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Table of Contents

Table of Contents	2
Acronyms and Abbreviations	3
1. Executive Publishable Summary	4
2. Introduction.....	5
3. Key Messages.....	8
3.1 What are key messages?.....	8
3.2 Why are key messages important?.....	8
3.3 What are the attributes of good key messages?.....	8
3.4 Key messages about bio-based chemicals, materials and products.....	9
4. Recommendations to overcome regulatory and societal barriers.....	13
4.1 Purpose of the recommendations.....	13
4.2 Recommendations to overcome regulatory barriers.....	13
4.3 Recommendations to overcome societal barriers.....	17
5. Overview of Key Messages (KM), Policy (PR) and Societal (SR) Recommendations.....	20
6. Conclusion	21
7. References.....	22

Acronyms and Abbreviations

Acronyms:

Short name	Full name
BBI JU	Bio-based Industries Joint Undertaking
BIC	Bio-based Industries Consortium
BioCannDo	Bioeconomy Awareness and Discourse Project (Project Acronym)
BTG	Biomass Technology Group B.V.
DECHEMA	Gesellschaft für chemische Technik und Biotechnologie e.V. (Society for Chemical Engineering and Biotechnology)
E4tech	E4tech (UK) Ltd.
nova	nova-Institut für politische und ökologische Innovation GmbH
RoadToBio	Roadmap for the Chemical Industry in Europe towards a Bioeconomy (Project Acronym)

Abbreviations:

CO ₂	Carbon dioxide
EU	European Union
GHG	Greenhouse Gas
IEG	Industry Expert Group
LCA	Life Cycle Assessment
NGO	Non-Governmental Organizations
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RED	Renewable Energy Directive
SDG	United Nations Sustainable Development Goals
SME	Small and Medium-sized Enterprises
UN	United Nations
WFD	Waste Framework Directive
WP	Work Package

1. Executive Publishable Summary

This report was prepared within the context of the RoadToBio project, which is a project funded by the European Union (EU) under the Horizon 2020 research and innovation programme that aims to pave the way for the European chemical industry towards a higher bio-based portfolio and competitive success based on the benefits offered by the bioeconomy. The project will deliver a roadmap for the chemical industry that will specify benefits as well as barriers towards a bio-based economy to meet the societal needs in 2030.

In this deliverable, the project has developed a set of key messages and recommendations for the chemical industry. Both shall play a part in overcoming the previously identified regulatory and acceptance hurdles. Thus, this deliverable is also step for transferring the previously collected knowledge about regulatory (D 2.1) and societal barriers (D 2.2 and D 2.3) into recommendations about how to overcome these barriers. The development of the key messages and recommendations went through an intensive stakeholder feedback process, where the Industry Expert Group (IEG) of the RoadToBio project provided valuable contributions and opinions to finetune the statements over multiple feedback rounds.

The key messages in this deliverable are meant to provide a basis to the chemical industry for communicating with the public about the bio-based economy. The key messages are based on the achieved understanding of public perception of bio-based chemicals and materials, as well as a first analysis of potential contributions of bio-based chemicals to societal needs. The recommendations are specifically aimed for stakeholders within the chemical industry, in order to provide guidance and offer some suggestions how the chemical industry can play a vital role in overcoming the identified barriers.

The results of this deliverable are intended to be used within the final roadmap of the RoadToBio project. The key messages and recommendations will be reformatted for the Engagement Guide of the roadmap and adapted after additional stakeholder feedback.

2. Introduction

The chemical industry of Europe is not only confronted with economic pressure and competition from the global market, but also several big societal challenges. Some examples are the climate goals of the EU following the Paris agreement or increasing awareness and demand for sustainability in the European society. As a consequence, there are some clear developments to which the chemical industry has to respond and adapt to:

- Overall energy demand needs to be reduced and increasingly covered by renewable energy
- The sustainability of products has to improve, especially in their use phase and at end-of-life
- The circular economy concept asks for improved resource efficiency

Increasing the market share of bio-based raw materials in the chemical industry is an option that can support, and already is supporting, all of the above-mentioned trends. In three prior reports of this project (RoadToBio deliverables D 2.1, 2.2 and 2.3) various policy and societal barriers to increase the market share of bio-based products have been identified. This report builds on these studies and intends to provide recommendations and key messages to the chemical industry in order to overcome these barriers.

Potential contributions the bio-based economy can make to fulfilling societal needs

The United Nations (UN) Sustainable Development Goals (SDGs) aim to tackle global challenges related to social, economic and environmental aspects. The bioeconomy, especially when integrated in a circular bioeconomy, offers huge opportunities in achieving the SDGs if resources are managed sustainably and policy coherence is achieved (BIC, 2018; EC, 2018).

The bioeconomy is at the centre of sustainable development strategies worldwide and contributes to many SDGs. For example, the Bio-Based Industries Joint Undertaking (BBI-JU), a public-private partnership in the EU with the intention to support the European bioeconomy, considers itself (and through this the bioeconomy in general) to contribute to the following societal needs (based on BIC, 2018 & FAO, 2017):

- *SDG 2 - Zero hunger*: A sustainable bioeconomy can contribute to sustainable yield increase, investments in agriculture, improved food and nutrition security.
- *SDG 3 - Good health and well-being*: The bioeconomy can contribute by reducing air, water and soil pollution with hazardous fossil-based products, by developing biopharma and functional foods.
- *SDG 6 – Clean water and sanitation*: The bioeconomy can, e.g. by using sewage water to produce bioenergy and bio-based materials, contribute to cleaner water and increased reuse
- *SDG 7 – Affordable and clean energy*: The bioeconomy, e.g. through the renewable energy directive (RED, Directive 2009/28/EC) or chemicals as energy storage, can reduce the use and dependency of fossil fuels, especially in the transport sector

- *SDG 8: Decent work and economic growth*: The bioeconomy can provide more jobs and additional income in local economies, and create opportunities to export value-added bio-based products
- *SDG 9: Industry, innovation and infrastructure*: The bioeconomy itself is a new and innovative sector, where especially the biotechnology is a driver for innovations and infrastructure development
- *SDG 11: Sustainable cities and communities*: The bioeconomy links surrounding rural areas to urban centres, e.g. by setting up innovative biorefineries for transforming parts of municipal solid waste into chemical building blocks.
- *SDG 12: Responsible consumption and production*: The bioeconomy contributes to improved use biomass and wastes, decouples production and consumption from fossil energy sources and raises the consumer awareness by providing sustainable and/or circular products
- *SDG 13: Climate action*: The use of renewable resources in the bioeconomy reduces the use of fossil-based resources and their related GHG emissions
- *SDG 14: Life below water*: Here, especially the blue bioeconomy leads to better and sustainable use of marina fauna and flora
- *SDG 15: Life on land*: The bioeconomy can support the combat against desertification, halt and reverse land degradation, limit and stop biodiversity loss and promotes sustainable management of forests and natural resources.

Naturally, there are also risks and challenges when developing the bioeconomy: Increased competition between the use of biomass for chemicals, materials, products, energy and food and feed, pressure on water and land for growing more biomass, threats to natural assets of small-scale farmers, or unequal access to the benefits of a developed bioeconomy. But given the proper circumstances and frameworks, the bio-based economy can make large contributions to achieving the SDGs and fulfilling societal needs. These opportunities are also reflected in the key messages and recommendations in this document.

Building on the BioCannDo project

A BBI-JU project running parallel to RoadToBio, named “The Bioeconomy Awareness and Discourse Project” (BioCannDo), developed a thorough approach to formulate key messages about the bioeconomy for consumers. Subsequently, key messages were formulated for three exemplary product categories: bio-based household cleaning products, bio-based insulation materials and bio-based food packaging. This process revealed that it is most convenient to provide general key messages, that can be further adapted by the producers to fit their specific products and audience, which might for example be industrial customers or end consumers. This way, what is not relevant or true for specific products can be omitted and specific characteristics of products can be highlighted. The wording of the messages can be adapted to the addressees, since industrial customers and end consumers require different communication and marketing strategies. Consequently, in this report we provide key messages that are of general relevance but not formulated for a specific audience. Furthermore, we provide background information for each key message to substantiate their claims and to provide starting points for customisation.

Developing key messages and recommendations for the chemical industry

The results of the BioCannDo project were incorporated and combined with the findings of the prior, above-mentioned RoadToBio deliverables for the development of this report. In total, we provide the following:

1. **Key messages** about bio-based chemicals, materials and products
2. **Recommendations** to overcome **policy barriers**
3. **Recommendations** to overcome **societal barriers**, including recommendations on communication

The key messages are intended as an instrument for the chemical industry to address target audiences in their communication about bio-based chemicals, materials and products. They can be customized by each stakeholder to highlight product characteristics and to be tailor fitted to the respective audience. Examples would be consumers along the entire value chain of the chemical industry.

With the recommendations we aim to provide the chemical industry with ideas and approaches how to tackle the barriers we have identified in prior studies. To some extent, these recommendations summarize reports and publications from recent years.

Both key messages and recommendations are built up the same way: First, a central sentence is intended to function as a “key” message or recommendation, summarizing the main argument in one short and concise statement. Second, each statement is then backed up by further information and clarification.

It should be noted that the final key messages and recommendations are based on several development and feedback rounds. The initial goal of this deliverable was to provide a set of options and approaches how to tackle the identified regulatory and societal barriers of the first three deliverables of WP2 D2.1 – D2.3. After internally developing a first set of messages within the project, a feedback round took place during the second project meeting with the IEG of RoadToBio in June 2018. Based on this meeting, the need for a clearly defined target group for the developed messages was identified. In turn, the deliverable was reshaped to focus entirely on the target group “Chemical industry & economic operators along the value chain”.

The revisited set of messages and recommendations was shared again with the IEG in September 2018. The received feedback was then used to polish and finalize the document. A number of recommendations for other target audiences, like policy makers, were removed from this document after the workshop in June 2018. Instead, they will be part of the final roadmap package delivered at the end of the RoadToBio project.

3. Key Messages

3.1 What are key messages?

Key messages are the essence of what someone wants to communicate. They are the main points of information that their audience is supposed to hear, understand, and remember. In other words, they function as bite-sized statements that articulate what someone does, why they do it, how they are different, and what value they bring to their stakeholders. In that way, key messages clarify meaning and provide the takeaway headline of the issue that is intended to be communicated.

3.2 Why are key messages important?

To the public eye, the chemical industry is often first and foremost connected to industrial emissions and environmental pollution, summoning a rather negative public image. Bio-based chemicals, materials and products can support societal efforts towards reduced greenhouse gas emissions and a change towards a circular economy. But, conveying this message to the wider public has proven difficult, partly based on barriers identified in the RoadToBio deliverables D2.1 and D2.2, which for example pointed out a lack of understanding of the term bio-based.

In this regard, key messages can be an important tool because with repeated use they serve as the foundation of an organization's branding and marketing efforts. At the same time, they can help an organization to:

- Prioritize and define information;
- Ensure consistency, continuity and accuracy;
- Measure and track success; and
- Stay focused when speaking with media or stakeholders.

Clear and concise key messages are a way of controlled communication that effectively bring home your message and minimize potential misinterpretations. For the chemical industry, key messages can be an important part of conveying the benefits of bio-based chemicals, materials and products to their customers and at the same time help to avoid misunderstandings.

3.3 What are the attributes of good key messages?

With the following set of key messages, we want to highlight some highly important statements concerning bio-based chemicals, materials and products, but also provide a basis for stakeholders within the chemical industry to develop their own key messages. When designing individual key messages, the following principles should be considered:

- **Concise:** Limit the focus on three to five key messages per topic; write one to three sentences for each key message; should be read or spoken in 30 seconds or less.
- **Strategic:** Define, differentiate, and address benefits.
- **Relevant:** Balance what you need to communicate with what your audience needs to know.
- **Compelling:** Design meaningful information to stimulate action.
- **Simple:** Use easy-to-understand language; avoid jargon and acronyms.
- **Memorable:** Ensure that messages are easy to recall and repeat; avoid long, run-on sentences.
- **Real:** Use active voice, not passive; do not use advertising slogans.

- **Tailored:** Communicate effectively with different target audiences by adapting language and depth of information.

For the RoadToBio context, we have decided to provide key messages that always consist of a single sentence. But, in order to enable the chemical industry to build on and adapt these messages, additional background information was provided. In the next segment, for each key message there is a textbox that consists of the key message followed by the background information.

The whole segment is based on information from the following sources: MSKTC, 2018; Pollard, 2016 and Wetherhead, 2011.

3.4 Key messages about bio-based chemicals, materials and products

#1 – Any chemical or material made from fossil oil and gas can be made from biomass



Many chemicals, materials and daily life products are made from fossil resources (e.g. plastics, synthetic fibres, washing detergents or solvents). The fossil resources (oil and gas) were originally biomass and are the result of a million-year long process. We can speed up or by-pass this process, so that any fossil-based ingredient can be replaced by renewable resources or residues from land and sea.

In the current bioeconomy, bio-based chemicals and materials partly or fully replace fossil-based ones.

#2 – Chemicals or materials produced from renewable resources can help to reduce CO₂ emissions



The emission of greenhouse gases like carbon dioxide (CO₂) from fossil resources is one of the major drivers of climate change. To stay below the 2°C target of global warming, 70% of all coal reserves and at least one third of oil and gas reserves need to stay in the ground or their CO₂ emissions have to be kept from entering the atmosphere (McGlade & Ekins, 2015).

The CO₂ in fossil resources was captured millions of years ago and is often released into the atmosphere at end of life of fossil-based products. Therefore, it contributes to an increase of greenhouse gas concentration in the atmosphere when fossil carbon is extracted from the ground and utilized.

In comparison, CO₂ released by bio-based resources was recently captured and will be captured again when resources regrow. These resources can then again be used to produce new bio-based products. This way, the carbon is kept in a cycle (within a reasonable time).

When bio-based resources are used instead of fossil resources, the fossil CO₂ can remain in the ground and therefore, the use of bio-based resources contributes to limiting climate change and global warming.

#3 – A lot of products are already made from chemicals based on renewable resources and are available on the market



The chemical industry already offers a broad variety of products featuring bio-based chemicals.

Some examples include: compostable plastic bags, personal care products from plants, natural detergents, plant-based drinking bottles, planting pots for your garden or even new glasses.

Even though these products are made from biomass, they can look, perform and feel the same as conventional, fossil-based products or even better.

#4 – Chemicals and materials from renewable resources can provide new and better functionalities



For example, in the building sector, architects and construction companies tend to return to bio-based construction materials and it is more than just wood for the walls. Insulation, flooring or paints & coatings can be made from bio-based materials as well, where they provide a healthier and more comfortable room climate.

Bio-based raw materials are also widely used in cleaning products. Biotechnology provides bio-based ingredients such as enzymes for detergents. Enzymes can help reducing the environmental impact of washing and cleaning products by using less energy and water, while providing the same or better cleaning results under milder conditions. Compostability is another example for a functionality that is highly sought after in bio-based materials and products.

#5 – The bioeconomy can contribute to a circular economy, which helps us to move away from a linear economy of “take, make and dispose”



Bio-based chemicals and materials are renewable and part of the natural cycle. They can provide a sustainable input of new materials for a circular

It is estimated that 90% of the raw materials used in manufacturing become waste before the product leaves the factory and 80% of products made get thrown away within the first six months of their life (Girling, 2005).

In a circular economy, ideally all materials are used repeatedly, recycled and circulated. However, some input of new raw materials remains necessary. Bio-based resources can provide a sustainable input, because they are renewable and regrow naturally. The bioeconomy can also make use of many (organic) waste streams from current production processes and support the circular economy.

#6 – In a sustainable bioeconomy, raw material supply at global level can be secured without threatening nature, biodiversity or food security



To produce bio-based products we need biomass feedstock. Various studies have shown that there are considerable potentials for the cultivation of biomass for energy and material use on a global level, even when conditions such as the preservation of biodiversity and climate protection are considered.

But the bioeconomy is not automatically more sustainable than the current fossil economy. The cultivation and processing of biomass needs to comply with standards of sustainable agriculture and forestry, which help to protect biodiversity, soil, water, air, and should also take social and labour standards into account. Furthermore, residual biomass can be an important resource for a sustainable bioeconomy.

The development of a sustainable bioeconomy can also be supported by certification standards for renewable raw materials and bio-based products (e.g. the Roundtable on Sustainable Biomaterials (RSB) certification scheme), which are offered by a variety of organisations. With increasing consumer demand for sustainable products, certification becomes more important for producers of raw materials and bio-based products.

#7 – The bioeconomy creates jobs in rural areas



The bioeconomy generates a turnaround of approximately 2.3 trillion € and value added of 620 million Euros. At the same time, it accounts for roughly 8.2% employment in the EU economy. Today, more than 18 million people are employed in bioeconomy related sectors.

Agriculture and the manufacture of food, beverages and tobacco accounted for about two thirds of the value added and turnover of the bioeconomy and three quarters of bioeconomy employment. Considerable future potential is seen in forest, marine and “waste” bioeconomy.

All of these fields can support rural and regional development. Especially the role agriculture plays in rural areas as an economic and social buffer should not be underestimated. In the future, the bio-based industries aim at creating an additional 700,000 jobs on all levels, 80% of which would be created in rural areas until 2030 (IRENA, 2017).

#8 – Switching to renewable resources/carbon reduces dependence on fossil resources



In the course of its life cycle, most of the extracted fossil carbon is sooner or later released into the atmosphere. If climate change is to be limited to the levels agreed upon in the Paris agreement, we have to stop releasing more CO₂ into the atmosphere than is taken up by natural or artificial pathways. Even with technical solutions like direct air capture, there is a need to balance the further extraction of fossil resources with the quantities of carbon that can be recycled.

In the long run, the carbon used as a raw material for organic chemistry has to become circular and reusable. What decarbonization represents in the energy sector is the switch to renewable carbon for the chemical industry. Besides carbon from recycling or CO₂ reuse, bio-based carbon is a valid candidate to contribute to the goal of renewable carbon and currently the most readily available option. A strong European bioeconomy would replace fossil-based products with bio-based alternatives, and reduce the EU's dependency on fossil resources.

4. Recommendations to overcome regulatory and societal barriers

4.1 Purpose of the recommendations

Unlike the key messages of the previous chapter, the recommendations in the following chapters are only partly designed with a communication focus in mind. Instead, they focus on pointing out different avenues the chemical industry could (continue to) explore in order to tackle the identified regulatory or social barriers. As such, these recommendations stay on a higher level and do not give highly specific advice, but rather provide guidance as to which options the chemical industry could pursue.

That said, the recommendations are presented in the same format as the key message: In the next segments, for each recommendation there is a textbox that consists of the central statement on blue background, followed by the background information on grey background.

4.2 Recommendations to overcome regulatory barriers

#1 – Consider first generation biomass for chemical and material uses



While the Renewable Energy Directive continues to push biomass for energy use, the chemical industry shows tendencies to avoid using biomass for chemicals or materials in fear of refuelling the arguments of the food vs. fuel debate. But analyses show that first generation (food) crops often have high land efficiency, deliver additional by-products and can act as a buffer in times of crop failure. In other words, these crops usually provide more biomass per hectare than other renewable feedstocks, making them more land-use efficient no matter the application. At the same time, there is room for expanding opportunities to use this biomass for high value products in ways that do not compromise global food needs.

A good example is sugar: When comparing commonly cultivated plants, sugar beet and sugar cane excel with an unsurpassed yield and per-acreage-efficiency. As of 2018, there is a global excess production of sugar (for example due to the end of the sugar quota in Europe), while consumption of sugar in society is trending down. The resulting sugar surplus could be picked up by the European chemical industry at competitive prices, but the industry is reluctant to do so, potentially missing out on a large bio-based feedstock.

Considering first generation biomass does not mean that the chemical industry should not also use non-edible second-generation biomass, especially as a developing cornerstone for the future. But when sufficient supply capacity and flexibility is given, food crops can cover food/feed demands and still be valuable assets for the chemical and material production.

#2 – Continue to lobby for balanced policy making and harmonization of relevant regulations



Despite awareness of a non-level playing field between energy and material use of biomass, and despite ongoing intentions to harmonize relevant regulations, existing legislation was created for specific goals that are not necessarily in line with the material use of biomass for chemicals and materials. There have been and there are ongoing revisions, recommendations and strategies to harmonize existing legislation and also better involve the material use of biomass. This process should be continued and supported, with a recommended focus on:

#2.1 – Lobby for reliable policies on bio-based chemicals, materials and products

Unknown risks prevent investment, market introduction and establishment of innovations. They can arise due to several factors but for bio-based chemicals and materials, the political framework is a dominant factor causing uncertainty. One of the risks is short-term political policy, which cannot be relied on persisting for longer investment periods. Long-term policies would reduce risks and make them quantifiable, so that investment can be better justified. Another example is the end of life of chemicals and products, which is often uncertain and difficult to assess, e.g. whether something is classified as a waste or as a product and whether legislation allows or prohibits recycling and reuse.

#2.2 – Lobby for greater policy coherence

There is still no clear and coherent policy approach regarding the regulation of bio-based products and their markets. Several legislations are directly affecting bio-based chemicals and materials, for example the Renewable Energy Directive (RED), the Waste Framework Directive (WFD) or the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation, but a central regulatory document for the bio-based economy is missing. A harmonization of and between regulations, and in particular also across fossil-based and bio-based products, should be further pursued to clarify and improve the situation for bio-based chemicals and materials.

#2.3 – Lobby for a level playing field for all biomass applications

The material use of biomass promises significant advantages over its use as energy source, both in terms of gross employment (factors 5-10) and gross added value (factors 4–9). Additionally, it opens the possibility for cascading use, where the biomass is first utilized for one or multiple material applications before it will be finally recycled for energy production.

But a non-level playing field between different applications of bio-based resources exists, i.e. between the use for energy and for material purposes. Policy instruments like the RED incentivize the direct energy use of biomass and thus systemically promote bioenergy and biofuels, leading to a disadvantage for the chemical and material sectors. Biomass availability at competitive prices could be achieved through different means, for example targeting the Renewable Energy Directive, waste and residue streams, agricultural policy or tax and tariff exemptions.

#3 – Work on an increased demand for bio-based products by developing and promoting the right instruments



Currently, no dedicated instruments at European level exist to support development of bio-based chemicals, materials and their markets. Such an instrument might provide incentives for early market creation, granting the chemical industry a degree of safety in the beginning. Once bio-based products are established, many producers are optimistic to stay competitive without further support.

Some exemplary tools exist in other countries, e.g. the BioPreferred Federal Procurement Preference Program operated in the United States, which mandates ‘affirmative public procurement practices’. Public procurement from the EU would send a strong signal and work as a market pull mechanism to stimulate the growth of bio-based products. The European Commission’s “Expert Group for Bio-based Products” published 15 recommendations in 2016 for an increased uptake of bio-based products (Commission Expert Group for Bio-based Products, 2016) but implementation has so far proven to be difficult.

An alternative could be politically set up rewards for chemicals and materials with low greenhouse gas emissions or labels that indicate the share of bio-based carbon in a product. One example for such a system is the “Renewable Chemicals Production Tax Credit” program that was recently introduced in Iowa (IEDA, 2018).

#4 – Establish integration within the circular economy and collaboration with the waste treatment sector



Bio-based chemicals and materials made from residues are gaining importance in the circular economy concept. Non-governmental organisations (NGOs) and policy makers agree that bio-based products, in principle, integrate well within the circular economy.

Collaborations of the chemical industry with the waste treatment sector and policy makers could develop and improve waste management and recycling strategies.

At the same time, communication about the positive impacts of circular products could further pave the way to an integration of the bioeconomy and the circular economy. In a circular economy context, the term “waste” should be avoided and instead be replaced with the term “by-product”.

#5 – Support the development of a coherent environmental assessment framework, possibly focused on the chemical industry



For an increasing variety of feedstocks and products the environmental performance is being determined. But, so far, there is no coherent European framework for the environmental performance assessment of chemicals, materials or products. This hinders the environmental benchmarking of bio-based alternatives, which can be a strong incentive and advertisement for market introduction and uptake.

Providing clear and comparable assessment results is difficult, especially for smaller producers. Life cycle assessments (LCA) have been identified as a scientifically sound method to evaluate the environmental impacts of a product, but are usually prohibitively expensive for small and medium-sized enterprises (SMEs).

4.3 Recommendations to overcome societal barriers

#1 – Anticipate increased public attention towards GHG emissions of chemical products



The chemical industry should be aware that their share of greenhouse gas (GHG) emissions, compared to other industries, is likely to rise in the future. This is based on two trends: First, other main contributors to today's GHG emissions will reduce their impacts in the future. The electricity sector will increasingly use renewable energy and in the transport sector, electric vehicles will more and more replace internal combustion vehicles on European roads. Second, with a globally increasing population and rising prosperity, the chemical industry is projected to continue to grow.

As a consequence, experts estimate that the material use of fossil oil will increase from current 8% up to 30% in 2050. Therefore, although the chemical industry will also profit from cleaner electricity and improved energy efficiency, the rising raw material demand means that the overall GHG emissions of the chemical industry will not be reduced in similar rates as for transport and energy. Consequences might include increased public scrutiny, negative public perception and actions by policy makers, which could be actively averted by activities like sustainable sourcing of resources and ingredients.

#2 – Providing proof of the environmental performance of a product can be a strong marketing incentive



While it is not the central purchase argument for the general public, many consumers are concerned about environmental performance of a product. Bio-based products do not always have a clear overall environmental benefit – more often than not they perform better in greenhouse gas emissions when compared to fossil-based alternatives, but the required land use can cause negative impacts like soil degradation, acidification or eutrophication.

If a bio-based chemical, material or product performs environmentally advantageous, consumers like to see proof for any environmental benefit that is claimed by the product. In these cases, it can be advantageous to inform consumers about the environmental impact in comparison to conventional products at the product level. The way environmental performance is proven should be set up in cooperation with NGOs and/or governmental organizations, as industry labelling their own products is vulnerable to criticism.

#3 – Communication: focus on and highlight advantages, positive impacts and innovative functionalities



Consumers primarily care about direct advantages and positive impacts of products and do not necessarily care if a product is bio-based or not. Communication should therefore not focus on the fact that a product is bio-based (only), but highlight personal benefits, added value and other positive impacts; in relation to its costs.

Creating added value (and proving it) can be challenge for bio-based products, but also an opportunity: if it exists, it can be used for communication and marketing strategies. Producers can strive for added value in innovation and design of bio-based products and use this as a selling point, rather than just focusing on the fact that the product is bio-based.

#4 – Communication: avoid raising unrealistically high expectations



The lack of understanding of the term bio-based also means that people often have unrealistically high expectations about attributes and environmental performance of a bio-based product. These expectations and consequent misunderstandings can lead to disappointment, negative consumption experiences and fewer repurchases.

For example, many people associate biodegradability with the term bio-based, which is not always the case. Another complicated example are products which are only partly made of bio-based resources. Communication should therefore always be very clear about the actual environmental performance and product characteristics, and fitting labels or certificates could go a long way to provide transparency and better understanding.

#5 – Communication: Consider your audience when using the term “bio-based”



Most consumers find the term bio-based confusing and abstract. Issues regarding the bioeconomy and bio-based products are, generally speaking, too complex to expect laypeople to understand. Using the term for marketing purposes is therefore not always an advantage. Consider the following approaches to address different audiences:

Approach A: address the environmentally conscious niche market specifically and inform consumers that a product is bio-based and what impact this has.

Approach B: address the broader public but do not mention the term bio-based. Instead, inform about improved characteristics and/or personal benefits.

#6 – Communication: Provide simple and reliable access to key information



End consumers may be willing to buy bio-based products, but few of them want to invest a lot of time in gathering and evaluating product information. Communication strategies should therefore provide easy and reliable access to key information and benefits. Informational cues such as labels, logos, infographics and stories can better represent the concept and the benefits in terms of clarity, understanding and attractiveness.

Consumer organizations, other NGOs and independent certifying organizations are perceived as highly trustworthy by consumers, and are potentially valuable communication channels (Open-Bio, 2015).

5. Overview of Key Messages (KM), Policy (PR) and Societal (SR) Recommendations

Type	Message
KM #1	Any chemical or material made from fossil oil and gas can be made from biomass
KM #2	Chemicals or materials produced from renewable resources can help to reduce CO ₂ emissions
KM #3	A lot of products are already made from chemicals based on renewable resources and are available on the market
KM #4	Chemicals and materials from renewable resources can provide new and better functionalities
KM #5	The bioeconomy can contribute to a circular economy, which helps us to move away from a linear economy of “take, make and dispose”.
KM #6	In a sustainable bioeconomy, raw material supply at global level can be secured without threatening nature, biodiversity or food security
KM #7	The bioeconomy creates jobs in rural areas
KM #8	Switching to renewable resources/carbon reduces dependence on fossil resources
PR #1	Consider first generation biomass for chemical and material uses
PR #2	Continue to lobby for balanced policy making and harmonization of relevant regulations
PR #2.1	Lobby for reliable policies on bio-based chemicals, materials and products
PR #2.2	Lobby for greater policy coherence
PR #2.3	Lobby for a level playing field for all biomass applications
PR #3	Work on an increased demand for bio-based products by developing and promoting the right instruments
PR #4	Establish integration within the circular economy and collaboration with the waste treatment sector
PR #5	Support the development of a coherent environmental assessment framework, possibly focused on the chemical industry
SR #1	Anticipate increased public attention towards GHG emissions of chemical products
SR #2	Providing proof of the environmental performance of a product can be a strong marketing incentive
SR #3	Communication: focus on and highlight advantages, positive impacts and innovative functionalities
SR #4	Communication: avoid raising unrealistically high expectations
SR #5	Communication: Consider your audience when using the term “bio-based”
SR #6	Communication: Provide simple and reliable access to key information

6. Conclusion

This document provides a set of key messages and recommendations that is intended for the chemical industry as main recipient and user. Key messages can be a foundation for a communication strategy towards customers along the value chain and the general public. The recommendations are mainly suggestions for the chemical industry to strategically overcome barriers.

The key messages have been developed as a set of high-level statements. They were partly based on work within BioCannDo, adapted to the chemical industry. Providing an effective message depends on the specific case, the involved company/organization and their audience, which means that key messages for the wider public are hardly feasible. Instead, the here presented set provides a basis to start developing communication tools/campaigns in favour of bio-based chemicals, materials and products and should be specifically tailored, dependent on the organization that wants to use key messages and the target audience of that organization. To help with the customization process, this deliverable provides a short introduction to key messages, their intention and some guidelines how to best design and phrase key messages. Additionally, the recommendations to overcome societal barriers targeted at communication should be used as additional input and guidelines when developing communication approaches and strategies for bio-based chemicals, materials or products. As a result, organizations should be enabled to highlight specific attributes, benefits or advantages of a bio-based product and develop a fact-based marketing strategy.

Recommendations have been developed to highlight different avenues which the chemical industry could pursue in order to tackle regulatory and societal barriers that hamper a higher share of bio-based resources in organic chemistry. They intend to give an idea about different options that are worthwhile to explore in order to remove hurdles and should help the chemical industry to focus their efforts into the right directions. Please note that some of the previously identified barriers cannot directly be tackled by the chemical industry. Instead, other stakeholders, like policy makers or NGOs, are in a better position to address these hurdles.

Looking at the further development of the project and for preparing the final roadmap, it becomes apparent that to overcome existing barriers, different stakeholders will be required to act in order to achieve the goal of increasing bio-based resources in the chemical industry: Not only the chemical industry has to take action, but also other stakeholders will be required, e.g. policy makers for regulatory barriers or NGOs as important actors to both validate identified social benefits of the bio-based economy and as reliable ambassadors.

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