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Detailed evaluation of GreenPremium prices for bio-based products along the value chain



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1.1 Introduction

GreenPremium prices for bio-based products are somewhat of a controversially discussed topic. Some say, there are none. However, several years of market analysis and manifold contacts to bio-based producers have shown that bio-based products achieve GreenPremium prices in many applications. There are even statistics that clearly give evidence e.g. for GreenPremium prices for bio-based building blocks. This study within the framework of the European Union project BIOFOREVER¹ intends to explore the phenomenon of GreenPremium prices in further detail. Are there differences along the value chain? Differences between distinct applications and sectors? Does the feedstock question, first or second generation biomass, play a relevant role? What do market participants expect in terms of how long GreenPremium prices for their products are going to last?

A comprehensive report by nova-Institute in 2013 (Carus et al. 2014a and b) clearly demonstrated that GreenPremium prices do exist in the value chain for bio-based plastics in the European market (for additional evidence of this finding, see chapter 1.4). These results, so far only valid for first generation bio-based plastics, were evaluated, updated and expanded by new insights gained during this project. In October 2016, a new survey was conducted on bio-based plastics in order to ensure comparability to the above-mentioned nova survey of 2013: “GreenPremium for bio-based plastics: Which premium extra price would you or your customer be willing to pay?”

A second comprehensive online survey covered an additional variety of product groups, sectors and positions in the value chain and took place in the first half of 2017. The results are published for the first time in this paper.

¹ European project BIOFOREVER (www.bioforever.org), task 6.2: Market study 2nd generation biomass – consumer perception, demand and GreenPremium price. This 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. 720710.

Results of the survey from October 2016 can be found in the BIOFOREVER paper from November 2016 (Carus et al. 2016). Altogether, almost 85% of the experts report that GreenPremium prices for bio-based plastics exist – only 15% see no surcharge. Most of the participants (60%) considered the GreenPremium to range between additional 10-20%, while 20% indicated a price premium of 20-40%. The remaining 6% reported even higher premium margins of 50% or more for bio-based plastics. The same question had been put to comparable LinkedIn groups in 2013. The comparison of the results from 2013 and 2016 shows a very similar picture. In chapter 1.3 this comparison will be examined in more detail and will also include new results from 2017.

Definition of GreenPremium prices

In the 2014 nova paper #3 “GreenPremium prices along the value chain of bio-based products”, the term ‘GreenPremium price’ is defined 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.” (Carus et al. 2014a and b). This means that the GreenPremium price is not paid for better technical performance of the bio-based product, but rather for the additional performance beyond the technical performance (Figure 1).

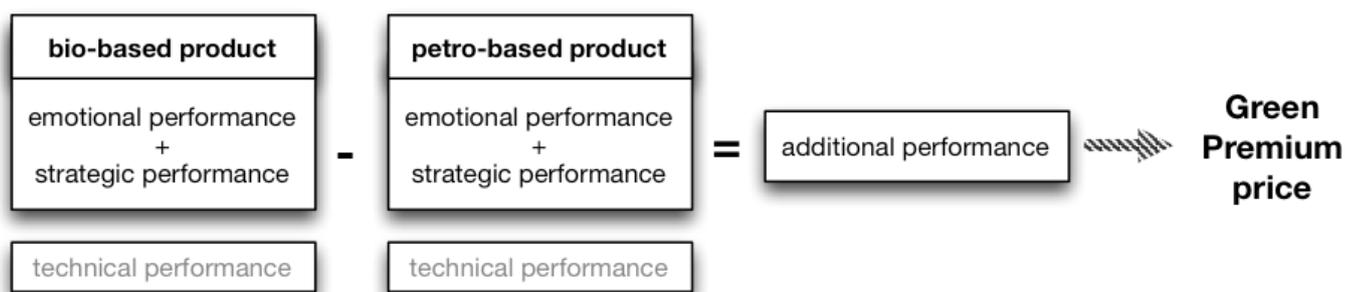


Figure 1: Definition of GreenPremium price, Source: Carus et al. 2014a

The definition was consequently also used in the new surveys. This allows for a profound comparison of the results from 2013, 2016 and 2017.

1.2 Design of the survey and composition of respondents

The new comprehensive survey in the first half of 2017 was conducted as an online survey and was shared in several LinkedIn online groups and in the monthly nova newsletter. Additionally, well-known experts were approached personally by email or telephone. All 52 participants can be identified as true insiders who either produce or trade bio-based products (or intermediates) themselves or consult related companies. These experts have in-depth market knowledge, granting the results a high credibility.

In the following, each question from the survey is stated individually with the respective results succeeding straight after the question.

1.a For which bio-based product are you an expert? All following questions consider only this bio-based product and its value chain. If you would like to answer for several bio-based products, please fill for each product a separate questionnaire.

In addition to the materials groups (1.b), the following specific products were noted by the participants as a field of expertise: Bio-based polymers and plastics, biodegradable polymers, chemicals for plastics, coffins, compostable food service items, compounds, composites, epichlorohydrin, films for bags, funeral urns, glue, lactate esters, lactic acid, lubricants, lumber, natural fibres, natural fibre-plastic mats, packaging, PHA, PLA, plant bottle, polyamides, potato-starch based compounds, tailor-made colouring, tall oil-based products, Wood-Plastic Composites, writing instruments.

1.b Please select the material group you would classify your bio-based product in!

Bio-based products are a very heterogeneous group of both new and already established products in the market. The participants could indicate their expertise for the following product categories: Building blocks, polymers, plastics, composites, surfactants, lubricants and others. The group of polymers (n = 16) and plastics (n = 15) producers, including the building blocks (n = 7), make up for about 73% of all participants of the survey (Figure 2). Composite materials such as wood or natural fibre reinforced plastics constitute the second largest material group of the respondents (n = 8).

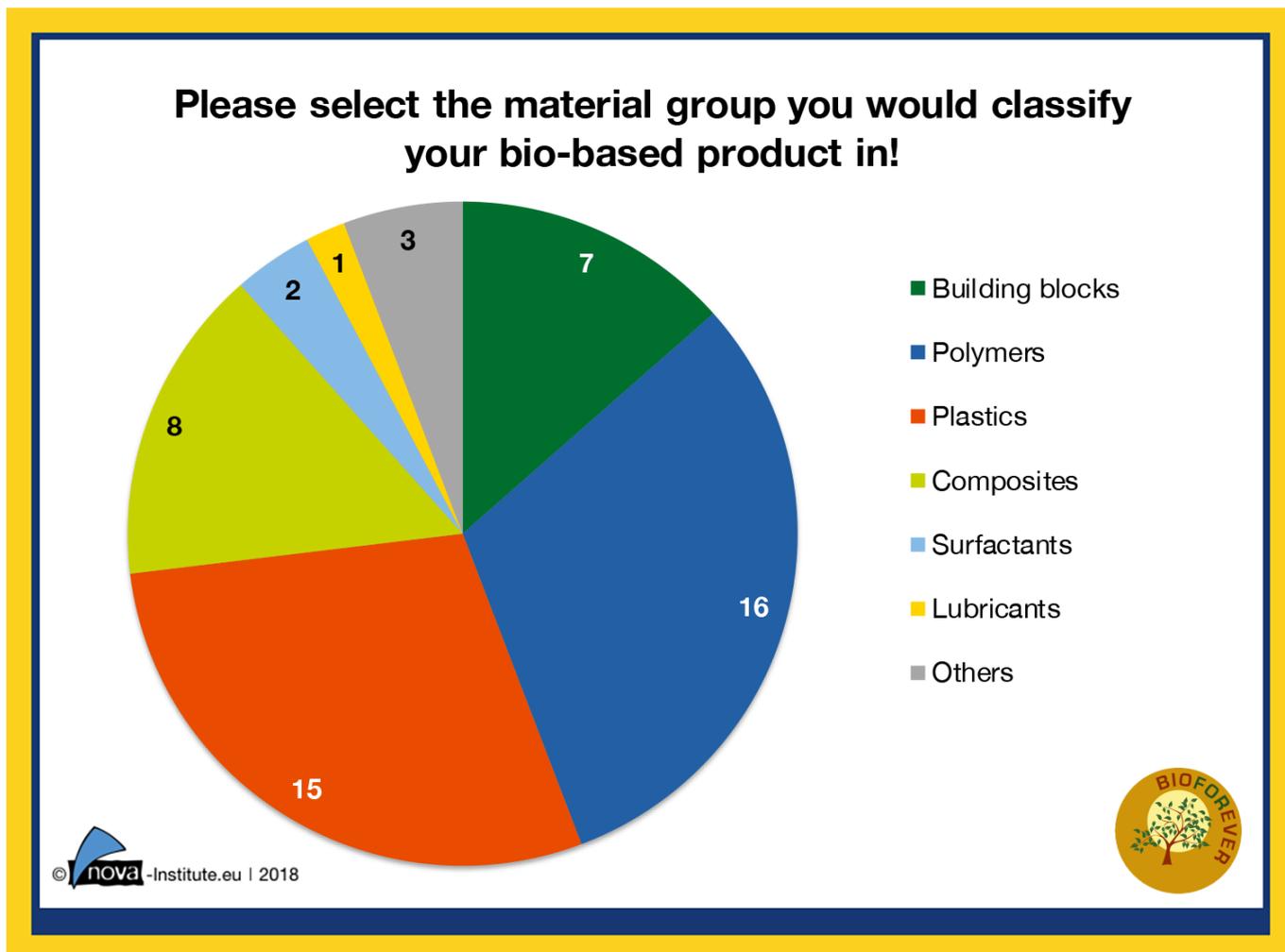


Figure 2: Range of material groups of the participants of the survey (n = 52 participants)

1.c Your position in the standard value chain?

It is hardly surprising for a B2B survey that different kinds of producers constitute the largest group of participants. The complete value chain from raw material suppliers to product producers is well represented. Additionally, a smaller share of retailers/distributors as well as consultants took part in the survey (Figure 3).

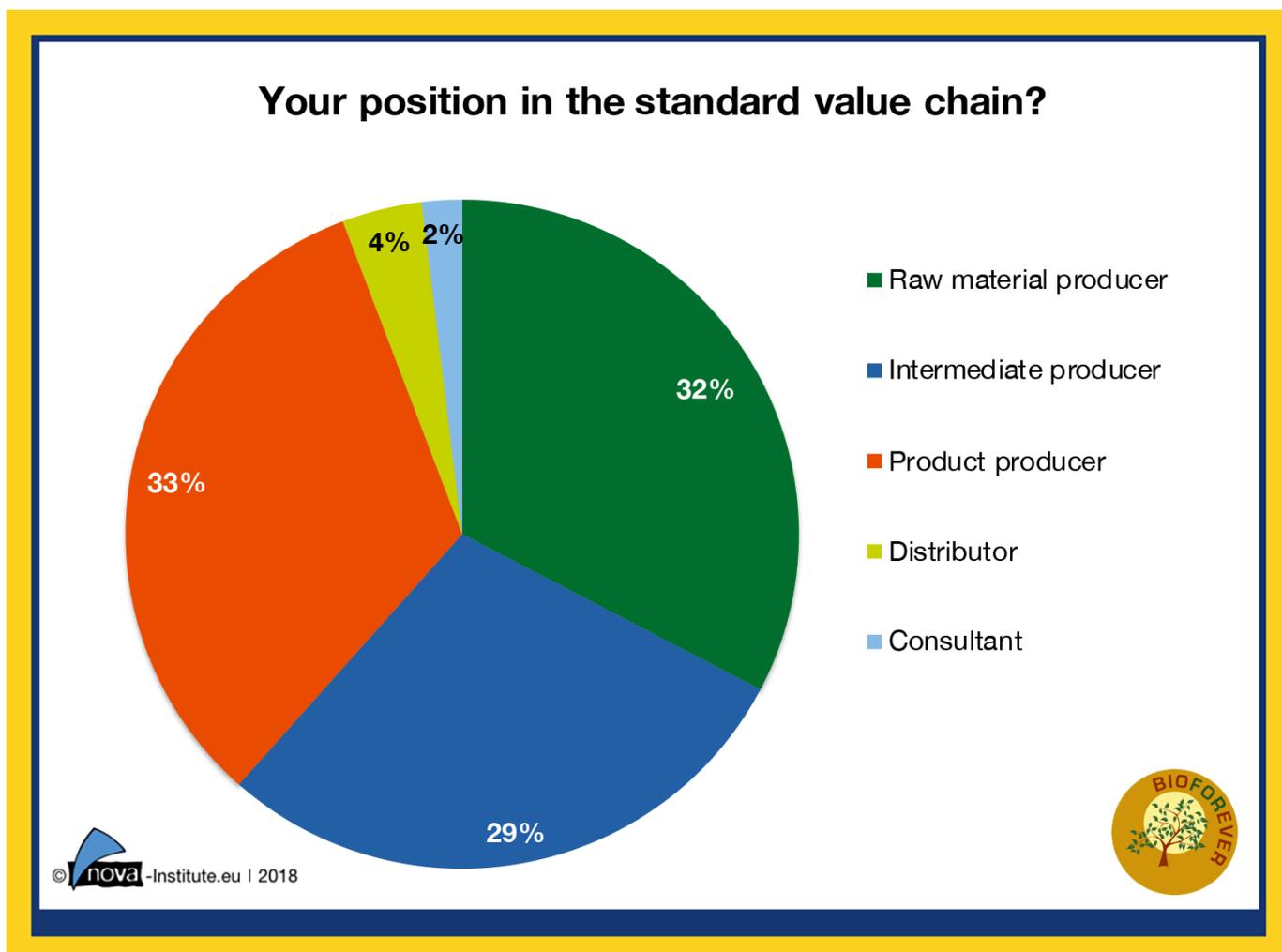


Figure 3: Share of the participants' positions in the standard value chain, n=52

1.d Please select the main application sector of your bio-based product!

Packaging (flexible) and bags as well as packaging (rigid) are the main application sectors of bio-based intermediates and products in this survey, making up for 44% of all participants (Figure 4). Consumer goods (17%) and construction materials (13%) are other groups with significant representation. All other groups have shares lower than 10%.

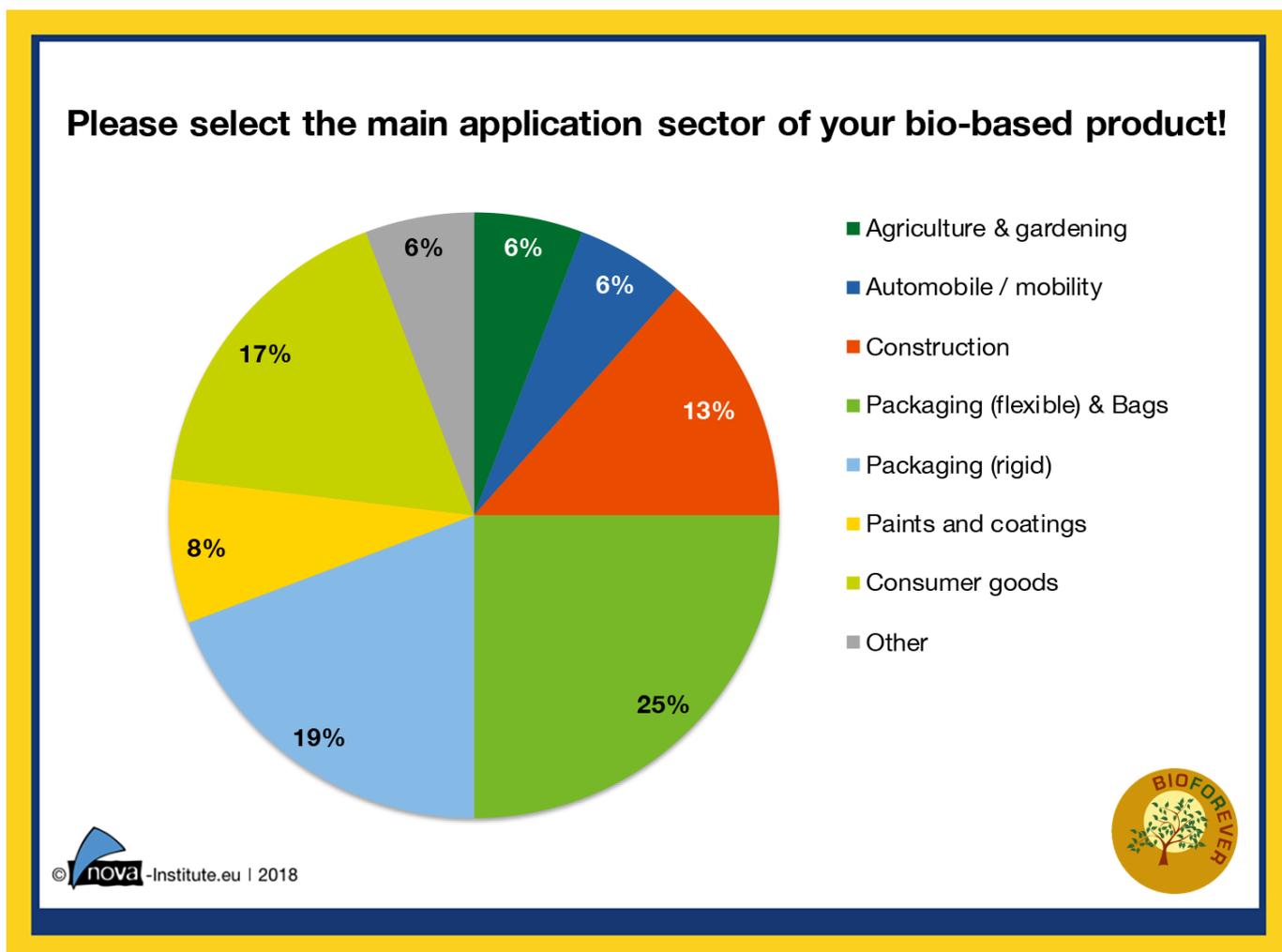


Figure 4: Application sectors of the bio-based products in 2017, n=52

1.e On which continent are your products primarily sold?

Europe makes up for almost half of the geographic market for the bio-based products in the survey (Figure 5). North America (19%) and Asia (16%) are other important markets.

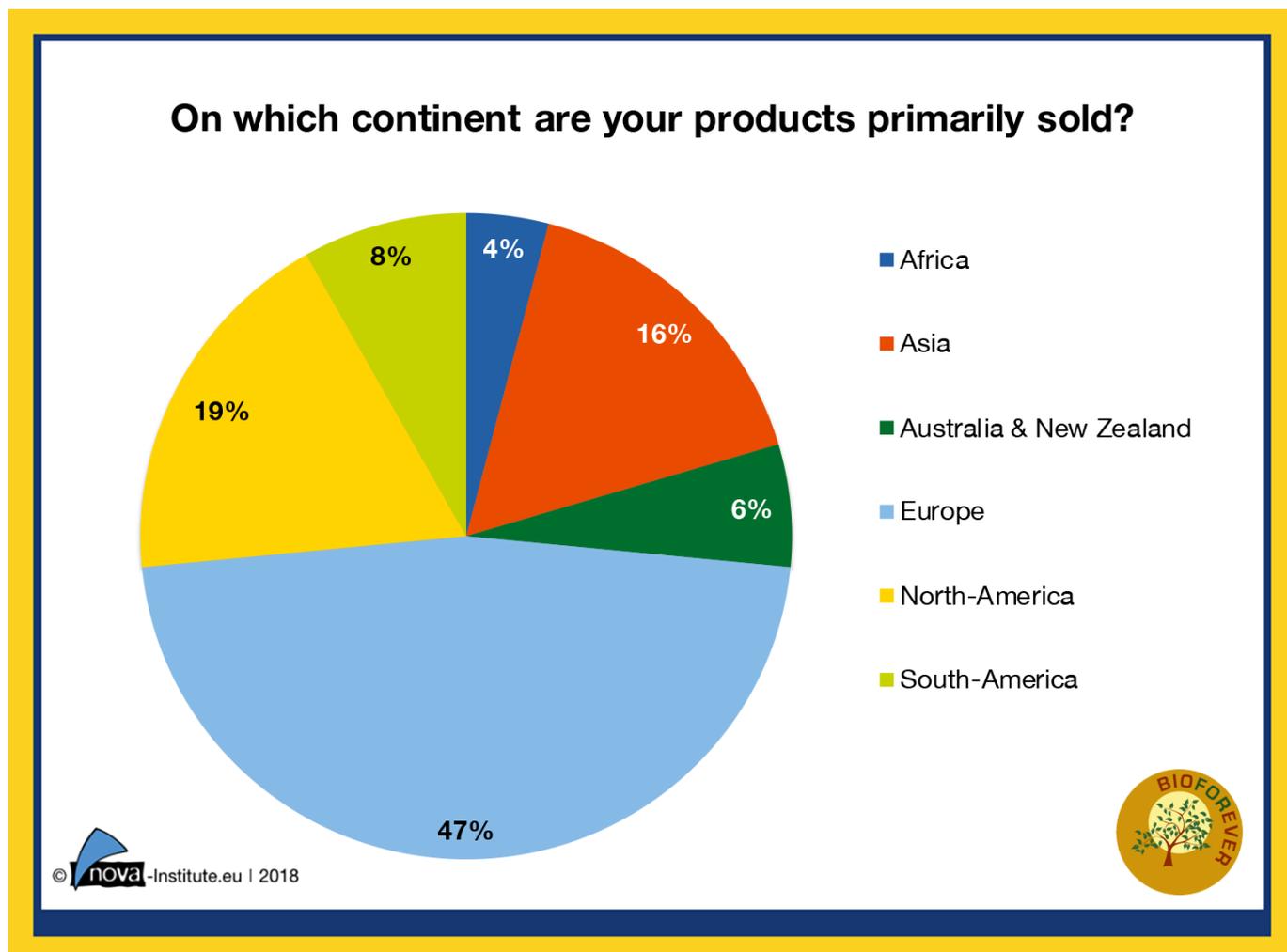


Figure 5: Geographical markets for the bio-based products in 2017, n=52

1.3 Results of the survey

2. Which premium extra price would your customer be willing to pay?

The core question of the survey measured the willingness of customers to pay a GreenPremium for products of the participants. GreenPremium was defined as described in chapter 1.1.

Almost 70% of the experts report GreenPremium prices for bio-based products (Figure 6). Most of the participants (44%) considered the GreenPremium to range between 10-20%, 21% indicated a price premium of 20-40%. About 4% of the respondents see a willingness to pay even more than 50%. 31% of the participants report no GreenPremium prices.

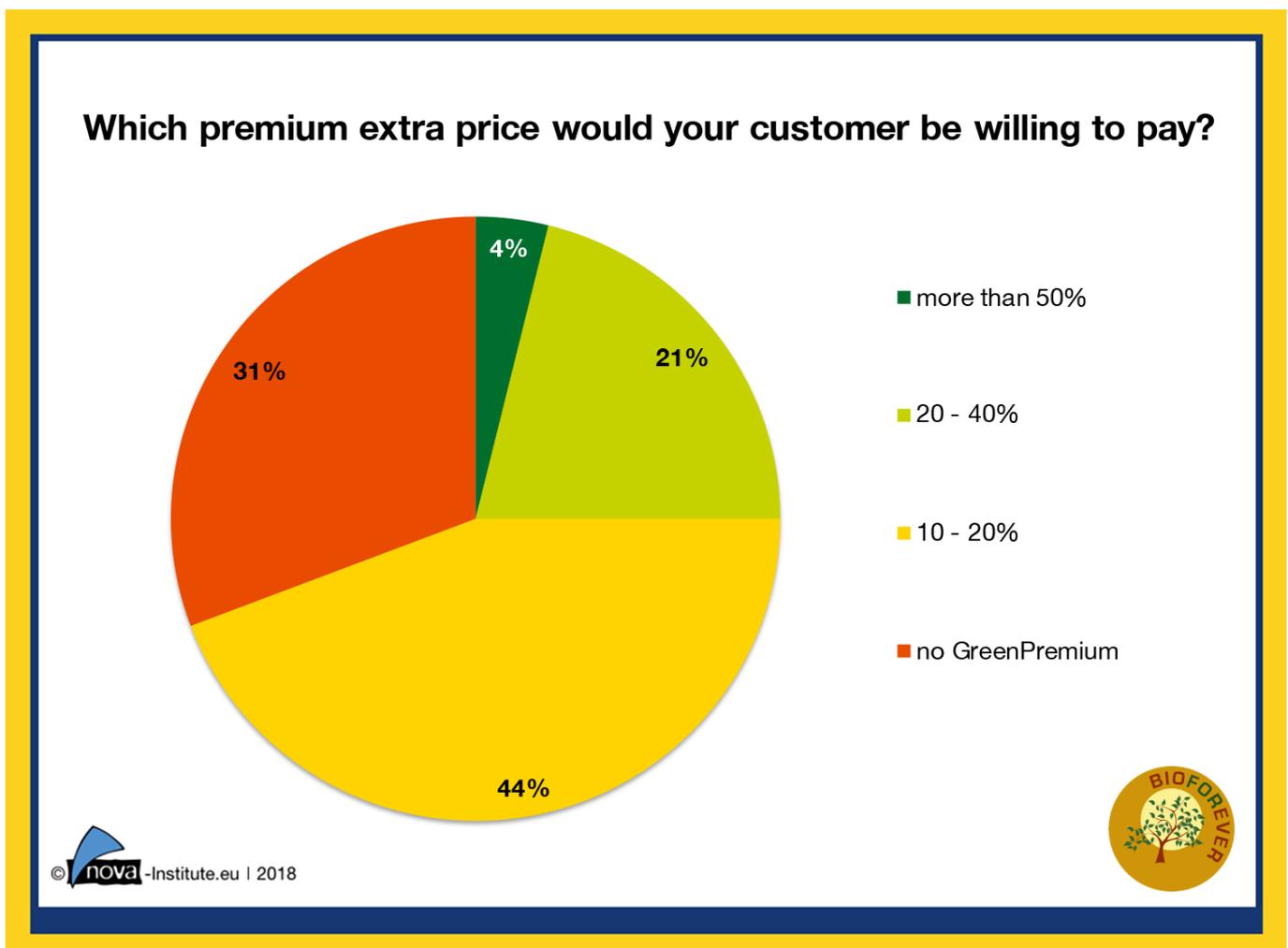


Figure 6: Share of the GreenPremium of bio-based products, n=52

Further analysis of these results revealed differences in the various application fields of the bio-based products such as packaging, consumer goods or construction:

- The packaging sector showed a minor difference compared to the total group of products reported on as the willingness to pay is almost 10% higher on average (30%), contributing to the group of 20-40% GreenPremium.
- In consumer goods, the price premium is indicated to be lower as the share of “no GreenPremium” was largest here, with half of the participants reporting accordingly.
- The option „more than 50% GreenPremium“ was only mentioned by respondents from the sectors agriculture & gardening and packaging.

A comparison of results of the different surveys from 2013, 2016 and 2017 is shown in Figure 7. Overall, the response patterns have changed only little. In all surveys, the range of “10-20%” GreenPremium is the most frequent answer and “more than 50%” is the least reported response. The most visible trend is an increase in the frequency of the “20-40%” range, while the “10-20%” and “more than 50%” are mentioned slightly less often over the years. At the same time (not displayed in the figure), the naming of “no GreenPremium” has increased (from 16% in 2016 to 31% in 2017), which was not available for selection in the first survey in 2013.

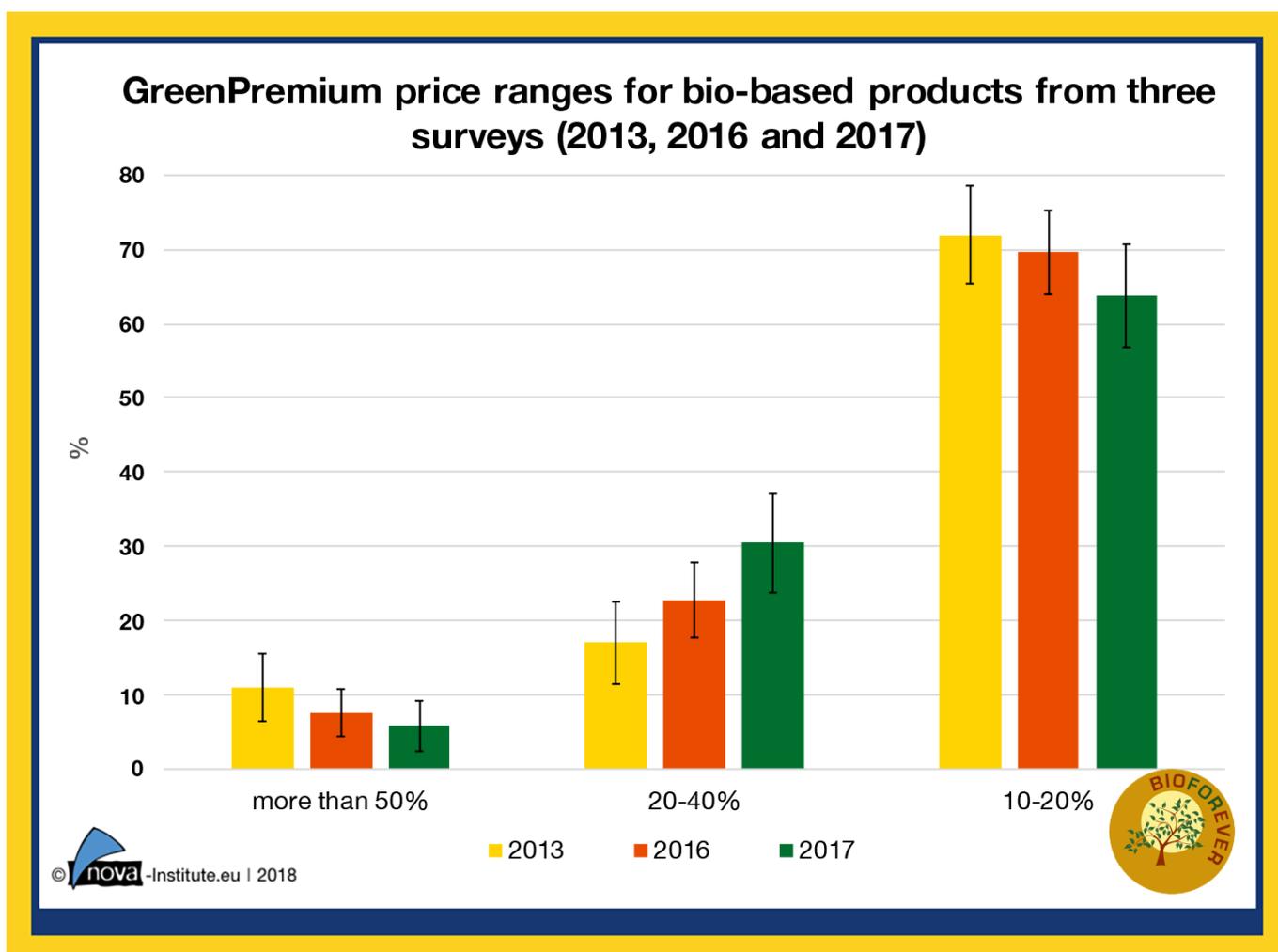


Figure 7: GreenPremium price ranges for bio-based products from three surveys (2013, 2016 and 2017) in percentage (calculated to 100% without “no GreenPremium”, as in the first survey “no GreenPremium” was not presented as an option. Therefore, the numbers are not the same as in Fig. 6).

3. Is the GreenPremium for the market being paid for a limited time?

It is important to know to what extent new technologies – that may require large investments – can rely on GreenPremium prices for their products on a long-term basis. The results of the survey show that 56% of the respondents expect no time limits for GreenPremium at all. However, 33% and 7% of the respondents see a limitation to the next five and ten years, respectively (Figure 8).

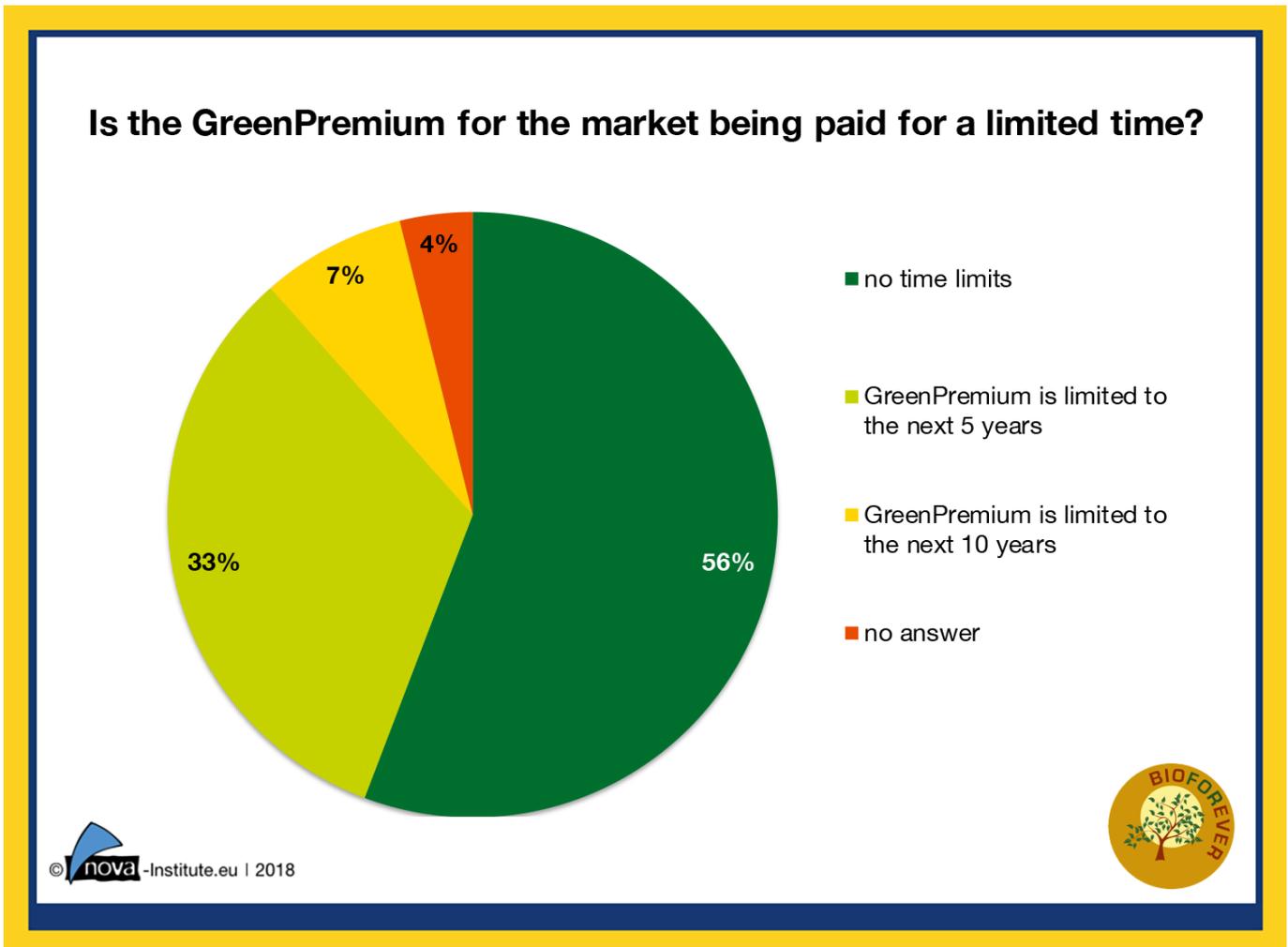


Figure 8: Time limit for the GreenPremium of the bio-based products, n=52

This result applies to the total group of bio-based products, but a comparison between the subgroups packaging, consumer goods and construction was made since differences, especially in construction, were noticeable:

- 86% of the respondents selling their product in construction see no time limits for GreenPremium at all.
- 50% of the respondents selling bio-based materials and products into packaging expect a time limit of 5 years for GreenPremium. On the other hand, 41% of the respondents expect no time limit at all.
- The sample of consumer goods displays almost no differences to the average of the overall result. Only the share of participants expecting a 10 years' limitation is larger (22%).

Value chain and main drivers

The next two questions were created with the aim to evaluate fluctuation of GreenPremium prices along the stages of the value chains the respondents were representing. Question 4 asked for the GreenPremium effect along the value chain and question 5.a for the main drivers for GreenPremium along the value chain (Figure 9 and Figure 12).

4. Please differentiate GreenPremium levels along the value chain!

Please differentiate GreenPremium levels along the value chain!

	More than 50%	20-40%	10-20%	No GreenPremium	No answer
Intermediate producer	<input type="radio"/>				
Product producer	<input type="radio"/>				
Distributor	<input type="radio"/>				
End consumer	<input type="radio"/>				

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Figure 9: Section of questionnaire concerning GreenPremium along the value chain

The most prevalent level of GreenPremium for bio-based products along all stages of the value chain is 10-20%, as indicated by Figure 10 and Figure 11. This level of GreenPremium is the most frequently reported margin paid by both product producers and consumers. The 20-40% level gets mentioned frequently as well. Figure 10 reveals that intermediate producers as well as distributors receive the lowest level of GreenPremium: the “no GreenPremium” share is at the highest level here.

On the other hand, consumers often expect and accept higher prices for green products, which is supported by the fact that participants reported the GreenPremium level at end consumer stage to be comparatively high. The highest GreenPremium (>50%) level is found only at a very low frequency and only at the two outer stages of the value chain. The sector analysis illustrates that the highest GreenPremium level was only reported for packaging, agriculture and gardening.

Please differentiate GreenPremium levels along the value chain!

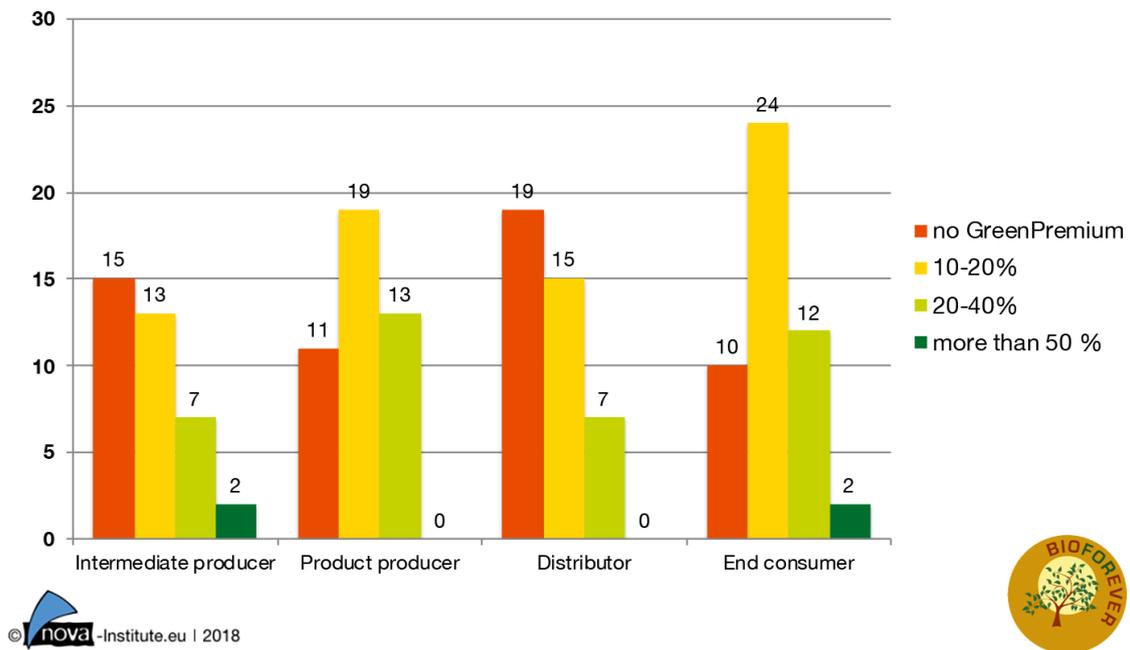


Figure 10: GreenPremium prices along the value chain of the bio-based products (a) (number of answers, multiple answers possible, n=52) Note: The question referred to the group paying the GreenPremium prices, not to the group receiving the GreenPremium.

Please differentiate GreenPremium levels along the value chain!

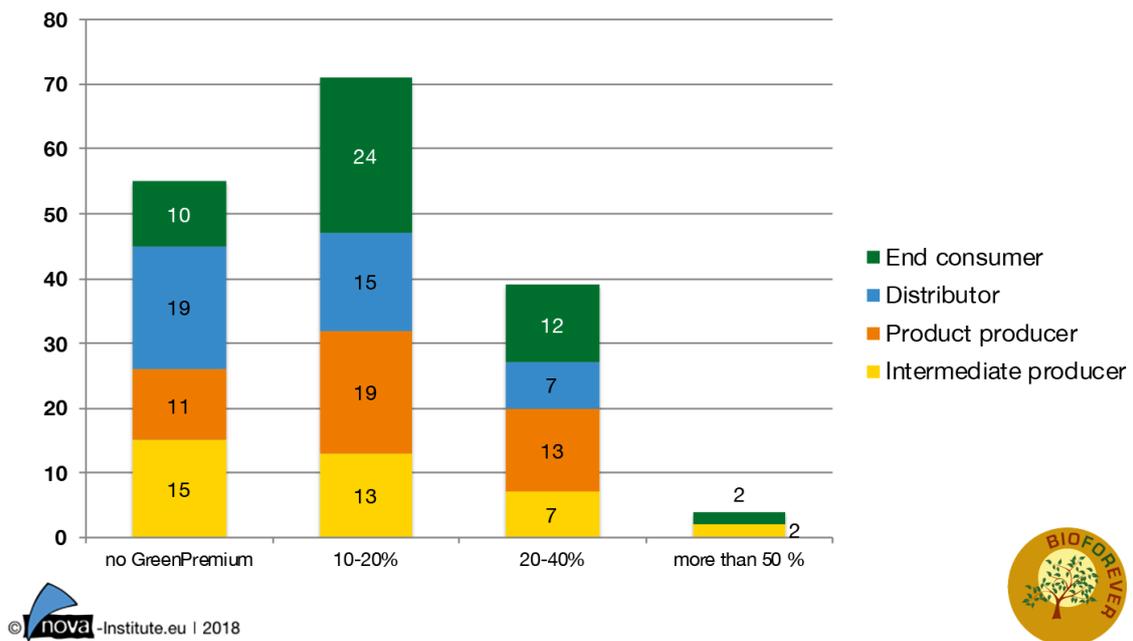


Figure 11: GreenPremium prices along the value chain of the bio-based products (b) (number of answers, multiple answers possible, n=52) Note: The question referred to the group paying the GreenPremium prices, not to the group receiving the GreenPremium.

5.a What are the most important drivers for GreenPremium along the value chain?

	Touch of innovation	Positive green image (1)	Enhanced attention (2)	Price expectations (3)
Intermediate producer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Product producer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Distributor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
End consumer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(1) Positive green image: Sustainability, climate protection
 (2) Enhanced attention: Easier to get an audience via press/social media, to get attention
 (3) Price expectations: Customer expects (and accepts) higher prices

Figure 12: Section of questionnaire concerning drivers for GreenPremium along the value chain

Perhaps not very surprisingly, as shown in Figure 13, the positive green image stands as the most important reason for GreenPremium prices being paid (41%). But there were also other relevant drivers found in the survey: Touch of innovation (23%), enhanced attention at media that can be achieved using bio-based materials instead of standard materials (18%) and expectations for higher prices to be accepted by customers (18%).

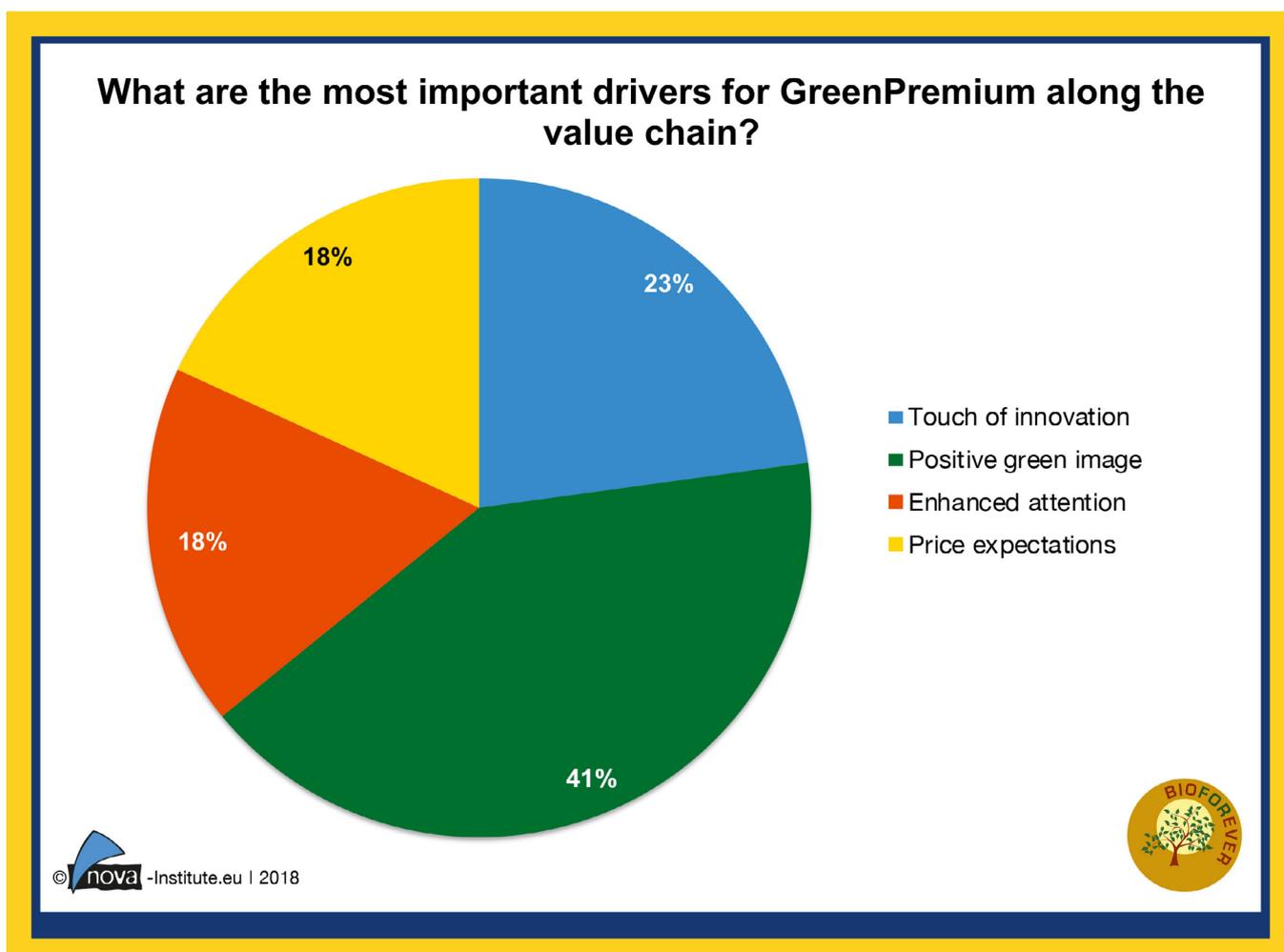


Figure 13: Drivers for GreenPremium for bio-based products in percent, n=52

Figure 14 and Figure 15 illustrate the differences between the importance of different drivers for the different stages of the value chain. The positive green image ranks highest for all segments of the value chain. Intermediate and product producers put a higher emphasis on the “touch of innovation”, while “enhanced attention” is more important for the distributors. For the end consumer, the “positive green image” is clearly the most influential driver.

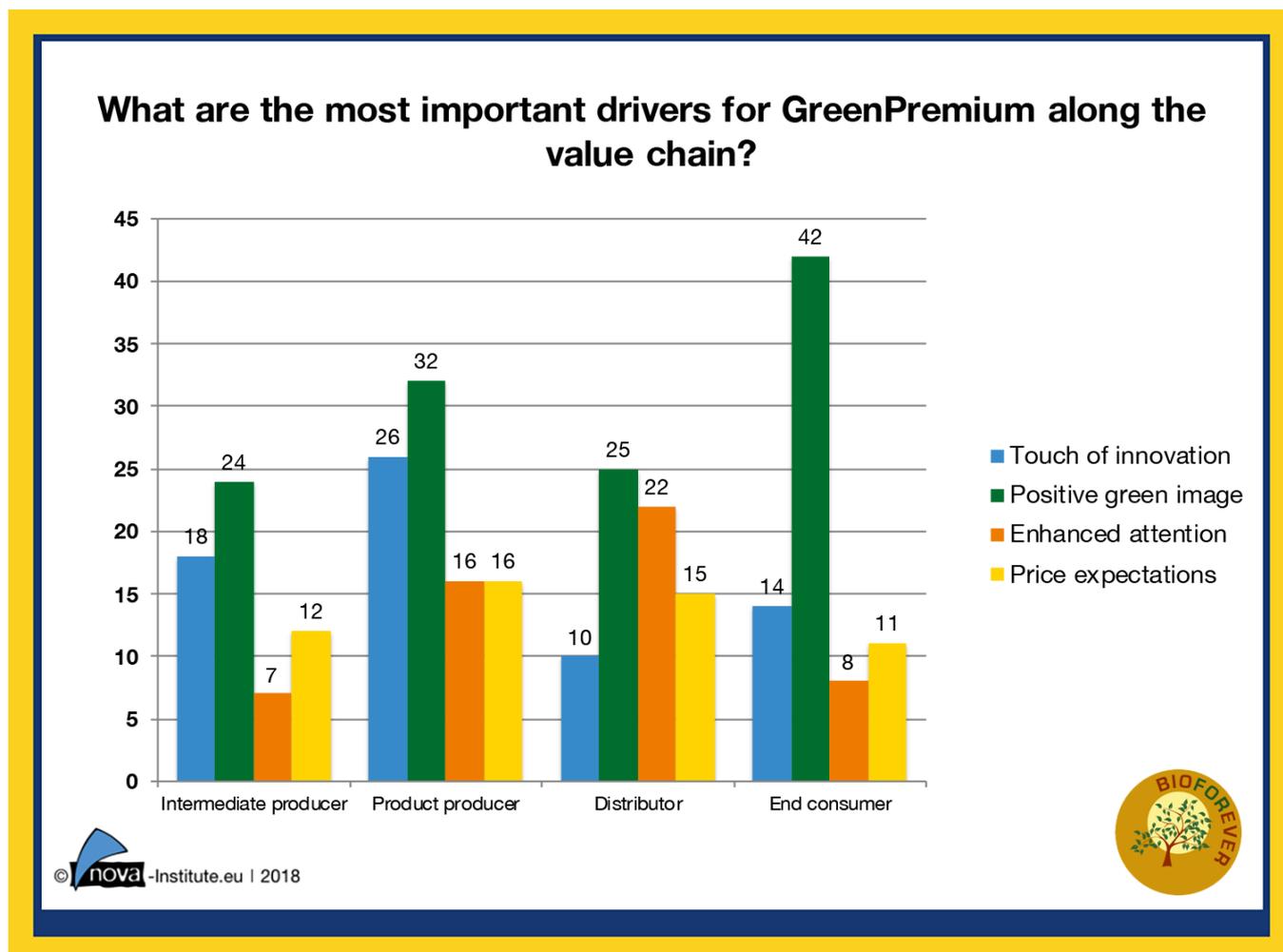


Figure 14: Drivers for GreenPremium for bio-based products along the value chain (number of answers, multiple answers possible, n=52)

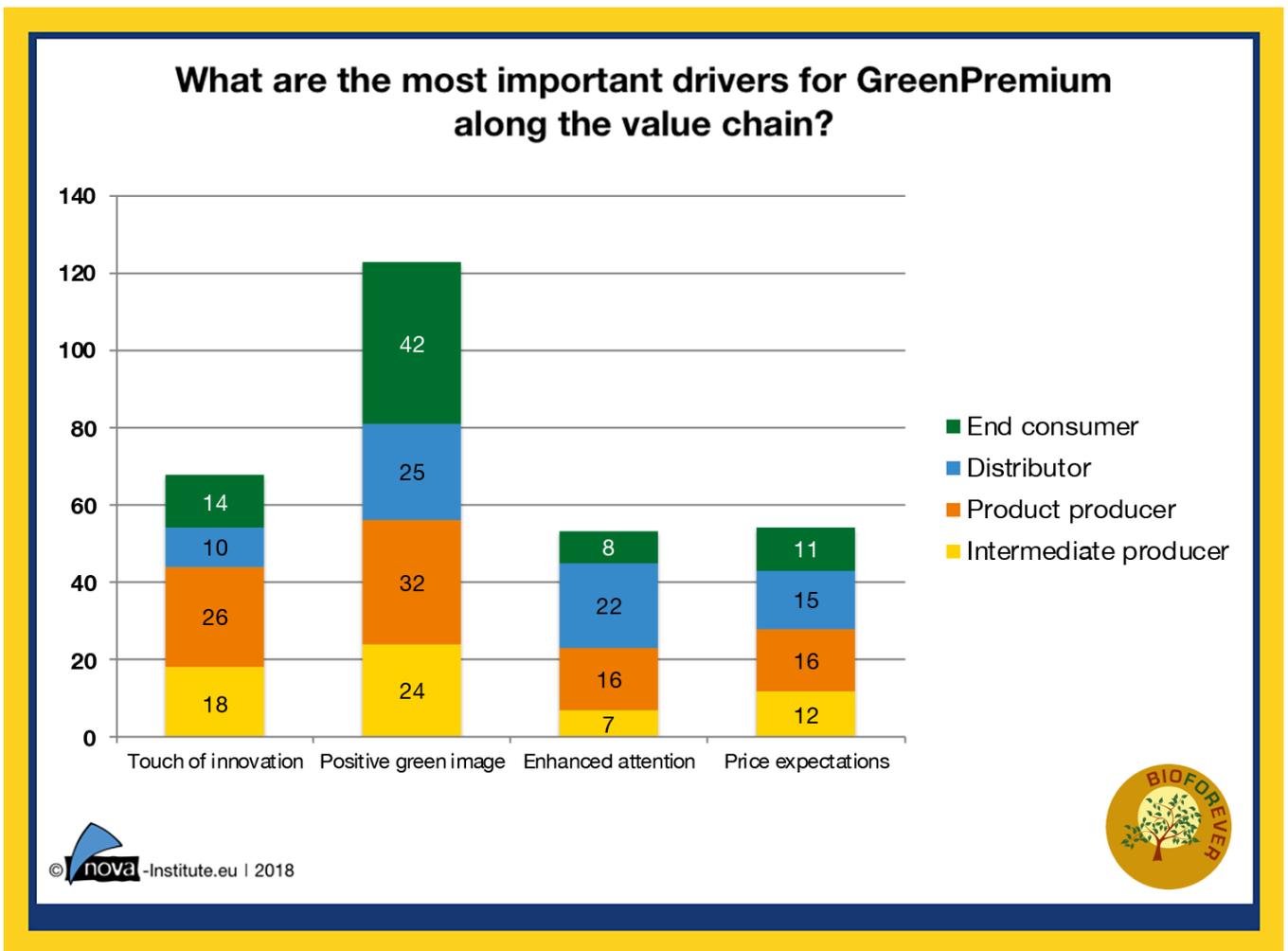


Figure 15: Drivers for GreenPremium for bio-based products along the value chain (number of answers, multiple answers possible, n=52)

5.b Are there other drivers for GreenPremium along the value chain?

The following Figure 16 shows what respondents experienced as additional drivers for the GreenPremium prices beyond the above-mentioned main drivers. These drivers range from different benefits for environment and health to the product differentiation and diversification possibilities for producers. Consumption of bio-based products also offers consumers the possibility to upgrade their image and demonstrate higher social status. The marketing of bio-based products tends to require intensive communication, which means the GreenPremium helps to finance these higher costs of communication.

Are there other drivers for GreenPremium along the value chain?

Intermediate producer	Product producer	Distributor	End consumer
(Eco)innovation	Innovation leadership	First mover	Be an actor of sustainable consumption
New business opportunities	Differentiation and diversification (clients, product portfolio)	Differentiation	To show higher social status
Showing expertise in processing of bio-based	Replacement of crude oil / fossil C	Willingness to promote green products more than other equivalent products	Aesthetic properties, material story
Production segregation	Safety for health and environment	Target new prospects and communicate differently	Safety for health and environment
Competition	Demand from the market	Safety to health	Product safety
	Competition	End of Life related aspects	Concern of environmental impact by using lubricants
	Being prepared for the future legislative impacts	Demand from the market	Environmental awareness on sustainable use of resources
		Possibility to be the first mover	End of life options and new functionalities
		Brand image	
		Higher marketing costs	



Figure 16: Other drivers for GreenPremium along the value chain as stated by respondents

6. Do GreenPremium prices for your product depend on single value-adding factors or functionalities?

The highest ranked factor determining the GreenPremium price is the “Higher bio-based share of the product” (24%) (Figure 17) and is especially dominant in construction (31%). “Lower greenhouse gas emissions” (17%) and “Biodegradability” (17%) are the next important single value-adding factors for GreenPremium prices. “Biodegradability” is less important (11%) in consumer goods, but important for packaging (15%).

The importance of “Sustainability certification of the biomass feedstock” (10%) is ranked differently throughout the application groups, for packaging and construction the importance (12% and 13%) is higher than for consumer goods (6%). “2nd generation biomass” and “GMO-free biomass” are the lowest ranked factors (8% and 9% respectively). An exception seems to be packaging, where GMO-free biomass (14%) reaches the same level of importance as “Biodegradability” and “Lower greenhouse gas emissions”.

In further research within the framework of the project BIOFOREVER, a detailed evaluation is planned in order to understand why a feedstock base of “2nd generation biomass” does not seem to play a large role in triggering GreenPremium. For example, a possible reason could be that the discussion about 1st and 2nd generation biomass feedstock was rather a discussion in the political arena than in the market or at the end customer level. Another explanation could be lack of awareness and understanding among end consumers.

What is striking are the frequent mentions of “other” factors for the group “construction”. The answers differed widely, but one was especially interesting: “Consumer expectations for nice-looking product, warm material, strong sustainable story” allow for a GreenPremium price.

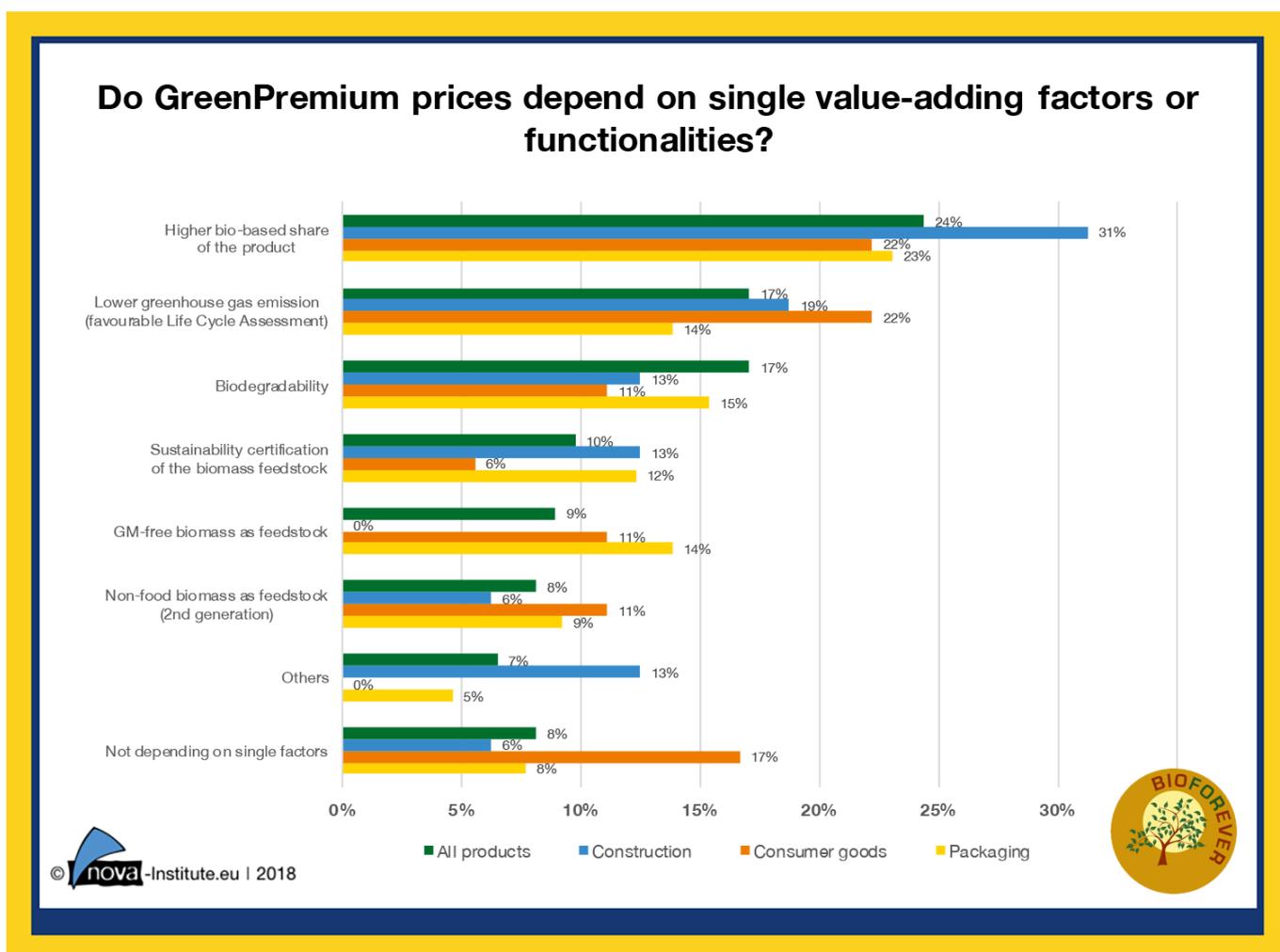


Figure 17: Dependence of GreenPremium of bio-based products on single value-adding factors or functionalities, n=52, multiple answers possible. Note: for single factors, the percentages over all products can be higher than those for the selected product groups, especially when a large number of respondents belong to other product groups not represented in the figure. This is the case for the factor biodegradability, where 7 respondents belong to product groups other than construction, consumer goods or packaging (mainly agriculture and paints and coatings).

1.4 Additional findings

Different studies show that, in general, consumers are willing to pay a GreenPremium price for more sustainable products, for example a report from Nielsen 2014:

“Fifty-five percent of global online consumers across 60 countries say they are willing to pay more for products and services provided by companies that are committed to positive social and environmental impact, according to a new study by Nielsen. The propensity to buy socially responsible brands is strongest in Asia-Pacific (64%), Latin America (63%) and Middle East/Africa (63%). The numbers for North America and Europe are 42 and 40 percent, respectively.

The findings reveal that two-thirds of the ‘sustainable mainstream’ population (a cluster of three of the five segments) will choose products from sustainable sources over other conventional products. These consumers will buy as many eco-friendly products as they can and have personally changed their behavior to minimize their impact on global climate change. Additionally, these consumers are more likely to buy products repeatedly from a company if they know the company is mindful of its impact on the environment and society.

Millennials (age 21-34) appear more responsive to sustainability actions. Among global respondents in Nielsen’s survey who are responsive to sustainability actions, half are Millennials; they represent 51 percent of those who will pay extra for sustainable products and 51 percent of those who check the packaging for sustainable labeling.” (Nielsen 2014)

Another report has a slightly different focus, but nevertheless it confirms our findings about fully bio-based products. Reinders et al. 2017 conducted two experimental studies in six European countries on bio-based products to test whether consumers responded differently to brands using fully (100%) bio-based materials compared to brands that use partially bio-based materials. The following effects are observed for multiple products, brands and countries.

“The results imply that introducing bio-based product attributes may help enhance the value of both global and private label brands – for example, to differentiate or reposition a product. At the same time, introducing a product that only partially contains bio-based materials does not always result in a better evaluation of the brand. This is relevant because, in practice, it is often technically or financially not feasible to implement the use of bio-based materials all at once. If future studies confirm the results of this study and find proof that consumers are willing to pay more for products with 100% bio-based materials as compared to products with 30% bio-based materials or products without bio-based materials, brand managers have strong arguments to consider using bio-based materials in their brands.” (Reinders et al. 2017)

In fact, there is even evidence for GreenPremium prices from statistical market reports. For example, according to the monthly Tecnon Orbichem market report, prices for bio-based monoethylene glycol (MEG) and bio-based polyester are about 20-30% higher than their fossil-based alternatives (Tecnon Orbichem 2018).

There is further evidence for GreenPremium prices reported by some companies. According to Braskem, their bio-based PE may achieve prices about 50% higher than conventional PE, and prices for the bio-naphtha produced by NESTE as the building block for bio-PE may be about double than fossil naphtha.

The “biomass balance approach” only works with GreenPremium

The “mass balance approach” or more correctly “mass balance & free allocation approach” was introduced by BASF & TÜV Süd a few years ago. Parallel activities are running by DuPont and especially by SABIC. BASF and SABIC are mostly on the same track: **Feeding a certain amount of biomass in a petrochemical refinery and allocating this amount (via mass balance) to those products which show most customer demand and/or highest GreenPremium prices (free allocation, independent of technical realities). The biomass mostly goes to other products in reality (see Figure 18).**

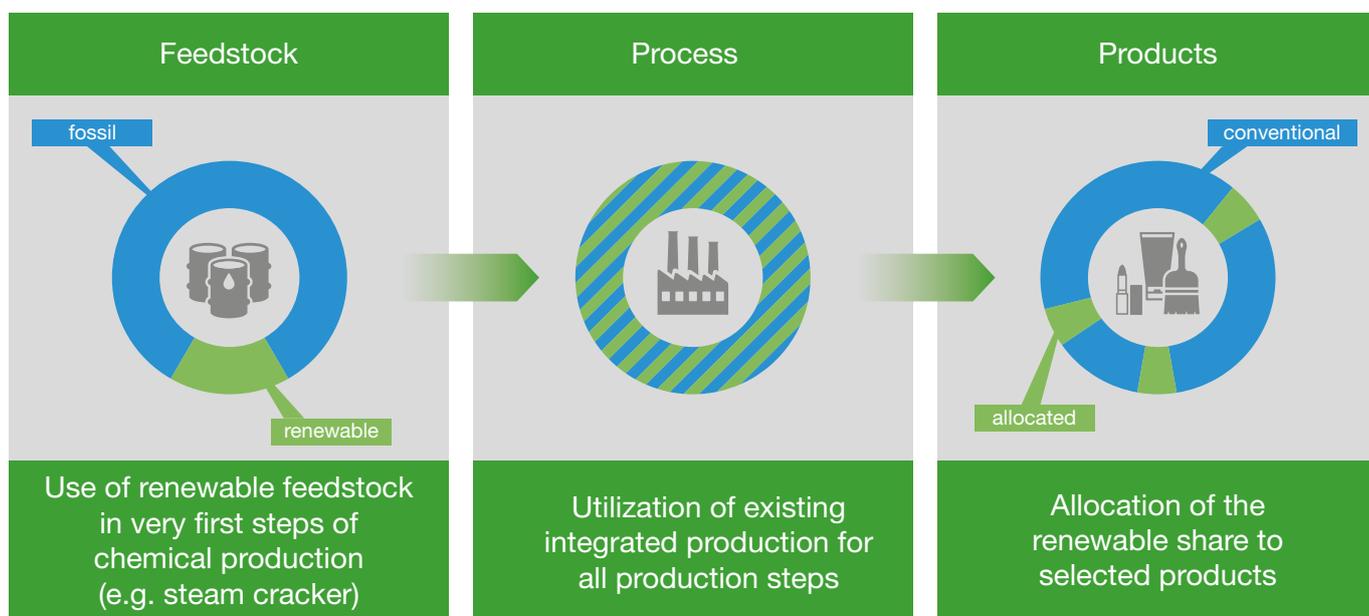


Figure 18: Presentation of the principle of the „Biomass Balance Approach“, Source: Chinthapalli et al. 2018

Joint umbrella definition by PlasticsEurope – the “biomass balance approach”

BASF, SABIC, DOW, DuPont and additional Naphtha producers are collaborating in a working group at PlasticsEurope to develop a joint “umbrella” definition for the “biomass balance approach” (this is the new and probably final name).

The target is to develop one label for the “biomass balance approach” for all involved companies, an umbrella document with the minimum requirements. Important topics to cover are:

- Transparency, mass balance and how the allocation works
- Avoid misuse
- NGO perception
- No double counting

Meanwhile, BASF uses the “biomass balance approach” for more than 50 certified products for various application areas. Customers represent various industries (packaging, paints and varnishes, diapers, insulating materials, etc.) and come from North America (USA/Mexico), Asia (Japan / China) and various European countries. The number of customers is growing steadily, and many will be coming onto the market in the next few months.

The price premium increases in linearity with bio-based content. A good example are BASF’s superabsorbent polymers (SAP). A GreenPremium price of up to 70% is requested for the fully “bio-based” polymer (due to the biomass balance approach). The price premiums for partially “bio-based” polymers are linear from 0%

for fully fossil-based to up to 70% for fully “bio-based”. That means for example that a 50% “bio-based” polymer would cost up to 35% more – using the biomass balance approach.

SABIC only sells a 100% “bio”-PE and the customer must mix the PE with fossil PE to lower the share. BASF sells polymers with bio-shares between 20% and 100%.

An interesting point in the context of GreenPremium prices is that the “biomass balance approach” only makes sense if the producer knows that they can receive relevant GreenPremium prices for specific products from their customers. The biomass fed into the “Verbundsystem” is then allocated to those applications for which the producer gets the highest prices or value added in relation to the “bio-based” content. This price difference is mostly due to image and other factors as explained above and not connected to the technical realities, i.e. not to the factual product which contains a given bio-based share.

Put differently, this means that the vigorous activities by big players to establish the “biomass balance approach” on the market clearly show that there is a relevant number of customers who are willing to pay a GreenPremium price for a bio-based material and product.

1.5 Executive summary

Several years of market analysis and manifold contacts to bio-based producers have shown that bio-based products achieve GreenPremium prices in many applications. Also the vigorous activities by big players to establish the “biomass balance approach” on the market clearly show that there is a relevant number of customers who are willing to pay a GreenPremium price for a bio-based material and product.

This study in the framework of the European project BIOFOREVER explores the phenomenon of GreenPremium prices in further detail. Are there differences along the value chain? Differences between distinct applications and sectors? Does the feedstock question, first or second generation biomass, play a relevant role? What do market participants expect in terms of how long GreenPremium prices for their products are going to last?

The 52 participants of the survey can be identified as true insiders who either produce or trade bio-based products (or intermediates) themselves or consult related companies. These experts have in-depth market knowledge, granting the results a high credibility. Almost 70% of these experts report GreenPremium prices for bio-based products. Most of the participants (44%) considered the GreenPremium to range between 10-20%, 21% indicated a price premium of 20-40%. About 4% of the respondents see a willingness to pay even more than 50%. 31% of the participants report no GreenPremium prices.

A comparison of results of the different surveys from 2013, 2016 and 2017 shows that overall, the response patterns have changed only little. In all surveys, the range of “10-20%” GreenPremium is the most frequent answer and “more than 50%” is the least reported response. The most visible trend is an increase in the frequency of the “20-40%” range, while the “10-20%” and “more than 50%” are mentioned slightly less often over the years. At the same time the naming of “no GreenPremium” has increased (from 16% in 2016 to 31% in 2017).

It is important to know to what extent new technologies – that may require large investments – can rely on GreenPremium prices for their products on a long-term basis. The results of the survey show that 56% the respondents expect no time limit for GreenPremium at all. 33% see a limitation to the next five years, 7% to the next ten years.

The result for the most important driver for GreenPremium is not very surprising: a positive green image has been identified as the most important reason for GreenPremium prices being paid (41%). But there were also other relevant drivers found in the survey: Touch of innovation (23%), enhanced attention at media can be achieved using bio-based materials instead of standard materials (18%) and expectations for higher prices (18%).

Additionally, single value-adding factors were named by the participants. The highest ranked factor for the GreenPremium price is the “Higher bio-based share of the product” (24%) and is especially valued in construction (31%). “Lower greenhouse gas emissions” (17%) and “Biodegradability” (17%) are the next important single value-adding factors for GreenPremium prices. “Biodegradability” is less important (11%) in consumer goods, but important for packaging (15%). The importance of “Sustainability certification of the biomass feedstock” (10%) is ranked differently throughout the application groups, for packaging and construction the importance (12% and 13%) is higher than for consumer goods (6%). “2nd generation biomass” and the “GMO-free biomass” are the lowest ranked factors (8% and 9% respectively). An exception seems to be packaging, where GMO-free biomass (14%) reaches the same level of importance as “Biodegradability” and “Lower greenhouse gas emissions”.

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