

Article

Social Perspectives towards Biobased Products and Textiles

Víctor Fernández *, Elena Laborda , Felipe Del-Busto  and Carmen Bartolomé 

Research Centre for Energy Resources and Consumption CIRCE, 50018 Zaragoza, Spain

* Correspondence: vfernandez@fcirce.es

Abstract: This study explores and compares stakeholders' perceptions of biobased products over the last few years. Three groups of stakeholders are included: consumers, the business-to-business market, and public procurers. The main research method consists of a qualitative analysis of some of the results obtained in a series of surveys in Europe-wide projects with the aim of understanding the behaviour, motivations, and concerns of stakeholders related to biobased products. The aim is to gather up-to-date information on the opinion of society from the perspective of the different actors on this type of product, focusing on textiles, in order to make a series of proposals to favour their inclusion in the market, while at the same time answering which are the most influential aspects when it comes to favouring or complicating the access of bioproducts to the market. The document compiles information from multiple sources and years (2014–2020) and, together with the most current and available information (2021), is processed in such a way that the information can be compared across years and stakeholders, allowing to observe the evolution over time of societal perspectives and the variation in opinion according to stakeholder. The results are presented according to three themes: (1) level of awareness, (2) product information, and (3) benefits, drivers, and barriers. The main findings indicate a general lack of awareness of biobased products, as well as several divergences in terms of the best methods to promote market access for biobased textiles.

Keywords: circular economy; textile sector; biobased; social acceptability



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1. Introduction

In recent years, as sustainability concerns have grown worldwide [1,2], industries have sought to ensure sustainable and efficient production conditions in their supply chains [3]. Circular economy strategies and bioeconomy approaches have risen as an effective way to address current and future environmental issues [1,2,4]. Among the sectors with the greatest potential application for the biobased solutions, the textile and clothing sector stands out [5–7] due to the accelerated growth of the clothing market and the consequent disposal rate of waste clothing observed in the last decades [4–6,8]. In Europe, 5.8 million tons of textile waste is generated annually, but barely 25% is recycled [8–10].

The textile and clothing industry is characterized by a high environmental impact, even considered to be one of the most environmentally harmful industries [10,11]. This issue can be observed throughout the value chain of textile products. The production of raw materials is intensive in land, water, fertilizers, and pesticides consumption [12–14]. The processing of textile materials and the production of garments requires the use of chemicals, some of them hazardous to health or the environment [15,16]. In terms of transport and distribution, issues are associated with worldwide delivery routes [10]. During the use phase, water, energy, and detergent is needed for washing, tumble drying, and ironing, with subsequent microplastics being shredded into water [1,11,17]. Finally, end of life of textile products is still characterized by lack of sustainable practices. For instance, most clothes in the EU are still thrown away and burned in incinerators or end up in landfill [10,18].

Moreover, these impacts are aggravated by the so-called fast fashion that, between 2000 and 2015, doubled the world garments production, whereas the use phase duration

was reduced 36% [15]. Garments are now extremely underutilized, either because consumers buy more than they need or because clothes are discarded shortly after use [15]. Within the textile and clothing sector, fashion emits 10% of global carbon emissions and is responsible for almost 20% of wastewater [14,17,19,20].

For this reason, textiles are identified by the European Commission's Circular Economy Action Plan as a priority product type [1]. This has favoured introduction of sustainable developments and the promotion of all kinds of measures, such as more efficient and less wasteful technologies/models, or longer-lasting products with greater potential for recycling [21].

Among these improvements, the use of biobased fibres for the manufacture of clothing is one with great potential. This is due to the multiple benefits they can bring, which, together with the overcoming of barriers, thanks to recent scientific advances, has led to the creation of several innovative materials and partnerships within the textile industry [13]. Therefore, there are many viable alternatives for the introduction of these materials [22], not to mention the possibility of changes in the ways that biobased materials are produced, used, collected, and managed as waste products, providing a solution to the main barriers that would prevent the implementation of biobased textiles [13].

However, its adoption is still held back by different technical, economic, or social aspects. Besides the fast-consumption tendency, other social acceptance issues, such as low level of awareness towards the biobased concept or the belief that all biobased products are biodegradable or can be easily recycled, are encountered [13]. From this situation, consumers have created a sense of scepticism around biobased products [23,24].

In this sense, the switch to a bioeconomy depends not only on being technologically feasible and economically viable, but also socially desirable [23]. One of the most important aspects to address are the misconceptions that consumers/producers may have about these products, as well as the interests they may have in them. It is therefore important to carry out a study of social perspectives on a regular basis in order to have the most up-to-date information possible and, therefore, the most useful for the correct introduction of the products on the market.

In this line, this study aims to contribute to the development of more effective actions to favour the access of these biobased products to the market, providing opinions and knowledge of society with regard to biobased products, and determining the most influential aspects from the perspective of different parts of society in promoting or complicating the access of this type of product to the market. In this way, the article provides views and knowledge of society and its different parts. This article is motivated by the intention to address the lack of information available on this topic by bringing together the available information and expanding it with new data. As for why this problem is being addressed, it is due to the contributions that the consumption of these products can have when it comes to achieving the objectives of the circular economy. For this, a comparison of the social perspectives towards biobased products over the last few years, as well as between the different stakeholders, is made in order to (1) show how society's view of these products has evolved, (2) what information would be of most interest, (3) the most important benefits to be obtained from these products, and (4) the best drivers and the most important barriers to be overcome in order to introduce biobased products to the market.

After the introduction, Section 2 describes the methodology designed to provide information on the level of public awareness of biobased products, as well as information on the interests, motivations, and concerns of consumers, companies, and public procurers about biobased textiles. Section 3 presents the results obtained, which are discussed and reflected upon in Section 4. Finally, a brief concluding section compiles the conclusions of this paper.

2. Methods

The methodology followed for the elaboration of this article is composed of two paths that end up merging, as can be seen in Figure 1 and the following subsections.

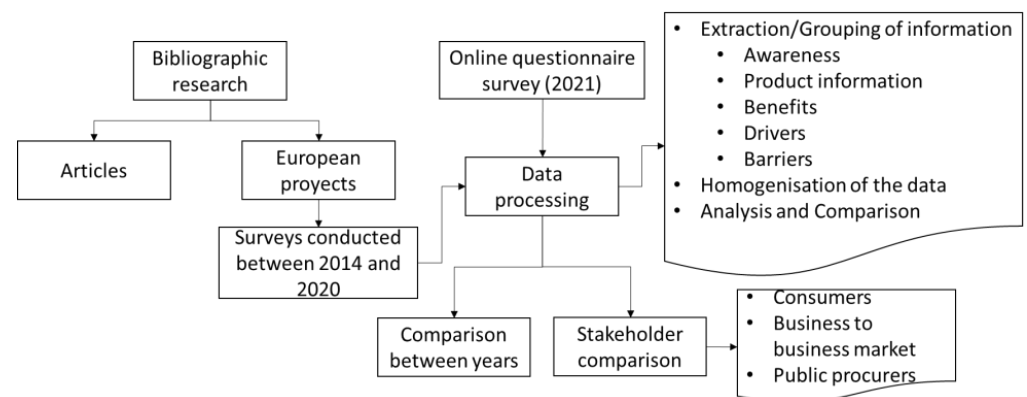


Figure 1. Summary of the methodology followed in the elaboration of this article.

As shown in Figure 1, the methodology followed consists of a bibliographic search not only used for the referencing of this document, but also as a means of obtaining the data to be analysed, all of which is described in Section 2.1 “Secondary information: literature review”, while Section 2.2 “Primary information: Online questionnaire survey” describes everything related to the latest survey carried out on this subject, and Section 2.3 “Data processing” includes the information related to the procedure followed to make the data from both sources comparable despite their differences in format, questions asked, etc.

2.1. Secondary Information: Literature Review

A review of the available literature of studies, reports, and results from relevant EU projects about the social acceptance of biobased products was carried out. For the compilation of the documentation, a variety of databases were used, which consisted of Q1 and Q2 scientific journals, European Commission’s (EC) publications, CORDIS portal, and related H2020 projects.

As a result of a keywords search and after pooling to avoid duplication, a total of 40 documents were collected. A series of inclusion criteria were applied, consisting of document type (scientific articles and projects results), language (English and Spanish only), years (between 2010 and 2021), and territorial framework (only European territory). As a result of the application of these filters, the 40 documents were narrowed down to 35.

A more in-depth analysis of the list of documents collected was then carried out, discarding those documents not relevant to the present study, for instance, if stakeholders were not involved or if social acceptance is not evaluated. A total of 32 documents remained and were used to support the writing of this article. The selection was not limited to biobased textiles, but open to other sectors so that sufficient data from the last decade could be gathered.

To revise the evolution of social perception of biobased products during the last years, the main sources of information are as follows: The results of a 2014 survey that focused on the analysis of the level of awareness and the most requested information by the 6228 participants [25]; insights from a 2015 project that involved 116 participants [26]; two consecutive surveys, one in 2017 with 452 participants and one in 2018 with 530 responses [27,28]; and finally, for 2020, the results provided by two surveys, with over 2000 responses between them, were used to extract information on the level of awareness and the information considered most interesting, as well as the best drivers and the main barriers to market entry [29–32]. Table 1 compile these projects and present the information that could be extracted from them for the comparison.

Table 1. Studies used for the comparative analysis.

Project	Product	Year	Stakeholders	Aspects	Source
Open-Bio	Biobased products	2014	All Business-to-business market	Awareness Product information Drivers Barriers	[25]
InnProBio	Biobased products	2015	Public procurers	Awareness	[26]
Bioways	Biobased products	2017	Consumers	Awareness Benefits Barriers	[27]
Bioways	Biobased products	2018	Consumers	Awareness Benefits Barriers	[33]
Biobridges	Biobased products	2020	Consumers	Awareness	[29]
Bioswitch	Biobased products	2020	Consumers Business-to-business market	Product information Drivers Barriers	[31,32]
EFFECTIVE	Garments Carpets	2021	All	Awareness Product information Benefits Drivers Barriers	[34]

As mentioned above, because of the different origins of the data used, their formats and responses differed from each other, but at the same time they all answered the following questions in one way or another for each aspect:

- Awareness
How much do you know about biobased materials and/or products?
In your opinion, which of the following phrases better describe the term biobased?
- Product information
In your opinion, what is the information people would care the most about these types of products?
- Benefits
In your opinion, what are the most important benefits people would get from these products?
- Drivers
In your opinion, what can be done to get more people to buy these biobased products?
- Barriers
In your opinion, what would people disapprove the most from these products?

2.2. Primary Information: Online Questionnaire Survey

As an activity conducted within the H2020 EFFECTIVE project, an online survey was launched during 2021 covering the social sphere of the project. EFFECTIVE's objective is the design of biobased polyamides and polyesters from renewable feedstocks, such as subproducts from sugar production or used cooking vegetable oils, to manufacture greener and structurally improved fibers and films. These biobased materials are tested across multiple markets, such as construction, automotive, packaging, garments, carpets, and textiles.

In this context, two types of online surveys, one per assessed type of textile product, were developed to gather stakeholders' opinions. The questions used in the respective surveys are available online (links to them can be found in the Supplementary Material section). The first one focused on garments, while the other sought to gather information regarding nonapparel products, specifically asking for opinions on carpets for the auto-

motive and construction sectors. The data collection involved the following stakeholders: consumers, business stakeholders, and public administration.

The surveys consisted only of yes/no and multiple-choice questions. The questions were designed to collect stakeholders' opinions regarding key aspects that consumers evaluate in each product, as well as the level of understanding of the term biobased, and what is considered a biobased material or product; perceptions on factors that would influence preference (or not) for products (accessibility of information, quality, environmental performance, and price); comparison of biobased versus conventional products; among others.

The data collection phase resulted in a total of 440 completed surveys of those related to garments, while those related to the carpets amounted to 220 [35]. The selection of countries from which to draw participants for the surveys was made with the aim of being as representative as possible and feasible of southern and northern European countries. Regarding the profile of the participants, the following segregation can be observed in the Table 2:

Table 2. Respondents profile from the 2021 survey.

Variable	Distribution
Gender	53% of respondents are women and 47% are men.
Age	58% of people are between 18 and 34 years old, 38% between 35 and 54 years old, and only 5% above 54 years old.
Main Countries	Belgium: 10%/Germany: 7%/Spain: 14%/France: 10% Croatia: 9%/Italy: 18%/Netherlands: 10%/Poland: 9% Sweden: 9%.

2.3. Data Processing

Processing data from multiple sources is solved after various iterations, required to align, as much as possible, different methodological approaches (e.g., benefits questioned individually in one project, while in other cases all benefits are valued at the same time) and even diverse format and content among the surveys. The strategy followed involved pairing two or more sources of information, one of them always being the 2021 survey from the EFFECTIVE project [34], according to the similarity found when addressing each main topic (i.e., awareness, product information, benefits, drivers, and barriers) or by the number and type of stakeholder consulted (consumers, businesses, and public procurers).

For the first part of the evaluation, data were analysed without distinguishing among stakeholders. This was performed to focus only on the analysis of the evolution on social acceptance across the last decade (see results in Section 3.1).

Afterwards, the stakeholder's perception was analysed to explore awareness, product information, benefits, drivers, and barriers in depth, taking into account differences between the surveys' recipients. First of all, for the study of awareness, where results are presented in Section 3.2.1, if the original source included a five-level ranking, the data of the two highest categories (e.g., stated "good" and "very good" level of awareness) were combined into a single category, which was considered as the representative of the percentage of participants with a good level of awareness. This was performed to compare these responses with other surveys with just three-level ranking (e.g., "low", "medium", and "high"). Each survey was evaluated individually to ensure that this grouping of answers led to comparable results among all the data sources.

In the case of the most important product information (Section 3.2.2), benefits (Section 3.2.3), drivers (Section 3.2.4) and barriers (Section 3.2.5), the main step was to generate common terms for comparison based on the aspects questioned. In some cases, this involved combining several aspects into a single category. An example of this is the combination of the aspects from the most important product information "Health impact (benefits)" and "Safety impact (benefits)"

from 2014 in the category “Health/safety benefits”. The processing within this phase is in turn accompanied by the discarding of some data due to the use of a methodology that does not allow for comparison, resulting in some cases in fewer years compared.

For the second part of the evaluation, two approaches were used to generate the results obtained in the stakeholder comparison. In the case of the comparison of awareness levels, the same methodology was used as in the previous section for this aspect but focusing only on the oldest available data and the most modern data, taking into account stakeholder segregation. For the remaining aspects, the oldest available results (data were not available for all stakeholder groups in all aspects studied) for each stakeholder group were compared again with the most modern ones, creating, in this case, a ranking that classified the comparable responses for each aspect studied according to the popularity received in each of the source projects. Once these rankings were created, a position-based scoring system was used to carry out the comparison, i.e., if the ranking consisted of six levels, the aspect in the first position received six points, while the aspect in the last position received only one point.

Finally, a logistic regression model was generated for each 2021 survey: garments ($n = 440$) and carpets ($n = 220$). Logistic regression is an effective technique to model a binary categorical dependent variable’s variation given a set of independent variables [36–38]. In this case, the dependent value “BB_success” was created based in the following yes/no questions: (1) “Finally, would you prefer to buy this biobased and more sustainable product over the conventional alternative?” and (2) “Would you like to find more and more biobased products like this in the market?”. Therefore, only if both questions were answered “yes” was it assumed that the person looks forward to acquiring biobased products, and “BB_success” value was set as 1. Otherwise, the value would be 0. This was performed with the aim of further exploring the data and identifying which might be the most influential variables towards a market uptake of biobased products. Logistic regression was applied using R, and 70% of each dataset was used to train the model, whereas 30% was used for validation. The methodological steps applied were (1) dependent value definition, (2) data preparation, avoiding multicollinearity issues, (3) model estimation, (4) results interpretation, and (5) results validation [39].

3. Results

3.1. Results of the Comparison between Years

Over the last years, the level of awareness about the biobased concept remains around 30% and 40%, as shown in Table 3. Variations among the revised sources might be caused by the way this question was designed in each case. Nonetheless, the 2021 survey shows more insights regarding the stated level of awareness and the actual knowledge on the topic.

Table 3. Evolution of the percentage of participants with a high level of awareness.

Year	% Awareness
2014	40%
2015	33%
2017	36%
2018	31%
2020	31%
2021 (Garments)	41%
2021 (Carpets)	49%

On one hand, results shown in Table 3 include the survey’s respondents that stated to be experts on the topic (8% for both carpets and garments), those that could explain the term and give concrete examples (13% for garments, 18% for carpets), and those that know about it but would require further explanations (27% for garments and 29% for carpets). On

the other hand, respondents were also asked to select some definitions that might describe the biobased term. In this case, 41% of respondents for the carpets survey and 33% for the garments one correctly associated biobased with “biological origin, excluding materials embedded in geological formations and/or fossilized” [40]. These numbers are aligned with the overall tendency check between 2014 and 2020. With regard to the trend, leaving aside the upturn in 2021, which would reflect a greater knowledge of biobased products within the textile sector with respect to the unspecific concept of biobased products, it would show a slight decrease, and in any case, the most current values continue to show quite low values of knowledge on the subject within society, which means that the major problem of lack of information, which was identified as early as 2014 [25], still exists today.

Regarding benefits, during 2017 and 2018, more than 50% of people considered that the use of biobased products contributed considerably to all the benefits studied, with “Reducing greenhouse gas emissions and dependence on non-renewable resources” and “Contribution to the after-use management” as the best rated (around 70%). However, during 2021, a different approach was used, asking which were the most important, resulting in a clear superiority of “Less fossil use and greenhouse gases emission” and “Less environmental impact” over the other, former two. This shift in focus, as shown in Table 4, makes it difficult to compare the data, but at the same time allows us to see which benefit is currently of most interest.

Table 4. Benefits resulting from the surveys carried out that were most interesting.

Year	Method	Less Environmental Impact	Less Fossil Fuel use and Greenhouse Gases Emission	Contribution to the After-Use Management	Contribution to a New Economic Activity
2017	1 vote per benefit	68.80%	70.45%	75.90%	52.90%
2018	1 vote per benefit	66.40%	69.70%	70.90%	64.20%
2021 (Garments)	3 votes for all benefits	51.36%	49.77%	27.73%	17.50%
2021 (Carpets)	3 votes for all benefits	39.62%	43.87%	14.62%	17.45%

In terms of the demand for information, or that which was most interesting to the public, during 2014 it was dominated by recycling properties and the range of health and safety benefits. By 2021, recyclability properties would still be one of the most important pieces of information, only this time, it would be matched by CO₂ savings compared to conventional alternatives. During these years, only health and safety benefits would have become less relevant. Another highlight is the narrowing of the gap between types of information demanded. Lifecycle benefits (compared with not-biobased alternatives) and the social impact of the production were the ones that developed the most during these years. Setting aside the recyclability properties, which, as mentioned above, would have maintained very similar values to those of 2014, the only aspect that would have barely developed would be the improvement of functionalities.

In the case of drivers and barriers, it can only be observed that, throughout the whole period for which data are available, high prices were considered as the main barrier for these products and with a large difference with respect to the rest of the barriers.

3.2. Results of the Stakeholder Comparison

In addition to the evolution of society’s vision, the individual opinions of the different stakeholders that make up society are considered important for a good analysis of society’s perspectives on this issue. Therefore, data that took this distinction into account were used to divide the participants into three groups: consumers, business-to-business market, and public procurers.

3.2.1. Awareness

When analysing the awareness of society from a stakeholder perspective, the following is observed, as reflected in Table 5, where the percentages of participants are distributed according to their level of awareness:

- The main bulk of the population across the three stakeholder groups created would be found among those who consider themselves somewhat familiar with the subject matter.
- Those belonging to group “Business-to-business market” would include the majority of people with quality knowledge on the subject, while “Public procurers” have the majority of people with no knowledge at all on the subject.
- The level of awareness of biobased products within the carpet sector in general terms is lower than for garments.
- In all cases, with the exception of public procurators within the carpet sector, there has been an improvement in the level of knowledge.
- In the case of consumers, the level of “very familiar” remains fairly stable over the years and across sectors; however, it can be observed that the percentage who considered themselves not at all familiar with biobased products has decreased considerably compared to 2014, especially in the case of the carpet sector. This results in an increase in the number of participants with a medium level of awareness.

Table 5. Stakeholders level of awareness.

Stakeholder	Year	Very Familiar	Somewhat Familiar	Not Familiar at All
Consumers	2014	22%	53%	26%
	2021 (Garments)	21%	68%	11%
	2021 (Carpets)	17%	77%	6%
Business-to-business market	2014	41%	44%	15%
	2021 (Garments)	38%	50%	13%
	2021 (Carpets)	27%	62%	11%
Public Procurers	2014	18%	60%	22%
	2021 (Garments)	23%	57%	20%
	2021 (Carpets)	23%	47%	30%

In terms of changes from 2014 to 2021, the only stakeholder that has shown significant changes since the collection of this type of data began is the consumer. Since then, the number of people classified as “Somewhat familiar” has increased to such an extent that today there are 20% more than in 2014, with the vast majority coming from the “Not familiar at all” category. This fact is also related with the statement included in the previous subsection in which an increase in the knowledge of bioproducts was detected.

3.2.2. Product Information

By dividing the data into the selected stakeholder groups, the variations and similarities between the diverse groups can be seen in Figure 2, where the different types of information are ordered according to the importance received by each stakeholder.

The highlights of each element studied are presented below:

- The percentage of biobased material. An element in which the “business market” would have lost interest or would have been overtaken by other factors, but which in any case it is valued more highly than the other two interest groups.
- The CO₂ savings with respect to a conventional alternative. As might be expected, given the great importance this element has acquired in recent years, as mentioned above, it is one of the most important for all stakeholders, especially for “Business-to-business market” and “Public procurers”.

- **Recyclability properties.** During 2014, information on the recyclability of the product was only highly rated by consumers, while in all other cases it was of the least interest. Since then, there has been a strong development along stakeholder lines. In the case of consumers it became the most important, while for the other two stakeholders it evolved to be at least in the middle of the ranking. In the case of the business market and the carpet sector, it would be among the most important, while in the case of the clothing sector from the perspective of public procurers, it is in the second position.
- **Lifecycle benefits compared with a not-biobased and similar product.** This information, as can be seen in the figure and from the perspective of all stakeholders and in both sectors, has declined in importance compared to the original. There is only one exception to this case, and that is in the clothing sector where the business market considers it as the most important benefit.
- **Social impact of the production.** An element that, despite the great development experienced, has, from the perspective of all stakeholders, an exceptionally low relevance compared to the rest of the elements. In 2014, it was only questioned by consumers. In spite of this, within the carpet sector, it is held in high esteem by the business market.
- **Health/safety benefits.** Originally one of the most important benefits, it would have lost some position today, but it would still be one of the most important, except for from the point of view of the business market, where a large decline is observed.
- **Improved functionalities (i.e., due to a better design).** As with the social impact of its production, this is a benefit that was only asked to consumers in 2014 and which, as can be seen, has not received any decent assessment from stakeholders at present.

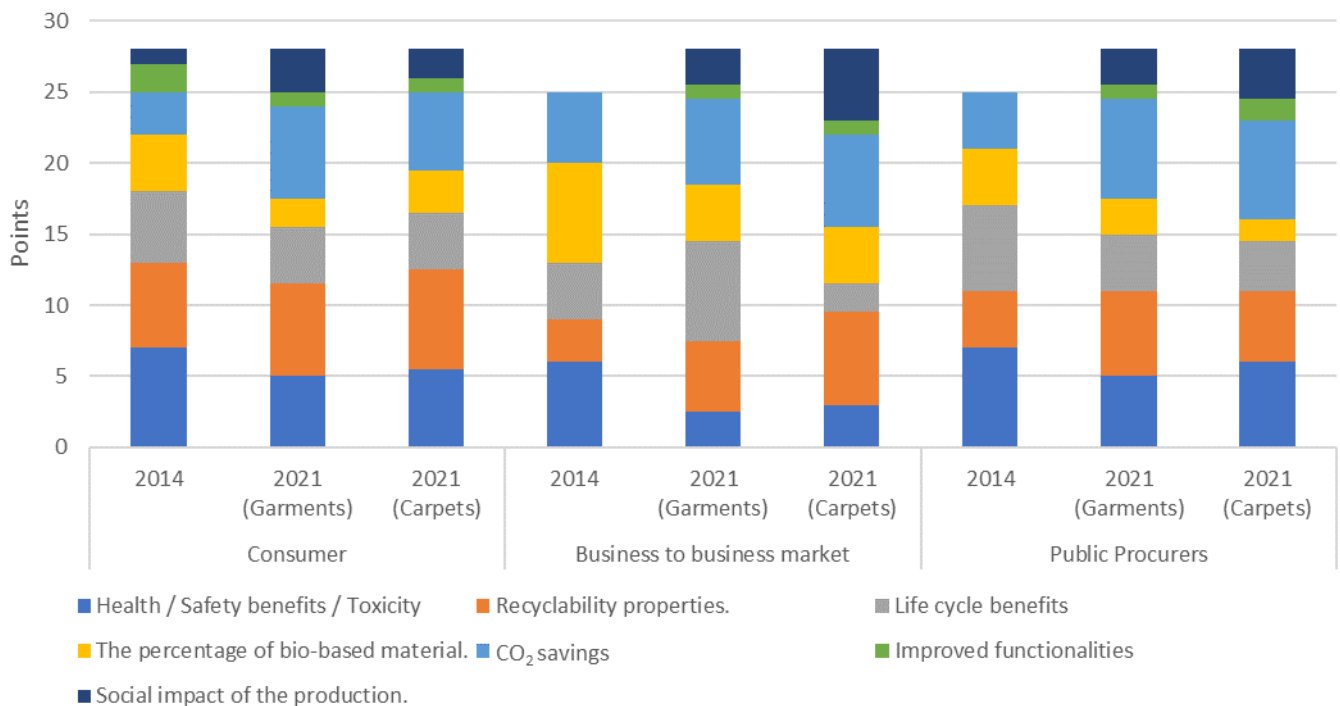


Figure 2. Information for which each stakeholder would be most interested.

As can be seen in Figure 2, recyclability and CO₂ savings properties are the type of information that not only show the two highest values overall but are also among the few that have experienced an increase from all three stakeholders. In the case of consumers, this increase is especially significant for CO₂ savings, while in the case of the business market it would be for recyclability properties. In addition to this, it should be noted that while these two types of information increased, two other types of information decreased, namely, health and safety benefits and biobased percentage. It should be noted that this decrease is

not necessarily caused by a loss of interest, but that the interest is the same or very similar, and that the increased importance of other parameters has had an impact on these aspects.

3.2.3. Benefits

Based on the most recent data for those that forced participants to choose to value benefits collectively rather than individually, Figure 3 shows stakeholders' views on what would be the most important benefits to be gained from the use of biobased textiles.

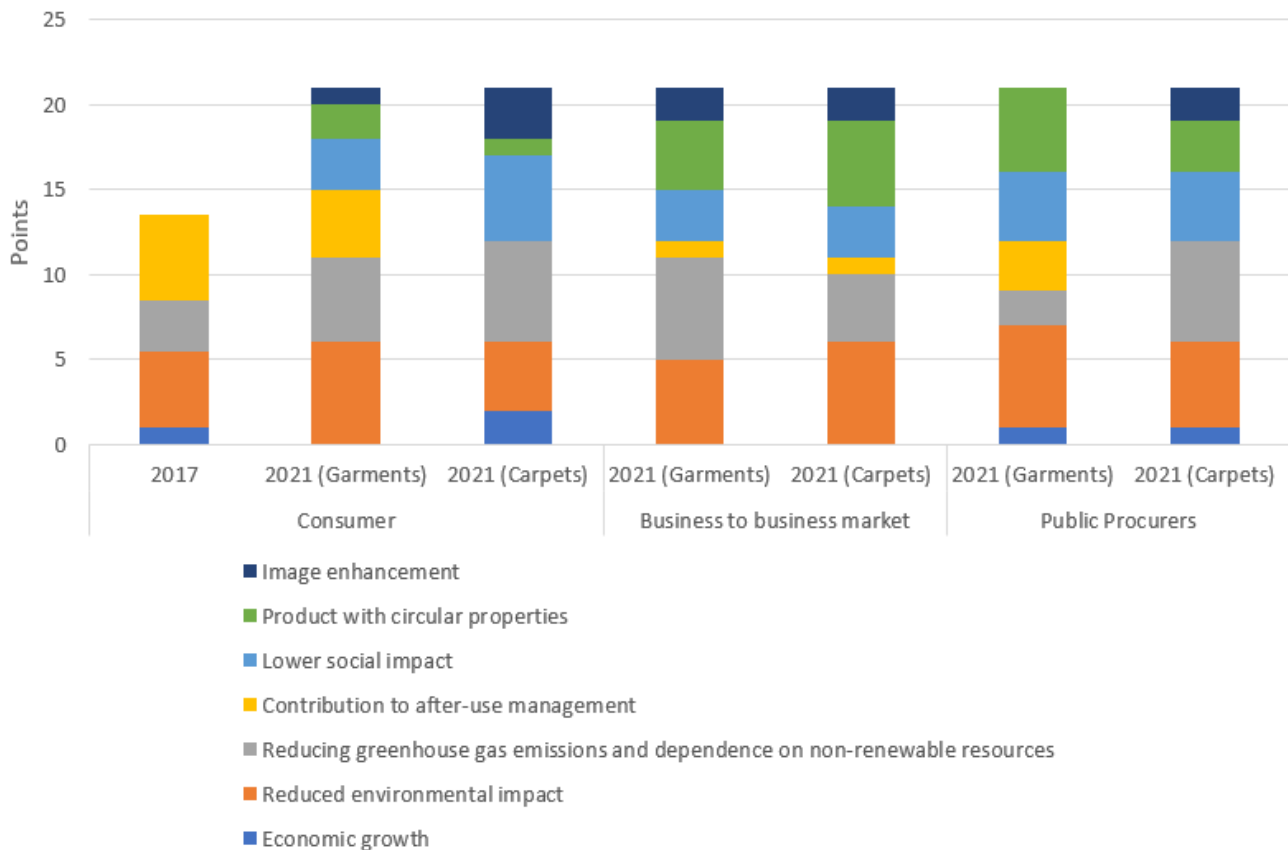


Figure 3. Most important benefits according to stakeholders.

As a result of the comparison, the following cases of differences/similarities in the valuation of benefits occur; note the absence of data on business-to-business market and public procurers among the older data:

- Reduced environmental impact. One of the most important benefits to be obtained, which all stakeholders agree on, specially, in the case of “Business-to-business market” and “Public procurers”.
- Reducing greenhouse gas emissions and dependence on non-renewable resources. Another of the most important benefits to be gained from the use of biobased textiles according to all stakeholders, especially from the consumers’ perspective.
- Economic growth. A benefit that, despite being considered individually as a fairly important benefit, according to the 2017 and 2018 data shown in the previous section, when compared to the rest of the benefits, is observed, in general terms, to be the least relevant for all stakeholders.
- Contribution to the after-use management. Similarly, to economic growth, this advantage was considered as one of the main advantages to be gained from the use of biobased products during 2017 and 2018. However, except by consumers to some extent, it is not considered an extremely relevant advantage.

- Lower social impact. Although information on the social impact of production was not in high demand by any of the stakeholders, the lower social impact of its use is of more interest, especially to consumers and “Public procurers”.
- Product with circularity properties. A benefit that is of little interest to consumers but is nevertheless particularly important for the “Business-to-business market”, as well as to “Public procurers”.
- Image enhancement. An advantage that, according to the results obtained, is of relatively low importance for all stakeholders.

Although a complete comparison is not possible because the stakeholders were not considered separately, some assessments were obtained from the analysis. It can be seen that consumers, after 4 years, have come to value “Reducing greenhouse gas emissions and dependence on non-renewable resources” as a benefit to a much higher degree, while the importance of “Lower social impact” has decreased considerably. Moreover, despite the lack of initial information, the values achieved by consumers for these benefits in 2021 are very similar to those obtained by the business-to-business market and public procurers.

3.2.4. Drivers

From the analysis at the level of the drivers it has been possible to determine, as shown in Figure 4, the differences and similarities of opinion among stakeholders on the best actions to take to promote market access and purchase of biobased textiles.

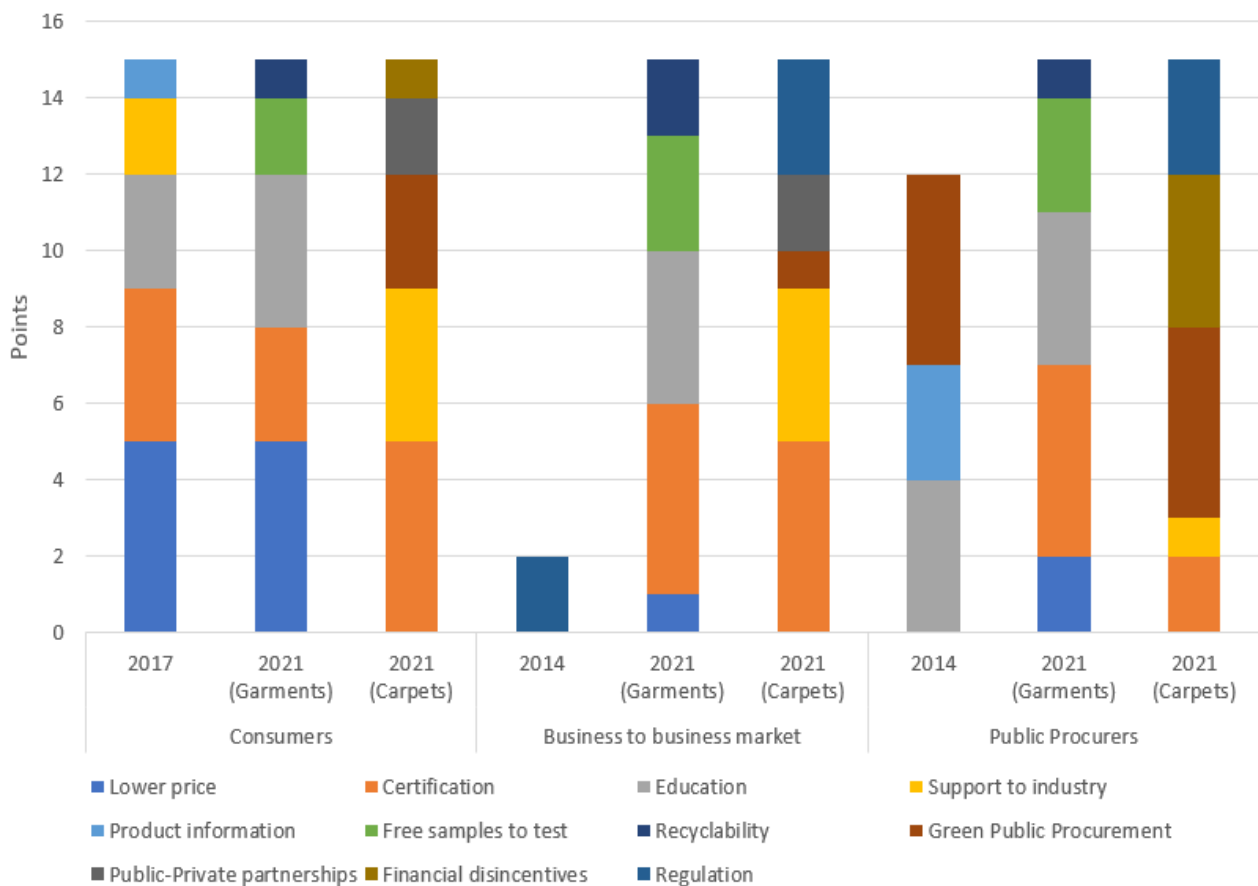


Figure 4. More efficient drivers according to stakeholders.

Based on this comparison, the differences and similarities in stakeholder views on the best ways forward for the promotion of biobased products are presented below. It should be noted that in the case of the promoters, the questionnaires were not conducted homogeneously over the years, nor were the sectors:

- Lower price. A driver highly valued by consumers, but less so by other stakeholders.
- Certification. The view on the use of certificates has moved from being only highly valued by consumers to being the most important for the business-to-business market and for public procurers within the garment sector.
- Education. Where questioned, all stakeholders consider the development of educational actions to be an important driver, which would correspond to a general lack of knowledge.
- Support to industry. As can be seen in the carpet sector column, support for the industry is a valuable driver for consumers (in this case, with a good development compared to 2017) and the business market.
- Product information. Making key product information available to stakeholders in a database was a prominent driver among public procurers during 2014 but has apparently lost importance given its disappearance among the most recent questionnaires, as well as the low importance received by consumers in 2017.
- Free samples to test. The use of free samples for the promotion of biobased textiles is appreciated by business-to-business market players and public procurers.
- Recyclability (accept as waste in the shop). Within the garment sector, it was considered interesting to question participants about ensuring the recyclability of waste through in-store delivery. However, all stakeholders considered this driver as ineffective compared to the others.
- Green public procurement. The use of green public procurement to accelerate the uptake of biobased textiles is seen by public procurers as the best method to boost them; however, from the perspective of other stakeholders, its potential would be much lower.
- Public–private partnerships. For all stakeholders, the creation of public–private partnerships would be an ineffective way to promote biobased textiles in relation to other alternatives.
- Financial disincentives. The use of financial discourse on conventional alternatives as a way of promoting biobased textiles is a welcome move for public prosecutors, but a very bad one for the other stakeholders.

Because of the characteristics of the available data, the possibility of analysis is more limited than for other aspects; however, the following cases can be discerned.

Firstly, the correlation between the need for information by society in general, as observed above, and the consideration as a relevant driver and, therefore, demand for it.

Secondly, it can be observed that while recyclability properties are quite important information to accompany the product, this is less so when it comes to product promotion. This may be due to the high presence of this property in multiple products, as the mandatory nature of this property that is being generated, causing a corresponding loss of importance when it comes to making it stand out in the market.

As far as the stakeholders are concerned, certain commonalities can be observed to a greater or lesser extent, such as education and certification, as well as a few areas in which they differ. An example of this is the great importance given to lower prices in the case of clothing by consumers, as opposed to the opinion of the rest of the stakeholders. In turn, there would be the public procurers, who consider, contrary to the other two stakeholders, that “industry support” within the carpet sector is not among the most important aspects and the same would be the case the other way around with green public procurement.

3.2.5. Barriers

In terms of the aspects that slow down or make it more difficult for biobased textiles to enter the market, these are reflected in Figure 5, according to each of the stakeholders.

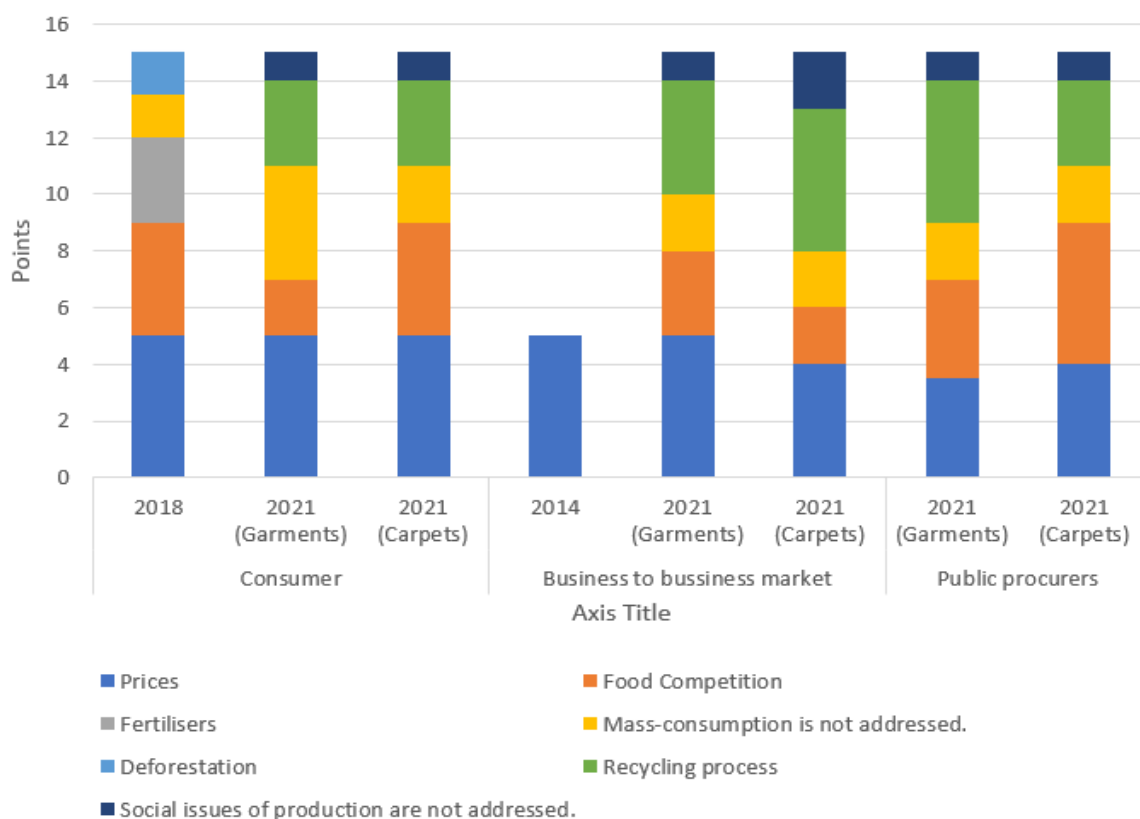


Figure 5. Most important barriers according to stakeholders.

As a result of the analysis, the following cases were identified where stakeholders' views were similar and differentiated; note the lack of data on the opinion of public prosecutors before 2021, as well as the difference in the origin in the other two cases and the corresponding differences between the questioned terms.

- Prices. Among the list of aspects that could cause the most problems for biobased textiles in their entry into the market, the fact that their products could be more expensive than their conventional versions would be one of the most important. This becomes a priority for consumers and the "business-to-business market".
- Food competition. Whether the production of biobased textiles can compete with food production is a barrier of great concern to all stakeholders, especially the public.
- Mass consumption. The fact that the effects of mass consumption of such products are not being considered in their introduction/production is not something that is generating much concern among stakeholders. In any case, it is the consumers from the garments sector who would be most concerned about this possible situation.
- Recycling process. The problems that may arise within the recycling process due to the introduction of these products is the cause of great concern among the business-to-business market, who would value them on a remarkably similar basis to higher prices, and public procurers.
- Social issues of production. The production of social problems due to the production and introduction of biobased textiles on the market is, according to all stakeholders, one of the least worrying barriers at the moment.

3.3. Logistic Regression Results

As mentioned, the logistic regression modelling was applied with the objective of further understanding of which might be the variables that could influence a future market uptake of biobased garments and carpets. The interpretation of the results has its own limitations given the size of the sample and the number of independent variables included

(more than 50). Therefore, the aim is not to generate a predictive model, but to statistically analyse how variables are related to a potential positive approach toward biobased products by stakeholders.

Nevertheless, the resulting model for garments seems to be efficient, whereas the carpets model would not be significant given a p -value of over 0.05 and an accuracy of 62%. The confusion matrix for both models is presented in Table 6 and also in Tables A2 and A4. Appendix A includes the coefficients logistic regression model coefficients for garments in Table A1, and carpets in Table A3.

Table 6. Confusion matrix for garments and carpets.

		Garments (2021)			Carpets (2021)		
		Predicted			Predicted		
		No BB_success	BB_success	TOTAL	No BB_success	BB_success	TOTAL
Real	No BB_success	18%	14%	31%	25%	23%	48%
	BB_success	12%	56%	69%	15%	37%	52%
	TOTAL	30%	70%	100%	40%	60%	100%
Model Accuracy		72%			62%		
Number of cases		131			60		
χ^2		19.783			3.215		
p -value		8.68×10^{-6}			0.07298		

In the case of garments, as shown in the Table 7, ensuring a good product performance in terms of CO₂ savings and recyclability properties seems to be key information that stakeholders would like to receive about biobased products. Furthermore, stakeholders might look forward to innovative products with less social impact if compared with those produced with conventional raw materials. Actually, results also show that not addressing social issues might have a negative impact in the final acceptance of products. Therefore, garments producers should progress in this line for a better market uptake of biobased clothing.

Table 7. Selection of the variables with higher p -value for garments.

	β	Std. Error	Z Value	Sig.	Exp(β)	(Exp(β)-1) × 100
(Intercept)	-3.300	1.437	-2.296	0.022	0.037	-96%
Q4_Local (identifying biobased as locally produced)	-1.151	0.555	-2.076	0.038	0.316	-68%
Q4_None (not identifying biobased with suggested terms)	-3.609	1.115	-3.236	0.001	0.027	-97%
Q9_Lack_advertisement (lack of advertisement as a main barrier)	1.314	0.511	2.575	0.010	3.722	272%
Q9_Overuse_bio (overuse of term "bio" as a main barrier)	1.251	0.516	2.426	0.015	3.493	249%
Q10_CO ₂ (CO ₂ savings as key required info)	1.330	0.509	2.612	0.009	3.780	278%
Q10_Recyclability (recyclability properties As key required info)	1.498	0.550	2.722	0.006	4.472	347%
Q10_LCA (lifecycle performance as key required info)	1.320	0.542	2.436	0.015	3.743	274%
Q12_env_impact (less environmental impact as key benefit)	1.187	0.549	2.163	0.031	3.277	228%
Q12_social_impact (less social impact as key benefit)	1.905	0.558	3.416	0.001	6.719	572%

Table 7. Cont.

	β	Std. Error	Z Value	Sig.	Exp(β)	(Exp(β)-1) × 100
Q12_social_issues (disapprove the product if social impact of production is not addressed)	-1.211	0.528	-2.293	0.022	0.298	-70%
Q14_participation_willingness (stakeholder Willingness to participate in product's end-of-life)	0.830	0.308	2.696	0.007	2.292	129%

It is worth noting that none of the suggested strategies to influence people into buying biobased garments, such as discounts, labels, or free samples, seems to be efficient in the final decision. In the case of understanding what a biobased material or product is, showing a low level of awareness about these terms might have a negative impact on the social acceptance.

In the case of carpets, the logistic regression results are not conclusive. Further data might be needed.

4. Discussion

4.1. Awareness

In line with what was observed in other years' data [25–27,30,32,33], as well as the findings of other articles [5,7,22,24], society experiences a lack of awareness or familiarity with biobased products. It is true that, in the case of consumers, there has been a large increase which can be justified by the increased interest shown in consumer awareness. This is evidenced by numerous projects and studies focusing solely on consumers [5,7,22,23,28,33]. However, those in the “business-to-business market” would be the best informed about quality today, but not even 40% of them consider themselves very knowledgeable on the subject. In terms of the reason or set of reasons for this situation, the responses to the 2021 surveys would indicate that it is mainly due to the following aspects:

- People do not understand/care how these products are made.
- Lack of advertisement in the streets, media, website, etc.
- Overuse of “bio” terms makes people stop caring.
- Keeping track of “bio” innovations demands a great effort.

In short, this lack of awareness stems from two aspects: on the one hand, insufficient education to address the lack of understanding, interest, and trust that society is experiencing; and, on the other hand, problems in transmitting information either by not informing enough or not doing it efficiently.

This lack of understanding, in addition to making it difficult to identify a true biobased product, results, as observed in the logistic regression results, in fewer purchases of biobased products.

Given this shortcoming, a successful market introduction for this type of product could be difficult. Therefore, the use of various means such as information campaigns is still necessary. However, since it is more than likely that such measures have already been used in the past and have apparently not achieved much better results, it would be of interest to investigate the effectiveness of these measures, either in terms of the number of people reached or the ability to convince the recipient of this information to switch from conventional to biobased products, as well as the level of awareness they gain. One way to increase this effectiveness could be to create a campaign aimed at each type of target group, or, in other words, a campaign designed for each stakeholder, with public procurators being the ones who would need the most knowledge on the subject.

4.2. Product Information

In terms of the demand for information, this is an aspect that has undergone some notable changes over time.

Firstly, we have moved from a state in which only two aspects generated interest to a situation in which, although there are still two aspects that dominate the rest, the

difference between them is no longer so great. Therefore, despite the lack of development in awareness levels, these results demonstrate an evolution of interest in the different facets that accompany these products.

The second would be the aforementioned change in the pair that would make up the most demanded information, moving from “Recyclability properties” and “Health and safety benefits” to “Recyclability properties” and “CO₂ savings compared to conventional alternatives”. This change is produced not only by the increase interest towards “CO₂ savings compared to conventional alternatives” by society, but also by a decrease in interest towards “Health and safety benefits”. Furthermore, it can be assumed that without the influence of the pandemic, the values would have been much lower. Regarding what would have triggered this increased interest in CO₂ savings within the business market and public procurers, it is most likely that such changes in interest stem from the efforts made from 2013–2020 to reduce emissions in the EU as a whole by 20% from 1990 levels, as well as future measures to be implemented to extend this to 55% by 2030 [41,42].

In terms of differences between stakeholders, for biobased textiles, the most notable is the lack of interest on the part of consumers and public procurers towards the percentage of biobased material, a type of information that is highly linked to the main certifications used for biobased products.

Introducing this type of information into products, so as to increase interest in them and, thus, facilitate their entry into the market, is not the only thing for which it can be valuable. As it is basically information that is of interest to society, its contribution to the abovementioned campaigns can be a good way to improve their effectiveness.

4.3. Benefits, Drivers, and Barriers

As far as benefits are concerned, given the methodological differences between the data, it was not possible to make a strong comparison between them. However, it can be concluded that without a large difference between stakeholders, biobased textiles would have a significant influence on the realization of most of the benefits studied and that “Reducing greenhouse gas emissions and dependence on non-renewable resources” and “Reduced environmental impact” would be considered the most important to obtain, which is understandable given the strong interest in CO₂ emission savings. It is also worth highlighting, in accordance with the results of the logistic regression, the significance for the purchase of biobased garments that they have a lower social impact than their conventional versions. In terms of the high value that the business-to-business market and public procurers place on the circularity properties of products as benefits, this may be influenced by the EU’s interest in moving from a largely linear economy, which causes human health problems, inefficient use of natural resources, and overdependence on Europe’s externalities, to a resource-efficient and low-carbon circular economy, all of this accompanied by the whole environmental policy guided from 2013 to 2020 (making up almost the entire period under study) by the Seventh Environment Action Programme (EAP) [43]. As with “Product information”, the benefits to be gained from such products can be a good way to turn consumer opinion to favour, and aspects of products should be focused on when improving existing biobased products or developing new ones.

In the case of drivers data, there are also few options for comparison, except in the stakeholder analysis, from which the following conclusions can be drawn. On the one hand, stakeholders agree that education and certifications would be among the most important drivers. This is in line with the lack of awareness and trust that has been detected. It should be noted that the “business-to-business market” is the only one to value certifications as the most important drivers, which would be in line with the great interest shown in information on the percentage of biobased material. However, on the other hand, there would be various discrepancies of opinion among stakeholders, such as the great importance given by consumers to a lower price of the bioproduct compared to its conventional versions, as well as support for the industry by the “business-to-business market” or for “Green Public Procurement” and “Financial disincentives” by public procurers. Thus, in addition

to looking at the drivers that are considered to be the best ways to promote the introduction of biobased products according to each stakeholder, it can be seen how actions that do not take these differences into account can result in ineffective measures, either by not raising sufficient interest or by not solving the problems that some stakeholders may be experiencing.

As for the barriers, these would also suffer from the same problem that would make it impossible to compare them between years, while from the stakeholder comparison, the following can be concluded. Firstly, biobased products may not be priced higher than their conventional versions and, as we saw in the case of boosters, it would be desirable, especially for consumers, that these prices were lower. Secondly, in line with the interest that has existed for years, producers should not negatively influence the existing recycling process. However, the problem today lies not so much in the impossibility to recycle these products, which are, in fact, suitable for a wide range of end-of-life options, including reuse, mechanical recycling, organic recycling, and energy recovery, but in problems related to their collection and management [44,45]. The vast majority of the volume of biowaste produced today can easily be recycled together with its conventional counterparts in separate recycling streams or, in the case of biodegradable and compostable waste, be part of industrial composting (organic recycling), and in cases where it cannot be reused or recycled, it can be used to produce bioenergy [44,45]. As far as textiles are concerned, their products can be recycled in most cases by mechanical means, while manmade fibres are generally recycled by chemical means and, in the case of biodegradable fibres, by composting. Despite these qualities, large quantities of this waste end up in incinerators and landfills. Therefore, the problem lies more in the lack of information and methodologies for collection/separation and treatment or streams to recycle these products, rather than in the properties of the product itself [44]. Thirdly, biobased products must not conflict with food production. Biobased products can be made from multiple feedstocks that would not necessarily conflict with food production. However, this concern would largely stem from biobased plastics which would mostly be derived from carbohydrate-rich plants such as maize or sugar cane [46], but in addition to feedstocks of agricultural origin, lignocellulosic feedstocks or feedstocks from organic waste can also be used [46]. In addition, the bioplastics industry is also investigating the use of non-food crops (second- and third-generation feedstocks), such as cellulose and algae, with a view to their further use to produce bioplastic materials [46]. In textiles, in addition to natural fibres and cellulosic chemical fibres, such as viscose, cupro, and acetate, there would be manmade fibres such as nylon and polyester for which biobased versions already exist from vegetable oils, starches, bio residues, and biomass sugars. Therefore, some competition may exist; however, in certain cases, substitution of food products by other feasible sources may require more land use, which at the same time may have an equal or greater impact on food production.

The information obtained from the drivers and barriers can be very useful both for producers to know what interests or demands their buyers have, what to target, and what to avoid, and for governments to legislate and create a strategy to facilitate the entry of biobased products into the market.

5. Conclusions

This exploratory study on society's perception of biobased products from 2014 to 2021 and differentiating between consumers, the business-to-business market, and public procurers shows the following main conclusions.

Firstly, the lack of awareness or familiarity with biobased products that was already detected in the past still exists today, which will require the use of various means to raise the level of awareness in society.

Secondly, there would be a greater demand for all types of information, and health and safety benefits would have been replaced by CO₂ savings over conventional alternatives as one of the most important types of information. Thirdly, stakeholders would present

fairly similar views regarding the main benefits to be gained from these products and the most important barriers to be overcome. However, stakeholders show clear differences in how to act to promote the introduction of these products in the market. These results could be key to developing such measures to raise the level of awareness of the issue in society, whether general or targeted, to develop products that appeal to consumers, and to establish strategies to encourage the introduction of such products on the market.

In the specific case of garments, in addition to this strong concern for CO₂ savings and recyclability properties, it is noted that a lower social impact compared to conventional products is of significant interest to stakeholders, and that not taking this aspect into account may pose a problem for the introduction of this type of product on the market. This, together with the limited influence that strategies such as discounts, free samples, or labelling have shown in encouraging the purchase of biobased clothing, implies that the strategies of companies in the sector should focus more on the aforementioned aspects, at least until the level of awareness rises further.

In addition to collecting and providing data on the perspectives of European society towards biobased products and especially textiles to facilitate their introduction into the market, all from a general and stakeholder-specific perspective, this article also exposes the difficulties surrounding the search for information and its comparative analysis, not only that this is a relatively new topic, but also that when carrying out this type of study, although it has been possible to take into account those carried out in the past, a methodology and a format for the survey questions that would allow a feasible or simple comparison of the results of each study was not followed. Therefore, this article encourages that until a standardized methodology exists, surveys developed in this field aimed at collecting this type of data should take into account the format and methodology of past studies so that their comparisons are simpler and the results of these even more enlightening.

6. Suggestion for Future Research

In addition to the results already presented, the development of this analysis made it possible to observe the lack of data and a sufficiently homogeneous methodology between studies to allow for a complete comparison. It is therefore proposed that in future cases, when designing surveys and other tools with which to collect information, this should be performed in such a way as to allow comparison with the aim of being able to more rigorously measure the effectiveness of the measures that have been implemented.

With regard to future actions to promote market access for biobased products, and in particular biobased textiles, in view of the results obtained, it is proposed that these actions should be developed, either with the aim of influencing only part of the market or the whole market, taking into account the differences between stakeholders and including means to raise public awareness, provided that the production of these products does not conflict with food production. In this sense, further research would be desirable to better understand the shortcomings that different stakeholders identify in the biobased products introduction in the market. Differences between products should also be addressed to implement the promotion of actions indicated before.

Supplementary Materials: The questionnaire used for the online survey is available online (5 January 2023) at: https://ec.europa.eu/eusurvey/runner/EFFECTIVE20_GARMENTS_VAUDE_001 and https://ec.europa.eu/eusurvey/runner/EFFECTIVE20_Carpet_BALSAN_002.

Author Contributions: Conceptualization, V.F. and F.D.-B., methodology, F.D.-B., software, F.D.-B., validation, C.B., formal analysis, V.F., investigation, V.F., data curation, V.F., writing—original draft, V.F. writing—review and editing, V.F., E.L., F.D.-B. and C.B., supervision, C.B., project administration, F.D.-B. and C.B. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: Ethical review and approval were waived for this study, due to the fact that the participants in the article have carried out their research tasks in compliance with the Organic Law 3/2018 of 5 December 2018, on the Protection of Personal Data and guarantee of digital rights and the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of individuals with regard to the processing of personal data and on the free movement of such data and repealing Directive 95/46/EC (General Data Protection Regulation), also following the internal procedures of their organization (CIRCE) regarding the respect and management of personal data. In addition, the project's certificate of ethical compliance during its activities is available.

Informed Consent Statement: Patient consent was waived since the survey was conducted by an expert company in the field, subcontracted by CIRCE. All survey participants are anonymous, and their personal data have been treated under the confidentiality commitment of the company that conducted the survey (attached link: <https://www.pollfish.com/gdpr/>).

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the embargo on the Ph.D. Thesis of the author at the time of publication of this article.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

LOGIT Result for Garments

Table A1. Logistic regression model coefficients for garments.

	β	Std. Error	Z Value	Sig.	Exp(β)	(Exp(β)-1) × 100	
(Intercept)	-3.300	1.437	-2.296	0.022	0.037	-96%	*
GenderFemale	0.289	1.342	0.216	0.829	1.335	34%	
Gendermale	0.052	0.410	0.127	0.899	1.053	5%	
GenderMale	-0.751	1.147	-0.655	0.513	0.472	-53%	
Age18-24	-0.754	0.824	-0.916	0.360	0.470	-53%	
Age25-34	-0.849	0.789	-1.076	0.282	0.428	-57%	
Age35-44	-0.508	0.792	-0.641	0.521	0.602	-40%	
Age45-54	0.189	0.943	0.201	0.841	1.208	21%	
StakeholderConsumer	-0.113	0.521	-0.216	0.829	0.893	-11%	
Stakeholderother	0.285	0.664	0.430	0.667	1.330	33%	
StakeholderPublic	-1.079	0.757	-1.425	0.154	0.340	-66%	
Q3_BB_knowledge	-0.050	0.120	-0.416	0.677	0.951	-5%	
Q4_natural	-0.756	0.434	-1.741	0.082	0.470	-53%	.
Q4_Biodegradable	-0.674	0.435	-1.551	0.121	0.510	-49%	
Q4_alt_petroleum	-0.761	0.455	-1.673	0.094	0.467	-53%	.
Q4_recycled	0.375	0.448	0.837	0.402	1.455	45%	
Q4_RES	-0.194	0.447	-0.433	0.665	0.824	-18%	
Q4_ECO	0.398	0.454	0.878	0.380	1.489	49%	
Q4_Local	-1.151	0.555	-2.076	0.038	0.316	-68%	*
Q4_None	-3.609	1.115	-3.236	0.001	0.027	-97%	**
Q7_Know_EFFECTIVE	0.118	0.276	0.426	0.670	1.125	12%	
Q9_Lack_advertisement	1.314	0.511	2.575	0.010	3.722	272%	*

Table A1. *Cont.*

	β	Std. Error	Z Value	Sig.	Exp(β)	(Exp(β)-1) × 100	
Q9_Overuse_bio	1.251	0.516	2.426	0.015	3.493	249%	*
Q9_not_care	0.183	0.499	0.367	0.714	1.201	20%	
Q9_biobased_section	-0.101	0.537	-0.189	0.850	0.904	-10%	
Q9_Info_lack	-0.498	0.495	-1.007	0.314	0.608	-39%	
Q9_store_staff	-0.584	0.536	-1.089	0.276	0.558	-44%	
Q9_social_media	-0.125	0.686	-0.182	0.856	0.883	-12%	
Q9_Lack_incentives	0.239	0.597	0.400	0.689	1.270	27%	
Q10_bio_percentage	0.836	0.519	1.612	0.107	2.308	131%	
Q10_CO ₂	1.330	0.509	2.612	0.009	3.780	278%	**
Q10_Recyclability	1.498	0.550	2.722	0.006	4.472	347%	**
Q10_LCA	1.320	0.542	2.436	0.015	3.743	274%	*
Q10_social	0.182	0.565	0.321	0.748	1.199	20%	
Q10_Health	0.525	0.508	1.035	0.301	1.691	69%	
Q10_functionalities	-0.227	0.574	-0.395	0.693	0.797	-20%	
Q11_Discounts	-0.146	0.536	-0.272	0.785	0.864	-14%	
Q11_samples	-0.940	0.520	-1.809	0.070	0.390	-61%	.
Q11_Certify50	0.555	0.490	1.133	0.257	1.743	74%	
Q11_Local_feedstock	0.073	0.560	0.131	0.896	1.076	8%	
Q11_recyclability_store	-0.406	0.585	-0.695	0.487	0.666	-33%	
Q11_production_process	-0.037	0.622	-0.059	0.953	0.964	-4%	
Q11_endoflife	-0.410	0.605	-0.677	0.499	0.664	-34%	
Q12_env_impact	1.187	0.549	2.163	0.031	3.277	228%	*
Q12_social_impact	1.905	0.558	3.416	0.001	6.719	572%	***
Q12_GHG	0.474	0.509	0.931	0.352	1.606	61%	
Q12_Circularity	1.024	0.559	1.832	0.067	2.784	178%	.
Q12_habits.	0.477	0.576	0.827	0.408	1.611	61%	
Q12_EndofLife	0.384	0.562	0.683	0.495	1.467	47%	
Q12_economic	1.030	0.570	1.808	0.071	2.802	180%	.
Q12_Higher_prices	-0.183	0.521	-0.351	0.725	0.833	-17%	
Q12_food_production	-0.122	0.496	-0.245	0.806	0.885	-11%	
Q12_recycle_complex	0.578	0.468	1.234	0.217	1.782	78%	
Q12_Mass_cons	-0.158	0.535	-0.296	0.768	0.854	-15%	
Q12_social_issues	-1.211	0.528	-2.293	0.022	0.298	-70%	*
Q14_participation_willingness	0.830	0.308	2.696	0.007	2.292	129%	**
Q17_Biobased_work	0.371	0.412	0.900	0.368	1.449	45%	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

Table A2. Confusion matrix for carpets.

		Predicted		
		No BB_success	BB_success	TOTAL
Real	No BB_success	18%	14%	31%
	BB_success	12%	56%	69%
	TOTAL	30%	70%	100%

Table A2. *Cont.*

Predicted		
No BB_success	BB_success	TOTAL
Number of cases in table: 131		
Number of factors: 2		
Test for independence of all factors:		
Chisq = 19.783, df = 1, p-value = 8.675×10^{-6}		

LOGIT Result for Carpets

Table A3. Logistic regression model coefficients for carpets.

	β	Std. Error	Z Value	Sig.	Exp(β)	(Exp(β)-1) \times 100	
(Intercept)	-45.5892	247.0384	-0.185	0.8536	1.588E-20	-100%	
Gendermale	-2.6143	2.597	-1.007	0.3141	0.07321902	-93%	
Age18-24	0.3736	245.6923	0.002	0.9988	1.45295585	45%	
Age25-34	-2.1484	245.6926	-0.009	0.993	0.11667068	-88%	
Age35-44	1.3647	245.6761	0.006	0.9956	3.91454851	291%	
Age45-54	-2.0201	245.7044	-0.008	0.9934	0.1326422	-87%	
Q2_stakeholderConsumer	5.4505	3.2832	1.66	0.0969	232.874574	23187%	.
Q2_stakeholderOther	4.27	3.2577	1.311	0.1899	71.5216356	7052%	
Q2_stakeholderPublic	1.5458	2.7275	0.567	0.5709	4.6917235	369%	
Q3_BB_knowledge	2.2316	1.234	1.808	0.0705	9.31475778	831%	.
Q4_natural	3.0919	2.2623	1.367	0.1717	22.0188741	2102%	
Q4_Biodegradable	0.3922	1.6589	0.236	0.8131	1.48023373	48%	
Q4_alt_petroleum	-0.5844	1.6106	-0.363	0.7167	0.55744023	-44%	
Q4_recycled	-7.6915	3.6958	-2.081	0.0374	0.00045669	-100%	*
Q4_RES	1.9663	2.2728	0.865	0.387	7.14419401	614%	
Q4_ECO	-3.8866	2.4558	-1.583	0.1135	0.02051498	-98%	
Q4_Local	-3.859	2.0282	-1.903	0.0571	0.02108908	-98%	.
Q4_None	-5.3164	4.2021	-1.265	0.2058	0.0049104	-100%	
Q7_Know_EFFECTIVE	0.9772	1.2306	0.794	0.4272	2.6570062	166%	
Q210_lack_adv	6.5487	3.673	1.783	0.0746	698.335747	69734%	.
Q210_effort_demanding	-1.8392	2.3918	-0.769	0.4419	0.15894453	-84%	
Q210_resource_demanding	7.5444	3.6232	2.082	0.0373	1890.12832	188913%	*
Q210_not_care	-0.8907	2.41	-0.37	0.7117	0.41036839	-59%	
Q210_Lack_database	-5.0302	2.7435	-1.833	0.0667	0.0065375	-99%	.
Q210_Lack_label	-0.1808	1.5166	-0.119	0.9051	0.83460226	-17%	
Q210_Sector_reluctant	-7.6762	4.1964	-1.829	0.0674	0.00046373	-100%	.
Q210_unaware_events	1.6085	3.1573	0.509	0.6104	4.99531264	400%	
Q10_bio_percentage	-0.4286	2.1147	-0.203	0.8394	0.65142045	-35%	
Q10_CO ₂	8.376	4.2729	1.96	0.05	4341.60772	434061%	*
Q10_Recyclability	-0.6889	1.9331	-0.356	0.7216	0.50212811	-50%	
Q10_social	1.2912	1.6857	0.766	0.4437	3.63714852	264%	
Q10_LCA	1.4039	2.2048	0.637	0.5243	4.07104613	307%	

Table A3. Cont.

	β	Std. Error	Z Value	Sig.	Exp(β)	(Exp(β)-1) × 100	
Q10_Health	7.927	3.633	2.182	0.0291	2771.10102	277010%	*
Q10_functionalities	-0.4491	2.6094	-0.172	0.8634	0.63820228	-36%	
Q211_financial_support	5.3296	2.714	1.964	0.0496	206.355415	20536%	*
Q211_PPP	-2.5277	1.9328	-1.308	0.191	0.07984245	-92%	
Q211_Green_PPP	-7.9949	3.2933	-2.428	0.0152	0.00033718	-100%	*
Q211_Fiscal_measures	1.8153	2.8972	0.627	0.5309	6.14291878	514%	
Q211_regulation	4.8389	2.7747	1.744	0.0812	126.330312	12533%	.
Q211_Ecolabel	-2.6119	1.8437	-1.417	0.1566	0.07339496	-93%	
Q211_green_certification	12.8544	5.9605	2.157	0.031	382467.897	38246690%	*
Q12_env_impact	4.0243	2.4622	1.634	0.1022	55.9411363	5494%	
Q12_social_impact	1.8642	2.8039	0.665	0.5061	6.4507732	545%	
Q12_GHG	7.0492	3.4125	2.066	0.0389	1151.93682	115094%	*
Q12_Circularity	2.3698	1.8329	1.293	0.196	10.695253	970%	
Q12_habits.	4.834	2.8727	1.683	0.0924	125.712808	12471%	.
Q12_EndofLife	0.4628	3.31	0.14	0.8888	1.58851561	59%	
Q12_economic	0.7038	2.9817	0.236	0.8134	2.02141953	102%	
Q13_Higher_prices	-8.6982	3.8159	-2.279	0.0226	0.00016689	-100%	*
Q13_food_production	5.0314	2.0266	2.483	0.013	153.147269	15215%	*
Q13_recycle_complex	4.7691	2.5249	1.889	0.0589	117.813162	11681%	.
Q13_Mass_cons	-4.9988	2.4415	-2.047	0.0406	0.00674604	-99%	*
Q13_social_issues	8.64	5.0085	1.725	0.0845	5653.32982	565233%	.
Q14_participation_willingness	3.2482	1.5429	2.105	0.0353	25.7439591	2474%	*
Q17_Biobased_work	3.1855	1.6327	1.951	0.0511	24.1793751	2318%	.

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

Table A4. Confusion matrix for carpets.

		Predicted		
		No BB_success	BB_success	TOTAL
Real	No BB_success	25%	23%	48%
	BB_success	15%	37%	52%
	TOTAL	40%	60%	100%
Number of cases in table: 60				
Number of factors: 2				
Test for independence of all factors:				
Chisq = 3.215, df = 1, p-value = 0.07298				

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