Open-BIO

Opening bio-based markets via standards, labelling and procurement

Work Package 9: Social Acceptance

Deliverable N° 9.1

Annex I: Acceptance of Bio-Based Products by consumers – an exploratory study

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prepared by:

Siet Sijtsema, Marleen Onwezen, Machiel Reinders, Hans Dagevos, Marieke Meeusen

DLO-LEI

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1 Introduction

The present deliverable was carried out within the project 'Opening bio-based markets via standards, labelling and procurement'. The objective of this project is to increase the uptake speed of standards, labels and harmonized product information lists for bio-based products. The present deliverable describes the results of focus groups that explore people's experiences, opinions, wishes, and concerns regarding bio-based products. Additionally, the deliverable provides implications for consumer acceptance of bio-based products.

Importance of consumers' acceptance of new products

During the introduction of new products consumers' acceptance is a critical success factor in many industries, such as the food industry, the automobile industry, and fast consumer goods. The development of new products is necessary to survive in today's global competitive market place. A large amount of money is invested by the industry in the development of new products. These new products are often not accepted by the consumers and therefore fail to succeed (Goldenberg, Lehmann, & Mazursky, 2001).

Consumer acceptance of bio-based products

There is not much known about consumer perceptions and acceptance of bio-based products. There are studies focussing on consumer acceptance of green products. For example studies on the acceptance of organic food (Kihlberg & Risvik, 2007), environmental packaging (Schwepker & Cornwell, 1991), food with added nutritional value such as functional food (Siro, Kapolna, Kapolna, & Lugasi, 2008) and environmentally friendly transport (Ozaki & Sevastyanova, 2011). There are also studies focussing on consumer acceptance of products made with new technologies, such as genetically modified products (Costa-Font, Gil, & Traill, 2008), and nanotechnology (Siegrist, Stampfli, Kastenholz, & Keller, 2008). However, there are only few studies available from consumers perception of bio-based products. Two studies focus on consumer acceptance of bio-based packages (Almenar, Samsudin, Auras, & Harte, 2010; Petersen, Væggemose Nielsen, Bertelsen, Lawther, Olsen, Nilsson, & Mortensen, 1999). Closer insight learns that the first one (Almenar et al., 2010) studies quality perception of blue berries after storage in a biobased package. Consumers did not see the biobased containers of poly lactic acid (PLA), but were asked questions about berries quality. The second study (Petersen et al., 1999) explores technical quality of biobased materials for food packaging. Both studies do not include consumers' perception of biobased package. No other studies concerning bio-based products and consumer perceptions are reported yet. Because there is not much known about consumer perceptions and acceptance of bio-based products, the present study is an exploratory study. The purpose of this deliverable is to increase our understanding of consumers' perception of bio-based products.

1.1 Aim of the study

The objective of this project is to explore people's experiences, opinions, wishes and concerns regarding bio-based products. This objective is divided in the following sub-goals:

a) Get insight in consumers perceptions of the term bio-based
- Provide insight in how consumers perceive the definition; which associations do consumers have with bio-based?

b) Get insight in consumers perceptions of specific bio-based products
a. Provide insight in how consumers perceive the definition of bio-based when applied to a range of specific products
b. Get insight in differences and similarities between products

c) Get insight in consumers perceptions of labelling bio-based products
- Provide insight in how consumers perceive a label for bio-based products; Is it necessary? What are requirements to trust the label?

1.2 Conceptual framework

Among others, the following streams of research can be used to understand consumer perceptions of bio-based; Research towards consumer acceptance of products in *general*, research towards acceptance of *green* products, and research towards acceptance of applications of *new technologies*. The research streams that focus on consumer acceptance of green products and products in general are dominated by rational-choice-based models of consumer behaviour, such as the Theory of Planned Behaviour (TPB) (Ajzen, 1991). The TPB states that consumer intentions are formed by attitudes, subjective norms, and perceived behavioural control. Intentions in turn guide consumer behaviour. The TPB is a well-established theory which is validated across a wide range of behaviours and countries. Critics of the TPB and other rational-choice-based model state that these models only explain intentional, cognitive, and logical behaviour (Godin & Kok, 1996). Incorporating emotions into decision-making models can greatly increase their explanatory powers (Bagozzi, Gopinath, & Nyer, 1999; Koenig-Lewis Palmer Dermodyc, & Urbye, 2014; Mellers, Schwartz, & Ritov, 1999).

The research streams focussing on acceptance of new technologies can be divided into three research streams. A first stream of research focuses on the formation of attitudes, intentions, and behaviour and developed models that are derived from the Theory of Planned Behaviour like the Technology Acceptance Model (TAM; Davis, Bagozzi, & Warshaw, 1989). The TAM is a theory that suggests that when users are presented with a new technology, two factors influence their decision about how and when they will use it: the perceived usefulness (i.e. perception of degree that using a technology enhances performance) and the perceived ease-of-use (i.e. perception that using a technology is easy) (Davis et al., 1989). A second stream of research focuses on risk psychology and risk assessment (e.g., Slovic, 1987; Siegrist, 2000). This stream identifies determinants of risk and benefit perception as predictor of consumer response, sometimes focussing on the relation between risk and

benefit perception (Alhakami & Slovic, 1994), relations with trust (e.g. Siegrist, 2000), or affect (e.g. Finucane, Alhakami, Slovic, & Johnson, 2000). More recently, several studies attempted to come to a synthesis of the literature by developing more comprehensive models in which several determinants have been added (Ronteltap et al., 2007; Huijts et al., 2012).

The used theories in these different streams of research have in common that they all state that perceptions or attitudes of consumers are used to form intentions to buy or use a product. This implies that consumer perceptions towards bio-based are important for the acceptance of bio-based products. Because up until this moment there is not much known about how consumers actually perceive the term on its own and in relation to bio-based products, this deliverable aims to increase insight in perceptions of bio-based. This allows us to better understand issues related to acceptance and intentions of bio-based products. In this study we thus focus on consumer perceptions of bio-based products. This concept of consumer perceptions includes associations, attitudes, emotions, knowledge and involvement.

From perception models is known that perceptions can be differentiated in multiple levels and dimensions. For example, in food choice there are 4 groups of determinants influencing consumer perceptions, i.e. individual characteristics, social environmental characteristics, food product characteristics, and contextual variables (Sijtsema, Linnemann, Gaasbeek van, Dagevos & Jongen, 2002). Due to the exploratory character of this study we focus on different levels of specificity. This allows us to explore in depth how consumers perceive the term bio-based. We include a) a broad and general level in which we explore whether individuals understand the term, and what kind of associations, feelings and motives are associated with this term, b) a product-specific level in which we guide consumers to apply the term to specific products to explore perceptions, associations and feelings on a product-specific level. As such we can explore whether bio-based applies to all specific products or not. We also include a third item, namely c) the label-specific level in which we guide consumers to think of the requirements they believe are important for a label on specific products.

1.3 Method

Focus groups are used to explore the objectives of this study. Focus groups can be defined as ‘a research technique that collects data through group interaction on a topic determined by the researcher’ (Morgan, 1997). Focus groups are originally a specific tool for qualitative data collection, based on dynamics of the group to broaden and deepen insights. They are helpful to generate hypotheses that can be validated in further quantitative approaches (Stewart & Shamdasani, 1990). The content of the focus groups is described below:

a) **Get insight in consumers perceptions of the <u>term</u> bio-based**
   Bio-based is the central topic in this study. The first task therefore aims to explore associations with the term bio-based. By means of word association, an example of an indirect technique (Burns & Lennon, 1993), perception of participants is explored. A

set of terms possibly playing a role when thinking about bio-based is presented to the participants. The keywords we used are: Environmentally friendly, Bio-based, Sustainable, Genetically modified, Nanotechnology, Biotechnology, Biodegradable, Recyclable, Carbon footprint, Bio fuel, Fair trade, Organic, No animal testing, Health, Safety, Natural, Price, Care, Education, Rural development, Waste, Independent from oil, and Blanc cards (can be filled out by participants if they miss a term). Participants were asked to group these keywords and describe which criteria they used to group these words together.

Then, participants were asked to perform a second task. They were asked to rank the set of keywords they associated with bio-based. They were asked to rank these keywords 1) from least to most technical, and 2) from least to most environmentally friendly.

b) Get insight in consumers perceptions of specific bio-based products

In the next phase we discussed the term bio-based at a product-specific level. We selected 7 products (see selection of products below) and asked participants for their perceptions of, and associations with, these products. We started with a grouping task, such that we asked participants to group products and to describe which criteria they used to group the products. In this way we explored which criteria are top of mind by consumers. Next, all products were discussed in detail. Participants were asked for their associations, feelings and buying and using intentions with the specific products.

c) Get insight in consumers perceptions of labelling bio-based products

Participants were asked whether they know labels and what they expected of labels on bio-based products. Examples of questions are, “what are requirements to trust a label?” , “what information would you like to see?”, and “what should a bio-based label look like?.”

Atlas version 7 was used to analyse the transcripts. Transcripts were coded by three independent coders. The analyses started with top-down coding in which the research questions were used to apply the first codes. Gradually, bottom-up coding became more prevalent since the different associations, perceptions and feelings were coded in vivo, which means that what is said is coded with the same wording. Later on in the process, codes that appeared to convey the same meaning were merged.

Output lists and co-occurrence tables were used to answer the objectives. The interpretation of the results was performed by three independent researchers. The analyses will be described in detail in the results section.

1.4 Selection of participants

Focus groups were held in six member states. The countries were selected to represent a wide range of European countries. The following countries were selected: Germany, The Netherlands, Italy, Slovenia, Denmark, and Czech Republic.

Table 1: Sample of participants

		Number of participants: 107
Interest in bio-based, based on...	Lead user	36
	Representative for the MS	71
	All participants Check GfK	
Gender	Man	45
	Woman	62
Age	20-39	40
	40-59	51
	60+	16
Education	Low	9
	Middle	59
	High	39
Member of an environmental NGO	Yes	17
	No	88
Family situation	Married/living together with children at home	29
	Married/living together with children who are not living at home	12
	Married/living together without children	18
	Single with children at home	8
	Single with children who are not living at home	4
	Single without children	25
	Living together with parents	5
	Other	6
Employment	Employed	87
	Student	4
	Housewife	4
	Not working	3
	Retired	6
	Sick	1
	Other	2

Seventeen out of the 105 responents that answered the question, were a member of a nature, environmental or green Non Governmental Organisation. WWF and Greenpeace were the most prevalent organisations.

Six participants per focus group have been selected of which two are so called lead users. Lead users were participants who scored high score on dispositional innovativeness (Steenkamp & Gielens, 2003) ***or*** personal norms (Gärling et al., 2003). The other four participants are representative for their country for age, gender, and education. Additionally, all

participants had to meet the following criteria: (1) Participants may not be illiterate and (2) Participants may not work in: (a) Petro-chemical industry, (b) Energy sector, (c) Cosmetic industry, (d) Media, (e) Farms, and (f) Market research (bureaus). These criteria were handled because we aimed to explore the perceptions of consumers towards bio-based, and not the perceptions of people having more or specific knowledge or expertise about bio-based. The sample included some participants working in the cosmetic industry repectively market research e.g. hairdressors and market research e.g. coordinator online travel agency. These were included in the analyses since we expect them to not have more knowledge about bio-based.

Slovenia was excluded from the analyses

Slovenia was excluded from the analyses, because the moderator decided to use a different term for these focus groups. They informed us afterwards that the term bio-based was not known in Slovenia and that it was therefore impossible to use it in the focus groups. Because the moderator decided to use the term naturally based we were afraid that including Slovenia in the analyses would result in a bias toward naturalness and environmentally-friendliness in the results. We therefore excluded Slovenia from the analyses. We performed the analyses separately for the focus groups from Slovenia to explore whether these group discussions show similar (or different) findings.

1.5 Selection of products

We decided to include a range of specific products in the focus groups. See Appendix A for a picture of each of the selected products. Product selection is based on the following criteria:

a. The product should concern a tangible **end-product or product packaging in a business-to-consumer context.** That is, a product that the consumer could buy and use (e.g., clothes). Thus, semi-finished products and business-to-business are excluded.
b. Products from different product categories. Below some examples of relevant product categories are mentioned[1]:
    i. Textile (e.g., clothing/ shoes/ furniture)
    ii. Personal care (e.g., cosmetics)
    iii. Cleaning products (e.g., detergents and soap)
    iv. Household products (e.g., paper products, disposable cups and plates)
    v. Packaging (e.g., plastics/ biodegradable plastics/ bottles)
    vi. Automotive (e.g., tires, dash boards)
    vii. Consumer electronics (e.g., casings)

[1] Biofuels are excluded, because they are out of focus of this project.

viii. Building material/ decking material (e.g., terrace floors)
ix. Outdoor/ garden products (e.g., mulching films)
x. Paint and lubricating oils

c. The degree of **sustainability** of the bio-based product. The extent to which a product could be perceived as a sustainable product.
d. The **physical proximity** of the product. The intensity with which a consumer comes into contact with a new technology impacts his/her evaluation of the technology and the specific product (Siegrist et al., 2007). We assume that the closer to the human body a new technology comes, the more resistant the consumer will be to accept and use the specific product.
e. The personal relevance of, or **identification with**, the product. The extent to which a consumer can identify with a product, or the extent to which a product says something about yourself.

Table 2 provides an overview of the selected products. The table shows which products are selected and concerning which aspects they are bio-based. Moreover, the table shows how these products meet the abovementioned criteria. The scores on sustainability, physical proximity, and identification are based on expert judgements of WP 9 partners. Note that these criteria might differ among participants, such that some participants might perceive a product as more sustainable than other participants, or some participants might identify themselves more with a product than others. To explore whether the expert judgements represent consumers' judgements the moderators are also asked to judge each of the seven products on the criteria for sustainability, physical proximity, and identification. These scores are shown in Table 12. The differences and similarities between the expert judgements and moderator judgements of participants' perceptions are described below.

Table 2: Overview of selected products

Product	Application of bio-based	Product category	Sustainable ('green') appeal	Is product close to the consumer (Physical proximity)	Identification with the product and Brand appeal
T-shirt	Cotton/Hemp	Textile (e.g., clothing/ shoes/ furniture)	Low	High	High
Foot cream	Plant oil based cream	Personal care (e.g., cosmetics)	Medium	High	Medium
Shopping bag		Household products	High	Medium	Low
Coca-Cola bottle	Bio-based PET from bio-based MEG	Packaging	High	Medium	Low (e.g., un-branded products) to high (e.g., Coca-Cola)
Door trimming/ dashboard	Soy based poly-ols in PU	Automotive	Medium-High	Low	High (with cars) to low (with tires)
WPC-decking	60% wood flour, PP and addi-tives	Building material/ decking material (e.g., floors)	Low	Low (outdoors) to high (indoors)	Medium
Natural paint	Plant oil based, inorganic fillers, volatile com-pounds	Paint and lubricating oils	Medium	Low (outdoors) to high (indoors)	Low

2 Results

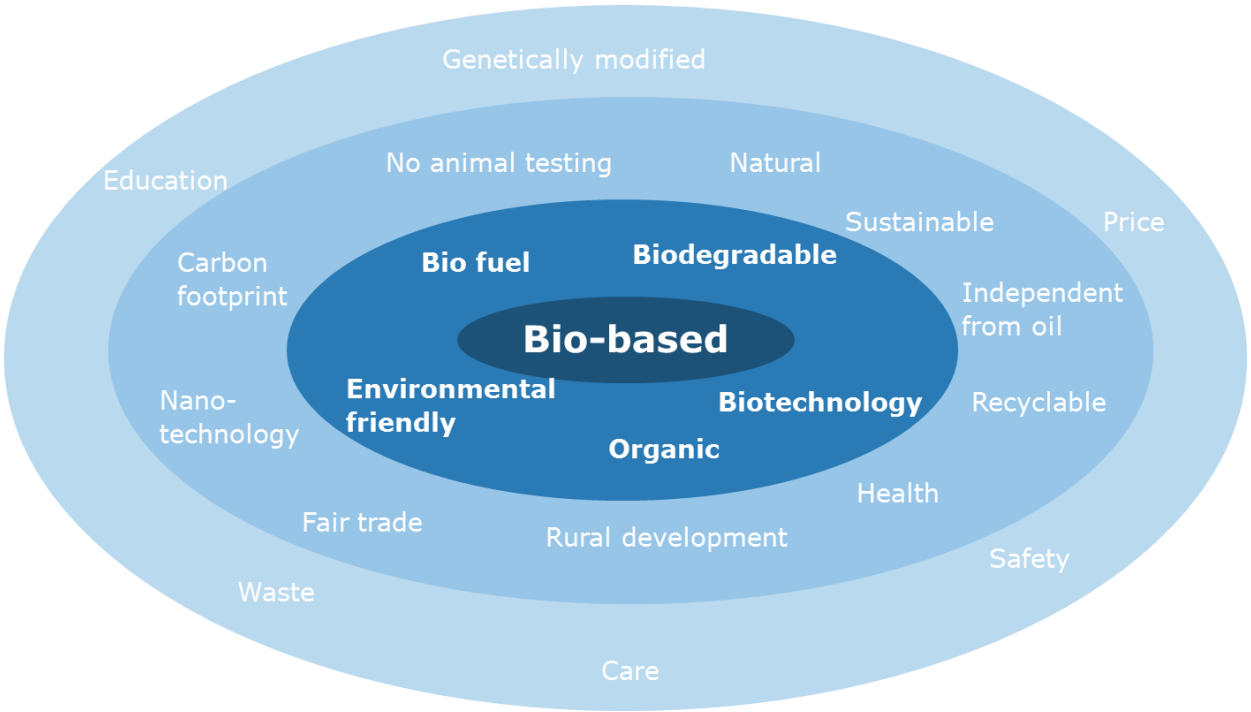
2.1 Participants' perceptions of the term bio-based (products)

This section provides insight in how participants perceive the definition of bio-based. Participants were asked to group provided keywords and discuss which associations they had with the term bio-based.

2.1.1 Associations with the keyword bio-based

In order to explore the associations with the term bio-based, participants were provided with a range of keywords written on cards. These keywords are listed in Figure 1. Participants were asked to form groups and to write down and discuss the criteria or associations they used to group the specific terms.

Figure 1: Associations of provided keywords with the term bio-based



For some participants this is a difficult tasks since they are not familiar with the term biobased. They group biobased in a group with other terms they are not familiar with. They for example mention that bio-based is a popular word without being properly understood by the public.; *"It [bio-based] is a very strange word. What does it mean? (DK group 1 #5)"; "Bio-based, carbon footprint, nanotechnology, genetically modified, biotechnology, bio fuel, inde-*

pendent form oil – i.e. words that are commonly used, but their accurate meaning it probably known only by experts, i.e. lab geeks, technical terms. (IT group 1 #5)". Another solution in this case is the possibility to group bio-based with other keywords which include 'bio' such as Biotechnology, Biodegradable, Bio fuel. The term bio-based is also grouped with keywords that relate to the environment, such as Organic, Environmentally friendly, Natural and Sustainable. Other keywords that are linked to the term are for example 'No animal testing', Health, Fair trade, and Nanotechnology. This indicates that the term bio-based is associated with all the provided keywords. Though the environmental aspect is clearly most often associated with the term bio-based.

Which associations came up while grouping keywords with bio-based?

We only discuss the associations that were mentioned for the group with the keyword bio-based. Note that providing keywords, might have steered participants in a specific direction or might have guided participants to use the keywords which were provided. By taking this bias into account, several findings are discussed below.

Participants often used environment-related associations to group the term bio-based, such as the decrease of waste and fossil fuels or sustainability. The associations ranged from 'bio' in general to more specific associations such as biodegradability. Furthermore, not all participants distinguish between bio-based, organic, and natural. These keywords are often mentioned in the same line of reasoning; *"Very simple, all bio-words in one [group]. I'm thinking everything that's bio is one group, its nature and natural. (NL group 3 #1)"*; *"Bio-based.. No clue. I thought based on biological... a biological fuel that's biodegradable, based on an biological element. (NL group 2 #6)"*. These participants had a positive association of bio-based with the environment. On the other hand, there are also participants who did not have faith in bio-based being environmentally friendly; *"The second group [including bio-based] is what more or less burdens this [preservation of nature], [...] it goes sometimes against nature. (CZ group 3 #5)".*

Some participants grouped keywords that related to products and product characteristics. Groups containing the term bio-based were formed based on associations with shopping, cosmetics, or food; *"Then I have a second group, the biggest one and this is called "Day-to-Day Life and Cosmetics". This one includes safety, natural, environmentally friendly, bio, that is to say bio-based, health and no animal testing. This goes a bit in the direction of foodstuffs and cosmetics that you use on a daily basis. (DE group 2 #5)"* Other participants related the keywords in their group to the product life cycle; "*Moderator: What does it mean, bio-based? #1: I'm thinking just how they cultivate food and the finished products and waste... : Production process. No insecticides. (NL group 3#2)".*

Another group of participants made the association between bio-based and development of new technologies or innovation. In this case, participants tend to see bio-based as a novel technique or method that can be used in the future for various purposes, such as a new form

of energy; *"I have also words [including bio-based] related to energy and the future in the same group. (DK group 1 #2)"* ; *"The second group was development and science, that's where I placed bio-based. [...] When we run out of fossil fuels, we'd have to look for alternatives in order to produce plastic. You can do that with bio plastic. (NL group 3 #2)".*

Thus, the main associations link to the environment, the product, product life cycle characteristics and new technologies or innovations. There is also a range of other associations that were used less often to group the term bio-based. Participants used safety for humans, ways for bio-based to relate to human or social life, and bio-based being an English term. These three associations were not further clarified by the participants who stated this.

Table 3 presents a structure of the associations that have been mentioned while grouping bio-based with other keywords. We have bundled the associations according to the associations that they were assigned to by participants. Bio-related can be seen as a subcategory of environmentally friendly. These associations were often grouped together, however, certain participants could also very specifically mention the bio-related group without explicitly referring to its environmental friendly characteristics. We refer to **appendix I** for a description of the criteria mentioned by the participants presented (codes)of tables 3 and 4.

Table 3: Associations with bio-based

Bundled associations	Participants' associations and arguments to group keywords with bio-based
Environmentally friendly	Environmental friendly, Sustainable , Solution/Salvation , Waste , Pollution.
Bio-related	Bio, Natural, Organic, Biodegradable, Biological.
Innovation/technique/science.	Innovative, Technical, Energy, Agricultural development, Future, International development, Transportation.
Products	Product, Life style, Health, Price, Food, Cosmetics, Shopping Criteria, Composition/Ingredients, Ideal, Quality.
Production life cycle	Product(ion) life cycle , No fertilizers, Fossil fuels, Pesticides.

Table 4: Feelings with biobased and it's associations

Feelings, and normative ideas	Participants criteria
Mixed feelings	Innovative, Organic, Bio, Biological, Environment, Health, Marketing, Distrust
Negative feelings	Buzzword, Unknown, Waste
Positive feelings	Bio, Environmentally friendly, Natural, Health, Agricultural development, Energy, Future, Ideal, Innovative, Shopping criteria, Sustainable
Normative ideas	Environmentally friendly, Future, Ideal

Aside from the product-related associations, there was another layer added to participants arguments; positive or negative feelings, mixed feelings, and normative ideas about an association (table 4). The results show that participants had negative feelings with the group of keywords including bio-based when they are not familiar with the term or perceive the term as a marketing trick. Participants had positive feelings with the group of keywords including bio-based when they perceive it as environmentally-friendly or natural, healthy, or energy-related and innovative. Mixed feelings related to the question whether bio-based is truly innovative, environmentally friendly or healthy. This included a certain degree of distrust. This is shown when participants mention that bio-based is a term that is trying to hide something; *"The profaned, tricky terms [including bio-based] that serve to eco-terrorism and make some tricksters richer, the Ministry of Finance, etc. (CZ group 2 #5)"; "It is a negative group where they only care about the price. I thought of Lidl and the like. And bio-based got in that group because it is a silly word, because everything is bio-based. I mean we live in this world and everything is bio-based. I think the term is silly and wants to hide something." (DE group 1 #1)*

There was also a group of participants that had normative ideas about buying specific products, such that they stated that one *should* use these products because they are better than others in terms of product characteristics (i.e. healthiness and environmental friendliness).

Some people question whether a certain characteristic is part of bio-based products, whereas others mention not to trust bio-based to possess a specific characteristics e.g. sustainable, biodegradable. Additionally, note that the categories of associations are *not* mutually exclusive. Participants often mentioned multiple associations at the same time and a feeling or multiple feelings on top of that. For example, the following quote shows the associations environmentally friendly and future as well as a positive feeling; *"I made a group I call good for the environment [...]. It is something I have worked with professionally, so for me the associations I get are positive. It is something I feel good about. That is the direction we have to go. (DE group3 #1)"*

2.1.2 Perceived technical and environmentally friendly characteristics of bio-based

Participants were asked to perform a second task. They were asked to rate how technical and how environmentally friendly they regarded the terms in their group of keywords including bio-based. Additionally, they were asked to motivate their choice. Thus, this paragraph only discusses participants' ideas regarding the term bio-based.

Participants completed this task in different ways. There were participants who completed this task with a group of keywords that did not include bio-based, some participants only ranked bio-based to be technical or bio-based to be environmentally friendly, whereas others ranked bio-based on both scales. On top of that, not everyone motivated their choice. Therefore, it is rather difficult to conclude findings about the rankings. However, the reasoning and discussion about these rankings gives interesting background insights.

The results indicate that participants perceive bio-based in many different ways; some participants thought bio-based to be both environmentally friendly and technical, others thought it to be both not environmentally friendly and technical, others thought bio-based to be environmentally unfriendly and technical; and others thought bio-based not technical, and environmentally friendly. Additionally, varying options in between were observed.

This task has been designed in order to get participants to talk about the reasons why they perceive bio-based to be more or less technical and environmentally friendly, or not. The same analyses are conducted and presented (Tables 5 and 6) as the former task presented in paragraph I.2.1.1 (Tables 3 and 4). The difference between these results is the fact that participants are in this task guided to focus on environmentally friendly and technical aspects. A comparison between these associations is decribed. In addition, an overview of the arguments that participants used to place bio-based high or low on the scale of environmentally friendly or technical is presented.

Table 5: Associations with biobased in technical and environmental friendly context

Associations bio-based	Participants criteria/associations
Bio-related	Bio, Natural, Organic, Biological
Environmentally friendly	Environmental friendly, Pollution, Waste
Innovation/technique/science.	Energy, Future, Transportation
Products	Fossil fuels, Health, Food, Genetically modified, Life style, Price, Product
Production life cycle	Product(ion) life cycle, No fertilizers

Table 6: Feelings with biobased in technical and environmental friendly context

Feelings.	Participants criteria/associations
Mixed feelings	Bio, Natural, Composition/Ingredients, Environment, Marketing, Organic, Unknown, Biodegradable, Biological, Food, Pollution, Distrust
Negative feelings	Bio, Waste
Positive feelings	Bio, Energy, Environmentally friendly

A comparison of the tables 3 and 5 indicates that participants mentioned only one new association when explicitly guided to think about technical and environmental aspects; Bio-based products were perceived as genetically modified products when guided to think of technical versus environmental aspects. Only a few associations from table 3 were repeated in table 5,

most of them were not mentioned again. This was to be expected since the rationale behind their self-formed groups was already explained.

We observe an interesting difference in the feelings reported in table 4 versus table 6. Participants mentioned a more diverse range of characteristics they associated with bio-based which they had mixed feelings about: Natural, Composition/Ingredients, Unknown, Biodegradable, Biological, Food and Pollution. An example of how one participant distrusts the Composition/Ingredients of bio-based products is presented in the following quote; *"The word is cheating, because somehow it is something based on something else. It might as well be full of all kinds of stuff we don't know what is. Bio is a good and positive word, but the word based is not entirely positive. (DK group 1 #4)"* In addition, there is mentioned that bio-based is not bio; the association was mentioned in a negative manner. To complete the comparison, no normative ideas were uttered during this task.

Again it should be noted that the list of keywords that were given to the participants may have coloured their associations. The results, however, show that not all keywords were mentioned as associations. For example, after having grouped the keywords, carbon footprint, care, education, and nanotechnology have not been mentioned anymore by participants while discussing bio-based. This might indicate that participants did not link all keywords to bio-based even though their attention was drawn towards these words in the first task.

Tables 7 and 8 present an overview of arguments that participants reported when they ranked bio-based to be Environmentally friendly and Technical. Please note that the number of arguments does not necessarily specify the frequency of bio-based being ranked high or low on the scales, because not everyone was asked to explain their choice.

The results show that the arguments for ranking bio-based high on environmentally friendliness mostly revolved around bio-related (including bio, natural, organic, and biological) and environmentally friendly-related associations. The results show that high or low rankings are associated with positive and negative feelings. Participants that ranked bio-based high on environmental friendliness provided a positive connotation. Participants that ranked bio-based in the middle of the scale also mentioned bio-related associations in a positive way, whereas participants that scored bio-based low on environmentally friendliness were concerned that bio-based (products) is/are not bio, natural, organic or biological; *"For me that [bio-based] is in the middle of environment friendly because I feel that it can mean a lot and for me that could be a biological resource and that is then processed chemically or mechanically in such a way that it isn't purely organic anymore. It is still bio-based, which is better than nothing, but it isn't purely organic anymore. (DE group 1 #4)"*

Other participants that ranked bio-based low on environmentally friendliness were uncertain about the exact meaning of bio-based and its implications for environmental friendliness. Some participants that ranked bio-based low on this scale acted on their gut feeling and were not able to clarify their choice. Again, the term biobased was not understood properly and

lastly, participants associated bio-based with being processed, and therefore not natural or environmentally friendly.

Table 7: List of arguments mentioned to position biobased on environemental friendly levels

Environmentally friendly

High	Middle	Low
- The impulse or impression that bio-based is environmentally friendly - Bio-based is positive/important - Because of the word bio - Bio-based means/ has to do with ecological - Bio-based means that you're living biologically - Bio-based is based on natural things - Probably positive for environment even though it might not be biodegradable	- Uncertain about the meaning of bio-based and its implications for environmental friendliness in general - Uncertain about how biological bio-based is - Uncertain about the biodegradability of bio-based products - Only part of the product is organic - Bio-based is not necessarily good - Bio-based can mean a lot: it is biological but still processed - Bio-based sums up everything that is bio - Bio-based is natural - Bio-based is neutral from an environmental point of view	- Impulse or gut feeling - Bio-based is not bio or biological - Does not clearly understand the word bio-based - The basis is altered so it is less environmental friendly – processed - Bio-based is not necessarily natural - Associations with a laboratory rather than environmental friendly - Bio-based food can only be trusted when grown by oneself - Cannot imagine bio-based to be more environmentally friendly than organic or natural

For ranking bio-based on the technical dimension, different sorts of arguments can be distinguished. A group of participants seemed to have a general feeling that bio-based is technical or has to do with a laboratory or research but they were not able to explain this association. Other participants perceived bio-based (products) as processed, which they perceive as technical. Some participants seem to regard technical as the opposite of environmental friendly in the context of bio-based. Their reasoning is that bio-based products are made of natural product which are processed. Therefore, it cannot be as environmental friendly as natural, organic or biological products; *"Bio-based sounds like technological work to me, because if it only the basis then it must be technically altered. That is why I rated it to be more technical and less environmentally friendly for the same reasons. (DE group 1 #2)"* Participants that ranked bio-based as medium technical questioned the bio-relatedness of bio-based products. Additionally, these participants also perceived technical aspects and environmental friendly aspects as opposites. The last group, ranking bio-based low on the technical scale, stated that they perceived other keywords to be more technological. Moreover, they stated that they acted on gut feeling.

Table 8 might give one the impression that bio-based was ranked high on the technical scale by the majority of participants. This is not the case, bio-based was, as already noted, placed in all categories (high, middle and low). However, not all respondents provided

an argumentation.The table thus gives an overview of the arguments that have been stated by participants, and not the frequency of placements

Table 8: List of arguments to position biobased on technical level

Technical

High	Middle	Low
- Impulse or gut feeling is that it is highly technical Associations with a laboratory or research - Bio-based is a manufactured, produced thing - You have to be able to extract it from nature It sounds genetically modified - Bio-based is connected to the context – the complexity of things Bio-based is related to biotechnology so it's technical - Bio-based is a technology - Hard to understand so than it is often technical - Sounds technical probably because of the English term - Bio-based is probably not environmentally friendly Bio-based is not necessarily natural	- Not sure whether it has anything to do with nature - Bio is not totally technological but bio-based is still a processed good	- Other words in group are more technological demanding than bio-based Impulse: you can do it, but you don't have to

2.1.3 Unawareness bio-based

A clear finding is that many participants in this study were unfamiliair with the meaning or definition of bio-based. The previous paragraphs (for example tables 7 and 8) already show that participants have many questions concerning the meaning of bio-based. Table 9 shows an overview of the questions that participants posed or that came up during the discussion of the previous tasks in the focus groups.

Table 9: Questions of participants about biobased

Topics mentioned as unknown	Questions raised:
Bio	Is bio-based bio (including organic, natural, biological) ?
Composi-tion/Ingredients	To what extent is a bio-based product actually bio (including organic, natural, biological)? What are other ingredients/compounds?
Environmentally friendly	Is bio-based environmentally friendly? Is it more friendly than biological, natural or organic?
Product/Production life cycle	Is a product bio-based or does it concern the production process/technique of producing?
Biodegradable	Is bio-based biodegradable?
Energy	Can you make energy/fuel with bio-based?
Waste	Does bio-based reduce waste?

The table shows that participants wondered about the meaning of bio (e.g. is it organic or natural?) and about the extent to which something is bio (e.g. organic or natural). Thus, the words 'bio' and 'based' raised questions and assumptions that the products are partially bio or organic; *"I'm thinking of products, bio-based is less than biological. So biological is 100% and bio-based is 50%, that's the feeling I've got, but I don't have a clue. (NL group 1 #5)"* In addition, participants wondered how environmental friendly bio-based was and whether the term applies to a product or production technique. Some participants wondered whether bio-based was biodegradable, whether it is a form of energy or if energy could be produced bio-based, or whether bio-based reduces waste. In short, there was many confusion regarding the term and its environmentally friendliness.

In this sample, only a minority was observed to know or perceive that bio-based has something to do with renewable resources rather than fossil fuels; *"I think that it [bio-based] might mean that is has no mineral oil and is not made of any basic resources. (DE group 1 #6)"*

This lack of knowledge can evoke negative feelings and feelings of distrust, which has already been illustrated in tables 4 and 6. Other participants seem to find the word bio-based deceiving since it is not totally bio; *"It doesn't tell me exactly what it is about. Perhaps it started out as something good, then it has taken a turn. Somehow, I have the feeling that it is a trap. (DK group 2 #5)"*

Another unfortunate example of this unfamiliarity with the term bio-based is that the moderator(s) in Slovenia felt the need to explain bio-based, because participants would not be familiar with the term and that there was no translation yet. The moderator explained the definition in terms of naturalness, which might have provided a bias towards natural associations with bio-based in Slovenia. Therefore, the data from the Slovenian focus groups were excluded in the results section. However, in paragraph I.2.4 the results for Slovenia will be discussed.

2.2 Participants' perceptions of the selected bio-based products

This paragraph can broadly be divided in three parts. First, as already noted in the methods section participants were asked to group products together. This task served two goals; it allowed participants to become familiar with the selected products and it allowed us to explore which criteria are used by participants themselves to group products, i.e. top-of-mind criteria.

Second, after performing the grouping task each product was discussed individually. For each product a short description of positive associations, negative associations, and mixed feelings is provided.

Third, the selected products served as examples of bio-based products. The perceptions of these products are therefore mostly interesting in comparison to each other. Thus, we are less interested in individual perceptions of these products, but more interested in differences and similarities across these products. These in the third section of this paragraph.

2.2.1 Relevant criteria for participants to group the 7 selected bio-based products

The criteria that participants mention to group products together are an indicator of which product characteristics are important for them in the context of bio-based products. These characteristics are not provided or forced, but spontaneous brought up by participants themselves. The results show that participants use a broad range of characteristics to group the seven products. Below we bundled these characteristics in overarching criteria (Table 10).

First, a large group of participants used their own perspective to group products together. For example some of the participants grouped products based on whether they would use or buy the products themselves. These participants thus refer to personal usage; *"I use and I don´t use, I buy a plastic (shopping) bag every day, the floor took me aback whether it is right, the foot cream, I often buy T-shirts, too, I don´t drink Cola, I drink water (CZ; group 1 #1)"; "I made two groups, the first things are those for personal, everyday use – the bottle, the bag, the T-shirt, the cream , the rest – the floor, the interior and the paint are like technical things (CZ group 2 #2)"* Other participants refer to the necessity of products. They distinguish groups based on whether they need the products in daily life or not; "*very different things, difficult to rank, so, for me, there are things dispensable and indispensable. (CZ group 3 #6)"* Another group of participants used the way how products are used. These participants for example differentiate between short-term and long-term usage, every-day versus rare usage; "*I grouped it very differently. I have interior, paint, and flooring, things you don't use very often and where the sustainability might be less important (DE group 1 #6)".*

Second, there was a group of participants that used the product perspective in which some participants refered to product categories to distinguish specific groups, such as interior & exterior, cosmetics, convenience, or practical products whereas others used specific product characteristics, such as the texture or materials that were used; "*Another group I call construction - it is the WPC-decking and the paint - and finally a group of cars (DK group 3 #1)";*

home care versus personal care (IT group 2 #1)"; "*3 groups for me, depending on the type of materials and texture (IT group 1 #3)".*

Third, a goup of participants mentioned environmentally friendly aspects to characterise their groups. Participants that focus on percentage of environmentally-friendliness; "*Plastic bag and plastic bottle because it was 100% recyclable, the foot cream paint and panel together, I'm not convinced that it is 100% natural and biodegradable .. by the packaging of the cream. And terrace tiles [WPC-decking] and T-shirt together .. because I felt almost 100% bio (NL group 1 #2)"; "I have cola, dashboard and tile [WPC-decking] in a group, it is 22.5% bio-based and foot cream and purse have more value bio-based, I think that T-shirt and bag can be 100% bio-based (NL Group 2 #5)".*

There were also participants that related environmental aspects with the product life cycle, for example production process, use of products and waste of products (recycling or throwing away). Participants, for example, focus on packaging versus raw materials, the use of plants versus (oil-based) plastic, packaging versus production, recycling and degradability; "*Solve the burden during the production process, the remaining products are the floor, the interior, it appears to me more like technical matters (CZ group 3 #5)".* Aside from the product-related associations, there was another layer added to participants arguments. Participants also used their feelings to distinguish groups of products. Often these product-related and feeling-related associations were used together. Participants for example used environmental aspects in combination with an emotional connation. There were participants that grouped products on negative and positive feelings, trustworthiness versus distrust of the products, or normative aspects (products one should buy versus products one should not buy); "*I think about whether it is good or bad for the environment (DK group 3 #2)"; "Distrust, there must be chemicals in these products (CZ group 2 #3)";"Then the paint which looks like it was natural but can´t be leaked into the water as it is poisonous, so it does not appear very natural to me, it is like against nature rather than natural in my opinion (CZ group 3 #5)".*

Many participants ended up with two groups which they perceived as positive versus negative. Positive feelings were present when products were perceived to be biodegradable, environmentally friendly, or produced with renewable resources. In addition, biobased products are mentioned to be positive when they are used frequently.

Negative feelings arose when participants had the feeling that certain products lacked specific characteristics such as biodegradability, durability, and environmental friendliness. Finally, participants did not always trust products being supposedly biodegradable, environmental friendly, natural and whether it was totally plant based. Thus, some products (e.g., paint, dashboard and WPC-decking) are by some participants not seen as natural or environmentally friendly products. These products are by a specific group perceived as toxic or environmentally damaging; *"Dashboard and packing the paint together because the car is .. not .. well .. the dashboard of the car itself is not as environmentally friendly .. petrol or diesel, so semi environmentally friendly, such as the packaging of the paint .. packaging of the paint is*

not on paper, it is a kind of metal. And the paint is to be environmentally friendly ... therefore together (NL group 1 #6)"

There were also participants with a third group; a group which they did not perceive as strongly positive or negative. Or a third group which was just not clear to them; "*I have cola, dashboard and tile in a group - plastic, so not biodegradable I do not know what it does when it is bio-based. I have idea that plastic does not degrade (NL group 2 #4)".*

Table 10: Criteria that consumer use to distinguish groups within the 7 bio-based products

Category	Associations
Personal perspective	daily use, usability, buying/trying
Product perspective	personal care, shopping, Exterior characteristics, aesthetics, price, innovative
Environmental aspects	biodegradable, natural, environmentally-friendly, organic, bio-based, plant plastic, durability, pollution, sustainable
Product life cycle	recycle, package, content, product life cycle, technology, transport
Trust-related aspects	noxious, distrust/trust, mass consumption, use of chemicals

Table 11: Feelings concerning characteristics of biobased products in general

Category	Associations
Positive feelings	Biodegradable, Environmental friendly, Mass-consumption, Renewable
Negative feelings	Biodegradable, Durability, Environmental friendly, Noxious, Partly plant based
Mixed feelings	Biodegradable, Environmental friendly, Natural, Partly plant based

A list of the definition of each code (i.e. associations in Tables) can be found in Appendix B.

Figure 2: Graphical representation of the top-of-mind criteria

2.2.2 Individual Products

In this section the individual products are discussed. Each product is presented to the focus groups and briefly discussed. Participants for example discussed associations, perceptions, usability, and willingness to buy. For each product the description is based on both an interpretation of the transcripts by independent researchers and the range of associations mentioned (Tables 10 and 11). The perception of each specific product is discussed in positive associations, negative associations, and mixed feelings.

Note that the amount of products discussed was large. It was therefore not possible to discuss each product in detail. Furthermore, we state again that this is an explorative study. The product-specific findings should therefore be interpreted with care. The products are selected to provide an overview of how bio-based can be applied to a range of products. Individual conclusions for the products are not the goal of this study, the products are used as examples of products that together provide insight in consumers perception of bio-based products.

Some general remarks are noticed: First of all, the definition of bio-based was not clear for participants. There was confusion and several questions regarding what bio-based exactly means for these specific products were asked. For example, questions regarding biodegradability, production process, content and percentage of bio-based; *"I suppose it also depends on the use of the product. How many times can you recycle the bottle and how many times*

can you recycle the shopping bag? (DK group 2 #6)"; "Yes, they are two different pairs of shoes. Recycling goes one step further. We need to take care of the waste that is produced by us. But you said that it does not mean that the bio-based products are 100% degradable. So, degradable and recyclable is perhaps one step further, but bio-based is also a good approach (DE group 3 #3)".

Additionally, people differentiate between package and content of a product. It was not always clear for participants which part of the product is made of bio-based materials. This was confusing for participants. For example, participants mentioned that they would like to have more information, such as which aspects of a product is bio-based; *"And that is made of special plastic. But I always thought that we don't want plastic. I am confused a bit by that. Plant bottle. Made from plants up to 22%. Am I right in saying that we don't want plastic anymore? (DE group 1 #3)"*

In general, the involvement of participants with the specific products and the bio-based characteristics was low. This comes up when participants mention that they would not buy, think about, or like a specific product; *"I don´t think about cars, I don´t use a car, so I don´t know, when someone tells me that it is organic, environmentally friendly, so like yeah, all right, because I believe it but that I would have a need like that, no, I don´t … in fact, I don´t think about it* (*CZ group 2 #4)". "For me an unnecessary product, I don´t buy, don´t drink and don´t care what the bottle is made from (CZ group 3 #6)."* However, there were other participants who did feel enthusiastic and involved when they discussed specific products; *"[...] and the bags are really exciting, because it is an interesting topic for me. Today, I went shopping, and they immediately put everything into a shopping bag. When I told them that I don't need the shopping bag, they were a bit angry about me and I had to unpack the things myself. I find that it is an important topic. And those plastic plastic bags rot indeed (DE group 3 #5)."*

Table 12 shows the percentage of scores of the moderators on the perceived criteria of sustainability, physical proximity and identification for the seven products. There are some differences between Table 2 and Table 12. The results show that the WPC-deck, the foot cream and dashboard were perceived as less *sustainable*, whereas the Coca-Cola bottle is perceived as more sustainable, by the moderators representing their groups of participants compared to the expert scores.

For *physical proximity* the results show that T-shirt and foot cream are perceived as less, and shopping bag as more, close to the participants' body. Physical proximity might have been perceived differently by moderators compared to experts. Physical proximity refers to the extent to which a product comes close to the body, it refers to physical contact. The results indicate that moderators used the amount of times used or the daily use. For example because shopping bag is rated as more close to the body than foot cream.

All products were rated by the moderators as products with low or medium *identification* with the product. T-shirt, foot cream, shopping bag, and Coca-Cola bottle were rated as medium, and dashboard, WPC-decking and natural paint were rated as low. This shows similarities

with the expert judgement. Though experts rated a T-shirt as high, and expected more variation in scores for the dashboard.

Table 12: Moderator scores (representing participants'perceptions) on product criteria of selected products

		Sustainable	Physical proximity	Identification
T-shirt	Low	17.65%	23.53%	35.29%
	medium	29.41%	47.06%	47.06%
	High	52.94%	29.41%	11.76%
Foot cream	Low	52.94%	52.94%	47.06%
	medium	23.53%	29.41%	47.06%
	high	23.53%	17.65%	5.88%
Shopping bag	low	0.00%	23.53%	29.41%
	medium	29.41%	29.41%	52.94%
	high	70.59%	47.06%	17.65%
Coca-Cola bottle	low	35.29%	23.53%	41.18%
	medium	58.82%	41.18%	47.06%
	high	5.88%	35.29%	11.76%
Door trimming/ dashboard	low	52.94%	82.35%	70.59%
	medium	41.18%	11.76%	23.53%
	high	5.88%	5.88%	5.88%
WPC-decking	low	17.65%	47.06%	70.59%
	medium	64.71%	41.18%	17.65%
	high	17.65%	11.76%	11.76%
Natural paint	low	23.53%	35.29%	64.71%
	medium	58.82%	47.06%	29.41%
	high	17.65%	17.65%	94.12%

2.2.3 T-shirt

Table 13 shows positive, negative and mixed feelings with T-shirt. **Positive aspects** are aesthetics, like the shape and colour and exterior characteristics, like a pleasant touch, and be-

ing modern, such that people like the shape or print of the T-shirt; *"It is pleasant to touch, it is important when you wear the T-shirt, the colour is pleasant (CZ group 1 #3)"; " it is pretty, yeah, it is (CZ group 1 #6)".* These pleasant feelings are related to health aspects as allergies: *"I don't think it will make you itch - I think it is softer and more comfortable to wear (DK group 3 #2)"; "That it is more natural, especially when you have a tendency towards allergies and itching, that this doesn't cause it. (DE group 2 #1)"* Participants are also positive regarding natural and environmentally-friendly aspects;"*It's definitely more natural than rayon for example or polyester. And it's probably much more pleasant to wear. Maybe also robust (DE group 2 #3)*"; "*Less dangerous for us people and the environment (IT group 3 #1)"; "It's a natural product, should be good for the skin (IT group 3 #1)".*

People mention that this naturalness gives them a good feeling. Doing the right thing makes them experience positive emotions. Also a group of participants links naturalness to healthiness and no allergies. These participants believe that a natural bio-based T-Shirt is better for their health.

Although most participants refer to bio-based and naturalness as a positive aspect, they also note that the use of bio-based materials is not a decisive aspect. Firstly and most important a T-shirt should look nice; **"***the important thing is whether it looks nice, if it's 10 euros more expensive than I would not buy, then I can buy 2 (NL group 2 #6)";* "*If I should buy it, my first priority would be the quality; i.e. the clothes had to be cool. It wouldn't be because of the hemp even though that would also be of some importance. The price also has to be okay (DK group 1 #4)"; " I think it's nice, if it's more expensive, but I fall on it, I just, buy it, it would not be a decisive story .. (NL group 1 #4)";"when buying T-shirts, it is more important to me to see what they look like, maybe it would make me buy it if I saw it was made by someone here "who needs to be helped a little bit (CZ group 3 #2)".*

Negative associations with the T-shirt. Some participants do not like the T-shirt. They mentioned that this T-shirt does not fit their taste. Other barriers for buying the T-shirt are durability and price. Participants question to what extent the T-shirt is more or less durable than a regular T-shirt. For example regarding to how to wash, amount of times washing and colour vanishing; *"Not to lose colour, natural things often lose colour; – I would expect less durability (CZ group 2 #3)".* Regarding, price, a group of participants thought that the T-shirt would be more expensive than a regular T-shirt. This is mentioned as a barrier; *"The price would take me aback (CZ group1 #1)";"I would not buy it for the price reason, I know how these things can be overvalued (CZ group 1 #2)".*

Participants questioned whether the T-shirt is a fully natural product, which results in negative associations and distrust: For example, some participants refer to the production process in China; *"It is a clothing item, and everyone needs the clothing, it is from hemp, I read it was made in China, which took me aback, once again carbon footprint, then that there are the terms and conditions created for those who make it, so it is positive but this carbon footprint and that it is not made in our country, companies should employ people here and not in China (CZ group 3 #3)*"; "*it took me aback that it is made in China (CZ group 3 #4)"; "I don't be-*

lieve those labels, not if it's Made in China (IT group 2 #5)". Others refer to the use of paint. Participants state that bright colours of paint cannot be natural. This results in scepticism; *"It is nothing but a con. It is made in China. You can read a number of different standards that you don't know anything about. Therefore, I'm very critical. If it were true, the colour would be a natural colour. This colour is much too dense (DK group 1 #5)"; " The material is not important for the health, it is the dying that is damaging (DK group 2 #2)".* Thus, we can observe that certain participants distrusted specific product characteristics of the production process, such as the colouring, the country of origin (China) or the environmentally friendliness.

Finally, Table 13 shows mixed feelings with the T-shirt. It is unclear whether it is more environmentally friendly; "*it is made of hemp, so I ask myself whether it is much better for the environment if you all are going to put down large fields, I do not know if that's better than cotton (NL group 3 #2)"; "T-shirt is not entirely clear, anyway, I think of a cotton T-shirt .. so .. I do not understand it's still good. If the part is cotton .. what is so unfriendly that it has to be organic. So a question mark (NL group 2 #3)".* Other statements that refer to mixed feelings can be bundled as the need for more product information. For example regarding how the T-shirt is produced.

Table 13: Associations with T-shirt

positive associations	aesthetics, buying/trying, convenience, exterior characteristics, environmentally-friendly, feelings, improvement over original, modern, health, natural, sustainable, human rights, organic, allergy, biodegradable, durability, image, kids, label, pesticides, , quality, renewable, trust, usability
negative associations	aesthetics, price, abroad, environmentally-friendly, buying/trying, human rights, distrust, pollution, transport, modern, durability, label, product life cycle, quality, mass consumption, partly plant based, product information
mixed feelings	Product life cycle, improvement over original, product information, aesthetics, environment, abroad, price, environmentally friendly, organic, convenience, natural, environment, relative effectiveness

Note. A definition of each code can be found in Appendix B.

2.2.4 Foot cream

Participants mentioned a range of **positive associations** with foot cream. The naturalness of the foot cream is mentioned as a highly positive aspect. Additionally, people use this cream on their own body and therefore believe that natural content is important for their health. These health aspects are often mentioned in relation to the absence of noxious substances. Participants believe that the use of natural creams is more healthy than regular creams; "*Naturalness, that you have something on your body that is natural and that has not been produced chemically but that has been made of plants. That gives you a good feeling*

and sooths your conscience (DE group 2 #5)"; "I think you buy it because it's better for yourself. for your skin, And your skin (NL group 2 #1)"; " You have less chance of rash (NL group 2 #6)"; "The brand is good (CZ group 1 #1)"; "It will have good effects, be more gentle, better tolerated, no rash after its application (CZ group 1 #5)"

The **negative aspects** that participants mentioned all indicate that it is important to market a coherent product. Participants did not like the package of the product, although they did like the content and the natural character of the content*; "I don´t think I would buy this cream, the packaging would put me off (CZ group 3 #4)", "when I took it into my hand, I could see the material used for the tube is a bit something else, and it is also important (CZ group 2 #1)", "the packaging looks more like a glue (CZ group 3 #)", "It would be very wrong to call it environmentally friendly, because it is made of metal (DK group 3 #2)". "Moderator: Would you require the content to be biobased? #6 Yes - there has to be a relation between packaging and content - they have to send the same signals (DK group 1 #6)."*

It should be noted however, that there were also participants who did not care about the package not being biobased; "*It wouldn't matter to me at all. I couldn't care less about the packaging; I would solely concentrate on the content. Then it would be a question whether it contained hormones or not. For me the primary focus would be on health related issues" (*DK group 1 #6).

Also regarding the content the results indicate the importance of a coherent product image. Participants stated that they would like to see a fully natural product; *"I see a lot of unnatural things in the ingredients and then I think you throw a few natural products in and then the rest is still junk .. there may be things in it that you are allergic to (NL group 1 #2)".*

Besides the package participants also referred to other negative aspects, like the price and the not-innovative character; *"this brand is very expensive (CZ group 1 #5)"*; *"This is not progressive, there are so many of those products (NL group 3 #2)".*

For **mixed feelings** similar associations as negative aspects are noted. These assocations are less negative though the content is comparable, such that they refer to similar concerns. The importance of a coherent product is again stated, such that there is referred to unclear issues from which people want to receive more information. Besides mixed feelings directed towards the product and it's products, there was also uncertainty regarding one's own feelings. Participants indicated for example that they feel natural products should be healthier but that they are unsure of the truth of their own statement; *"I would think that it would be healthier for your body when you use natural products on your body. It should but I don't know if that's true" (DE group 2 #6).*

Table 14: Associations with Foot cream

positive associations	natural, content of product, health , noxious , feelings, improvement over original, package of the product, exterior characteristics, biobased, buying/trying, chemicals, environmentally-friendly, brand, organic, renewable
negative associations	package of product, price, convenience, content of product, health, noxious, buying/trying, involvement, organic, abroad, biodegradable, aesthetics, allergy, exterior characteristics, bio-based, environmentally-friendly, partly plant-based, distrust, product information, unknown, waste, usability, recycle, reuse, image
mixed feelings	package of product, , health, bio-based, partly plant-based

Note. A definition of each code can be found in Appendix B.

2.2.5 Shopping bag

A diverse range of **positive aspects** is mentioned. Participants liked exterior characteristics, as that they were positive on the touch of the product; *"It is really pleasant to touch (CZ group 1 #1)", "it is nice to touch (DK group 1 #6)".* Participants generally liked the idea of a natural bag. The production of bags with more natural production methods is seen as a development in the right direction. Participants refer to environmentally friendliness and degradability of the bag, which they associate with a positive feeling. Participants note that it makes them feel good to do good. Moreover, the bag is referred to as a bag with multiple usability's; "*A dual purpose product (IT group 2 #5)"; "The shopping bag is good, it is degradable (DK group 3 #2); It's a smart product, really useful, and good for the environment (IT group 2 #3)", " is more friendly to nature (CZ group 1 #6)".*

There was also a range of **negative aspects**. Many doubts were raised concerning the convenience of the product. It is rather small, and maybe not as strong as a regular bag; *"I wish they wrote the load bearing capacity on the bag (CZ group 1 #2)", "I don´t think you could carry the two-litre-bottle Cola in it (CZ group 1 #5)"; "it is quite small" (CZ group 1 #2)", "I think that it is a very thin shopping bag. I usually use a shopping bag several times. I'm not sure that this shopping bag can stand up to that. I think that it will break faster than an ordinary shopping bag (DK group 1 #4)", "No, it's small and easily tears (IT group 2 #4)", "It might be a problem that it is transparent, so other people can see what you have bought. It is not so nice. (DK group 2 #6)"* Another interesting observation is that some participants disliked the bag for being biodegradable. They want a bag that lasts and does not dissolve when things are being stored inside it. Others liked the bag because it was biodegradeble. Thus, the same characterisitc was perceived positive and negative by different groups of respondents.

Then, people refer to alternatives to shopping bags in general. There are several remarks regarding the waste aspect of short-term used bags in general. People mention alternatives such as durable bags, taking one's own bag, or use no bag at all; *"I take my own purse (NL*

group 2 #2)", "it remains a plastic bag, you did not think about it when you went to a super-market .. (NL group 3 #2)".

There were also some issues unclear. Participants asked questions regarding the biodegradability, production process and waste management (where to dispose the bag); *"How much energy is needed for the production of such a bag? (DE group 3 #5)".*

Finally, regarding **mixed feelings**. Participants referred to similar issues as mentioned by negative associations. They referred to unclear issues which made them feel ambivalent towards the shopping bag. Questions for example involve a concern regarding how long it takes to degrade for the plastic bag. Is it 1 week, 2 months, or 25 years?; *"If I knew it would degrade in nature on its own, if it happened to get there accidentally (CZ group 1 #6)".* Other questions referred to whether plastic is not waste in itself and how environmentally friendly the use of a plastic bag in general is.

Table 15: Associations with Shopping bag

positive associations	biodegradable, environmentally-friendly, price, aesthetics, buying/trying, convenience , exterior characteristics, feelings, bio-based,improvement over original, mass consumption, modern, plastic, sustainable, waste
negative associations	convenience, waste, biodegradable, environmentally-friendly, aesthetics, price, improvement over original, abroad, companies, durability,marketing, organic, reuse
mixed feelings	waste, environmentally-friendly, bio-based, unknown, product information.

Note. A definition of each code can be found in Appendix B.

2.2.6 Coca-Cola bottle

There are **positive** reactions to the partly plant based bottle of Coca-Cola. A group of participants believed it is positive that the company does something on environmental aspects. Participants related these environmental aspects to a positive feeling for themselves, and to handling environmental problems worldwide;*"I think it is a product that you only have for a short time. It belongs to the use and throw away-products. So it is a good thing that they have done something about the material (DK group 1 #2)", "it is better for the environment, because plastic bottles are a problem (NL group 2 #5)"; "This you do not buy every day, but gives you a good feeling (NL group 2 #4)"; "Good that a big company like Coca-Cola does. if it does then Coca-Cola Pepsi also thinks that we should do (NL group 3 #2)".*

There were also **negative associations** with the Coca-Cola bottle. Many participants stated that the impact is low: *"#6: But it's still 80% not biobased. Is this better degradable or not? It's only a small share that is bio. #2: It should be more (DE group 2)",* and even too low *" why can not the whole bottle be 100% recyclable (NL group 3 #1)".* Due to the low percentage

there are many questions raised regarding the true motive of the company. Some refer it to a win-win situation:*" it's a win - win. For them and the consumer (NL group 3 #6)".* However, other participants question whether it is performed out of environmental motives, or only for profits such that the bottle is used as green washing: *"It is marketing and money (NL group 3 #4)"; "it is pure business (NL group 3 #6)"; "I would expect that the Coca-Cola Company only used this kind of package. Otherwise, it is nothing but a media stunt (DK group 1 #4)"; "The message is bad: Coke is claiming that they're using a plant-derived plastic for their bottles, c'm on! Aren't they making enough profits already? Do they need to increase their sales? (IT group 1 #3)".* Finally, some people just do not like cola: *"Cola is poisonous, so the bottle can´t be ecological (CZ group 2 #3)".*

Additionally, participants mentioned other alternatives for the packaging of cola , such as recycling and using glass bottles: *"I would prefer to go back to glass (CZ group 2 #5)", "I cannot help wondering whether the bottle is recyclable or not. It is important. It would be very bad if it were meant to be thrown into the waste bin. If that were the case, I wouldn't buy it (DK group 1 #6)"; "Moderator: Is it of any importance that the bottle is bio-based? #1: No, it is more important that it can be recycled (DK group 2 #1)", "I believe it. I don't think a company like Coca-Cola would lie about it. But from an environmentally point of view it is a question whether it is clever to produce half litre bottles - that is not particularly environmentally friendly (DK group 3 #4)".* Taken together, this points to the importance of telling a coherent product story. Many participants experience mixed feelings and questions as they don't know what the product precisely stands for.

Then some participants provide arguments for not buying the product. A bio-based bottle is only relatively important when buying Coca-Cola. Participants are not highly involved with this fast consumer product and the bio-based characteristics. For example, some participants did like Coca-Cola and bought the product, but they were not involved with the biobased aspects of the product:: *"I wouldn't buy the product because of the bottle (DK group 2 #2)".* "*It is not a profile I would associate with Coca-Cola. It is a unhealthy soft drink. I do drink it nevertheless, but I don't need an environmentally friendly package (DK group 2 #3)".* The last quote also shows that bio-based does not fit of the company Coca-Cola. Additionally, the price would be a barrier to buy this product: "*the price of a half-a-litre bottle at the shop is that of a two-litre-bottle, so the price would put us off (CZ group 1 #2)".* Finally, it is frequently stated that it was difficult to see the logo: "*they could have promoted better, the logo is very small (NL group 2 #1)"; "I guess I would overlook it, I rarely buy it, it would seem the same to me (CZ group 1 #4)"; "It might be more natural, it's something you can recycle, it's not going to waste… still, please make it more conspicuous, not just a terrible green tiny logo against a red backdrop (IT group 3 #4)".*

Mixed feelings associated with the Coca-cola bottle often refer to the meaning of bio-based. A lot of issues remain unclear regarding the environmentally-friendliness of the product: *"Coca-Cola bottle, which can be both recycled and polluting (IT group 3 #3)", "If it takes, like, 35 years to be biodegraded instead of the standard 50… it's no big deal at all (IT group 1 #3)",*

"In any case, it's more polluting than glass because it's plastics after all. (IT group 1 #2)", "I like that it is made from plants, but still we have to be careful, maybe I'm more environmentally conscious but I would like to point to the fact that we are destroying forests in Amazonia or in Borneo, just to make a small plastic bottle (IT group 3 #3)".

Table 16: Associations with Coca –Cola bottle

positive associations	environmentally-friendly, partly plant-based, recycle, bio-based,feelings, aesthetics, biodegradable, buying/trying, convenience, daily use, health, image, mass consumption,package of product, product life cycle, relative effectiveness, reuse, sustainable, usability
negative associations	package of product, environmentally-friendly, partly plant-based, health, plastic, buying/trying, companies, content of product, marketing, usability, recycle, bio-based, , noxious, waste, distrust, innovative, price
mixed feelings	partly plant-based, environmentally friendly, plastic, marketing, recycle, bio-based, biodegradable, product life cycle, brand, resources, transport, trust

Note. A definition of each code can be found in Appendix B.

2.2.7 Dashboard

First of all, we can see that some participants talked specifically about the dashboard whereas others referred to a complete car referring to an electric or hybrid car. Since it was not always clear what participants talked about, we choose not to make a distinction in the results.

The **positive aspects** which were associated with the dashboard mainly refered to natural aspects. People like the idea that a part of the car is produced in a more environmentally friendly way. For example the use of less chemicals: "*The design looks really nice! (IT group 2 #1)", "It means respect for the environment (IT group 2 #5)", "you have to travel. You cannot do everything by bike or on foot do. I would be attracted to an environmentally friendly car ..(NL group 3 #6)".*

We do like to note that the naturalness is also mentioned to be only relatively important. A group of participants stated that they do not think the bio-based production of the dashboard is a decisive aspect: "*It wouldn't make any difference whether I would buy the car or not (DK group 1 #2)", "I think that's te last priority for a car (DE group 1 #2)".* Participants mentioned to have many other priorities instead of naturalness (safety image etc): *" No; issues such as petrol consumption etc. is much more important" (DK group 3 #2)", "I think it is good, but it would never be something that would make me buy the car (DK group 2 #6)", " What about the rest of the car? Of course it is good, that some of the interior is made from alternative materials, but it isn't enough (DK group 3 #4)".*

Some participants are willing to pay more for the dashboard: *"I would support it, I like it, I would pay more, some extra money for it (CZ group 2 #6)."* Or even for a whole car: " *When discussing the whole car, then I would be for it, I would be willing to pay extra money but up to 20 % not that I would have the same car in petrol version for 240,000 and in electrical version for a million, in this case I would not be willing to pay more money(CZ group 2 #1)".*

Few participants seemed positive about the dashboard being partly plant based. One reason seemed to be the higher percentage of plant materials: "*That Toyota obviously has the leading edge again with the research of this technology, I find that remarkable. And 60% sounds different to 22% with the cola bottle (DE group 2 #4)".*

Some people had **negative feelings** and a negative reactance towards the dashboard. In contrast with other participants they did not like the product being partly plant based. In this case, the participant did not believe how plastic can be fabricated out of plant material*: "I think biological plastic is a contradiction in itself. I just don't believe it. You would have to explain in detail why it is biological plastic (DE group 1 #2)".*

Others mentioned that the design is not pretty or looks too much like plastic. This indicates that bio-based products in the perception of consumers - cannot or should not look like plastic: *"When somebody tells me that it is biobased and I love this, although it looks like plastic… well the design should be a bit different, a different colour (DE group 3 #2)".*

Some participants thought the quality of the biobased dashboard to be worse than an original plastic dashboard; the durability would be lower and the waste would be worse since it would be harder to recycle such a mixed product.

There were participants that stated that driving a car in itself is an environmentally unfriendly act. It is so clearly not environmentally friendly to drive a car, that a small improvement in a bio-based dashboard is perceived as insignificant: *"Or at least a less bad impact on the environment (DE group 3 #5)", "If you already drive car then you are not thinking about the environment, a dashboard doesn't make a difference (the Netherlands, group 3 #4)".*

Additionally, the bio-based dashboard in some cases reflects negative upon the image of a company or brand. Some participants refer to the bio-based dashboard as a marketing stunt or sales trick; a way of greenwashing to make additional profits: *"a marketing gimmick, competition among car manufacturers is fierce, so they must come up with something, this might be one of the way to impact and win the customer, always you should look at what the manufacturing causes, whether it is not far worse than the production of the leather or aluminium that burdens the environment subsequently when we chuck it (CZ group 2 #2)", "I think of is as a sales trick from the manufacturer's side (DK group 3 #3)", "They used 60% recyclable plastic, but I wonder: will they actually recycle it or is it just a hype? It sounds like a mere sales pitch, at least for now (IT group 2 #6); " I wonder, is this procedure truly money-saving or is it just a gimmick? When it comes to car I'd mention fuel economy... (IT group 2 #3)".*

Finally, price is referred to as a barrier: "*It depends on the price. I'm considering changing my car into a hybrid, so if the car turned out to be much more expensive because of this, then I don't think I would choose it (DK group 3 #2)".*

There were no **mixed feelings** associated with the dashboard. It looks like participants were more often explicitly negative about certain associations whereas for the other products these associations are both associated with negative feelings and mixed feelings.

Table 17: Associations with Dashboard

positive associations	Environmental friendly, aesthetics, modern, partly plant plastic, biobased, buying/trying, chemicals, innovation, exterior characteristics, quality, improvement over original, relative effectiveness, renewable, price
negative associations	Aesthetics, biobased, companies, durability, marketing, partly plant based, quality, recycle, waste , price
mixed feelings	-

2.2.8 WPC-decking

In general the involvement was low. The product was in all focus groups discussed relatively shortly, which is an indication that it was difficult for participants to talk about the WPC-decking. Additionally the low involvement is also mentioned explicit*: "I do not know, I'm not so concerned with tiles. Though based bio speaks to me (NL group 3 #5)", "nothing, I don´t know what it is for (CZ group 2 #3)"; "floor, I am not very much interested in these things (CZ group 3 #4)".* Additionally, the relative importance of this product is mentioned, such that it is just one of many products necessary to decorate a house.

Positive associations with the WPC-decking refer to aesthetics, such as the way it looks in terms of colour and texture: "*I like them. Because I like walking on wood. It's a nice feeling, nicer than stone. I often have cold feet. It's fancy, too (DE group 1 #2)"*. Other positive associations refer to environmentally-friendliness and durability: "*very well, from recycled material, which is good, that's why I seperate my plastic waste. This is made from recycled material, no other resources (NL group 1 #3)"; "maybe, it lasts longer than wood, I would believe it (CZ group 3 #6)",* "*Positive aspects are useful and durable (IT group 1 #3)", "Durability, and less damage to the environment (NL group 3 #6)", "I would buy it. I do not buy wood or other materials, and I think that it is durable and long durability (NL group 3 #3)".* The idea that the WPC-decking is made from renewable materials is also mentioned as a positive association: "*Moderator: "Why would you buy a product like this? #5 Because it made of renewable raw material (DE group 2 #5)."* A group of participants believes that these tiles might be cheaper than regular or wooden tiles. For these participants this low price would be a reason to buy the WPC-decking.

Note that aesthetics and environmental aspects were also mentioned as **negative aspects**: "*It's relevant, considering all these features, but I don't know whether I'd like to have it in my place, in aesthetic terms it's far from appealing: I wouldn't use it to tile my floors, not even my balcony! (IT group 1 #5)"* or because it is unclear what the product precisely withholds concerning environmental and durability aspects.

Furthermore, there is a range of other negative associations, such as the use of chemicals in production (noxious). Additionally, the WPC-decking raised many questions indicating distrust and unclarity: *"I don´t believe it, not that the manufacturing process of this product is less harmful than wood(CZ group 3 #6)".* The product information that participants liked to have concerned the durability, and convenience aspect like maintenance and production methods: "*It is difficult to comment on this product, when we don't know exactly what it is (DK group 1 #1)".* All questions regarding how produced and threated*: "How should it be treated?, How is it produced, I imagine that it probably has an isolating effect (DK group 1 #??)", "up to ten per cent yes, depends on its maintenance, if it needed special, expensive products, whether you can clean it, in short, it is necessary to try it out (CZ group 1 #3)".*

Finally, the price is an important barrier. Groups of participants state that they would only use the tiles if the WPC-decking is cheaper or at least not a lot more expensive: "*Not necessarily. It depends of the difference in price. But if I plan to live in my house for at least 10 years, it might be a possibility. But there are several things to consider (DK group 3 #5)", "the question of price, otherwise I like it, I think it is easy to maintain, too (CZ group 1 #3)".*

There were also **mixed feelings** with the WPC-decking. Some people wondered whether it was really environmentally friendly or what the improvement was over wooden tiles.

Table 18: Associations with WPC-decking

positive associations	durability, aesthetics, price, buying/trying, convenience, renewable, natural, quality, bio-based, feelings, image, modern, recycle, unknown, usability
negative associations	aesthetics, involvement, noxious, product life cycle, trust, price, convenience, quality, bio-based, distrust, environment, exterior characteristics, product information, waste
mixed feelings	unknown, environmentally-friendly, resources

Note. A definition of each code can be found in Appendix B.

2.2.9 Natural paint

Positive aspects that were associated with natural paint referred to the environment, better than regular, less noxious or toxic, better for one's own health and the health of one's children. Participants perceived the product often as an organic paint which is produced more

natural and environmentally-friendly than regular paint: *"It sounds as if it is good for the environment - and for the health as well. It is my impression (DK group 3 #1)", "better for the environment and for yourself (NL group 2 #5)", "It's just as good as any other paint, but it's not polluting. Paints are among the most polluting products, by the way. I just assume plant-based oils are less polluting (IT group 2 #1)".*

We can also observe a range of **negative associations** with natural paint. Paint seemed to be a product which is difficult to match with naturalness. There is for example often referred to the use of toxics (noxious). People are sceptical about the level of chemicals and toxic that is inserted in this paint: *"Nothing substantial, nothing that comes across as a real solution. When I read the paint label, it gave me the creeps: it pollutes the water and can kill water-living organisms. This is just a trifle, a lure, without any lasting positive impact on the environment (IT group 1 #3)", "I'm sceptical. In my world it is something awful that I wouldn't use - even though it is biobased. It is not just some ordinary paint. I don't think that the painter would appreciate working with it. And I definitely don't think it is good for our health. But perhaps it is good for the environment (DK group 3 #5)".*

The price is mentioned as a barrier to buy natural paint. On the other hand a different group of participants is willing to pay more money for natural compared to regular paint: *"#3: price is a barrier as every time", "#5: I would pay more money for it", "#6: so would I; depends how much of it you would need (CZ group 1)", "Once again, it is about quality and price. When it is about paint, it is always a question of coverage. Therefore, if the quality and price were the same, I would probably choose it (DK group 1 #4)".*

There are also many concerns about durability and covering. These concerns seem the result of unfamiliarity with the product. *"#6: It is unknown. I wouldn't dare choosing such a product that I don't know that all, #3: It has to be put to the test (DK group 1)"; "I would check it out - or talk with somebody else about it. I wouldn't throw me at it right away. I'm just as lazy as everybody else; when I'm going to paint I want it to be as fast as possible, i.e. I want to paint as few times as possible. If other people could tell me that it worked fine, then yes. But right here and now I must say that I'm rather sceptical (DK group 3 #2)".*

There are **mixed feelings** and distrust due to the warnings stated on the package of the paint. These warning raise the question whether the the paint is really natural: *"It is not good. It says that on one hand, it is produced from essential oils, and on the other that children shouldn't come close to it. That information is enough for me not to use it. I prefer using water-based paint (DK group 1 #6)", "The warning is far more serious than I imagined. And it is much more dangerous than I would like to use. That you have to change clothes and you must not smoke etc. In no way would I consider it as something biological, rather as something dangerous. I would almost be inclined to believe that a similar paint, which isn't biobased, is less hazardous. Perhaps not pollution-wise but from a health point of view it seems worse. From an environmental point of view it might be better (DK group 3 #2)".* In line with this reasoning, participants also wondered whether biobased is always positive in every aspect (regarding healthiness or the lack of noxiousness and environmental friendliness).

Table 19: Associations with Natural paint

positive associations	environment, kids, quality, price, noxious, bio-based, buying/trying, convenience, feelings, health, home, organic, partly plant-based
negative associations	noxious, health, price, convenience, distrust, quality, buying/trying, organic, durability, natural, environmentally-friendly, kids, bio-based, partly plant-based, exterior characteristics, companies, improvement over original, unknown
mixed feelings	bio-based, partly plant-based, noxious, health, organic, environmentally-friendly, improvement over original, unknown, feelings

Note. A definition of each code can be found in Appendix B.

2.2.10 Participants' need for product information

Participants indicated that they missed specific information, or asked for additional product information, while discussing the seven specific products. It is likely that these questions result from participants' unfamiliarity with the term bio-based;*"It is very much a matter of confidence in the word bio-based. I have to be 100% sure about what bio-based means (DK group 2 #3)"; "Very often it is not clear whether some product is right or good, what has been done and where it is from, we don't know. We often know too little about a product when we buy it (NL group 1 #3)".*

Participants wanted to know what bio-based products look like and what percentage of a product should be bio-based in order to position the product as bio-based. Others asked what the characteristics of bio-based products are in general;*"Perhaps we should say it more precisely. How does bio-plastic look like? Is it also made from oil or rapeseed oil? Or do we talk about raw materials like shredded and re-used bamboo? (DE group 3 #1)"* In addition, participants asked for information regarding the production of bio-based products: from which renewable resource has the product been made?, what other resources have been necessary for the production of bio-based products?, and which additives are necessary?. Others wondered whether the materials are grown for this purpose or if plants could have been used as food for people in need, whether it is made from waste, whether it takes less energy to produce bio-based products, and what are the production costs; *"How much energy is needed for the production of such a [bio-based] bag? (DE group 3 #5)"* In addition, participants posed questions regarding the environmental friendliness: how long it will take for bio-based products to degrade, how durable bio-based products are, whether the used colour in bio-based products are not harmful to nature, whether bio-based floors are treated with non-toxic materials, andwhether bio-based products are recyclable; *"I cannot help wondering whether the bottle is recyclable or not. It is important. It would be very bad if it were meant to be thrown into the waste bin (DK group 1 #6)".*

2.2.11 Arguments for buying or trying bio-based products

Participants were asked whether they would like to try or buy the bio-based products that were presented to them. The arguments that they came up, are presented in table 20. Note that not every participant answered this question, therefore the number of arguments in the table does not show the real division of participants that were willing or unwilling to buy or try bio-based prodcuts. Instead, table 20 shows the range of arguments that have been given.

A group of participants said they were willing to try or buy the products without further elaborating on their reasons. Others were more precise and explained they wanted to try it to see how such a product performs (e.g. how durable is it?). Furthermore, the table shows that participants wanted to contribute to the environment, the future, or to their own well-being (e.g. because I apply the cream on my skin).

Other participants stated certain conditions for their willingness to buy or try a product. Many were concerned about the price of a product, convenience (e.g. when I forget my bag or when my groceries are not too heavy), or aesthetics (e.g. if it is pretty).

Taking a look at participants who were not interested in buying or trying bio-based products, we can see that their involvement was often low (e.g. it doesn't matter to me). Others were concerned with aesthetics (e.g. not if it looks like this) and convenience (e.g. not strong enough). Finally, there was a group of participants that did not trust bio-based products enough to buy or try it (e.g. I avoid these products just to play safe).

For an overview of the arguments per product, we refer to appendix III.

Table 20: Answers on the question "Would you buy or try the product?" and "why?"

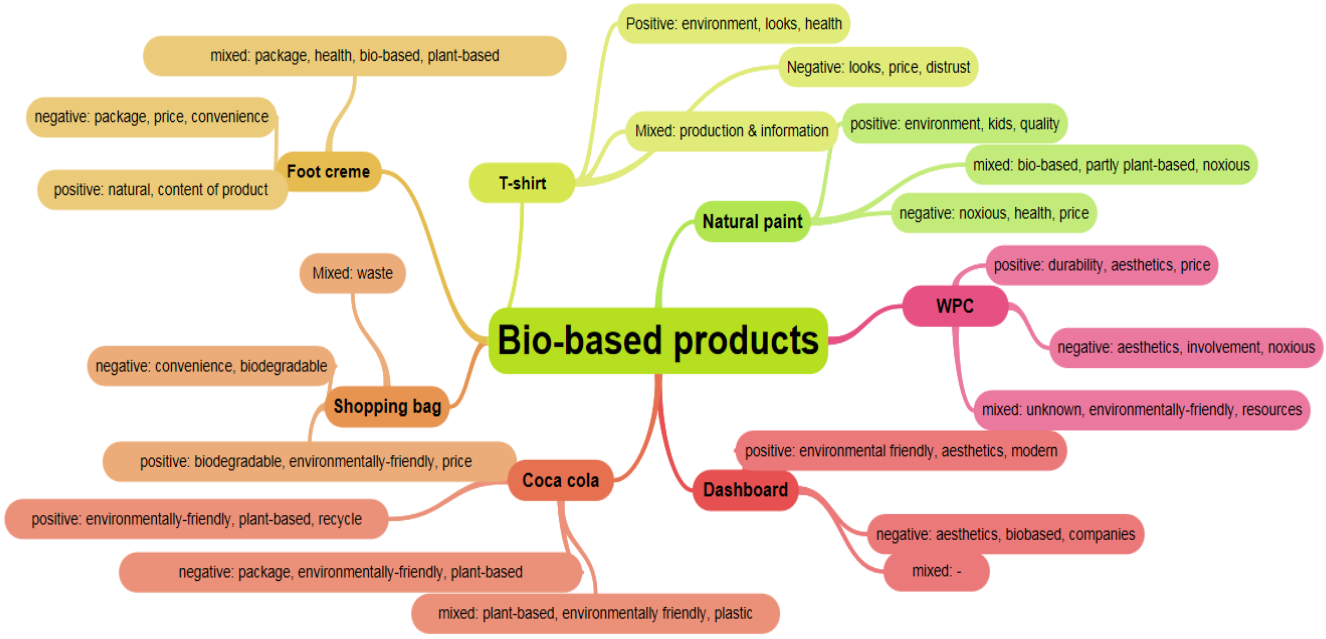
Would you buy or try the product?		
Yes	Under certain conditions	No
I would like to try it out (T-shirt, natural paint, foot cream)	When it is not too expensive (T-shirt)	It doesn't matter to me (Coca-Cola bottle)
Material is pleasant (touch) (T-shirt)	If I do not have to pay a lot more than for the normal bag (shopping bag)	I do not care about tiles and whether they are natural or bio-based (WPC-decking)
It's comfortable to wear (T-shirt)	If it is pretty and it suits me (T-shirt)	I would not wear it (T-shirt)
I would like to try out something different (T-shirt)	If it is pleasant and widely spread in the market (T-shirt)	You do not know how your skin reacts to it (T-shirt)
Because of the natural basis/it is natural (foot cream, T-shirt, WPC-decking).	If it was made by someone who needs to be helped a little bit (e.g. a Czech producer) (T-shirt)	Not if it looks like this (T-shirt)
Feeling that you support a good cause: environmentally friendly (T-shirt, shopping bag)	If it is comparable to cotton and no pesticides have been used (T-shirt)	I would not think about it (natural paint)
To find out how the product performs (natural paint, shopping bag)	If they would give discount and advertise the characteristics (natural paint)	The packaging puts me off (foot cream)
Yes, even if the price was higher (natural paint)	If it would be cheaper than the normal product (dashboard, natural paint)	I avoid these products, just to play safe (foot cream)
Because of my kids (natural paint)	If it would make me feel better (dashboard)	Not strong enough to use several times (shopping bag)
Even if other designs look better (dashboard)	If it is from Czech (foot cream)	I'll just grab a bottle (Coca-Cola bottle)
Because you are applying it on your skin (foot cream)	If my normal crème would be in this tube (foot cream)	
It is sensible (shopping bag)	If I would've forgotten my bag and it would be clear that this is a biodegradable bag (shopping bag)	
Yes, even though in principle I do not buy shopping bags	If my groceries are not too heavy (shopping bag)	
I like Coca-Cola	Would consider it if I would have to renovate my house (WPC-	
To deck my balcony (WPC-decking)		
Yes, I think it is durable and sustainable (WPC-decking)		
It looks pretty and I would like to		

know what it feels like to walk on it (WPC-decking)

decking)

Because of the future (bio-based products in general)

Figure 3: Feelings and arguments of seven bio-based products



2.2.12 Comparisons across products

As already noted the individual products are chosen to get an overview of how the definition of bio-based is perceived at a *product-specific level*. We selected the seven products to represent a large range of bio-based products varying in sustainability, physical proximity, and identification. These single products cannot be seen as a good representation of a whole category. We therefore recommend to bundle the findings of these products and use similarities and differences to draw conclusions across all products.

In general participants were positive on the idea that the products were produced in a (more) natural way. At the product specific level there was more emphasis on the naturalness of bio-based products instead of their innovative or technical character. Participants mainly refer to the environmentally-friendliness and were rather positive on the use of more natural production methods. Participants thus seem to link bio-based products to a range of naturally and pro-environmentally related aspects.

There were differences between products in how environmentally friendly they were perceived. The results imply that certain participants are more positive towards bio-based products that represented 100% bio-based or natural materials versus products that were only partly plant based. For example, some participants were more positive towards the shopping bag and the T-shirt versus the Coca-Cola bottle and natural paint, because they differentiated these products on percentage of environmentally friendliness. People thus used this percentage as a criteria to group these products. The partly plant based products were more often associated with negative terms as environmentally unfriendly or toxic, distrust, and marketing tricks of large companies. This implies that percentage of bio-based can be too small.

It is important that there is a match between the use of bio-based and the image and all other aspects of a product. There is a group of participants that like to have a coherent story. They do not like inconsistencies in the product image. It seems that an integrated clear story is necessary to take away all doubts and mixed feelings among participants. This finding is shown for all specific products, though manifested differently for each of them. For example the T-shirt is questioned because the paint is too bright and therefore probably not natural and because it is produced in China, which does not fit with the image of a fully 'good product' because it takes many flying miles and strikes with human rights. The Coca-Cola bottle is questioned, because it is only partly plant based and because the use of plastic bottles is not an environmentally friendly act. The dashboard is questioned because it is only a small part of a car, and driving a car is not environmentally friendly at all. The natural paint is questioned because it is perceived as toxic due to the warnings that for example state that one may not breath the paint. All these products are thus questioned, and even distrusted, because the bio-based production does not match the total story. For example: "*With respect to the wall paint, I feel a bit ambivalent, because I couldn't define the exact contents.... consciously only use products, which also convey the feeling of bio when it comes to their haptics. Again, a Cola bottle, which contains – consciously or not – oil, cannot be converted into an organic product by only adding 20% of organic material. It still contains 80% non-organic material. This would spoil or devaluate the word bio (DE group 3 #1)".*

A related finding refers to the importance a specific group of individuals attach to internal versus external (green washing) motivation of companies to process bio-based. The perception that the bio-based production method is only used as a way to increase profits, results in a negative association with companies. Furthermore, they seem to relate the percentage of bio-based to the effort that companies have made to produce a product in an environmentally friendly manner. Thus, small percentages of bio-based are linked to low efforts and external motivations, and therefore more often seen as 'marketing tricks'.

The majority of participants mentioned that they had a low involvement with the products and the use of bio-based production methods. The products that were in direct contact with oneself, because one drinks (Coca-Cola), breaths (natural paint), or touches the skin (foot cream and T-shirt) had a higher involvement among groups of participants. These products were

associated with health and allergy compared to the products that did not involve a close contact with the participants, because these products were inserted or directly contacted the body.

During the decision making process many participants think of characteristics that benefit themselves. Bio-based production methods were seen as a positive innovations, that might help decrease environmental problems. This results in a good feeling among participants. It feels good to do good. Though, this was not a reason for buying a product. It is not a decisive characteristic. It can be regarded as an additional plus, but other aspects (e.g., convenience, looks and price) are more important and must be fulfilled for consumers to choose the specific products. It is rather seen as an additional advantage, but other important quality aspects (which differ across products) need to be fulfilled and familiar to the users first. Many questions are raised for additional benefits in convenience and use due to the bio-based process methods, for example a longer durability, ease of cleaning, dealing with waste etc. This raised many questions which could not be resolved during focus groups. ”what’s in it for me?’

Many participants did not seem to be familiar with the term bio-based and seem to associate bio-based with environmental friendliness. Moreover, others even tend to see bio-based and environmental friendliness as synonymous. There were only a few participants who linked bio-based to renewable materials. Thus, in this sample participants seem to have a misconception with regard to the term bio-based. Moreover, the unfamiliarity with the term can lead to distrust. Some participants showed how unfamiliarity can lead to distrust when asked about biobased products in general: *“Moderator: Do you think that those biobased products contain harmful materials?*
#3: Yes, in part yes.
(Everybody is talking): Partly, yes.
Moderator: Which harmful materials?
#1: With respect to the car…
#6: It has to stick together somehow.
#2: The consistency of the cream…
#1: But I would not associate it with harmful materials. Perhaps incompatible; but not harmful. (DE group 3)”

2.3 Participants perceptions of labelling and bio-based

As a final task participants were asked to discuss labels of bio-based products. Note that this task was the final task of participants. As participants were already talking about bio-based products for more than 1,5 hours this task is in general discussed rather briefly. . In some cases, this part had not been discussed at all.

Do we need a logo for bio-based products?

People are in general familiar with logo's and labels. They mention a range of different labels. For example, Fair Trade, organic, animal testing labels: *"For example what I have is this EU Energy label, I looked out for that when I was buying my coffee machine, I find that important. (DE group 2 #6)".* Participants have said to look at logo's for food and other products that you absorb, such as cosmetics.

Participants answer rather positively to the question whether they would like to see a bio-based label: *"yes is good, then they really have to do what they say (NL group 2 #1)"; "it becomes clearer to us" (NL group 2 #5)," "Yes, and it should be with a graded scale just like the energy label. The product might consist of 22% bio-based materials, but if it at the same time has been transported 3,000 km then we have a problem. There has to be a reasonable balance (DK group 3 #2)".*

However, there are also remarks on the introduction of a bio-based logo. Some people refer to an overload of logo's: "*There are so many seals already. That may be the problem. It could be confusing if there was a seal that said: bio-based. As a seal. It must be made clear how many ingredients and so on. The percentage. That would be good if the percentage was the same (DE group 1 #1)"; "That's something that is currently a big issue and I find you as consumer are simply not provided with enough information about what all these labels mean. What is it telling me, what is it not telling me? You simply don't know (DE group 2 #6)".*

Related to this issue some participants mention an alternative. They refer to the need for a broader label that involves all environmental aspects of a product: " *It would be a brilliant point that it is not a label for bio-based products alone, but rather for the total environmental strain. An environmental strain labelling (DK group 1 #1)".*

Price is often referred to as a barrier for buying products with labels *"The price. If bananas cost 5 Euros a kilo then that would be too much for me, it has to be within my budget. But if the price is okay then I do prefer to buy Fair Trade products* (DE group 2 #5)".

Participants mention a range of product categories for which they would like to see whether the product is produced with bio-based technology or not. Some participants would like to see every product from China being labelled. Others mentioned that toys, clothes, dye for textile, foods, cosmetics, medical products, floor coating and plastic bags should also be labelled with a bio-based label.

"Moderator: For which products would it [bio-based label] be relevant?
#1: Al products coming from China
#3: On all types of packaging
#6: Products that is close to the body - clothes or dye for textile
#4: Toys
#1: Packaging for foodstuffs. It is not necessary with all the packaging that they use today (DK group 2)".

What are important requirements?

Many participants refer to the importance of a clear definition. It was for example not clear to individuals how bio-based relates to environmental friendliness and organic: *"it is more than being environmentally friendly" (NL group 2 #1), "Solve unclear definition: It should be written down, what the difference between the label and usual organic label is. Because there should be a differentiation (DE group 1 #1).*" The results also show that certain participants seem to have a misconception regarding bio-based products. For instance, some participants mentioned they would like a bio-based label to contain information regarding animal testing, an expiration date, nutrition facts and that the product is fair trade.

Additionally, there was a need to solve the issues regarding the unclear definition: *"A clear definition (DE group 1 #4)", "when we know it more, are better familiar with it (CZ group 3 #4)", "if one knew what the label meant, one could decide this way or that way, the question is where to learn what the label means, what is the catch, stores should be active in this respect (CZ group 3 #1)", "it becomes clearer to us (NL group 2 #5), "According to that description, it may be enough to have just 1% of bio-based ingredients. This one is a 100% (IT group 3 #1)".* Again, people refer to the importance of a clear definition: *"It has to be totally unambiguous what it means to be bio-based (DK group 1 #1)".*

Labels are important at moment of purchase. At the moment of decision making participants use labels to make a final choice between a regular and an environmentally friendly or other-labelled product. It is therefore important that the label is visible and understandable for participants at the moment of decision making. A label is the only way to see whether a product is produced with bio-based production methods. Participants state the importance of a visible and understandable label: *"should be easy to read, intelligible; Not just clear words, but no obscure marks/symbols either; It should make it easy for the product to be identified (IT group 1 #4)", "It should be on the front of the product, not on the back (IT group 1 #5)".*

A group of participants called for a transparent label. Individuals mentioned a large range of product information they would like to see. Information regarding the following aspects: the lack of fertilizers, lack of GMO's, lack of toxics, lack of pesticides, lack of softening agents, lack of gas, lack of oil, lack of pollution, biodegradability, production process, company investments due to saved money, instructions for use, and provenance: "*That no fertilizers have been used (IT group 1 #1); No oil (IT group 1 #6); That the product has been grown in an organic way (IT group1 #1); The label should specify the ingredients and the production method (IT group1 #2); How much of t is bio-based, e.g. 20%, 30%... (IT group 1 #5)"; "If I have to buy a pack of cookies, it's very relevant for me to know whether they've used extra virgin olive oil or butter to make them, rather than palm oil… it can make a difference and it has to be specified (IT Group 1 #5)".*

Percentage of Bio-based results in discussion among participants. Specific percentages are not often mentioned. Though the results provide some indication, 22% of the Coca Cola bottle is generally seen as too low. Participants refer often to more than 50%. Participants also refer to different percentages for different products: *"I would find 50% positive for such a bot-*

tle. The T-shirt should be 100% (DE group 2 #6)", "It depends on what the criteria for the labelling is. If it is only 2% of the content in the product that has to be bio-based, it doesn't make sense. The content should be higher in order to be meaningful (DK group 1 #2)". Other participants said to favour a point system that refers to the bio-based percentage, such as the energy label: *"A point system. That there are e.g. five stars that are being filled depending on the product. And probably the cola bottle would have fewer points than... like the energy label, that there is a differentiation (DE group 1 #3)."* In addition, there were participants that would like to see how much better or environmental friendly the bio-based product is in comparison to the 'old' products.

Trust is a highly important aspect of labels because it forms the basis of a label: *" we can´t do anything else but trust (CZ group 2 #6)".* Participants refer to different aspects to gain trust. Requirements are mentioned as necessary conditions for a label to know where the label stands for, and to have the possibility to monitor whether companies follow the standards: " *yes it is good, then they really do what they say (NL group 2 #1)", "mainly that it is not just an advert to make people buy it (CZ group 1 #6)"*, *"that it meets some requirements; to use this logo they had to have fulfilled something; the manufacturer has to have passed some tests, get the certificate, it is like a guarantee (CZ group 1 #3)".*

It is also highly important that organisations are monitored. Inspection and monitoring are mentioned as ways to gain trust *when someone uses it then it should be like that, it can be controlled, and it is often inspected (CZ group 3 #1), "Moderator: What would make you feel confident about it? #3: Having some reassurance... (IT group 2 #3)".* Mostly individuals refer to independent organisations or authorities, like the government or the EU: "*Well, we have the European Union - it would be logical that it should be an EU task. They could be responsible; they do have authority to do it (DK group 1 #3)".* Sometimes food industry is also referred to, but most of the time it is not mentioned or explicitly mentioned as a party that should not be involved in monitoring: *"Definitely not the company that sells the product (DE group 2 #6)".*

Certain participants also mentioned another charachteristic that would make them trust a label; traceability. This basically means that they want to be able to look for more information by themselves, for example on the internet; " *Neuland have launched an App some months ago. You can check on the product its origin. Who the producer is and where the product had been produced. This would be an honest label. When I know that I can check it. (DE group 3 #1)"; " I think it would be very important that it states the name so you can find out more information. Because you have labels that only show an image and you don't know what it even stands for. (DE group 2 #6)"*

Familiarity is an important boundary condition. Among the general public a label is only successful when it is recognized and people know where it stands for. Therefore people recommend to promote and communicate the logo: *"to communicate, promote these things is very important, to inform people about it so that people were in the know because who is engaged in it, looks at the issue differently, no one really does much about it in our country and people*

should know what it is (CZ group 3 #1)", these labels should be more written about, more communicated for people to learn more about them (CZ group 3 #4)".

Finally, one should take care of negative publication, such that the label is not seen as a cheap way to provide a company with a green image; Bio based as a form of window-dressing. "*I think that would be window dressing. We were all the same, that we were not able to understand that. And I think many other people would feel the same (DE group 1 #1)."*

2.4 Slovenia

As already noted we excluded Slovenia from the analyses, because they used a different term which might have biased the results. We performed the analyses separately for Slovenia to explore whether the group discussion result in similar (or different) findings.

This paragraph compares the data from the Slovenian sample to that of the other countries to find out whether there are differences between the two groups in terms of th perception of bio-based due to the difference in the focus (bio-based vs. natural materials) of the discussions.

Slovenia was the only country in which participants did not state to have problems understanding the term bio-based. With regard to differences in product perceptions, , the discussions had a higher focus on natural. This probably occured because Slovenian focus groups used the term natural materials. To strengthen this idea, natural has been coded 30 times in Slovenia versus 68 times in the other five countries combined.

Slovenians did not mention abroad, allergy, animal welfare, biotechnology, car, cosmetics, fossil fuels, government incentives, indifference, innovative, kids, life style, pollution, waste, renewable, resources, side-effects, and unknown whereas the other countries did. It is possible that participants from Slovenia did not mention these perceptions since they discussed natural materials instead of the term bio-based. This implies that participants have different associations with the term bio-based and the term natural materials. To see whether there were any specific differences concerning the products, we opted for a product that was commonly discussed in a positive manner; the shopping bag. And for a product that was often discussed in a less positive manner; the Coca-Cola bottle.

Even though participants in the Slovenian sample discussed another term, certain participants were also concerned with the fact that the Coca-Cola bottle was only partly made of natural materials;*"I will take consumers point of view. I don't know if I would be convinced. Why isn't all made of it [plant material]? Probably can't be. Interesting try, but I would like to see production (Slovenia group 2 #1).*

Comparing the product perceptions concerning the shopping bag, we can observe that participants in the Slovenian focus groups were in general positive just like the other countries were. Similar to the other countries, some Slovenian participants doubted whether the bio-based shopping bag was more durable whereas others thought it to be stronger. In addition,

Slovenian participants thought the bag to be biodegradable comparable to the participants from other countries; *"It [shopping bag] decomposes in 2 years, I tried at a similar products (Slovenia group 2 # 2)."*

These examples imply that there were no big differences between Slovenia and the other countries concerning the product perceptions of the specific products.

Even though participants used the term natural materials throughout the focus group, some of them still distrusted the term in relation to the natural paint: *"And natural paint - I didn't understand exactly what is it made of. If I can't define ingredients, it can't be so natural. (Slovenia group 1 #3)"*

Concerning labels, participants from the Slovenian focus groups did not mention provenance, animal testing, expiration date, bio-based, distinctive, distrust, eco-research, environment, fair trade, food, GMO's, ingredients, instructions, international, kids, media, missing ingredients, noxious, organic, organisations, package, percentage bio, point system, pollution, production method, quality, recycle, renewable, responsiveness, understandable and waste. Thus also for labelling, the Slovenian respondents seem to have a smaller definition compared to the other countries, again probably due to the fact that they used a different term (natural products instead of bio-based).

3 Key findings

3.1 Discussion of general findings on consumer perception of bio-based

Research on consumers' perception of bio-based is scarce. This study is therefore an exploratory study, in 6 countries each organizing 3 focus groups with all togehter 107 participants.

Although some of the participants were not familiar with the term bio-based. There is variation in participants' familiarity with bio-based. For example, those unfamiliar with bio-based tend to categorize bio-based under keywords that include 'bio' such as bio fuel, biodegradable, biotechnology, whereas those participants that were more familiar with bio-based grouped bio-based with keywords like Organic, Environmental friendly, No animal testing, and to a lesser extent Natural, Sustainable, Independent from oil, and Recyclable. Thus, associations with bio-based were often linked to environment-related terms. Other keywords were used less often, for example, technical-, health-related and human rights-related aspects. Still, all keywords were used by participants, indicating that participants have a wide range of associations with bio-based.

The familiarity with bio-based is also reflected in questions raised during the group discussions. These questions ranged from the extent to which bio-based is organic, environmentally friendly, to the composition, production and waste of bio-based products. There is a wide range of questions, of which many refer to the environmental aspects of bio-based. Additionally, this unfamiliarity is associated with mixed feelings, distrust, and negative feelings. The results imply that lack of clarity on the meaning of bio-based result in negative feelings. Some respondents are less extreme in their negative reaction, resulting in mixed feelings. These participants believe it is positive that more sustainable products and techniques are developed, though due to the lack of clarity they experience distrust regarding the motives behind and actual consequences of these products and techniques.

Associations of bio-based vary on environmental friendliness. Some respondents perceive bio-based products as pro-environmental products whereas others do not perceive bio-based to be environmentally friendly. Additionally, these associations range from positive to negative. Some participants perceive contributions to environmentally friendliness as an additional plus of products. Finally, there are participants who are not sure how to think about it. They feel positive on the one hand and negative on the other. These mixed feelings are often associated with distrust. Taken together, although many participants link bio-based to environmental aspects, this link shows a wide variety of considerations which results in a wide range of feelings.

Besides the most often mentioned associations of bio-based with environmental aspects, there are also associations with technical aspects. Many participants mention the link between bio-based and bio-technology, technical aspects (i.e. nanotechnology) and product life

cylcle (i.e. production process). Especially when participants are guided to think of bio-based in terms of technical aspects the link with processing and the contradiction between technical and natural/environmentally friendliness arises. Some participants opposed a product's environmental friendliness because of its technical character. Their motivation was that environmental friendly products are natural and organic which means that it cannot be processed (technical) since that is highly environmental unfriendly. In their case, it might be difficult to perceive bio-based as both technical and environmental friendly.

3.2 Discussion of findings on consumer perceptions of bio-based for specific products

This section involves how consumers perceive bio-based at the product-specific and the label-specific level. For the product-specific level a range of seven bio-based products was included to represent products that vary in sustainability, physical proximity (to the consumer), and degree of identification with the consumer. These products are perceived in different ways by consumers, which allowed us to explore similarities and differences of bio-based across a wide range of products.

Discussing seven specific bio-based products showed that each product is perceived in its own way. The products that were in direct contact with oneself, because one drinks (Coca-Cola), breaths (natural paint), or touches the skin (foot cream and T-shirt) for example had a higher involvement among participants. However, there are some clear overarching findings to discuss. There was a low involvement with the products and the use of bio-based production methods. In general, bio-based aspects are not a decisive characteristic for buying or trying a product. It can be regarded as an additional plus, but other aspects (e.g., convenience, looks and price) are more important and must be fulfilled for participants to choose the specific products. Consumers strive to maximize personal benefits, such as convenience, price, and status. These benefits might differ across products and across individuals. Though in each case personal benefits should be fulfilled first, and bio-based production methods are only perceived as a small additional plus. Additionally, bio-based was matched to these personal benefits. Many questions are raised for additional benefits of the use of bio-based. In short all comprised in one question: "what's in it for me?' Consumers link bio-based to health-benefits, convenience-benefits, and price-benefits. Note that these links can be both positive or negative, such that one for example can perceive bio-based products to be more (costs) or less (benefits) expensive.

As was already clear from participants' general perceptions of bio-based, bio-based products were mainly linked to environmental aspects and to a lesser extent to technical and health-related (mostly via natural) aspects. Participants thus seem to link bio-based products to a range of naturally and pro-environmentally related aspects. In comparison with the general associations with bio-based there were less associations of bio-based with technical aspects, and more associations with health-related aspects. Since technical aspects are not related to

a personal benefit and therefore probably less relevant at a product-specific level, this finding indicates that on the product-specific level personal benefits are more relevant for the perception of bio-based. Additionally, environmentally friendliness and healthiness of bio-based products do relate to personal benefits, such as a good feeling, or personal motives, such as having a sustainable and healthy lifestyle.

Participants' associations of bio-based products with the environment show a similar diverse range compared to the associations with bio-based on a general level. There were respondents that were very positive to see products having pro-environmental improvements. These participants stated that small improvements are also important. Others were negative to see only partially natural products. They were not convinced by the environmental benefits, and noted that these marginal steps have no meaning. Again there were also participants in between, showing mixed feelings. They mention both positive associations with companies or products trying to be more environmentally friendly and negative associations because they do not know what is actually meant by the term, what the actual consequences are, or because more should be done to produce environmentally friendly products.

There were differences between products in how environmentally friendly they were perceived. The results imply that certain participants are more positive towards bio-based products that represented 100% bio-based or natural materials versus products that were only partly plant based. The partly plant based products were more often associated with negative terms as environmentally unfriendly or even toxic, distrust, and marketing tricks of large companies. Participants seem to differentiate between internal versus external (green washing) motivations of companies to process bio-based. Small percentages of bio-based products are sometimes perceived as an external motivation, such that the bio-based production method is only used as a way to increase profits. Thus, the percentage of bio-based can also be too small.

The results indicate the importance of a coherent product concept. Participants do not like inconsistencies in the product image or insecurities about the quality. Products are questioned, and receive negative associations and distrust when bio-based production does not match the total picture. This finding indicates that one might question whether all products or elements of products are suitable to be marketed as bio-based product. At least producers should show that they did whatever they could to make this product as natural as possible. This involves all aspects of the production process, because consumers seem to use all available information on the product to evaluate the product. For example there were negative associations on the content, package, production method, country of production (e.g., China was by some participants associated with bad human rights) and transport. Note that this finding is based on the assumption of participants that bio-based production methods are aimed at finding pro-environmental or natural solutions, whereas the link with bio-based products as innovate products, necessary to adapt to a changing world, was made less clearly by participants. In sum, participants link bio-based products to naturalness. This has advantages in terms of positive associations with environmentally friendliness. It also has

disadvantages, such that participants have high expectations regarding the environmentally friendliness of the total production process.

Also with regard to specific products, there was lack of clarity with the term bio-based. There were many questions asked by the participants what bio-based means and how it was specifically applied to the product. This lack of clarity resulted in some cases to distrust and negative associations. Additionally, many participants asked for more information. This involved questions regarding characteristics of bio-based products, production of bio-based products, the used materials, and the environmental friendliness.

Finally, although this study mainly focussed on consumer perceptions of bio-based products, the willingness to try and buy a product was also discussed to get an indication of consumers' intentions. Note that this only refers to self-reported intentions, which is not the same as real buying behaviour which is for example also affected by many other aspects such as habits, emotions, unconscious associations, and time constraints. The findings regarding self-reported intentions do indicate how consumers themselves believe they would like to act. The results show that participants wanted to buy or try the specific products to contribute to the environment, the future, or to their own well-being or healthiness. Besides these long-term goals participants also noted immediate benefits, such as price, convenience, or aesthetics. Barriers for buying the products involve some of the same arguments, such as price, aesthetics, and convenience. Additionally, a low involvement and distrust were mentioned as barriers for the intention to try or buy a specific bio-based product.

3.3 Discussion of findings on consumer perceptions of bio-based for labels

It is important for consumers that it is clear what a bio-based label adds to already existing labels. Why is the (additional) label necessary and helpful to consumers? Consumers indicate that it is important for them that these questions are answered by a new label.

Price is often mentioned as a barrier. If the price of labelled products is higher compared to regular products, it is important to make clear to consumers what the benefits are for consumers themselves (durability, convenience, feel good).

There are differences between product categories. It seems that food, cosmetics, textile, and other products that are in close contact with the body are most often referred to as products for which consumers look for bio-based labels.

A number of participants clearly stated the need for a transparent label that would inform them sufficiently. Additionally, many participants refer to the importance of a clear definition. Related to having a clear definition respondents mention a wide range of aspects to which they would like to see more information. They would like to see information regarding the following aspects: the lack of fertilizers, lack of GMOs, lack of toxics, lack of pesticides, lack of softening agents, lack of gas, lack of oil, lack of pollution, whether it is biodegradable, in-

formation regarding the production process, how companies invest the money they are saving by this way of producing, instructions for use, and provenance. This range probably decreases when the definition of bio-based is more clear to consumers. Though the wide range of information consumers would like to see does indicate that they would like to look for more information when they want to. Note that this implication does not indicate that consumers are really going to look for this information, though they would know that the information is available.

Familiarity is an important boundary condition. Among the general public a label is only successful when it is recognized and people know where it stands for. Therefore people recommend to promote and communicate the label.

Labels are important at the moment of purchase. It is important that the label is clearly visible at the moment of decision making. Additionally, the label should be understandable in itself at this moment. Thus, the text, percentages, or pictures should speak for themselves and should not need a cognitive delibation and search for additional information to understand the meaning.

Whether to include the percentage of bio-based resulted in discussion among participants. Specific percentages are not often mentioned. Though the results provide some indication, 22% is often seen as too low. Participants that refer to a percentage, often mention more than 50%.

Trust is a highly important aspect of labels because it forms the basis of a label. Consumers can do nothing more than trust whether the products indeed follow the requirments from the label. It is important to gain, and maintain, this trust. Requirements for a bio-based label refer to specifc needs, a label must fulfill in order to be allowed to be labeled as bio-based. These requirements are mentioned as necessary conditions for a label to know where the label stands for, and to have the possibility to monitor whether companies follow the standards. Inspection and monitoring are mentioned as ways to gain trust. The government and EU, or other independent bodies are most often mentioned as parties that handle this responsibility.

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Appendix A: Photos of products

T-shirt

Foot cream

Shopping bag

Coca-Cola bottle

Door trimming/ dashboard

WPC-decking

Natural paint

Appendix B: definitions of codes

4.1 Appendix I

AS_Agricultural development	Associations with bio-based and how it is applied on the countryside and/or farming and/or agriculture
AS_Bio	Associations with the term bio-based related to the general term Bio.
AS_Biodegradable	Associations with the term bio-based and whether this is biodegradable.
AS_Biological	When bio-based is associated with biological products/production chains etc.
AS_Buzzword	Ideas about bio-based being a buzzword; used frequently without being defined appropriately or being understood appropriately.
AS_Composition/Ingredients	Associations with the term bio-based concerning composition/ingredients (i.e. what percentage is bio-based, what are other components?).
AS_Cosmetics	Associations that have to do with make-up or cosmetics.
AS_Distrust	Associations with the term bio-based that are about distrust. Ideas how it can be tricky, cheating or fraud.
AS_Energy	Associations with bio-based and energy sources; bio-based being related to new sources of energy.
AS_English term	Associations due to the English based word bio-based.
AS_Environment	Associations with the term bio-based and how it relates to nature/the environment without necessarily being good or positive.
AS_Environmental friendly	Associations with the term bio-based that are environmental friendly. Clean environment/no pollution/etc.
AS_Fertilizers	Associations with the term bio-based and the use of fertilizers.

AS_Food	Associations with the term bio-based and how it relates to food.
AS_Fossil fuels	Associations with the term bio-based and how that relates to fossil fuels while producing such a product.
AS_Future	Associations with the term bio-based linked to future; will be used in the future or working towards the future, etc.
AS_Genetically modified	Associations with bio-based products that have to do with genetic modification.
AS_Health	Associations with the term bio-based and how it relates to health.
AS_Human rights	Associations about bio-based and human rights or how humans are being treated during the production process.
AS_Ideal	Ideas about how bio-based relates to an ideal world or ideal products.
AS_Innovative	Associations with the term bio-based that have to do with innovations in science/research.
AS_Integrated view	Associations with the term bio-based considering the world as a whole.
AS_International Development	Ideas how bio-based relates to international development (ontwikkelingshulp).
AS_Lifetyle	Associations with the term bio-based that relate to lifestyle, what people do consider. Associations with the term bio-based that have to do with an alternative way of living.
AS_Marketing	Ideas about bio-based being a way of advertisement or a marketing strategy.
AS_Mixed feelings	Associations in terms of emotions, seemingly both positive as negative.
AS_Natural	Associations with the term bio-based that have to do with natural products or natural ways of producing.
AS_Negative	Negative association with the term bio-based.

AS_Normative	Normative ideas about bio-based: one's supposed to use bio-based or it's bad if this technique hasn't been used.
AS_Organic	Associations with the term bio-based that have to do with organic products or natural ways of producing.
AS_Pesticides	Associations with the term bio-based and how it relates to the use of pesticides.
AS_Pollution	Associations with bio-based and pollution.
AS_Positive	General positive associations with the term bio-based.
AS_Product	Associations concerning bio-based products (rather than the production process or the term in general).
AS_Product(ion) life cycle	Associations concerning bio-based production processes.
AS_Quality	Associations with bio-based and quality-characteristics of products.
AS_Recyclable	Ideas about bio-based and recyclibility (only mentioned in Slovenia).
AS_Rest	Associations with the term bio-based that do not link with other associations mentioned.
AS_Safety	Associations with the term bio-based that link to safety.
AS_Shopping criteria	Associations and criteria for shopping including bio-based.
AS_Social	Associations that bio-based links to people.
AS_Solution/salvation	Certain keywords (i.e. bio-based) can be understood to be the key to saving the world. Or to keep from destroying it.
AS_Sustainable	Associations with the term bio-based that link to sustainability.
AS_Technical	Associations with the term bio-based that have to do with technical words/definitions or techniques.
AS_Transportation	Associations with the term bio-based that have to do with transportation.

AS_Unknown	Term bio-based is unknown or not well defined (as are the other associations). Associations are expressed but with uncertainty about it.
AS_Waste	Ideas about how bio-based relates to waste.

4.2 Appendix II

Associations	**DK**	**NL**	**IT**	**CZ**	**DE**	**SL**
Bio	4	10	2	7	13	1
Biodegradable	3	1				
Biological	3	2		1	2	1
Buzzword		1	2		1	
Compositi-on/Ingredients	2		1	1		
Cosmetics		1			1	
Countryside/farming	1	1				
Distrust	5	1	2	7	7	1
Energy	3	1	1	2	1	
English term		3				
Environment		4		7	2	2
Environmental friendly	10	8	2	11	12	7
Fertilizers	1	2	1			
Food		1	2	1	4	
Fossil fuels	1	3		3	2	1

Future	1					1
Genetically modified					2	
Health	1	1	2	3	3	5
Human rights				1		
Ideal	1		1			2
Innovative	2	1		1	1	
Integrated view	1	1				6
International Develop-ment			1			
Lifestyle		9	1		1	1
Marketing	1	1		1		
Mixed feelings	6	1		2	6	3
Natural	3	5	2	9	3	4
Negative	5			4	4	1
Normative	2		2	1	1	3
Organic		11	1	3	7	1
Pesticides		1				
Pollution	1			1		
Positive	8	3	1	8	11	9
Product	1	5	6		5	2
Product(ion) life cycle		3	1	2	4	7
Quality	1					
Recyclable						2

Rest				1	1	
Safety				1		
Shopping criteria					2	
Social	2					1
Solution/salvation	1		1	1	1	1
Sustainable		1			3	2
Technical	9	3	2	5	15	4
Transportation			2			
Unknown	10	10	5	4	13	
Waste	1			1	2	

4.3 Appendix III

This table presents the arguments participants gave for their willingness to buy or try a specific bio-based product.

Products	**Would you buy or try the product?**		
	Yes	Under certain conditions	No
T-shirt	I would like to try it out (7) Material is pleasant (touch) (2) It's comfortable to wear. I would like to try out something different Because of the natural basis Feeling that you support a good cause: environmentally friendly	When it is not too expensive(5) If it is pretty and it suits me (3) If it is pleasant and widely spread in the market. If it was made by someone who needs to be helped a little bit (e.g. a Czech producer) If it is comparable to cotton and no pesticides have been used.	I would not wear it You do not know how your skin reacts to it Not if it looks like this

Natural paint	To try it out (4) To find out how the paint performs (how many coating do I need?) Yes, even if the price was higher Because of my kids	If they would give discount and advertise the characteristics If it would be cheaper than normal paint	No (2) I would not think about this
Dashboard	Definitely Even if other designs look better	If it costs the same as a normal car If it would make me feel better	
Foot cream	It is worth trying (2) Yes, because it is natural Because you are applying it on your skin	If it is from Czech If my normal crème would be in this tube	The packaging puts me off I avoid these products, just to play safe
Shopping bag	Yes It is sensible Yes, even though in principle I do not buy shopping bags. Yes, better for the environment. I like it and I would like to try how much it can carry.	If I do not have to pay a lot more (4) If I would've forgotten my bag and it would be clear that this is a biodegradable bag If my groceries are not too heavy	Not strong enough to use several times
Coca-Cola bottle	I like Coca-Cola		It doesn't matter to me (2) I'll just grab a bottle No
WPC-decking	To deck my balcony Yes, I think it is durable and sustainable Tree derives 100% from nature, that is my choice anytime It looks pretty and I would like to know what it feels like to walk on it	Would consider it if I would have to renovate my house	I do not care about tiles and whether they are natural or bio-based (2)

Bio-based products in general	Because of the future; for you and your children		