D1.3 – REPORT ON BRAND OWNERS' INCENTIVES AND CONSUMER DRIVERS AND MOTIVATIONS

BTG Biomass Technology Group BV, VTT Technical Research Centre of Finland Ltd / Teknologian tutkimuskeskus VTT Oy & Institute of Technology Tralee (part of Munster Technological University)

This document is the BIOSWITCH project *Report on brand owners' incentives and consumer drivers and motivations* (contract no. 887727) corresponding to D1.3 (M9). It is prepare in two separate parts. The first part describes the main incentives and motivations for brand owners for switching-to-bio-based. The second part describes the main incentives for consumers to choose bio-based products.

This project has received funding from the Bio Based Industries Joint Undertaking (JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 887727.

Introduction to Deliverable 1.3

This BIOSWITCH deliverable comprises two separate reports, which together describe the results of research conducted in Task 1.4 of the BIOSWITCH project, as follows

- The first report, led by BTG Biomass Technology Group BV (Netherlands), assesses main incentives and motivations for **brand owners** for switching-to-bio-based.
- The second report, led by VTT Technical Research Centre of Finland Ltd / Teknologian tutkimuskeskus VTT Oy aims to gain an understanding of the main incentives for **consumers** to choose bio-based products.

It was decided to detail the findings of BIOSWITCH Task 1.4 in two stand-alone documents as the subject matter and the target audience for the reports are rather different

The two parts of the Deliverable are prepared as free-standing documents, that can be read without further introduction.

Part 1: Report on brand owners' incentives and motivations

This first part of the report discusses motivations of brand owners for switching-to-bio-based, presenting insights gained through a range of research activities, including: desk research (literature study), a survey into BO views and opinions (1-on-1 interviews combined with an online survey), cross assessment of best practice case studies and a short targeted desk research into (product group or application) specific drivers. Assessing the various sources it draws up the main narrative, lessons learnt and conclusions that can be drawn regarding brand owner motivations.

The first part also presents findings from a desk research (literature study) into incentives that can stimulate brand owners to develop and market bio-based solutions. Both "hard measures" and "soft measures" are discussed.

Part 2: Report on consumer drivers and motivations

The second part of the report describes social research for capturing consumers' drivers and motivation with regard to bio-based materials, products and brands. This research again includes several components: (i) a desk-based literature review of earlier consumer surveys, (ii) a qualitative online focus group discussion with 50 consumers in Finland, and (iii) two quantitative consumer surveys in Ireland and Netherlands, both including 500 consumers.

This project has received funding from the Bio Based Industries Joint Undertaking (JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 887727.

DELIVERABLE 1.3, PART 1:

REPORT ON BRAND OWNERS' MOTIVATIONS AND INCENTIVES

Lead Contractor (Sub-task 1.4a): B.T.G. Biomass Technology Group BV

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This document is one of the two stand-alone reports prepared to be part of the BIOSWITCH Deliverable *D1.3 - Report on brand owners' incentives and consumer drivers and motivations* (contract no. 887727).

This project has received funding from the Bio Based Industries Joint Undertaking (JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 887727.

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Type of Action	CSA	**Coordinator**	CLIC Innovation Oy
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Report details			
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Report responsible	BTG Biomass Technology Group	**Contact person**	**John Vos, vos@btgworld.com**

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ACRONYMS AND ABBREVIATIONS

ACRONYM	FULL NAME
B2B	business to business
B2C	business to consumer
BBI JU	Bio-based Industries Joint Undertaking
BI	Bio-based Industry
BIC	Bio-based Industries Consortium
BO	Brand Owners
BTG	B.T.G. Biomass Technology Group BV
CBE JU	Circular Bio-based Europe Joint Undertaking
CEN	European Committee for Standardization
CLIC	CLIC Innovation Oy
CSA	Coordination and Support Action
CTA	Corporación Tecnológica de Andalucía
DoA	Description of Action
EC	European Commission
FBC	Food & Bio Cluster Denmark
FF	Flanders' FOOD
GDPR	General Data Protection Regulation
ITT	Institute of Technology Tralee (since 1.1.2021 part of MTU)
KCB	Knowledge Centre on Bioeconomy
MTU	Munster Technological University
R+D+I	Research, Demonstration and Innovation
SIE	Sustainable Innovations Europe SL
VTT	Teknologian tutkimuskeskus VTT Oy
WP	Work Package

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1 INTRODUCTION TO PART 1: REPORT ON BRAND OWNERS' MOTIVATIONS AND INCENTIVES

1.1 Objective of BIOSWITCH

The main aim of the BIOSWITCH project is to bring Europe to the forefront of the bio-based economy, encouraging and supporting brand owners to switching to bio-based approaches by following a holistic, systemic approach built on two pillars:

- A framework where brand owners are placed as the centre of the public administration-bio-based industry consumers triangle through a set of events and communication actions that will allow shaping solutions to mitigate their perceived risks; and
- The BIOSWITCH toolbox as the ultimate instrument that will assist them in the bio-based transition journey.

1.2 Objective of Work Package 1

The aim of WP1 (Framework development and mapping and analysis exercise) is to set up the brand owners' networks and to involve public administration, consumers and bio-based industries in the BIOSWITCH framework:

- To analyse brand owners needs and perceived risks when switching to bio-based
- To gather best practices and case-studies so they can inspire brand owners
- To identify motivations and incentives as well as bio-based products consumer acceptance drivers
- To promote a co-creation exercise (via. a design thinking approach) between brand owners, public administration and consumers where all previous information can be analysed and discussed, and efficient solutions to mitigate perceived risks can be developed.

1.3 Objective of Task 1.4

Task 1.4 combines two sub-tasks, analysing (a) brand owners' incentives and motivations (b) consumer drivers and motivations respectively, which jointly feed the development of a comprehensive set of recommendations. Task 1.4 related research will be accordingly reported in two parallel documents:

- The first report (the current document) assesses motivations and main incentives for brand owners for switching-to-bio-based.
- The second report aims to gain an understanding of the drivers and motivations for consumers to choose bio-based products.

The two reports and the overarching Task 1.4 results will be jointly documented in BIOSWITCH Deliverable *D1.3 Report on brand owners' incentives and consumer drivers and motivations*. Task 1.4 results will also be presented at five online project workshops in early 2021, as follows:

- A series of four national workshops, *"Shaping solutions for overcoming risks and mitigation actions for switching from fossil-based to bio-based products"*, taking place between 20 and 28 January 2021 and hosted by regional cluster partners from Finland, Belgium, Spain and Denmark respectively.
- One pan-European co-creation workshop, "Shaping a global set of solutions for perceived risks when switching from fossil-based to bio-based approaches", taking place on 17 February 2021.

At each of these workshops, stakeholder feedback will be collected to validate Task 1.4 findings. The collected feedback will be presented in Deliverable *D1.4 Summary of results of regional and pan-European workshops* , which documents the workshops series.

1.4 Short introduction to this report

This report first zooms in on the motivations of brand owners (BO) for switching-to-bio-based. It presents insights that were gained in the project on such motivations through a range of research activities, including :

- Desk research (literature study)
- Survey into BO views and opinions (1-on-1 interviews combined with an online survey)
- Cross assessment of best practice case studies
- Short targeted desk research into (product group or application) specific drivers

After presenting these insights, it draws up the main narrative, lessons learnt and conclusions that can be drawn regarding brand owner motivations.

Next, the report presents findings from a desk research (literature study) into incentives that can stimulate brand owners to develop and market bio-based solutions. Two types of measures ("hard measures" such as legal requirements or hard euros as well as "soft measures") are discussed, further split into six categories:

1. Direct regulation
2. Economic instruments
3. Voluntary approaches
4. Information and advice sharing systems
5. Market-based signalling approaches
6. Other measures/instruments

Finally, the report provides a summary and some overall conclusions of the work presented

2 METHODOLOGY

2.1 Brand owner motivations

The first aspect discussed in the current document concerns the **motivations** for brand owners (BO) for switching-to-bio-based. Insights in such motivations were gained in a number of ways:

- Desk research (literature study)
- Survey into BO views and opinions (1-on-1 interviews combined with an online survey)
- Cross assessment of best practice case studies
- Short targeted desk research into (product group or application) specific drivers

Although each of these research activities had a broader scope, they all considered BO motivations. For the current report, relevant findings were extracted from their outcomes, as explained below.

Desk research

First, desk research was performed by Institute of Technology, Tralee (ITT, since 1 January 2021 part of MTU, Ireland)[1] and BTG Biomass Technology Group BV (BTG, The Netherlands). In autumn 2020 they undertook to assess international literature to gain a greater understanding into the perspectives of Brand Owners (BO), operating either in business-to-business (B2B) or business-to-consumer (B2C) markets, on the perceived risks, barriers and motivations for switching to bio-based ingredients, products or packaging. As only a handful of studies in the public domain appeared to specifically consider brands, ITT and BTG decided to widen the scope of their desk research to include businesses in the broadest sense.

The literature research did not focus on a particular type of bio-based product, however, it was found that a substantial share of the studies (both within the original as well as in the widened scope) looked in particular at bio-based packaging.

A full report of *the* literature analysis is presented in Chapter 3 of BIOSWITCH D1.1 *Report on European and Regional Analysis of the Needs, Risks and Motivations of Brand Owners Switching to Bio-based Approaches* (November 2020). This research provided the partners with a good baseline of the current work to date and provided a platform for the development of a survey and questionnaire subsequently targeting brand owners.

For the current document, the specific findings with regard to businesses' motivations were extracted from D1.1. These are presented in Section 3.1.

Brand Owner survey

Based on the above findings, ITT and BTG drafted a questionnaire and survey skeleton, that they and cluster partners CLIC Innovation (Finland), Food & Bio Cluster (Denmark), Flanders' FOOD (Belgium), and Fundación Corporación Tecnológica de Andalucía CTA (Spain) used to conduct 1-on-1 qualitative

[1] From January 2021, ITT (Institute of Technology, Tralee) has merged with Cork Institute of Technology to form the Munster Technological University (MTU). In this document the original institute name is used.

interviews and/or an online quantitative survey. The survey had a much wider scope than just BO motivations, looking also into various other issues such as: BO background with regards to sustainability and bio-based products; Risks, barriers and needs of BO with regards to bio-based product uptake; Incentives of BO with regards to bio-based product uptake.

A full overview of survey findings is presented in Chapter 4 of BIOSWITCH D1.1 *Report on European and Regional Analysis of the Needs, Risks and Motivations of Brand Owners Switching to Bio-based Approaches* (November 2020).

For the current document survey findings with regard to BO motivations were extracted from D1.1. These are presented in Section 3.2.

Cross assessment of best practice case studies

The development of a series of best practice case studies, in the second half of 2020, provided a further opportunity to obtain insights into BO motivations. Led by BTG, partners CLIC, FBC, FF, CTA, ITT and BTG developed and led a case study each. Subsequently BTG conducted a cross-analysis to assess best practices, zooming in on (a) brands' motivations, (b) bio-based product innovations, (c) barriers and challenges encountered, and (d) lessons learned and take-home messages. The work (case studies and cross-analysis) is documented in D1.2 *Report on best practices and switch-to bio-based case studies for the agriculture, food, forestry and chemical sectors* (December 2020).

For the current document cross-analysis findings with regard to BO motivations were extracted from D1.2. These are presented in Section 3.3.

Targeted desk research into (product group or application) specific drivers

Finally, to get better insights in the relevance of selected specific motivators, e.g. occupational and personal health, short additional targeted desk research was conducted by BTG. This is documented in Section 3.4.

Overall findings and conclusions

Comparing the outcomes of the different research components, overall findings, lessons and conclusions were drawn regarding the main motivations of brand owners (considering) switching-to-bio-based. These are presented in Section 3.5

2.2 Incentives

The second aspect discussed in the current document concerns the incentives for brand owners for switching-to-bio-based. To get insights in these incentives another desk research was performed by BTG Biomass Technology Group BV.

To keep the desk research manageable, it was decided to provide an illustrative, rather than comprehensive, overview showcasing a selection of (recent) incentives, focusing primarily on incentives that are relevant at EU27 level.

3 BRAND OWNER MOTIVATIONS

3.1 Literature survey

Desk research was performed by ITT and BTG to gain a greater understanding of existing studies into the perspectives of brand owners (and other businesses) on perceived risks, barriers and motivations for switching to bio-based ingredients, products or packaging. This is documented in Section 3 of BIOSWITCH D1.1 *Report on European and Regional Analysis of the Needs, Risks and Motivations of Brand Owners Switching to Bio-based Approaches* (November 2020). What did this report observe?

With regard to bio-based products:

1. In particular for brands and retailers, central drivers for the adoption of bio-based products and packaging are frequently environmental regulation and external pressures from the stakeholders-clients who demand environmentally friendly practices and products.
2. Furthermore, bio-based is seen to offer an independence from fossil sources and a reduction of CO_2-emissions. In terms of business drivers, having bio-based alternatives help businesses to create a more positive image, and it can offer a competitive and strategic advantage in the markets.
3. Barriers hampering the commercialisation of new bio-based products include (a) feedstock-related barriers, (b) investment barriers and the perception of high investment risk, (c) poor public perception and awareness of industrial biotechnology and bio-based products and (d) absence of incentives or efficient policies to increase the demand.
4. Practical challenges for brand owners to switch to bio-based approaches also include: (1) lack of specific labelling and certification; (2) functionality and performance versus cost; (3) connection with the industry to create new value chains; (4) skills and occupational health; and (5) communication of the product.
5. The weight of important drivers of the market for bio-based products differs distinctively across countries and product groups. Each bio-based product is perceived in its own way.

Some specific observations with regard to bio-based packaging:

6. Bio-based materials offer (food packaging) businesses the potential to help them comply with newer and future environmentally-conscious regulations, such as requirements to use compostable packaging for food.
7. Options that brands consider include switching to a portion of the packaging being made from bio-based, biodegradable, compostable or recycled substrates.
8. Regarding bio-based packaging, some brand owners express concern about the suitability of the material, including its biodegradability. Other brand owners express concern over how the product will be disposed and confusion among their consumers over differences between bio-based, biodegradable and compostable products.

3.2 Brand owner survey and regional interviews

Regional interviews and online surveys were performed by CLIC, FBC, FF, CTA, and ITT among brand owners. In total there were 60 responses received from the brand owners, these comprise 20 regional interviews and 40 pan-European online survey responses. The regional interviews covered Finland, Denmark, Belgium, and Spain. The Pan-EU survey additionally covered Ireland, Netherlands, Sweden and the UK. Findings are reported in Section 4 of BIOSWITCH D1.1 *Report on European and Regional Analysis of the Needs, Risks and Motivations of Brand Owners Switching to Bio-based Approaches* (November 2020).

The questionnaires used for the regional and pan-EU survey largely overlapped and included the question: *What would be your main motivation for switching to bio-based products?* What replies did the survey yield?

Pan-European survey

Figure 1 illustrates the feedback obtained from brand owners when asked about the main motivations for brands switching to bio-based products. The majority of Pan-EU brand owners (69%) indicated that meeting the company sustainability targets is a main motivation, while 63% indicated meeting customer demand. Green marketing also featured quite prominent at 39%, with improved product functionality at 27%, and existing and anticipated regulatory changes both at 22%. 14% of Pan-EU brands said using local feedstocks was the main motivation, with only 5% indicating that higher prices for green products was a motivation. Other motivations included creating key selling features in products, demonstrating that the company continues to innovate, delivering products that can achieve ecolabels and delivering benefits for a global society.

Regional surveys

Zooming in to the regional level, some clear differences became apparent. On a regional level, 66% of Belgian brand owners indicated meeting company sustainability targets as the main motivation, with 50% choosing meeting consumer demands and 50 % choosing green marketing, 71% of Danish brand owners indicated meeting customer demand and meeting company sustainability targets as main motivations, while 28% chose meeting existing and anticipated regulations; 100% of Finnish brands choose meeting customer demands with 75% choosing meeting company sustainability targets and a further 50% indicating anticipated regulatory changes; while in Spain 100% chose meeting existing regulations while 66% chose meeting customer demand and a further 66% chose meeting company sustainability targets.

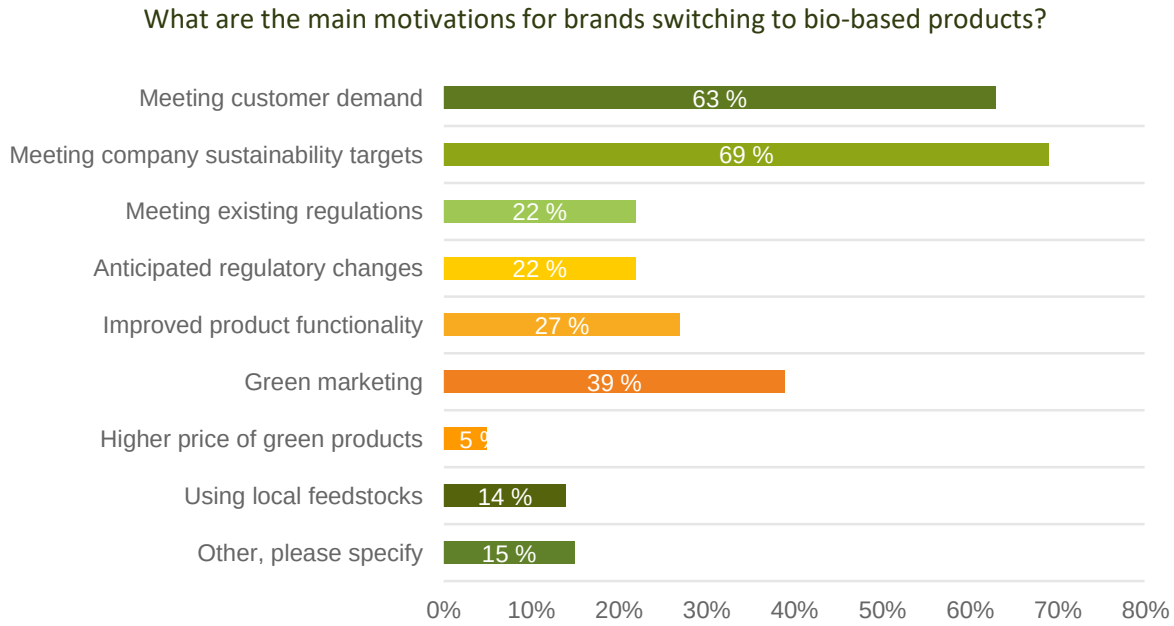

Figure 1. Main motivations for brand owners switching to bio-based products (source: BIOSWITCH pan-European survey, n = 60)

Discussion

In the Pan-European survey, when asking brand owners about their main motivations for switching to bio-based products the following Top 3 emerged: meeting **company sustainability targets** (69%), **meeting customer demand** (63%), and - following at some distance but also featuring quite prominent - **green marketing** (39%). Existing and anticipated **regulatory changes** (both at 22%) were less relevant as key motivators.

Looking at the motivations for bio-based ingredient/product uptake on a regional basis[2], **meeting customer demand** was described a key motivation for integration of bio-based ingredients across Finland (100 % of brands indicated), Denmark and Spain (71% and 66% respectively) with a little less emphasis in Belgium (50%). **Meeting company sustainability targets** was also a key motivation, across the regions with Finland (75%), Denmark (71%), Belgium and Spain (66% each) indicating this to be one of the key motivating factors. **Green marketing** was a moderate motivation for Belgian brands, which was not seen as strongly in the other regions, this is likely linked to a particular interest from food companies in marketing potential of sustainable packaging for their produce. **Meeting regulation** was also cited as a motivation for brands in some of the regions with 100 % Spanish brand owners citing existing regulations, 50% of Finnish brand owners citing anticipated regulatory

[2] The country where a multinational company owning a brand is headquartered was used as the basis for the geographical analysis presented here.

changes, and 28% of Danish brands each indicated existing or anticipated regulatory changes as a key motivation.

The Pan-EU survey findings (which are mirrored in Belgium and Denmark) would seem to illustrate that becoming, and being acknowledged as, a sustainable brand is a prime motivator. Whereas in Finland and in particular Spain existing and anticipated regulatory changes are also key.

Summary

From the survey the following trends emerged: meeting company sustainability targets and meeting customer demand are the main motivations for switching to bio-based products. A sizeable cohort of brand owners are motivated by green marketing, with fewer brand owners overall motivated by regulation (existing or future), except for Spanish brands that consider this a key motivation for bio-based product uptake.

These survey findings are fully in line with the literature research findings, which identified environmental regulation, customers demanding environmental-friendly products and brands wanting to improve their public image as the key motivations and drivers (see Section 3.1 above).

3.3 Cross-assessment of best practice case studies

A series of best practice case studies was developed by CLIC, FBC, FF, CTA, ITT and BTG, after which BTG conducted a cross-analysis, zooming in brand owners' (a) motivations, (b) bio-based product innovations, (c) barriers and challenges encountered, and (d) lessons learned and take-home messages. An overview of the companies covered in the best practice case studies is presented in Table 1.

Company	Main products	BIOSWITCH sector(s)	HQ	Established	No. of staff
Bioco	Craft coffee	Food	BE	2016	Just 2
Dantoy	Games and toys	Chemistry	DK	Early 1960's	About 50
Naty	Baby care products	Forestry	SW	1995	Few hundred
Vaude	Outdoor clothing	Chemistry	DE	1974	About 500
Alhóndiga La Unión	Vegetables & fruit	Agriculture, Food	ES	1993	750 – 1000
Stora Enso	Paper, packaging, wooden construction, biomaterials	Forestry	FIN	1289	Some 26,000

Table 1. Companies (brand owners) covered in the BIOSWITCH best practice case studies

The work (case studies and cross-analysis) is documented in D1.2 *Report on best practices and switch-to bio-based case studies for the agriculture, food, forestry and chemical sectors* (December 2020). What did this document observe regarding the motivation of these brand owners?

- For all brand owners **sustainability is a the main driver**, if not part of their brand ethos and DNA. Usually, brands do not only consider the (environmental, social and economic) sustainability of a line of products, but also the products' packaging. Many of the bio-based products covered in the case studies carry an environmental-friendly label (such as EU-Ecolabel or Nordic Swan) or other certified labels (e.g. for bio-based content, or for biodegradability).
- It stands out that several brand owners made radical choices, indicating explicitly that they want to **break away from doing business as usual and are pioneering high–quality bio-based solutions instead.** For Naty this was the reason to start the company in the mid-nineties. Nappy producer Naty was founded because its CEO was unable to find a viable alternative to conventional plastic diapers. For its Green Shape core collection of outdoor clothing, the German sports equipment brand Vaude opted out of the race for higher, faster, farther, optimising product design instead. Initially incited by a push of their consumers, organic, artisan coffee roasting company Bioco made a radical shift towards packaging that is 100% bio-based and industrial compostable. Danish producer of toys and games dantoy also decided to fully do away with using plastic (netting) for packaging products of its "I'm green" brand, applying recycled cardboard instead.
- Few if any of the customers and consumers of the products covered in the case studies make conscious product choices or explicitly ask for bio-based products. They express their needs and expectations in various other terms instead. They ask for products that are high-quality and long-lasting, produced with minimized negative impact on environment and climate (dantoy); free of chemicals and contributing to healthy living (Naty); and ensuring a sense of well-being and comfort (Vaude). When it comes to packaging, the situation is likewise. Eco-friendly customers of the Nordic renewable solutions provider Stora Enso in the hospitality sector, e.g. takeaway food companies that consider alternatives to plastic food containers want to reduce the use of plastic for packaging. Or they demand eco-friendly alternatives for food packaging, as is the case for Spanish exporter of fruit and vegetables Alhóndiga La Unión. **In short, shifting to bio-based products and packaging is more a means to an end, and not a goal by itself.**

3.4 Product group or application-specific drivers and motivations

Beyond the general drivers and motivations, discussed in the previous sections, there are a wide range of specific drivers and motivations (including e.g. improved product functionalities), which

depend on the product group or application. Three recent EU-sponsored projects/studies are worth mentioning:

- RoadtoBio's Roadmap for the Chemical industry in Europe towards a Bioeconomy.
- JRC's Insights into the European market for bio-based chemicals
- EU Biorefinery Outlook to 2030

These studies consider drivers (and barriers) for bio-based industries in general (rather than for brand owners) and focus -mainly- on intermediate products (biochemicals and biomaterials) rather than on consumer products. Researching these studies in detail is beyond the scope of BIOSWITCH. Nonetheless some study findings are worth summarising here.

The **RoadToBio roadmap** provides in-depth background information on drivers for bio-based market growth, as well as on the opportunities and barriers to increasing the share of bio-based chemicals in nine product groups: Adhesives; Agrochemicals; Cosmetics; Lubricants; Man-made fibres; Paints / Coatings / Dyes; Plastics / Polymers; Solvents and Surfactants. For each of these groups specific (barriers and) opportunities are discussed. Details can be found in the RoadToBio strategy.[3]

The **Insights report**, published by the EC Joint Research Centre (JRC)[4], provides detailed description of ten bio-based chemical product categories, and the application markets: 1. Platform chemicals; 2. Solvents; 3. Polymers for plastics; 4. Paints, coatings, inks and dyes; 5. Surfactants; 6. Cosmetics and personal care products; 7. Adhesives; 8. Lubricants; 9. Plasticisers (and stabilisers for rubber and plastics) and 10. Man-made fibres. The study presents an assessment of the potential for technological development and considers the opportunities for further developing and commercialising bio-based products starting from the current situation. To assess the innovation potential of the bio-based chemical industry, a strengths, weaknesses, opportunities and threats (SWOT) analysis was performed for the product categories. This SWOT incorporates drivers/motivators regarding the covered biochemicals.

The **Biorefinery Outlook 2030** is a very recent study to look into product group specific drivers and barriers (report to be published in Q1, 2021), and therefore will be covered in more detail. It considers drivers (and barriers) for biorefineries in general, and -like the previous two studies- for specific product groups and chemicals, i.e.: Additives; Lubricants; Solvents; Surfactants; Fibres (in particular Microfibrillated cellulose; Polymers & Plastics (Thermoplastic starch & Poly lactic acid); chemical building blocks (1,4-Butanediol, Lactic acid and Methanol) and (lignin based phenolic) resins. For each of these 10 (sub-)groups a detailed analysis was made in the form of a factsheet, after which stakeholder interviews were conducted for validation followed by a synthesis also assessing what drivers and barriers were mentioned most frequently by stakeholders. Table 2 shows the result of this synthesis (number of mentions are provided in parenthesis, where X/10 means that X out of a total of 10 respondents agreed to this driver/barrier).

[3] https://www.roadtobio.eu/uploads/publications/roadmap/RoadToBio_strategy_document.pdf
[4] https://ec.europa.eu/jrc/en/publication/insights-european-market-bio-based-chemicals-o

Category	Drivers	Barriers
1: Business	1. Many products have multiple applications (6/10) 2. Bio-based is an advantage for marketing, demand for bio-based increasing (7/10)	1. Cost competitiveness (7/10) 2. Poor performance (4/10) 3. Difficult to enter existing markets (4/10)
2: Innovation	1. Technology consolidated (3/10) 2. Increasing investments in R&D or R&D is widespread (2/10) 3. Improved properties (4/10)	1. Issues with IP (2/10)
3: Economy	1. Increasing EU competitiveness (2/10)	1. High investment costs for scale-up or production costs (3/10)
4: Feedstock	1. In most cases feedstocks are available from several sources (6/10) 2. Efficient extraction of lignocellulosic sugars creates more feedstock opportunity (2/10) 3. Possibility to use waste (4/10)	1. Security of supply now or when scaling up is required (6/10) 2. Food crop use/sustainability questions (3/10)
5: Climate change and environment	1. Offers GHG savings (10/10) 2. Biodegradability (6/10)	1. Lack of standardized, detailed studied information about environmental performance/difficulty proving it (5/10)
6: Citizen and Society	1. Growing consumer awareness (4/10) 2. Non-harmful to health, low toxicity (6/10)	1. Lack of consumer awareness, lack of product labelling to increase awareness, bio-based not a selling argument or "fake products" (lack of knowledge) (2/10) 2. Confusing terminology (3/10)
7: Policy and regulation	1. Ban on plastics, regulations towards sustainable packaging (4/10)	1. Lack of regulatory push, regulations country/region dependent (6/10) 2. Some regulatory requirements (e.g. REACH) are costly and time consuming (3/10) 3. Lack of standards/labels (2/10)

Table 2. Specific drivers and barriers mentioned frequently by stakeholders with regard to biorefineries (source: Platt et al, 2021[5])

For the current report on brand owners' motivations and incentives, the centre column (Drivers) and the bottom three rows (covering the categories Climate change and environment; Citizen and

[5] Richard Platt, Ausilio Bauen, Martin Behrens, Patrick Reumerman, René Van Ree, Iris Vural Gursel, Lesly Garcia, Cecile Geier, Jo Howes, Yamini Panchaksharam, Philipp von Bothmer, Kaisa Vikla, Valerie Sartorius (forthcoming), Biorefinery pathways and outlook for deployment. Studies on support to R&I policy in the area of bio-based products and services.

society; and Policy and regulation) are the most important and worth having a closer look at. The listed issues are covered in different parts of BIOSWITCH Deliverable 1.3, as follows.

- The frequent mentioning by interviewed stakeholders of "*Greenhouse gas savings*" and "*Biodegradability*" is fully in line with BIOSWITCH survey findings already reported above in this chapter.
- The aspect "*Non-harmful to health, low toxicity*" is discussed right below.
- The "*Ban on plastics, regulations towards sustainable packaging*" is discussed in the next chapter in Section 4.2.1. Direct regulation instruments, and
- "*(Growing) consumer awareness*" is surveyed and discussed in the sister report (the other part of D1.3) that discusses consumer drivers and motivations.

Occupational Health, Personal Health and Well-Being

Improved health can be one of the considerations for brand owners and other businesses to switch to bio-based. This aspect is relevant for various biochemicals, biomaterials and bio-based products. Some examples include:

- **Bio-based surfactants** offer biological activity (antibacterial, antifungal, antiviral, anticancer and immunomodulation activities) and positive impact on personal health. Alkyl polyglycoside (APG) has an added advantage of not causing skin irritations.
- **Bio-lubricants** are increasingly used in metalworking, not for environmental reasons, but employee health, and metalworking fluids, used in the primary metals, automotive manufacturing, and general manufacturing sectors, are the second largest bio-lubricant product category. Total loss lubricants used in chainsaws and outboard marine engines in pleasure crafts, greases used for railroads, and transformer oils used in electrical transmission are other examples of specialist lubricant categories that see a high level of bio-lubricant penetration[6]
- **Bio-based insulation materials** contribute to a pleasant and healthy indoor climate. Insulation measures have caused the relative air humidity in many houses to be high, which can lead to growth of moulds. This is where bio-based materials can help. Scientific research has shown that most natural insulation materials can accumulate and conduct moisture. This moisture-regulating effect contributes to a balanced indoor climate throughout the year. This is especially important for people with respiratory diseases, asthma, atopic dermatitis, for which constant indoor humidity is very important.[7]

A representative of the Biobridges project informed that for consumers, health (i.e. their personal health and their children's health) may be an even more important topic than the environment[8]. This also features as a key message in the promotional video, produced by Biobridges in early 2020. The video, *A Bio-Based Day*, is following a young lady during her bio-based day, from the wake up to the

[6] Sharbel Luzuriaga & Max Marioni / Kline & Company (2018), The key market drivers of bio-lubricants. In: Lube Magazine o. 143, February 2018, https://www.panolin.com/pdf/Lube-magazin-143.pdf
[7] http://www.allthings.bio/fact-or-myth/bio-based-insulation-materials-facts-myths/
[8] Interview with Susanna Albertini (in context of RoadToBio project), held on 12 February 2019

goodnight, discovering how bio-based products can substitute fossil-based ones in everyday's lives. The video emphasises the potential positive impact in a consumer's live (societal, environmental, wellbeing, health) and showcases the economic, sustainability, growth and employment opportunities for brands and industries.[9]

3.5 Lessons learnt and conclusions

Reflecting the outcome of the different research components, what is the main narrative and what are the lessons and conclusions that can be drawn regarding brand owner motivations?

A consistent picture emerges from the literature research, the BO survey, the cross-assessment of the best practice case studies:

- Meeting **company sustainability** targets, (upcoming) **environmental regulation**, customers demanding **environmental-friendly products** and brands wanting to improve their **public image** are the main motivations for businesses switching to bio-based products.
- A sizeable cohort of brand owners are motivated by **green marketing**, with fewer brand owners overall motivated by regulation (existing or future), except for Spanish brand owners.
- Bio-based materials are a way to **reduce** a product's and therewith a brand's and company's **impact on climate change** and use of resources while also improving technical attributes.
- Bio-based is seen to offer an **independence from fossil sources** and a reduction of CO_2-emissions. In terms of business drivers, having bio-based alternatives help businesses to create a more **positive image**, it can also offer a competitive and **strategic advantage** in the markets.
- Bio-based materials offer (food packaging) businesses the potential to help them **comply with** newer and future **environmentally-conscious regulations**, such as requirements to use compostable packaging for food.
- For "best practice" companies presented in the case studies **sustainability is a part of their brand ethos and DNA**. Some brand owners indicated that they wanted to break away from doing business as usual and are pioneering high–quality bio-based solutions instead.
- Shifting to bio-based products and packaging is commonly a means to an end, and not a goal by itself. **Consumers do not explicitly ask for bio-based products**, but express their needs and expectations in other terms, wanting products that are high-quality and long-lasting, produced with minimized negative impact on environment and climate (dantoy); free of chemicals and contributing to healthy living (Naty); ensuring a sense of well-being and comfort (Vaude) or not harmful to (their personal and their children's) health (Biobrides project). For many consumers **considerations regarding health and well-being** may be even more important topic than the environment.
- When it comes to (food) packaging, eco-friendly customers want to avoid or reduce the use of plastic (Stora Enso case) or demand eco-friendly alternatives (Alhóndiga La Unión case).

[9] https://www.biobridges-project.eu/results/a-bio-based-day-video/urlen

- What general and specific **drivers and motivations** help brand owners and other businesses consider to switch to bio-based products **differs distinctively across countries and across product groups**. Each bio-based product (group) and application is perceived in its own way.
- As for any product innovation it is key to **listen to and understand customers** and consumers. Brand owners can take advantage of the growing trend among, and awareness of, consumers for sustainable products, offering opportunities for bio-based innovations.

4 BRAND OWNER INCENTIVES

4.1 Introduction

There are different ways in which governments can regulate, influence behaviour, and alter incentives for market actors. Each of these instruments has its pros and cons, strengths, and weaknesses. In a recent overview, the POWER4BIO project[10] categorised the different types of incentives as follows:

1. **Direct regulation** – a command and control approach using obligatory standards and licenses that require people/companies/market players to change their behaviour and punishes them if they are detected to be non-compliant;
2. **Economic instruments** – includes all instruments changing price incentives (taxes, subsidies, feed-in tariffs), but also quantity constraints ((tradable) quota, tariff rate quota), and charges. These instruments give people incentives to voluntary (e.g. based on their own rational cost-benefit calculations) change their behaviour;
3. **Voluntary approaches** – could be codes of good practice, self-regulation and other industry-led initiatives. Financial incentive schemes could be part of these instruments. These approaches typically encourage rather than force people or businesses to show the desired behaviour;
4. **Information and advice sharing systems** – comprising measures aimed at raising the awareness and facilitating changes in behaviour;
5. **Market-based signalling approaches** – such as labelling, traceability, and voluntary certification schemes. These approaches are often related to informational problems (lack of information about product quality and food safety) hindering the proper functioning of markets;
6. **Other measures/instruments** not in the categories above such as vision documents, roadmaps, strategies.

Together, the last 4 categories form, according to (Pelkmans et al, 2016)[11] the 'soft measures'. They are all based on voluntary principles such as voluntary standards and labelling, capacity building, education and platforms for collaboration or information sharing. They also include action plans, roadmaps and strategies which are elaborated by countries or regions. In this report, we adopt this term the 'soft measures', and in addition use the term 'hard measures' for the first 2 categories.

[10] Elbersen et al (2020), POWER4BIO project D4.2 An overview of suitable regional policies to support bio-based business models, https://power4bio.eu/wp-content/uploads/2020/06/POWER4BIO_D4.2_Policies_support_bio-based_business_models.pdf

[11] Pelkmans et al (2016) S2BIOM project D6.3 Policy options to mobilize sustainable non-food biomass resources for the biobased economy, https://s2biom.wenr.wur.nl/doc/S2Biom_D6.3_PolicyOptions_v2.pdf

Across Europe, a lot of incentives that are more or less relevant for the growth of the bioeconomy and the deployment of bio-based products have been in place, at all geographical (European, national, regional and even local) levels. In the current document, we focus on incentive measures that are within the following scope:

1. The presented overview of incentives is illustrative, rather than comprehensive, and is showcasing a selection of relevant incentives.
2. The focus is primarily on incentives that are relevant at the European (EU27) level. Incentives on other geographical levels (from international to local) can be just as relevant, or even more important, but are not within our scope.[12]
3. The incentives discussed are relevant to bioeconomy businesses and bio-based (packaging) products in general (i.e. not limited to brand owners or to specific bio-based product group or application).
4. Incentives providing more general support to start-up companies or (other) small and medium-sized enterprises (SMEs), innovation, (business) collaboration, rural/regional/economic development, green recovery/sustainable development, economic growth, etc. and incentives supporting the production and use of bioenergy (including biofuels) are also not within the scope.
5. Particular attention is given to more recent development and examples (dating from the last five years or so).

4.2 Hard measures

4.2.1 Direct regulation instruments

Direct regulation refers to legislation requiring certain behaviour of market actors. Compliance is obligatory, and actors can be punished for non-compliance. Examples of direct regulation instruments in bioeconomy are quotas, mandates, product standards, targets and qualifying criteria for incentives, green procurement rules and permitting and zoning instruments.

European and national quotes/mandates are in place for e.g. the blending of liquid biofuels used in road transportation. When ruling out uses for bioenergy production (which is not within the scope of BIOSWITCH) these seems to be little use of direct regulation of economic actors in the European bioeconomy.

Some limited relevance for the switch-to-bio-based and the general market uptake of bio-based products have specific European Directives as well as bio-based procurement.

European Directives

A "Directive" is a legislative act that sets out a goal that all EU countries must achieve. It is up to the individual member states how to do so. EU countries must adopt measures to incorporate them into

[12] The above mentioned Power4Bio project presents good policy examples at the national/regional level. The LIFT factsheet #5 Regional Potential, Bioeconomy Strategies and Action Plans Standardisation provides details on this and other EU-funded bioeconomy policy projects and initiatives. URL: https://www.bioeconomy-library.eu/wp-content/uploads/2020/03/05_LIFT_FactSheets_regional_potential.pdf

national law (transpose) in order to achieve the objectives set by the Directive. Such transposition into national law must generally take place within 2 years. When a country does not transpose a directive, the Commission may initiate infringement proceedings.[13]

Among the Directives expected to have impact on the use of bio-based and biodegradable materials are the recently issued or revised (a) Waste Framework Directive, (b) Packaging and Packaging Waste Directive and (c) Single-Use Plastics Directive.

In April 2018, the European Parliament approved the package to update the EU waste legislation, including a revision of the Waste Framework Directive and the Packaging and Packaging Waste Directive. Apart from new ambitious recycling and landfilling targets to boost the re-use of valuable materials in waste, the new legislation also acknowledges that bio-based feedstock for plastic packaging as well as compostable plastics for separate bio-waste collection contribute to a more efficient waste management.

The revised **Waste Framework Directive**[14] describes general waste management requirements, such as environmental and human health protection during waste treatment and priority for waste recycling, and also contains specific bio-waste related elements. This Directive allows biodegradable and compostable packaging to be collected together with bio-waste and recycled in industrial composting and anaerobic digestion, which has already successfully been implemented in several Member States. By 2023, separate collection of bio-waste is set to be mandatory throughout Europe. Biodegradable plastics verifiably help to collect more bio-waste and ultimately contribute to reaching the new recycling targets.

The **Packaging and Packaging Waste Directive**[15] acknowledges that bio-based plastics help to minimise the environmental impacts of plastic packaging and to reduce Europe's dependence on imported raw materials. Bio-based and recycled materials are equally viable solutions to make packaging more sustainable. While Member States are encouraged to promote the use of bio-based recyclable packaging and bio-based compostable packaging, in the opinion of industry trade association European Bioplastics the European legislators missed the chance to introduce concrete legislative measures stimulating their use and improving market conditions for such products.[16]

The 2018 EU Plastics Strategy set outs a cautious approach for the use of biodegradable plastics as it identified a number of concerning challenges associated with their uptake: "*It is important to ensure that consumers are provided with clear and correct information, and to make sure that biodegradable plastics are not put forward as a solution to littering*". An approach that was confirmed in the **Directive**

[13] https://ec.europa.eu/info/law/law-making-process/types-eu-law_en

[14] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705

[15] Directive (EU) 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32018L0852

[16] https://www.european-bioplastics.org/new-eu-waste-rules-adopted/

on single use plastics and fishing gear[17] which makes no distinction between conventional, non-biodegradable plastics and biodegradable plastics, capturing them all in its ambition to phase out the most polluting single-use plastics. Under the Directive, the EU is banning the use of various single-use plastics (plastic cutlery, cotton buds, straws and stirrers etc.). The ban will come into force by 2021 in all EU Member States.

The European ban follows earlier national legislation put in place by member states with similar goals. Italy (in 2011), France (in 2015), Brussels (in 2017) and Spain (in 201) announced and since implemented decrees to prohibit the marketing and/or reduce the use of disposable plastic bags.

Product standards

Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes, and services are fit for their purpose. Standards provide a basis for mutual understanding among individuals, businesses, public authorities, and other stakeholders, facilitating communication, commerce, measurement/testing and manufacturing. Most of the standards, including those of highest relevance to the uptake of bio-based products, are voluntary market agreements. Therefore, standards are discussed in more detail in Section 4.3.3 on market-based signalling approaches.

Green Public Procurement

Public procurement plays a vital role in Europe's economic performance. EU public spending on purchasing supplies, works and services amounts to nearly 19% of the EU's gross domestic product. This tremendous power from the European public sector can be used as a market pull mechanism to help boost the market of bio-based products and their associated services.

Green procurement refers to purchasing products and services that cause minimal adverse environmental impacts. It incorporates human health and environmental concerns into the search for high quality products and services at competitive prices. Green Public Procurement (GPP) is an important tool for governments and public authorities to achieve environmental policy goals relating to climate change, resource use and sustainable consumption and production – especially given the importance of public sector spending on goods and services in Europe.

In principle, GPP can be used as an instrument to support the market uptake of bio-based products and their associated services. In the United States (US), the public procurement of bio-based products is being promoted by the federal government since 2002. The BioPreferred® Program led by the US Department of Agriculture aims to spur economic development, create new jobs and provide new markets for farm commodities[18].

[17] Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the reduction of the impact of certain plastic products on the environment, https://eur-lex.europa.eu/eli/dir/2019/904/oj

[18] https://www.usda.gov/media/press-releases/2016/02/18/fact-sheet-overview-usdas-biopreferred-program

With an eye on the long-running USDA's BioPreferred® Program, there have been various initiatives to stimulate a similar deployment of bio-based (public) procurement in the EU, its member states and regions. Examples include:

1. Spurred by the EU's 2009 Lead Market Initiative, a European innovation policy designed to stimulate the development of six important markets, including bio-based products, the EU Expert Group for Bio-based Products set-up a working group Public Procurement of Bio-based Products. The working group issued 15 concrete recommendations in April 2016.[19]
2. Commissioned by DG Internal Market, Industry, Entrepreneurship and SMEs, the Dutch firm RoyalHaskoning DHV developed Guidance for bio-based products in procurement in 2017[20]. This guidance aims to help organisations to obtain more information about bio-based products and to consider innovative bio-based products alongside other products when making their buying decisions.
3. Funded under the H2020 programme, the InnProBio project provided public procurement practitioners an elaborated and legally solid database & toolbox in February 2018 assisting them with the procurement of (innovative) bio-based products and services.
4. Funded under the Interreg 2 Seas programme, the Circular Bio-based Construction Industry (CBCI) project commissioned Europe Decentraal to develop the document The European Union & Circular Bio-based Construction[21] that addresses applying public procurement for circular bio-based construction
5. At the national level, there are or have been also various initiatives supporting the procurement of bio-based products including the German national procurement project 'Nachwachsende Rohstoffe im Einkauf' and the Dutch Community of Practice "Bio-based Inkopen" led by the Public Procurement Expertise Centre PIANOo. The latter published an inspiration booklet covering 20 showcases of bio-based procurement in September 2016.[22]

After more than a decade of European attention to the topic, and following some successes at the national and regional level (e.g. the Dutch provinces of Zuid-Holland, Noord Brabant and Zeeland[23]), it seems that public procurement of bio-based products has yet to make a significant impact on bioeconomy market development in the EU.

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[19] Commission Expert Group for Bio-based Products, Working Group Public Procurement of Bio-based Products, Recommendations (April 2016), https://bbia.org.uk/wp-content/uploads/2016/04/Public-Procurement-of-Bio-based-Products-Recommendations-FINAL-adopted.pdf

[20] RoyalHaskoning DHV (August 2017), Guidance for bio-based products in procurement, https://ec.europa.eu/growth/content/guidance-bio-based-products-procurement_en

[21] Europa Decentraal (2020), The European Union & Circular Bio-based Construction, https://europadecentraal.nl/wp-content/uploads/2020/09/EU-public-procurement-and-circular-biobased-construction-report.pdf

[22] PIANOo/Dutch Public Procurement Expertise Centre (September 2016), https://www.pianoo.nl/sites/default/files/documents/documents/inspiratieboek20showcasesbiobasedinkopen-september2016.pdf

[23] https://biobaseddelta.com/biobased-procurement/

4.2.2 Economic instruments

Examples of economic instruments in bioeconomy include: investment grants and subsidies, loans and loan guarantees, tradable certificates, feed-in tariffs or premiums, tax incentives/exemptions, user charges, and research and technology and innovation funds. Economic instruments offer an alternative to the traditional 'command-and-control' instruments (direct regulation, discussed above in Section 4.2.1).

There would seem to be an increasing number of programmes, schemes and instruments specifically targeting the further deployment of the bioeconomy.

Research, demonstration and innovation (R+D+I) grants

At the European level, hundreds of millions of euros are available annually for research, demonstration and innovation (R+D+I) projects in the bioeconomy field. In the period 2013-2020 the best funded programmes in this field included the Horizon 2020 framework research programme and the BBI JU public-private partnership that operates under it.

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money attracts. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. Bioeconomy is covered primarily under Societal Challenge 2 (SC2) "Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy". Each annual SC2 call included multiple bioeconomy-related research themes. Under Horizon 2020, the EC dedicated €3.85 billion of public funds into bioeconomy projects over the implementation period. Further research on innovative bioeconomy areas is needed and will be financed through Horizon Europe (2021-2027).[24]

The Bio-Based Industries Joint Undertaking (BBI JU) is a €3.7 billion Public-Private Partnership between the EU and the Bio-based Industries Consortium operating under Horizon 2020. A portion of the BBI JU budget is allocated to flagships i.e. demonstration of an integrated biorefineries. The nine flagships granted until summer 2020 are generating private investments of around EUR 1,200 million against a BBI JU financing of EUR 200 million. They represent the creation of more than 3,300 direct and more than 10,000 indirect jobs evenly shared between EU15, EU13 and associated countries. More than half of the flagships expect to contribute to waste reduction, reuse, valorisation or recycling and a decrease of their energy consumption.[25]

In 2018 the European Commission proposed a new ambitious seven-year R+D+I programme - Horizon Europe - to succeed Horizon 2020. The EU institutions reached political agreement on Horizon

[24] How the bioeconomy contributes to the European Green Deal, https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_greendeal-bioeconomy.pdf

[25] https://www.jointprogramming.nl/upload_mm/1/6/2/e1d0b695-37da-46b6-b03b-b31261dd0289_PP_HEU_Biobased.pdf

Europe in December 2020 (agreed budget €95.5 billion), and the first call for proposals would be opened in mi-April 2021. Bioeconomy would be covered primarily under Cluster 6 "Food, Bioeconomy Natural Resources, Agriculture and Environment".

As successor to BBI JU, the BBI JU founding partners proposed a more ambitious initiative to start in 2021[26]. On 23 February 2021 the EC gave the green light to the successor, which is to be known as the Circular Bio-based Europe Joint Undertaking[27]. CBE JU aims to accelerate Europe's transformation into a circular bio-based economy and would have a budget in the order of €3-4 billion[28]. The partnership would actively contribute to achieving several actions mentioned in the updated 2018 EU Bioeconomy Strategy, both in area 1 'Strengthen and scale-up the bio-based sectors, unlock investments and markets', area 2, which is about deploying local bioeconomies rapidly across Europe, and area 3 about understanding the ecological boundaries of the bioeconomy. CBE would continue biorefinery deployment in Europe, while involving all stakeholders along the value chain, strengthening collaboration with regional actors and systematically measuring the environmental and socio-economic impacts of funded projects.

Details and outcomes of the projects funded under the various programmes mentioned above (as well as under the predecessor research programme FP7) are provided in the CORDIS EU Research database. There is also a database exclusively covering BBI JU funded projects . The LIFT project recently made an inventory and assessment of knowledge deriving from EU-funded Coordination and Support Actions (CSA) implemented in the bioeconomy field. LIFT results are documented as a series of factsheets and in the European Bioeconomy Library, a document repository.

R+D+I investment loans

Beyond research grants, European institutes are also making available investment loans to economic operators in the bioeconomy. Since a few months, a dedicated venture fund exclusively focused on the bioeconomy and the circular economy in Europe is operational.

With a target size of €250 million, to which the European Investment Bank (EIB) has committed €100 million, the European Circular Bioeconomy Fund (ECBF) will be an important financial instrument in achieving the European Green Deal goals of making Europe climate neutral by 2050.

The ECBF partners with ambitious and visionary entrepreneurs to accelerate late-stage circular bioeconomy companies and will invest in innovative projects in the areas of agriculture, aquaculture and fisheries, the forest-based sectors, biochemicals and biomaterials, focusing on scaling up innovative bio-based companies in a late-stage (demonstration or commercial phases). The investment size ranges from € 2.5- 10 million.

[26] https://www.openaccessgovernment.org/circular-bio%E2%80%90based-industries-driving-europes-green-recovery/97831/

[27] https://www.bbi.europa.eu/news/commission-gives-green-light-successor-bbi-ju

[28] https://www.jointprogramming.nl/upload_mm/1/6/2/e1d0b695-37da-46b6-b03b-b31261dd0289_PP_HEU_Biobased.pdf

Further funding that exists under Horizon Europe or with the EU regional policies and their instruments include the European Structural and Investment Funds (ESIF), the Programme for Environment and Climate Action (LIFE), the Invest EU programme, the EU Emission Trading System Innovation Fund (EU ETS IF) and the Connecting Europe Facility (CEF).

Further information about funding opportunities provided by European institutes for bioeconomy research and innovation is available here.

The level of national funding (grants and loans) in individual Member States available for R+D+I into bio-based products was not investigated. However, without doubts in most countries the value of the relevant national funding will exceed the available/secured European funding, sometimes by far.

Tax incentives

Another approach to reduce the net costs of manufacturing bio-based products, such as renewable chemicals, is the introduction of tax incentives or production grants. These help reduce operational costs, rather than capital costs.

Various tax incentive schemes supporting the production of renewable chemicals are in place outside Europe. Since 2016 the US state of Iowa is operating the Renewable Chemical Production Tax Credit scheme. The programme incentivizes the production of 30 high-value chemicals derived from biomass feedstocks (at a rate of $0.05 per pound produced). Iowa developed the programme to capitalize on its resources and infrastructure and to capture the renewable chemical manufacturing industry. According to the US Department of Agriculture, the credit represents the "strongest" incentive package for the bio-based chemical industry.[29] Other US States are following the example set by Iowa. States currently offering tax incentives and credits to encourage the use of environmentally friendly resources include Nebraska, Maine, Kentucky, and New Mexico.[30]

At the federal level in the US, Bill Pascrell (New Jersey) and Brian Fitzpatrick (Pennsylvania) introduced the Renewable Chemicals Act (RCA) in the House of Representatives in December 2020. The proposed bill would provide, for five years, a production tax credit (PTC) for certain "renewable chemicals" produced from renewable biomass and a 30% investment tax credit (ITC) for facilities producing such chemicals.[31]

In June 2019, the Thai Government announced that it would offer a tax deduction on expenses from corporate income for using biodegradable plastic packaging, Companies would be allowed to claim deductions of up to 1.25 times for their expenses buying biodegradable plastic packaging in the

[29] https://www.iowaeconomicdevelopment.com/RenewableChem
[30] https://www.betalabservices.com/renewable-chemicals-production-tax-credits/ and http://news.cchgroup.com/2020/05/08/renewable-chemicals-credits-enacted/news/state-tax-headlines/
[31] http://biomassmagazine.com/articles/17593/bill-aims-to-enact-tax-credits-to-support-biobased-chemicals

period January 2020 - December 2021. The tax measures were expected to attract 10% of existing plastics entrepreneurs to change production to bioplastics.[32]

Production grants

Under the Renewable Energy Directive (RED), the production of bioenergy and biofuels (including bio-ethanol used for transport) is receiving wide support across Europe[33], and this is leading to a higher demand and higher prices for biomass in general, resulting in a non-level playing field with scarcity and higher prices for biomass that also serves as feedstock for the bio-based industry. To ensure a level-playing field between the different applications for biomass, it was proposed already in 2014 that the EC would adopt a similar production support scheme for renewable materials[34]. However, so far there are very few, if any, such schemes in place. The possible use to support production of bio-ethylene from ethanol or bio-ethanol was to be considered in The Netherlands.[35]

4.3 Soft measures

4.3.1 Voluntary approaches

Voluntary approaches are schemes whereby firms make commitments to improve their (environmental) performance. They cover (self-regulatory) arrangements such as public voluntary programmes, negotiated agreements, unilateral commitments, and codes of conduct.

There do not seem to be any voluntary approaches in place specifically addressing bio-based products, but for illustration purposes two examples can be mentioned, both from the plastics sector, that might indirectly boost biodegradable packaging options. This includes the New Plastics Economy Global Commitment (October 2018) and the European Plastics Pact (March 2020).

[32] https://bioplasticsnews.com/2019/06/09/thai-government-gives-tax-deduction-for-using-bioplastics-packaging/

[33] See e.g. Banja et al (2019), Biomass for energy in the EU – The support framework, In: Energy Policy Volume 131, August 2019, Pages 215-228, https://doi.org/10.1016/j.enpol.2019.04.038 or Murnaghan, Kitty (2017) : A comprehensive evaluation of the EU's biofuel policy: From biofuels to agrofuels, Working Paper, No. 81/2017, Berlin, https://www.econstor.eu/bitstream/10419/149890/1/878094121.pdf)

[34] nova-Paper #4 on bio-based economy: "Proposals for a Reform of the Renewable Energy Directive (RED) to a Renewable Energy and Materials Directive (REMD), September 2014.

[35] The Dutch subsidy scheme Sustainable Energy Transition (SDE++) supports the production of renewable energy and (since some years) the application of CO_2-reducing technique. For each technique, the 'operating shortfall' is subsidised i.e. the difference between the cost price of the technique that reduces the CO_2 (the 'base amount') and the market value of the product giving rise to the technique (the 'correction amount'). The Dutch SDE++ scheme is fine-tuned annually. For SDE++ 2021 the inclusion of the production of bio-ethylene from ethanol or bio-naphtha is being considered. See https://www.dentons.com/en/insights/alerts/2020/april/16/ams-dutch-subsidies-for-renewable-energy-the-end-of-the-sde-scheme.

- Launched by the Ellen MacArthur Foundation (EMF), the New Plastics Economy Global Commitment, aka 'A line in the sand'[36] – seeks to eliminate plastic waste at source. More than 250 parties have signed it and one part of the commitment's targets is that 100% plastic packaging is easily and safely reused, recycled or composted in 2025.
- The European Plastics Pact[37] is a public-private coalition launched in March 2020, that sets targets for signatories (which include including plastics manufacturers, retailers, governments, and civil society organisations) by 2025 e.g. designing all packaging to be re-useable or at least recyclable, reducing virgin plastics by 20%, increasing recycling by 25%, having 30% recycled content. Current major signatories to the Pact include large multinational brand owners such as Nestlé and Unilever.

4.3.2 Information and advice sharing systems

Accessibility to (online) initiatives sharing information and advice on bioeconomy topics has received a boost in recent years, first after publication of the initial European Bioeconomy Strategy in 2012 and more recently since the update of this strategy in October 2018. Below a snapshot of some relevant initiatives with a particular focus on bioeconomy is presented. These are categorised into: (a) web portals and platforms; (b) project-based information and advice sharing; (c) Stakeholder networks and clusters; (d) European Commission-linked bioeconomy networks; and (e) Informal information and advice channels.

Web portals and platforms

In July 2017 the EC launched the Knowledge Centre on Bioeconomy (KCB) as the Commission's central knowledge hub on the bioeconomy. The KCB provides a common and robust knowledge base for a sustainable and circular bioeconomy. For example, in early 2020 the KCB set up an Interactive dashboard[38] that keeps track of strategies and other policy initiatives dedicated to the bioeconomy in the EU, its Member States and beyond.

Also in 2020, the Bio-Based Industries Consortium (BIC) launched a digital bioeconomy platform to connect industry & European regions. This was set-up as a digital, partnering platform where regions and industry can make contact based on mutual interest. The platform focuses on creating local value chains and access to finance, namely helping regions and industry to bridge the gap between bio-based investment opportunities and financial incentives at regional level.[39]

There are numerous further portals and platforms, including some set-up by EU-funded projects. A recent example is the map published by the BIOSWITCH project in early 2021. The map, entitled "Who can help me in my transition from fossil-based to bio-based approaches?" shows bio-based

[36] A line in the sand (October 2018), https://www.ellenmacarthurfoundation.org/news/a-line-in-the-sand-ellen-macarthur-foundation-launch-global-commitment-to-eliminate-plastic-pollution-at-the-source
[37] European Plastics Pact (March 2020). "The European Plastics Pact"
[38] https://knowledge4policy.ec.europa.eu/visualisation/bioeconomy-different-countries_en
[39] https://mcusercontent.com/6b3173b732149de1f464c5dcc/files/9f0d8bf3-d2d9-4125-873f-d56a5a56fc5a/BIC_bioeconomy_platform_leaflet.pdf

industry entities and local/regional facilitators that can support brand owners considering switching to bio-based production.

Project-based Information and advice sharing

In EU research programmes, information and advice sharing takes place in any type of project. However, in a specific kind of projects (known as Coordination and Support Actions, or CSAs)[40] it is one of the key objectives. The earlier mentioned LIFT project (May 2019- April 2020) synthesised key results, findings and outcomes of EU-funded CSAs and CSA-like projects on bioeconomy that were implemented since 2010. LIFT found many bioeconomy CSAs to be of relevance regarding the sharing of Information and advice. Detailed LIFT findings can be found on the project's website, in the series of LIFT factsheets (e.g. Awareness Raising (Factsheet No. 1) and Stakeholder Engagement and Co-creation (Factsheet No. 3)) and in the European Bioeconomy Library initiated by the LIFT project.

Stakeholder networks and clusters

Ever more clusters and networks that (also) focus on bioeconomy issues, commonly bringing together industry, academia and government (the triple helix), and sometimes also citizen/consumer representatives (quadruple helix) are being set-up all across Europe, at all levels (European, national, regional and cross-regional). Some examples at different geographical levels:

European/international networks/clusters:

- The Bio-based Industries Consortium (BIC) is Europe's leading industry organisation, putting circularity, innovation and sustainability at the heart of the European bioeconomy. BIC has more than 240 industry members (of which approximately 80% are SMEs), and over 200 associate members (academia, research organisations, trade associations, etc.). BIC is the private partner in a public-private partnership with the EU Commission - the Biobased Industries Joint Undertaking (BBI JU).[41]
- Various European Technology Platforms including ERA-Net for Industrial Biotechnology, BioHorizon Project (a network of BIO NCPs), PLATFORM project (Platform of bioeconomy ERA-NET Actions), BECOTEPS project (Bioeconomy Technology Platforms), SUSCHEM - European Technology Platform for Sustainable Chemistry, SPIRE - Sustainable Process Industry through Resource and Energy Efficiency, FTP - Forest-Based Sector Technology Platform, European Technology Platform for the Future of Textiles and Clothing.
- the 3BI Intercluster[42] with members from The Netherlands, France, Germany and the UK;

[40] Coordination and support actions (CSAs) consists primarily of accompanying measures such as standardisation, dissemination, awareness-raising and communication, networking, coordination or support services, policy dialogues and mutual learning exercises and studies, including design studies for new infrastructure and may also include complementary activities of strategic planning, networking and coordination between programmes in different countries.

[41] BIC, https://biconsortium.eu/sites/biconsortium.eu/files/publications/A%20glimpse%20into%20BIC.pdf

[42] http://www.3bi-intercluster.org/home

- the BioInnovation Growth mega-Cluster (BIG-C)[43] with partners in the Netherlands, Flanders and North Rhine-Westphalia (Germany)

Some of the stakeholder networks in the bioeconomy have been set-up and/or are sponsored by the European Commission. Examples of these include:

- The Expert Group for Bio-based Products (EGBP), formally set up in mid-2013 for initially four years, serve as advisory body to the Commission. Like the BSP above, the EGBP provided input for the review of the EU Bioeconomy Strategy. The officially final EGBP meeting took place in Brussels on 22 September 2017. Since then, the core membership of the EGBP continued the initiative on a self-funded basis[44].
- The Bioeconomy Stakeholders Panel (BSP) brought together a broad range of stakeholder groups, including regional governments, chambers of commerce, regional clusters, industries, industry trade associations, public research institutes, environmental NGOs, et cetera.
- The European Bioeconomy Network (EuBioNet) is a proactive alliance of EU funded projects dealing with bioeconomy promotion, communication and support launched in May 2018. The main goal of EuBioNet is to maximise the efforts, increasing the knowledge sharing, networking, mutual learning, coordination of joint activities and events. EuBioNet originally operated without dedicated funding. In the period 2021-2022 it will receive funding through the Transtion2Bio education and awareness raising H2020 project.

Regional/National networks/clusters in the field of bioeconomy include for example:

- BioEconomy Cluster (Central Germany)
- BioVale (Yorkshire and the Humber, UK)
- Circular Bio-based Delta (South-western Netherlands)
- IAR, The French Bioeconomy Cluster
- CLIC Innovation (Finland)
- Food & Bio Cluster Denmark
- Flanders FOOD (Belgium)

Working groups

A working group is a group of experts working together to achieve specified goals. The groups are domain-specific and focus on discussion or activity around a specific subject area. Working groups are also referred to as task groups, workgroups, or technical advisory groups.

Several European networks have set-up working groups of experts dealing with bioeconomy topics, for example:

- The Vanguard initiative, a network of regions and companies (SMES and large industries) with a business focus targeting exchange across Europe. The Bioeconomy Pilot in Vanguard aims at supporting the deployment of high TRL technologies, through the setting up of

[43]http://www.bigc-initiative.eu/

[44] Phone interview with Martin Behrens, FNR, 16 September 2019

transregional value chains in an industry-driven process, where public support comes into play to help bridging the valley of death.

- The Bioeconomy Working Group[45] of the European Regions Research and Innovation Network (ERRIN) focuses on increasing the influence of regions and their stakeholders in shaping the European circular bioeconomy while also working to increase the awareness of the sector as a whole. The group covers the bioeconomy in the widest sense.
- the European Network for Rural Development (ENRD), who operated a Thematic Group on Bioeconomy and Climate Action in Rural Areas from September 2018 to July 2020[46]
- The Standing Committee on Agricultural Research (SCAR), who set-up the Bioeconomy Strategic Working Group (BSW)[47]

When creating (product) standards, working groups are also commonly used. The European Committee for Standardization (CEN) is officially recognised by the European Union as a European Standardization Organization (ESO) responsible for developing and defining standards at European level. Within CEN, a number of different Technical Committees (TCs) are involved in managing standardization activities that relate to bio-based products. See also Section 4.3.3 below.

Informal information and advice channels

A last, but strategic, method to share knowledge and information are informal contacts and informal channels that economic actors in the bioeconomy are connected to. As shown in BIOSWITCH deliverable *D1.2 on best practices in the shift to bio-based production*, to succeed developing and deploying innovative bio-based products at commercial scale collaboration within the supply chain, upstream (with suppliers), downstream (with customers), with technology suppliers and even across and beyond value chains (in "value webs") is needed.

4.3.3 Market-based signalling approaches

Market-based signalling approaches include labelling, traceability, and voluntary certification schemes. Product standards can also be included in this category. These approaches are often related to informational problems (lack of information about product quality) hindering the proper functioning of markets.

Signalling refers to the concept that one party credibly conveys information about itself, its products or services to another party. Various mechanisms signalling specific information are in place, for example:

- **Ecolabels**: Ecolabelling is a voluntary method of environmental performance certification and labelling that is practised around the world. An ecolabel identifies products or services proven to be environmentally preferable within a specific category.
- **Certification schemes**: Certification is a procedure by which a third party gives written assurance that a product, process or service is in conformity with certain standards.

[45] See http://errin.eu/node/221 & http://www.ncpacademy.eu/wp-content/uploads/2016/12/20161129_ME_Regions-smart-specialisation-and-synergies.pdf
[46] https://enrd.ec.europa.eu/sites/enrd/files/tg2_bioeconomy_draft-briefing.pdf
[47] www.scar-swg-sbgb.eu

Certification can be seen as a form of communication along the supply chain. The certificate demonstrates to the buyer that the supplier complies with certain standards, which might be more convincing than if the supplier itself provided the assurance.

- **Standards:** Standards are documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes and services are fit for their purpose. They provide a basis for mutual understanding. Most standards are voluntary market agreements.

With regard to different aspects of bio-based products, relevant ecolabels and certification schemes include for example[48]:

- Multi-issue ecolabels specifying bio-based products – e.g. the EU Ecolabel, the Nordic Ecolabel or "Swan", and the Blue Angel ecolabel.
- Schemes certifying the sustainability of biomass used as raw material, such as wood (FSC – Forest Stewardship Council and PEFC - Programme for the Endorsement of Forest Certification or agricultural biomass – e.g. ISCC – International Sustainability & Carbon Certification, RSB - Roundtable on Sustainable Biomaterials, REDcert or Better Biomass
- Schemes certifying the bio-based (carbon) content e.g. TÜV Rheinland / DIN CERTCO), TÜV Austria (founded by Vinçotte), and European Biobased Content (founded by NEN)
- Schemes certifying end-of-life options of bio-based products, such as industrial compostability, home compostability, biodegradability in soil, biodegradability in sea water, et cetera. Relevant certification schemes are operated by TÜV Rheinland / DIN CERTCO and by TÜV Austria (founded by Vinçotte),

The European Committee for Standardization (CEN) is officially recognised by the European Union as a European Standardization Organization (ESO) responsible for developing and defining standards at European level. In May 2011 CEN initiated Technical Committee CEN/TC 411 on bio-based products whose main objective is to develop standards for bio-based products covering horizontal aspects. This includes a consistent terminology for bio-based products, sampling, bio-based content, application of and correlation towards life cycle assessment and sustainability of biomass used, and guidance on the use of existing standards for the end-of-life options. An overview of other CEN TC's working in the area of bio-based products can be found in the CEN brochure "European standards supporting the market for bio-based products" or in the IEA Bioenergy publication "Standards and Labels related to Bio-based Products. Developments in the 2016-2018 triennium".

In the last few years, the role of standardisation as a bridge between research activities and the market has been increasingly recognised by EU institutions and stakeholders. The Horizon 2020 research programme identified standardisation as one of the measures that will support the market take-up of research results and innovation. Beyond coverage in specific Coordination and Support Actions, including KBBPPS, Open-BIO and STAR4BBI, standardisation work has therefore become

[48] For an overview of globally available logos demonstrating compostability, see KBBPPS project, 2013, Report on current relevant biodegradation and ecotoxicity standards (D6.1). Available at https://www.biobasedeconomy.eu/app/uploads/sites/2/2017/03/Current-relevant-biodegradation-and-ecotoxicity-standards-chapter-5-10.pdf

an integral component of many innovation projects[49]. The new Horizon Europe research framework programme.is anticipated to financially support future research on standards and labels for business-to-consumers communication of climate-neutrality and environmental impacts/benefits/trade-offs and performances of bio-based materials and products.

4.3.4 Other measures/instruments

This last category comprises other measures/instruments not included in the categories above such as vision documents, roadmaps, strategies.

Vision documents

A **vision document** defines the high-level scope and purpose of a programme, product, or project. A clear statement of the problem, proposed solution, and the high-level features of a product helps establish expectations and reduce risks.

A recent example with relevance to bioeconomy is the June 2019 vision document "The circular-bio society in 2050", which was the result of the collective input from the Bio-based Industries Consortium (BIC) and its members, the Bio-based Industries Joint-Undertaking (BBI JU) advisory bodies: the States Representatives Group and Scientific Committee, and 15 other associations and stakeholders, encompassing sectors as diverse as agriculture, food and feed production, forestry and pulp & paper, aquatic and marine, chemicals and materials including bioplastics, technology providers and beyond.[50] The vision focuses on four key drivers (1. Foster food security for a growing world population and meet its demand for sustainable products; 2. Contribute to a sustainable planet; 3. Create jobs and growth in the circular bioeconomy; 4. Achieve a circular bioeconomic society) and describes a sustainable and competitive bio-based industry in the EU enabling a circular bio-society by 2050 (see textbox below).

Roadmaps

An industrial **technology roadmap** is a flexible planning technique to support strategic and long-range planning, by matching short-term and long-term goals with specific technology solutions. It is a plan that applies to a new product or process and may include using technology forecasting/technology scouting to identify suitable emerging technologies.

[49]LIFT project (2020), Factsheet #4: Standardisation, LCA, Labelling and Regulatory Hurdles, https://www.bioeconomy-library.eu/wp-content/uploads/2020/03/04_LIFT_FactSheet_Standardisation_LCA_Labelling_Regulatory_Hurdles.pdf

[50] These are: Confederation of European Forest Owners (CEPF); Confederation of European Paper Industries (CEPI); European Association for Bioindustries (EuropaBio); European Association of Sugar Manufacturers (CEFS); European Bioplastics (EUBP); European Farmers and European Agri-Cooperatives (Copa-Cogeca); European Renewable Ethanol Producers Association (ePURE); European Starch Industry Association (Starch Europe); European Vegetable Oil and Protein Meal Industry (FEDIOL); Forest-based Sector Technology Platform (FTP); Primary Food Processors (PFP); European Agricultural Machinery Industry (CEMA); European Chemical Industry Council (Cefic); European Technology Platform 'Food for Life'; European Technology Platform for Sustainable Chemistry (SusChem)

A circular bio-society by 2050

Sustainable and climate-neutral solutions accelerate the transition to a healthy planet in respect of the planetary boundaries, and at the same time increase industrial competitiveness. In line with the objectives of the European Green Deal, the EU has been transformed into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases and where economic growth is decoupled from resource use. Valorising bio-based feedstock in a cascading approach increases the circularity of the bioeconomy, offers significant opportunities for recycling nutrients, and provides durable bio-based carbon sinks and storages. Primary producers get higher socioeconomic returns from the sustainable production of much needed biological resources, help cherish and preserve our rural areas and invest in their future.

Developing an industrial roadmap has three major uses. It helps to reach consensus about a set of needs and the technologies required to satisfy those needs, it provides a mechanism to help forecast technology developments, and it provides a framework to help plan and coordinate technology developments. It may also be used as an analysis tool to map the development and emergence of new industries.

Some examples of recent (technology) roadmaps include:[51]

- The RoadToBio project developed a roadmap for the chemical industry in Europe towards a Bioeconomy where the aspiration is to increase the share of bio-based or renewable feedstock to 25% of total volume of organic chemicals raw materials/feedstock used by the chemical industry in 2030.
- The BIO-TIC project undertook a comprehensive, multi-step stakeholder consultation process to assess innovation hurdles in industrial biotechnology and to define potential solutions. BIO-TIC's Overcoming hurdles for innovation in industrial biotechnology. Research and Development Roadmap revolves around the setting of R&D priorities and identifying needs for research, pilot and demonstration plant activities. The analysis focused on the identification of R&D bottlenecks and required breakthroughs across a broad range of technological domains.
- The Confederation of European Paper Industries (CEPI) unfolded the future when launching "Unfold the future: The Forest Fibre Industry 2050 Roadmap to a low-carbon bio-economy", their 2050 Roadmap to a low-carbon bio-economy. The roadmap attempts to lay out the future of the forest fibre industry and its potential to meet future consumer demands, stay competitive and deliver a CO_2 emission reduction.
- "A journey into the Future of Europe with the European Chemical Industry" is an initiative of the European Chemical Industry Council (CEFIC) to describe a plausible path toward a prosperous, more sustainable Europe in 2050.

[51] LIFT project (2020), Factsheet #11 Industrial roadmapping, https://www.bioeconomy-library.eu/wp-content/uploads/2020/03/11_LIFT_Factsheets_Industrial_Roadmapping.pdf

- The Blue Bioeconomy Forum (BBF) Roadmap identified 14 challenges that fall within four main themes: Policy, environment and regulation; Finance and business development; Consumers and supply chains; Science, technology and innovation. With the help of the BBF community, solutions were formulated to tackle these challenges.

European, national, and regional bioeconomy strategies

After publishing its first European Bioeconomy Strategy in 2012, the EC unveiled an updated Bioeconomy Strategy[52] in October 2018 that seeks to accelerate the establishment of a sustainable European bioeconomy while maximising its contribution towards Europe's 2030 Agenda, the UN Sustainable Development Goals (SDGs), as well as the Paris Agreement on climate change. Bioeconomy furthermore features prominently in other European policies and strategies including the European Green Deal, the Circular Economy Action Plan and the EU Common Agricultural Policy (CAP).

A contributor to systemic change and an opportunity for rural areas

The European Green Deal is a set of EC policy initiatives with the overarching aim of making Europe climate neutral in 2050. Initially a strategy for economic and social growth it is also at the core of Europe's Covid-19 recovery strategy. The bioeconomy, as a catalyst for systemic change, tackles the economic, social and environmental aspects of the Green Deal, seeking new ways of producing and consuming resources while respecting our planetary boundaries and moving away from a linear economy based on extensive use of fossil and mineral resources.

Source: European Commission (2020). How the bioeconomy contributes to the European Green Deal

The updated 2018 EU Bioeconomy Strategy highlighted the relevance of developing national bioeconomy strategies and action plans to deploy a sustainable and circular bioeconomy across Europe taking into account economic, social and environmental aspects. At the **country or regional level** an increasing number of dedicated bioeconomy strategies or other policy initiatives exist or are under development. The Knowledge Centre on Bioeconomy (KCB), the Commission's central knowledge hub on the bioeconomy, set-up an Interactive dashboard in February 2020 that keeps track of strategies and other policy initiatives dedicated to the bioeconomy in the EU, its Member States and beyond.

At the **industry level**, no specific EU policies and legislation exist in sectors which traditionally use biomass, such as the textile, wood and wooden furniture and pulp and paper sectors. However, they are covered by cross-cutting initiatives and policies such as the raw material initiative. They are also subject to the more generally applicable product safety standards and internal market legislation.

[52] EC (2018), updated Bioeconomy Strategy, https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf

There also is no policy strategy or legislation specifically dedicated to the bio-based chemicals and materials sectors. However, bio-based products have been identified as selected market under the following initiatives:

- The communication 'A stronger European industry for growth and economic recovery' and
- The communication 'For a European industrial renaissance'.

More recent relevant documents are:

- The communication 'Investing in a smart, innovative and sustainable industry - A renewed EU Industrial Policy Strategy',
- The communication 'A new industrial strategy for Europe' and
- The communication 'A new Circular Economy Action Plan For a cleaner and more competitive Europe'.

Bio-based chemicals and materials have to comply with requirements for chemicals and materials in general (REACH).[53]

It is observed that bio-based sector forms part of a wide range of policies, already being dealt with at EU level, leading to a complex and sometimes fragmented policy environment. Action at EU level on the bio-based sector should help to rationalise and overcome the fragmented policy framework.

4.4 Discussion

In this Chapter it was illustrated that, even considering the limited scope (only incentives at the European level relevant to bioeconomy businesses and bio-based (packaging) products in general; excluding incentives providing general support to business, to bioenergy/biofuels production and use, or to specific bio-based product groups or applications) there seem to be an increasing number of relevant incentives.

At the European level the following general picture emerges when assessing the presence and availability of bioeconomy market incentives (see Table 3):

Degree of development	Incentive measures
Most widely-available, targeted incentive measures	• **Cat. 4:** Information and advice sharing systems • **Cat. 6:** Other measures/instruments
Somewhat developed incentive measures	• **Cat. 2:** Economic instruments • **Cat. 5:** Market-based signalling approaches
Least developed incentive measures	• **Cat. 1:** (Obligatory) Direct regulation • **Cat. 3:** Voluntary approaches

Table 3. Existence/availability of bioeconomy incentives at EU level

Which category of incentives is the most important is really situation specific. It can depend on a wide range of factors, including the type of company, its products and production processes, the markets it operates in, etc.

[53] https://knowledge4policy.ec.europa.eu/bioeconomy/bioeconomy-biobased-industries-policy_en.

5 SUMMARY AND DISCUSSION

Reflecting the outcome of the different research components, what is the main narrative and what are the lessons and conclusions that can be drawn regarding brand owners' motivations and incentives?

5.1 Brand owners' motivations

Regarding brand owners' **motivations**, a consistent pictures emerges from the literature research, the BO survey, the cross-assessment of the best practice case studies:

1. Meeting **company sustainability** targets, (upcoming) **environmental regulation**, customers demanding **environmental-friendly products** and brands wanting to improve their **public image** are the main motivations for businesses switching to bio-based products.
2. A sizeable cohort of brand owners are motivated by **green marketing**, with fewer brand owners overall motivated by regulation (existing or future), except for Spanish brand owners.
3. Bio-based materials are a way to **reduce** a product's and therewith a brand's and company's **impact on climate change** and use of resources while also improving technical attributes.
4. Bio-based is seen to offer an **independence from fossil sources** and a reduction of CO_2-emissions. In terms of business drivers, having bio-based alternatives help businesses to create a more **positive image**, it can also offer a competitive and **strategic advantage** in the markets.
5. Bio-based materials offer (food packaging) businesses the potential to help them **comply with** newer and future **environmentally-conscious regulations**, such as requirements to use compostable packaging for food.
6. For "best practice" companies presented in the case studies **sustainability is a part of their brand ethos and DNA**. Some brand owners indicated that they wanted to break away from doing business as usual and are pioneering high–quality bio-based solutions instead
7. Shifting to bio-based products and packaging is commonly a means to an end, and not a goal by itself. **Consumers do not explicitly ask for bio-based products**, but express their needs and expectations in other terms, wanting products that are high-quality and long-lasting, produced with minimized negative impact on environment and climate (dantoy); free of chemicals and contributing to healthy living (Naty); ensuring a sense of well-being and comfort (Vaude) or not harmful to (their personal and their children's) health (Biobrides project). For many consumers **considerations regarding health and well-being** may be even more important topic than the environment.
8. When it comes to (food) packaging, eco-friendly customers want to avoid or reduce the use of plastic (Stora Enso case) or demand eco-friendly alternatives (Alhóndiga La Unión case).

9. What general and specific **drivers and motivations** help brand owners and other businesses consider to switch to bio-based products **differs distinctively across countries and across product groups**. Each bio-based product (group) and application is perceived in its own way.
10. As for any product innovation it is key to **listen to and understand customers** and consumers. Brand owners can take advantage of the growing trend among, and awareness of, consumers for sustainable products, offering opportunities for bio-based innovations.

5.2 Brand owners' incentives

Following the categorisation adopted in the POWER4BIO project, we identified different types of incentive measures:

7. Direct regulation
8. Economic instruments
9. Voluntary approaches
10. Information and advice sharing systems
11. Market-based signalling approaches
12. Other measures/instruments

We assessed current availability and application (at European level) of these incentive measures:

- When ruling out uses for bioenergy production (which is not within the scope of BIOSWITCH) there seems to be little use of **direct regulation** (cat. 1) in the European bioeconomy.
- There would seem to be an increasing number of programmes, schemes and **economic instruments** specifically targeting the further deployment of the bioeconomy. Within the EU framework research programmes several 100's of millions of euro are available annually in the form of grants to support research, development and innovation in the bioeconomy field. Since 2020 the European Circular Bioeconomy Fund provides focused investment support. However, so far there are very few, if any, schemes in place in Europe to directly support the operational costs of manufacturing bio-based chemicals or products (other than for energy use, which is beyond the scope of BIOSWITCH).
- We did not find examples of **voluntary approaches**, whereby firms make commitments to improve their environmental performance, specifically related to the bioeconomy.
- There seems to be an increasing number and wide variety of **initiatives sharing information and advice** on bioeconomy topics.
- Regarding bio-based products various **market-based signalling approaches** were identified and described, such as multi-issue ecolabels, (voluntary) sustainability certification schemes and (voluntary) product standards.
- Last but not least, in the category **Other measures and instruments** we presented examples of bioeconomy vision documents, (market or industry) roadmaps, strategies and action plans.

Determining which of the above types of incentives are the most relevant for the agriculture, food, forestry and chemical sectors covered by the BIOSWITCH project appeared not straightforward, for various reasons. Firstly, because of the limited scope of the desk research, which provides an illustrative, rather than comprehensive, overview showcasing a selection of (recent) incentives, focusing primarily on incentives that are relevant at EU27 level and not covering any national measures that may also be in place. Secondly, because the relevance of incentive measures will be highly situation-specific, depending also on factors such as: type and background of the company, the markets it operates in and which type of bio-based product (packaging) is being considered.

Based on our limited research the overall picture emerges that information and advice sharing systems (cat. 4) and other measures/instruments (cat. 6) would seem to be the most widely-available incentives and direct regulation (cat. 1) and voluntary approaches (cat. 3) the least developed incentive measures. Economic instruments (cat. 2) and market-based signalling approaches (cat 5.) would take a middle position (see table 3 above).

However, zooming in on a particular product group or application the relative importance of incentive measures can be very different. In the current report we observed that at present there does not seem to be any direct obligations or any voluntary approaches in place specifically addressing bio-based products. Nonetheless European Directives in other related fields (such as the Waste Framework Directive and the Packaging and Packaging Waste Directive) and codes of good practice from the plastics sector (such as 'A line in the sand' and the European Plastics Pact) seem to be giving a boost to the uptake of compostable/biodegradable (plastic) packaging and such packaging will in many cases be bio-based. This helps explain why in our 2020 survey of the needs, risks and motivations (see deliverable *D1.2 on best practices in the shift to bio-based production*) we found brand owners mentioning Packaging the most often as the "product" category of their greatest interest for switching from fossil-based to bio-based; and almost all (95%) of the 60 brands interviewed stating that they would consider using bio-based packaging (with only 29% of the brands applying it already).

To validate the findings of our desk research, and to get a further understanding of the relevance of different categories of incentives as well as specific individual incentives, the participants of four regional workshops (organised online in the second half of January 2021) and a pan-European workshop (held online on 17 February 2021) were asked to share their views. Results of this engagement will be documented in BIOSWITCH deliverable D1.4 *Summary of results of regional and pan-European workshops*.

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DELIVERABLE 1.3, PART 2:

REPORT ON CONSUMER DRIVERS AND MOTIVATIONS

Lead Contractor (Sub-task 1.4b): VTT Technical Research Centre of Finland Ltd

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This document is one of the two stand-alone reports prepared to be part of the BIOSWITCH Deliverable *D1.3 - Report on brand owners' incentives and consumer drivers and motivations* (contract no. 887727).

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Type of Action	CSA	**Coordinator**	CLIC Innovation Oy
Contact persons	**Anna Tenhunen anna.tenhunen@clicinnovation.fi**		
Website	www.bioswitch.eu		

Report details			
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Final review and quality approval				
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ACRONYMS AND ABBREVIATIONS

ACRONYM	FULL NAME
BBI JU	Bio-based Industries Joint Undertaking
BBP	Bio-based products
BI	Bio-based Industry
BIC	Bio-based Industries Consortium
BO	Brand Owners
BTG	B.T.G. Biomass Technology Group BV
CLIC	CLIC Innovation Oy
CTA	Corporación Tecnológica de Andalucía
DoA	Description of Action
EC	European Commission
FBC	Food & Bio Cluster Denmark
FF	Flanders' FOOD
FGD	Focus Group Discussion
GDPR	General Data Protection Regulation
IRL	Ireland
ITT	Institute of Technology Tralee
NL	Netherlands
SIE	Sustainable Innovations Europe SL
VTT	VTT Technical Research Centre of Finland Ltd / Teknologian tutkimuskeskus VTT Oy
WP	Work Package
WTP	Willingness to pay

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1 INTRODUCTION TO PART 2: CONSUMER DRIVERS AND MOTIVATIONS ANALYSIS

1.1 Objective of BIOSWITCH

The main aim of the BIOSWITCH project is to bring Europe to the forefront of the bio-based economy, encouraging and supporting brand owners to switching to bio-based approaches by following a holistic, systemic approach built on two pillars:

- A framework where brand owners are placed as the centre of the public administration-bio-based industry consumers triangle through a set of events and communication actions that will allow shaping solutions to mitigate their perceived risks; and
- The BIOSWITCH toolbox as the ultimate instrument that will assist them in the bio-based transition journey.

1.2 Objective of Work Package 1

The aim of WP1 (Framework development and mapping and analysis exercise) is to set up the brand owners' networks and to involve public administration, consumers and bio-based industries in the BIOSWITCH framework

- To analyse brand owners needs and perceived risks when switching to bio-based
- To gather best practices and case-studies so they can inspire brand owners
- To identify motivations and incentives as well as bio-based products consumer acceptance drivers
- To promote a co-creation exercise (via. a design thinking approach) between brand owners, public administration and consumers where all previous information can be analysed and discussed, and efficient solutions to mitigate perceived risks can be developed.

1.3 Objective of Task 1.4

Task 1.4 combines two sub-tasks, analysing (a) brand owners' incentives and motivations (b) consumer drivers and motivations analysis respectively, which jointly feed the development of a comprehensive set of recommendations. Task 1.4 related research will be accordingly reported in two parallel documents:

- The first report assesses main incentives and motivations for brand owners for switching-to-bio-based.
- The second report (the current document) aims to gain an understanding of the main incentives for consumers to choose bio-based products.

The two reports and the overarching Task 1.4 results will be documented in BIOSWITCH Deliverable 1.3 - Report on brand owners' incentives and consumer drivers and motivations. Task 1.4 results will also be presented and validated at the project workshops in early 2021 and included in WP3 and WP4 activities.

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1.4 Introduction to this report

This social research presents two case study set-ups that were built in order to study drivers and motivations of consumers in European countries (more particularly Finland, Ireland and Netherlands) as regards to bio-based materials, products and brands. In social research, it is common to build a practical framework in order to develop a better understanding of the broader inspected context together with the ecology participants (Geels, 2004). This social research for capturing consumers' drivers and motivation approached the research context with mixed methods, as it is acknowledged that combining both qualitative and quantitative research methods in social research can provide a broader understanding of a topic (William, 2012). For the qualitative part, semi-structured Focus Group Discussion (FGD) was selected in order to build upon the existing knowledge, but also to allow new, pertinent information to arise (Stewart & Williams, 2005). In FGD the onus is not on generalizable findings, but purposeful use of social interaction in generating data. As for the quantitative part, the social research framework included consumer surveys (Granello et al. 2004). In practice, the social research for capturing consumers' drivers and motivation was carried out by three regional studies: a qualitative online focus group discussion with 50 consumers in Finland, and two quantitative consumer surveys in Ireland and Netherlands, both including 500 consumers.

As for the content, most attention was placed on consumer awareness, public perception, main incentives for consumers to choose bio-based materials, products and brands, and future consumer behaviour on 'bio-based' alternatives. In practice, the social framework included the following objectives:

- Consumer awareness:
  - How consumers recognize or recall bio-based materials, products, and brands.
- Illustrating examples and their consumer acceptance:
  - Examples on bio-based products on BIOSWITCH sectors and their acceptance.
- Consumption habits:
  - Consumption decision, expectations, and habits: main incentives and key barriers for choosing the bio-based alternatives.
- Future consumer:
  - Value-sensitive design: future concerns, willingness to adopt bio-based products, future expectations, and consumption in the future.

The emphasis on capturing the consumer feedback was on the community acceptance, which Huijts et al. (2011) label as citizen acceptance. This refers to the behavioural responses within communities that are affected by the placement of a technological object close to their home. The framework was generally built upon the Theory of Planned Behaviour (Azjen, 2011) that focuses on the attitudes towards the perception of a product. The basis of the FGD and survey material was applied from previous EU-funded bioeconomy-related projects: e.g. Biobridges, RoadToBio, Open-BIO, STAR-ProBio and market research studies: e.g. Brand Perspectives on Biomaterials, although more important was to remain within the nominated social framework that was dedicated to the project specific objectives.

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The first part, consumer awareness, studied the prior knowledge, which, in practice, refers to the ability of a consumer to recognize or recall bio-based products and willingness to adopt and purchase them. The concepts for explaining the terminology (bio-based materials, products and brands) were sought from previous studies (e.g. Biobridges, OpenBio, Biovoices and Brand perspectives on Biomaterials).

The second part, examples and their consumer acceptance, presented regional examples of 'bio-based' brands. The aim was to study the main incentives for consumers to choose bio-based products. The background research for the part was carried out by studying bio-based examples used e.g. in Brand perspectives on Biomaterials, InnProBio and BioCannDo, in addition with bio-based-product galleries:

- https://www.biovoices.eu/gallery/
- http://www.allthings.bio/find-bio-based-products/
- https://www.biobasedconsultancy.com/

The consumption habits-part of the framework studied the consumer habits, decisions and expectations in order to find the main incentives and key barriers for choosing bio-based alternatives. The questionnaire exploited some material from the BioBridges project as a basis for the set of questions.

The fourth, value-sensitive part studied the future consumer behaviour: future concerns, willingness to adopt bio-based products, future expectations and consumption in the future. From this aspect, some earlier studies had briefly considered the consumer point of view (e.g. Biobridges) or focused on the positive and negative associations for the bio-based products (e.g. Open-BIO).

In this report the qualitative Focus Group Discussions frames the research and presents the results of the social study framework. The quantitative survey and its results combine the qualitative information with quantitative data. Within the context of the social framework, part 3.3., the consumer surveys, were more limited in scope: they included less but more targeted questions for large populations. Due to the difference of the methodologies and population samples (50 consumers in Finland/500 consumers in Ireland and Netherlands each) the cross-analysis of the results are not representative. Therefore, the report presents these two different study setups separately: online Focus Group Discussions in 2.2. and 3.2; and structured surveys in 2.3. and 3.3.

2 METHODOLOGY

2.1 Desk research

Desk research was performed by partner BTG to gain a greater understanding of existing studies into citizens' and consumers' perceptions in relation to bioeconomy and bio-based products. The desk research mainly covered research conducted in the context of earlier EU-funded projects. It did not focus on any particular type of bio-based product.

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It was established that in autumn 2017 the RoadToBio project had already conducted a meta-study that systematically reviewed several tens of earlier bioeconomy consumer studies (that applied very divergent methodologies), identifying common themes and filtering out relevant results. Among others, the BIOSWITCH desk research builds and expands on these RoadToBio findings.

Overall, the desk research provided the partners with a good baseline of the work to date, thus establishing a platform for the development of questionnaires for the focus group discussion in Finland and the structured survey on consumers' drivers and motivations in Netherlands/Ireland.

2.2 Online focus group discussions

2.2.1 Background of online focus group discussions

The aim of online focus group discussions was to study consumer acceptance towards bio-based products and brands, and to gain an understanding of the main incentives for consumers to choose bio-based products. The selected FGD method provided an opportunity to interview several respondents systematically and simultaneously. The benefit of FGD is that discussions can spark off one another, suggesting different dimensions and nuances of the original problem that any single one participant might not have thought of. The content for the study was planned simultaneously with the structured survey (chapter 2.3) by VTT in collaboration with ITT/MTU and BTG. Once finalized, the content was translated from English to Finnish.

The Howspace platform was used to interact with the Finnish participants, and the study was implemented in the period of 7-13 December 2020. Howspace is a collaboration platform, developed by a Finnish company Humap Software. The discussion was facilitated by two VTT researchers for assuring that the discussion threads remained active and the received comments were understandable. The qualitative nature of research defined that additional questions were requested during the research period. The limitations of the software conditioned that the participants could not be forced to reply on the quantitative questions, as opposite to the structured survey. This is why the quantitative data of the FGD study is not representative and why the number of respondents will be less than 50 in some of the results. The study protocol was approved on 24 November 2020 by the Ethics Committee of VTT.

50 Finnish consumers participating in the online discussions were recruited to volunteer in the survey in compliance with the project's ethical requirements guidelines via the company Bilendi (a survey recruitment provider operating in several EU countries). The target consumer group for the survey were citizens aged 36-50 with a family, and consumers making buying decisions in their household. For a qualitative research, the sampling was sufficient and representative in the particular age group on criteria Gender, Age and Geography. From the gender part, there was quite an even spread of respondents (52% women, 48% men). Participants live in different parts of Finland; 88% of them live with their partner or spouse and kid(s), and 12% with their kid(s). The age segments of the respondents are presented in figure 1.

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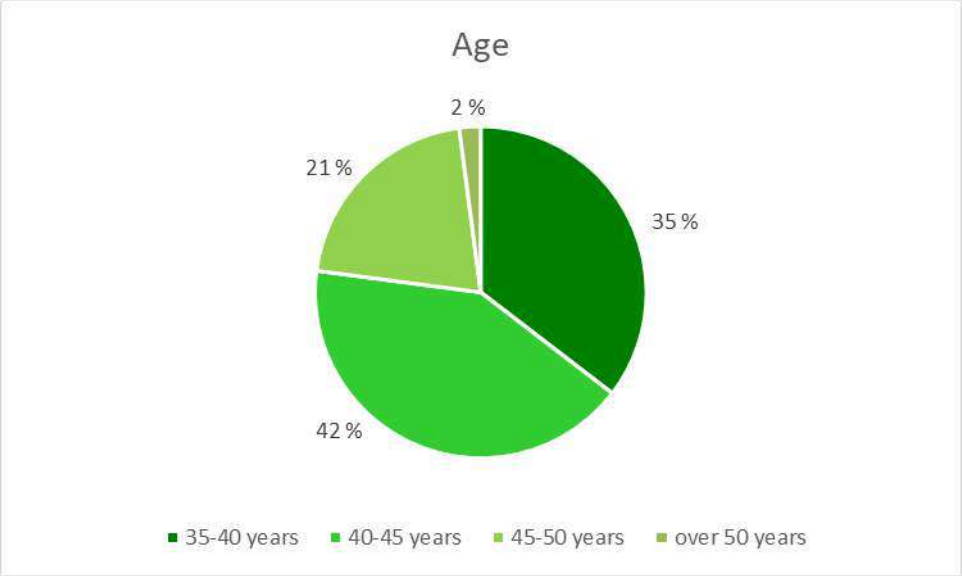

Figure 1. The age deviation of participants in the online focus group discussion.

77 % of the participants were the joint decision makers of their household, and 23% were the main decision makers. 70 % of the participants were working full time, see figure 2.

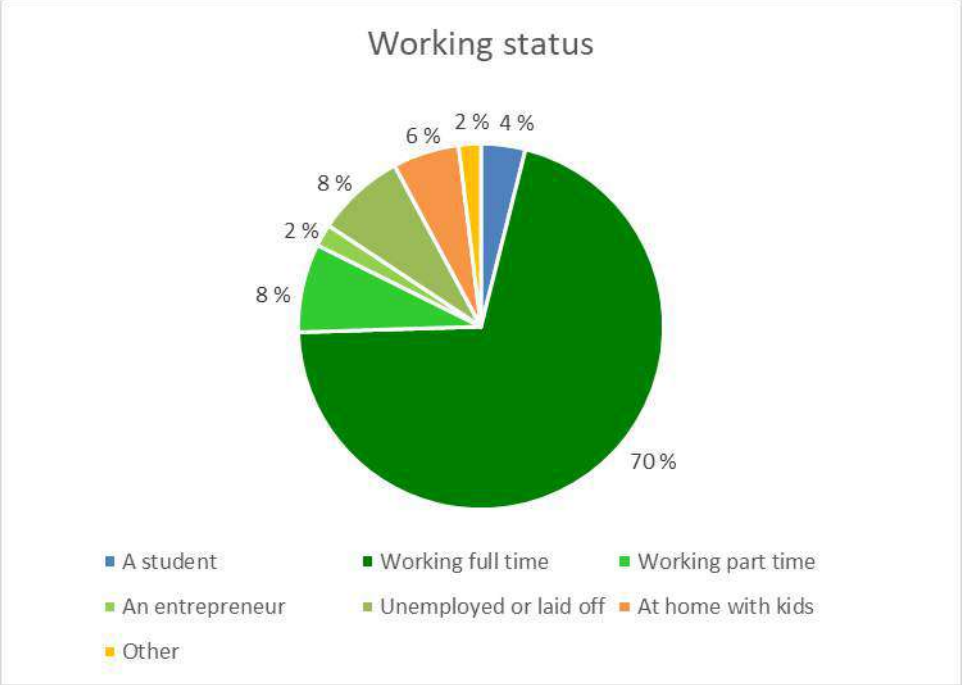

Figure 2. Working status of participants in the online focus group discussions.

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2.2.2 Questions of online focus group discussions

The FGD framework included both survey polls and open-ended questions. Participants were able to see all answers from the other respondents in order to enable the discussion, and the results from the polls became visible after answering the questions. When dealing with concepts that the consumers were not familiar with, it was seen useful to present the topics in the form of narratives. In the second part the framework, illustrating examples and their consumer acceptance, the brands and their bio-based solutions were presented to consumers with short narratives including illustrations. Special emphasis was put on the regional aspects; i.e. that the selected brands were familiar to the nominated consumer groups. In the Finnish study, the evaluated brands were Fazer, Lumene, Nestlé, Adidas, and LEGO. The content of the study is presented in detail in Annex 1, including the full narratives.

2.3 Structured survey on consumer drivers and motivations

2.3.1 Structured survey background

To complement the online focus group discussions (see 2.2 above), and to ensure a more comprehensive representation of views among European consumers across jurisdictions, two further consumer studies were undertaken in the form of a structured survey. These surveys were focused on assessing consumer demands, drivers and motivations for alternative bio-based products. To begin with, core project partners involved in the task discussed and agreed the requirements for this additional study, gained an understanding of the resources involved (financial and time) and secured the necessary partner to implement the study. With support from VTT, ITT/MTU representing Ireland and BTG representing the Netherlands worked together to design a structured consumer survey, to be targeted at consumers in Ireland and the Netherlands.

This short online survey was designed to gain an understanding of consumers' drivers and motivations, paying specific attention to buying intentions, bio-based alternative products of most interest, willingness-to-pay and brand preferences. The partners dedicated time to drafting and refining research plans and the structured survey, taking into account the maximum length and time duration (10 minutes) and based on insights gained from the review of relevant literature (above), and avoiding overlaps with ingoing surveys (including our own online consumer debate as detailed above). The partners focused on ensuring that the survey was product-specific so that consumer trends towards product areas of most interest (e.g. packaging, or disposable products) could be identified. Once finalized, background information was integrated and translation (from English to Dutch) of the questionnaire was completed. With support from VTT, a survey recruitment provider, Bilendi, was identified to support survey implementation in Ireland and the Netherlands. The BIOSWITCH task team worked closely with Bilendi to bring the survey online and address any remaining issues to implementing the survey. The target consumer group for the survey were citizens aged 18-75, and 500 answers were to be collected from each country. Sampling was representative according to the national population statistics in the particular age group on criteria Gender, Age and Geography. There was quite an even spread of respondents across age categories. In relation to geographical breakdown of respondents, the Netherlands sampling included 41 % form a large city

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(more than 100,000 inhabitants), 33 % from a smaller city (more than 25,000 inhabitants) and 26 % from an area with less than 25,000 inhabitants. Ireland sampling included a breakdown by regions including Dublin (29%), and the 4 provinces as follows: 12 % Connacht, 28% Munster, 26 % Rest of Leinster outside Dublin, and 6% Ulster. Sampling was based on soft-quota approach in the spread of 0.75 to 1.25. The BIOSWITCH online consumer survey for Ireland and Netherlands was then implemented by Bilendi Oy Partner panel in the period 14 – 23 December 2020.

The survey structure included some background information to provide consumer respondents with some context for the study. This included some general information about what bio-based products are, and the different products that can be produced from bio-based materials (see figure 3 below).

Figure 3. Infographic used in online consumer survey NL/IRL to give context and information on bio-based products.

2.3.2 Structured survey questions

The survey begins by capturing some background information on the respondents including age group and gender. There follows a general question about consumer choice perspectives, regarding whether the respondent believes that their individual consumer choices can have a positive impact on the environment. This is important in order to understand the degree to which consumers feel that they can play a role in helping to solve environmental challenges through the purchases that they make. We then asked the consumer respondents to list any bio-based brands that they are familiar

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with. As BIOSWITCH focuses on the need to support brand owner uptake of bio-based products, it is important to understand the degree to which consumers recognise brands who may already be leading the way in bio-based product uptake. Next, in order to understand the willingness of consumers to switch from fossil-based to bio-based products, we asked the respondents if they prefer buying bio-based products as opposed to fossil-based products. Then, in order to get an idea regarding specific product categories that consumers may be more interested in purchasing bio-based options, we provided consumers with a list of product categories to choose from with the possibility of selecting up to 3 options, including;

- Disposable products
- Packaging products
- Furniture and home decoration
- Children's toys
- Gardening products
- Cleaning, hygiene and sanitary products
- Cosmetics and personal care
- Home office supplies
- Construction materials
- Vehicles and mobility
- Clothes and textiles
- Sports equipment
- Other

We then attempted to understand the main motivating factors for consumers to choose bio-based products by asking the respondents to indicate what could motivate them to buy bio-based products in the selected category. Again, a range of closed-ended options were provided with the possibility to select as many as the respondent wished. These motivating factors included;

- Products being easy to recognise as being bio-based (vs. fossil-based)
- Reliable information on the environmental impact of the product
- Examples from social media influencers or celebrities
- Lower price of the product
- Supporting regional products and brands
- Knowing more about the innovation behind the product
- The possibility to contribute to the product design
- Other

As consumers often have different positive or negative associations with certain words or terms, we wanted to understand how various relevant sustainability terms may motivate a consumer to choose a bio-based product. This information can also be useful for brand owners to understand what is important to the consumer, and to better develop their branding and messaging. In this case we presented the consumer with a range of terms and asked which of the terms would motivate them to choose a product, with up to 3 choices allowed. The list included.

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- Bio-based
- Biodegradable
- Compostable
- Home compostable
- Recycled
- Recyclable
- Sustainable
- Eco-friendly
- Environmentally friendly
- Low Carbon Footprint
- Low harmful emissions
- Animal Friendly
- Non-Toxic
- Fair trade
- Planet friendly
- None of these terms

Using the list of product categories indicated above, we then asked the consumer respondents to indicate the likelihood of them purchasing more bio-based products from each category in the future. Here once again, we wanted to keep the responses product-specific, as it would provide brands with more detail on the types of products that consumers prefer to be bio-based, rather than a generic "bio-based product" response. In this case consumers were asked to agree/disagree with the statement that they would buy more bio-based products in the specified category in the future. Again, using the list of product categories, we asked the consumer respondents if they were willing to pay more for bio-based products in the specific product category. While various other studies have looked at a generic green premium for bio-based products, in our survey we ascertain the consumer green premium perspective on many different bio-based product categories. In this case the consumer can choose one of the following green premium options for each specified product category;

- No, I would not like to pay more
- Yes, up to 10% more
- Yes, up to 25% more
- Yes, up to 50% more
- Unable to answer

We then asked the consumers to pick the most important criteria when deciding on a specific product. In this case the consumer was asked to list a first, second and third choice from the following options;

- Product price and performance
- Feedstock (Ingredients/Materials)
- Branding and product labelling

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Finally, consumers were asked to indicate the most important factors that help them choose between similar products. In this case the consumer could choose up to 3 options from the following list;

- Price
- Performance
- Brand image
- Personal lifestyle
- Personal health
- Animal well-being
- Climate change
- Environmental sustainability
- Social sustainability
- Other

Some examples of how the questions were presented to the consumer are highlighted below (see figure 4), while the summary of results and analysis are covered in Section 3.3.


Do you think that in the future you are going to buy more bio-based products in the following category/categories?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Disposable products (e.g. dishes, cups, straws, etc.)	●	○	○	○	○
Packaging products	●	○	○	○	○
Furniture and home decoration	○	●	○	○	○
Children's toys	○	●	○	○	○
Gardening products	○	●	○	○	○
Cleaning, hygiene and sanitary products	●	○	○	○	○
Cosmetics and personal care	●	○	○	○	○
Home office supplies	○	●	○	○	○
Construction materials	○	●	○	○	○
Vehicles and mobility	○	○	○	●	○
Clothes and textiles	○	●	○	○	○
Sports equipment	○	○	●	○	○

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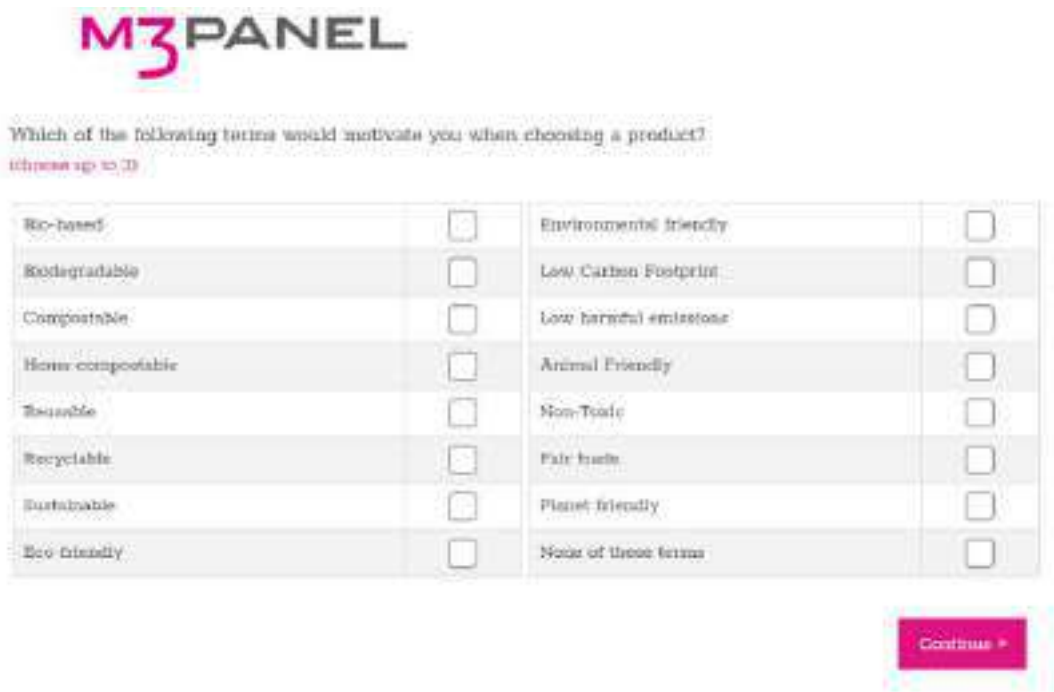

Figure 4. Example questions from structured online consumer survey.

3 RESULTS

3.1 Desk research findings

Research by (Van Winkle *et al*, 2015)[1] found a mixed image of bio-based products and a high level of uncertainty (particularly regarding the benefits and risks of using agricultural products as an alternative to petroleum). Importantly, they found that consumers' uncertain opinions of bio-products are likely the result of a lack of exposure to information about bio-based products. Their survey showed that, on average, consumers are willing to pay 10 % more for household products and packaged goods made from biologically-derived plastic alternatives, although, similar to concerns regarding biofuels, they did not feel strongly that bio-products were of better quality than traditional products.

A survey carried out by (Koenig *et al*, 2014)[2] of 312 Norwegian consumers focused on consumers' cognitive and affective responses to ecological packaging (in this case a bottle made partly of plant-

[1] Christina van Winkle, C., Katia Karousakis, Rosalind Bark, and Martijn van der Heide, (2015), "Biodiversity Policy Response Indicators", OECD Environment Working Papers, No. 90, OECD Publishing, Paris. http://dx.doi.org/10.1787/5jrxd8j24fbv-en

[2] Koenig-Lewis, N., Palmer, A., Dermody, J. and Urbye, A. (2014), Consumers' evaluations of ecological packaging—rational and emotional approaches, Journal Environmental Psychology, 37 http://dx.doi.org/10.1016/j.jenvp.2013.11.009

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based material). Their survey found that purchasing intentions were significantly influenced by general environmental concern, but not by rational evaluations of benefits. In the context of packaging the implication is that marketers should not only rely on consumers' cognitive responses to advertising but also emphasise the positive emotions evoked by using ecological packaging.

This is consistent with research by (Hartmann *et al* , 2012)[3] who found that functional and emotional strategies should be complementary rather than being used as alternatives, as the rational benefits of pro-environmental consumption alone might not be sufficient as a motivating factor to adopt pro-environmental purchasing behaviour. Their research found that for consumers to perceive a significant level of utilitarian benefits, brand communications should supply relevant and sufficiently detailed information.

A study by (Nielsen, 2015)[4] surveyed customer behaviour in 60 countries with an online questionnaire. The company polled 30,000 respondents to ask what influences their purchasing behaviour. The following key purchasing drivers were weighed "very heavy" or "heavy" influence by respondents when making a choice.

- Trust in the brand and company (62%)
- Known health & wellness benefits (59%)
- Fresh, natural and/or organic ingredients (57%)
- Company is known to be environmentally friendly (45%)
- Company is known to commit to social values (43%)
- Environmentally friendly packaging (41%)
- Company making the product is known to commit to the community (41%)
- Company's advertisement on social or environmentally responsible behaviour (34%)

Customers choose brands that they know to care about environment and the community. Products that are known to be healthy or better for the environment are chosen. Customers are also more willing to pay more for known sustainable goods. This becomes evident when millennials and generation Z are considered.

In 2015 the Open-BIO project conducted qualitative and quantitative research among consumers to increase the understanding of consumers' perception of bio-based products. A positive perception is a condition for a positive attitude and buying intention. In order to understand consumers' perception of bio-based products respondents were asked for familiarity, associations, emotions and awareness. In the qualitative research focus group discussions were held involving 89 consumers from five EU Member States. Survey results show a high degree of unfamiliarity with bio-based concept and bio-based products among consumers. They have positive associations linked to the environment.

[3] Hartmann, P. and Apaolaza, V. (2012), Consumer attitude and purchase intention toward green energy brands: the roles of psychological benefits and environmental concern), Journal of Business Research 65(9), DOI: 10.1016/j.jbusres.2011.11.001

[4] Nielsen (2015), The Sustainability Imperative: new insights on consumer expectations, https://www.nielsen.com/wp-content/uploads/sites/3/2019/04/Global20Sustainability20Report_October202015.pdf

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However, there are also mixed and negative feelings due to the lack of knowledge and arising questions about the bio-based concept and products. Figures 5, 6 and 7 show the results of the three types of associations that respondents were asked to report (1) positive associations (Figure 5.), (2) negative associations (Figure 6.) and (3) associations with specific products (Figure 7.).

Figure 5. Word cloud showing positive associations with bio-based products. Source: Open-BIO.

Figure 6. Word cloud showing negative associations with bio-based products. Source: Open-BIO.

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Figure 7. Word cloud showing associations with specific products. Source: Open-BIO.

In Open-BIO's quantitative research 6,241 respondents from six EU Member States completed a cross-national online consumer survey. For each country, the study sample (n>1,000) was representative in terms of age, gender, education, and income distributions. Discussing seven specific bio-based products showed that each product is perceived in its own way. For every product it is important that one's personal benefits are fulfilled first. The bio-based element is perceived as only a small additional positive aspect. Therefore, it is important to have a coherent product concept in which all production process phases are sustainable on the social, environmental, and economic dimension[5].

The BIOWAYS project conducted two online consumer surveys, the first at project start and the second at project end. In the second online survey (June 2018) 530 respondents from 17 EU Member States participated. Survey results revealed that there remains uncertainty and confusion among consumers regarding bio-based products. Despite the fact that some people incorrectly associate the term "bio-based" with "organic", consumers can easily recognise bio-based products that are used in everyday life, such as paper products, packaging, cleaning materials and cosmetics. Meanwhile, however, the public seems to be unfamiliar with the bio-based applications used by industry and has a lack of understanding about the production processes involved in developing them.

In general, respondents have a positive attitude towards and interest in bio-based products. Consumers find them trustworthy in terms of their content, they recognise their potentially positive

[5] Open-BIO (2015) D9.2: Acceptance factors for bio-based products and related information systems, https://www.bio-basedeconomy.eu/app/uploads/sites/2/2017/07/Acceptance-factors-for-bio-based-products-and-related-information-systems.pdf

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environmental impact and are willing to pay more for a bio-based product of the same functionality and properties than for a fossil-fuel derived one. Nevertheless, the BIOWAYS survey does indicate that limited market availability and high prices are important factors inhibiting the wider use of bio-based products[6].

Building on the Open-Bio findings, the RoadToBio project conducted a literature survey in autumn 2017, analysing the 17 most relevant reports about public perception of bio-based products, in order to identify barriers for further market development[7]. The literature study focused on consumer perception, referring to the awareness and attitudes of consumers towards bio-based products and their willingness to buy them. Study findings are grouped in four sub-sections, addressing respectively (a) awareness and knowledge, (b) associations and connotations; (c) buying decision and willingness to pay; and (d) information and labels. These are discussed further below.

With regard to **awareness and knowledge**, the RoadToBio desk research findings show that while there is a general understanding of the general public what bio-based products are, specific knowledge about product characteristics is mostly missing and misconceptions occur. Associations with bio-based products are related to environmental aspects, personal benefits and product properties, and include:

- Made from renewable resources
- Biodegradable
- Environmentally friendly or sustainable
- Possibility for recycling
- Bio-based is also organic
- Lower carbon footprint
- Health
- Safe to use

Various studies included in the RoadToBio meta-review show that people assume that bio-based production is aimed at finding environmentally friendlier solutions. This results in a positive attitude towards bio-based products, but also brings with it the problem of high expectations towards them.

There appear to be as many positive as negative **associations about bio-based products** (see Table 1). Negative associations in themselves could provide barriers for further market development. It stands out that on both the positive and the negative side, many are related to the impact on the environment and refer to a global scale. The factual environmental impact of a bio-based product could thus prove to be a very important aspect in the final attitude of consumers. A difference in scale was noticed for economic connotations: positive connotations are related to rather global advantages, while negative ones are on a personal scale. Three of the research studies covered in the

[6] BIOWAYS (2018) D2.4 Public perception of bio-based products – societal needs and concerns (updated version), http://www.bioways.eu/download.php?f=307&l=en&key=f1d76fb7f2ae06b3ee3d4372a896d977

[7] RoadToBio (2017), D2.2: Public perception of bio-based products, https://www.roadtobio.eu/uploads/publications/deliverables/RoadToBio_D22_Public_perception_of_bio-based_products.pdf

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RoadToBio meta-review pointed out that personal benefits are most influential on perception and consumption decision, these negative connotations could be especially disadvantageous. While expected health benefits and innovativeness of bio-based products are valued positively, participants in the evaluated studies do not seem to trust bio-based producers completely regarding their claims and are concerned about ethical issues.

Table 1. Positive and negative connotations about bio-based products. Source: RoadToBio.

Positive connotations	Negative connotations
Environment • Environmentally friendly • Sustainable • Natural • Waste reduction • Reduced dependence on non-renewables • Climate friendly • Renewable • Compostable	**Environment** • Slow biodegradation • Agricultural pollution • Land use • Deforestation • Monocultures • Uncertain environmental impacts
Economy • Economic growth • Regionally produced • Agricultural development	**Economy** • Expensive • Limited availability • Product quality
Health • Healthy • Safe	**Trust** • Misleading • Greenwashing • Buzzword • Marketing item
Innovation • Innovative • Useful	**Ethics** • Competition with food • Genetic modification

With regard to **buying decision and willingness to pay**, the RoadToBio study found that around two thirds of participants in various studies state to prefer bio-based products over conventional products (given no other restrains, like a difference in price), but only 12% have ever consciously chosen bio-based products over conventional ones. On the one hand, this could be related to limited availability. On the other hand, it shows that the consumer pool that actively chooses bio-based products is small, but has potential to grow.

Aspects that influence the consumption decision positively or negatively, clustered in overarching topics, are summarised in Table 2 below. It does stand out that participants mentioned various personal benefits influencing their decision to buy a product. Analysing the motives of consumers more closely shows that consumers generally drawn to environmentally friendly products also have

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a more positive attitude towards bio-based products and are willing to pay more for them. Most consumers, however, are relatively unaffected by the fact that a product is bio-based. It counts as an additional benefit, but personal benefits are far more important in the consumption decision. Finally, participants mentioned a range of personal benefits influencing their decision to buy a product, considering that personal benefits were not mentioned when consumers were asked to mention connotations. It illustrates the **importance to focus communication on personal benefits** (potentially communicated through a label).

Table 2. Aspects that influence the consumption decision positively or negatively. Source: RoadToBio.

Positive influence on consumption decision	Negative influence on consumption decision
Product characteristics • Just as good as conventional • Improved properties • High bio-based content • Better aesthetics	**Product characteristics** • Low quality • Low bio-based content
Environment • Better for the environment • Certified products • Environmentally friendly cultivation, preferably organic • Substantial CO_2 reduction	**Environment** • Not better for the environment over the life cycle
Personal benefits • Lower prices • Health benefits • Safe to use • No toxic ingredients • Good conscious • Feeling of doing something good • Being more eco-friendly • Green lifestyle • Convenient	**Personal benefits** • Higher prices • Limited availability
Raw materials • Produced regionally (e.g. in the EU) • Produced from non-food resources	**Raw materials** • Produced globally (e.g. outside of the EU) • Resources from GMOs
Disposal • Compostable • Recyclable • Reduction of waste	**Disposal** • Slow biodegradation in nature
Future and conservation of resources • Reduced use of oil	**Information**

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• Conserve resources for future generations • Contribute to a better future	• Lack of relevant information or knowledge about benefits • Lack of labelling or guarantees • Unclear environmental benefits • Unclear how to dispose of products

Source: RoadToBio, D2.2

The willingness to pay (WTP) describes the price a buyer is willing to pay for a certain product. It is a measure that reflects the subjective value that consumers assign to a product. This value includes any "additional value" that a property creates in comparison to a conventional product e.g. a product being bio-based instead of fossil-based.

WTP is a relevant issue for public acceptance only in those cases where bio-based products will be more expensive and the higher price is not compensated by better product functionalities. Moreover, the fact that a product is bio-based is only one aspect among many others that influence buying decisions. The results –mainly of theoretical studies– show that a significant percentage of participants (between 55% and 64%) would be willing to pay a little bit more for a bio-based product than for a conventional product, mainly if the benefits of the resource base are clear to them. The results also found WTP to be related to the personal interests of consumers in e.g. health and the concern of consumers about the environment, welfare and future generations. This suggest that a higher WTP would be found mainly in a niche market.

Finally, the RoadToBio survey explored findings of other studies with regard to **information and labels**. Most participants thought that information on the benefits of bio-based products is not readily available. Participants even mentioned the lack of information on these benefits as a barrier for not consuming more bio-based products. This need for differentiated information, however, is contradictory to the need for simplicity stated in other contexts.

Labels were mentioned as being more effective to present detailed information than textual information. A multitude of ecolabels exists in Europe, but few of them are specific enough for most bio-based products. There is no ecolabel that was developed purposely for bio-based products. Creating such a label would be a costly exercise, after which it may take a very long time before a label is known to consumers, if ever. It seems doubtful that those labels focussing specifically on the fact that a product is bio-based (these do exist, without a focus on environmental aspects) would be convincing for a general public, since many participants were not convinced purely by the fact that a product was bio-based. It is seen merely as an added value next to other product properties and impacts.

When presented mock-ups of self-developed labels, participants preferred information directly on a product label over the possibility to search for further details on the internet. The label should give information about altruistic motives like environmental protection or resource conservation, and about the origin of the raw materials. The term "renewable resources" is preferred above "bio-based" and the term "sustainability" should be avoided.

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Using a series of focus groups, the BioCannDo project explored consumer appreciation of three groups of bio-product products (bio-based household cleaning products, bio-based insulation materials, and bio-based food packaging materials). Regarding bio-based food packaging, once introduced to the concept, consumers expected bio-based packaging to be more expensive than other materials, but thought it was a good idea and said that they would look to buy it in the future. Bio-based packaging materials were considered less polluting, more sustainable to produce, and more likely to be recyclable and biodegradable than other packaging. People also believed that bio-based packaging could improve the taste of food and thought that it might be better – healthier – for them[8].

BioCannDo also conducted consumer surveys related to the three mentioned bio-product groups, adopting a face-to-face interview format in a live setting at three trade fairs (two in Germany and one in Italy). Each of the three surveys covered between 125 and 155 respondents, for a total of 420 respondents. The interviews covered the following themes and topics: (a) Buying behaviour; (b) Expectations towards bio-based products and (c) Information needs and sources.

To find out about respondents' associations towards bio-based products they were asked to choose up to five (5) expectations from a predefined list of 12 (cleaning), 16 (insulation) or 13 (packaging) items, plus an additional option to name an item of their choice. The respondents overwhelmingly expected the bio-based product to be better for the environment (**Error! Reference source not found.**3). In terms of technical performance and price level, the responses were mixed. In all three surveys the answers "performs better" or "performs just as well" were given more often than "performs worse". In all three surveys the answer "is more expensive" was given more often than "costs just as much".[9]

Table 3. Consumer expectations towards three groups of bio-based products. Source: BioCannDo.

What are your top 5 expectations towards bio-based…		
…detergent or cleaner? (n=140)	…insulation material? (n=125)	…packaging? (n=155)
• Is better for the environment (112) • Is less harmful to water (110) • Is better for your health (87) • Cleans as well (78) • Contributes to climate protection (61)	• Is better for a healthy living environment (78) • Is easier to dispose of (69) • Contributes to climate protection (66) • Bio-based materials are grown sustainably (59) • Is more expensive (48) • Insulates just as well (46)	• Can be composted/is biodegradable (124) • Is better for the environment (107) • Can be solution to plastic in the sea/marine litter (94) • Production causes less greenhouse gas emissions (81) • Can be recycled (76) • Bio-based raw materials are grown sustainably (55)

[8] http://www.allthings.bio/pageflow/bio-based-food-packaging/

[9] BioCannDo (2018), D5.7 Report on market survey interviews and research results on public perception of bio-based products (confidential)

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• Bio-based raw materials are grown sustainably (61) • Reduces the packaging waste (57) • Is expensive (41) • Costs just as much (23) • Is easily available everywhere (21) • Others (13) • Cleans better (11) • Cleans worse (11)	• Has less negative health effects during installation (42) • Insulates better (29) • Other (22) • Have the same lifespan (21) • Are more prone to fire (21) • Is easily available (20) • Have a longer lifespan (19) • Are more prone to mould and insect infection (18) • Costs just as much (17) • Have a shorter lifespan (9) • Insulates worse (6)	• Is more expensive (43) • Help to avoid food waste (33) • Is healthier and safer compared to conventional food packaging (32) • Thinner packaging can be produced with less raw materials (25) • Food stays fresh for longer time (14) • Costs just as much (9) • Food does not stay fresh as long as in conventional packaging (7) • Others (3)
Note: The answers are represented in order of frequency of the responses		

The STAR-ProBio project developed sustainability assessment tools for bio-based products. The project undertook a two-round Delphi survey, to identify sustainability assessment preferences of end-consumers with regard to bio-based products, and their influence on buying decisions. The survey results show that private individuals consider a broad spectrum of criteria important for sustainability. Information on environmental issues is clearly regarded as the most important. For consumers, the top three environmental issues were: (1) Biodegradability; (2) Recyclability; and (3) Type and origin of raw material. The top three social issues were: (1) Impact of the product on people's health; (2) No child labour; and (3) Respect for human rights in the production of raw materials and products. The three most important aspects to be considered before buying a product in addition to sustainability related characteristics were found to be: (1) Price; (2) Functionality/ performance of the product; and (3) Better performance than alternative fossil-based products. STAR-ProBio concluded that being able to prove and communicate that sustainability criteria are met will be a key acceptance driver for bio-based products.[10]

In the summer of 2018, the BIOFOREVER project conducted and evaluated sixty in-depth psychological interviews of 1.5 hours each in Cologne, Berlin, Warsaw and Milan. All interviewees had a mainstream affinity towards organic products. They are neither too excited about purchasing organic products nor do they refuse to buy organic products. Some of the results are surprising: [11]

- Consumers generally have no idea about mineral oil being the feedstock for plastics. It is a widespread perception that plastics are "bad" and kill animals in the sea.

[10] STAR-ProBio (2019) D5.1: Acceptance factors among consumers and businesses for bio-based sustainability schemes, http://www.star-probio.eu/wp-content/uploads/2017/04/STAR-ProBio_D5.1_final.pdf

[11] BIOFOREVER (2019) D7.2 Market analysis, https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c7086741&appId=PPGMS

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- With consumers, the knowledge of chemistry is very low and the transformation from liquid mineral oil to solid plastic works like a miracle. Chemistry is "toxic magic".
- For soft and single-use applications, consumers are in fact less concerned about using food crops (often they even prefer food crops) than the academic and political debate might suggest.
- Nobody understands "bio-based" and all plant-derived products will be biodegradable
- Consumers feel overwhelmed, not competent and not responsible for the decision which materials are good or bad. Respondents wanted a simple, official and trustworthy label to help them identify the "good" materials.
- The relevance of feedstocks in consumer products is given in products that have impact on ourselves or on the environment. Highly relevant is the replacement of "evil products" with bad eco-image. Also, highly relevant are products that influence the body, get in touch with food as well as drinks and offer opportunity for the consumers to a great visibility and potential to show off.

The study authors concluded that in-depth psychological interviews are better suited to explore deep-seated opinions, prejudices and contexts than B2C online surveys and focus group analyses.

A preliminary market study conducted by the NEWPACK project investigated consumer opinion and perception with regard to bio-based food packaging. A consumer community made up of different pilot households spread throughout Spain was surveyed. The Top 3 of consumer motivations and interests from a psychological point of view are: Health, Pleasure and Natural (ingredients). Regarding the most-valued aspects of packaging, the survey results showed men to most value more comfort (that it is microwaveable, easy to open) and women to rate whether it is useful, safe and healthy.[12]

In a desk-analysis conducted by the Biobridges project in 2019 collaboration challenges were identified among industry stakeholders, brand owners and consumers. For consumers, challenges in interaction with brands were identified as:

- Lack of standardized labelling and certifications
- Level of acceptance of bio-based products in terms of safety and performance
- Absence of well-targeted promotion of bio-based products[13]

Building on these findings, Biobridges implemented an online consumer survey in 2020. The survey aimed to assess consumers' awareness on the bioeconomy and bio-based products (BBPs), the perceived positive and negative impacts of BBPs, consumers' purchase habits (their willingness to pay and the motivation to buy BBPs) and the sectors in which they would be in favour or not to buy such products, the usefulness of labels in guiding consumers' choices and the information that they would find there, and what would be the best actors and channels to inform consumers about BBPs.

[12] NEWPACK (2019?) D1.3 Final product technical requirements, http://www.newpack-h2020.eu/docs/NEWPACK %20Factsheet_D1.3.pdf

[13] Biobridges (2019) D2.1 Cooperation challenges among consumers, brand owners and bio-based industry. https://www.biobridges-project.eu/download.php?f=60&l=en&key=a29511909da37d58562f46600bb8e811

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Survey findings were published in December 2020.[14] Key findings from the Biobridges consumer survey are presented in Table 4.

Table 4. Summary of consumer survey findings. Source: Biobridges.

Category or cluster	Key findings
Misunderstanding of terminology	• Bioeconomy & bio-based products (BBPs) are terms unknown or less known by the large public; these terms are also frequently confused with other meanings (e.g., organic or biodegradable products) • Circular economy and sustainability are topics better known by the large public, also thanks to the current public debate on specific topics (e.g., the climate change); meanwhile, bioeconomy and bio-based are terms that are often confused with these or not known at all
Lower awareness of bioeconomy and bio-based products in youngsters and elderly people	• Young people are open to sustainability but generally confuse bioeconomy and circular economy • Young people are not aware of bioeconomy and BBPs, but they presume they can recognize them correctly when they shop • Older people are not as familiar with the bioeconomy and bio-based products
Low perception of possible positive economic and social impacts generated by the bioeconomy	• People are more interested in sustainability and environmental impacts generated by the BBPs • Even if strongly promoted by policy makers, potential economic impacts are not perceived by consumers (for instance, the possibility to create new jobs, the development of new technologies, etc.)
Request for more informative labels	• Labels can definitively guide consumers to choose BBPs instead of fossil-based ones • Information on BBPs – that could be provided also through labels – are more effective in motivating consumers choices rather than a reduction of the products price • Consumers ask to be informed through labels regarding the raw materials used for creating the BBP and the products' end-of-life
Motivations for increasing the purchase of BBPs	• Price is an obstacle, but the large majority of respondents are available to pay more (in particular up to 5%) and there are actions motivating more consumers than a price reduction (e.g., providing better information on BBPs)

[14] Biobridges (2020), D6.2, Action Plan for raising consumers' awareness, https://www.biobridges-project.eu/download.php?f=310&l=en&key=dd712023b6d8ddeb450d971a18048ee1

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	• Environmental issues and sustainability aspects are pushing people towards buying BBPs (and more sustainable products in general) and this is particularly true for young people
Sectors	• Consumers are generally open to buy BBPs in all sectors rather than to exclude some of them; however, they prefer buying bio-based consumables above bio-based durable goods • More known sectors and products by consumers - such as packaging, single-use products, food, textile - are the ones in which people would buy BBPs (also because they confuse BBPs with products perceived as more sustainable) • Consumers are sceptical of buying BBPs in some sectors and they would not buy them (for instance, pharma & nutraceutical), but consumers are probably already making a large use of BBPs without knowing it.

3.1.1. Take home messages from the literature review

What can be concluded from the studies and surveys included in the literature research? The following general pattern seems to emerge:

1. A large share of consumers expects and perceives bio-based products and solutions as being beneficial for environment and health. They are often seen as less polluting, more sustainable, more recyclable and more biodegradable than fossil counterparts.
2. Bio-based is often confused with "natural" or "organic", which acts as a driver as people expect them to be healthier for themselves and the environment. This can also be become as a barrier as expectations for bio-based are high. If the expectations do not meet the reality it can damage the image of bio-based.
3. In the surveys where price and value of bio-based were considered, customers showed willingness to pay a higher price, green premium, for bio-based products. It is even expected that the price should be higher due the benefits and expectations that comes with bio-based; it is better for the environment, health and society. In the contrary, the performance of bio-based must be at least the same or higher than the conventional product. Bio-based products are expected to also perform at a higher level in social aspects than conventional products.
4. To increase the acceptance and adaptation of bio-based in consumer preference, communication seems to come a crucial role. There are many misconceptions, lack of knowledge or understanding what is bio-based, the origin, production and processing of bio-based products. Furthermore, customers have doubts about the trustfulness of the claims given by companies and brand owners. Clear labels are expected to answer the misconceptions, provide knowledge and more visibility for bio-based.
5. Raising consumer awareness of bio-based products is far from straightforward, as in-depth psychological interviews with consumers revealed. The knowledge of chemistry is very low

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and generally consumers have no idea about mineral oil being the feedstock for plastics. Most end consumers have very little knowledge of concepts like bio-based" and 'biodegradable". They (incorrectly) assume that all plant-derived products will be biodegradable. Consumers feel overwhelmed, not competent and not responsible for the decision which materials are good or bad. They want a simple, official and trustworthy label to help them identify the "good" materials.

6. The relevance of bio-based feedstocks in consumer products is given in products that have impact on ourselves or on the environment. Highly relevant is the replacement of "evil products" with bad eco-image. Also, highly relevant are products that influence the body, get in touch with food as well as drinks and offer opportunity for the consumers to a great visibility and potential to show off.

Some ideas and concrete suggestions for consumer communication strategies are provided by the BIOFOREVER[15] and Biobridges[16] projects.

3.2 Online focus group discussions

The qualitative online focus group discussion with 50 consumers in Finland was implemented in the period of 7-13 December 2020. Due to the small and geographically limited population sample, when relevant, the following results are presented according to the population size (denoted as N) rather than percentages. The exception is the thematic analysis and positive/negative association analysis that presents relevant results with percentage value. Both of these methods are based in the type of words the participants are using when responding in the Howspace-platform, and therefore the N is counted based on the number of responses, not the number of participants. The content and the demographic details of the participants are presented in the chapter 2.2 above.

3.2.1 Consumer awareness about bio-based products

As a positive response, about 3 out of 4 Finnish consumers participating in the study had earlier heard about bio-based products and brands, see figure 8.

[15] See e.g. Section 2.2.4.3 in BIOFOREVER (August 2019) D7.2 Market analysis, https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5c7086741&appId=PPGMS

[16] See e.g. Chapter 5 in Biobridges (December 2020), D6.2, Action Plan for raising consumers' awareness, https://www.biobridges-project.eu/download.php?f=310&l=en&key=dd712023b6d8ddeb450d971a18048ee1

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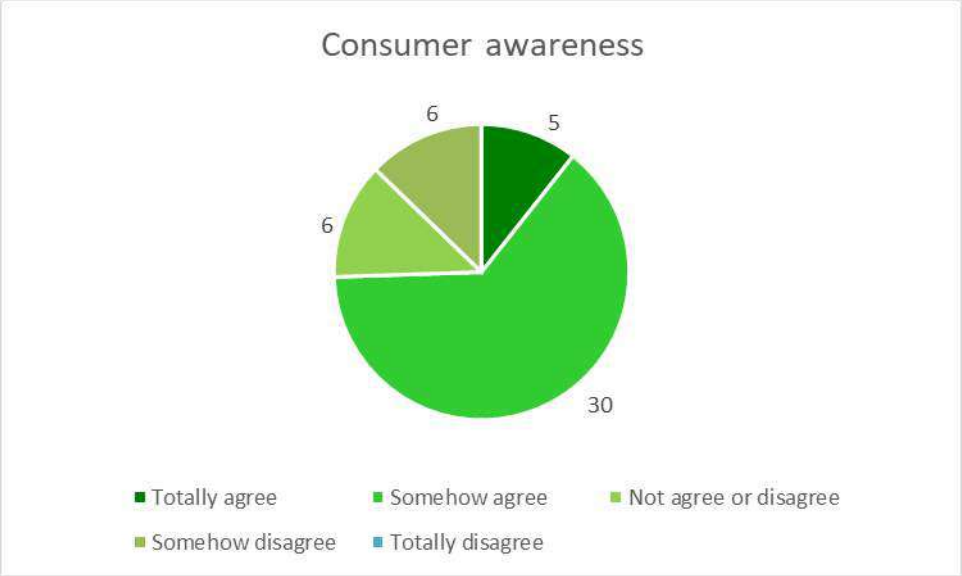

Figure 8. Consumer awareness - bio-based products and brands (N=47).

The bio-based materials, products and brands were introduced to the Finnish FGD participants by two definitions: the first one created by European Committee for Standardization (CEN), and the second one by USDA BioPreferred program (see figure 9). The consumers were able to understand both of the definitions, although the first one (a bit shorter), seemed to be clearer. In six (6) responses Definition 1 was stated to be clearer, concise and more understandable than Definition 2. Three (3) participants favoured specifically Definition 2. Eight (8) participants thought that both definitions were obvious with a glance, six (6) thought they were overly complex. As a positive response, participants were eager to hear more about bio-based products based on the definitions. In particular they expected to hear more examples about the products in question. Questions were raised about: ethical issues, vegan alternatives, biomass, animal-based biomass, and biological treatment. Most concern was raised about the chemical treatment, e.g. "What it is...?", "Definition is not clear", and comments like "It is always a risk to the environment". All in all, positive associations were received about 42% of all the responses, 15% of negative associations, and 43% neither / in between.

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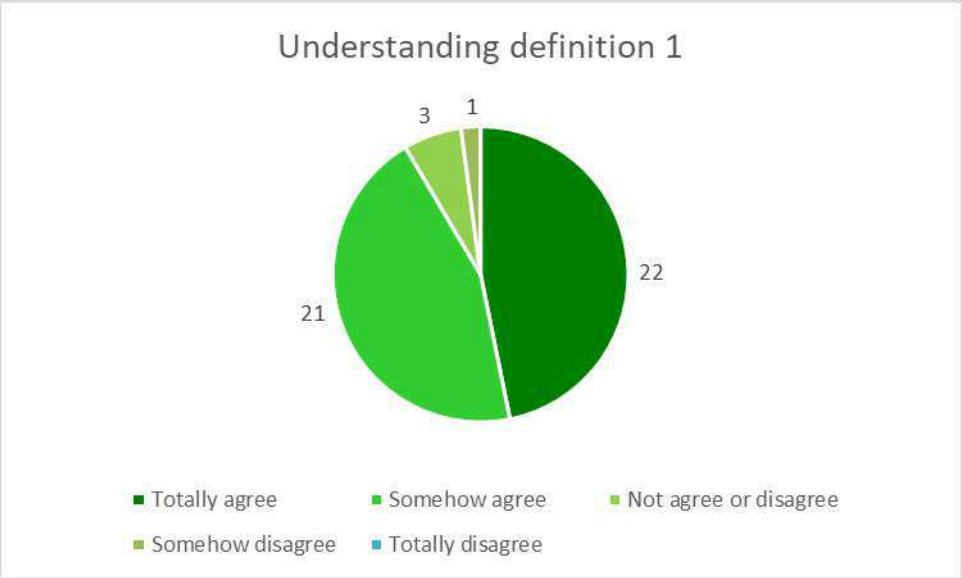
Definition 1 by European committee for standardization: The term bio-based product refers to products wholly or partly derived from biomass, such as plants, trees or animals (the biomass can have undergone physical, chemical or biological treatment).



Definition 2 by USDA BioPreferred® Program:
The term bio-based product refers to commercial or industrial products (other than food or feed) which are composed, in whole or in significant part, of biological products, including renewable domestic agricultural materials (e.g., plant, animal, and aquatic materials), forestry materials, intermediate materials, or feedstocks. As opposite, bio-based materials exclude motor vehicle fuels, heating oil, or electricity produced from biomass.

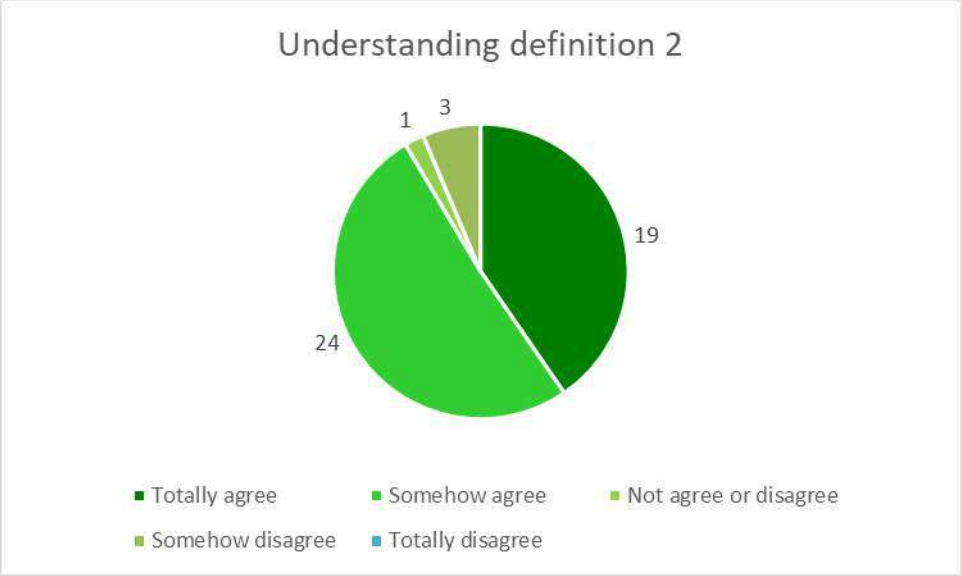


Figure 9. Consumer awareness - understanding the definitions for bio-based products (N=47).

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Organic, natural, ecological, and recyclable were the first word associations for the Finnish consumers towards the term 'bio-based product', see the word-cloud in figure 10.

Figure 10. Consumer awareness - word associations towards 'bio-based product'.

Positive associations (48%) that the words raised were stated to be:

- The material of the product has its basis in nature
- It is manufactured from organic ingredients
- It is just as biodegradable as the original material it was produced from

Similarly, negative associations (22%) were clarified to be:

- The processing of the material can be as contaminating as the non-bio-based alternative
- After the process it may not be biodegradable
- This is only greenwashing: more research-based knowledge than brand-based knowledge
- The whole production chain needs to be environmentally friendly: if the manufacturing requires a lot of energy and chemicals, it is not an ecological alternative.

When requesting about the companies and brands associated with the bio-based products, most responses were "nothing comes to mind" (29%). The articulated domestic/regional brands were:

- Ingredients: (Mäntynestesaippua, Pineline tehopesu, Erittäinhieno, Bilthamber autofoami) 10,6%
- Coating: (Teknos, Ekosata, Uula pellavaöljymaali, Kiilto) 10,6%
- Garbage bags: (Bioska) 7,6%
- Food: (Bioferme Yosa, Huhtamäki, Oatly, Oddlygood, Seitan) 7,6%
- Forest industry: (Metsä Group/MetsäFibre, UPM Kymmene) 7,6%
- Cosmetics: (Lumene) (4,6%)

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3.2.2. Examples and evaluation of bio-based products

3.2.2.1. FAZER

Short narrative: "Fazer focuses on reducing emissions and the amount of food waste, develops more and more sustainable packaging, and increases the use of plant-based ingredients in its products. Now Fazer has brought pralines in a compostable, microplastic-free box to Christmas sales."

According to Finnish consumers, Fazer is seen as a trusted brand (44/46), see figure 11. They also feel that the brand refers to sustainability (32/46). A minor part of consumers (13/46) feels that the work of Fazer towards bio-based future is green washing.

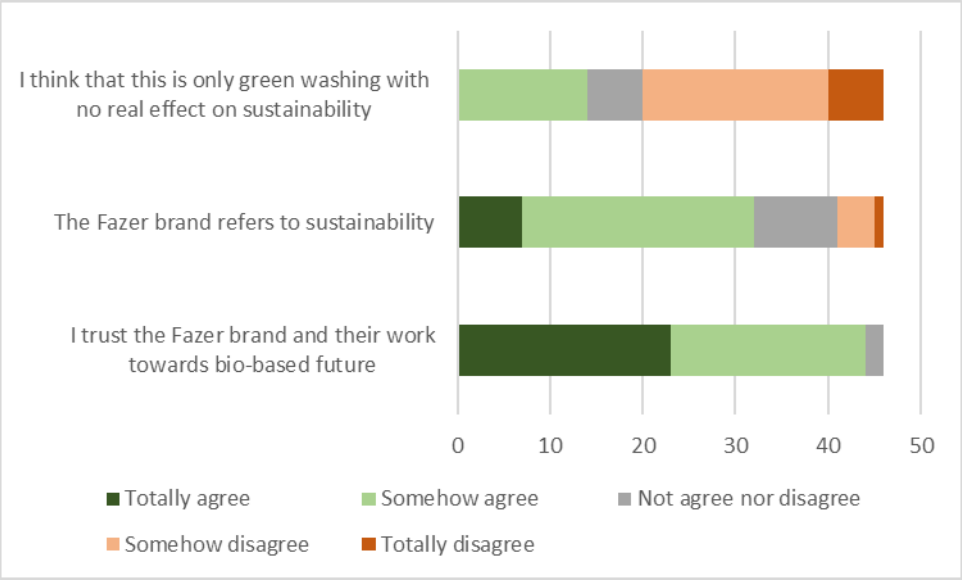

Figure 11. Evaluation of the Fazer brand.

Generally, related to bio-based food packaging, consumers felt that bio-based packaging materials do not affect the taste of food inside (43/46), and they would like to buy products in bio-based packages (44/46), see figure 12. In addition, consumers feel that bio-based packaging materials are environmentally friendly (41/46), less polluting (39/46), and easy to recycle (37/46). 37/46 of consumers said that they already prefer to buy food products packed or wrapped in bio-based alternatives. Only 15/46 of consumers would pay more for food products packed in bio-based alternatives.

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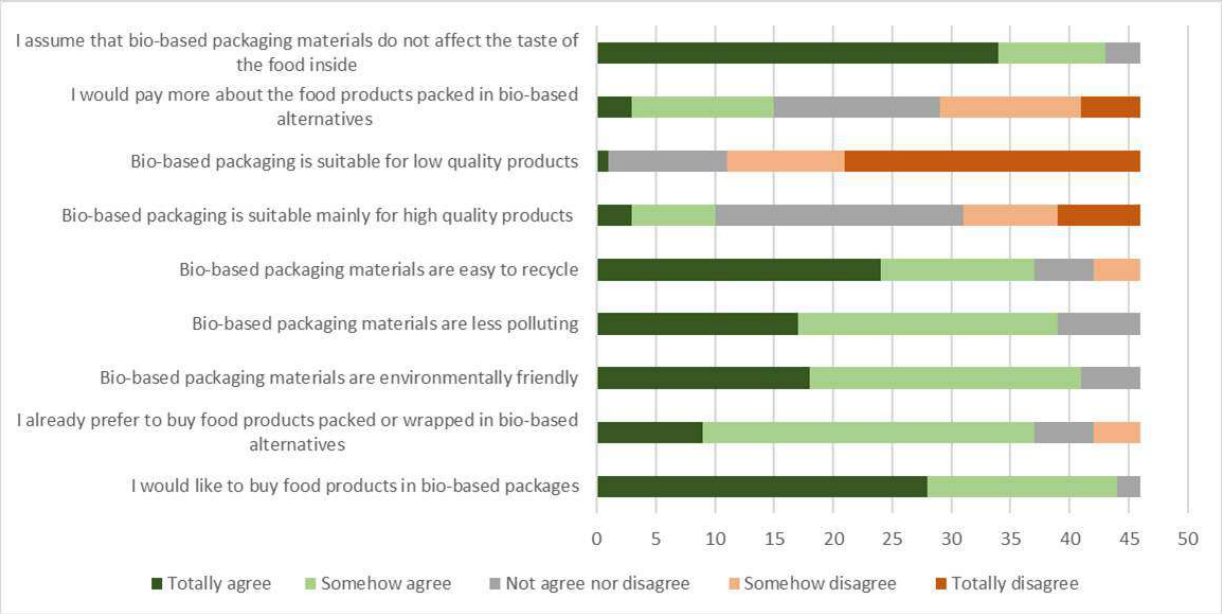

Figure 12. Evaluation of bio-based food packaging materials.

Other food and beverage products consumers would like to see packaged in bio-based packages (N=46) included vegetables (31), fruits (33), dairy products like milk (34), juice (32), meat (30), and pre-cooked meals (35).

Consumers felt that in general, "*The amount of used packaging material should be decreased*", and the use of bio-based materials should be significantly increased, like "*I hope all the packages could be bio-based in the future*." However, some consumers were wondering e.g. "*Are the bio-based packages microbiologically / hygienically comparable to plastics?*" Still, this work was seen valuable, one of the respondents commented that "*The plans are encouraging. Waiting for new innovations*."

3.2.2.2. LUMENE

Short narrative: "Lumene has replaced the exfoliating rinse-off plastic microbeads with salt, and silica sand-like ingredients. Many of Lumene products are also developed from by-products of the food and forest industries. They aim to replace packaging materials by bio-based or biodegradable materials."

According to Finnish consumers, Lumene is seen as a trusted brand (33/45), see figure 13. They also feel that the brand refers to sustainability (28/45). A minor part of consumers (12/45) feels that the work of Lumene towards bio-based future is green washing.

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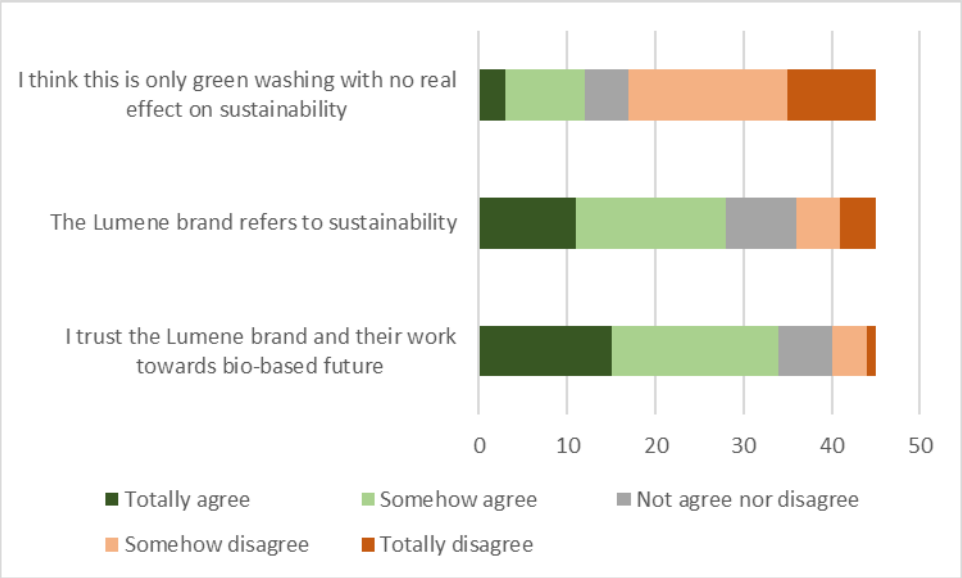

Figure 13. Evaluation of the Lumene brand.

Generally, related to cosmetics, consumers felt that bio-based cosmetics are safer for skin and health (36/45), and they would like to buy cosmetics produced wholly or partly from bio-based materials (40/44), see figure 14. In addition, consumers feel that bio-based cosmetics are environmentally friendly (32/44), less polluting (38/45), and easy to recycle (38/45). Only 18/44 of consumers said that they already prefer to buy bio-based cosmetics. They felt that bio-based cosmetics are high quality products (33/45). About half of the consumers (21/45) would pay more for bio-based cosmetics.

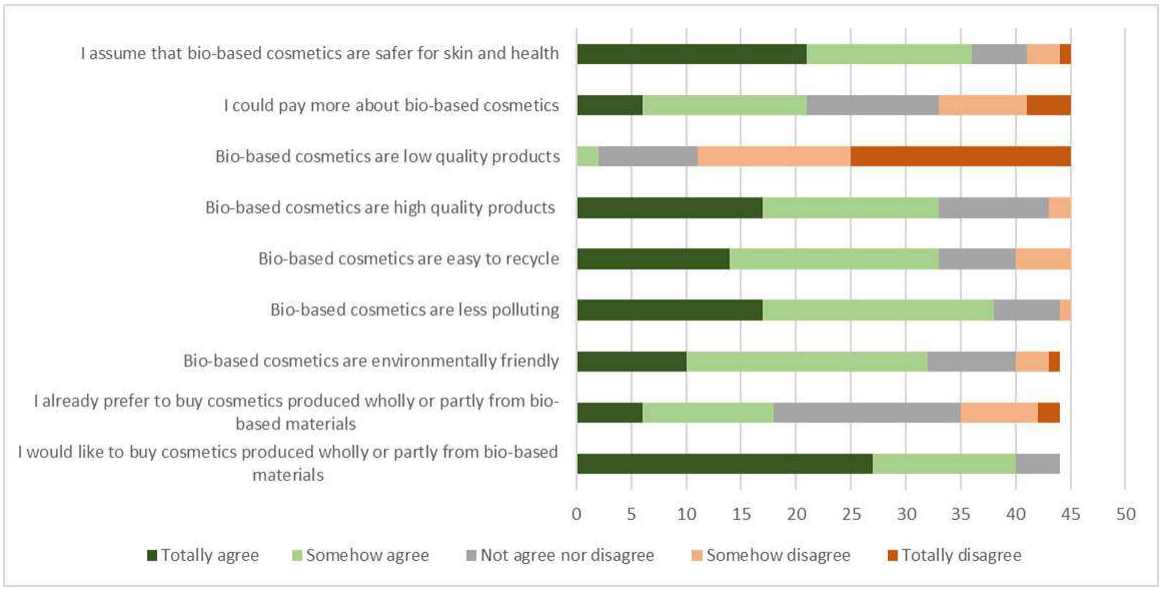

Figure 14. Evaluation of bio-based cosmetics.

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Consumers felt that in general "*The use of bio-based cosmetics will increase in the near future*." and that "*Bio-based cosmetics should be a new normal*." Consumers felt that the prices for bio-based cosmetics are too high at the moment, like "*I would like to test bio-based cosmetics more. However, usually special products are too expensive.*" They liked the idea for bio based-cosmetics "*It's good that plastic is being replaced. The different thing then is whether the product is any more sustainable option than before*", and pointed out an important issue, "*Allergy-friendliness must also be taken into account in bio-based cosmetics*".

3.2.2.3. Nestlé

Short narrative: "Nestlé aims to develop 100% bio-based bottles. Focusing on waste biomass such as cardboard and sawdust, the goal is to bring Origin Materials' technology to commercial scale, making bio-based PET accessible for the entire beverage industry."

According to Finnish consumers, Nestlé was not seen as a trusted brand (less than half, 18/46, saw Nestlé as a trusted brand), see figure 15. Only 7/45 thought that the brand refers to sustainability. More than half of the consumers (25/45) feel that the work of Nestlé towards bio-based future is green washing.

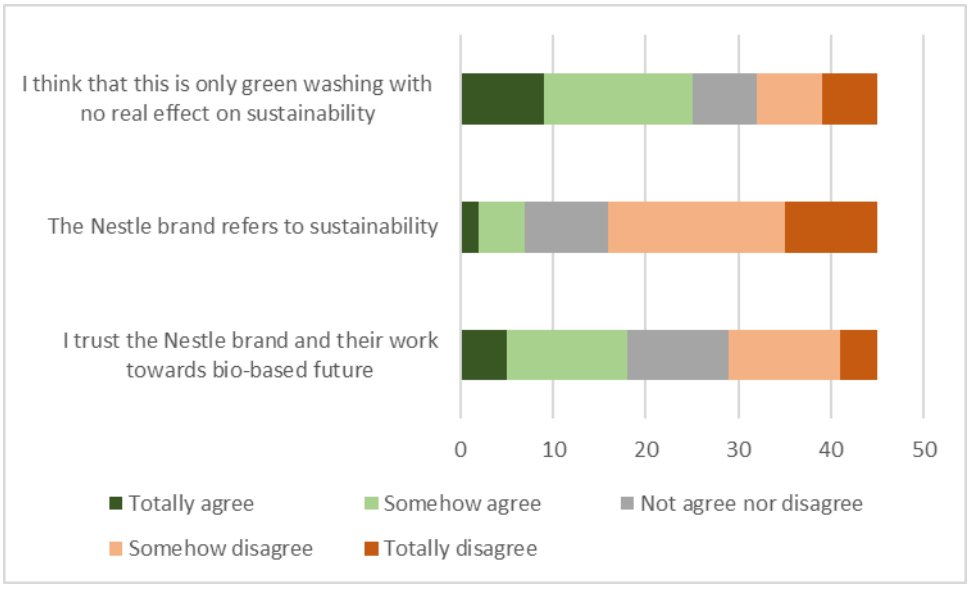

Figure 15. Evaluation of the Nestlé brand.

Generally, related to bio-based food packaging, consumers felt that bio-based packaging materials (bottles) do not affect the taste of food inside (37/44), and they would like to buy products in bio-based packages (35/44), see figure 16. In addition, consumers feel that bio-based bottles are environmentally friendly (28/44), less polluting (31/44), and easy to recycle (30/44). Only 5/44 of consumers said that they already prefer to buy food products packed or wrapped in bio-based alternatives. Only 14/44 of consumers would pay more for food products packed in bio-based alternatives.

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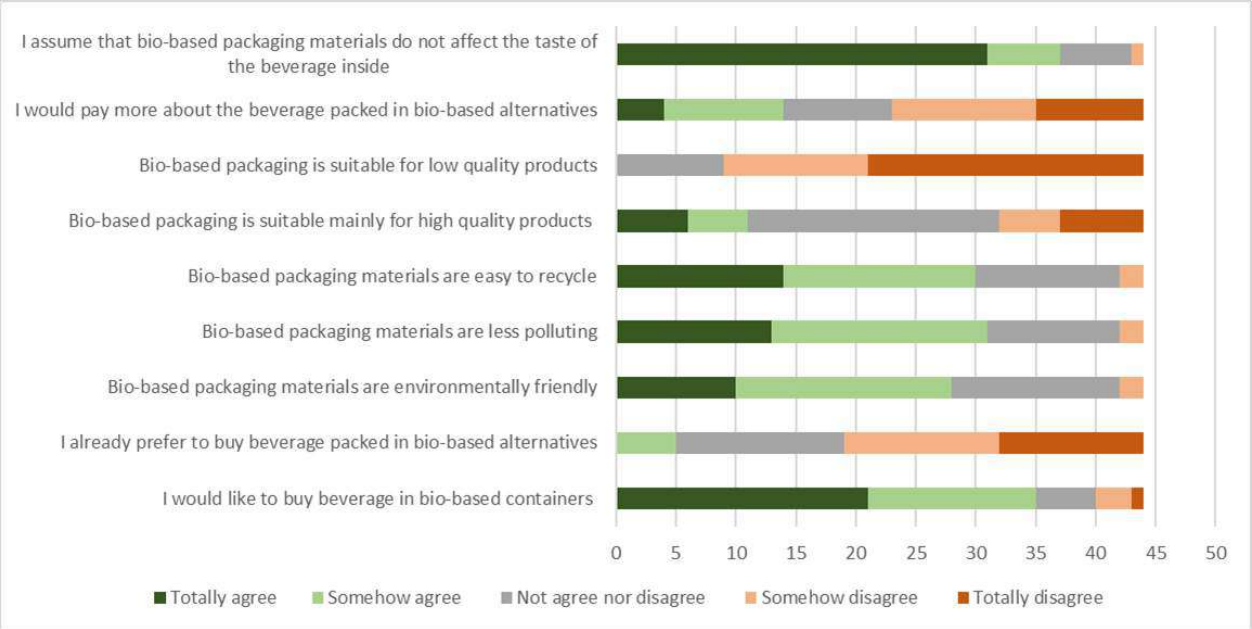

Figure 16. Evaluation of bio-based packaging materials for bottles.

Consumers felt that in general, the replacement of plastics in bottles, is "*Better direction*" and "*Absolutely a great idea due to a huge consumption of plastic bottles*". Consumers were sceptical towards the sustainability of bio-based bottles, by saying: "*Are the bio-based bottles as sustainable as (recycled) plastic bottles?*" and "*How to recycle the bio-based bottles?*" because they felt that in Finland bottle recycling already works sufficiently due to the deposit and reusing system.

3.2.2.4. ADIDAS

Short narrative: "Adidas aims to produce shoes from 100% biodegradable material created from biopolymers which aims to replicate natural silk. The company has also pledged to eliminate virgin plastic from its supply chain."

According to Finnish consumers, Adidas was not seen as a trusted brand (less than half, 16/44, saw Adidas as trusted brand), see figure 17. Only 6/44 thought that the brand refers to sustainability. However, less than half of consumers (16/44) feel that the work of Adidas towards bio-based future is green washing.

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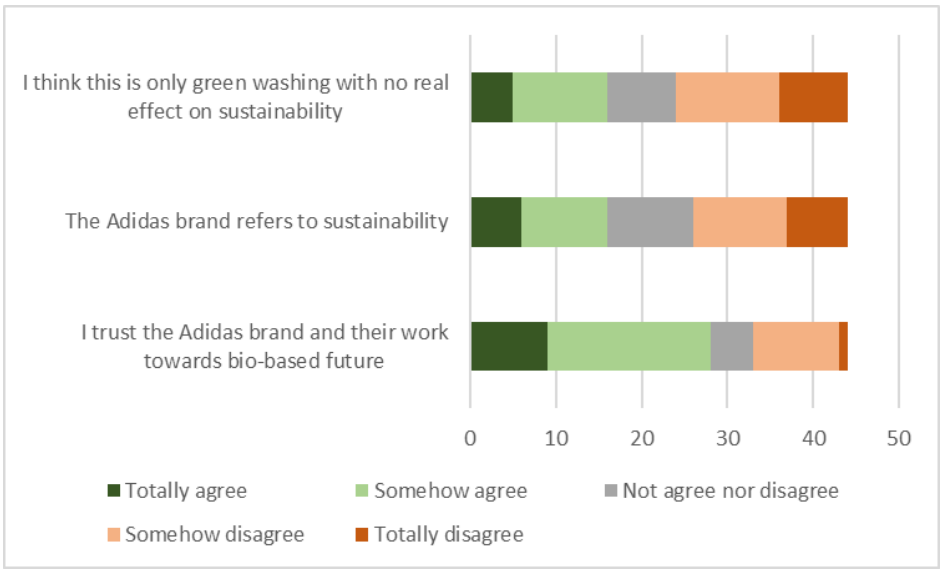

Figure 17. Evaluation of the Adidas brand.

Generally, related to bio-based garments, consumers felt that bio-based garments are safer for skin and health (39/44), and they would like to buy textiles and clothes produced wholly or partly from bio-based materials (39/44), see figure 18. In addition, consumers feel that bio-based clothes are environmentally friendly (31/44), less polluting (34/44), and easy to recycle (37/44). 27/44 of consumers said that they already prefer to buy clothes produced wholly or partly from bio-based materials. They felt that bio-based clothes are high quality products (28/44). Only half of the respondents, 22/44, would pay more for bio-based clothes.

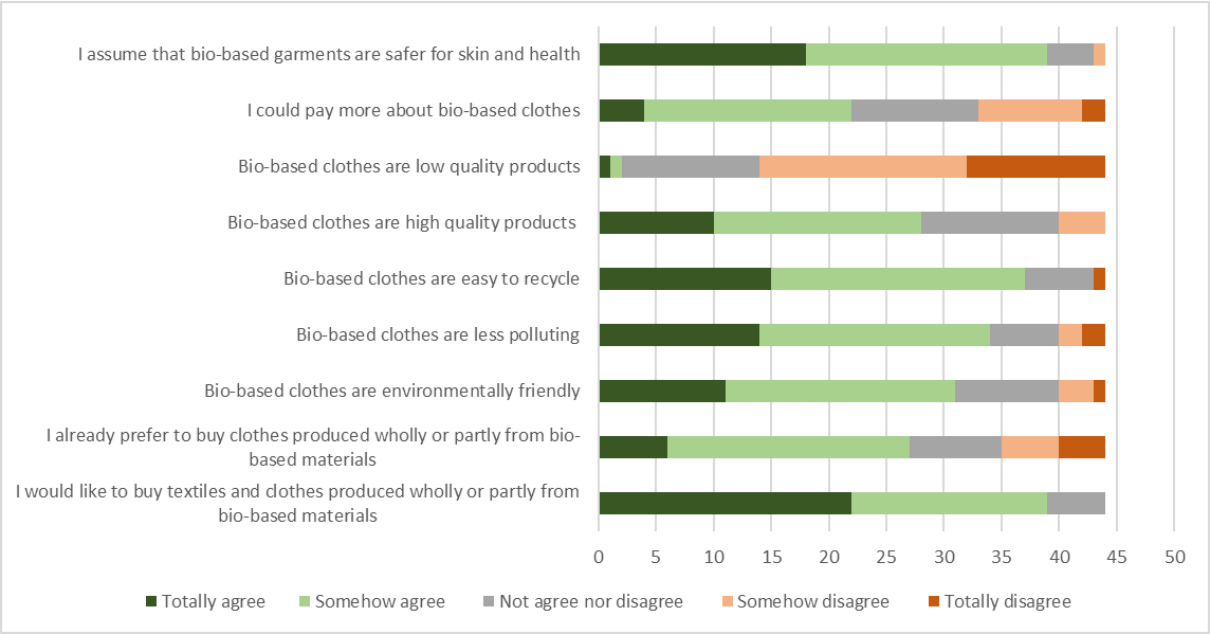

Figure 18. Evaluation of bio-based garments.

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Consumers felt that in general, they would like to see more bio-based clothes in the future, like "*I hope these bio-based materials will be widely used in the future.*" They would be ready to pay more for bio-based clothes. One respondent commented that: "*If the price of a clothing goes up because of higher quality and more ecological, it is ok. Modern one-time consumption is shocking and completely pointless.*" Still, consumers were wondering the durability of the bio-based clothes, and their environmental friendliness.

3.2.2.5. LEGO

Short narrative: "Recently called the 'world's most powerful brand', toy manufacturer LEGO is looking for a bio-based replacement for its iconic plastic bricks. LEGO is developing sustainable raw materials to manufacture elements, as well as packaging materials."

According to Finnish consumers, Lego is seen as a trusted brand (33/44), see figure 19. They thought that the brand refers to sustainability (26/44). Only minor part of the respondents, 7/44, felt that this is only green washing.

In addition to Legos, games or toys that would be especially suitable for bio-based products from the consumer viewpoint were board games, sand toys and other outdoor toys, baby toys, all plastic toys, dollhouses, books, craft material, train tracks, and game controllers.

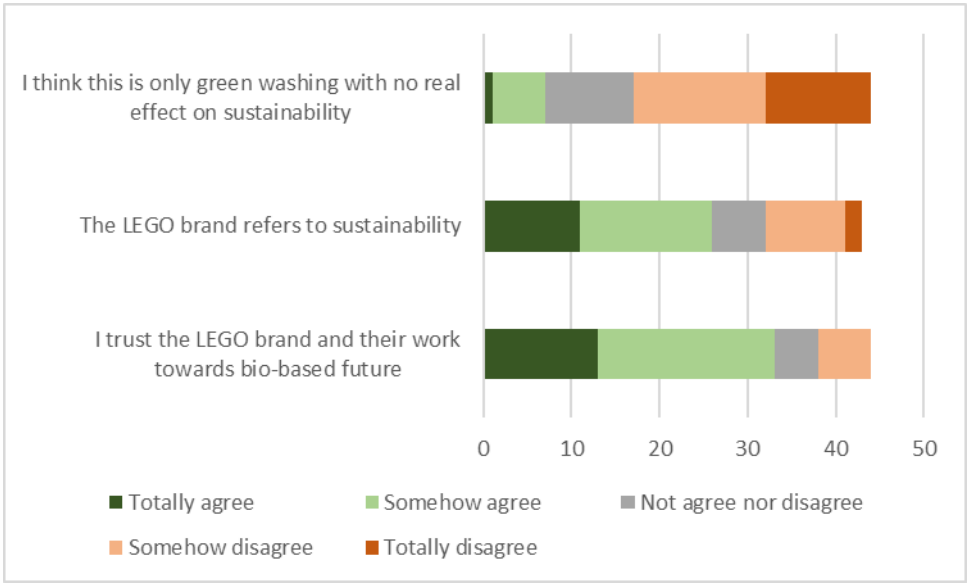

Figure 19. Evaluation of the Lego brand.

Generally, related to bio-based toys, consumers felt that bio-based toys are safer for children (31/44), and they would like to buy toys produced from bio-based materials (38/44), see figure 20. In addition, consumers feel that bio-based toys are environmentally friendly (32/44), less polluting (31/44), and easy to recycle (29/44). Only 9/44 of consumers said that they already prefer to buy toys produced from bio-based materials. They felt that bio-based toys are high quality products (24/44). Half of the respondents, 22/44, would pay more for bio-based toys.

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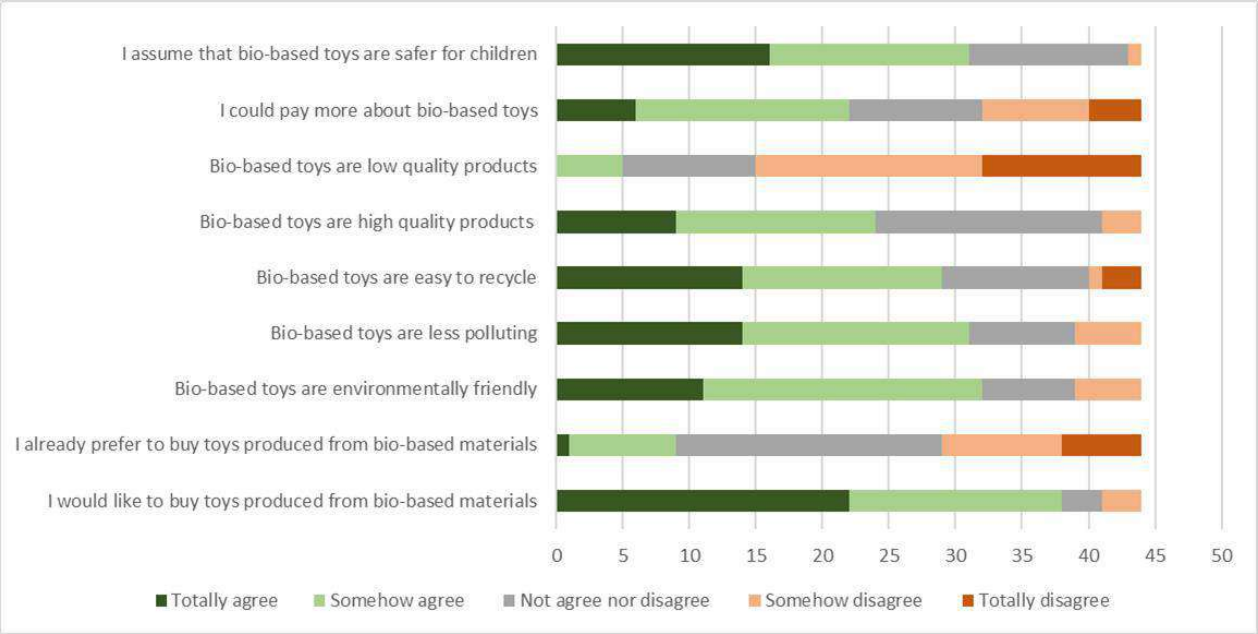

Figure 20. Evaluation of bio-based toys.

Consumers felt that "*Lego is a valuable brand and could be a good example for others*." and they liked this idea due to a huge number of plastic products in the families. They hoped that "*I really hope that the bio-based toys are new normal in the future*", and saw a lot of potential in the toy packages. Still, they pointed out that: "*Safety is the most important issue in this case*."

3.2.3. Consumption habits

When shopping, Finnish consumers are mainly looking for certain brands they are familiar with (34/45), and do not actively try to find bio-based products (20/45 were looking for bio-based products). However, 27/45 do not rely that the trusted brands are able to provide them the bio-based solutions. Only 16/45 compare the products they are buying with similar alternatives, and prefer the bio-based option, and 31/45 feel that it is not easy to find bio-based products in the store. There is lack of communication related to bio-based products, Finnish consumers feel that the communication related to bio-based products is not clear (26/45), and the product labels are not easy to read and understand (24/45). 17/45 mention that advertisements lead them to find bio-based products. These results are presented in figure 21.

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Figure 21. Consumption habits of Finnish consumers (N=45).

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When choosing between several products, the following issues affect the decision to buy specific brand products (N=31):

- Familiar product, domestic/local, well-recognized (35%)
- Price (26%)
- Brand (image), familiar company, reputation (23%)
- Quality (& reliability) (19%)
- Long-wearing/durable, functionality/practicality, need/demand (19%)
- Advertising, impression, vision, mental image (19%)
- Recommendations, user experience, personal experience (16%)
- Quality-price ratio (13%)
- Environmentally friendly, ecologically certificated product (9,6 %).

Besides the price, the most important factors that help consumers to make a choice between similar products, are (N=29):

- Domestically/locally produced (31%)
- Quality (31%)
- Packaging, labels, appearances (13,8%)
- Country of origin (10%)
- Prior experience (10%)
- Material, usability (10%)
- Brand image (10%).

The consumers were able to share their viewpoint about the bio-based products and brands, and their communication. Positive associations reached 17,5%, share including viewpoint such as: "*I recycle all the plastics. Any solution for the packaging materials is always interesting.*" Negative associations reached 32% share, and here the concern was related to accuracy of the information that is available: "*I wonder how accurate the information about the bio-based products is; are they even safe at all*", and lack of communication, like "*First alarming things that comes to mind are the terrace garden materials and single-use plastics; I have not seen much communication about those*." Comments that were neither negative nor positive, rather something in between, reached 47% share. Here, consumers pointed out that they have not paid much attention to different options available, e.g.: "*I have not paid much attention to the bio-based brands. There seems to be not enough advertisements or communication about those*", and, some felt that there were other factors that affected the decision making than bio-based materials, "*I prefer bio-based alternatives, if they are available. Otherwise, bio-based solution is just some extra benefit. It seldom is the critical decision to make the choice.*"

The most interesting categories in which Finnish consumers would like to buy bio-based products are: (1) Cosmetics and personal care, (2) Cleaning, hygiene and sanitary products, (3) Disposable products, and (4) Packaging products (see figure 22.). The reason why consumers chose these categories, included comments such as: "*They are easily available*"; "*I use them already and I thought that bio-*

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based materials would suit well for those", and: "*I selected products that have a short life-span and those are consumed a lot*".

Figure 22. Categories in which Finnish consumers are interested in to buy bio-based products.

The most influential media or social connection from which the Finnish consumers would like to receive or share information about the bio-based products were researchers, family, and TV. Many consumers feel that: "*Fact-based knowledge and research data is most reliable source of information*". Some preferred articles in newspapers. Consumers also pointed out the importance that the information should be easily available: "*Information should be easily available, even when one is not specifically pursuing it*". Social media was pointed out as a visible media: "*I react mostly to social media*". Some consumers felt that advertisements in different media were more convenient, and some mentioned that they were not able to trust the advertisements. Consumers preferred also to discuss about the issues with their families and friends.

Figure 23. The most interesting channels for Finnish consumers to receive information about the bio-based products.

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3.2.4. Future Consumer

About consumption in the future, the Finnish participants responded accordingly to the questions "Do you think that you are going to buy more bio-based products in the future?" and "Do you think that you will buy more products packaged in bio-based materials in the future?" (see figure 24.):

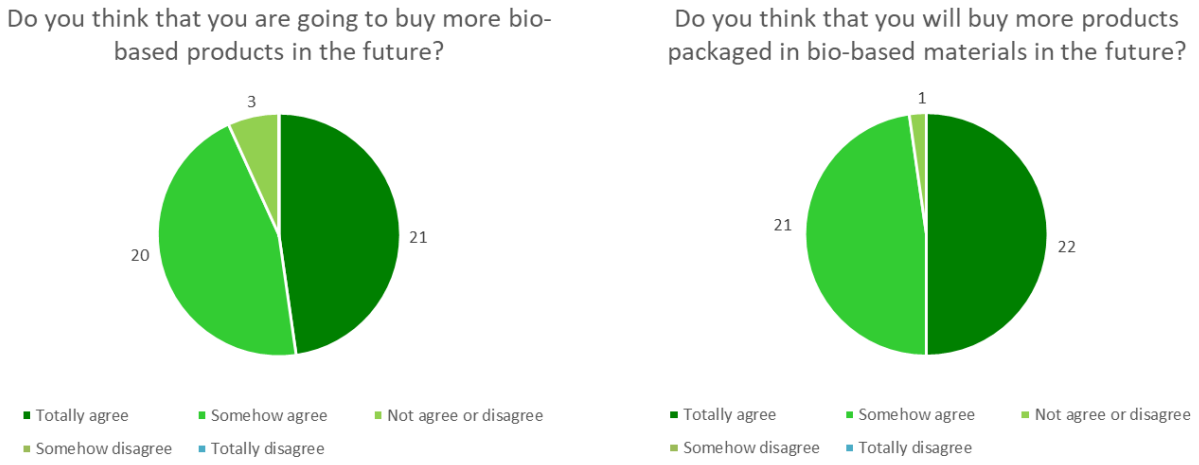

Figure 24. Future expectations (N=44).

As the figure shows, vast majority of consumers expected to buy more bio-based products as well as products packaged in bio-based materials in the future. As for the question "What would specifically motivate you to buy bio-based products?", the participants responded as demonstrated in figure 25:

Figure 25. Motivation to buy bio-based products (N=44).

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As the figure shows, most motivation aroused financial incentives (e.g. discounts, tax reduction, etc.), clear information on the whole value chain, clear information on product's end-life and price reduction. Less motivation seemed to provoke: the possibility to contribute on the product design, information on the feedstock used (in food products), higher adoption by brands, information campaigns and example from social media influencers or celebrities.

In the open discussion about the incentives and expectations, the participants highlighted reasonable price (17/57) by stating that "*Eco is not just a privilege for the rich*" and especially underlined the role of brands and their quality-price-responsibility. About the higher price, the participants urged the brands to demonstrate some certificate that they "*really are environmentally friendly (by taken account also the manufacturing and end of life)*". 8/57 required more information, by stating: "*Motivation is about understanding why the bio-based alternatives are better; labelling needs to be informative in this sense*", and "*fact-based knowledge should be presented in a way that is easy to comprehend*". 7/57 mentioned "environmentally friendly products" as their main motivation, in addition with "clear conscious", "saving the planet" and "making good and achieving more". 4/57 participants mentioned that the bio-based alternatives should be: "Mainstream offering in the selection" and "Natural alternatives in compact sizes". In individual answers, the participants aroused issues relating to: quality, trustworthiness, "carrot rather than stick", benefit and user experience.

When requested in particular about whether the participants saw bio-based materials as a solution to our environmental challenges in the future, a modest 3/56 responded positively, but most saw that the problem can be issued only "as part of the whole" (14/56), by detailing: "together with other solutions; part of solution but not enough alone; the overall burden of chemicals and contaminations counts; Western counties cannot solve these problems alone". 6/56 were overly sceptical by stating that bio-based alternatives had little influence on climate change and more information is needed on the complete lifecycle effects and consumption reduction. In individual answers it was stated that: "The non-bio-based alternatives are equally important when recycled properly, e.g. efficient recycle of plastics", "Bio-particles in the oceans are a huge concern" and "It depends on how globally inclusive the bio-based concept is".

For the question, "How the environmental issues should be communicated to the consumers", the participants responded accordingly: "*Honestly, without cover up stories, no greenwash*" (7/25); openly and transparently (5/25): all benefits and disadvantages on the table; brand owners commercial material does not increase trust; by presenting all the global players and subcontracting parties; with research and fact-based knowledge (5/25); multifaceted or multichannel information with wide distribution (2/25) and with clear customer-driven communication (2/25).

The Finnish participants saw that the biggest advantages of the bio-based products and materials were: recyclable material, composability, reducing of waste, fast degradability (18/53); environment friendliness, less pollution, consume less planet resources (7/53); naturalness, make use of the natural materials (4/53), no end-of-life pollution aspects (2/53), sustainable development (2/53), it creates new employment (2/53), safety & reliability, to some extent safer for the living organisms. In individual answers the participants highlighted topics such as: ecological awareness, cut back of

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natural resources, cleanness, non-toxicants, regeneration, manageability, better for the next generation and better solutions that save the planet.

About the biggest concerns, risks and negative impacts related to bio-based products and materials, the participants mentioned the following issues:

- Harm to the environment: intensive farming, destroying of the rainforests, agriculture for the materials replace fields and natural forests (13/53)
- Manufacturing: cost of it; manufacturing is polluting, consumes more energy than non-bio-based alternatives, information about it: who, where, how is manufacturing the products (12/53)
- Higher price creates an overwhelming barrier to take into use (10/53)
- Consumers are misinformed; bio-based alternatives are promoted being ecological although they are not (4/53)
- Are they durable? How they are preserved? (4/53)
- I have no opinion: I am not sufficiently aware of the bio-based products (4/53)
- Safety: is the research reliable; the definitions of bio-based alternatives allow the use of toxic chemicals and create hazardous emissions (4/53)
- Overall and global effect on planet, climate and employers (2/53)
- How they are recycled? Is there a need for a new recycling model? (2/53)
- Sufficiency of the resources (2/53)
- I see no risks (2/53)

As a final question it was asked if the Covid-19 pandemic had affected consumers to make more cautious decisions as regards to bio-based alternatives. The participants responded accordingly: no effect (9/56); not much/perhaps some (3/56), and detailed that "*as for the part of bio-based alternatives, there is some increase but not due to the Covid-19 situation*"; some effect (2/56): "*it has forced to think about the overall situation of the planet, but not so much the over consumption*"; and, the situation has caused less consumption (3/56), as, "*Money is saved because of the lack of eating out, culture and entertainment*". In individual answers it was stated that consumption has been steered towards sustainable consumption, since "there is more time to pick up berries" or "buy clothes and toy used or from the flea market".

3.2.5. Consumer Focus Group discussions and analysis

The discussions and analysis of the qualitative FGD is issued as regards the social research framework. The first part of the framework studied consumer awareness that aimed to define how FGD participants recognized or recalled bio-based materials, products and brands. All evidence indicated that Finnish consumers were extremely well informed, as they had heard about bio-based products and brands and were able to understand the two definitions that were presented as an introduction. Organic, natural, ecological, and recyclable were the first word associations for the consumers towards the term 'bio-based product', with positive associations (48%) and negative associations (22%). The FGD participants were able to enumerate several domestic brands associated with the bio-based products that related to: ingredients, coating, garbage bags, food, forest industry and

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cosmetics. In the early phase discussion, the participants raised important questions about ethical issues, vegan alternatives, biomass, animal-based biomass, and biological and chemical treatment.

The second part illustrated five brand examples, Fazer, Lumene, Nestlé, Adidas and Lego, and their plans towards bio-based future. From these five brands, Fazer was the most trusted brand among Finnish consumers (44/46). Lumene and Lego shared the second place, when 33 respondents felt them to be trusted brands. These most trusted brands were referred also to sustainability, and their work towards bio-based future was not seen as green washing. Both Adidas and Nestlé were not usually seen as trusted brands and consumers felt that these brands do not refer to sustainability. Consumers really preferred to buy food products (44/46) and liquids (35/44) packaged in bio-based materials, but also cosmetics (40/44), textiles and clothes (39/44), and toys (38/44) produced from bio-based materials. In general, they thought that bio-based packaging materials and products were environmentally friendly, less polluting and easy to recycle. However, usually they were not willing to pay more for bio-based options.

The third part of the survey framework, on consumption habits elicited consumption decision making, expectations and current habits, elicited consumption decision making, expectations and current habits, e.g. the main incentives and key barriers to choose bio-based alternatives. As result, Finnish consumers were mainly looking for certain brands they were already familiar with and did not actively try to find bio-based products. In particular, when choosing between several products, most participants highlighted that the product should be familiar, domestic/local and well-recognized. Price came second place; brand (image, familiar company, and reputation) on third. This result suggests that the brand (including advertising, impression, vision, and mental image) is an important factor for consumers. However, the majority of the respondents did not rely on that the trusted brands were able to provide them the bio-based solutions, which is a huge concern from the brand owner perspective. In essence, the participants highlighted the lack of communication in relation to bio-based products, which manifested itself in the product labels and advertisements. Most influential media or social connection for the Finnish consumers were: researchers, family, and TV. During several discussion threads the consumers highlighted the role of "fact-based knowledge that should be presented in a way that it is easy to comprehend".

The last part of the framework, future consumer, focused on future concerns, willingness to adopt the bio-based products, future expectations, and consumption in the future. Finnish consumers expected to buy more bio-based products as well as products packaged in bio-based materials. Most motivation was aroused by financial incentives (e.g. discounts, tax reduction, etc.) and price reduction. Information campaigns and example from social media influencers or celebrities, did not improve consumers' motivation to choose bio-based alternatives, which is a rather distressing result from the brand owner perspective. On the other hand, the consumers highlighted the role of brands: that more information and transparency from their part was needed, and that could be presented e.g. by some certification in relation to environmental aspects. When requested in particular how the participants saw that environmental issues should be communicated, the participants underlined honesty, with no cover up stories & greenwashing, and all benefits and disadvantages on the table.

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When considering about the pros and cons of the bio-based products and materials, Finnish participants saw that the biggest advantages were: recyclable material, compostability, reducing of waste, fast degradability; environmental friendliness, less pollution and naturalness. About the biggest concerns, risks and negative impact related to bio-based products and materials, the participants raised: harm to the environment, intensive farming, manufacturing (cost of it, consumes more energy than non-bio-based alternatives, information about it: who, where, how is manufacturing the products), higher price and in some case, disinformation.

3.3. Structured survey on consumer drivers and motivations

3.3.1. Introduction to Consumer Survey Results

The structured survey on consumer drivers and motivations was conducted online between 14th and23rd December 2020 in Ireland and the Netherlands. In total there were 1000 respondents to the consumer survey, with 500 responses collected from each country. The target group were 18 – 75-year-old citizens and the sampling group was evenly spread across the criteria of age, gender and region (see Chapter 2.3 for details).

3.3.2. Consumer Survey Responses

Do you think that your individual consumer choices can have a positive impact on the environment?

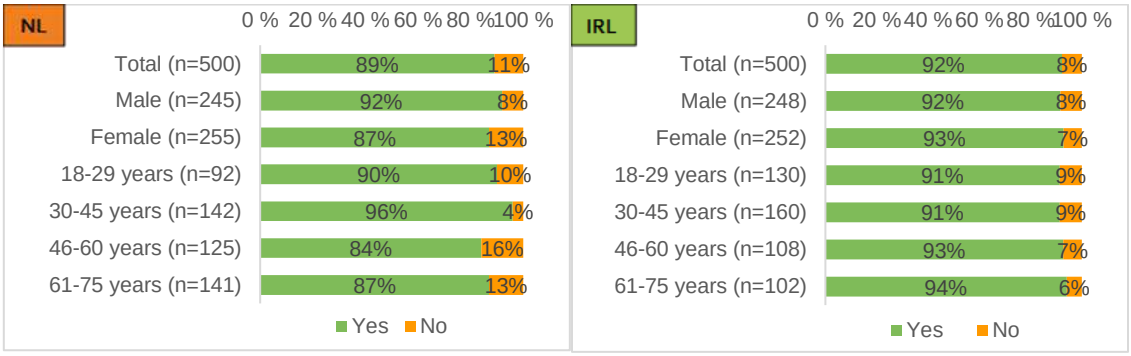

Figure 26. Consumer awareness on the impact on individual choices (NL & IRL).

The first question in the survey, looked at whether respondents felt that individual consumer choices can have a positive impact on the environment. **For Netherlands, 89.4 % (n=500) and for Ireland 92.3 % (n=500)** agree that their individual consumer choices can have a positive impact on the environment. The most positive respondents were Irish females with 93% believing that their consumer choices can have a positive impact on the environment, with only 87% of Dutch females feeling the same way. The average results are quite similar through the gender and age groups for Irish respondents, while there is more variance among Dutch respondents. The highest overall positive response among the Dutch respondents is in the 30-45 year old age category, with 96% having the opinion that their individual consumer choices can have a positive impact on the environment, with respondent in the age category of 46-60 having the least positive response among Dutch respondents, at 84%. A list of all responses is displayed in figure 26 above.

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Are you familiar with any bio-based companies or brands?

We then asked respondents to indicate if they were aware of any bio-based brands and to list up to three examples of such brand that they were familiar with. In response, **72.9 % of Irish respondents and 77.0 % of Dutch respondents** indicated that they do not know any bio-based brands. The respondents that indicated familiarity with bio-based brands provided the examples below, which have been captured via word cloud in figure 27 and figure 28. Bio-based brands listed among Irish consumers include; Ecover, Coillte, Airtricity, Body Shop and Johnson and Johnson, while Dutch respondents mentioned brands such as Body Shop, Alpro, Delta and Ikea.

Figure 27. Word cloud of bio-based companies or brands familiar to Irish respondents.

Figure 28. Word cloud of bio-based companies or brands familiar to Dutch respondents.

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Would you prefer buying bio-based products rather than fossil-based products?

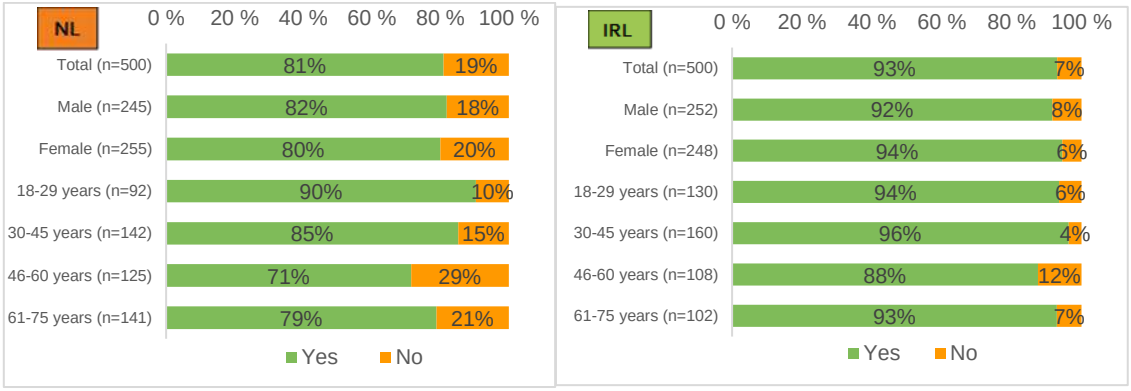
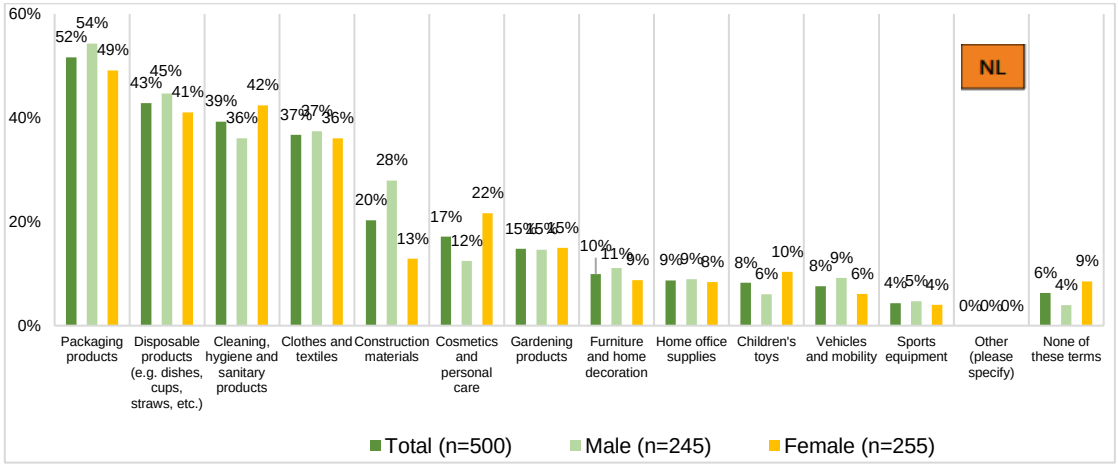


Figure 29. Consumer preference buying bio-based products rather than fossil-based products (NL & IRL).

Next, we looked at whether consumers would prefer to buy bio-based products as opposed to fossil-based. Irish consumers were much more positive about this with **93% of Irish respondents and 81%** of Dutch respondents indicating that they would prefer buying bio-based products rather than fossil-based. The average results for both males and females are relatively similar in both counties, with small variances seen by age. Overall, Irish people seem to have a much greater preference for bio-based products over fossil-based products, with respondents in the 30-45-year age category showing the greatest preference (96%). In the Netherlands, the 18- to 29-year-old age group are most likely to prefer buying bio-based over fossil-based (90%), with Dutch consumers in the 46–60-year-old age group least likely to indicate that they would prefer to buy bio-based products rather than fossil-based (71%). A full list of responses is shown in figure 29 above.

In which category are you most likely to buy bio-based products?



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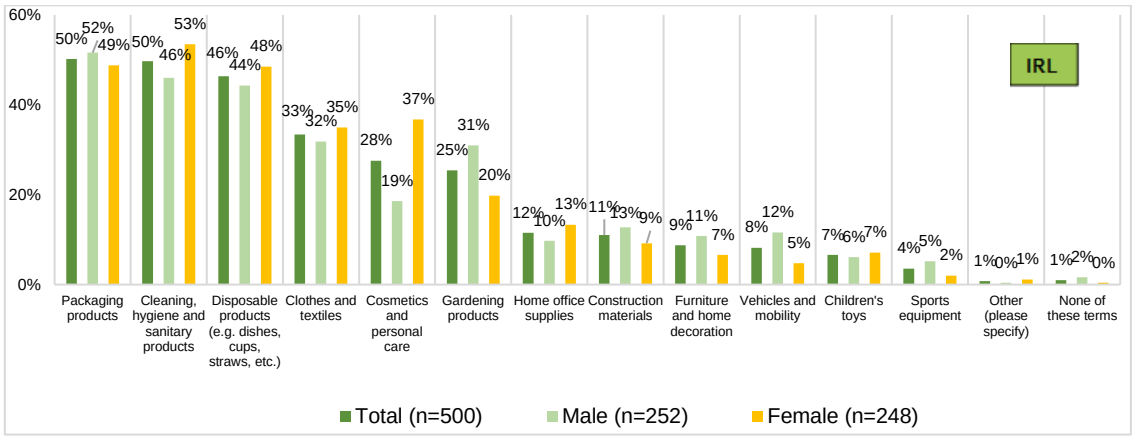

Figure 30. Consumer buying behaviour by product category (NL & IRL).

We then surveyed respondents regarding from which categories of products they are most likely to buy bio-based products. The top categories for both countries are very similar. Taking the results of both countries (Ireland and Netherlands) together (n=1000) the top 3 categories for consumer bio-based product demand are **50.9 % packaging products** (52 % NL, 50 % IRL), **44.6 % disposable products** such as dishes, cups and straws (43 % NL, 46 % IRL), and **44.5 % cleaning products** including hygiene and sanitary products (39 % NL, 50% IRL). Among other product categories of interest, Irish females are most likely of all groups surveyed to buy bio-based in the cosmetic and personal care category (37%), while Dutch men are most likely to buy bio-based construction materials (28%). Clothing and textiles is another major category for both countries (37% NL, 33% IRL). In the 61 to 75 age group in Ireland, 58% would purchase bio-based cleaning products while 34% of this group would purchase bio-based gardening products. In Netherlands, the 61 to 75 age group also indicated a preference for certain bio-based product categories; 49% would purchase bio-based cleaning and hygiene products, 42% bio-based clothes and textiles and23% bio-based construction materials. For Dutch responses, the 18-29-year olds are the most likely to buy bio-based cosmetic products (26%). Taking into account the results of both countries (n=1000), sports equipment (4.0 %), children's toys (7.4 %), and vehicles and mobility (7.9%) are the least likely categories that consumers indicated that they will buy bio-based products. A full list of responses is shown in figure 30 above.

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What could motivate you to buy bio-based products in the selected category/categories?

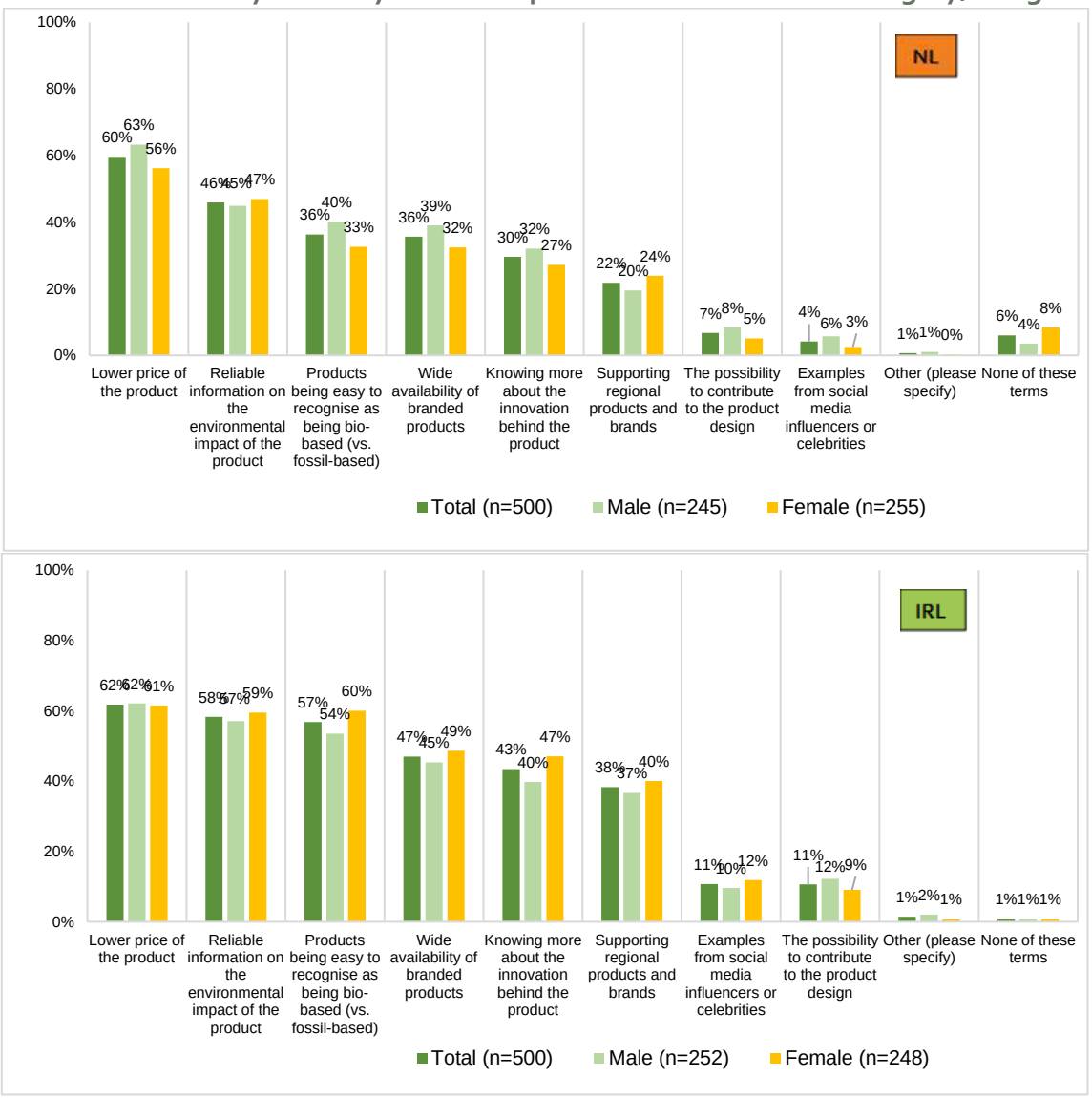

Figure 31. Consumer motivations for buying bio-based products (NL & IRL).

We then surveyed consumer respondents on the motivating factors for buying bio-based products in the selected categories. For both the Netherlands and Ireland, the consumer motivations to buy bio-based are very similar, with the highest categories being the same for both countries. Taking into account the combined responses from both countries (n=1000) the top five motivating categories are; lower price of the product (60.7 %), reliable information on the environmental impact of the product (52.1 %), products being easy to recognise as being bio-based compared to fossil-based (46.5 %), wide availability of branded products (41.3 %), knowing more about the innovation behind the product (36.5 %). While the overall order of motivating factors is largely consistent across both countries, a greater share of Irish respondents than Dutch respondents indicated positive responses

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to some of the motivating factors including; reliable information on the environmental impact of the product (58% IRL compared to 46% NL), products being easy to recognised as being bio-based vs. fossil-based (57% IRL compared to 36% NL), wide availability of branded products (47% IRL compared to 36% NL), and knowing more about the innovation behind a product (43% IRL compared to 30% NL). Supporting regional and local products and brands is also a greater motivating factor for Irish consumers (38 % IRL compared to 22% NL). A full list of responses is shown in figure 31 above. The variance in response by gender is quite small, with a slightly higher likelihood for males in both countries to be motivated by lower price. Irish females are the most likely group to be motivated by products which are recognisable as bio-based as opposed to fossil-based.

Which of the following terms would motivate you when choosing a product?

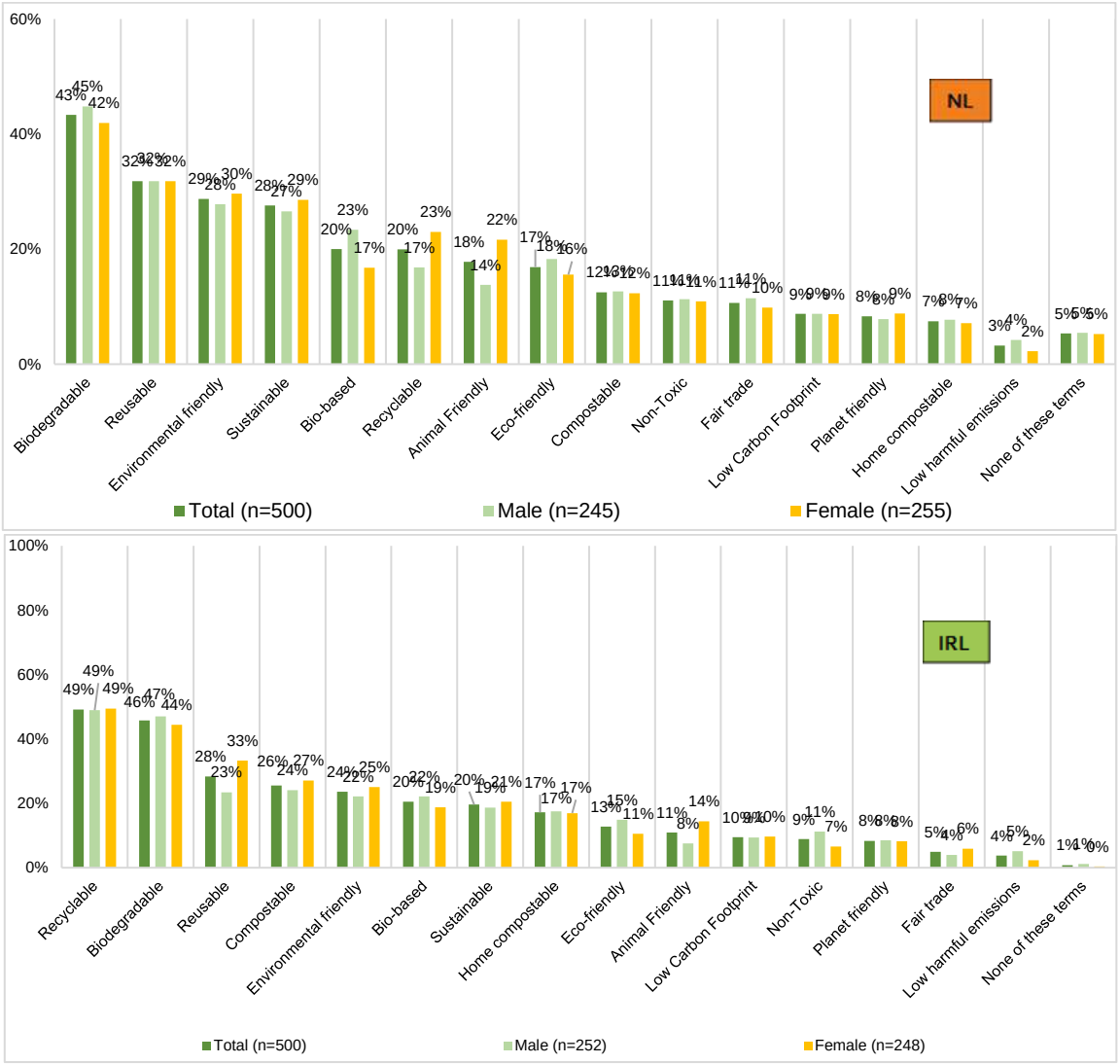

Figure 32. Product terms that would motivate consumer (NL & IRL).

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Next, we asked respondents to indicate which sustainability terms could motivate them when choosing a product. Taking into account the combined results of both countries (n=1000) the top three motivating terms for consumers to purchase products are; **biodegradable** (44.5 %), **recyclable** (34.6 %) and **reusable** (30.1%). There is some variability in the most popular motivating term for consumers in the Netherlands and Ireland. For Dutch consumers 43% chose biodegradable, 32% chose reusable and 29% chose environmentally friendly as the top motivating terms. The top motivating terms for Irish consumers when choosing a product are overwhelmingly recyclable (49 %) and biodegradable (46 %) quite far ahead of reusable at 28%. An equal share of Dutch and Irish consumers (20%) indicated that bio-based was a term that could motivate them, while compostable fares much better among Irish consumers (26% IRL compared to 12% NL). There are only small variances in gender choices in both countries.

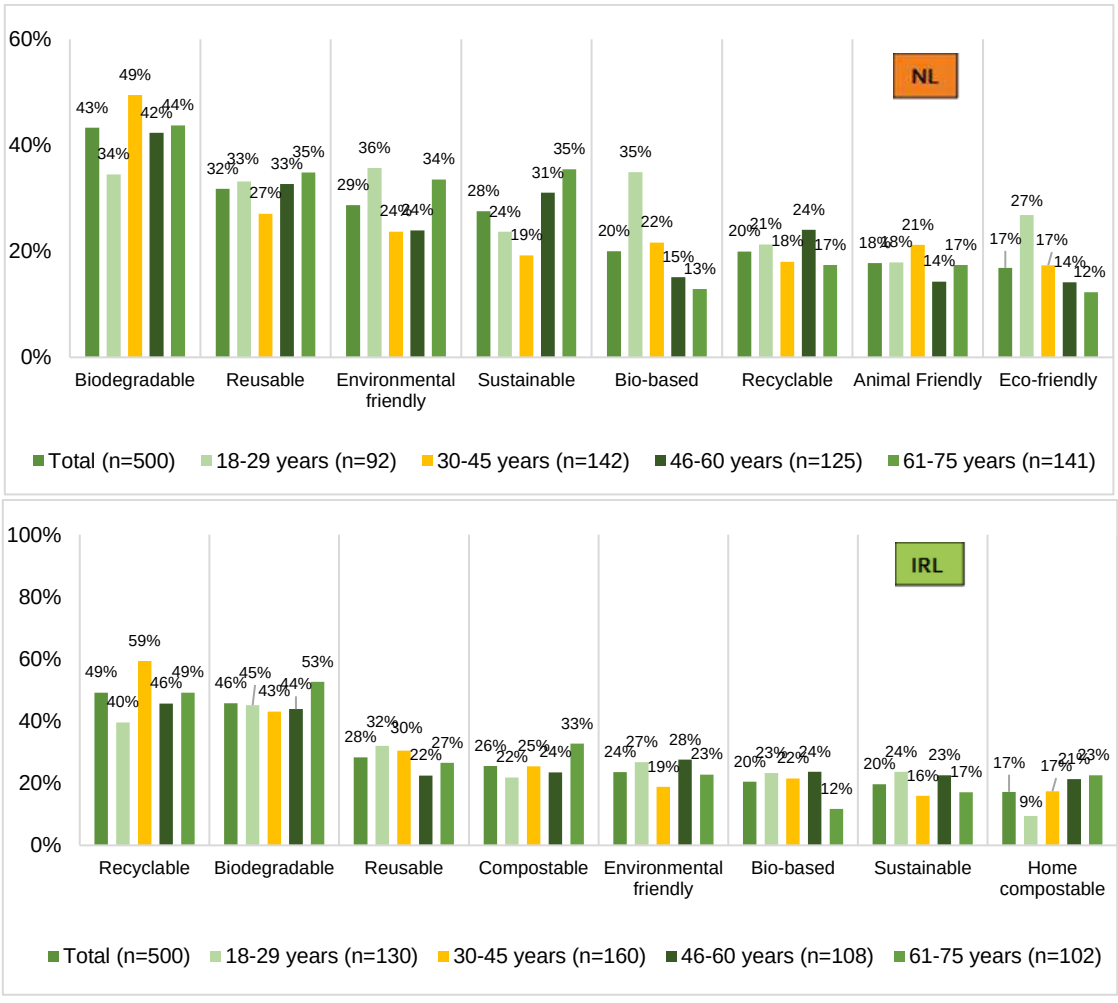

Figure 33. Motivating purchase terms for consumers by age group (NL & IRL).

Looking at how these sustainability terms motivated consumers from different age categories, we can see some variances. Notably the term bio-based is a motivating term for a high proportion of 18-

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29-year olds in the Netherlands (at 25%, significantly higher than any of the other surveyed groups), with eco-friendly also performing best amongst this cohort (27%). 30-45-year olds from the Netherlands (49%) and 61-75-year olds from Ireland (53%) were most likely to be motivated by the term biodegradable. In Ireland 18-29-year olds were least likely to be motivated by the term home compostable (9%).

Do you think that in the future you are going to buy more bio-based products in the following category/categories?

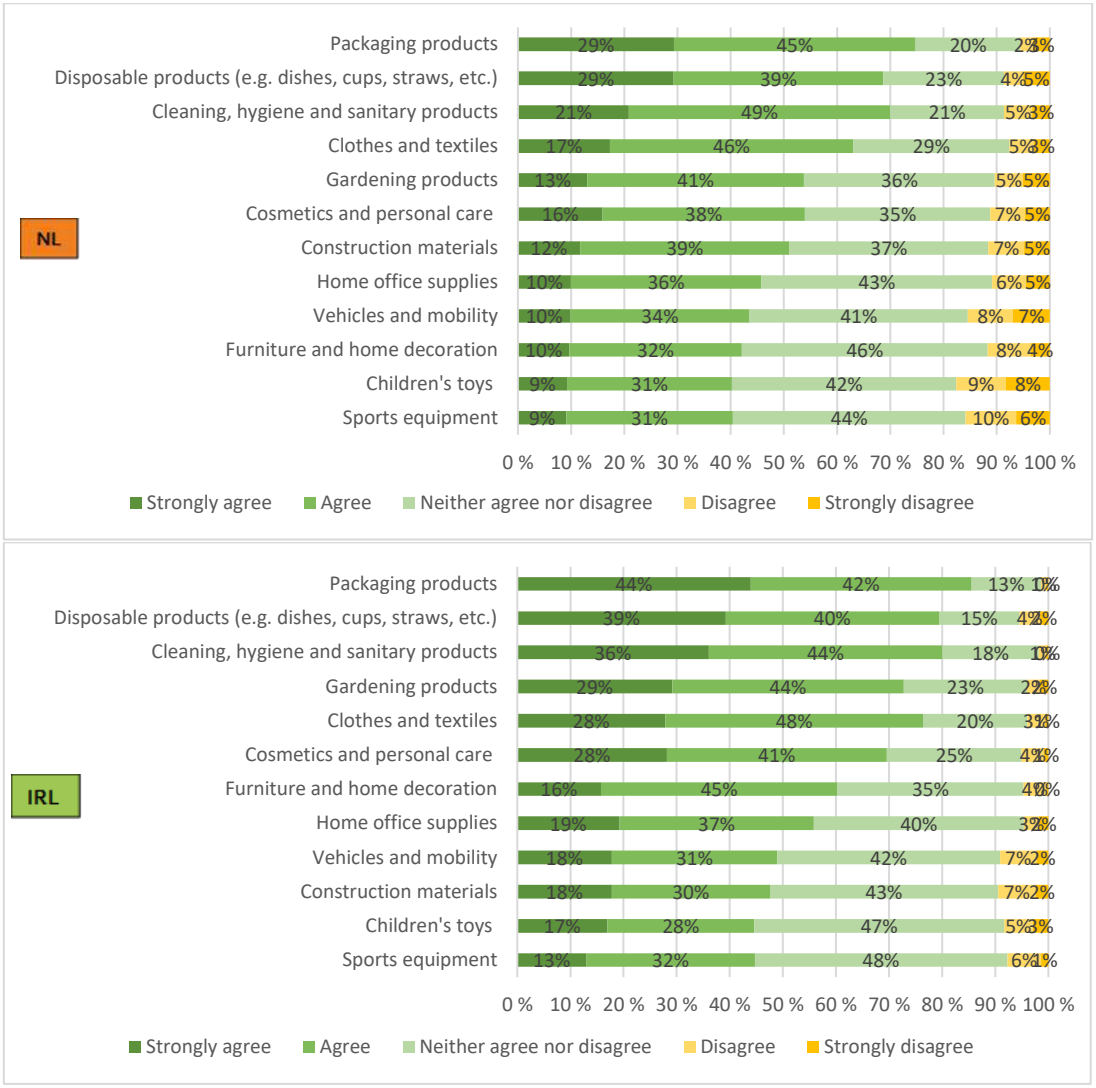

Figure 34. Willingness to purchase more bio-based products in the future by category (NL & IRL).

We then surveyed consumers to see if they expect to buy more bio-based products in specific product categories in the future. This gives us product specific responses to the future consumer demand for bio-based products. Overall, consumers trend towards the same bio-based products in both countries with a few variations. Irish consumers indicate that they expect (indicating either "strongly agree" or

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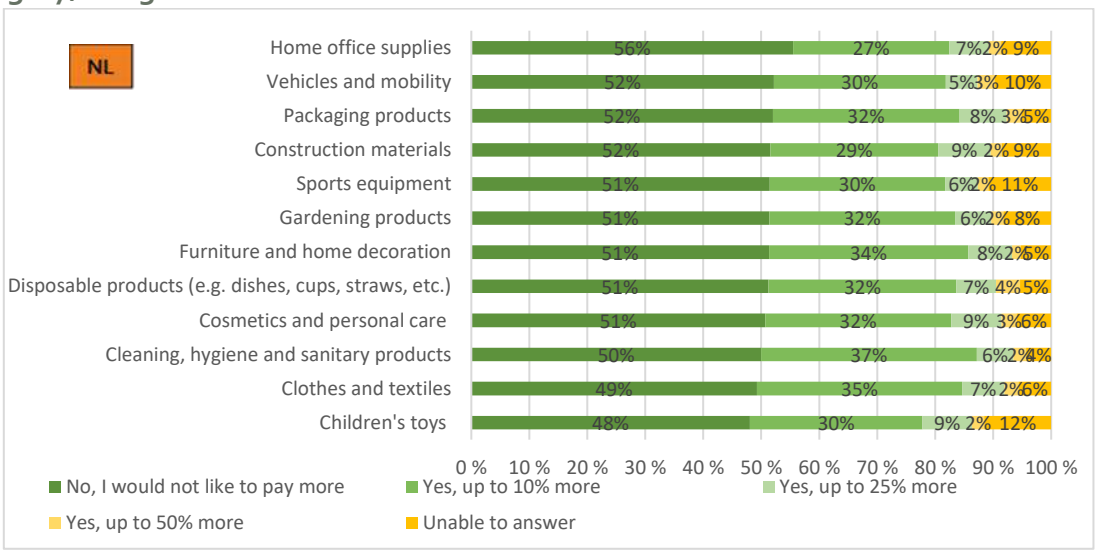
"agree") to buy more bio-based products in the following categories; Packaging products, disposable products, cleaning, hygiene and sanitary products, gardening products, clothes and textiles, cosmetics and personal care, furniture and home decoration and home and office supplies. For Irish consumers, packaging products was the top product category option, with 44% and 42% of consumers indicating that they "strongly agree" or "agree" respectively, that they will buy more bio-based packaging in future. Disposable products (39% strongly agree, 40% agree) and cleaning hygiene and sanitary products (36% strongly agree, 44% agree) also perform strongly. Dutch consumers indicate that they expect to buy more bio-based products in the following categories: packaging products, disposable products, cleaning hygiene and sanitary products, clothes and textiles, gardening products, cosmetics and personal care and construction materials. Again, packaging products was the top option for Dutch consumers (29% strongly agree, 45% agree), with disposable products (29% strongly agree, 39% agree) and cleaning, hygiene and sanitary products (21% strongly agree, 49% agree) also performing well.

Would you consider to pay more for bio-based products in the following category/categories?



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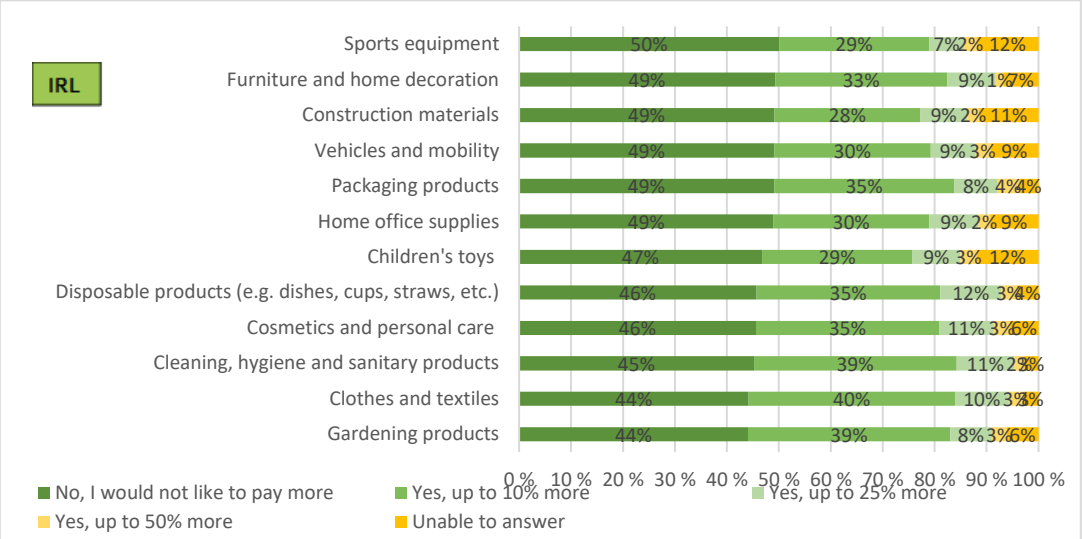

Figure 35. Consumer willingness to pay more by category of products (NL & IRL).

Next, we surveyed participants on whether they would be willing to pay a "green premium" for a bio-based product in different product categories, and if so, to indicate the amount extra that they would be willing to pay. The response was quite similar across both countries, with the same categories receiving the highest value consideration where consumers would be willing to pay up to 25%-50% extra, which includes disposable products (15% willing to pay up to 25%-50% extra in IRL, and 11% in NL) and cosmetics and personal care products (14% willing to pay up to 25%-50% extra in IRL and 12% in NL). In Netherlands there was no product category in which over 50% of consumer indicated that they would be willing to pay extra for a bio-based product, however the categories that Dutch consumers were most likely to pay extra include; cleaning, hygiene and sanitary products (45% would pay extra), cosmetics and personal care (44%) textiles (44%) and furniture (44%). In Ireland there was a higher degree of willingness overall among consumers to pay extra for bio-based products with 50% or more of consumers indicating that they would pay extra for bio-based products in the following categories of products; clothes and textiles (53%), cleaning, hygiene and sanitary products (52%), disposable products (50%) and gardening products (50%).

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Which are most important areas when you decide for a specific product brand?

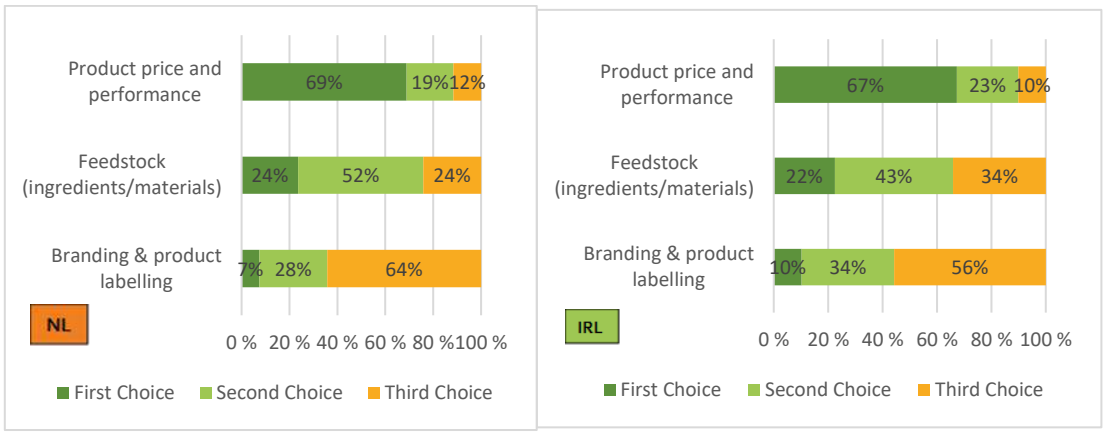

Figure 36. Consumer reasons for purchasing a certain brand (NL & IRL).

Next, we asked consumers to indicate the most important of 3 criteria when deciding on a specific product. These criteria include (i) product price and performance, (ii) feedstock (ingredients/materials) and (iii) branding and product labelling. From the responses, the prioritization of these criteria was the same in both countries, with product price and performance (first choice among 69% in NL and 67% in IRL), coming out as the top choice followed by feedstock (first choice among 24% in NL and 22% in IRL) and branding and product labelling (first choice among 7% in NL and 10% in IRL). Overall, there was a bit more emphasis on branding & product labelling among Irish consumers (with 10% as first choice, 34% as second) than among Dutch consumers (7% as first choice, 28% as second).

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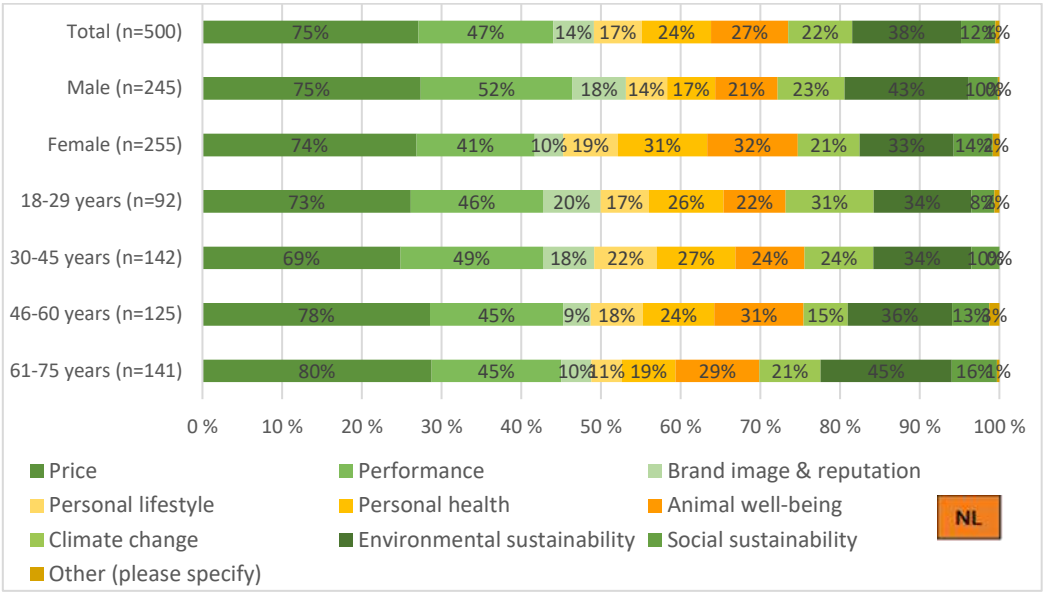
What are the most important factors that help you make a choice between similar products?



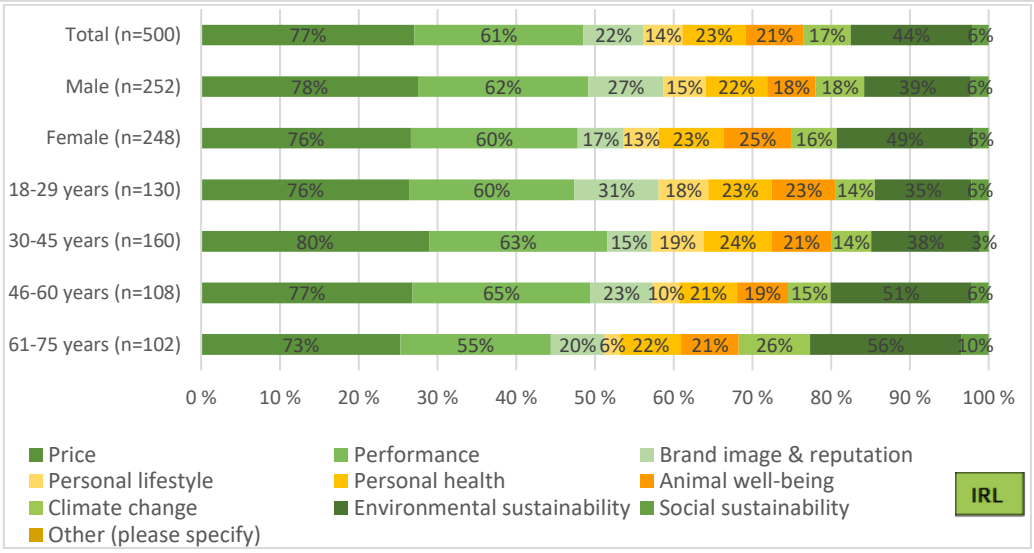


Figure 37. Consumer deciding factors between different products (NL & IRL).

Finally, we asked consumers in both countries to indicate the factors which help them to choose between similar products. Taking into account the combined results from both countries, price is the most important factor that helps the consumer make a choice between similar products, with 75.9% of the 1000 consumers surveyed indicating price as the most important factor. Performance (53.8%, n=1000) and environmental sustainability (40.8%, n=1000) are the next most important factors for consumers when choosing between similar products. While a similar percentage of Dutch and Irish consumers indicated price to be the most important factor in both countries (75% in NL compared to 77% in IRL) Irish consumers placed more importance on the performance of a product (61 % IRL

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compared to 47 % NL) as well as brand image and reputation (22% IRL compared to 14% NL). Environmental sustainability was also an important factor for consumers in both countries (44% IRL compared to 38% NL). While, in both countries' respondents in the 61-75 years category placed a greater emphasis on environmental sustainability as an important factor (56% IRL compared with 45% NL).

3.3.3. Consumer survey discussion and analysis

The results of our structured survey provide a unique insight into the consumer perspectives in relation to bio-based products in Ireland and the Netherlands. While some previous work has been undertaken to assess consumer acceptance of bio-based products in the Netherlands through the Open-BIO project, this represents a first such study in Ireland. This survey also takes into account the views of different demographic groups within both countries (gender, age etc.). Overall, the results show a slightly more positive response to bio-based products among Irish consumers than among consumers in the Netherlands, evidenced by the greater share of Irish consumers who would prefer buying bio-based products as opposed to fossil-based. Irish consumers also have a slightly more positive impression that their consumer choice can be beneficial for the environment. Overall respondents in both countries are most likely to buy bio-based products in the same top selected categories which include packaging products, disposable products and cleaning, hygiene and sanitary products. But there are variances in other categories lower on the list, with bio-based construction materials more popular among Dutch consumers and bio-based cosmetics and personal care products, as well as bio-based gardening products more popular among Irish consumers. The order of motivational criteria for buying bio-based products was almost the same in both counties, with lower price of product the top option for each country. However, the response rate of Irish consumers to many of the motivational criteria (including reliable information on environmental impact of the product, product being easy to recognise as bio-based versus fossil-based, wide availability of branded products, knowing more about the innovation behind the product, supporting regional products and brands) was higher than among the Dutch respondents. Biodegradable was the term most likely to motivate Dutch consumers when choosing a product, with recyclable followed by biodegradable the most likely term for Irish consumers. Consumers in both countries indicate that they are likely to buy bio-based products in similar product categories which include packaging products, disposable products and cleaning, hygiene and sanitary products. Looking at whether Irish or Dutch consumers would be willing to pay a green premium for bio-based products in different categories, overall, Irish consumers were slightly more willing to pay extra for bio-based products. In relation to a large premium, between 25%-50%, this was reserved for the same product categories in both regions (disposable products, and cosmetics and personal care). Consumer respondents in both countries indicate that product price and performance is the most important criteria for deciding on a specific brand, followed in both countries by feedstock or ingredients and then branding and product labelling. Looking at the most important factors for helping consumers to choose between products, a similar percentage of Dutch and Irish consumers indicated price to be the most important factor in both countries with Irish consumers placing more importance on the performance of a product as well as brand image and reputation. Environmental sustainability was also an important factor for consumers in both countries.

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When observing trends in gender-based responses, we can see that Irish females stand out as the cohort most likely indicate that they prefer buying bio-based rather than fossil-based products and are also the most likely to believe that their individual consumer choices can have a positive impact on the environment. Dutch males are most likely to buy bio-based construction materials with Irish females most likely to buy bio-based cosmetics and personal care products as well as cleaning, hygiene and sanitary products. In both countries male respondents are more likely to be motivated by lower cost of products. In Ireland, females are more likely than males to be motivated by products that are easy to recognize as bio-based versus fossil-based, while in the Netherlands the opposite is the case. Dutch females and Irish females are more motivated than their male counterparts to support regional products and brands.

Finally looking at trends which emerge associated with age categories, we see that Dutch respondents in the 30-45-year old age group are most likely of all age groups to believe that their consumer choices can have a positive impact on the environment, while in Ireland the 61-75 age group are most likely to agree with this belief. Irish consumers in the 30-45 age group are most likely to prefer buying bio-based products rather than fossil-based products followed by 18-29-year olds and 61-75-year olds. In the Netherlands 18-29-year olds are most likely to prefer buying bio-based rather than fossil-based. Notably 40-60-year olds in both countries are the least likely to prefer buying bio-based rather than fossil-based. When looking at the most important criteria for choosing between similar products, the largest age group to indicate price as the primary factor were 61-75-year olds in the Netherlands, while in Ireland more 30-45-year-old respondents indicated price than any other age group. Environmental sustainability was indicated to be an important factor among the 61-75-year-old age group in both countries. Climate change was selected as an important factor most often by Dutch consumers in the 18-29 category and Irish consumers in the 61-75 category, while social sustainability was indicated most often by the 18-29-year-old age category in both countries.

4 CONCLUSIONS

The social research aimed to study drivers and motivations of consumers in European countries (more particularly Finland, Ireland and Netherlands) as regards to bio-based materials, products and brands. A mixed methods including both qualitative and quantitative were used. The nature and set-up of the research components discussed in this document are highly different. In the qualitative focus groups held in Finland, in-depth discussions were organised with 50 consumers. In the quantitative structured surveys held in Ireland and Netherlands, 500 consumers per country were involved, and key findings from the Finnish qualitative consumer survey were validated. All the three surveys built on the findings of the desk-based literature research that is also covered in this report.

Detailed discussion of the findings of each research component are presented at the end of sections 3.1, 3.2 and 3.3.

To collect further views of stakeholders on solutions to raising consumer acceptance and stimulating the purchase of bio-based products, selected outcomes of the surveys were presented at four

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regional workshops (organised online in the second half of January 2021) and at a pan-European workshop (held online on 17 February 2021). Results of this engagement will be documented in BIOSWITCH deliverable D1.4 Summary of results of regional and pan-European workshops.

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ANNEX 1. CONTENT OF THE ONLINE FOCUS GROUP DISCUSSION

WELCOME

Welcome to take part to the online discussion, where we would like to hear your viewpoint on bio-based products and brands, and the main incentives and key barriers to choose them.
The official interpretation of the term bio-based product is:

- The term bio-based product refers to products wholly or partly derived from biomass, such as plants, trees or animals (the biomass can have undergone physical, chemical or biological treatment). (European committee for standardization).

The online discussion is part of BIOSWITCH project (https://bioswitch.eu/) aiming to ensure the continued uptake of the outputs of the bio-based industry by encouraging brand owners to adopt it as a core value. The project is being implemented in co-operation with partners from Finland, Netherlands, Ireland, Spain, Belgium, and Denmark. The project is funded by BBI JU (https://www.bbi-europe.eu/).

DEMOGRAPHIC INFORMATION

1. Gender
   - Man
   - Woman
   - Other
   - I do not want to respond

2. Year of birth (age segments)

3. Country of residence / City

4. Do you live…
   - Alone
   - With my partner or spouse
   - With my partner or spouse and kid(s)
   - With my kid(s)
   - With my parent(s)
   - Other…?

   (allow two options)

5. Are you…
   - A student
   - Working full time
   - Working part time
   - An entrepreneur
   - Unemployed or laid off

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- At home with kids
- Other…?

6. Who is responsible for shopping consumables in your household?
   - I am the main decision maker of the household
   - I am the joint decision maker of the household
   - Someone else in my household is the main decision maker

QUESTIONS

Consumer awareness

7. Have you heard about bio-based products and/or brands before?
   - I am completely aware about them - I have never heard about them before

   (five-option Likert scale/individual answer)

8. Are the following two definitions clear to you:

   Definition 1: The term bio-based product refers to products wholly or partly derived from biomass, such as plants, trees or animals (the biomass can have undergone physical, chemical or biological treatment). (European committee for standardization).

   Definition 2: The term bio-based product refers to commercial or industrial products (other than food or feed) which are composed, in whole or in significant part, of biological products, including renewable domestic agricultural materials (e.g., plant, animal, and aquatic materials), forestry materials, intermediate materials, or feedstocks. As opposite, bio-based materials exclude motor vehicle fuels, heating oil, or electricity produced from biomass. (USDA BioPreferred® Program)

   I completely understand the definition - I do not understand what the definition means in practice (five-option Likert scale)
   - Please, specify your answer (open-ended question/open for all)

9. What are the first specific types of words that come to you mind when you think of the term 'bio-based product? Define three (3) words. (word cloud/open for all)

   "Organic", "Natural" and "Ecological" were the first word-associations relating to bio-based products. What thoughts those words arise in the context of bio-based products?

10. Are you familiar with any bio-based companies or brands? Please, define those and share your experience with others. (open-ended question/open for all)

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Examples and consumer acceptance

In the following will be examples of some brands in different sectors and how they exploit bio-based materials. Please, read the short explanation of each brand
and then answer to the specific questions related to the brand and product sector in general.

FAZER (food)
Fazer focuses on reducing emissions and the amount of food waste, develops more and more sustainable packaging, and increases the use of plant-based ingredients in its products. Now Fazer has brought pralines in a compostable, microplastic-free box to Christmas sales.

11. Please, estimate the statements below: Totally agree - Totally disagree (five-option Likert scale)
    - I trust the Fazer brand and their work towards bio-based future
    - The Fazer brand refers to sustainability
    - I think that this is only green washing with no real effect on sustainability

    Please remark that the following questions are targeted for food products in general.
    - I would like to buy food products in bio-based packages
    - I already prefer to buy food products packed or wrapped in bio-based alternatives
    - Bio-based packaging materials are environmentally friendly
    - Bio-based packaging materials are less polluting
    - Bio-based packaging materials are easy to recycle
    - Bio-based packaging is suitable mainly for high quality products
    - Bio-based packaging is suitable for low quality products
    - I would pay more about the food products packed in bio-based alternatives
    - I assume that bio-based packaging materials do not affect the taste of the food inside

    (individual answer/outcome graph available for all)

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12. What other food and beverage products you would like to see packaged in bio-based packages (you are able to choose several options)
    - vegetables
    - fruit
    - diary (like milk)
    - juice
    - meat
    - pre-cooked meals
    - other, what?

    (individual answer/outcome graph available for all)

13. Open discussion about Fazer and bio-based food packaging products
    (open discussion thread)

LUMENE (cosmetics)
Lumene has replaced the exfoliating rinse-off plastic microbeads with salt, and silica sand-like ingredients. Many of Lumene products are also developed from by-products of the food and forest industries. They aim to replace packaging materials to bio-based or biodegradable material.

14. Please, estimate the statements below: Totally agree - Totally disagree (five-option Likert scale)
    - I trust the Lumene brand and their work towards bio-based future
    - The Lumene brand refers to sustainability
    - I think this is only green washing with no real effect on sustainability

    Please remark that the following questions are targeted for cosmetics in general.
    - I would like to buy cosmetics produced wholly or partly from bio-based materials
    - I already prefer to buy cosmetics produced wholly or partly from bio-based materials
    - Bio-based cosmetics are environmentally friendly
    - Bio-based cosmetics are less polluting
    - Bio-based cosmetics are easy to recycle

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- Bio-based cosmetics are high quality products
- Bio-based cosmetics are low quality products
- I could pay more about bio-based cosmetics
- I assume that bio-based garments are safer for skin and health

(individual answer/outcome graph available for all?)

15. Open discussion about Lumene brand and bio-based cosmetics
    (open discussion thread)

NESTLÉ

Nestlé aims to develop 100% bio-based bottles. Focusing on waste biomass such as cardboard and sawdust, the goal is to bring Origin Materials' technology to commercial scale, making bio-based PET accessible for the entire beverage industry.

16. Please, estimate the statements below: Totally agree - Totally disagree (five-option Likert scale)
    - I trust the Nestle brand and their work towards bio-based future
    - The Nestle brand refers to sustainability
    - I think that this is only green washing with no real effect on sustainability

    Please remark that the following questions are targeted for beverage and food products in general.
    - I would like to buy beverage in bio-based containers
    - I already prefer to buy beverage packed in bio-based alternatives
    - Bio-based packaging materials are environmentally friendly
    - Bio-based packaging materials are less polluting
    - Bio-based packaging materials are easy to recycle
    - Bio-based packaging is suitable mainly for high quality products
    - Bio-based packaging is suitable for low quality products
    - I would pay more about the beverage packed in bio-based alternatives
    - I assume that bio-based packaging materials do not affect the taste of the beverage inside

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(individual answer/outcome graph available for all)

17. Open discussion about Nestlé and bio-based beverage products
    (open discussion thread)

ADIDAS

Adidas aims to produce shoes from 100% biodegradable material created from biopolymers which aims to replicate natural silk. The company has also pledged to eliminate virgin plastic from its supply chain.

18. Please, estimate the statements below: Totally agree - Totally disagree (five-option Likert scale)
    - I trust the Adidas brand and their work towards bio-based future
    - The Adidas brand refers to sustainability
    - I think this is only green washing with no real effect on sustainability

    Please remark that the following questions are targeted for textiles and clothes in general.
    - I would like to buy textiles and clothes produced wholly or partly from bio-based materials
    - I already prefer to buy clothes produced wholly or partly from bio-based materials
    - Bio-based clothes are environmentally friendly
    - Bio-based clothes are less polluting
    - Bio-based clothes are easy to recycle
    - Bio-based clothes are high quality products
    - Bio-based clothes are low quality products
    - I could pay more about bio-based clothes
    - I assume that bio-based garments are safer for skin and health

    (individual answer/outcome graph available for all?)

19. Open discussion about Adidas brand and bio-based textiles and garments
    (open discussion thread)

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What clothes, garments and accessories would be suitable for exploiting the bio-based alternatives?

LEGO

Recently called the 'world's most powerful brand', toy manufacturer LEGO is looking for a bio-based replacement for its iconic plastic bricks. LEGO is developing sustainable raw materials to manufacture elements, as well as packaging materials.

20. Please, estimate the statements below: Totally agree - Totally disagree (five-option Likert scale)
    - I trust the LEGO brand and their work towards bio-based future
    - The LEGO brand refers to sustainability
    - I think this is only green washing with no real effect on sustainability

    Please remark that the following questions are targeted for toys in general.
    - I would like to buy toys produced from bio-based materials
    - I already prefer to buy toys produced from bio-based materials
    - Bio-based toys are environmentally friendly
    - Bio-based toys are less polluting
    - Bio-based toys are easy to recycle
    - Bio-based toys are high quality products
    - Bio-based toys are low quality products
    - I could pay more about bio-based toys
    - I assume that bio-based toys are safer for children

    (individual answer/outcome graph available for all?)

21. Open discussion about Lego and bio-based toys. What play products (toys and games) are in particularly suitable for exploiting the bio-based alternatives?
    (open discussion thread)

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Consumption Habits

22. When I shop (in shopping malls, grocery stores, online stores, etc) …

(Totally agree - Somehow agree - Not agree nor disagree - Somehow disagree - Totally disagree)

- I try to find bio-based products
- I am usually looking for certain brands
- I compare products and prefer the bio-based alternatives
- I rely on trusted brands to provide me the bio-based solutions
- It is easy to find bio-based products
- Advertisements related to bio-based products lead me to find them
- I find the bio-based related communication to be clear
- I find the product labels easy to read and understandable

(individual answer/outcome graph available for all)

23. Open discussion about the shopping habits, bio-based products and brands, and the communication about the bio-based alternatives.
    (open discussion thread)

23. When choosing between several products, what makes you decide for a specific brand/company?
    (open discussion thread)

24. In which sector are you most likely to buy bio-based products? (you are able to choose up to three options)
    - Cosmetics and personal care
    - Cleaning, hygiene and sanitary products
    - Clothing and textiles
    - Packaging products
    - Disposable products (e.g. dishes, cups, straws, etc.)
    - Children's toys
    - Furniture and home decoration
    - Construction materials
    - Gardening products
    - Vehicles and mobility
    - Sports equipment
    - Other, what?

    (individual answer/outcome graph available for all)

25. Why did you select these alternatives? Open discussion about the bio-based product sectors.
    (open discussion thread)

26. What would be the most influential media or social connection from which you would like to receive or share information about the bio-based products? (you are able to choose several options)

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- Family
- Friends
- Colleagues from the workplace
- Researchers
- TV
- Social media networks
- Influencers
- Brands
- Shopping centres
- Service companies
- Magazines/journals
- Other media
- Other, what?

(individual answer/outcome graph available for all)

27. What made you to choose that media or social connection?
    (open discussion thread)

28. Where else would you like to receive more information about bio-based products?

29. Could you share an example about sustainable marketing that you have experienced particularly attractive?
    (open discussion thread)

Consumption in the future

30. Do you think that you are going to buy more bio-based products in the future?
    (five-option Likert scale: totally agree - totally disagree) (individual answer/outcome graph available for all)

31. Do you think that you will buy more products packaged in bio-based materials in the future?
    (five-option Likert scale: totally agree - totally disagree) (individual answer/outcome graph available for all)

32. What would specifically motivate you to buy bio-based products? (you are able to choose several options)
    - Information campaigns
    - Clear information on product's end-life
    - Financial incentives (e.g. discounts, tax reduction, etc)
    - Financial disincentives on fossil-based products (e.g. plastic-tax, etc)
    - More information on bio-based products performance
    - Clear information on the whole value chain
    - In food products: information on the feedstock used
    - Information about the product carbon footprint or handprint

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- Example from social media influencers or celebrities
- Higher adoption by brands
- The possibility to contribute on the product design
- Price reduction
- Making them more recognisable (in particular, respect to the fossil-based ones)
- Higher products availability in the malls, online stores, etc.
- Knowing more about the innovation behind the product
- Supporting regional products and brands

(individual answer/outcome graph available for all)

33. Open discussion about the incentives and expectations
(open discussion thread)

34. Do you see bio-based materials as a solution to our environmental challenges in the future?
(open discussion thread)

35. How the environmental issues should be communicated to the consumers?
(open discussion thread)

- What are the biggest advantages of bio-based products and materials?

(open discussion thread)

37. Open discussion about the positive impact
(open discussion thread)

38. What are the biggest concerns or risks related to bio-based products and materials?

39. Open discussion about the concerns, risks and negative impact
(open discussion thread)

39. Has the covid-19 situation affected so that you make more cautious discussions in regards to bio-based products?
(open discussion thread)

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