D1.1 – REPORT ON EUROPEAN AND REGIONAL ANALYSIS OF THE NEEDS, RISKS AND MOTIVATIONS OF BRAND OWNERS SWITCHING TO BIO-BASED APPROACHES

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This document is the BIOSWITCH project Dissemination and Communication Plan (contract no. 887727) corresponding to D1.1. (M5) led by ITT. This document describes Needs, Risks and Motivations of Brand Owners switching to Bio-based using a Pan-Eu and Regional Analysis by the BIOSWITCH project.

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Executive Summary

This report explores the needs, risks and motivations of brand owners switching to bio-based products. Brand owners can play a leading role in supporting market acceleration of bio-based products, allowing access for bio-based industries to bulk markets. Brands can also be a key influencer of consumers choosing new products. In order to support a greater brand owner transition to bio-based products, and thereby increase the overall demand for bio-based products, it is vital to understand their perspectives on bio-based ingredients, products or packaging. To this end, we need to understand their current interest in bio-based products, as well as understanding the factors that drive them or roadblocks in their way, when it comes to choosing bio-based product products.

BIOSWITCH works with brand owners by developing tools, which can support their transition to bio-based alternatives. In order to inform this work, the BIOSWITCH team have been analysing the needs, risks and motivations of brand owners in switching to bio-based. To achieve this, the project has combined a desk-based literature review (see Chapter 3) which identifies and analyses prior relevant studies, with additional primary research based on direct engagement with brand owners. This primary research was in the form of a survey with brand owners across EU, complemented by a small series of interviews with brands across four regions, Belgium, Denmark, Finland and Spain. The results of the surveys and interviews are summarized in Chapter 4, with analysis of the main trends and findings in Chapter 5.

Overall, brand owners participating in our analysis, appear to have a largely positive perspective with regards to bio-based ingredients, products and packaging with 85% of brands who don't currently include bio-based ingredients in their brands, and 95% of brands who don't currently use bio-based packaging, interested in doing so in future. Overall, there is a positive outlook regarding future customer demand for bio-based products, with almost 75% of brands indicating strong to moderate growth in their customer demand for bio-based products. The study found that high cost and uncertainty around functionality were the main barriers to uptake of bio-based products among brand owners, while poor functionality of bio-based products was indicated as the main risk followed by incompatibility with existing processes.

On a regional level it was clear that there were quite some variations between the perspectives of regional brand owners. Overall, Spanish brands view high cost as a key barrier and seem more uncertain around the extent of customer demand for bio-based products, indicating that more cost competitive products will help to increase this demand. Meeting regulations is also a key motivating factor for Spanish brands switching to bio-based alternatives. Finnish brands, in contrast, are more certain around existing customer demand and anticipate further customer growth. They do however, express some concerns over the functionality and ease of integrating bio-based ingredients/products within their production lines and products. Cost is also somewhat of a barrier for Finnish brands. Danish brands expect strong-moderate growth in demand for bio-based products among their customers and meeting this customer demand is a key motivating factor. High cost seemed least likely to represent an issue for Danish brands compared with other regions. The requirement for products with a sound functional performance appears to be one the main criteria for Danish brands, with improved environmental performance appearing as another key requirement. Finally, in the case of Belgian brands, there is less certainty that growth in customer demand for bio-based

ingredients/products will be strong over the next 5 years. At the same time, some Belgian brands do seem to value the potential for green marketing which could be provided by bio-based products or packaging. Cost is an important aspect for Belgian brand owners, with other important factors including feedstock or ingredient supply reliability, functional and environmental performance of products, as well as compatibility with existing processes.

Overall, the work contained within this report provides a starting platform to understand the perspectives of brand owners when it comes to switching to bio-based ingredients, products and packaging. The results of this analysis will feed into future BIOSWITCH co-creation activities among brand owners, consumers and other stakeholders to develop solutions to mitigating these challenges and supporting uptake of bio-based products among brand owners. The information will also help to inform the BIOSWITCH tools which will be developed over the coming months to support brand owners on the transition to bio-based product integration.

CONTENTS

ACRONYMS AND ABBREVIATIONS 8
LIST OF TABLES 8
LIST OF FIGURES 9

1 INTRODUCTION 10

1.1 Introduction to BIOSWITCH and the framework development 10

2 METHODOLOGY 12

3 LITERATURE REVIEW 166

3.1 Literature Review Introduction 166

3.2 Literature Research Findings 222
3.2.1 Brand Owners 222
3.2.2 Businesses in broadest sense 244
3.2.3 Citizens' and Consumers' Perceptions 30

3.3 Take home messages from literature review 399

4 SURVEY FINDINGS 411

4.1 Introduction to Survey Results 411
4.1.1 Brand Owner Background 411
4.1.2 Brand Owner Background with regards to Bio-based Products 422
4.1.3 Brand Owner Risks, Barriers and Needs with regards to Bio-based Product Uptake 477
4.1.4 Brand Owner Motivations and Incentives with regards to Bio-based Product Uptake 522
4.1.5 BIOSWITCH Cooperation Questions 555

5 DISCUSSION 577

5.1 Analysis of Pan-EU Brand Owner Survey Results 577
5.1.1 Prioritized applications 577
5.1.2 Barriers to bio-based ingredient/product uptake 577
5.1.3 Market growth barriers 588
5.1.4 Risks Associated with bio-based product uptake 588
5.1.5 Specific needs of brand owners switching to bio-based 588
5.1.6 Motivations of brand owners switching to bio-based 599
5.1.7 Drivers for growth 599

5.2 Inter-regional Analysis of Brand Interview Responses 60
5.2.1 Regional brand owner respondent background 61
5.2.2 Prioritized products 622
5.2.3 Barriers to bio-based product uptake 622

5.2.4 Motivations of brand owners switching to bio-based 633
5.2.5 Drivers for growth..... 633
5.2.6 Emerging regional trends..... 644
5.2.7 Outlook.....64

6 CONCLUSIONS 655

6.1 Take home messages from Pan-EU and Regional Brand Owner Survey and Interviews 655

6.2 Next Steps 666

7 APPENDIX 677

7.1 Appendix 1: Guidelines for Interviewers..... 677

7.2 Appendix 2: Interview Survey Form..... 71

7.3 Appendix 3: Interview Report Format 833

7.4 Appendix 4: Consent Form ... 8447.5 Appendix 5: Peer-Review Publication: Switching to Biobased Products – The Brand Owner Perspective
.....87

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	Biomass Technology Group BV
CLIC	CLIC Innovation Oy
CPG	Consumer Packaged Goods
CTA	Corporación Tecnológica de Andalucía
DoA	Description of Action
EC	European Commission
CEN	European Committee for Standardisation
FBC	Food & Bio Cluster Denmark
FF	Flanders' FOOD
GDPR	General Data Protection Regulation
GMO	Genetically Modified Organisms
ITT	Institute of Technology Tralee
LCA	Life-cycle Assessment
LCC	Life Cycle Costing
MX	Month of relevant work package/deliverable
PET	Polyethylene terephthalate
PHA	Polyhydroxyalkanoates
PLA	Polylactic Acid
PP	Polyproplyenere
RED	Renewable Energy Directive
SIE	Sustainable Innovations Europe SL
SDG	Sustainable Development Goals
VTT	Teknologian Tutkimuskeskus VTT Oy
WP	Work Package

LIST OF TABLES

Table 1. Market Drivers and Market Barriers.....25

Table 2. Positive and negative connotations about bio-based products..... 35

Table 3. Expectations towards bio-based products.....36

LIST OF FIGURES

Figure 1. Bioplastics Value Chain.....17

Figure 2. Influence of Brands over Consumers.....18

Figure 3. New Plastics Economy Initiative 20

Figure 4. Word cloud showing positive associations with bio-based products.....32

Figure 5. Word cloud showing negative associations with bio-based products.....33

Figure 6. Word cloud showing associations with specific products.....33

Figure 7. Primary sectors of participating brand owners.....42

Figure 8. Future inclusion of bio-based ingredients.....43

Figure 9. Future inclusion of bio-based ingredients for regional clusters.....43

Figure 10. Level of stakeholder engagement 44

Figure 11. Main categories of products that brand owners would consider integrating bio-based ingredients.....45

Figure 12. Current use of bio-based packaging.....46

Figure 13. Future use of bio-based packaging.....46

Figure 14. Main barriers of bio-based ingredient/product uptake within brand organisation.....48

Figure 15. Main barriers for growth of customer demand for bio-based products.....49

Figure 16. Main risks for brand owners associated with bio-based product uptake.....50

Figure 17. Needs of brand owners choosing bio-based ingredients and products.....51

Figure 18. Support needed to identify opportunities for integrating bio-based ingredients within their brands.....51

Figure 19. Main motivations for brand owners switching to bio-based products.....52

Figure 20. Projected future growth of customer demand for bio-based products over the next 5 years.....53

Figure 21. Main drivers for growth of customer demand for bio-based products.....54

Figure 22. Key stakeholders for brand owners to engage with in order to ensure uptake of bio-based products.....55

Figure 23. Engagement with the BIOSWTICH project.....56

Figure 24. Brand owner interest in BIOSWITCH supports.....56

1 INTRODUCTION

This document describes the Report on European and Regional Analysis of the Needs, Risks and Motivations of Brand Owners Switching to Bio-based Approaches undertaken by the BIOSWITCH project, which provides a better understanding of the perspectives of brand owners in relation to bio-based materials.

The report begins with a literature review which provides context and background to the report and a review of the studies to date which focuses on the participation of brand owners within the bio-based bioeconomy and previously identified risk, barriers and motivations.

The report will then focus on the BIOSWITCH approach for implementation of a Pan-European and Regional needs, risks and motivations analysis on brand owners switching to bio-based approaches, followed by findings and analysis of the survey and questionnaires implemented with brand owners.

This deliverable 1.1 builds on Work Package (WP) 1 Task 1.1 of the BIOSWITCH project, and documents work undertaken as part of Task 1.2 and Task 1.4.1 of the BIOSWITCH Description of Actions (DoA). The context of this work and relevant tasks is detailed in Sections 1.1 below.

1.1 Introduction to BIOSWITCH and the framework development

The main objective of this WP is to create a framework for engagement in project activities to conduct mapping and analysis exercises, which will support project knowledge and co-creation activities. More in detail, the specific objectives are:

- To set up the brand owner 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.

WP1 consists of five tasks (T):

- T1.1 BIOSWITCH framework set-up;
- T1.2 European and regional analysis of the needs, risks and motivations of brand owners switching to bio-based approaches;
- T1.3 Scoping of best practices & success cases to support the switch-to-bio-based;
- T1.4 Brand owner incentives and consumers drivers and motivations analysis;

- T1.5 Regionals and pan-European co-creation workshop to support brand owners and consumers to switch-to-bio-based.

Tasks Related to Deliverable 1.1

Deliverable 1.1 builds on T1.1 of the BIOSWITCH project, and documents work undertaken as part of T1.2 and T1.4.1 of the BIOSWITCH work plan. T1.1. is the BIOSWITCH framework set-up, which involves the creation of brand owner networks, along with other stakeholder networks for participation in BIOSWITCH activities. Development of this network commenced from the first month of BIOSWITCH, and this network was accessed in order to gain insights into brand owner perspectives through surveys and interviews (T1.2).

Following this and under T1.2, BIOSWITCH has undertaken a European and Regional Analysis of the needs, perceived risks and motivations among cross-sectorial brand owners regarding a switch to bio-based approaches. The EU analysis aims to identify macro-trends while the regional level analysis within individual clusters aims to identify regional trends and differences. The results of this Deliverable 1.1 will be complemented by a consumer acceptance analysis in T1.4.2 with the findings of both the brand analysis and consumer analysis feeding into T1.5, regional and Pan-EU co-creation activities to co-develop solutions for identified risks and barriers.

The work of T1.2 began at the project outset with co-development of a pan-EU survey and regional questionnaire and interview report templates to support collection of responses from brand owners. Potential brand owner respondents were also identified, and a plan was put in place to run the survey for 5 weeks, from August 11th2020 to September 15th 2020. Finally, the results were then analysed for the development of the completed deliverable on November 30th 2020.

Objective of Deliverable 1.1

The main objective of D1.1 is to engage with brand owners, and to gain a better understanding of the needs, risks and motivations of brand owners switching to bio-based approaches. Subsequent project activities identify solutions and support for brand owners who are starting out or in the transition to bio-based approaches, the work of this deliverable will help to tailor the supports offer by BIOSWITCH to the needs identified by the brand owners and offer more effective support.

2 METHODOLOGY

Task 1.2 of BIOSWITCH corresponds to the deliverable which is focused on European and regional analysis of the needs, risks and motivations of brand owners switching to bio-based approaches. To implement the task, a series of interlinked research steps were undertaken, including;

- a desk-based literature review to identify the main outputs of previous projects and work focused on perceived needs, risks and motivations of brand owners switching to bio-based approaches;
- a series of interviews by participating project cluster partners with brand owners within their networks;
- a Pan-EU online survey for brand owners to complement the regional interviews.

Desk research was initially performed by partners ITT and BTG to gain a greater understanding of existing studies into brand owner perspectives on the perceived risks, barriers and motivations for switching to bio-based ingredients, products or packaging. A summary of this literature is included within the Literature Review, Section 3 of this report. 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 to be subsequently target towards brand owners. The results and analysis of the brand owner survey and interviews can be found in Section 4 and Section 5 of this report respectively. Previous brand studies included SustConsult's #WhatBrandsWant survey, packaging studies from L.E.K. Consulting, Green Alliance and Packaging World Magazine as well as inputs from previously funded projects such as BIOBRIDGES, BIOWAYS, STAR4BBI, and ROADTOBIO. In order to expand the literature review and to identify additional perspectives on bio-based products, the literature review considered studies and surveys addressing/targeting a wider range of actors i.e. businesses in the broadest sense, including professional experts, and consumers.

As T1.4.1 focused on incentives for brand owners switching to bio-based approaches, and this also included brand owner interviews, a decision was made by the consortium to integrate the incentive questions within the needs, perceived risks and motivations questions, and to allow both sets of questions to be completed together. This decision was made to avoid brand owner fatigue from multiple interviews. To prepare for the task, a workshop was held with partners active in WP1 activities, during M1 of the project to agree the scope of brand owners to be included within the interviews/surveys and other activities, to agree target sectors and to identify products which are within scope. Following this ITT along with BTG began initial work in drafting a questionnaire and survey skeleton, which would be used for conducting the interviews and surveys. Questions were loosely broken down into;

- Company background questions: Contact points, sectors, HQ, brands
- Brand owner background with regards to sustainability and bio-based products: company sustainability goals, existing and potential use of bio-based ingredients/packaging, interaction with stakeholders (suppliers/customers/researchers) in relation to bio-based ingredients/packaging)
- Risks, barriers and needs of brand owners with regards to bio-based product uptake

- Motivations and incentives of brand owners with regards to bio-based product uptake
- BIOSWITCH related questions: Interest in project collaboration and BIOSWITCH activities of interest

Draft questions were then discussed and refined with the cluster partners (CLIC, CTA, FF and FBC), before reaching a final version of the regional questionnaire and Pan-EU survey. Overall, the questionnaire and survey overlapped in many questions; however, to improve the response rate, the survey was kept shorter to reduce the time required for completion. In addition to having some additional questions, the interview template also allowed for greater feedback on questions asked, as interviewees we frequently asked to provide a rationale for their response, in order to provide more qualitative feedback. To support the interviewers and to guide the regional interviews and associated reports in structured way, a guidance pack was developed for the interviewers which can be found within the appendices to this report. This guidance pack included;

1. Survey guidelines for interviewees i.e. a memo presenting Guidance to interviewers for conducting and reporting on Interviews with brand owners (the current document);
2. Survey questionnaire;
3. A format for reporting information collected during the survey interviews, documenting answers and key information collected and summarizing additional info collected (If any);
4. A memo to explain data consent issues;
5. A data consent agreement form, for signing by each interviewee.

Interviews were then conducted with identified cluster brand owners on a regional level in Belgium, Denmark, Finland and Spain over a six-week period between 3rd August 2020 and 15 September 2020. Due to the COVID-19 situation, a decision was made to host these interviews remotely. The final reports were compiled by the cluster partners and submitted back to ITT and BTG, with findings integrated within this report.

The Pan-EU survey was administered online via Webropol by CLIC and was online for 4 weeks from 11th of August 2020 to 15th of September 2020. The survey was distributed through the BIOSWITCH social media channels with a specific blog page at the BIOSWITCH website linking to the survey. This page received 346 unique page views. This blog post was also shared on the project's social media channels, reaching over 4,000 impressions on Twitter and more than 1,000 impressions in LinkedIn. In addition, the survey was distributed through partner networks including:

- The BIOSWITCH Framework establish through T1.1
- Direct emails to relevant brand owner networks
- Direct emails to industry associations representative of brand owners

- Social Media networks (project, partners, affiliates, external)
- Newsletters and Bulletins
- Collaborations with other EU projects

On completion of the surveys and interviews, work was undertaken to document the results of the survey and interviews. In total there were 40 survey responses and 20 regional interviews. In order to increase the geographical representation of the Pan-EU survey, the interview question responses which corresponded to Pan-EU questions were added to Webropol for analysis increasing the Pan-EU response to 60. In addition, a regional analysis of interviews was undertaken to determine quantitative and qualitative feedback. These results are document in Section 4, with additional analysis of trends summarized in Section 5.

To ensure compliance with ethical procedures, the BIOSWITCH team ensured that interviewees and survey respondents were informed of the purpose of involvement in the study, the conditions for participation, and how the data and information from their interview/survey would be stored and used. Information provided to the respondents included:

- data processing methods (detailed below),
- data privacy protection and confidentiality,
- voluntariness, handling of personal data and other rights of the subject.

These terms were accepted by participants through the signing of a consent form, in the case of interviews, or via digital approval in the case of survey participants. Survey responses were completed and logged in digital format via the Webropol system, while interviews were recorded and logged in written format. This is stored on project sharing platform, restricted to project personnel, which is on secure and password protected closed server system that is operated according to CLIC Innovations data management procedures. Any recordings and notes will be deleted when the project is finished or at any time by the request of the interviewee. The processing of personal data is based on the consent of the person. The interviewee/respondent may revoke his / her consent to the processing of personal data by notifying the responsible person who held the interview or the project coordinator that consent has been withdrawn. Information on the possible withdrawal will be handled discreetly and will not be published in any way. The subject has the right to ask for access to their own personal data, as well as the right to request rectification or erasure or restriction of the data. The subject may oppose the processing of the personal data, which he / she has provided to the interviewer.

Overall, the number of survey respondents and interviewees was relatively small at 40 and 20 respectively. It is possible that this was impact by COVID 19, wherein companies were at the early stages of having to deal with new challenges, and fewer companies were in a position to complete the surveys and interviews. In addition, the timing of the task was quite challenging. As the survey required collaboration between lead partners and the regional clusters, the survey and questionnaire were only ready to implement in early August, during the holiday season. The survey and questionnaire were later implemented during August (a holiday month for many countries) and early September (a busy time for workplace returnees). The deadline for the survey was initial scheduled for 8th of September, but this was extended to September 15th to provide more time for completion of the survey and interviews. Due to the short timeline of the deliverable, it was not possible to extend

beyond this point. To help boost number participant numbers, a number of social media campaigns were run during the course of the implementation phase, and additionally project partners made direct contact with companies within their networks to seek participation.

3 LITERATURE REVIEW

3.1 Literature Review Introduction

The updated EU bioeconomy strategy highlights the role that a sustainable bioeconomy can play in helping the content to meet several key priorities including job creation, climate objectives, waste reduction and the modernisation of the EU industrial base[1]. A recent study has showed that the bioeconomy is increasingly becoming a contributor to our overall European economy, with the total turnover of the bioeconomy (including food and beverages and the primary sectors agriculture and forestry) amounting to over 2.4 trillion Euro in the EU-28 in 2017, an increase by 25 % since 2008[2]. Around 30 % of this amount was contributed by bio-based industries, such as chemicals and plastics, pharmaceuticals, paper and paper products, forest-based industries, textiles, biofuels and bioenergy. Roughly half of the turnover was accounted for by the food and beverages sector, with 20 % created by the primary sectors agriculture and forestry. A sustainable bioeconomy will need to play an increasingly important role as Europe attempts to meet very ambitious European and International climate and sustainability targets including a 55 % reduction in greenhouse gas emissions by 2030[3].

A sustainable bioeconomy can play a role in meeting many of the 17 UN Sustainable Development Goals (SDGs). Bio-based Industries Joint Undertaking (BBI JU) noted 11 SDGs which a sustainable bioeconomy can contributed to, including Sustainable Consumption and Production (SDG12) and Climate Action (SDG 13). The bioeconomy can also play a central role in the EU shift towards a circular economy as outlined in the EU Circular Economy Action Plan[4] 2020 including more sustainable management of plastics[5], packaging and nutrients, while ensuring a sustainable supply of local protein[6] and contributing to our Renewable Energy Directive (RED) II targets in energy, heat and transport.

In addition, the Bio-based Industries Consortium (BIC) have through their Strategic Innovation and Research Agenda[7] committed to contributing to ambitious non-binding 2030 targets across a multitude of product including protein for feed (halving imports of imported soy), nutrients for

[1] European Commission (2018) Updated Bioeconomy Strategy - A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment

[2] Porc, O., Hark, N., Carus, M., Dammer, L., Carrez, D. (2020) European Bioeconomy in Figures 2008–2017

[3] European Commission (2020) State of the Union: Commission raises climate ambition and proposes 55 % cut in emissions by 2030 https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1599

[4] European Commission (2020) Circular Economy Action Plan – for a cleaner and more competitive Europe

[5] European Parliament (2019) Parliament seals ban on throwaway plastics by 2021 https://www.europarl.europa.eu/news/en/press-room/20190321IPR32111/parliament-seals-ban-on-throwaway-plastics-by-2021

[6] European Commission (2018) Report from the Commission to the Council and European Parliament on the development of plant proteins in the European Union

[7] Bio-Based Industries (2017), Strategic Innovation & Research Agenda for Development & Growth in Europe, https://biconsortium.eu/sites/biconsortium.eu/files/downloads/SIRA-2017-Web.pdf

fertilisers (25 % reduction in potash and phosphate) and 25 % of chemicals and materials coming from bio-based sources. New bioeconomy value chains required to meet all these targets will require new collaborations between the multiple stakeholders across the chain. Primary producers, such as farmers who typically supplied food co-operatives are now linking arms with fuels and chemical producers across Europe[8][9].

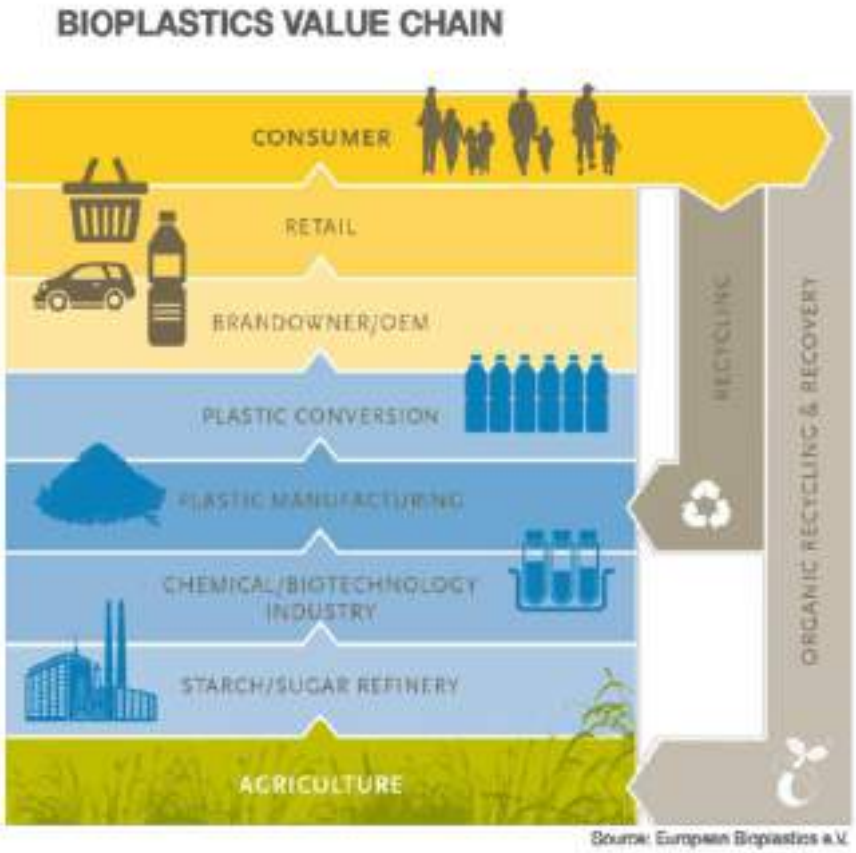

Figure 1. Bioplastics Value Chain, European Bioplastics

An example of the various actors required to develop a full bioplastic value chain is illustrated in Figure 1 for the case of bioplastics. While the bio-based industries play a key a role in the processing and conversion of biomass into an intermediate or product, these industries will need to engage with the primary producers of agriculture, forestry and marine as well as waste sectors to acquire the feedstock and develop a supply chain. Of equal importance are the downstream actors who can develop a final product, retail and use the products. These actors include the **brand owners**, the retailers and the consumers. As noted by earlier projects such as **Star-Colibri, Star4BBI** and **BIOTIC**, while many technical and process challenges exist for the bioeconomy to fully develop, there are also many challenges to address on the market-end, involving these downstream actors, including poor

[8] Lignoflag (2020) https://www.lignoflag-project.eu/
[9] First2Run (2020) http://www.first2run.eu/

awareness and perception and lack of cost competitiveness. More therefore needs to be done to work with these stakeholders to understand and address many of the challenges.

In this context, BIOSWITCH is focused on working closely with brand owners, end customers such as consumers, businesses, and public bodies to support this transition to bio-based product market uptake. According to Dammer *et al*, 2017[10], the world market for bio-based products is growing in large part as a result of efforts by retailers, brands, manufacturers, consumers, and government officials to promote the environmental benefits and acceptance of these products as they become commercially viable. In particular, BIOSWITCH will play a supporting role to brand owners who are considering a switch-to-bio-based products and increasing awareness of bio-based products among other brand owners who are still at an early transition stage. It is clear that brand owners listen closely to their consumers when bringing new products to the market. However, conversely **brand owners can also be key influencers of consumers choosing new products**. Chovanová *et al* (2015) conducted research with 1250 respondents in Slovakia to understand the influence of brands on consumers[11]. In response to the question of whether brands affected the respondents purchasing choice, 52% of respondents indicated this to be the case.

Figure 2. Influence of Brands over Consumers, Chovanová *et al* (2015)

According to Chovanová *et al* (2015), branding works as a signal allowing consumers to quickly recognise a product as one they are familiar with or one they like. As for the motivational factors for the respondents choosing a particularly brand, **consumers indicated product quality (72.6 %) to be the main factor**. This makes the seal of approval from a brand owner desirable for bio-based industries and their products.

As many bio-based alternatives are still quite new on the market, and consumer knowledge about bio-based products is still quite low (according to **RoadtoBio** only about **50 % of consumers are aware of the existence of bio-based products, while only about 12 % of consumers have intentionally purchased bio-based products**), brand owners can also play a potentially key role in increasing awareness of these products and helping them to access mass consumer markets.

At the same time, bio-based products can play a key role in brand owners become more sustainable and greening their image. As noted by **BIOVOICES**, brand owners increasingly consider the Sustainable Development Goals (SDG), in particular SDG 12 "Responsible production and consumption" for promoting the circular economy and SDG 13 "Climate change" to avoid global

[10] Lara Dammer, Michael Carus, Kerstin Iffland, Stephan Piotrowski, Luis Sarmento, Raj Chinthapalli, Achim Raschka (2017), Current situation and trends of the bio-based industries in Europe with a focus on bio-based materials - Pilot Study for BBI JU, https://www.bbi-europe.eu/sites/default/files/media/bbiju-pilotstudy.pdf

[11] Chovanováa, H. H.. Korshunovb, A. I., Babčanovác, D. (2015) Impact of Brand on Consumer Behavior, https://www.academia.edu/19730752/Impact_of_Brand_on_Consumer_Behavior

warming [12]. Bio-based products can support them to reach these goals and targets, as in the example of Unilever, who have committed that by 2025 it will only use packing that could be reduced, reused, composted or recycled. Increasingly sustainable products can also help brand owners to meet the needs of consumers.

In 2015, sales of consumer goods from brands with a demonstrated commitment to sustainability rose more than 4 % globally, while those without grew less than 1 %[13]. The same Nielsen study found that 66 % of consumers say they are willing to pay more for sustainable brands. A 2017 international study by Unilever revealed that a third of consumers (33 %) are now choosing to buy from brands they believe are doing social or environmental good[14]. This trend is likely to continue according to 2020 White Paper from Evergreen, which notes the growing role of millennials in shaping trends. According to the paper, millennials are particularly sensitized to climate change and expect action from brands and retailers. They expect brands to be more selective in the products and packaging they provide and see a role for brands, in consumer education, responsible waste management, and supporting eco-friendly consumption[15].

There are a growing number of examples in which brand owners across a variety of sectors have taken a leading role in integrating bio-based ingredients or products within their products and packaging. A key opportunity area for bio-based ingredients is in the sustainable packaging market. Brands such as Ferrero, Lego and Henkel have all made strong commitments to introduce sustainable packaging on their products. Other commitments can be seen from signatories of the **New Plastics Economy** initiative led by Ellen McArthur Foundation[16], in which brands like Walmart, PepsiCo, M&S and Unilever have committed to use 100 % reusable, recyclable or compostable packaging by 2025.

[12] BIOVOICES (2018) Deliverable 3.1 Synthesis of market perspectives to develop bio-based value chains

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

[14] Unilever (2017) Report shows a third of consumers prefer sustainable brands https://www.unilever.com/news/press-releases/2017/report-shows-a-third-of-consumers-prefer-sustainable-brands.html

[15] Evergreen Packaging (2020) Sustainable Packaging Trends: How Millennials Will Change Packaging Forever https://evergreenpackaging.com/fresh-news/2020-food-and-beverage-sustainable-packaging-trends/

[16] https://www.newplasticseconomy.org/

Figure 3. New Plastics Economy Initiative (2018)

Recent market figures from industry trade association European Bioplastics[17] show rigid packaging was the main market segments for bio-based plastic in 2019, with textiles, flexible packaging, automotive and transport sectors, building and construction and consumer goods, being the main identified market segments. Looking at biodegradable plastics, flexible packaging accounted for nearly half of the market, with rigid packaging, agriculture and horticulture, coatings and adhesives, consumer goods and textiles being the other main market segments.

According to Dammer *et al* (2017) brand influence can be a major driver of the success of bio-based products where large brands can champion a technology or product and jumpstart its expansion into vast markets. Several examples of where biomaterials are penetrating the packaging market can be found among global brand owners in the food and beverage industry.

Coca-Cola introduced the original Plant Bottle in 2009. It is 30% bio-based, based on sugarcane-derived monoethlyene glycol blended with 70% fossil-based purified terephthalic acid. Between 2009 and 2015, Coca-Cola had distributred more than 35 billion plant bottles in 40 countries helping to save the equivalent annual emissions of more than 315,000 metric tons of carbon dioxide[18].These figures underscore the important of brand owner participation in ensuring bio-based products penetrate mass markets and the benefits that can be achieved from this. In 2015, Coca-Cola also unveiled the prototype of the first all-bio-based polyethylene terephthalate (PET) bottle demonstrating their

[17] European Bioplastics, Bioplastics facts and figures (2020), https://docs.european-bioplastics.org/publications/EUBP_Facts_and_figures.pdf. Accessed October 2020

[18] Coca Cola (2015) Coca Cola produces worlds first PET bottle made entirely from plants https://www.coca-colacompany.com/press-releases/coca-cola-produces-first-pet-bottle-made-from-plants

continued committed to developing bio-based packaging. Full commercialisation of the prototype was not foreseen five years later.

Nestlé Waters, PepsiCo and Danone are currently collaborating with the Californian bio-based materials development company Origin Materials in the NaturALL Bottle Alliance research consortium. They develop innovative packaging solutions made with 100 % sustainable and renewable resources (non-food, non-feed crop related biomass, such as previously used cardboard and sawdust) and aim to launch a PET bottle with up to 95 % bio-based content by 2022[19].

In 2019, the Danish-Swedish dairy multinational **Arla Foods** announced that they were making 600 million fresh milk cartons renewable across their main EU markets, with the inclusion of bioplastic derived from sugarcane or forest waste[20]. It is estimated that these cartons will contribute 25 % less carbon dioxide into the atmosphere compared to their fossil-based plastic predecessors. From 2005 to 2019, Arla has reduced the CO_2 impact of its packaging by 25 %, equating to 123,000 tonnes of CO_2 being diverted from the atmosphere. The total emissions figure from Danish agriculture is just over 10 million tonnes per annum.

In addition to developing bio-based packaging, brand owners are also beginning the transition to develop consumer goods that use bio-based ingredients.

In 2015, **Lego** announced plans to produce all its toys from bioplastic by 2030, with the first of these botanical elements such as bioplastic shrubs and trees on the market already[21].

In 2018, **IKEA** announced that they had started the transition to bio-based polyproplyenere (PP) replacing 20 % fossil based plastic in the short term in a number of existing products within their product, such as plastic storage boxes[22].

Unilever recently announced that it will source 100 % of the carbon derived from fossil fuels in its cleaning and laundry product formulations by 2030 with renewable or recycled carbon[23]. Unilever, through its brands, have already been playing a leader role in supporting market update of bio-based materials into key consumer markets including biodegradable teabags and sunscreen.[24] and sunscreen[25].

[19] Bio-based News (2017) A bio-based packaging revolution: Danone and Nestlé Waters form the NaturalALL Bottle Alliance Danone and Nestlé Waters form the NaturalALL Bottle Alliance

[20] Arla (2019) Arla makes over one billion pieces of packaging more sustainable across Europe Arla Sustainable Packaging

[21] Guardian (2018) First Sustainable Lego Pieces go on sale First Sustainable Lego pieces

[22] Bioplastic News (2018) IKEA and NESTE go bioplastics https://bioplasticsnews.com/2018/06/08/ikea-and-neste-go-bioplastics/

[23] Bio-based News (2020) Unilever to eliminate fossil fuels in cleaning products by 2030 http://news.bio-based.eu/unilever-to-eliminate-fossil-fuels-in-cleaning-products-by-2030/

[24] Unilever (2018) First 100 % biodegradable PG tips tea bags in stores https://www.unilever.co.uk/news/press-releases/2018/first-100-biodegradable-pg-tips-tea-bags-in-stores.html

[25] Biomarket Insights (2019) Unilever and Bio-on officially unveil new sunscreens made from biodegradable bioplastics https://biomarketinsights.com/unilever-and-bio-on-officially-unveil-new-sunscreens-made-from-biodegradable-bioplastics/

3.2 Literature Research Findings

Desk research was initially performed by partner ITT to gain a greater understand of existing studies into brand owner perspectives in relation to bio-based materials or packaging. Initially ITT found only a handful of studies to be within scope. It was therefore decided between ITT and BTG to widen the scope, and that BTG would consider studies and surveys adressing/targeting a wider range of actors i.e. businesses in the broadest sense, including professional experts, and consumers.

The literature research did not focus on a particular type of bio-based product, however, it was found that many of the studies (both within the original as well as in the widened scope) looked in particular at bio-based packaging. The literature research could only consider studies/reports on this topic that are available in the public domain. It mainly covers research conducted in the context of EU-funded projects in addition to some studies commisisoned by trade associations or other member organisations and/or initiated by public relations, communications, marketing or market research agencies. Nonetheless the literature research provided the partners with a good baseline of the current work to date, and also provided a platform for the development of the survey and questionnaire.

3.2.1 Brand Owners

In 2017 Sustainability Consult published the results of the **#WhatBrandsWant** survey and study into brand perspectives on biomaterials[26]. The survey was undertaken over a six-month period, with responses from over 40 brands across different sectors ranging from apparel, footwear & textiles, to food & beverages and personal care. In the study, 52 % of brands said they have clear objectives for sourcing bio-based materials, while 26 % said bio-based content is one of the selection criteria used when choosing a supplier based on sustainability performance. According to the responding brand owners, growth factors for bio-based materials include consumer demand for environmentally-friendly products (65 %) and packaging (46 %), as well as brands wanting to improve public image (48 %). When it came to identifying key barriers to widespread uptake of bio-based products, **87 % indicated cost as the biggest barrier**. **Performance (42 %)** and **security of supply (37 %)** were identified as the next biggest barriers. To evaluate whether to adopt bio-based materials, **63 % said they need more information from suppliers on pricing, 61 % on availability** and **57 % on performance**. 71 % said their brand communicated externally on its use of bio-based materials. The survey found that half of the brands not currently using bio-based materials for products are conducting R&D on them.

A 2018 survey conducted by G&S Business Communications and Packaging World Magazine among 349 brand owners identified new packaging technologies (57 %), bio-based materials (38 %), biodegradable packaging (38 %) and increased recycled content (35 %) as the main sustainability

[26] Sustainability Consult (2017) Brand Perspectives on Biomaterials #WhatBrandsWant, https://www.sustainabilityconsult.com/downloads-blanks/our-work/104-brand-perspectives-on-biomaterials-executive-summary-2017/file

trends likely to drive change in packaging processes over the next 5 years[27]. The survey identified cost as major issue for brand owners shifting towards sustainability with cost-related factors being the biggest barrier both in identifying new packaging and prohibitive costs being the biggest barrier towards increasing general sustainability efforts within the surveyed organisations.

Also in 2018, the international non-profit Textile Exchange surveyed its 200 or so members from the textile sector about the barriers to the market growth of biosynthetics[28]. In descending order the brands and retailers mentioned;

- lack of understanding/knowledge
- lack of sustainability standards
- commercial availability

as the Top 3 barriers, all of which were mentioned by 45-55 % of the respondents.

Suppliers response mentioned;

- price (ca. 53 %),
- lack of understanding/knowledge (ca. 43 %), and
- commercial availability (ca. 33 %)

as being the three main barriers they experience[29].

A study by **Green Alliance** (2020) interviewed brands and retailers representing a cross section of the UK grocery sector, including supermarkets as well as branded producers of food and drink and consumer goods like personal care and home cleaning products, to gain perspectives on packaging and plastic waste[30]. While the study noted postive public perceptions of biodegradable packaging, the interviewees were wary about replacing conventional plastic with biodegradable alternatives in their packaging. Some of this came down to cost, but more often, the companies expressed concern about the suitability of the material, including its biodegradability. Others expressed concern over how the product will be disposed and confusion among their consumers over differences between bio-based, biodegradable and compostable products.

In its 2020 **Brand Owner Packaging Study**, L.E.K. Consulting surveyed 287 brand managers and other packaging decision-makers at consumer packaged goods (CPG) companies across many industries (food and beverage, healthcare and wellness, pet and household, beauty and personal

[27] Packaging World Magazine (2018) Brand owner, consumer sustainable packaging perceptions diverge https://www.packworld.com/design/flexible-packaging/article/13375974/brand-owner-consumer-sustainable-packaging-perceptions-diverge#next-slide

[28] A biosynthetic fibre consists of polymers made from renewable resources, either wholly or partly. Biopolymers, commercially available today, have come from renewable sugars, starches and lipids and include polymers that are 100 % bio-based as well as partially bio-based.

[29] Findings quoted in: René Bethmann (2019), VAUDE, presented at: Bioplastics and Biocomposites Innovative Building Blocks of the Emerging Bioeconomy, 14 February 2019, Rotorua, New Zealand, https://www.scionresearch.com/__data/assets/pdf_file/0008/65816/Bio2AN-Vaude.pdf

[30] Green Alliance (2020) Plastic promises : What the grocery sector is really doing about packaging https://www.green-alliance.org.uk/resources/Plastic_promises.pdf

care, consumer electronics, and industrials) to gauge how their packaging needs are evolving[31]. All surveyed brands operate in the U.S. and in some cases internationally. Approximately 23 % of respondents indicate that consumer demand for green products and services will be the biggest growth driver for their primary brands over the next two years. The L.E.K. study found that a majority of brands have introduced environmentally friendly products (67 %) and packaging (53 %) within the last two years in a bid to appeal to the growing green-conscious consumer base. In terms of materials used, 42 % of survey brands had made the switch to a portion of the packaging being made from recycled substrates. Adoption of biodegradable substrates and lightweight packaging over the same period was also noteworthy: 36 % of respondents have embraced some form of biodegradables, while 35 % of respondents have made efforts to lightweight (i.e. reduce the amount of material) in their packaging. Within the study brand owners expect the total value of packaging with biodegradable, recycled or compostable material to grow by 15 %-20 % over the next two years. In terms of specialty packaging technologies, polyhydroxyalkanoates (PHA) bioplastics, polylactic acid (PLA), bioplastics, micro-fibrillated cellulose specialty fiber and aqueous coatings all had the highest interest from brand owners, compared to other new packaging attributes such as edible packaging with some 45 % of brand owners stating an interest in adopting chemically recycled plastics in the future. Packaging decision-makers in the food and beverage and pet and household sectors were particularly drawn to chemically recycled plastics, with 52 % of each group indicating a high degree of interest.

3.2.2 Businesses in broadest sense

In 2015 the **Open-Bio** project conducted a 2-round Delphi survey among resp. 324 and 134 business experts in the bio-based economy, asking respondents to assess both **drivers and barriers** of the future development of the business-to-business (B2B) market for bio-based products. Table 1 below presents a full ranking of the mentioned market drivers and market barriers in descending order of relevance[32]. Respondents considered high production costs and volatile feedstock prices to be among the most important barriers in this market; the positive image of bio-based products and their ability to ensure stronger independence from fossil-based resources are expected to become the most important drivers. An unsupportive regulatory environment and uncertainty about future regulation hinder a stronger market uptake of bio-based products. Concerns about social and environmental impacts and the use of genetically modified organisms (GMO) in feedstock production are not considered important market barriers. A further key finding that emerged from the survey is that important drivers of the market for bio-based products differ distinctly across countries and product groups.

[31] LEK Consulting (2020) Unwrapping the Results of L.E.K.'s 2020 Brand Owner Packaging Study https://www.lek.com/insights/ei/unwrapping-results-leks-2020-brand-owner-packaging-study

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

Table 1. Market Drivers and Market Barriers (from the most to the least important items) OpenBio (2015)

Rank	Market drivers	Market barriers
1	positive public image	higher cost of production
2	independence from fossil sources	uncertainty about future regulation
3	savings in CO_2 emissions	volatility of feedstock prices
4	compliance with environmental regulation	unsupportive regulatory environment
5	reduced human toxicity	low performance or uncertainty regarding performance
6	utilization of waste products	uncertainty about available feedstock quantity and quality
7	new or added functionality	lack of public awareness about bio-based products
8	recyclability	incompatibility with existing supply arrangements or high replacement costs
9	potential to source feedstock locally	higher life-cycle costs to buyers (from purchase to disposal)
10	local employment creation	difficulty in obtaining finance
11	improved performance	difficulty in communicating environmental benefits
12	potential to attract new customers	limited local feedstock availability
13	reduction of environmental pollutants (other than CO_2)	uncertainty regarding environmental benefits
14	energy savings during production	environmental impacts of feedstock production
15	lower production cost	incompatibility with existing recycling schemes
16	biodegradability / composability	concerns regarding GMOs in feedstock production

17	life-cycle cost savings for buyers (from purchase to disposal)	increased ecotoxicity and negative effects on the eco-system
18	willingness to pay green premium[33]	social impacts of feedstock production

Building on Open-Bio research, (Peuckert & Quitzow, 2016) concludes that multiple drivers may lead to the adoption of bio-based products or practices by businesses. Central drivers are frequently environmental regulation and external pressures from the stakeholders-clients who demand environmentally friendly practices and products. In the absence of demand and immediate pressure from the client side or other regulatory incentives, businesses may decide to invest in this market sector drawn on the competitive advantage that may gain. Moreover, it seems that the adoption of circular economy products and practices may be driven by strategic motives, such as cost- and performance related benefits, which for the case of bio-based products may include the aim of supply chains diversification or to safeguard against oil price increases[34].

In 2017 the **BIOWAYS** project determined that the barriers that may prevent the acceptance and promotion of bio-based alternatives are manifold and are related to the:

- Low price of crude oil and natural gas that make the use of biomass feedstock and bio-based production processes economically unattractive
- High cost of bio-based products compared to their fossil-fuel derived equivalents
- Lower performance of many bio-based products compared to their fossil-fuel derived equivalents
- No dedicated and detailed EU legislation framework, conflicts between sustainability goals and market needs, lack of uniform standardisation and certified labelling for bio-based products
- Gaps in the policy and subsidy framework
- Intellectual property (IP) related barriers
- Low public awareness of the benefits of using bio-based products
- Lack of reliable and sufficient information about bio-based products

Furthermore, investment barriers and financial hurdles to the wider adoption of bio-based products are deriving from the limited availability of public R&D funding, the limited public support for scale-up activities, which makes also difficult the demonstration activities for upscaling of products and

[33] The term GreenPremium prices is defined by nova-Institute as: "*The additional price a market actor is willing to pay for the additional emotional performance and/or the strategic performance of the intermediate or end product the buyer expects to get when choosing the bio-based alternative compared to the price of the conventional counterpart with the same technical performance.*" See e.g. See Carus, M., Eder, A., Beckmann, J. 2014a: nova paper #3: "GreenPremium prices along the value chain of bio- based products". Hürth 2014. http://bio-based.eu/nova-papers/#GreenPremium

[34] Peuckert, Jan & Quitzow, Rainer. (2016). Acceptance of bio-based products in the business-to- business market and public procurement: Expert survey results. Biofuels, Bioproducts and Biorefining. 10.1002/bbb.1725

processes, as well as the limited financial support for new production facilities. There are gaps at policy and subsidy level as well[35].

Considering the importance of regulations as market barriers, as established in the Open-Bio research, a 2018 report of the **STAR4BBI** project further explored what market entry barriers related to regulation and standardisation companies in the bio-based economy experience. Seven companies were interviewed, mainly active in the B2B market, with some also producing and selling products (notably packaging material) for the consumer market. Hurdles that were mentioned during the interviews were grouped under five main themes: (a) End-of-life; (b) Certification and standards; (c) Biofuel policy; (d) Missing long term policy and (e) Communication and image.[36]

Within the **ROADTOBIO** project, nova-Institute assessed regulatory barriers hindering the production and material uptake of bio-based chemicals and materials. The work built on existing knowledge on hurdles and barriers for the bio-based economy from previous studies (such as the BIO-TIC, KBBPPS, and STAR4BBI projects) and brought these earlier findings up to date according to new developments in legislation, with a focus on understanding why legislative barriers came to be[37]. ROADTOBIO classified general barriers into six main categories (barrier groups): (a) Access to feedstock, (b) Competition with established fossil industry, (c) Policy and regulatory framework, (d) Public perception and societal challenges, (e) Markets, Finance and Investment and (f) Research and Development.

In 2018 the **BIOCANNDO** project explored the business view on bio-based food packaging. It was established that where packaging producers focused on technical issues, brands and retailers had more personal and image-related concerns. Manufacturers are concerned about regulation, the availability of raw materials and waste streams at the end of a product's life. Ultimately, they want to know that they can easily produce and market their products. Corporate environmental and social responsibility is more important to brands and retailers. They are often making a conscious choice to stock bio-based products and need assurances that they are more environmentally friendly. They also like labels that effectively communicate the advantages of bio-based products and gave them a 'green' image.

Food packaging producers, brands and retailers all see opportunity in bio-based materials. This is mainly linked to their perceived environmental credentials. As well as wishing to improve the sustainability of their products, they believe there is an exploding market, driven by consumer demand, for environmentally friendly products. They consider moving away from fossil resources to renewable raw materials to be a positive step. While they are concerned about complying with regulation, they also think that bio-based materials have the potential to help them comply with newer and future environmentally-conscious regulations, such as requirements to use compostable packaging for food.

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[35] BIOWAYS (2017) D2.1 Bio-based products and applications potential, http://www.bioways.eu/download.php?f=150&l=en&key=441a4e6a27f83a8e828b802c37adc6e1

[36] STAR4BBI (2018), D2.1 Market entry barriers (2018), https://www.bioeconomy-library.eu/star4bbi-market-entry-barriers-report/

[37] RoadToBio (2018) D2.1: Report on regulatory barriers, https://www.roadtobio.eu/index.php?page=publications

In terms of challenges, producers, brands and retailers indicate that;

- Customer is price-sensitive and is not willing to pay 5 cents more just for the packaging.
- To be just bio-based is not enough – you have to guarantee good performance.
- There is lack of trust, so many products are labelled as bio-based even though they are not.
- Uncertainty what is actually better or preferable: Bio-based or recyclable?
- Different labels are very confusing for the consumers.
- Public acceptance – some people think that the quality is not as good as traditional materials[38].

In 2018 the BIOVOICES project assessed barriers that hamper the commercialisation of new bio-based products as described in current literature, including (Peuckert & Quitzow, 2015) and (Hodgson *et al.*, 2016)[39]. Barriers were found to include[40]:

- Feedstock-related barriers: the logistics of securing large quantities of biomass feedstock all year round, and the availability of feedstock at affordable prices;
- Investment barriers and the perception of high investment risk;
- Poor public perception and awareness of industrial biotechnology and bio-based products;
- An absence of incentives or efficient policies to increase the demand

Nonetheless, BIOVOICES concludes that the results of recent studies reveal an increasing interest of business to invest in bio-based market or gradually redirect their business models and strategies to bio-based sector[41].

Based on the data collected through interviews, desk-analysis[42] and co-creation events, tbe BIOBRIDGES project compiled a factsheet[43] presenting barriers affecting the adoption of bio-based practices in four industrial sectors (chemical, bioplastic, bioenergy and food, feed and cosmetics ingredients). Barriers listed include:

- Low technology readiness level (TRL) and commercialization status for many bio-based products;
- High costs of feedstock and seasonality of biomass cropping versus need of continuous feedstock supply;
- Lack of standards to guarantee the quality and stability of feedstock;
- Need to improve the cascade using of biomass, prioritizing the extraction of added value compounds;

[38] http://www.allthings.bio/pageflow/bio-based-food-packaging/
[39] https://onlinelibrary.wiley.com/doi/full/10.1002/bbb.1665
[40] BIOVOICES (2018) D3.1 Synthesis of market perspectives to develop bio-based value chains, https://www.biovoices.eu/download.php?f=5&l=en&key=d4d623ecfaf04313fb52c36f48bcccf2
[41] BIOVOICES (2018) D3.2 Interviews Data Analysis Identification of Stakeholders' Interests and Motivations, https://www.biovoices.eu/download.php?f=34&l=en&key=6b75b921fe9a263e48ce727aad68bdba
[42] 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
[43] BIOBRIDGES (n.d.) Factsheet – Current and future trends and barriers faced by the bio-based industry, https://www.biobridges-project.eu/results/factsheet-trends-and-barriers-for-the-bio-based-industry/

- Inefficient transport and distribution of biomass;
- Lack of cooperation between the stakeholders in the relevant value chains;
- Hurdles in establishing partnerships between academia and industry;
- Limited financial support for new production facilities;
- Lack of a trained/skilled workforce

BIOBRIDGES concluded that, when switching to bio-based approaches, central drivers are frequently environmental regulation and external pressures from the stakeholders-clients who demand environmentally friendly practices and products. Barriers and challenges they founds included: (1) absence of labelling and certification; (2) functionality and performance vs. cost; (3) connection with the industry to create new value chains; (4) skills and occupational health; and (5) communication of the product.

The STAR-PROBIO project developed sustainability assessment tools for bio-based products. The project undertook a two-round Delphi survey, to identify sustainably assessment preferences of business professionals with regard to bio-based products, and their influence on buying decisions. The survey results show that professionals consider a broad spectrum of criteria important for sustainability. Information on environmental issues is clearly regarded as the most important. For professionals, the top three environmental issues were found to be: (1) Recyclability; (2) Type and origin of raw material; and (3) Percentage of bio-based content. For professionals, the top three social issues were found to be: (1) No child labour; (2) Impact of the product on people's health; and (3) Respect for human rights in the production of raw materials and products. They ranked the two economic issues as follows: (1) Fair business practices of the company; and (2) Fair land use rights practices in the production of feedstock. The three most important aspects to be considered before buying a product in addition to sustainability related characteristics were found to be: (1) Functionality/performance of the product; (2) Price; and (3) Life cycle costing (LCC). 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.[44]

In 2020 the **GLOPACK** project investigated the market and existing business concepts designed for respectively bio-based/biodegradable, active and intelligent packaging applications. The project conducted a literature survey and expert interviews with a wide range of packaging manufacturers as well as food packaging and food service providers. The expert interviews aimed at mapping and analysing stakeholder's preferences, acceptances and expectations. Experts interviewed in the project expect changes in the packaging sector in the next years. Environmentally friendly packaging, such as biodegradable or sustainable packaging will become more important. Adapting to changing packaging markets is seen as the highest priority. It is also expected that global investments in recyclable packaging will exceed those in biodegradable packaging. The perception of the experts toward bioplastics revealed that they consider the term bioplastics misleading or misinterpreted, especially when it comes to biodegradability. Both bio-based and biodegradability is preferred by experts. Market barriers, such as, ability for large scale production, high price and compatibility in

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

recycling loop with other plastics needs to be overcome in order for bio-based packaging to grow from niche markets towards conventional ones[45].

The **BioÄly ("Biosmart")** project aimed at strengthening bio and circular economy in Pirkanmaa-area in Finland by creating a collaboration platform for bio-based smart materials. The target group for this project were different players along the value chain, such as producers, logistical operators, downstream processors, commercial parties and as well the end user – the customer. The project investigated the issues that development of bio and circular economy faces. They studied the challenges that the uptake of bio-based solutions in smart applications (at various TRL levels) are facing. In a recent survey bottlenecks, barriers and incentives for the uptake of bio-based applications were studied within the target group. The Top 6 of factors, each of which were mentioned by at least 80 % of the respondents as being challenging or extremely challenging include (a) R&D funding, (b) Workforce/people with the right knowhow and expertise, (c) Unclear terminology, (d) Commercialization, (e) Customers' awareness of benefits and functionalities and (f) Meeting performance criteria. BioÄly combined a list of actions to be taken and the knowledge needed to enhance the transition to smart bio-based solutions. The list was validated with a survey of within the project target group. The Top 5 factors that at least 70 % respondents partially or fully agreed with were a) Aids to implement bio-based solution with the traditional ones, b) Informing and educating users if the new solution is used differently than the conventional one, c) R&D to improve the functionality and the cost-competitiveness of the solution, d) Collaboration within the value chain, e) Funding methods for the approval procedures for switching materials and technologies to bio-based. Conclusions from the survey were that comprehensive knowledge and collaboration within the value chain is needed within the next 5-10 years to realise the bio-based and circular economy. Ensuring innovations to be commercialized and scaled up, especially by SMEs, support from institutions is important. Data analysis and life-cycle assessment (LCA) play important roles in communicating environmental benefits[46].

3.1.3 Citizens' and Consumers' Perceptions

Research by Van Winkle *et al* (2015)[47] 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

[45] GLOPACK (2020) D5.4 Deliverable 5.4 Progress report on market and business concept analysis. Summary **https://glopack2020.eu/public_deliverables/d5-4-progress-report-on-market-and-business-concept-analysis/**

[46] BioÄly-tiekartta (2020), Biopohjaiset älykkäät ratkaisut -ekosysteemi kiertotalouden alueellisena vahvistajana (BioÄly draft roadmap). http://www.bioaly.fi/wp-content/uploads/2020/10/BioAly-tiekartta-Lokakuu-2020.pdf

[47] 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

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)[48] of 312 Norwegian consumers focused on consumers' cognitive and affective responses to ecological packaging (in this case a bottle made partly of plant-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)[49] who found that functional and emotional strategies should be complementary rather than 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)[50] 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.

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[48] 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

[49] 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

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

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 of bio-based products is a condition for a positive attitude and intention to buy bio-based products. In order to understand consumers' perception 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. 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 4, 5 and 6 show the results of the three types of associations that respondents were asked to report (1) positive associations (Figure 4), (2) negative associations (Figure 5) and (3) associations with specific products (Figure 6).

Figure 4. Word cloud showing positive associations with bio-based products

Figure 5. Word cloud showing negative associations with bio-based products

Figure 6. Word cloud showing associations with specific products

In the **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[51].

The **BIOWAYS** project conducted two online consumer surveys, at project start and end respectively. 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, for example. Meanwhile, however, the public seems to be unfamiliar with the bio-based applications used by industry and business 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 environmental impact and are willing to pay more for a bio-based product of the same functionality and properties to a fossil-fuel derived one. Nevertheless, the survey does indicate that limited market availability and high prices are important factors that inhibit the wider use of bio-based products[52].

Building on the Open-Bio findings the **ROADTOBIO** project conducted in autumn 2017 a literature survey, analysing the 17 most relevant reports about public perception of bio-based products, in order to identify barriers for further market development. 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.

With regard to **awareness and knowledge**, the literature survey 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

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

[52] 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

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 2) 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 research studies 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 2. Positive and negative connotations about bio-based products

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
• Economic • Economic growth • Regionally produced • Agricultural development	• Economic • Expensive • Limited availability • Product quality
• Health • Healthy • Safe	• Trust • Misleading • Greenwashing • Buzzword • Marketing item
• Innovation • Innovative	• Ethics • Competition with food

• Useful	• Genetic modification

Using a series of focus groups the BIOCANNDO project explored consumer appreciation of e.g. bio-based food packaging in 2018. 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[53].

Besides the focus groups BIOCANNDO also conducted consumer surveys related to its three case study topics (bio-based household cleaning products, bio-based insulation materials, and bio-based food packaging materials) in a face-to-face interview format in a live setting i.e., at trade fairs; two fairs in Germany and one fair 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 the respondents' associations towards bio-based products respondents were asked to choose up to five (5) expectations that they had regarding the bio-based product. They could choose those from a predefined list of 12 (cleaning), 16 (insulation) or 13 (packaging) items, plus an additional option to name an item of their choice, categorised under "other". The respondents overwhelmingly expected the bio-based product to be better for the environment (Table).

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".[54]

Table 3. Expectations towards bio-based products (up to five answers possible)

What are your top 5 expectations towards…		
… bio-based detergent or cleaner? (n=140)	… bio-based insulation material? (n=125)	… bio-based packaging? (n=155)
• Is better for the environment (112) • Is less harmful to water (110)	• Is better for a healthy living environment (78) • Is easier to dispose of (69) • Contributes to climate protection (66)	• Can be composted/is biodegradable (124) • Is better for the environment (107) • Can be solution to plastic in the sea/marine litter (94)

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

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

What are your top 5 expectations towards…		
… bio-based detergent or cleaner? (n=140)	… bio-based insulation material? (n=125)	… bio-based packaging? (n=155)
• Is better for your health (87) • Cleans as well (78) • Contributes to climate protection (61) • 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)	• Bio-based materials are grown sustainably (59) • Is more expensive (48) • Insulates just as well (46) • 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)	• Production causes less greenhouse gas emissions (81) • Can be recycled (76) • Bio-based raw materials are down sustainably (55) • 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 sustainably 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 found to be: (1) Biodegradability; (2) Recyclability; and (3) Type and origin of raw material. For consumers, the top three social issues were found to be: (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. They ranked the two economic issues as follows: (1) Fair land use rights practices in the production of feedstock and (2) Fair business practices of the company. 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.[55]

[55] 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

In summer 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 [56]

- 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.
- Another interesting result is that 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 motivation and interest 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.[57]

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

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

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

- Absence of well-targeted promotion of bio-based products[58]

Building on these findings BIOBRIDGES has initiated an online consumer survey in 2020. The survey aims to assess consumers' awareness about bio-based products and to understand their purchase habits. Survey findings are to be published in December 2020.[59]

EFFECTIVE is another BBI JU project that is currently researching consumer sentiment towards bio-based products. The survey is led by CIRCE project. Results have yet to be published.[60]

3.3 Take home messages from literature review

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

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 more positive image, it can offer a competitive and strategic advantage in the markets.
3. 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.
4. Options that brands consider include switching to a portion of the packaging being made from bio-based, biodegradable, compostable or recycled substrates.
5. 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.
6. 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.

[58] 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

[59] BIOBRIDGES (2020), Survey on consumers' awareness on bio-based products, https://www.biobridges-project.eu/survey-for-consumers-/

[60] EFFECTIVE (2020) newsletter, https://www.effective-project.eu/f/docs/DOWNLOAD/EFFECTIVE---Spring-Newsletter---A-biobased-economy-for-the-post-virus-world.pdf

7. 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.
8. A large share of consumers expect and perceive 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.
9. Bio-based is often confused with "natural" or "organic", which acts as a driver as people expect them to be more healthy 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.
10. 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.
11. 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.
12. 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 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.
13. 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.
14. 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.

4 SURVEY FINDINGS

4.1 Introduction to Survey Results

The BIOSWITCH survey and regional interviews were conducted among brand owners across Europe between the beginning of August and mid-September 2020. In total there were 60 responses received from the brand owners, these comprise 40 pan-European survey responses and 20 regional interviews. To compile our Pan-EU survey we have combined the results of both the survey and interviews to increase the survey size and geographical representation. In addition, an overview of the breakdown of regional responses is provided below. In total, 8 countries were represented in the Pan-EU survey, including; Belgium, Denmark, Finland, Ireland, Netherlands, Spain, Sweden and UK. The survey and interview respondent profiles represent a broad range of company roles including senior management positions. Respondent roles within the brand companies related to R&D, new business ventures, innovation management and sustainability management. A summary of the findings and trends of the Pan-EU analysis can be found in Section 6.1 while an inter-regional analysis of regional interviews can be found in Section 6.2. We have broken down our survey response into the following sections;

- Brand Owner Background
- Brand Owner Background with regards to Bio-based Products
- Brand Owner Risk Barriers and Needs with regards to Bio-based Product Uptake
- Brand Owner Motivations and Incentives with regards to Bio-based Product Uptake
- BIOSWITCH Co-operation Questions

4.1.1 Brand Owner Background

Which sectors participated in the survey?

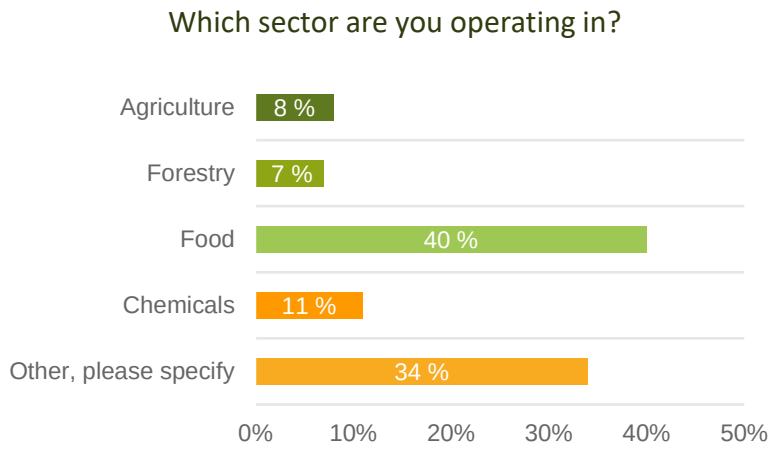

Figure 7: Primary sectors of participating brand owners

In terms of sectoral participation from respondents, the interviews and surveys focused on the four sectors of primary focus within BIOSWITCH, Agriculture, Food, Forestry and Chemicals. While all of the 4 major sectors were represented in the respondents, there was a particularly high representation of brand owners coming from the food sector (40 %), with lower representation from each of chemicals (11 %), agriculture (8 %) and forestry (7 %). Looking at the 34 % of brand owners who indicated other as their sector, these sectors included nutraceutical, biopharmaceutical, aquaculture, bioenergy, horticultural products and health and well-being. Looking at the regional breakdown, all interview brands from Belgium were from the food sector, with food and agriculture sectors represented from Spain. In Demark participating brands came from agriculture, forestry, food (including beverage), chemicals, construction and packaging sectors, while Finland was represented by brand owners from the forestry, food, chemicals and textiles sectors.

4.1.2 Brand Owner Background with regards to Bio-based Products

Do the surveyed organisations have brands which include products with bio-based content, and if not, would they consider including bio-based feedstocks or ingredients within their products?

In response to whether brand owners currently have brands which include products containing bio-based content as per European Committee for Standardisation (CEN) definition (i.e., 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), 72 % of Pan-EU brand owners indicated this to be case. This seems quite a high number and may be influenced by the high participation rate of food brand owners within the survey. According to the CEN definition used, food could be understood as qualifying as a bio-based product. Of those respondents that do not currently have brands which include products with bio-based content, 85 % indicated that they would consider including bio-based feedstocks/ingredients within some of their brand products with 79 % indicating that this would apply to both existing and new products, 15 % saying this would apply to new products only and 6 % indicating that this would apply to existing products only. On a regional level there is quite a lot of variation between the participating countries over the proportion of brand owners who already include products within bio-based content within their brands, with all of the Finnish and Danish respondents indicating that they currently include bio-based content within their brands, and none of the Spanish respondents indicating this to be the case. Looking at future inclusion of bio-based ingredients/products within their brands, all the Finnish and Danish brands indicated that they would consider including bio-based ingredients/products, with most Belgian brand and a minority of Spanish brands confirming this (see Figure 9 below).

Figure 8. Future inclusion of bio-based ingredients

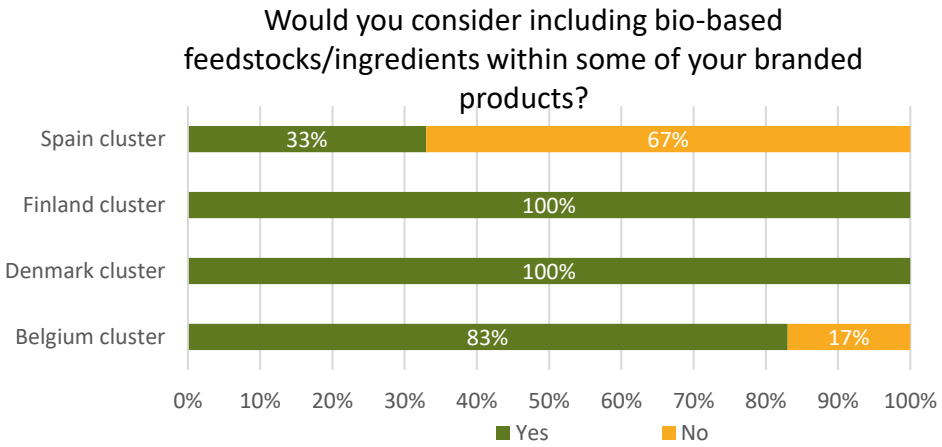

Figure 9. Future inclusion of bio-based ingredients for regional clusters

Which stakeholders have brands engaged with in relation to bio-based products?

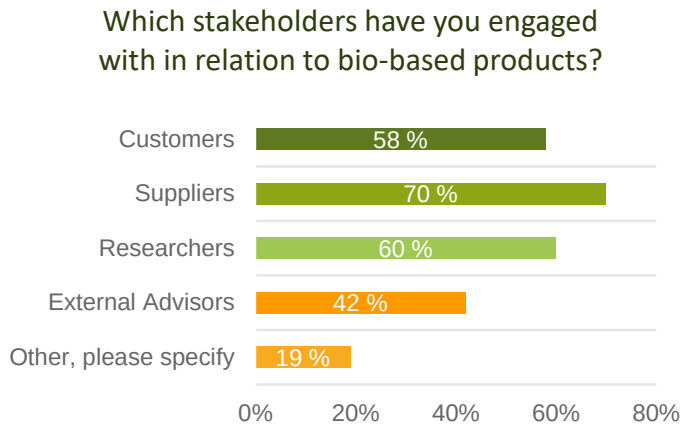

Figure 10. Level of stakeholder engagement

When asked which stakeholders they have engaged with in relation to bio-based products the organisations, brands indicated that they have mainly engaged with suppliers (70 %), followed by researchers (60 %) and consumers (58 %), with a smaller number indicating that they have consulted with external advisors (42 %). On a regional level, 83 % of Belgian brands have engaged with suppliers, and 66 % have engaged with customers, while 32 % have engaged with both researchers and external advisors. 100 % of Danish respondents have engaged with their suppliers and customers with regards to bio-based products, with 85 % engaging with researchers and 57 % engaging with external advisors. 100 % of Finnish respondents have engaged with both customers and suppliers, with 50 % engaging with researchers and external advisors, while in Spain all respondents had engaged with customers, suppliers, researchers and external advisors.

What are the main categories of products that brands would consider integrating bio-based ingredients?

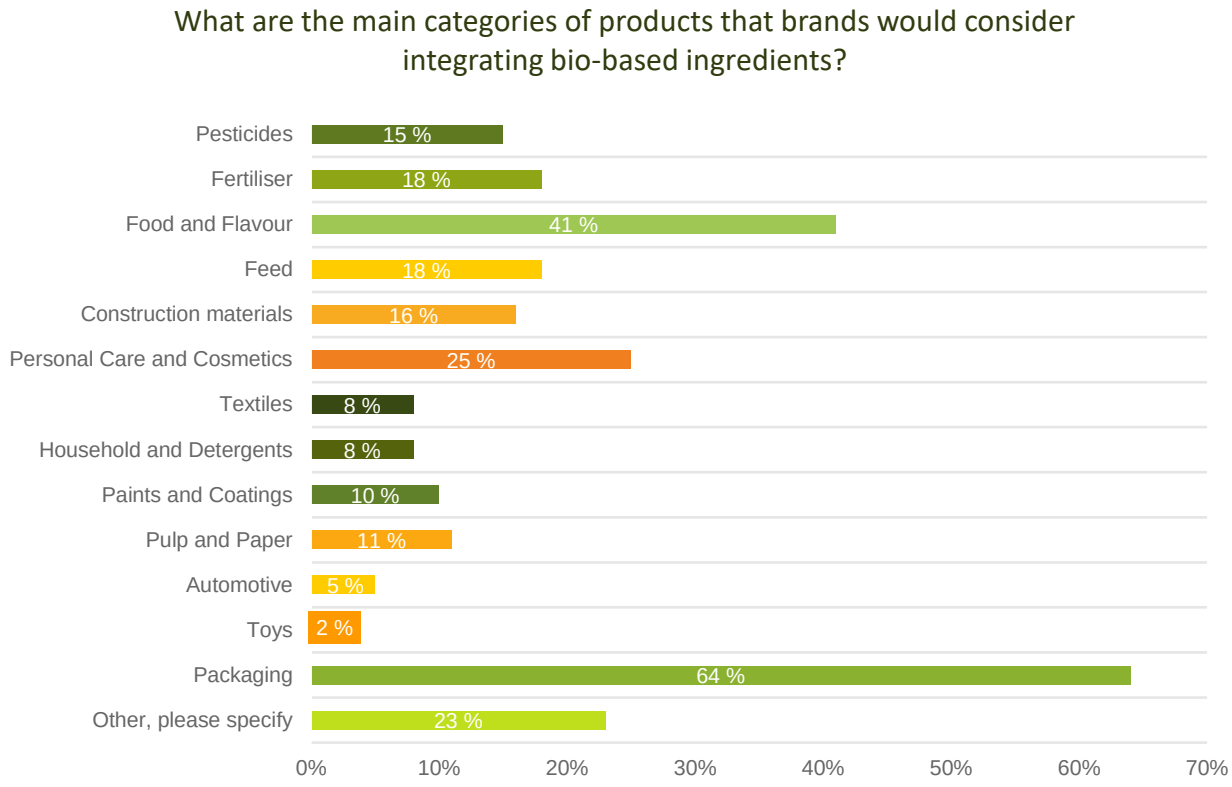

Figure 11. Main categories of products that brand owners would consider integrating bio-based ingredients

When asked about the main categories of products which brand owners were interested in, bio-based packaging was a key area of interest for 64 % of respondents. Other products of interest included food and flavour (41 %), personal care and cosmetics (25 %), fertiliser (18 %), feed (18 %), construction materials (16 %) and pesticides (15 %). There was smaller interest in pulp and paper (11 %), paints and coatings (10 %), textiles (8 %), household detergents (8 %), automotive (5 %) and toys (2 %). 23 % of respondents indicated other products including bioactive ingredients, nutraceuticals, pet foods, plastic trays. On a regional level, in Belgium 100 % of brands indicated interest in bio-based packaging with 83 % interested in food and flavour ingredients. In Denmark 49 % of Danish brands indicated an interest in bio-based packaging, with 28 % interested in food and flavour and 14 % interested in both household detergents and construction materials. In Finland 75 % of brands were interested in bio-based packaging, 50 % interested in construction, 50 % in personal care and cosmetics, 50 % in paints and coatings, and 25 % interested in each of food and flavour, pulp and paper, textiles and automotive products. In Spain two thirds of brands interviewed indicated an interest in bio-based packaging with 1/3 each indicating fertiliser and feed.

Do brands use bio-based packaging and if not, would they consider using it in future?

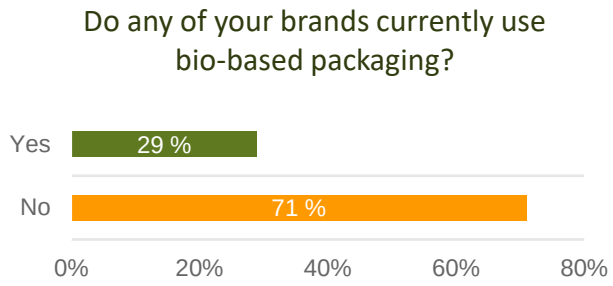

Figure 12. Current use of bio-based packaging

When asked about whether their brands currently make use of bio-based packaging, the Pan-EU stakeholders indicated that only 29 % currently use bio-based packaging, with 71 % not using bio-based packaging. When those Pan-EU brand owners who do not currently used bio-based were asked if they would consider using bio-based packaging in future, the overwhelming majority 95 % indicated that they would be interested. On a regional level 33 % of Belgian respondents, 57 % of Danish respondents, 25 % of Finnish respondents and 0 % of Spanish respondents currently have brands which use bio-based packaging, while 100 % of Belgian respondents, 100 % of Danish respondents, 50 % of Finnish respondents and 67 % of Spanish respondents who do not currently use bio-based packaging would consider using bio-based packaging in future.

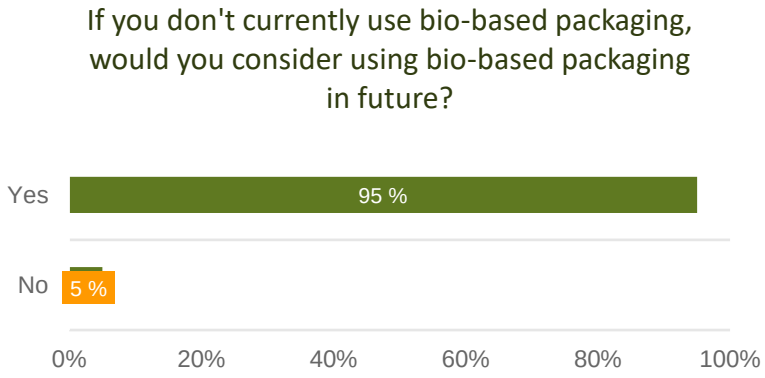

Figure 13. Future use of bio-based packaging

4.1.3 Brand Owner Risks, Barriers and Needs with regards to Bio-based Product Uptake

What are the main barriers to bio-based ingredient/product uptake within brand organisations?

When asked about the main barriers to bio-based ingredient/product uptake within brand organisations, Pan-EU respondents indicated cost (too expensive) as the most prominent barrier at 58 %. Other prominent barriers indicated include uncertainty around functional performance at 54 %, and incompatibility within existing processes was seen as key barrier at 32 %, indicating that the brands are looking for bio-based alternatives which fit seamlessly within their processes and product lines. Other noted barriers for Pan-EU respondents include; feedstock or ingredients supply uncertainties (27 %), regulatory challenges placing the product on the market (24 %), uncertainty around environmental benefits (17 %), insufficient customer demands (17 %), uncertainty around end of life management (17 %), lack of supporting policies (15 %), challenges in communicating the environmental benefits of the products (10 %). On a regional level the most prominent barriers in Belgium; were too expensive (83 % of brand owners indicated), feedstock or supply chain uncertainties (66 %), uncertainty around environmental benefits (50 %) and incompatibility with existing process (50 %), in Denmark; uncertainty around functional performance (71 %) too expensive (42 %), uncertainty around functional performance (28 %), feedstock or supply chain uncertainties (28 %) and uncertainty around end of life management (28 %), Finland; too expensive (50 %), uncertainty around functional performance (50 %), incompatibility with existing process (50 %), Spain; too expensive (100 %), uncertainty around functional performance (66 %), insufficient customer demand (66 %).

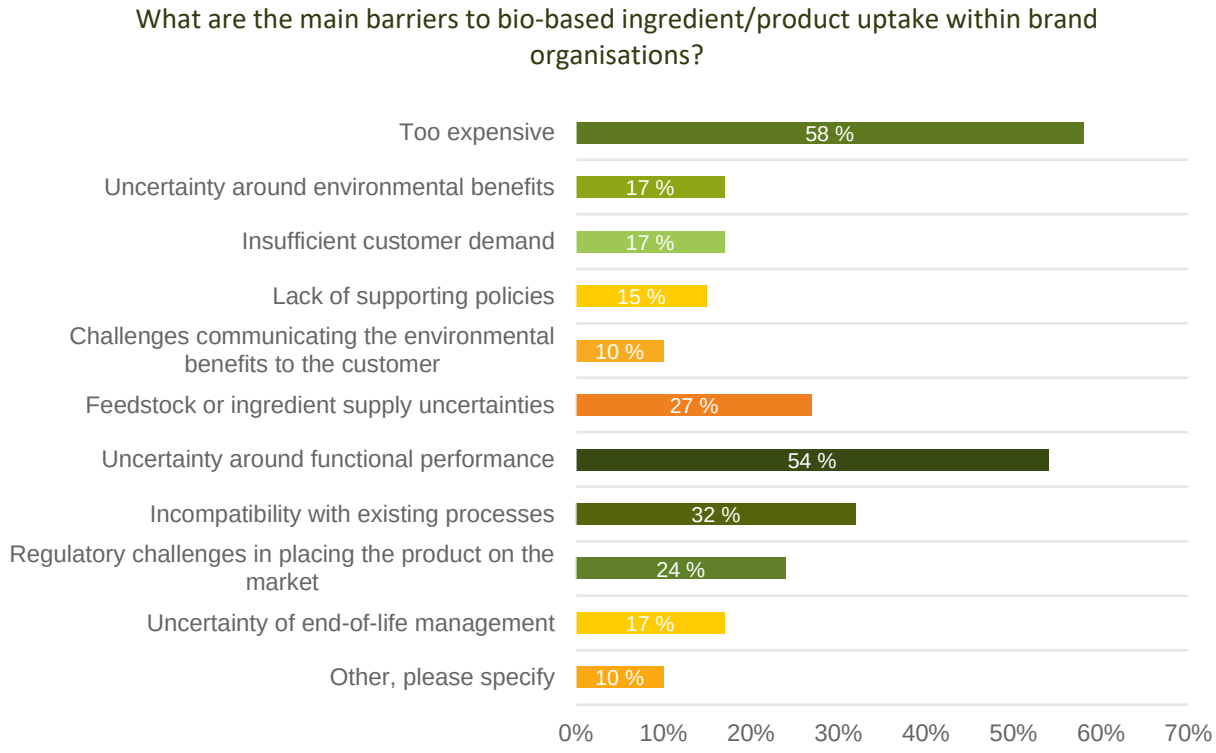

Figure 14. Main barriers of bio-based ingredient/product uptake within brand organisation

What do brand owners see as the main barriers to growth of customer demand for bio-based products?

When asked their opinion on the main barriers to growth of customer demand for bio-based products Pan-EU brand indicated that cost again was the main barrier at 77 % with lack of customer knowledge on the benefits of bio-based products also featuring as a key growth barrier according to 67 % of brands. Half of brands surveyed see lack of on the market products as a barrier to customer demand, while 47 % indicated uncertainty around sustainability of bio-based products as a primary barrier to growth of customer demand. On a regional level when assessing the main barriers to growth of customer demand, Belgian brands indicated expense (83 %), lack of customer knowledge on the benefits of bio-based products (50 %), uncertainty around sustainability of bio-based products (33 %); Danish brands chose too expensive (57 %), uncertainty around sustainability of bio-based products (42 %), lack of on the market products (42 %) and lack of customer knowledge (42 %); Finnish brands chose too expensive (100 %), lack of customer knowledge (25 %), uncertainty around sustainability of bio-based products and lack of on the market products (25 %); Spanish brands choose too expensive (100 %) and lack of customer knowledge on bio-based products (66 %).

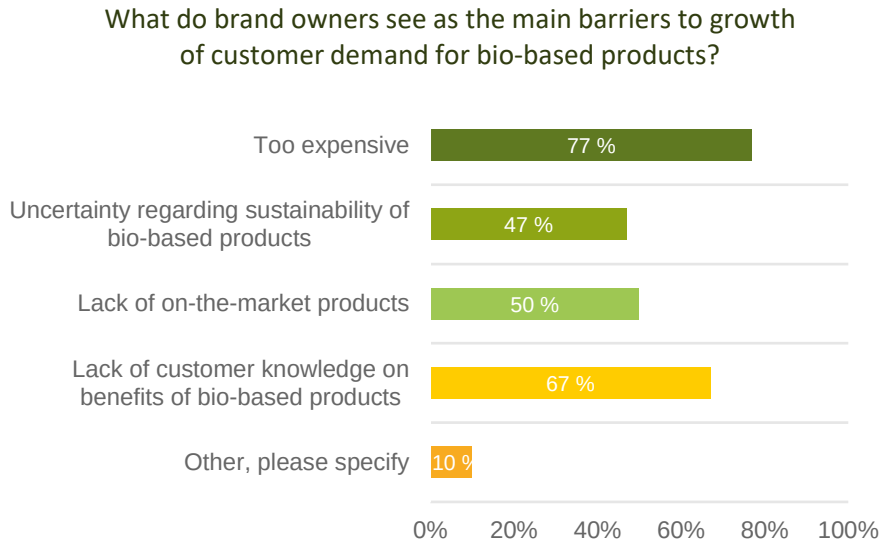

Figure 15. Main barriers for growth of customer demand for bio-based products

What do brands see as the main risks associated with bio-based product uptake?

When asked what they see as the main risks associated with bio-based product uptake, 61 % of brands indicated poor functionality and 52 % indicated incompatibility with existing processes, once again indicating concerns over the challenges associated with seamless transition to bio-based alternatives. 48 % of respondents chose identified uncertainty around future regulations, 41 % feedstock or ingredients supply chain uncertainties and 38 % insufficient customer demand as other main risks associated with bio-based product uptake. Other risks indicated included uncertainty around the product sustainability, lack of standardization and the inability to make claims about the products to the consumers. On a regional level Belgium brands identified the main risks as poor functionality (66 %), feedstock or ingredient supply chain uncertainties (50 %), incompatibility with existing process and insufficient customer demand (33 %); Danish brand owners identified poor functionality (85 % of brands), feedstock or supply chain uncertainties (42 %), and incompatibility with existing processes (28 %) as the main risks, Finnish brand owners indicated the main risks as being uncertainty over future regulations (100 %), incompatibility with existing process (75 %) and poor functionality (50 %), while Spanish brands identified, insufficient consumer demand (100 %), poor functionality (66 %) and uncertainty around future regulations (33 %) as the main risks associated with bio-based product uptake.

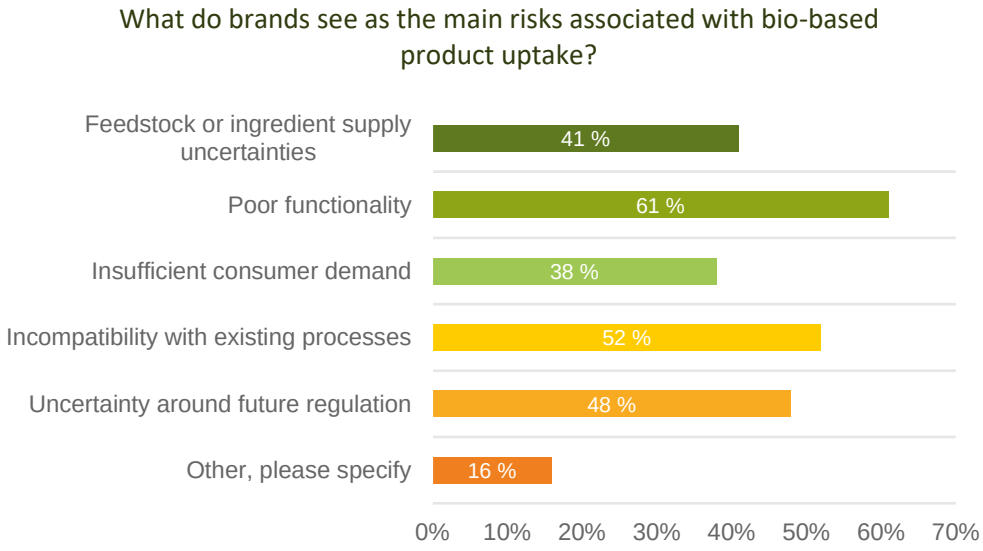

Figure 16. Main risks for brand owners associated with bio-based product uptake

What are the specific needs of brands when it comes to choosing an alternative bio-based ingredient/product?

When surveyed on their specific needs when it comes to choosing an alternative bio-based ingredient or product, 83 % Pan-EU brands indicated that competitive price is a key need, followed by superior functional performance (65 %) and compatibility with existing process (63 %). 58 % of brands indicated that superior environmental performance was a specific need, although in feedback some brands indicated that equal performance to the incumbent product would be adequate. Other needs indicated included a reliable supply of ingredient/product, clear details on how product should be managed at end of life and a high degree of biodegradability. We also queried whether brand owners need support on choosing alternative bio-based ingredients or products to use in their brands, with 75 % indicating that they do require support on this. On a regional level Belgium brand indicated the main needs when choosing an alternative bio-based ingredient/product as competitive price (83 %) and superior environmental performance (83 %), followed by superior functional performance (66 %); Danish brands indicated their main needs as products with superior functional performance (71 %), superior environmental performance (71 %), competitive price and compatibility with existing process (both 57 %), Finnish respondents indicated compatibility with existing process (100 %), competitive price (100 %), superior functional performance and superior environmental performance (50 % each) as the main needs; while Spanish brands indicated competitive prices (100 %), superior environmental performance (66 %) and superior functional performance (33 %) as the main needs.

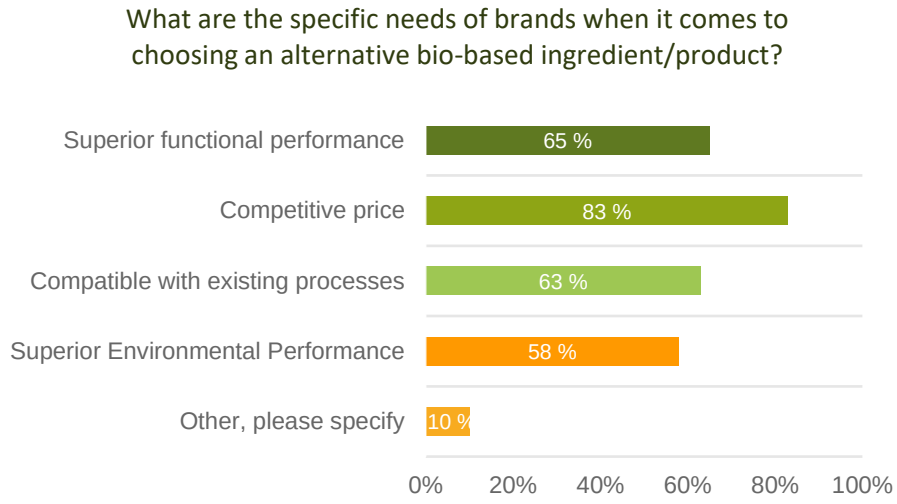

Figure 17. Needs of brand owners choosing bio-based ingredients and products

Do the respondents require support identifying opportunities for integrating bio-based ingredients within their brands?

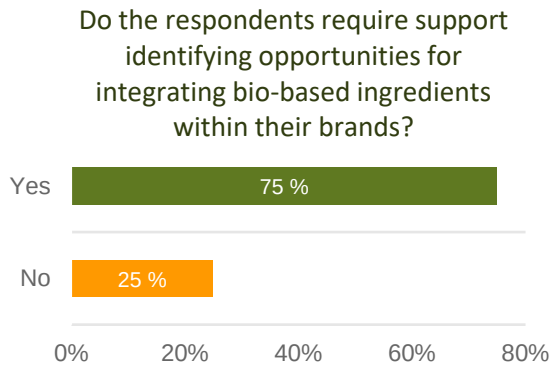

Figure 18. Support needed to identify opportunities for integrating bio-based ingredients within their brands

When asked if they need support identifying opportunities for integrating bio-based ingredients within their brands, 75 % of Pan-EU brands indicated that this support is required. On regional level 100 % of Belgium brands require this support, with 42 % of Danish brands, 75 % of Finnish Brands and 33 % of Spanish brands requiring this support.

4.1.4 Brand Owner Motivations and Incentives with regards to Bio-based Product Uptake

What are the main motivations for brands switching to bio-based products?

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 a 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. On a regional level, 66 % of Belgian brand owners indicated meeting company sustainability targets as a 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.

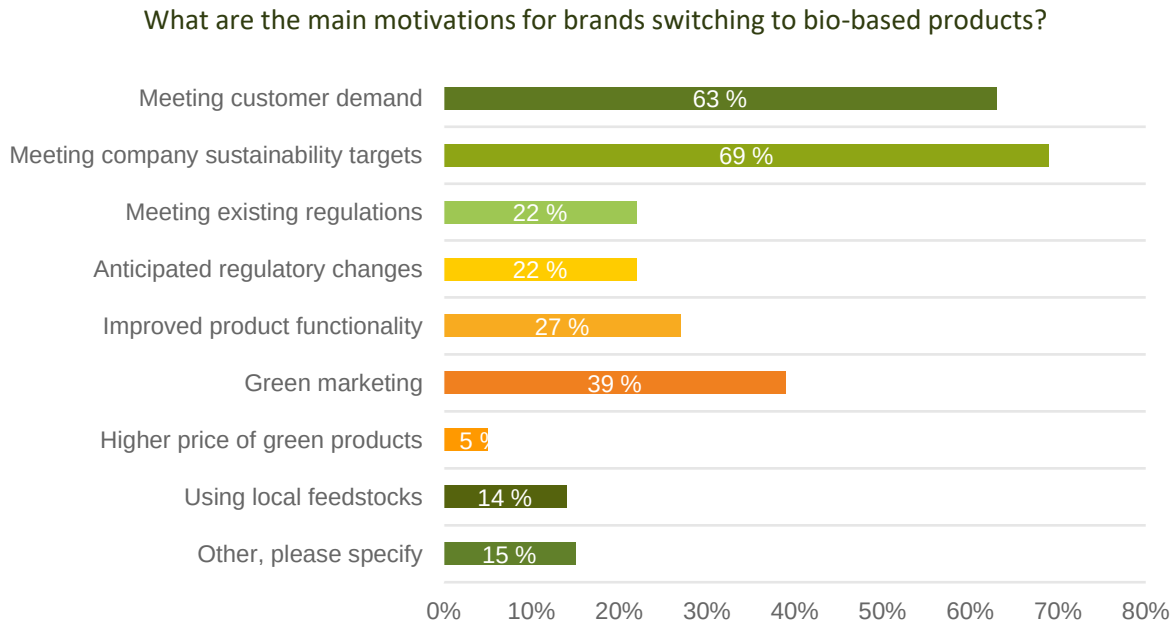

Figure 19. Main motivations for brand owners switching to bio-based products

How do brands foresee their customer demand for bio-based products over the next 5 years? And what are the main drivers for growth of customer demand?

When asked to predict how their customer demand for bio-based products is likely to develop over the next 5 years, almost a quarter of Pan-EU brands indicated that the foresee either strong growth (30 %) or moderated growth (44 %) with 13 % predicting slow growth, and 3 % indicating no growth. When asked about the main drivers of growth in consumer demand, the Pan-EU brand owners indicated that the main drivers were customer preference for products with low environmental impacts (73 % chose this as a driver), followed by improved customer awareness of the benefits of bio-based products (71 %). 46 % indicated greater availability of bio-based products as a driver towards growth in customer demand, while 36 % indicated more cost-competitive products as a driver. 19 % said that customer demand for superior products was a driver while 17 % indicated customers prefer for locally sourced products. Other indicated drivers among customers as perceived by brand owners, include regulation and young people and millennials influencing older people in households.

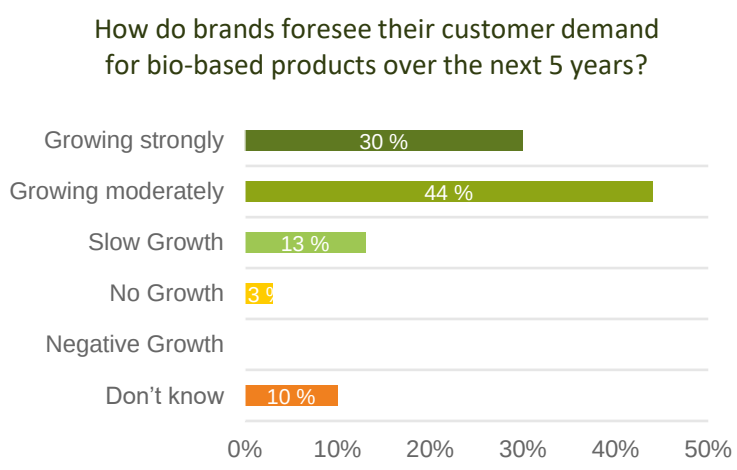

Figure 20. Projected future growth of customer demand for bio-based products over the next 5 years

On a regional level, 15 % of Belgian brands project strong growth, while 32 % project moderate growth and further 32 % project slow growth. 42 % of Danish brand see their consumer demand growing strongly, while 58 % foresee demand growing moderately, in Finland 75 % project strong growth, while 25 % project moderate growth ; and in Spain 33 % each project strong growth, moderate growth and slow growth. When asked about the drivers of growth in customer demand, most Belgian brands indicated that the main drivers were improved customer awareness of bio-based products and customer preference for products with low environmental impact (66 % each), followed by greater availability of bio-based products (33 %); 85 % of Danish brands said improved customer awareness of bio-based products and customer preference for products with low environmental impact were two of the main drivers, while 42 % indicated greater availability of bio-based products; 100 % of Finnish brands indicated that improved customer awareness of bio-based products and customer preference for products with low environmental impact were among the primary drivers while 50 % indicated more cost competitive products as being one of the main drivers ; while 2/3 of Spanish brands indicated more cost competitive products as being a driver, with 1/3 each indicating improved customer awareness of bio-based products, customer preference for products with low environmental impact and greater availability of bio-based products.

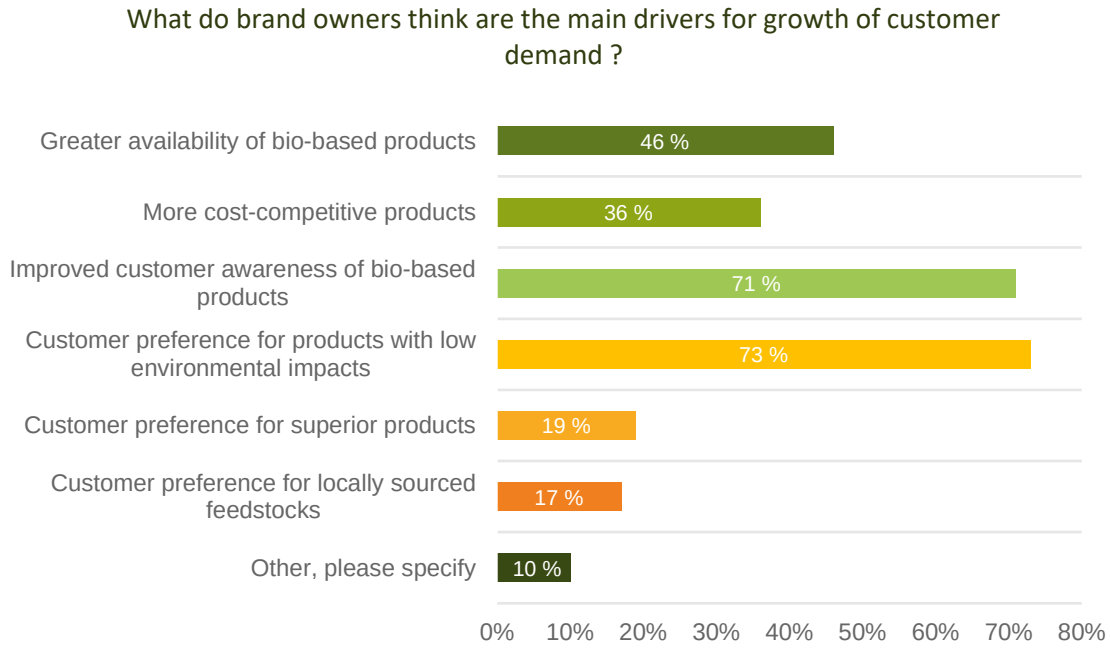

Figure 21. Main drivers for growth of customer demand for bio-based products

Who are the most important stakeholders with whom brand owners need to engage in order to ensure uptake of bio-based products?

When ask who they felt were the most important stakeholders whom they need to engage with in order to ensure uptake of bio-based products, the majority of Pan-EU brands indicated that customers (78 %) and suppliers (77 %) are among the most important stakeholders, followed by authorities or legislators (48 %), the public (37 %), their own employees (12 %), and associations (8 %). On a regional level, Belgian brands indicated their most important stakeholders with whom they need to engagement to ensure uptake of bio-based products is the suppliers, while Danish, Finnish and Spanish stakeholders all indicated the consumer to be the most important stakeholder.

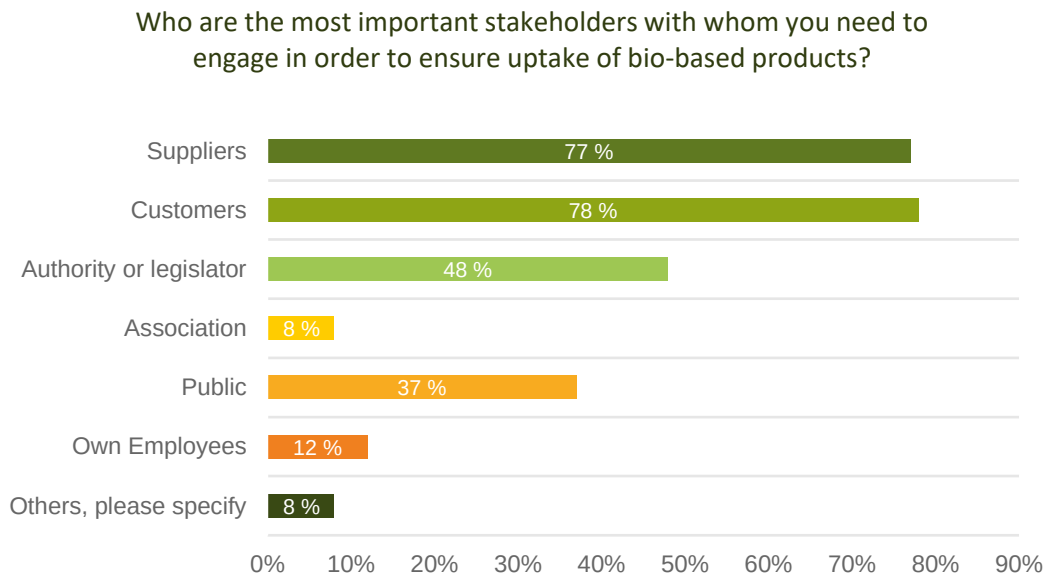

Figure 22. Key stakeholders for brand owners to engage with in order to ensure uptake of bio-based products

4.1.5 BIOSWITCH Cooperation Questions

The BIOSWITCH project is developing tools and events which will support brand owners in their transition towards uptake of bio-based products. In order to demonstrate our future activities and to offer support to brand owners, we asked some engagement-related questions to understand if brands wished to co-operate future with the BIOSWITCH project, and if so, to understand which activities the brand owners were most interested in participating.

Do the brand owners wish to engage with the BIOSWITCH project to gain support on the journey of switching to bio-based? And if so, which supports are they interested in?

When asked if they wish to engage with the BIOSWITCH project to gain support on the journey of switching to bio-based, 73 % of brands indicated that they wished to engage. The main activities that the brands wanted to participate on included ; newsletter subscription (79 % of brand owners), access to switch-to-bio-based best practice case studies (57 %), access to BIOSWITCH toolbox (55 %), online networking event for brand owners as well as participation in project webinars (both 49 %). Looking at regional responses 100 % of Belgian, Finnish and Spanish brands indicated that they wish to engage with the BIOSWITCH projects, while 57 % of Danish brands are wanting to engage with BIOSWITCH and the project activities.

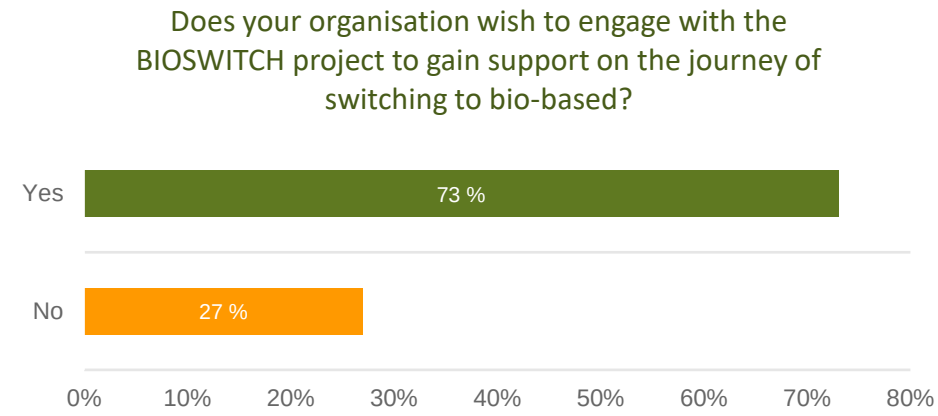

Figure 23. Engagement with the BIOSWITCH project

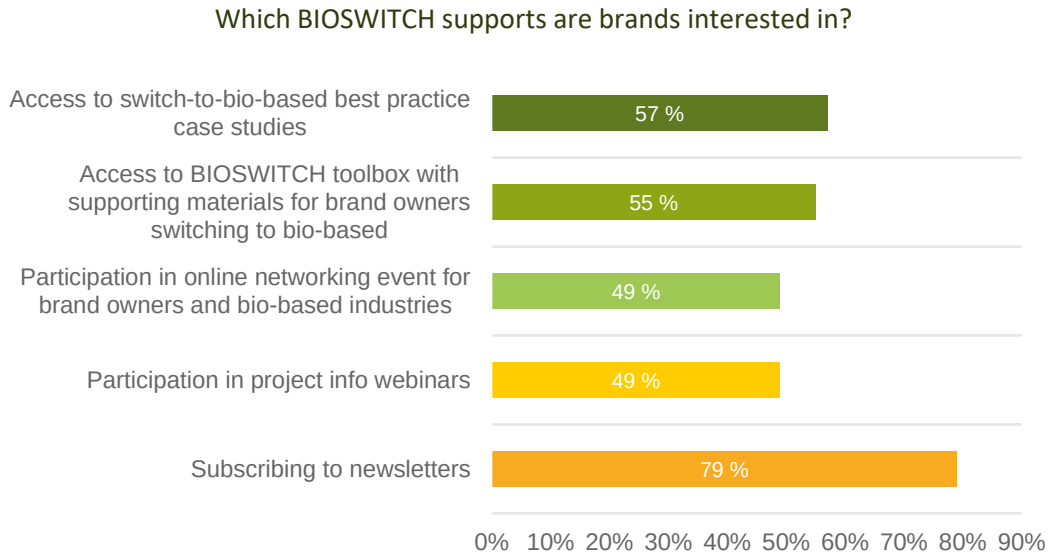

Figure 24. Brand owner interest in BIOSWITCH supports

5 DISCUSSION

5.1 Analysis of Pan-EU Brand Owner Survey Results

The pan-EU survey (conducted online) and the regional survey in Belgium, Denmark, Finland and Spain (conducted through telephone or online meeting interviews) covered respective of some 40 and 20 respondents, for a total of 60 participants. Although care should be taken to draw absolute conclusions due to the limited number of respondents included in the study, some useful insights were gained from this targeted study.

5.1.1 Prioritized applications

By a large margin, the key category that brands would consider applying bio-based ingredients in is **packaging (64 %)**, followed at (significant) distance by food and flavour (41 %) and personal care and cosmetics (25 %). In Finland and Belgium, the interest in packaging is particularly high (75 % resp. 100 %).

When asked specifically about bio-based packaging, Pan-EU brand owners currently not using this type of packaging overwhelmingly (95 %) indicated they would consider using bio-based packaging in future. For Belgium, Denmark, Spain, and Finland the respective percentages are: 100 %, 100 %, 67 % and 50 %.

That a far majority of brands prioritises bio-based packaging does not come as a surprise and was the reason to include specific questions on this topic. In the literature review an increased interest in bio-based packaging was found to be a distinct trend. Reasons for this trend may include (a) compliance with stricter European packaging and packaging waste regulations, and (b) changing packaging composition is considered easier than changing product composition (as brands are looking for bio-based alternatives which fit seamlessly within their processes and product lines).

5.1.2 Barriers to bio-based ingredient/product uptake

Within the Pan-EU brand organisations the two most prominent barriers to bio-based ingredient/product uptake were found to be **higher cost** (58 %) and uncertainty around **functional performance** (54 %), followed at some distance by **incompatibility within existing processes** (32 %) and feedstock or ingredients **supply uncertainties** (27 %). Interesting, less than one in four Pan-EU brand owners listed such factors as regulatory challenges, uncertainty around environmental benefits, insufficient customer demands, uncertainty around end of life management, lack of supporting policies and challenges in communicating the product's environmental benefits as key barriers. At the regional level the same key barriers were reported, with few exceptions in particular for the third barrier, which in Belgium was brand uncertainty around **environmental benefits** (50 %) and in Spain insufficient **customer demand** (66 %).

In the literature review, the **policy and regulatory framework** was mentioned often as a key barrier, beyond higher costs, functional performance and supply uncertainties, whereas **incompatibility with existing processes** was not specifically mentioned.

Above we observed that brand organizations would consider switching to bio-based packaging. It may be that in this specific field (European) policies and regulations are sufficiently clear, and that therefore policy and regulatory framework was not often mentioned by the respondents.

Incompatibility with existing processes is a very practical barrier, that companies may only get experience with when they actively research a shift to bio-based. For this reason, it may not have come up in the more generic studies and surveys covered in the literature review.

5.1.3 Market growth barriers

Within the Pan-EU brand organisations, the two most prominent barriers to market growth were found to be **higher cost** (77 %) and **lack of customer knowledge** on the benefits (67 %), followed at some distance by **lack of on-the-market products** (50 %) and **uncertainty around sustainability** (47 %).

In the literature review, the barrier **lack of on-the-market products** did not come up. This is again a very practical barrier, that only companies exploring or actively researching a shift to bio-based may experience.

The answers incompatibility with existing processes (above) and **lack of on-the-market products** (here) would seem to indicate that among the surveyed brand organizations there are several with clear intentions and plans to shift to bio-based.

5.1.4 Risks Associated with bio-based product uptake

When asked what they see as the main risks associated with bio-based product uptake, 61 % of brands indicated **poor functionality** and 52 % indicated **incompatibility with existing processes**. Further risks associated with bio-based product uptake mentioned at the pan-EU level included uncertainty around future regulations (48 %), feedstock or ingredients supply chain uncertainties (41 %) and insufficient customer demand (38 %).

In terms of ranking the main risks, at the country level a somewhat different pattern emerges. In Belgium (where all respondents come from the food sector), incompatibility with existing processes is not listed in the Top 2. In Finland all respondents (100 %) consider **uncertainty around future regulations** a key risk. In Spain (where all respondents come from the food and agriculture sector) the same applies for insufficient **customer demand** (66 %).

The above factors were also found in the literature review, with the clear exception, as already mentioned above, of **incompatibility with existing processes.**

Although the Top 2 risks once again indicate brands' concerns over the **challenges associated with seamless transition** to bio-based alternatives it is clear that what is considered a key risk varies strongly between countries, sectors and even individual brands. And is also linked to the stage of the bio-based transition journey that the company is at.

5.1.5 Specific needs of brand owners switching to bio-based

When it comes to choosing an alternative bio-based ingredient or product, half or more of the Pan-European brands indicated as key needs competitive price (83 %), equal or superior functional

performance (65 %), compatibility with existing process (63 %) and superior environmental performance (58 %).

Looking at the regional level, in Belgium and in Denmark superior environmental performance ranked (*ex aequo*) first place, whereas in Finland and Spain competitive price was deemed by all respondents (100 %) to be the most important need.

With the already known exception (**incompatibility with existing processes)** the same factors are also mentioned in literature, with the environmental aspect (compliance with environmental regulations and consumers demanding environmentally-friendly practices and products) clearly gaining key importance in recent years.

5.1.6 Motivations of brand owners switching to bio-based

When asking Pan-EU 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.

At the regional level, the picture in (again) Finland and Spain differs somewhat. In Finland anticipated regulatory changes were mentioned by 50 % of the respondents. In Spain meeting existing regulations was the top motivator, mentioned by all (100 %) respondents.

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.

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 drivers.

5.1.7 Drivers for growth

Within the Pan-EU brand organisations, the two most prominent drivers for market growth were found to be customer preference for products with **low environmental impacts** (73 %) and improved **customer awareness** of the benefits of bio-based products (71 %), followed at some distance by greater **availability of bio-based products** (46 %) and **more cost-competitive products** (36 %).

In the regional surveys the same Top 2 applies, with one clear exception. In the survey in Spain more cost-competitive products was by far the most important driver, mentioned by all (100 %) of the respondents.

In literature there is agreement on the importance of low environmental impacts, the availability of bio-based products and improved customer awareness as drivers for growth. The need for a simple, official and trustworthy (eco-) label to help consumers identify the "good" materials is often mentioned. As is the observation that realising such label is not straightforward.

Regarding the need for costs-competitive prices there seem to be slight differences in opinion. According to literature, a certain share of customers are willing to pay a higher price, a green

premium, for bio-based products. These consumers even expect the price to be higher due the benefits and expectations that comes with bio-based. However, there is debate which type and share of consumers is really willing to pay more in practice, for which kind of products, and how much the green premium would really be. It would seem that the Spanish brand organisations have low anticipation of the green premium effect when it comes to their products.

With one or two exceptions the survey findings seem to be well in line with the literature research findings. In the literature review, the policy and regulatory framework was mentioned often as a key barrier to bio-based ingredient/product uptake, whereas incompatibility with existing processes was not specifically mentioned. And in the literature review, the market growth barrier lack of on-the-market products did not come up. Incompatibility with existing processes was mentioned once again when brands listed the main risks associated with bio-based product uptake.

In Finland and –in particular- Spain price seemed to be a very important factor overall. This is in line with literature findings. However, the survey has also made clear that what is prioritised and deemed most important, whether it concerns barriers, risks, needs or motivators, varies strongly between countries, economic sectors and even individual brands. And is also linked to the stage of the bio-based transition journey that the company is at.

5.2 Inter-regional Analysis of Brand Interview Responses

Section 5.2 provides a comparison of the regional responses to the different interview questions across our participating clusters in Belgium, Denmark, Finland and Spain. These clusters are;

CLIC Innovation: CLIC Innovation is a Finnish ecosystem orchestrator for research, development and innovation collaboration between industries and academia in the fields of circular economy, bioeconomy and energy system. The mission of CLIC Innovation is to boost creation of breakthrough solutions in Finland and EU. CLIC Innovation builds and manages collaborative RDI projects to construct systemic solutions which are beyond the resources of individual operators. The shareholders of CLIC Innovation include 30 companies and 17 universities and research institutions. CLIC Innovation is a full member of the Bio-based Industries Consortium.

CTA: CTA is a private foundation born from a public-private partnership. For 15 years, CTA has been supporting R&D activities through financing, mentoring and cooperation with main Andalusian stakeholders, emerging as a singular multi-sectorial, innovation cluster. Currently, CTA is owned by more than 160 companies (70% of them SMEs) and participates in international projects related to the bio-based industry aimed at accelerating new value chains, developing new bioproducts, digitizing biomass supply chains and promoting education.

Flanders Food: Flanders' FOOD is the spearhead cluster for the agri-food industry in Flanders. Flanders' FOOD operates as an industry- and strategy-driven innovation platform, contributing to a more competitive and sustainable agri-food sector. Concretely, we initiate and facilitate collaboration not only between our +300 member companies, research institutions and government, but also across sectors, across borders and between all links of the value chain. Flanders' FOOD is a full member of the Bio-based Industries Consortium.

Food and Bio Cluster: Food & Bio Cluster Denmark is a cluster with more than 300 members from the entire food and bioeconomy value chain. Food & Bio Cluster Denmark is a team of 40 specialists with different skills and backgrounds and manages on average about 40 regional, national, and international projects at any one time – all centred around innovation, financing, and internationalisation within the agriculture, bioresources, energy, environmental technology, and food sectors. FBCD is a full member of the Bio-based Industries Consortium (BIC) and has many years of experience in developing projects to support the growth of innovative SMEs in the bioeconomy and developing new projects along the value chain.

Overall, the brand owner sample size was relatively small, with 7 brands interviews undertaken within the Danish Cluster, 6 within the Belgian Cluster, 4 within the Finnish Cluster and 3 within the Spanish cluster. Care should therefore be taken when interpreting these results as a full representation of these regions, nevertheless there were some interesting comparisons which are summarized below.

5.2.1 Regional brand owner respondent background

When we compare the sectors that participated from the various clusters, we can see that the food sector was particularly well represented among respondents in Belgium through the Flanders Food Cluster, and Spanish Cluster led by CTA, with a larger representation from the forestry sector being seen in Denmark and Finland led by FBC and CLIC respectively. In addition, we had some representation from other sectors including agriculture, chemicals, construction, and packaging.

There was a good variety of company sizes participating; with Belgian, Finnish and Spanish brand owners being primarily large enterprises, but with Denmark seeing greater participation of small and medium enterprises; 67 % of Belgian respondents represented **large enterprises** with 33 % coming from **medium enterprises**; 43 % of Danish respondents were from medium enterprise with 29 % from large enterprises and 14 % each from small and **micro-enterprises**; 75 % of Finnish respondents were from large enterprises with 25 % coming from **small enterprises**; 67 % of Spanish respondents were from large enterprises with 33 % coming from small enterprises. As to whether the participating regional brands identified businesses **(B2B)** or consumers **(B2C)** as their primary customer base, all of the regions showed a stronger focus on B2B but with some B2C activity also; 50 % of Belgian brands said B2B was their primary customer with 33 % indicating B2C and 17 % indicating a mix of B2B and B2C, 57 % of Danish brands indicated B2B with 28 % indicating a mix of B2B and B2C, and 14 % indicating B2C as their primary customer; 75 % of Finnish brands indicated B2B with 25 % indicating B2C; 67 % of Spanish brands indicated B2B with 33 % saying their main customer was a combination of B2B and B2C. In general, almost all of the participating brands across the 4 clusters have sustainability goals in place within their organisation.

When asked if the current **COVID-19** crisis has impacted on strategic decision making within the brand owner organisations, the results were quite variable across the clusters. In Finland none of the brand owner organisations indicated that COVID-19 has impacted on strategic decision making, whereas all of the other cluster indicated that COVID-19 has had a least some impact on strategic decision making; this was the case for half of Belgian brand owners, two thirds of Danish brand owners and two thirds of Spanish brand owners.

COVID-19 has impacted on Danish brand owner's strategic decision-making, Belgian brand owners indicate only short-term changes, and Spanish brand owners express positive impacts. Danish brand owners have made changes to their business models because of the impact of COVID-19. For one Danish brand their customer base has shifted from 90 % B2B and 10 % B2C to 80 % B2B and 20 % B2C, with a new target to reach 40 % consumers. These changes have affected their production, packaging, and procurement. Belgium brand owner noted no changes to their long-term strategic decision making but short-term business operations were affected by COVID-19. Huge demand at the beginning of the pandemic for certain products forced short-term strategic changes as they could not process for all retail business. Two thirds of Spanish brand owners have been impacted by COVID 19 but stated that the impact has not been negative as they have easily adapted.

5.2.2 Prioritized products

Overall, the interest in **bio-based packaging** is strong across all regions, and this was the bio-based "product" of most interest in all 4 clusters. In terms of brands that already use bio-based packaging on their products there is significant variation with most Danish brand owners (57 %) already using bio-based packaging, some Belgian and Finnish brands (33 % and 25 % respectively) and no Spanish brands currently using bio-based packaging. Overall, survey brands across the cluster who do not currently use bio-based packaging, would be interested in considering bio-based packaging in future, although the interest varies by region with all Belgian and Danish respondents, two thirds of Spanish respondents and only half of Finnish respondents considering bio-based packaging in the future.

Other products of interest varied depending on cluster focus. In Belgium, there was a keen interest in food and flavour ingredients, as food was the sector of participating brand owners. In Spain there was interest in **feed** and **fertiliser**, in Denmark there was interest in **food** and **flavour** as well as **household products** and **construction materials**, while in Finland there was diverse interest in bio-based products including **construction materials**, **personal care and cosmetics**, **paints and coatings**, **food and flavour**, **pulp and paper**, **textiles** and **automotive** products.

5.2.3 Barriers to bio-based product uptake

Looking at the barriers to bio-based ingredients/product uptake within the regions, the **higher cost** associated with bio-based products is a barrier of varying significant across regions. All of the Spanish respondents indicated this to be one of their top 3 barriers, with 83 % of Belgian brands, 50 % of Finnish brands and 42 % of Danish brands including this within their primary barriers. **Lack of customer demand** was seen a significant barrier for Spanish brands, but this was seen less strongly in the other regions. **Feedstock or ingredient supply** uncertainties was a significant barrier in Belgium, but this was less obvious among brands from other regions. **Uncertainty around functional performance** of products was cited as a key barrier in Denmark, Finland, and Spain, while uncertainty around environmental benefits was among the key barriers identified in Belgium. **Incompatibility**

with existing processes was a key barrier to bio-based product uptake for both Belgian and Finnish surveyed brand owners. When it comes to risks associated with bio-based ingredient/product uptake on a regional level, it is clear that some brands in all regions share some doubts concerning the **functionality** of the bio-based product alternatives. Poor functionality was raised as a key risk in Denmark (85 %), Belgium and Spain (66 % each) with a smaller number of Finnish brand owners (50 %) also citing this. Once again, Spanish brands indicated issues around **insufficient consumer demand** for bio-based products, with all Spanish brands citing this as a key risk. This was less of key issue across the other regions. All of the participating Finnish brands citied uncertainty over **future regulations** as a key risk, which was not seen so strong in the other regions. On the issue of specific needs when selecting a bio-based alternative**, competitive price** was identified as a key requirement among brand owners in Belgium, Finland and Spain but with slightly lower focus in Denmark. **Superior environmental performance** associated with the bio-based products was also a key requirement, particularly in Belgium, Denmark and Spain, featuring less strongly in Finland. **Compatibility with existing processes** was one of the primary requirements of Finnish brand owners, **while superior functional performance** was a key requirement for Belgian and Danish brands.

5.2.4 Motivations of brand owners switching to bio-based

Looking at the motivations for bio-based ingredient/product uptake on a regional basis, **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 changes, and 28 % of Danish brands each indicated existing or anticipated regulatory changes as a key motivation.

5.2.5 Drivers for growth

When it comes to anticipated growth in their own consumer demand for bio-based products, Finnish brands were the most optimistic, with 75 % projecting **strong growth**, much higher than in Denmark (42 %), Spain (33 %) and Belgium (15 %). Overall, most brand owners expected **moderate to strong growth** in Denmark, Finland, and Spain, with a little more scepticism in Belgium where slightly less than half of brands anticipate moderate to strong growth. Looking at the key drivers of growth in consumer demand, **improved customer awareness of bio-based products** was a key driver for Finnish, Danish and Belgian brand owners, less so for Spanish brands who indicated more **cost competitive products** as the key driver of customer growth. **Customer preference for products with low environmental impact** is seen as a key driver of growth in Finland, Denmark, and Spain, and again for Spain brand owners it is not so significant.

5.2.6 Emerging regional trends

Looking at some of the emerging trends from the regional response, it is clear that bio-based packaging is a strong area of interest across the regions. Spanish brands overall seem uncertain around the customer demand for bio-based products, high costs for associated with bio-based product uptake is a clear barrier to integration and it seems they also view this a barrier to consumer uptake, which could be improved with most cost competitive products. Meeting existing regulations is a key motivation for bio-based product uptake among Spanish brand owners.

Finnish brands overall seem more certain that there is an existing consumer demand for bio-based product uptake and anticipate further strong growth in demand, they are less certain around the functionality and ease of integrating bio-based ingredients within their production lines and products. Cost also remains somewhat of barrier.

For Belgian brands, there is less certainty around strong-moderate growth in customer demand for bio-based ingredients/products, at the same time some brands do seem to value the potential for green marketing that could provide by bio-based products or packaging. Cost is once again an important aspect for Belgian brand owners, with key issues including feedstock or ingredient supply reliability, functional and environmental performance of products, and compatibility with existing processes.

Danish brand owners expect strong-moderate growth in demand for bio-based products among their consumers and meeting this consumer demand is one the key motivating factors for the respondents. In Denmark high cost was least likely to represent an issue among brand owners compared to the other regions. The uncertainty and need for products with a sound functional performance appears to be one the main criteria for Danish brands, with improved environmental performance appearing as another key requirement.

5.2.7 Outlook

The study of brand owner perspectives, documented within this report provides a high-level overview regarding the perspectives, needs, barriers and motivations of brand owners switching to bio-based products, ingredients and packaging. This analysis has also been included within the peer-reviewed publication Gaffey *et al.*, 2021 included in Appendix 5[61]. Despite these interesting initial trends, caution must be exercised when drawing conclusive findings from quite a low number of regional findings. In this regard, future work should examine the robustness of these initial findings through a more in-depth regional analysis of brand owner perspectives of bio-based materials, which should include a larger cohort of respondent brands. Furthermore, future work could examine in a more detailed way, how brands from different sectors vary in their perspectives towards bio-based products, and how different categories of bio-based products may be viewed in different ways by brands.

[61] Gaffey, J.; McMahon, H.; Marsh, E.; Vos, J. (2021) Switching to Biobased Products – the Brand Owner Perspective. Industrial Biotechnology Journal. 17,3. DOI: 10.1089/ind.2021.29246.jga

6 CONCLUSIONS

This report summarizes work which was been undertaken by the BIOSWITCH project to gain a better perspective of the perceived risks, barriers and motivations which brands face when switching to bio-based approaches. This includes results of a literature reviews around the needs, risks, motivations and incentives for brand owners switching to bio-based approaches, along with results and analysis of the Pan-EU survey of EU brand owners and regional brand owner interviews. The main take home messages and next steps are summarized in Sections 6.1 and 6.2 respectively.

6.1 Take home messages from Pan-EU and Regional Brand Owner Survey and Interviews

From the Pan-EU Survey Analysis the following trends have emerged:

1. Brand owners overall seem positively disposed to bio-based ingredients, with 85 % of brand owners who do not currently include bio-based ingredients, responding that they would consumer inclusion in future.
2. They also seem to have a strong interest in bio-based packaging alternatives. More brand owners indicated that they have an interest in bio-based packaging than any other product option provided. Despite a relatively small segment of surveyed brands currently utilising bio-based packaging, almost three quarters of brand owners who do not currently use bio-based packaging would consider using this in future. This indicates a key potential growth area.
3. While cost is the primary barrier to bio-based ingredient or product uptake among brand owner organisations, doubts concerning the seamless integration of bio-based ingredient/products to within existing processes and the ability of the product to perform comparably with incumbent fossil products are other prominent barriers and risks for brand owners switching to bio-based.
4. Brand owners perceive cost and lack of customer knowledge as the main barriers to growth in customer demand for bio-based products.
5. Competitive price of bio-based ingredients or products is the main need of brand owners, followed by superior functional performance and superior environmental performance in comparison with incumbent products.
6. 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).
7. Almost three quarters of survey brands expect strong to moderate growth in customer demand for bio-based products over the next 5 years with customer awareness of the benefits of bio-based products and customer desire for products with low environmental impact identified as the main drivers.

8. There are some notable differences between the response of individual regions.
9. Spanish brands overall seem uncertain around the customer demand for bio-based products, high costs for associated with bio-based product uptake is a clear barrier to integration and it seems they also view this a barrier to consumer uptake, which could be improved with most cost competitive products. Meeting existing regulations is a key motivation for bio-based product uptake among Spanish brand owners.
10. Finnish brands overall seem more certain that there is an existing consumer demand for bio-based product uptake and anticipate further strong growth in demand, they are less certain around the functionality and ease of integrating bio-based ingredients within their production lines and products. Cost also remains somewhat of barrier.
11. Danish brand owners expect strong-moderate growth in demand for bio-based products among their consumers and meeting this consumer demand is one the key motivating factors for the respondents. In Denmark high cost was least likely to represent an issue among brand owners compared to the other regions. The uncertainty and need for products with a sound functional performance appears to be one the main criteria for Danish brands, with improved environmental performance appearing as another key requirement.
12. For Belgian brands, there is less certainty around strong-moderate growth in customer demand for bio-based ingredients/products, at the same time some brands do seem to value the potential for green marketing that could provide by bio-based products or packaging. Cost is once again an important aspect for Belgian brand owners, with key issues including feedstock or ingredient supply reliability, functional and environmental performance of products, and compatibility with existing processes.

6.2 Next Steps

Using the information collected within this Deliverable, combined with feedback from a consumer acceptance analysis (Deliverable 1.4), BIOSWITCH will design regional and Pan-EU workshops involving all relevant stakeholders. The participation of brand owners, consumers, industry and public administration to rank the identified perceived risks and barriers, and then to co-develop regional and EU-wide solutions with input from key stakeholders. These will help overcome the perceived risks and provide recommendations to support uptake of bio-based products among brand owners. The information collected within this report will be presented as some of initial identified perspectives of brand owners in relation to bio-based products.

7 APPENDIX

7.1 Appendix 1: Guidelines for Interviewers

BIOSWITCH

Encouraging Brand Owners to Switch-to-Bio-Based in highly innovative ecosystems

Guidance to interviewers for conducting and reporting on
Interviews with Brand Owners
Combined BIOSWITCH tasks 1.2 and 1,4
Tralee / Enschede, July 2020

DRAFT 1

AVAILABLE DOCUMENTATION

Documentation developed for the current assignment includes:

1 Interview guidelines for interviewers i.e. a memo presenting Guidance to interviewers for conducting and reporting on Interviews with Brand Owners (the current document);

2 Questionnaire;

3 A format for reporting information collected during the survey interviews, documenting answers and key information collected and summarizing additional info collected (If any);

4 (A memo to explain data consent issues;)

5 (A data consent agreement form, for signing by each interviewee)

INSTRUCTIONS FOR INTERVIEWERS

Summary of the assignment

Interviews with Brand Owners (BO) will be conducted by the four BIOSWITCH Cluster Partners (ABP, CTA, CLIC, FF) under the joint guidance of task managers ITT (T1.2) and BTG (T1.4).

Ideally **6-8** Brand Owners should be interviewed by each of the Cluster Partners

Scope

The BIOSWITCH project focuses on encouraging Brand Owners to Switch-to-Bio-Based. All of the following options are considered within scope:

- Bio-based packaging replacing fossil-based packaging
- Fully bio-based packaging replacing partly-based packaging (e.g. Tetra Rex®)
- Bio-based product replacing fossil-based product
- Fully bio-based product replacing partly-based product (e.g. replacing the resin in a composite)
- Bio-based product replacing (less sustainable) bio-based product
- Biomass Balance approach (as advocated by e.g. BASF)

The use of biomass exclusively for energy generation is not considered within scope.

Identifying and interacting with Brand Owners

Brand Owners may be large or small, and operate internationally or locally. They may serve one or more of the following markets: business-to-business (B2B), business-to-consumers (B2C), business-to-public procurers (B2P). They may or may not be active in any of the four BIOSWITCH sectors (chemical, forest-based, food and agro). They may have reached very different levels of transition from fossil-to-bio-based, from anywhere of making the very first steps on that pathway to having made a full switch. They may already produce bio-based products, and/or may make use of the biomass-balance method, and/or use bio-based packaging, or none of these (as they are still at the orientation stage).

To **identify** suitable Brand Owners for the interviews, it is recommended that the Cluster Partners first approach their member organisations to gauge their interest. If there is insufficient interest among their member organisations the Cluster Partners should widen their search span.

When approaching interview candidates, it is helpful to present some arguments why Brand Owners should participate in the interview. Some examples of brand owner benefits from engagement with BIOSWITCH include**:**

- Knowledge transfer: learning about opportunities to start a transit from fossil-to-bio, learning about prior (experience of other Brand Owners through best practice case studies)
- Coaching/mentoring: get support to help make/prepare the transitions
- Co-creation: help shape the content of the BIOSWITCH toolbox
- Access to supports via the BIOSWITCH toolbox

- Networking with like-minded brand owners and other relevant stakeholders in the same economic sector/region/country as well as beyond

Survey questionnaire

The task managers, with feedback from the Cluster Partners, have elaborated a structured questionnaire. This questionnaire is helping the latter to conduct and structure interviews and to make sure that all relevant issues will be adequately covered. To allow later analysis and extraction of valuable insights from the interviews, interviewers are invited to ask at least these "official" questions.

Interviewers are encouraged to ask further questions and/or address additional issues during the interviews. Collecting additional information is important and highly relevant, as this usually generates worthwhile / relevant additional insights.

For the purpose of "localisation" cluster partners may want to make small adjustment to the standard survey questionnaire, prior to implementing the first interview. When such adjustments are made please liaise with the task leaders (James & John) about the modifications before you start the survey.

Interviews can be conducted and recorded in any preferred language. When an interview is not conducted in English, it is recommended to translate the questionnaire before implementing the interviews.

It is recommended to make a voice recording of each interview, to help ensure that all information provided can be captured

It is necessary to inform interviewees and reach agreement prior to conducting the interview on organisational issues and practicalities e.g. (a) that the interview is recorded, and what is done with the recording, (b) that interview results will be reported anonymously (c) other relevant issues/restrictions.

Reporting

Interviews need to be **reported in writing**, so that the results can be shared between task partners. A format for reporting the information collected during an interview, documenting answers and key information collected, and summarizing additional info collected (If any), is made available as a separate document.

When an interview is not conducted in English, it is suggested to first elaborate interview reports in the language used for the interview, before translating the interview report into English. The non-English interview report can be useful in case an interviewee would like to check how we documented the interview. There is no need to share the non-English interview reports with task partners

Cluster Partners are invited to write a short memo, synthesising key finding and observations, after completing (most of the) interviews,

The task leaders (James & John) would appreciate getting access as early as possible to cluster partners' outputs i.e. (a) interview reports, in English (b) synthesis reports.

Planning

It is recommended that Cluster Partners make a planning for conducting the survey.

Activities to be covered in the planning may include

- Localisation (if any) and translating (if any) of the survey questionnaire
- Pre-identifying Brand Owners (companies) and company staff that could be interviewed
- Contacting and engaging Brand Owners to schedule individual interviews
- Conducting interviews with staff Brand Owners
- Reporting individual interviews
- Translating of the interview reports into English, if needed
- Preparing a short memo (synthesis report) summarising key insights from the interviews conducted

Background Information from DoA

T1.2 Analysis of needs, risks & motivations of brand owners switching to bio-based approaches

T1.2 will undertake an analysis of the **needs, risks and motivations** among the cross-sectorial brand owners to switch to the bio-based industry. The analysis at pan-European level will generate macro-trends along with more specific analysis at regional level within individual clusters in order to identify specific needs and risks

During M1-M3, the needs, motivations and perceived risks of brand owners to switch to bio-based will be identified via a desk work, reviewing literature and outputs of other EU projects. In addition, **face-to-face interviews** will be conducted by each cluster in order to have first-hand information. This information will be then completed with a pan-European online survey. At M3-M5 analysis of the information gathered about needs, risks and motivations of stakeholders will be conducted.

T1.4 Analysis of brand owner incentives

BIOSWITCH will undertake literature review, **face-to-face interviews** with brand owners (coupled with those from T1.2) to gain an understanding of main incentives for switching-to-bio-based. This will include:

- Legislative Framework Incentives
- Occupational and/or personal health
- Economic incentives
- Product functionalities

7.2 Appendix 2:

BIOSWITCH

Encouraging Brand Owners to Switch-to-Bio-Based in highly innovative ecosystems

Questionnaire on risks, needs, motivations and incentives for Brand Owners switching-to-bio-based products

DRAFT 2 .0

Combined BIOSWITCH tasks 1.2 and 1.4

Tralee / Enschede, July 2020

INTERVIEWEE AND COMPANY BACKGROUND

1. Interviewee Name and Contact Details

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.....

.....

2. Company Name and Address

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.....

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3. **Which sector** are you operating in?

☐ Agriculture ☐ Forestry ☐ Food ☐ Chemicals ☐ Other

a. Please elaborate on the sector you chose

.....

.....

b. If you answered other to **3**, please specify

.....

.....

4. What size of organisation are you?

- ☐ Microenterprise (1 to 9 employees) ☐ Small enterprise (10 to 49 employees)
- ☐ Medium size enterprise (50 to 249 employees) ☐ Large enterprise (250 employees or more)

5. In which **Country** is your HQ based?

.....

6. What are the names of some of your organisation's **key brands**?

- a. .....
- b. .....
- c. .....
- d. .....

7. Who are your main **customers**?

☐ Businesses (B2B market) ☐ Consumers (B2C market)

8. Has **COVID 19** impacted on your company's strategic decision making?

☐ Yes ☐ No

If you answered yes to **8,** please describe the impact

.....

.....

.....

BRAND OWNER BACKGROUND IN SUSTAINABILITY AND BIO-BASED PRODUCTS

9. Does your company have **sustainability goals**?

☐ Yes ☐ No

a. If you answered yes to **9,** in which areas does your company have specific sustainability goals?

☐ reducing greenhouse gas emissions

☐ increasing renewable energy use

☐ reducing energy and/or material usage for products or packaging

☐ increasing recycling/recyclability of products or packaging

☐ increasing bio-based content of products or packaging

☐ increasing biodegradability of products or packaging

☐ lowering eco-toxicity of process/products/packaging

☐ lowering human toxicity of process/products/ packaging

☐ reducing waste

☐ Other

b. If you answered other to **9a.,** please specify

.....

10. Do some of your brands include products with **bio-based content,** as per CEN definition**?** (i.e. 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) CEN)

☐ Yes ☐ No

a. If you answered yes to **10,** please specify some examples of these brands and products

Brands	*Products*
a.	*a.* .....

b. ..... *b.* .....

c. ..... *c.* .....

b. If you answered no to **10a,** would you consider including bio-based feedstocks/ingredients within some of your branded products?

☐ Yes ☐ No

c. If you answered yes to **10b,** which would this apply to?

☐ Existing products only ☐ New products only ☐ Both existing and new products

11. Have you had any engagement with **your customers** to seek feedback on provision of bio-based products?

☐ Yes ☐ No

a. If you answered yes to **11,** please give some details of how/when

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12. Have you had any engagement with **your suppliers** to understand if your products could become more sustainable by switching to bio-based?

☐ Yes ☐ No

a. If you answered yes to **12,** please give some details of how/when

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.....

13. Have you had any engagement with **research partners or external advisors** to understand if your products could become more sustainable by switching to bio-based?

☐ Yes ☐ No

a. If you answered yes to **13,** please give some details of how/when

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.....
.....
.....

14. What are the main **categories of products** that your organisation would consider integrating bio-based ingredients?

☐ Pesticides	☐ Fertiliser	☐ Food and Flavour
☐ Feed	☐ Construction materials	☐ Personal Care and Cosmetics
☐ Textiles	☐ Household and Detergents	☐ Paints and Coatings
☐ Pulp and Paper	☐ Automotive	☐ Toys
☐ Packaging	☐ Other	

a. If you answered other to **14,** please specify
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15. Do some of your branded products make use of **bio-based packaging**?

☐ Yes ☐ No

a. If you answered yes to **15,** please give details about packaging used

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b. If you answered no to **15,** would you consider using bio-based packaging in future?

☐ Yes ☐ No

c. If you answer no to **15b**. above, please provide an explanation for your answer

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RISKS, BARRIERS AND NEEDS W.R.T. TO BIO-BASED PRODUCT UPTAKE

16. What is the main **barrier** to bio-based ingredient/product **uptake** within your organisation? (pick the 3 most relevant and prioritize from 1-3 (1 = highest priority ; 2 = second highest priority ; 3 = third highest priority) using the space next to the answer option)

☐ Too expensive ____

☐ Uncertainty around environmental benefits ____

☐ Insufficient customer demand ____

☐ Lack of supporting policies ____

☐ Challenges communicating the environmental benefits to the customer ____

☐ Other ____

☐ Feedstock or ingredient supply uncertainties ____

☐ Uncertainty around functional performance ____

☐ Incompatibility with existing processes ____

☐ Regulatory challenges in placing the product on the market ____

☐ Uncertainty of end-of-life management ____

a. If you answered other to **16,** please specify .....

b. *Please provide details of your response to Question* ***16***

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17. In your opinion/experience, what factors are the main **barriers** to growth of **customer demand** for bio-based products? (pick the 3 most relevant and prioritize from 1-3 (1 = highest priority ; 2 = second highest priority ; 3 = third highest priority) using the space next to the answer option)

☐ Too expensive ____

☐ Uncertainty regarding sustainability of bio-based products ____

☐ Lack of on-the-market products ____

☐ Lack of customer knowledge on benefits of bio-based products ____

☐ Other ____

a. If you answered other to **17,** please specify
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b. *Please provide details of your response to Question **17***
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18. What do you see as the **main risks** associated with bio-based product uptake? (pick the 3 most relevant and prioritize from 1-3 (1 = highest priority ; 2 = second highest priority ; 3 = third highest priority) using the space next to the answer option)

☐ Feedstock or ingredient supply uncertainties _____

☐ Poor functionality _____

☐ Incompatibility with existing processes _____

☐ Feedstock or ingredient supply uncertainties _____

☐ Insufficient consumer demand _____

☐ Uncertainty around future regulation _____

☐ Other ____

a. If you answered other to **18,** please specify
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b. *Please provide details of your response to Question **18***
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19. What are your **specific needs** when it comes to choosing an alternative bio-based ingredient/product? (pick the 3 most relevant and prioritize from 1-3 (1 = highest priority ; 2 = second highest priority ; 3 = third highest priority) using the space next to the answer option)

☐ Superior functional performance _____ ☐ Competitive price _____

☐ Compatible with existing processes _____ ☐ Superior Environmental Performance _____

☐ Other ____

a. If you answered other to **19,** please specify .....

b. *Please provide details of your response to Question **19***
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20. Does your organisation **need support** identifying opportunities for integrating bio-based ingredients within your brands?

☐ Yes ☐ No

a. If you answered yes to **20,** please provide details on the supports required

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.....

MOTIVATIONS AND INCENTIVES W.R.T. BIO-BASED PRODUCT UPTAKE

21. What would be your **main motivation** for switching to bio-based products? (pick the 3 most relevant and prioritize from 1-3 (1 = highest priority ; 2 = second highest priority ; 3 = third highest priority) using the space next to the answer option)

☐ Meeting customer demand _____

☐ Meeting company sustainability targets ____

☐ Meeting existing regulations _____

☐ Anticipated regulatory changes _____

☐ Improved product functionality ____

☐ Green marketing ____

☐ Higher price of green products _____

☐ Using local feedstocks _____

☐ Other ____

a. If you answered other to **21,** please specify

.....

b. *Please provide details of your response to Question* ***21***

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22. How do you foresee your **customer demand** for bio-based products over the next 5 years?

☐ Growing strongly

☐ Growing moderately

☐ Slow Growth

☐ No Growth

☐ Negative Growth

☐ Don't know

23. Who are the most important **stakeholders** with whom you need to engage in order to ensure uptake of bio-based products? (pick the 3 most relevant and prioritize from 1-3 (1 = highest priority ; 2 = second highest priority ; 3 = third highest priority) using the space next to the answer option)

☐ Suppliers ____

☐ Customers ____

☐ Authority or legislator ____

☐ Association ____

☐ Public ____

☐ Own Employees ____

☐ Others ____

a. *If you answered others to **23**, please specify* ……

b. *Please provide details of your response to Question **23***

……

……

……

……

24. In your opinion/experience, what factors are the main **drivers for growth** of customer demand for bio-based products? (pick the 3 most relevant and prioritize from 1-3 (1 = highest priority ; 2 = second highest priority ; 3 = third highest priority) using the space next to the answer option)

☐ Greater availability of bio-based products ____

☐ More cost-competitive products ____

☐ Improved customer awareness of bio-based products ____

☐ Customer preference for products with low environmental impacts ____

☐ Customer preference for superior products ____

☐ Customer preference for locally sourced feedstocks ____

☐ Other ____

a. If you answered other to **24,** please specify .....

b. *Please provide details of your response to Question* **24**
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BIOSWITCH ENGAGEMENT RELATED QUESTIONS

25. Does your organisation wish to engage with the BIOSWITCH project to gain support on the journey of switching to bio-based?

☐ Yes ☐ No

26. If you answered yes to above, on which areas can the BIOSWITCH project support your organisation?

☐ Access to switch-to-bio-based best practice case studies

☐ Access to BIOSWITCH toolbox with supporting materials for brand owners switching to bio-based

☐ Participation in online networking event for brand owners and bio-based industries

☐ Subscribing to newsletters

☐ Support in LCA of bio-based alternatives

☐ Participation in project workshops

☐ Participation in project info webinars

27. Would you be willing to do a follow-up interview or answer some follow up questions if required?

☐ Yes ☐ No

7.3 Appendix 3: Interview Report Format

WRITTEN SUMMARY OF INTERVIEW

Please provide a 2-3 page (approx.) summary of the main findings of the interview to include any qualitative feedback from the interviewee. If possible, please include some direct quotes from the interviewee.

Interviewee and Company Background :
Brand Owner Background in Sustainability and Bio-based Products :
Risks, Barriers and Needs w.r.t. Bio-based Products Uptake :
Motivations and Incentives w.r.t. Bio-based Products Uptake :
BIOSWITCH Engagement-related Questions :
Noteworthy Direct Quotes from Interviewee (optional) :

7.4 Appendix 4: Consent Form

BIOSWITCH

Encouraging Brand Owners to Switch-to-Bio-Based in highly innovative ecosystems

NOTICE OF CONSENT ON THE DATA FROM INTERVIEWS AND QUESTIONNAIRES

The **BIOSWITCH** project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement no. 887727. **BIOSWITCH** aims to bring Europe to the forefront of the bio-based economy by encouraging and supporting brand owners from different sectors to switch to bio-based approaches.

The project is coordinated by CLIC Innovation, which is responsible for the lawfulness of the processing of personal data in connection with the BIOSWITCH related research.

Ethical procedures for an EU H2020 project require that interviewees agree to be interviewed and are informed of how the data and information from their interview will be stored and used. The signing of the consent form is necessary to ensure that the interviewee understands the purpose of the involvement and that the conditions of the participation are understood.

DATA PROCESSING METHODS

The interview may be recorded, and it will be logged as a written file, notes can also be taken. The confidentiality of the data provided can be individually agreed upon. The data and information that has been agreed to be kept confidential will not be reported. The interview material will be stored on project Microsoft Teams site, which is CLIC's secure and password protected closed server system that is operated according to CLIC's data management procedures . Members of the project team can only access the data, any recordings and notes will be deleted when the project is finished or at any time by the request of the interviewee.

DATA PRIVACY PROTECTION AND CONFIDENTIALITY

Various BIOSWITCH consortium partners are involved in the study and the data collection conducted in connection to the project. The BIOSWITCH consortium collects and processes, for example, the following information: the name and general details of the entity, interviewee, and the interviewee's observations and views on e.g. bio-based products and bioeconomy stated in the questionnaires and interviews. All data and individual comments are anonymized in public reports by not associating the comments with the individual without their explicit consent. The anonymized data and information gathered will only be used for the purposes of the BIOSWITCH project, e.g. in its publications like project deliverables, academic papers, policy papers, news articles, website, or presentations. If agreed, the name of the interviewee/entity can be recorded in the list of sources for public reports.

VOLUNTARINESS, HANDLING OF PERSONAL DATA AND OTHER RIGHTS OF THE SUBJECT

Participation in this study and the disclosure of personal data/data requested in the investigation is voluntary and participation will not be paid for. The subject may at any time during and after the interview without giving any reason and without any penalty;

1) refuse to participate in the interview,
2) refuse recording of the interview or parts of it,
3) decline answering any questions,
4) end the interview at any point,
5) suspend his / her participation, or
6) withdraw his / her consent to participate

The processing of personal data is based on the consent of the person. The subject may revoke his / her consent to the processing of personal data by notifying the responsible person who held the interview or the project coordinator that consent has been withdrawn. Information on the possible withdrawal will be handled discreetly and will not be published in any way.

The subject has the right to ask for access to their own personal data, as well as the right to request rectification or erasure or restriction of the data. The subject may oppose the processing of the personal data, which he / she has provided to the interviewer.

CONTACT INFORMATION FOR PERSON IN CHARGE

In the case of any questions or requests about the study and/or data protection, the subject can contact the person who is responsible for the interview:

Interviewer FIRST NAME LAST NAME
TITLE, ORGANISATION
E-MAIL
PHONE NUMBER

Coordinator of the BIOSWITCH project/ representative of the personal data register:

Anna Tenhunen
Project Coordinator, CLIC Innovation
anna.tenhunen@clicinnovation.fi
+358404868713

By signing this form of consent, I confirm my participation in the research described in this document, agree voluntarily to be interviewed and give my voluntary consent to the processing of personal and or other data.

Place and date

_____

Name and signature

_____

7.5 Appendix 7.5 Peer-Reviewed Publication: Switching to Biobased Products – The Brand Owner Perspective

BIOSWITCH

Commentary

Switching to Biobased Products – The Brand Owner Perspective

James Gaffey,[1] Helena McMahon,[1] Emily Marsh,[1] and John Vos[2]

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Abstract

Brand owners can play a key role in enabling biobased products to penetrate mass markets and to influence consumer choices in relation to biobased products. The current paper explores the role that brand owners can play in supporting market uptake of biobased products and captures the perspectives of European brand owners in relation to biobased products. Based on the findings of this paper, brand owners have an overall positive outlook towards biobased products, with 85% of brands who don't currently use biobased ingredients or products within their branded products and 95% of brands who don't currently use biobased packaging interested in including these in future. However, brand owners still perceive some concerns surrounding biobased products including their high cost, functional performance and ease of integration, as well as their reliability of supply. Regional differences among brand owners have also been identified, with cost and uncertainty around customer demand appearing as a bigger issue in continental Europe, with functional performance concerns appearing as a more pressing issue for brands in northern Europe.

Introduction

The 2018 EU bioeconomy strategy update highlights the role that a sustainable bioeconomy can play in helping the continent meet several key priorities including job creation, climate objectives, waste reduction and the modernization of the EU industrial base.[1] The bioeconomy is increasingly becoming a contributor to the overall European economy, with the total turnover of the bioeconomy (including food and beverages, and the primary sectors of agriculture and forestry) amounting to over €2.4 trillion in the EU-28 in 2017, an increase by 25% since 2008.[2] Around 30% of this amount was contributed by biobased industries, such as chemicals and plastics, pharmaceuticals, pulp and paper products, forest-based industries, textiles, biofuels and bioenergy. Roughly half of the turnover was accounted for by the food and beverages sector, with a further 20% created by the primary sectors of agriculture and forestry.[2] A sustainable bioeconomy will play an increasingly important role as Europe attempts to meet very ambitious climate and sustainability targets including a 55% reduction in greenhouse gas emissions by 2030.[3]

Globally, a thriving bioeconomy can also play a role in meeting many of the 17 Sustainable Development Goals (SDGs) set out by the United Nations, with the Biobased Industries Joint Undertaking (BBI JU) noting 12 SDGs that a sustainable bioeconomy contributes to, including Sustainable Consumption and Production (SDG12) and Climate Action (SDG 13).[4] A sustainable and circular bioeconomy can also play a central role in the EU shift towards a circular economy as outlined in the EU Circular Economy Action Plan 2020,[5] contributing to more sustainable management of plastics,[6] packaging and nutrients, creating a more sustainable supply of local protein[7] while also contributing to the EU Renewable Energy Directive (RED) II targets in energy, heat and transport.[8] Additional non-binding 2030 targets set out across a multitude of sectors by the Biobased Industries Consortium (BIC) include halving imports of soy by producing sustainable, locally-produced protein, circular use of nutrients reducing potassium and fertilizer requirements by 25% and ensuring 25% of all chemicals and materials used in the EU come from bio-based sources.[9]

VALUE CHAIN INTEGRATION

New biobased value chains will be required to meet these challenging targets, and these will require new collaborations between the multiple stakeholders across the chain. An example of the steps involved in delivering a biobased value chain is illustrated in *Fig. 1*.[10] Primary producers, such as farmers who have traditionally supplied food co-operatives, are already beginning to link arms with fuel and chemical producers in new bioeconomy initiatives across Europe.[11–13] Of equal importance are the downstream actors such as brand owners, retailers and consumers who can develop, retail and use the biobased products. According to Dammer et al. (2017),[14] the world market for biobased products (BBPs) is growing in large part as a result of efforts by retailers, brands, manufacturers, consumers, and governments to promote the environmental benefits and acceptance of these products as they become commercially viable.

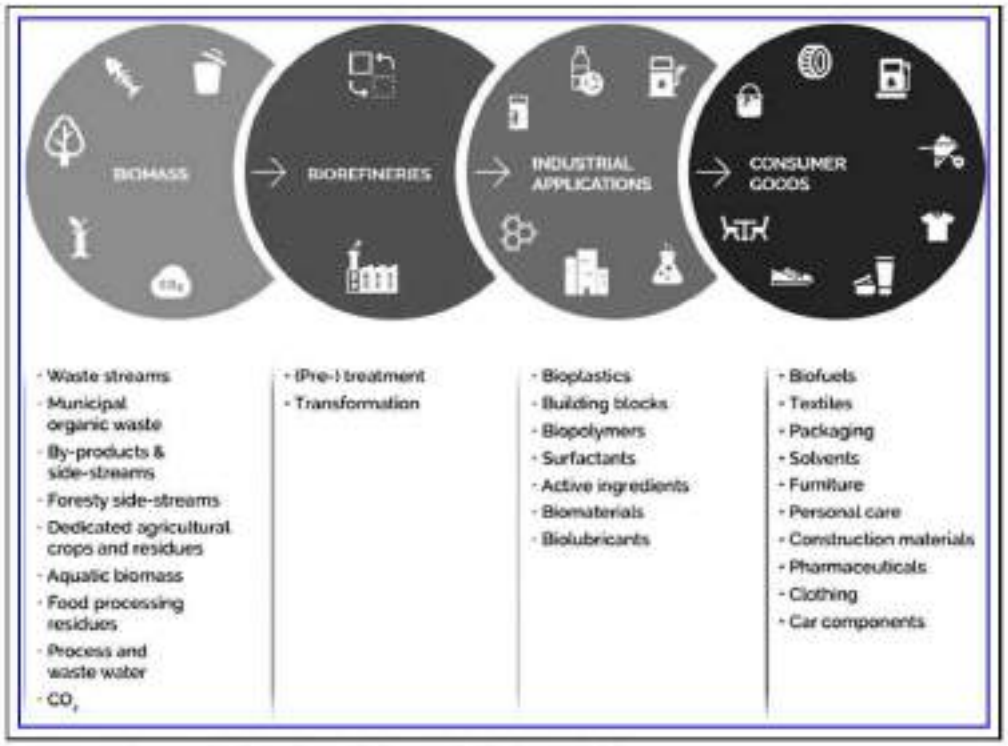

Fig. 1. Biobased Industries value chain. Source: Bio-based Industries Joint Undertaking.

HOW CAN BRAND OWNERS ACCELERATE MARKET UPTAKE OF BIOBASED PRODUCTS?

Brand influence, in particular, can be a major driver of the success of BBPs where large brands can champion a technology or product and jumpstart its expansion into vast markets.[14] It is clear, that brands listen closely to their consumers when bringing new products to the market. However, conversely, brand owners can also be key influencers of consumers choosing new products. Chovanová et al. (2015) conducted research with 1,250 consumer respondents in Slovakia to understand the influence of brands on consumer choices.[15] In response to the question of whether brands affected the respondents' purchasing choice, 52% of respondents indicated this to be the case. Branding can work as a signal allowing consumers to quickly recognize a product as one, they are familiar with or one that they like.[16] As for the motivational factors for the respondents choosing a particular brand, consumers indicated product quality (73%) to be the main factor.[15] This makes the seal of approval from a brand owner desirable for biobased industries and their products. As many biobased alternatives are still quite new on the market, and consumer knowledge about BBPs is still quite low (only about 50% of consumers are aware of the existence of BBPs, while only about 12% of consumers have intentionally purchased BBPs[16]), brand owners can also play a potentially significant role in increasing awareness of these products and helping them to access mass consumer markets.

HOW CAN BIOBASED PRODUCTS HELP BRAND IMAGE?

At the same time, BBPs can play a key role in helping brand owners to become more sustainable and greening their image. As noted by Overbeek & Hoes (2017), brand owners increasingly consider the importance of alignment with the UN Sustainable Development Goals (SDGs), in particular SDG 12 Sustainable Consumption and Production for promoting the circular economy and SDG 13 Climate Action to avoid global warming.[17] BBPs can support brands to reach corporate sustainability goals and targets, as in the example of Unilever, who have committed to only use packaging that could be reduced, reused, composted or recycled by 2025.[18]

Increasingly sustainable products can also help brand owners to meet the demands of their consumers. In 2015, sales of consumer goods from brands, with a demonstrated commitment

to sustainability, rose more than 4% globally, while those without, grew less than 1%.[18] The same study found that 66% of consumers say they are willing to pay more for sustainable brands. According to Chen et al. (2020), green brands are those brands that consumers associate with environmental sustainability and particularly appeal to consumers who care about environmental protection.[20] Due to the increasing recognition and awareness of environmentalism in the market, the positioning of green branding strategies is to build up a unique sustainable image in the targeted customers, in order to meet their green claims.[20] Since more and more consumers are willing to give priority to greenness, by developing positive emotional responses as the basis for green brand influence, brand differentiation and generating green purchase intentions are crucial to green brand strategies.[20,21]

A 2017 international study by Unilever revealed that a third of consumers are now choosing to buy from brands they believe are doing social or environmental good.[22] This trend is likely to continue according to a 2020 White Paper from Evergreen,[23] which notes the growing role of millennials in shaping trends. According to the paper, millennials are particularly sensitized to climate change and expect action from brands and retailers. They expect brands to be more selective in the products and packaging they provide and also see a role for brands, in consumer education, responsible waste management, and supporting eco-friendly consumption.[23]

FIRST MOVER BRANDS SWITCHING TO BIOBASED

There are a growing number of examples in which brand owners across a variety of sectors have taken a leading role in integrating biobased ingredients or products within their branded products and packaging. A key opportunity area for biobased ingredients is in the sustainable packaging market. Brands such as Ferrero,[24] Lego,[25] and Henkel[26] have all made strong commitments to introduce sustainable packaging for their products. Other commitments can be seen from signatories of the New Plastics Economy initiative led by Ellen MacArthur Foundation,[27] in which brands like Walmart, PepsiCo, M&S and Unilever have committed to use 100% reusable, recyclable or compostable packaging by 2025.

Coca-Cola introduced their original PlantBottle in 2009, which is 30% biobased, based on sugarcane-derived monoethylene glycol blended with 70% fossil-based purified terephthalic acid. Between 2009 and 2015, Coca-Cola had distributed more than 35 billion plant bottles across 40 countries helping to save the equivalent annual emissions of more than 315,000 metric tons of carbon dioxide.[28] These figures underscore the important role of brand owners in enabling BBPs to penetrate mass markets and the benefits that can be achieved from this. In 2015, Coca-Cola also unveiled the prototype of the first all-biobased polyethylene terephthalate (PET) bottle, demonstrating their continued commitment to developing biobased packaging.[29] Nestlé Waters, PepsiCo and Danone are currently collaborating with the Californian biomaterials development company Origin Materials in the NaturALL Bottle Alliance research consortium. They develop innovative packaging solutions made with 100% sustainable and renewable resources (non-food or -feed crop related biomass, such as previously used cardboard and sawdust) and aim to launch a PET bottle with up to 95% biobased content by 2022.[30]

In 2019, the Danish-Swedish dairy multinational Arla Foods announced that they were making 600 million renewable fresh milk cartons across their main EU markets, with the inclusion of bioplastic derived from sugarcane or forest waste.[31] It is estimated that these cartons will contribute 25% less carbon dioxide into the atmosphere compared to their fossil-based plastic predecessors. From 2005 to 2019, Arla has reduced the CO_2 impact of its packaging by 25%, equating to 123,000 tonnes of CO_2 being diverted from the atmosphere.[31] Total CO_2 emissions from Danish agriculture are just over 10 million tonnes per annum.[32]

BRANDED BIOBASED CONSUMER GOODS

In addition to developing biobased packaging, brand owners are also beginning the transition to develop consumer goods that use biobased ingredients. In 2015, Lego announced plans to produce all its toys from bioplastic by 2030; with the first of these, botanical elements such as bioplastic shrubs and trees, already on the market.[33] In 2018, IKEA announced that they had started the transition to biobased polypropylene (PP) replacing 20% fossil-based plastic, in the short term, in a number of existing products, such as plastic storage boxes.[34] Unilever recently announced that it will source 100% of the carbon derived from fossil fuels in its cleaning and laundry product formulations by 2030 with renewable or recycled carbon.[35] Unilever, through its brands, have already played a leading role in supporting market uptake of biobased materials into key consumer markets including biodegradable teabags[36] and sunscreen.[37]

INCENTIVES FOR BRAND OWNDERS TO SWITCH TO BIOBASED PRODUCTS

Public support in the form of incentives can play a role in accelerating innovation and boosting market uptake and public awareness of BBPs. There are different ways in which governments can regulate, influence behavior, and alter incentives. Elbersen et al. (2017) apply a categorization of incentives into: (category 1) regulations, (category 2) economic instruments, (category 3) voluntary approaches, (category 4) information and advice sharing systems, (category 5) market-based signalling approaches and (category 6) other measures/instruments not covered in the categories above such as vision documents, road maps and strategies.[38] Pelkmans et al. call the last four types of instruments "soft measures". Mirroring this terminology, the first two types of instruments could be referred to as "hard measures".[39]

Which European, national or even local incentives are key for a particular brand owner, business case or value chain will be highly case-specific. Based on limited and explorative desk research, the overall picture emerges that so far, at the European level, information and advice-sharing systems (cat. 4) and other measures/instruments (cat. 6) would seem to be the most widely used incentives. In general, the "hard measures" direct regulation (cat. 1) and economic instruments (cat. 2) and the "soft measures" voluntary approaches (cat. 3) and market-based signalling approaches (cat 5.) would have had somewhat lower importance for the average brand owners.

Nevertheless, an increasing number of economic actors benefit from the hundreds of millions of euro that are available annually under the EU framework research programs (including Horizon Europe, the recently started successor to the Horizon 2020 research framework programme, and Circular Bio-based Europe Joint Undertaking,[42] the recently approved successor to the Biobased Industries Joint Undertaking), in the form of grants to support research, development and innovation benefitting BBPs. This is in addition to the equity, quasi-equity, and debt funding to SMEs, midcaps, large caps, and special purpose vehicles/entities being offered since autumn 2020 by the European Circular Bioeconomy Fund.[43] Indirectly, European Directives (such as the Waste Framework Directive[42] and the Packaging and Packaging Waste Directive[43]) and codes of good practice from the plastics sector (such as 'A line in the sand' by the Ellen MacArthur Foundation[44] and the European Plastics Pact[45]) seem to be giving a boost to the uptake of compostable/biodegradable (plastic) packaging, and such packaging will in many cases be biobased.

Methodology

Understanding the perspective of brand owners with regards to biobased ingredients, products and packaging can help biobased industry, policy makers and other relevant stakeholders to engage more effectively with brands, understanding their needs and motivations, as well as the barriers they face when integrating BBPs. In order to assess the perspectives of brand owners in relation to BBPs, the authors undertook a series of steps that included: (i) desk research and literature review, (ii) development and implementation of structured quantitative survey, (iii) a series of regional brand interviews and (iv) a series of interviews and case studies with brands who have already successfully transitioned to BBPs from fossil-based products. A total of 66 brands were consulted in the different tasks encompassing a wide variation of companies in terms of size, sectors and geographical distribution.

Results

LITERATURE REVIEW ASSESSING BRAND PERSPECTIVES IN RELATION TO BBPs

To date, a limited number of studies have been conducted to assess the perspectives of brands with regards to BBPs. Most notably, in 2017 Sustainability Consult published the results of the #WhatBrandsWant survey and study into brand perspectives on biomaterials.[46] Collecting responses from over 40 brands across different sectors ranging from apparel, footwear & textiles, to food & beverages and personal care, the study found that 52% of brands said they have clear objectives for sourcing biobased materials, while 26% said biobased content is one of the selection criteria used when choosing a supplier based on sustainability performance.[46] When it came to identifying key barriers to widespread uptake of BBPs, 87% indicated cost as the biggest barrier. Performance (42%) and security of supply (37%) were identified as the next biggest barriers. According to the responding brand owners, growth factors for biobased materials include consumer demand for environmentally friendly products (65%) and packaging (46%), as well as brands wanting to improve public image (48%). To evaluate whether to adopt biobased materials, 63% said they need more information from suppliers on pricing, 61% on availability and 57% on performance. 71% said their brand communicated externally on its use of biobased materials.

A number of studies have examined biobased packaging within the broader concept of sustainable packaging. In a 2018 study by G&S Business Communications, 349 brand owners identified new packaging technologies (57%), biobased materials (38%), biodegradable packaging (38%) and increased recycled content (35%) as the main sustainability trends likely to drive changes in packaging processes over the next five years.[47] A separate study by Green Alliance (2020) interviewed brands and retailers representing a cross section of the UK grocery sector, including supermarkets as well as branded producers of food and drink and consumer goods, to gain perspectives on packaging and plastic waste. While the study noted positive public perceptions of biodegradable packaging, the interviewees were wary about replacing conventional plastic with biodegradable alternatives in their packaging, partly due to cost, but more often, the companies expressed concern about the suitability of the material, including its biodegradability.[48] Another 2020 study by LEK Consulting on packaging with 287 brand owners, found that 36% of respondent brands had embraced some form of biodegradable materials, with brand owners expecting the total value of packaging with biodegradable, recycled or compostable material to grow by 15–20% over the next two years.[49]

A number of other studies have looked more broadly at market acceptance of BBPs including the barriers and motivations to uptake of BBPs. The findings of these studies are captured in *Table 1*.[50-51]

BRAND PERSPECTIVES ON SWITCHING TO BIOBASED PRODUCTS: BIOSWITCH CASE STUDIES

To take the pulse of brand owners and gain their perspectives and interests in relation to biobased products, as well as assessing the barriers, risks and motivations they encounter when considering a switch to biobased, the BIOSWITCH project elaborated and cross-assessed 6 best practice case studies covering brand owners from four sectors (agriculture, chemistry, forestry and food) and six countries.

For all brand owners covered in these case studies (Bioco, dannoy, Naty, Vaude, Alhóndiga La Unión and Stora Enso) environmental, social and economic sustainability was identified as a main driver, if not part of their brand ethos and DNA. Several of these brand owners made radical choices, indicating explicitly that they wished to break away from doing business as usual and pioneer high-quality biobased solutions instead. According to these brand owners, few if any of their customers and consumers of the products covered explicitly ask or require that products are biobased. They express their needs and expectations in various other terms instead, asking for products that are high-quality and long-lasting, produced with minimized negative impact on environment and climate (dannoy); free of chemicals and contributing to healthy living (Naty); or ensuring a sense of well-being and comfort (Vaude). When it comes to packaging, the situation is similar. Customers look for eco-friendly alternatives for plastic food packaging (Bioco, Alhóndiga La Unión) or wish to limit using plastic to package food at

Table 1. Previous Relevant Studies Assessing Brand Owner Perspectives of BBPs

SOURCE	STUDY TYPE AND SIZE	FINDINGS
Meeusen et al. (2015)	Two-round Delphi Study survey. Round 1 (N=324) Round 2 (N=134)	Meeusen et al. conducted a 2-round Delphi survey among resp. 324 and 134 business experts in the biobased economy. Respondents considered high production costs and volatile feedstock prices among the most important barriers to market. The positive image of BBPs and their ability to ensure stronger independence from fossil-based resources are expected to become the most important drivers. An unsupportive regulatory environment and uncertainty about future regulation hinder a stronger market uptake of BBPs. Concerns about social and environmental impacts and the use of genetically modified organisms (GMO) in feedstock production are not considered important market barriers.
Peuckert and Quitzow (2016)	Two-round Delphi Study survey	Peuckert and Quitzow concluded that multiple drivers may lead to the adoption of BBPs or practices by businesses. Central drivers are frequently environmental regulation and external pressures from the stakeholders-clients who demand environmentally friendly practices and products.
Tsagaraki et al. (2017)	Literature research and qualitative interviews (N=40)	Tsagaraki et al. determined that the barriers that may prevent the acceptance and promotion of biobased alternatives are manifold and related to: ○ Low price of fossil feedstock that make the biomass use uneconomical ○ High cost of BBPs compared to fossil-fuel derived equivalents ○ Perceived lower performance of many BBPs compared to their fossil equivalents ○ No dedicated and detailed EU legislation framework, conflicts between sustainability goals and market needs, lack of uniform standardization and certified labeling for BBPs ○ Gaps in the policy and subsidy framework ○ Intellectual property (IP) related barriers ○ Low public awareness of the benefits of using BBPs ○ Lack of reliable and sufficient information about BBPs
Bos et al. (2018)	Company interviews (N=7)	Bos et al. explored the market-entry barriers related to regulation and standardization among companies in the biobased economy experience. Seven companies were interviewed, mainly active in the business-to-business (B2B) market, with some also producing and selling products (notably packaging material) for the consumer market. Hurdles that were mentioned during the interviews were grouped under five main themes: (a) end-of-life, (b) certification and standards, (c) biofuel policy, (d) missing long-term policy and (e) communication and image.
Van den Berg et al. (2018)	Literature survey	Van den Berg et al. classified general barriers hindering the production and material uptake of biobased chemicals and materials into six main categories (barrier groups): (a) access to feedstock, (b) competition with established fossil industry, (c) policy and regulatory framework, (d) public perception and societal challenges, (e) markets, finance and investment and (f) research and development.

all (Stora Enso). In short, for the brand owners covered in the case studies, shifting to BBPs and packaging is more a means to an end, and not a goal by itself.

BRAND PERSPECTIVES ON SWITCHING TO BIOBASED PRODUCTS: BIOSWITCH SURVEY

In addition to cross assessment of success case studies, the BIOSWITCH project has undertaken a broader study comprising 60 participant brands in the form of structured surveys and regional interviews.

From the study findings, participant brands appear to have a largely positive perspective overall with regards to biobased ingredients, products and packaging, with 85% of brands who don't currently include biobased ingredients within their branded products, and 95% of brands who don't currently use biobased packaging interested in doing so in the future. When selecting the products of greatest interest for inclusion of biobased ingredients, packaging is the area of greatest interest, selected by 64% of brands, followed by food and flavor products (41%), personal care and cosmetic products (25%), fertilizer and feed (both 18%), construction materials (16%) and pesticides (15%). That a majority of brands prioritizes biobased packaging does not come as a surprise and was the reason to include specific questions on this topic. In the literature review, an increased interest in biobased packaging was found to be a distinct trend. Reasons for this trend may include (a) compliance with stricter European packaging and packaging waste regulations, and (b) changing packaging composition being considered easier to implement than changing product composition (as brands are looking for biobased alternatives that fit seamlessly within their processes and product lines).

The study found that high cost (indicated by 58% of brands) and uncertainty around functional performance (54%) are the primary barriers to uptake of BBPs among brand owners, followed by incompatibility of new biobased ingredients with existing company processes (32%) and feedstock or ingredient

supply uncertainties (27%). Interestingly, less than one in four Pan-EU brand owners listed factors such as regulatory challenges, uncertainty around environmental benefits, insufficient customer demands, uncertainty around end of life management, lack of supporting policies, and challenges in communicating the product's environmental benefits as key barriers. In the literature review, the policy and regulatory framework was mentioned often as a key barrier to BBPs, beyond higher costs, functional performance and supply uncertainties, whereas incompatibility with existing processes was not specifically mentioned. Above we observed that brand organizations would consider switching to biobased packaging. It may be that in this specific field (European) policies and regulations are sufficiently clear, and therefore policy and regulatory framework was not often mentioned by the respondents. Incompatibility with existing processes is a very practical barrier that companies may only get experience with when they actively research a shift to biobased. For this reason, it may not have come up in the more generic studies and surveys covered in the literature review.

A risk of poor functionality of BBPs compared with incumbent fossil-based products is indicated as the primary risk brand owners face in switching to biobased products (61%) followed by incompatibility with existing processes (52%) and uncertainty around future regulations (48%). The above factors were also found in the literature review, with the clear exception, as already mentioned above, of incompatibility with existing processes. Although the Top 2 risks once again indicate brands' concerns over the challenges associated with seamless transition to bio-based alternatives, it is clear that what is considered a key risk varies strongly between countries and individual brands.

Meeting company sustainability targets (69% of brands) as well as meeting customer demand (63%) are identified as the main drivers motivating brands to switch to BBPs, followed by green marketing opportunities (39%) and improved functionalities obtained from bio-based products (27%) with existing and anticipated regulatory changes both at 22%. 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 key drivers.

Overall, there is a positive outlook among brand owners, regarding future customer demand for BBPs, with almost 75% of brands expecting strong to moderate growth in their customer demand for BBPs over the next 5 years. According to brands, the main drivers of this expected consumer growth will be customer preference for products with low environmental impacts (73%) and improved customer awareness of BBPs (71%), followed by greater availability of BBPs (46%) and more cost-competitive products (36%). In literature there is agreement on the importance of low environmental impacts, the availability of BBPs and improved customer awareness as drivers for growth. The need for a simple, official and trustworthy (eco-) label to help consumers identify the "good" materials is often mentioned in the literature. As is the observation that realising such a label is not straightforward. Regarding the need for costs-competitive products, there seems to be slight differences in opinion. According to literature, a certain share of customers is willing to pay a higher price, a green premium, for BBPs. These consumers even expect the price to be higher due to the benefits and expectations that come with bio-based. However, there is debate around which type and share of consumers is really willing to pay more in practice, for which kind of products, and how much the green premium would really be.

INTERREGIONAL BRAND OWNER PERSPECTIVES BASED ON INTERVIEWS

The analysis included 20 interviews with regional brands in Belgium, Denmark, Finland and Spain with a number of regional trends emerging. Spanish brands overall seemed most uncertain around the customer demand for BBPs. High costs represent a clear barrier to BBP uptake among Spanish brands who also viewed the high price of BBPs as a key barrier to consumer uptake, which could be overcome if more cost competitive products are developed. Meeting existing regulations was also a key motivation for BBP uptake among Spanish brand owners, more so than in other regions. Finnish brands, by comparison, seemed more certain that there is an existing customer demand for BBPs and anticipate further strong growth in demand. Finnish brands were more concerned around the functional performance and ease of integrating biobased ingredients within their production lines and products. Cost also remains a barrier for Finnish brands. For Belgian brands, there was less certainty around the customer demand for bio-based ingredients/products. At the same time Belgian brands were most likely to see the potential for green marketing opportunities that could be provided to brands using BBPs or packaging. Cost was once again an important consideration for Belgian brand owners, with other key issues including feedstock or ingredient supply chain uncertainties, functional and environmental performance of BBPs, and compatibility of BBPs with existing processes. Danish brand owners are more confident about customer growth in demand for BBPs and meeting this customer demand is one the key motivating factors for brands switching to BBPs. In Denmark high cost was least likely to represent a barrier to brand owner uptake of BBPs compared to the other regions. Greater certainty surrounding the sound functional performance of BBPs appears to be a key criterion for Danish brands, with improved environmental performance appearing as another key requirement.

Conclusion

Brand owners can play an essential role in opening up key markets for BBPs and it is therefore important for industry and policy makers to understand the perspectives of brands with regards to BBPs. Overall, brand owners have a relatively positive outlook towards bio-based products with 85% of brands who don't currently use biobased ingredients or products within their branded products, and 95% of brands who don't currently use biobased packaging, interested in introducing these in future. Furthermore, most brands expect to see either strong or moderate growth for bio-based products among their customer base within the next 5 years, driven mainly by improved customer knowledge and demand for more sustainable products. Among products of interest, packaging appears to be of greatest interest among the majority of brand owners. Despite these positive sentiments, brands still perceive some barriers surrounding BBPs especially their high cost, functional performance and ease of integration, as well as their reliability of supply. Regional differences among

brand owners have also been identified, with cost and uncertainty around customer demand appearing as a bigger issue in continental Europe, with functional performance concerns ranking as a bigger concern among brands in northern Europe.

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