WTP with respect to organically- and regionally produced food. In the median, there is a positive WTP for organic food compared to that conventionally produced (i.e., participants are willing to pay more for organic than for conventionally-produced grapes). Only a few participants have a negative WTP for organic grapes. A negative WTP indicates that a monetary compensation would be needed to offset a perceived disadvantage of the considered attribute compared to the default option. From a methodical point of view, allowing negative WTP values increases accuracy of valuation differences (Bass et al., 2021). The median WTP for regional products is also positive (0.85) and higher than for organic food. The standard deviation in the WTP for regional products is 0.91[13] and that of the WTP for organic food is 0.30. Thus, there is a more consistent WTP for organic than for regional food.

The WTP for packaging alternatives in comparison to both the reference packaging (ordinary plastic) and to each other are summarized in Fig. 3. The significant differences in preferences (Table 2) between

[10] In 2019, Germany accumulated 227.5 kilograms of packaging waste per capita. This makes Germany one of the largest packaging consumers within the EU (Eurostat, 2021). The legal framework with regard to packaging in Germany is defined by the Packaging Act. An analysis of the law can be found in Simoens and Leipold (2021).

[11] The remaining almost 50% of packaging waste is currently incinerated for energy recovery or is exported to other countries (Umweltbundesamt, 2019).

[12] This means that individuals prefer cheaper grapes to more expensive ones. This is in line with both price theory and the results of other empirical investigations studying product choices (e. g., Bronnmann and Asche, 2017).

[13] The absolute WTP-values are to be interpreted with care as they might be inflated due to the lack of an opt-out alternative (Veldwijk et al., 2014).

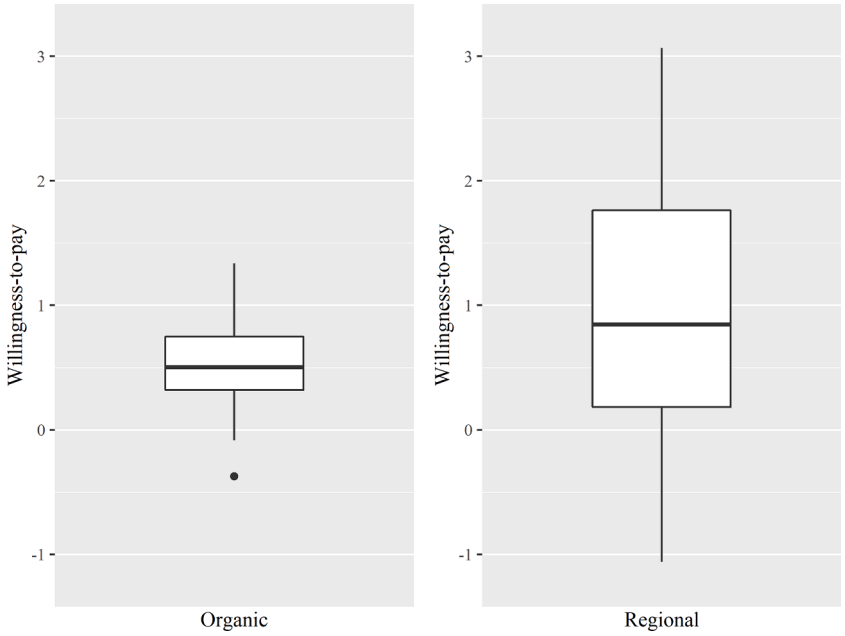

Fig. 2. Individual willingness-to-pay for organic produced or regional products (authors' illustration, *N*= 252).

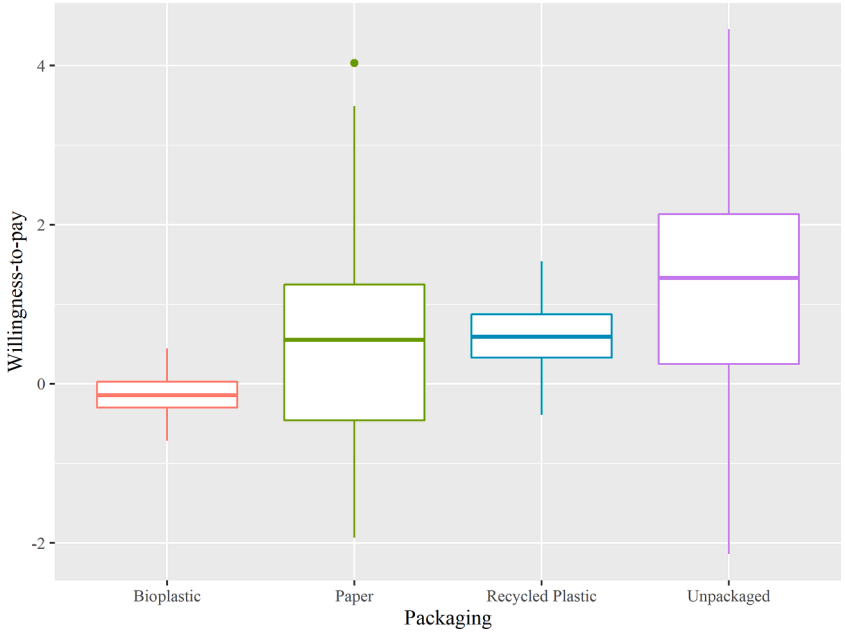

Fig. 3. Individual willingness-to-pay for different packaging substitutes (authors' illustration, *N*= 252).

Table 3
Ranks for the perceived sustainability of packaging substitutes (in absolute values and median rank) .[11]

Rank	Unpackaged	Paper	Recycled plastic	Bioplastic	Plastic
1	239	5	3	0	2
2	4	168	46	28	2
3	0	39	114	88	7
4	2	29	79	111	27
5	4	7	5	21	210
Median rank	1	2	3	4	5

plastic and recycled plastic, plastic and paper, as well as plastic and unpackaged products are also reflected in the respective WTP[14]: there is a positive median WTP for these alternatives. The median individual WTP for both paper and recycled plastic is between 0.56 and 0.59; the highest median WTP (1.33) is that of non-packaging. The individual WTP for paper, however, has a larger variance that also covers negative WTP values.

The WTP for bioplastic slightly differs from those of ordinary plastic. Approximately 75% of respondents have a negative WTP for bioplastic; the median and average WTP for bioplastic are negative.

Interrelation between WTP and perceived sustainability. To find possible explanations for the WTP, we asked participants to rank the packaging alternatives with regard to their perceived sustainability (Table 3). In median, unpackaged products (median rank 1) are perceived to be the most sustainable followed by paper (median rank 2) and recycled plastic (median rank 3). The results point to the fact that participants are not in agreement about whether recycled plastic or bioplastic (median rank 4) is more sustainable. However, most place recycled plastic on rank 3. From the participants' point of view, the worst packaging material in terms of sustainability is plastic.

In order to learn more about the relation between the perceived sustainability of (non-) packaging material and the WTP, we determined the respective Spearman correlation for each participant (Fig. 4). As the correlation coefficient is, therefore, based on four observations only, the results must be interpreted cautiously and are to be handled as an exploratory determined indicator. For more than 75% of the participants, there is a positive relationship between the WTP and the sustainability ranking.

5.3. Qualitative results

The open survey questions were qualitatively analyzed to identify additional explanations for the quantitative results. Responses to the question "What do you think is special about bioplastic?" reveals a great deal of uncertainty, which reflects the lack of both a generally valid, simple definition and consumer information. Fig. 5 illustrates a network graph of those associations with bioplastic that occur at least four times in the dataset. Key-terms are connected if they occur together in one and the same explanation, i.e., one and the same unit of sense.

The prevailing uncertainty is most obviously reflected in the statements "I don't really know." (36 respondents) – "I have not heard much about it." (7 respondents).[15] Besides this explicitly expressed uncertainty, the variety of further associations as well as their deeper analysis point to the fact that consumers are (in large part) quite unsure what bioplastic might be, even if they do not give voice to their uncertainty in such an explicit way. Referring to the upper part of Fig. 5, many respondents state that "there is (or might be) something special about the production" (71 respondents) or that "there is (or might be) something special about the degradability" (67 respondent) or both (18 respondents). What exactly the respondents perceive as special about production and degradability, however, varies within the statement: regarding production, respective associations range from: "Bioplastic is made from renewable resources" (27 respondents "is"/1 respondent "maybe"), "natural resources" (13/6), "sustainable resources" (3/2), "biodegradable resources" (3/2), etc. to "Bioplastic is produced in better working conditions" (2) and "with less CO2 emission" (1). regarding degradability, uncertainty is even greater: The most common association is that "bioplastic is (or might be) bio-degradable" (21/9). However, there are a lot of further, partly contradictory associations like "it is partly bio-degradable" (1/1), "it can be thrown on the compost" (5/1), "it must not be thrown in the organic waste collection bin" (2) and it is "degradable fast" (5), "faster than ordinary plastic" (1/2), and "slow" (4) – just to cite a few. Besides degradability, bioplastic is said to be "recyclable" (Fig. 5, right side) and comes *without* various things like harmful "chemicals" (1), "plasticizer" (1/2), "pollutants" (1/2), and other attributes. Likewise, opinions differ widely regarding the general ecological assessment and range from "bioplastic is more environmentally friendly than ordinary plastic" (7) to "bioplastic is exactly as bad as the ordinary one" (9) – whereby the latter evaluation is linked to the idea that there is nothing special about bioplastic and that it is just corporate marketing (6) that helps to greenwash the use of plastic.

The question whether there is something they would like to have in terms of packaging, when they do their everyday shopping, was answered by 205 participants (Fig. 6). It turns out that a significant number of respondents would like to see generally less packaging. This desire is frequently concretized by asking for less *unnecessary* plastic packaging which, in turn, is contextually related to the evaluation of "packaging in packing" (e.g., the individual packaging of single servings) as unnecessary and, thus, dispensable:

"Considering the example of grapes, I do not reject packaging in principle, but, in my opinion, plastic tray in plastic repackaging is unnecessary." [B98]

In addition, respondents frequently ask for less plastic (packaging) and more paper. Especially with regard to fruits and vegetables, they state that they would like to have more unpackaged alternatives and reusable packaging. Detached from fruits and vegetables, eleven respondents would value the opportunity to use their own reusable packaging in 'normal' supermarkets that are not specialized in offering unpackaged goods:

"I wish it would be easier to take your own Tupperware [multi-use boxes] to the store and fill it. That is often not possible. I would appreciate that." [C26]

However, even though there is a lot of evidence in the qualitative data pointing to the fact that consumers would like to see a (radical) change in the current practice of packaging, some of the responses reflect the fact that consumers often have a difficult time finding their position regarding alternative (non) packaging and that they are – more often than not – torn between two minds. Just to cite one exemplary comment that deals with paper-packaged and unpackaged alternatives:

"Why should I pay more for paper or [goods] without packaging? I'm willing to do that, but it shouldn't actually be the case. But unfortunately, this is reality." [C48]

Aside from the desire to have less (unnecessary plastic) packaging,

[1] Wilcoxon signed rank tests are performed to check if the packaging alternatives are ranked differently. We find significant differences between all packaging alternatives (unpackaged vs. paper: W = 29469, p-value < 2.2e-16, unpackaged vs. recycled plastic: W = 29928, p-value < 2.2e-16, unpackaged vs. bioplastic: W = 30268, p-value < 2.2e-16, unpackaged vs. plastic: W = 30568, p-value < 2.2e-16, paper vs. recycled plastic: W = 22815, p-value = 5.151e-12, paper vs. bioplastic: W = 25751, p-value < 2.2e-16, paper vs. plastic: W = 30210, p-value < 2.2e-16, recycled plastic vs. bioplastic: W = 19579, p-value = 5.86e-05, recycled plastic vs. plastic: W = 29661, p-value < 2.2e-16, bioplastic vs. plastic: W = 28370, p-value < 2.2e-16).

[14] Additionally, we perform a pairwise t-Test to check if there are significant differences between the average WTPs for packaging substitutes. Particularly, we find significant differences between the WTP for bio-based plastic and all the other substitutes (recycled plastic: t = −27.54, df = 417.45, p-value < 2.2e-16, paper: t = −8.53, df = 271.23, p-value = 1.028e-15, and unpackaged: t = −19.04, df = 268.79, p-value < 2.2e-16). Furthermore, also the WTP for recycled plastic or paper differs from the WTP for unpackaged products (recycled plastic: t = −9.06, df = 297.56, p-value < 2.2e-16, paper: t = −8.1767, df = 499.93, p-value = 2.421e-15). This validates the indication that people are willing to pay significantly more for unpackaged products. We cannot reject the hypothesis that there is a difference between recycled plastic and paper in terms of WTP (t = −1.76, df = 303.83, p-value = 0.07961).

[15] The key-term "I don't really know" was coded if respondents *explicitly* state that they don't really know or that they are unsure. Some of these respondents then guessed what bioplastic might be.

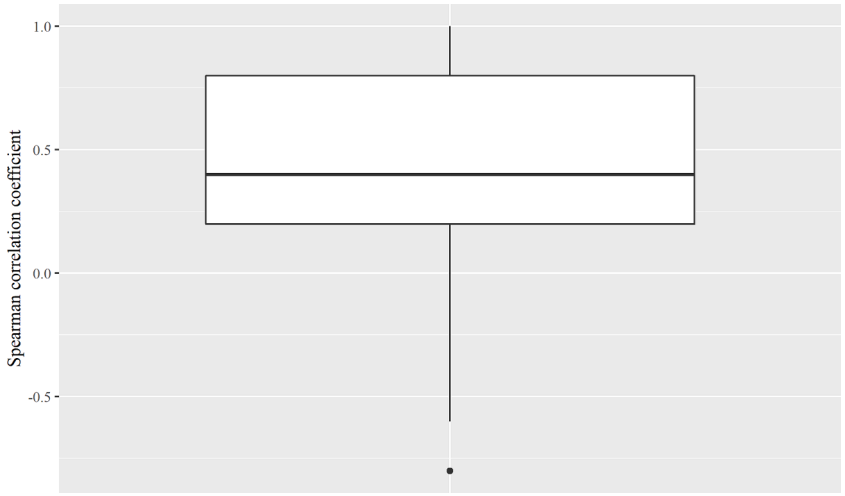

Fig. 4. Spearman correlation coefficients between WTPs and perceived sustainability (authors' illustration, N= 248).

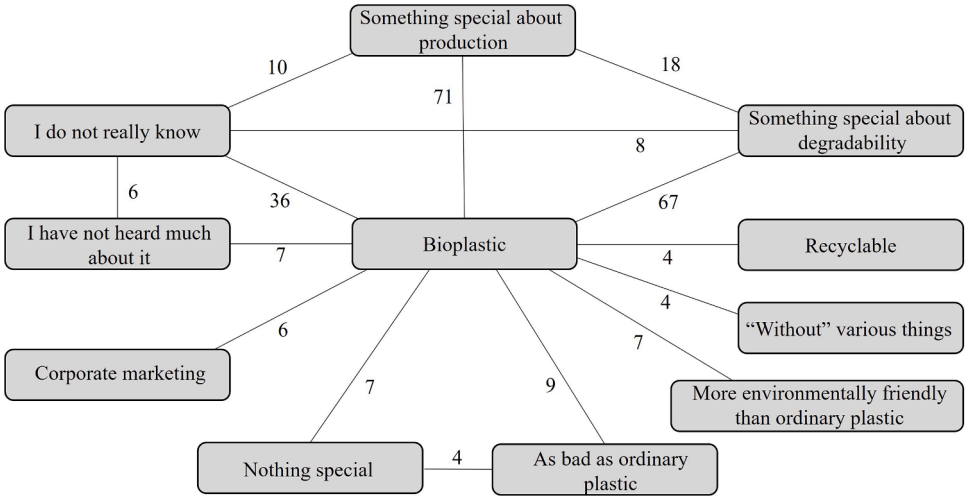

Fig. 5. Associations with bioplastic that occur at least four times in the dataset (authors' illustration).

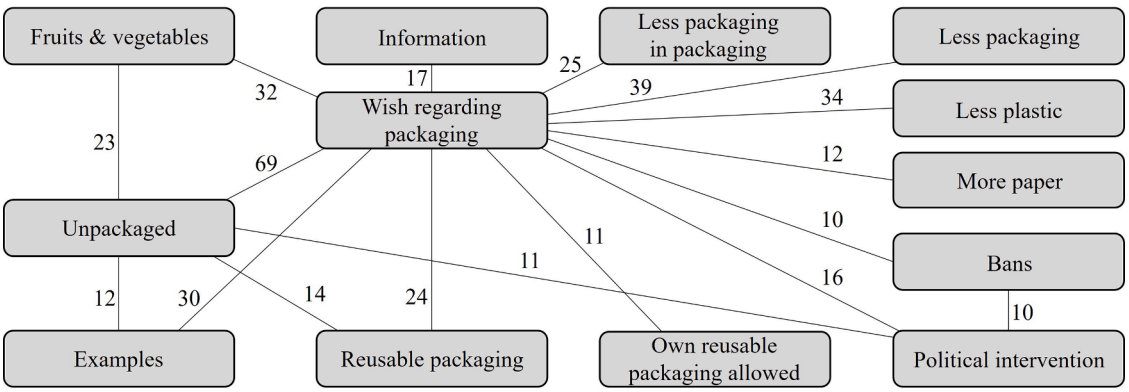

Fig. 6. More than ten times recurring wishes regarding packaging in everyday shopping situations (authors' illustration).

participants frequently want to have more information on the packaging (material) itself, its environmental friendliness as well as the correct way to dispose of it. When asked for wishes regarding packaging, consumers also ask for political interventions like bans, taxes on plastic and subventions in favor of alternative packaging.

Besides these different aspects outlined above, which address the reduction of unnecessary packaging in particular, results point to the fact that the participants differentiate between different kinds of products and also value the positive characteristics of plastic packaging, including ensuring freshness and longevity of fresh produce, as the following quotations underline:

"In the case of sensitive foods that wastes quickly, it [packaging] is

understandable […]" [B71]

"I can't give a general answer to that. It depends on the goods. But generally, less plastic would be nice." [C13]

*"I am a fan of little packaging if the product is suited for it (*e.g.*, fruits, nuts etc.) and enough packaging if it is crucial for the product not to waste too quickly (*e.g.*, fish)."* [C91]

Moreover, results reveal that functionality and practicality of packaging play a role in the respondents' thinking as, for example, they recognize the need to have space for information and/or state that self-packaging unpacked goods would be (too) time consuming.

6. Discussion

As a preamble to interpreting and discussing this study's results, the sample's special characteristics must firstly be recalled as all results are to be interpreted in light of these features. On average, the sample is younger and has (currently) less income compared to the German average. In addition, most participants seem to be rather environmentally sensitive. As there is a general trend towards sustainable consumption, particularly on the part of younger consumers, it can be assumed that our sample might be able to represent an environmentally more sensitive generation of consumers. As the 'young' sample is, on average, well educated, it could be justified to assume that the respective individuals might have the spending capacity to translate their theoretical WTP to practice in the future. Thus, we decided against weighting the data.

Regarding the model's main effects as well as the WTP, our results are, in part, in accordance with previous studies. Supporting the findings of, for example, De Marchi et al. (2020) or Rokka and Uusitalo (2008), we found, in median, a positive WTP for recycling plastic, paper and unpackaged goods, whereby the latter two have a large variance. However, contrary to, for example, Wensing et al. (2020) or Orset et al. (2017) there is, in median, a negative WTP for bioplastic.

As we did not provide any information on the sustainability of different packaging materials, the identified WTP-values represent the WTP for *individually-perceived* advantages and disadvantages of different kinds of (non) packaging. Considering the sustainability-related ranking of (non) packaging, the Spearman correlation as well as the qualitative results, it can further be assumed that most of the WTP can be ascribed to aspects of *perceived* sustainability.

It can, thus, be concluded that consumers (at least theoretically) have a positive WTP for packaging alternatives that they themselves perceive as sustainable – and they do not have a WTP for those materials about which they are unsure or which they assess as not being environmentally friendly at all. This is particularly evident in the case of bioplastic:

- the respective free-text responses point to the fact that there is a great degree of uncertainty regarding the sustainability of bioplastic (Fig. 5),
- regarding perceived sustainability, bioplastic occupies the lowest rank among plastic alternatives (Table 3),
- and there is, in the median, a negative WTP.

In contrast, paper-based packaging is perceived to be more sustainable. This kind of packaging

- occupies the second-best sustainability-related rank among alternatives to conventional plastic packaging (Table 3). In addition,
- participants explicitly ask for more paper-based packing to mitigate the plastic crisis (Fig. 6),
- and there is, in median, a positive WTP. The WTP regarding paper-based packaging, however, has a comparably large variance indicating that consumers are not in agreement about whether and how much (more) they would be willing to pay for paper rather than plastic packaging.

The fact that consumers are, at least in median, willing to pay for alternatives that they themselves perceive to be sustainable is, on one hand, *good news*, for example, for those (companies, legislators) who strive to implement innovative, *sustainable* (non) packaging solutions that do have additional expenses. On the other hand, this insight puts the dilemma regarding the general disagreement about what kind of packaging actually *is* sustainable into focus. If neither theorists, nor companies, nor the political/legislative level agree on the sustainability of various types of packaging – how is a consumer supposed to make an assessment?

When consumers attempt to make an assessment regarding the sustainability of (non) packaging, they are (mostly) forced to and *do* rely on information that is immediately available – and this places a great responsibility on researchers, companies and legislators to provide clarity on what kind of (non) packaging actually *is* sustainable. Research indicates that (positive) information on the sustainability of packaging and/or respective environmental nudges have the power to increase consumers' WTP (e.g., Wensing et al., 2020) and, thus, points to the fact that it is possible to *induce* WTP in consumers. Against this background, it seems important to ensure that WTP is only induced for those alternatives that are actually sustainable and that "greenwashing" is prevented.

Regarding interaction effects, the results raise a few questions. The negative interaction effect for organic and regional products is in line with the results of Meas et al. (2014), who found substitution effects between organic and regional production that they ascribe to a misperception "of local food as being organic" (Meas et al., 2014: 1061), among others. The interaction effects considering bioplastic, however, remain difficult to explain. It might be possible to speculate that these effects are somehow in line with the results of Lindh et al. (2016), who identified that consumers assess sustainable packaging to be more important in the case of conventional than organic food as they "(…) tend to assume that packages for organic food products are environmentally sustainable (…)", per se, (Lindh et al., 2016, p.16). However, there is an urgent need for further research to gain a deeper understanding of the respective interaction effects as even "the most environment-friendly consumers do not choose products or services merely on the basis of their environmental aspects. Rather, the choice is always a multi-attribute choice where the consumer has to trade-off between various product attributes" (Rokka and Uusitalo 2008; p.517).

Aside from the sustainability-related assessment of packaging alternatives and the respective individual WTP, there is a general *dissatisfaction* with the packaging situation among the participants even though they generally value the positive aspects of plastic-packaging regarding, e.g., aspects of food safety. Participants are, to a large extent, in agreement that they would like to see less (plastic, i.e., virgin plastic) packaging and in particular, less unnecessary packaging: our – on average, rather young and well educated – sample often asks for unpackaged goods and would value the opportunity to avail of multi-use systems. Thus, there seems to be a great willingness to change consumption behavior. These consumers (who want to change consumption patterns) often transfer the responsibility to achieve sustainability to food retailers who are blamed for not offering unpackaged goods and/or not allowing individual multi-use boxes. Thus, considering the results of, for example, Gong et al. (2020), it seems to be the case that both consumers and food retailing companies blame each other for hindering the development of sustainable (food) packaging. This emphasizes the need for further research to identify actions that will favor the environment, and thereby preclude reciprocal blaming. In this context as well as in light of the ongoing COVID-19-pandemic, a detailed discussion seems essential to clarify when packaging is necessary and when it is not – and how necessary packaging can be reconciled with environmental concerns (e.g., Silva et al., 2021).

Additional indications for the need of further research result from the limitations of our study: First, this study only considers Germany's specific market structure and culture. Further research is needed to

investigate the WTP for packaging substitutes for regions with different market environments and cultural backgrounds. Second, the only food product considered to elicit packaging preferences were grapes. The WTP for packaging substitutes, product origin, and the production process, however, can be expected to be different for other kinds of food, e.g., pastries, and non-food products, e.g., detergent. Thus, it would be interesting to investigate the WTP also considering other types of products. Third, for reasons of clarity regarding revealed preference structures, this study presented alternatives on a textual basis only. However, in real-life shopping-situations, many products as well as packaging are labeled, and this may have an effect on the consumer's attitude because consumers' perception of sustainable packaging is not only influenced by the material itself but also by the visual and verbal presentation (Magnier and Schoormans, 2015). Further research is needed to investigate possible effects of product- and packaging labeling as well as the provision of information. Last, Kitz et al. (2021) highlight that the COVID-19 pandemic has increased food-safety concerns on the part of consumers. These concerns may also have affected the WTP for packaging alternatives and, in particular, may be accountable for the high standard of the WTP for unpackaged products. Further research is needed to investigate the impact of the COVID-19 pandemic in more detail.

7. Conclusion

This study contributes to gaining a deeper understanding regarding consumers' perception of and WTP for alternatives to conventional plastic packaging. The mixed-method approach enables support for the interpretation of the mixed logit results with qualitatively determined insights into consumers' perception of packaging alternatives and, thus, leads to the following conclusion: According to our results, there is a positive WTP for packaging alternatives that consumers perceive to be sustainable – and there is no WTP for those alternatives that consumers perceive to be non-sustainable or that they are unsure about. This is particularly evident in the case of bioplastic. The qualitative results point to the fact that there is a great deal of uncertainty regarding the sustainability of bioplastic among consumers and that they perceive bioplastic as greenwashing rather than a sustainable alternative to conventional plastic. Going hand in hand with these insights, there is no WTP for bioplastic packaging.

As we wanted to bring our choice situations as close to reality as possible, additional production features of the packed product (conventional versus organic, regional versus global) were integrated into the choice sets, which allow the determination of interaction effects. Some of the respective interaction effects, particularly the negative one of organic and regional food, are in line with results of existing research pointing to a substitutional relation between these attributes. Interaction effects between packaging and production are, however, difficult to interpret and point to the fact that there is an urgent need for further research.

Both the positive WTP for perceived sustainability as well as the results of the qualitative analysis of free text questions, indicate that consumers are generally dissatisfied with the current situation regarding (unnecessary plastic) packaging. It becomes clear that the general disagreement regarding the question of which (non) packaging is actually sustainable does not help consumers, who explicitly ask for more information regarding the (real) environmental impact of packaging. In this context, the political level seems to have to take greater responsibility. Because WTP for sustainability may be inducible, it is important to ensure that consumers are provided with clear and easily understandable information and that greenwashing is avoided.

On a methodological level, the paper demonstrates that a combination of DCEs/mixed logit model estimation and qualitative research is mutually beneficial. Even though all findings must be interpreted with respect to the sample being young and well-educated, this paper attempts to serve as a kind of umbrella that bridges the gap between previous studies as it explicitly accounts for both consumer perception and their WTP.

CRediT authorship contribution statement

Christoph Herrmann: Conceptualization, Methodology, Writing – review & editing, Data curation, Formal analysis, Investigation, Writing – original draft, Visualization, Project administration. **Sebastian Rhein:** Conceptualization, Methodology, Writing – review & editing, Data curation, Formal analysis, Investigation, Writing – original draft, Visualization, Project administration. **Katharina Friederike Sträter:** Conceptualization, Methodology, Writing – review & editing, Data curation, Formal analysis, Investigation, Writing – original draft, Visualization, Project administration.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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