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Proposal for a co-regulation framework for the use of sustainability certification schemes in the production of bio-based products

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Abstract

Urgency for the attention to sustainability of bio-based materials and bio-based products is growing. Sustainability certification schemes and standards can help companies to ensure their products meet certain sustainability requirements. Co-regulation is an alternative solution or a complement to conventional regulation in this regard. The European Union (EU) has developed valuable experience in adopting co-regulation under the Renewable Energy Directive (RED and REDII) and the EU Timber Regulation. However, research by the STAR-ProBio project shows that currently no coherent and comprehensive regulatory framework exists for other sectors of the bioeconomy.

This report puts forward a proposal for a co-regulation framework to introduce the use of sustainability assessment tools (and in particular, certification schemes) in a co-regulative framework for the market uptake of the broader bio-based materials and products. It is identified that establishing such co-regulation framework requires more coherence between different EU policy mechanisms and between legislation and private mechanisms such as certification schemes and standards.

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1 Introduction

Attention for sustainability of bio-based materials and bio-based products, both from companies and from governments is growing. However, due to globalization and outsourcing, relevant sustainability issues take place increasingly outside the fences of the company that puts a product on the market. Sustainability issues can take place at any step of complex and international supply chains, usually under the responsibility of other companies, and often in other countries and other continents. This situation leads to minimal attention for sustainability, either because of lack of proper legislation or insufficient enforcement in the various countries participating in the supply chain. EU and Member State legislation can regulate certain sustainability aspects, but only within their geographical jurisdiction. Moreover, sustainability requirements are continuously developing and need norms that are flexible and can further develop at the same pace.

Sustainability certification schemes and standards can help companies to ensure their products meet certain sustainability requirements. Certification schemes and standards are usually of voluntary. However, legislation can also adopt them into regulation, or support their development and use in different ways through co-regulation.

Co-regulation is an alternative solution or a complement to conventional regulation. The first co-regulation initiatives in Europe focused on the adoption or support by EU legislation of technical standards developed by European Committees, national standardisation bodies and certification schemes.

The European Union (EU) has developed since then experience in adopting co-regulation frameworks for the sustainability in certain sectors of the bioeconomy. The Renewable Energy Directive (RED and REDII) has set sustainability requirements for biofuels, bioliquids and biomass for energy. It has also set a mechanism for the use of product certification schemes for demonstrating compliance with those sustainability requirements. The EU Timber Regulation (EUTR) establishes obligations to counter illegal logging on companies that place or buy timber and timber products on the EU market. These obligations aim at contributing to sustainable management of forests and reduced emissions from deforestation and forest degradation beyond EU borders. Sustainability certification is one of the methods used to inform risk mitigation actions.

Research by the STAR-ProBio project (STAR-ProBio, 2018) shows, that currently, no coherent and comprehensive regulatory framework exists in the EU for other sectors of the bioeconomy. Instead, many different types of policies with different scope and degree of detail are available. The focus of requirements included in this policy framework is on the environmental sustainability, while economic and social aspects are less represented. While certification was found to be an accepted instrument for the assessment of sustainability in these policies, there is a lack of measurable targets and adequate co-regulation mechanism.

This report puts forward a proposal for a co-regulation framework to promote the sustainability of the broader bio-based products in the European Union:

- Chapter 2 discusses the mandate for mainstreaming sustainability assessments for bio-based products in EU policy, and the Commission services concerned for such goal.

- Chapter 2.3 defines and describes three types of co-regulation for introducing the use of sustainability certification schemes for the assessment of bio-based products.
- Chapter 4 presents a proposal for including the SAT-ProBio sustainability assessment tools in an overarching EU co-regulation framework.
- And finally, chapter 5 elaborates on further policy recommendations for mainstreaming sustainability assessment of bio-based products in EU policies.

2 Mainstreaming sustainability in EU policy

2.1 Mandate for mainstreaming sustainability in EU policy

Systematic integration of environment and climate change is an obligation under the EU policy framework. Article 11 of the Treaty on the Functioning of the European Union establishes that environmental protection must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development.

Environmental protection is also a priority of the New European Consensus on Development. Adopted in 2017, the New European Consensus on Development, is a shared vision and framework for action for development cooperation for the European Union (EU) and its Member States. It is a blueprint that aligns the Union´s development policy with the 2030 Agenda for Sustainable Development. The five pillars of this policy framework are: People, Planet, Prosperity, Peace and Partnership. The Consensus commits the EU and its Member States to, inter alia:

- Promote access to safe drinking water and sanitation.
- Sustainable and integrated water management as well as more efficient use of water.
- Address chemical pollution and poor air quality.
- Strengthen resilience, particularly of vulnerable populations, in the face of environmental and economic shocks.
- Promote resource efficiency and sustainable consumption and production, including the sustainable management of chemicals and waste, with a view to decoupling economic growth from environmental degradation and enabling the transition to a circular economy.
- Build capacity to mainstream environmental sustainability, climate change objectives and the pursuit of green growth into national and local development strategies.
- Support the conservation and sustainable management and use of natural resources, and the conservation and sustainable use of biodiversity and ecosystems, including forests, oceans, coastal areas, river basins and other ecosystems.
- Tackle illegal logging and its associated trade, land and forest degradation, desertification, drought, and biodiversity loss.
- Support better environmental governance; integrate environment and climate change throughout their development cooperation strategies, including by promoting a sound balance between mitigation and adaptation.
- Contribute to scaling-up private and public investments in the low-emission, climate-resilient green economy.

However, and despite decades of efforts on sustainable development, scientific warnings on several planetary emergencies have increased in urgency and frequency in the past few years. From climate change and biodiversity loss to land use change, resource use and the overall state of the global environment, the trends continue in

the wrong direction. These global emergencies do not only affect the environment, but also impact negatively the well-being of communities and the sustainable development challenges they face, including food security, fighting poverty and global health issues.

The most recent EU environment assessment – the European Environment Agency's State of the Environment 2020 (EEA, 2020) report issues stark warnings: "The message of urgency cannot be overstated. In the last 18 months alone, major global scientific reports from the IPCC, IPBES, IRP and UN Environment[1] have been published, all carrying similar messages: current trajectories are fundamentally unsustainable; these trajectories are interconnected and linked to our main systems of production and consumption; and time is running out to come up with credible responses to bend the trend."

In response to a number of these warnings, the EU has announced a landmark European Green Deal (EGD), presented by the European Commission as "the most ambitious package of measures that should enable European citizens and businesses to benefit from sustainable green transition" (European Commission, 2020b). The Commission states that the EGD "resets the Commission's commitment to tackling climate change and environmental-related challenges that is this generation's defining task. It is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use." (European Commission, 2019a).

For its part, the European Parliament has prepared a Resolution on the EGD in which it states that it "Believes that sustainably-sourced renewable materials will play an important role in the transition to a climate-neutral economy, and highlights the need to stimulate investments in the development of a sustainable bioeconomy where fossil-intensive materials are replaced with renewable and bio-based materials in, for example, buildings, textiles, chemical products, packaging, shipbuilding and, where sustainability can be assured, energy production; stresses that this will have to be done in a way that is sustainable and respects ecological limits; highlights the potential of the bioeconomy to create new green jobs, including in rural parts of the EU, and to stimulate innovation; calls for support for research and innovation in sustainable bioeconomy solutions that should take into account the need to protect unique biodiversity and ecosystems; calls for the efficient implementation of the EU Bioeconomy Strategy as part of the European Green Deal."

The EGD also addresses global aspects, recognising that its environmental ambitions will not be achieved by Europe acting alone and that the EU can mobilise its neighbours and partners by using its influence, expertise and financial resources to "join it on a sustainable path." (European Commission, 2019b)

Prior to the European Green Deal, the EU historically addressed its environmental ambitions and priorities through Environment Action Programmes (EAPs). The first EAP was delivered in 1973 and the latest one – the 7th EAP – will expire in 2020. The 7th EAP is titled "Living well, within the limits of our planet" (European Union, 2014), and includes several priority objectives of relevance to bio-based products: to protect, conserve and enhance the Union's natural capital; to turn the Union into a

[1] Intergovernmental Panel on Climate Change (IPCC) reports on 1.5 °C Global Warming and Climate Change and Land; Intergovernmental Science-Policy Platform report on Biodiversity and Ecosystem Services (IPBES) Global Assessment Report on Biodiversity and Ecosystem Services; International Resource Panel (IRP) Global Resources Outlook report; UN Environment Global Environment Outlook 6.

resource-efficient, green and competitive low-carbon economy; and to safeguard the Union's citizens from environment-related pressures and risks to health and well-being. There is obvious repetition of EAP priorities in the EGD, this is to contribute to a high level of environmental protection and to an improved quality of life and well-being for citizens.

In conclusion, environmental and socio-economic sustainability are fundamental components of EU policy. These components still need to be more ambitiously mainstreamed in EU policy instruments, under the umbrella of the European Green Deal, to achieve the transformation of our production and consumption systems, and abandon current unsustainable trajectories.

2.2 Commission services concerned

Mainstreaming sustainability policies for bio-based products requires a multi-sectoral approach and therefore the cooperation of several Commission services.

2.2.1 DG Environment

DG Environment is primarily concerned with protecting, preserving and improving the environment for present and future generations, proposing and implementing policies that ensure a high level of environmental protection and preserve the quality of life of EU citizens. Fields of work include natural capital, green economy, health, EU law and global challenges. DG Environment also makes sure that Member States apply EU environmental law correctly within the EU.

Outside the EU boarders, DG Environment promotes environmental protection through multilateral environmental agreements in areas such as global biodiversity, trade in wild plants and animals, trade in illegally harvested timber, the safe handling of chemicals, and waste. It supports the international process for sustainable development and, together with DEVCO, played a key role at the UN Conference on Sustainable Development in Rio de Janeiro in 2012 and in the process leading to the adoption of the 2030 Agenda for Sustainable Development.

2.2.2 DG Clima

DG CLIMA helps the EU to deal with the consequences of climate change and meet its 2020 and 2030 targets. DG Clima also develops and implements the EU Emissions Trading System and leads international negotiations on climate. The EU is the world's largest contributor of climate finance to developing countries and increasingly integrates climate change into its broader development strategy. The EU is scaling up climate finance to help the poorest and most vulnerable countries mitigate and adapt to climate change.

International action on climate change includes the promotion of ambitious global action through the UN Framework Convention on Climate Change (UNFCCC) and other international fora, bilateral relations with non-EU countries, policies and initiatives at EU and international level and finance to support developing countries in their efforts to tackle climate change.

2.2.3 DG GROW

The Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) is responsible for EU policy on the single market, industry, entrepreneurship and small businesses. As such, it is responsible for sectoral and product legislation such as the Construction Products Regulation. It also leads on the

Knowledge Centre for Bioeconomy which ostensibly links the knowledge base with policy-making on the bioeconomy.

2.2.4 DG Trade

The Directorate-General for Trade is responsible for EU policy on trade with countries beyond the EU's borders. This entails leading on trade negotiations and agreements, such as the ongoing EU-Mercosur (with South American countries) agreement, as well as dealings with the World Trade Organisation (WTO).

This DG is particularly relevant for imports and exports of bio-based materials and products and any performance requirements placed on them including on sustainability.

2.2.5 DEVCO and DG NEAR

The Directorate-General for International Cooperation and Development (DG DEVCO) is in charge of development policy in a wider framework of international cooperation, adapting to the evolving needs of partner countries. DG DEVCO plays a leading role in supporting the implementation of the 2030 Agenda of the United Nations and its Sustainable Development Goals (SDGs) in developing countries, and coordinates actions to implement the 2017 European Consensus on Development. DG DEVCO is responsible for formulating the Union's development cooperation policy across the different sectors and financing instruments in order to reduce poverty in the world, to ensure sustainable economic, social and environmental development and to promote and support peace and security, democracy, the rule of law, good governance and the respect of human rights.

Development cooperation action in the EU neighbourhood countries falls under the Directorate-General for Neighbourhood and Enlargement Negotiations (DG NEAR). In the case of the enlargement area, DG NEAR assists countries with a perspective to join the EU in meeting the accession criteria, including alignment to the environmental acquis.

2.2.6 DG RTD

The Directorate-General for Research and Innovation (DG RTD) is responsible for EU policy on research, science and innovation, aiming to help create growth and jobs and tackle our biggest societal challenges. It is the lead DG on bioeconomy, working with key DGs such as Environment and GROW.

2.3 Overview of policies on sustainability assessment

The STAR-ProBio project (STAR-ProBio, 2018) has evaluated how the current EU bioeconomy policy framework consider sustainability aspects. It has found that the current framework consists of policies and strategies that have already established links between private governance approaches and conventional (public) regulation. The elements included in these strategies and policies focus on both the traditional bioeconomy sectors such as food and feed production as well as novel bio-based materials and biochemical sectors (German Bioeconomy Council,2018a; Meyer, 2017)). The more sustainable use of resources seems to be one of the most important elements across the existing strategies (Imbert et al., 2017).

An inventory of bioeconomy policy documents on EU and EU member state levels relevant to sustainability was conducted applying desktop research, and major sustainability risk perceptions in the BE sectors were identified. The selected policy

and strategy documents, which were found relevant for further analysis based on the defined criteria for selection, are given in Table 4 in Annex. They took effect between 2001 and 2018. For a better overview, the selection was separated according to the strength of their commitment. Thus, 32 (64% of the sample) strategies, roadmaps, action plans, guidance and documents referred to as "report" were compiled in Table 4 in Annex. As a second group, 18 documents (36% of the sample) considered to have a more binding character were categorized as policies, ordinances, regulations, directives and decisions (Table 5 in Annex). Twenty-two of the documents were EU documents valid in all member states. As well, this selection included national documents from 14 different EU member states.

The inventory exemplifies the focus on sustainability while distinguishing between the three sustainability dimensions. Main findings from this inventory are:

- Existing policy frameworks of the bioeconomy are partly fragmented and have been developed independently for the different sectors, such as agriculture, forestry, food and feed production, building materials, chemicals, consumer goods and pharmaceuticals as well as energy.
- Specific targets and goals are included in 72% of the analysed bioeconomy policy documents, but only 50% are quantifiable.
- Sustainability requirements have been identified in 56% of the policy documents.
- Most important sustainability risk perceptions matched with requirements in policy documents, but requirements were mostly stated in a noncommittal way.
- The influence of the policy frameworks on the industry was found to be rather low.
- Identification of major sustainability risks revealed that in the biomass production stage, mostly environmental risks are most relevant.
- A comprehensive consideration of environmental, economic and social aspects has only been found for 12 of the 50 documents.
- A "hot spot sector" with accumulated sustainability risk perceptions or a tendency to higher risk levels was not identified.
- Most sustainability requirements are worded ambiguously. The strictest requirements were found in the RED.

2.4 Recommendations for better mainstreaming

The in-depth analysis of a sample of the policies listed in the inventory revealed that sustainability requirements for bio-based materials and bio-based products in policy documents and the perceived sustainability risks are largely overlapping. However, a qualitative analysis of the context in which the requirements are embedded, showed overall low concreteness and vague wording of the requirements. Recommendations for future policy making are:

- Coherence among the sustainability criteria included in the various bioeconomy frameworks should be increased.

- Groundwork developed by non-governmental governance approaches should be picked up by policy makers for more harmonized terminologies of sustainability requirements, bioeconomy definitions, etc.
- Monitoring approaches should take policy targets, sustainability requirements and sustainability risks into account and should adjust them in a dynamic way.

In relation to the potential for co-regulation, STAR-ProBio research also found that over the past decades, private actors, such as NGOs and companies, have increasingly become involved in regulation activities (Abbott, 2008). There are some examples of existing links between the public governmental policy frameworks and activities organized by private stakeholders: An example for the use of a co-regulation instrument in the EU is the use of sustainability certification schemes for the implementation of the RED sustainability criteria. Several sustainability certification schemes have been recognized by the European Commission and have been applied over the last decade (European Commission, 2019).

Another example for synergies between private governance and policies is the uptake of established voluntary sustainability schemes as basis for requirements in policy documents. This has been the case with the sustainable forest certification schemes FSC and PEFC, which were accepted, for instance, by the German government as a mandatory public procurement requirement. Certification schemes, for instance, can be used to close gaps in the legal frameworks of jurisdictions. In this regard, the concept of co-regulation means that countries define legislative sustainability obligations for supply chains of a certain economic sector and allow private control mechanisms (e.g. certifications) for demonstration of compliance (Ugarte, 2015). Other private governance approaches have evolved and have been widely applied (Majer et al., 2018) and their application have been expanding during the last decade (Thrän et al., 2018).

From these considerations, the question of how basic biomass cultivation criteria should be governed, still remains. Since 2009, sustainability criteria for liquid biofuels in the EU are governed in a co-regulative way, meaning that compliance with the criteria is verified by private organizations within the framework of voluntary schemes recognized by the European Commission. This governance method has been proven to work and will be continued during the RED II validity period 2021-2030 (European Commission, 2018b).

3 Co-regulation as policy option

The challenge in policy design is to ensure that regulations are effective and efficient: effective in the sense that they resolve the problem they were introduced to address; and efficient in the sense that they minimise both the direct compliance costs borne by those subject to the regulation, and other, often more indirect, costs which may be imposed on the society.

EU and member state's legislation offers limited possibilities to regulate sustainability aspects of bio-based products in the EU market. It is often difficult judge adherence to sustainability criteria based on the product itself. Environmental and socio-economic sustainability criteria are especially relevant for international supply chains. Very often, these supply chains include materials or intermediate products that originate outside the EU where EU and member state regulations do not apply. In such cases, demonstration of compliance with sustainability criteria is very much dependent on information provided by either the importer or the exporter. Such approach has been successful in some cases (for instance the Montreal protocol to phase out CFK's,) but proves to be a very slow and difficult process in case of greenhouse gas emissions.

There is an alternative: Co-regulation. Co-regulation makes use of public regulation and private mechanisms that can freely operate internationally (such as many certification schemes).

3.1 Definition and main characteristics

Co-regulation was defined by the inter-institutional agreement "Better Law-making" (European Commission, 2003) concluded on 16 December 2003 between the Parliament, the Council and the Commission, as "the mechanism whereby a Community legislative act entrusts the attainment of the objectives defined by the legislative authority to parties which are recognised in the field (such as economic operators, the social partners, non-governmental organisations, or associations). This mechanism may be used on the basis of criteria defined in the legislative act so as to enable the legislation to be adapted to the problems and sectors concerned, to reduce the legislative burden by concentrating on essential aspects and to draw on the experience of the parties concerned".

Co-regulation builds upon the combined strengths of two types of policy instruments: public regulation and private mechanisms, such as certification schemes. Strengths of public regulation include democratic legitimacy and enforceability within its jurisdiction. Weaknesses include the lack of flexibility to quickly adapt to evolving situations, and no applicability outside its jurisdiction. On the other hand, private mechanisms are often more flexible, close to relevant developments in the market and more innovative in nature; they may have an international focus and most of times, it can be applied internationally. The combination of both types of instruments has the potential to use the strength of both instruments and their stand-alone capabilities towards a common policy objective. While the idea might sound simple, the implementation of co-regulation is complex and carries many technical and political aspects:

- What are the minimum sustainability criteria expected to be required?

- What does it mean for the functioning, modification and competition of private mechanisms (certification schemes)?
- What capacities are needed at administrative level to develop, implement and maintain the co-regulation framework?

3.2 Use of certification schemes and standards in co-regulation

European Committees participated by certification schemes and national standardization bodies have drawn thousands of technical standards in consensus with stakeholders representing different interests (producers, sellers, users, consumers, test laboratories, public authorities, research institutions, etc.).

Most of these standards are voluntarily adopted by the parties concerned in a practice called 'self-regulation'. Companies practicing self-regulation accept responsibility for the social and environmental impact of their activities. This positively influences how the company interacts with suppliers, workers, consumers and society in general. Voluntarily adopted standards provide a point of leverage on corporate behaviour and open them to criticism if they fail to implement the standard. And in the case of sustainability standards, they cover environmental and social aspects, going beyond what is produced to look at how it is produced. This feature makes it more difficult for companies to externalize costs, whether social or environmental, widening the concept of their responsibility in relation to environmental and socio-economic sustainability of their products. Voluntary certification and standards are already in use in many sectors such as agriculture, forestry, fisheries, food, textiles, carbon and water. They are also emerging in a range of other sectors such as mining and minerals and could have long-term implications for the way economic activity is viewed. However, in the absence of independent monitoring, it is difficult to know whether a company is abiding by the terms of such standard.

Other certification schemes and standards have been adopted or their development supported by EU legislation in co-regulative frameworks. Those have been standards that help harmonizing essential requirements of regulation, mainly linked to considerations of safety, health, the environment and consumer protection. co-regulation entails explicit government involvement. It is the degree of government involvement and legislative backing that determines the difference between self-regulation and co-regulation.

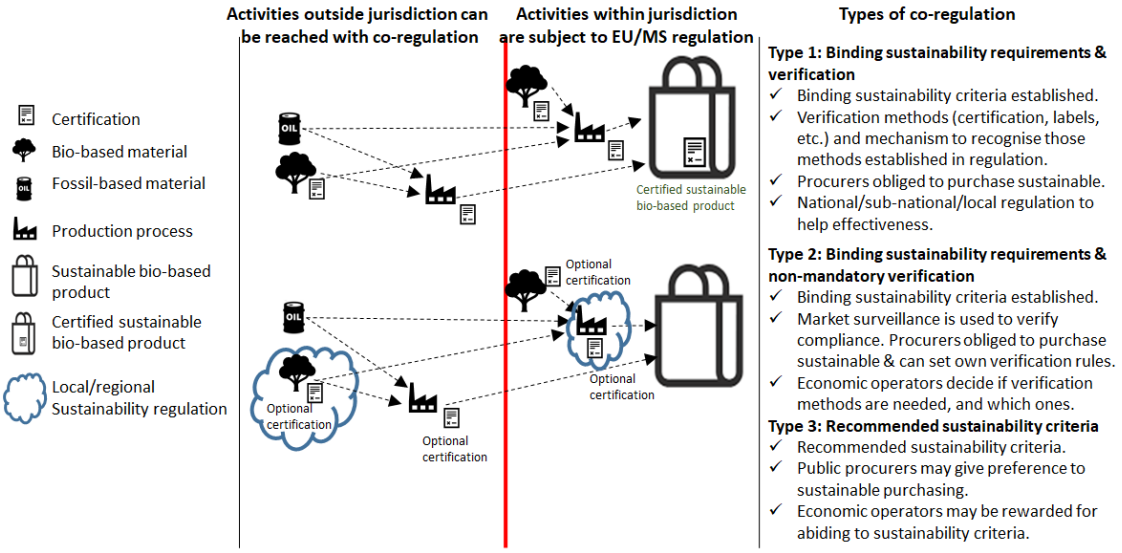
Co-regulation usually involves the industry or professions developing and administering its own rules but with government providing legislative backing to enable the arrangements to be enforced. It also requires that those subject to the instrument have appropriate training and instruction relating to their obligations and how the instrument is administered.

3.3 Proposed co-regulation frameworks

Broadly speaking, at least three types of co-regulation approaches for bio-based products can be recommended (see Figure 1):

1. Binding sustainability criteria and verification.
2. Binding sustainability requirements and non-required verification.
3. Recommended sustainability requirements.

Figure 1: Proposed types of co-regulation for sustainable bio-based products



3.3.1 Type 1. Binding sustainability requirements and verification

EU regulation establishes a set of minimum binding sustainability requirements for bio-based products legally recognised as "sustainable". The verification of such requirements by a third independent party using a private mechanism such as officially recognised certification or labelling is required to demonstrate compliance. Only compliant sustainable bio-based products are eligible to any public economic and financial incentives. Non-compliant products are not barred from EU markets, but cannot be referred as "sustainable" and cannot receive public incentives or public financial support of any kind.

A mechanism for the official recognition of verification methods (certification schemes, standards, official labels) and authorised verification bodies must be established. Transparency to inform about non-compliant bio-based products is needed.

Public procurers are obliged to purchase only sustainable bio-based products verified by one of the recognised verification methods.

National, sub, national and local sustainability regulation, within or outside EU territory, may contribute to strengthen the effectiveness of the whole system.

3.3.2 Type 2. Binding sustainability requirements and non-required verification

EU regulation establishes a set of minimum sustainability requirements for bio-based products. Verification by a third independent party is not required. Instead, market surveillance techniques are used to verify compliance. Economic operators may freely decide to use or not any verification method (certification schemes, standards, labels) to strengthen its activities.

Public procurers are obliged to purchase only sustainable bio-based products and can set their own rules or requirements to verify compliance. Transparency to inform about non-compliant bio-based products is needed. Economic operators that are found breaching sustainability requirements may be subject to sanctions.

3.3.3 Type 3. Recommended sustainability requirements

EU policies promote observance of a recommended sustainability framework for bio-based products. No market surveillance is put in place and verification by third independent party is not required. Economic operators are free to decide the use any verification methods (certification schemes, standards, labels).

Public procurers may have authority to give preference to sustainable bio-based products in their purchases. Economic operators observing the recommended sustainability framework may be subject to recognition and reward in a transparent way.

4 Proposal for including sustainability assessment tools in an overarching EU co-regulation framework

4.1 Objective

The new Circular Economy Action Plan (CEAP) identifies that public authorities have considerable purchasing power – 14% of EU GDP or around €2 trillion per year) which can be better exploited through minimum sustainability requirements and targets for public procurements in key sectors. Mandatory reporting on Green Public Procurement (GPP) is also to be phased in.

The development of sustainability requirements relating to bio-based aspects of materials and products would mean that large scale procurers – public and private procurers and buyers – will more easily be able to integrate these requirements as a minimum into their purchasing decisions.

This chapter sets guidelines for developing an overarching co-regulation framework using sustainability assessment tools for bio-based materials and products for selected sectors in the bioeconomy. Those sustainability assessment tools refer to standards, labels and certification schemes, including the SAT-ProBio tools (STAR-ProBio, 2020). All referred sustainability assessment tools can set sustainability requirements for different bio-based materials and products, and related verification methods. Such an overarching co-regulation framework for the sustainability of bio-based materials and products would contribute to give the needed push to public procurers to purchase bio-based products and materials that claim meeting those sustainability requirements. Ideally, such larger scale shifts in consumption behaviour will result in similarly larger scale shifts in private procurement (corporate purchasing and product design and requirements) and have the final effect of disruptive transformation of product design, production processes, material selection and sourcing, and user behaviour.

4.2 Relevant sectors and products covered

The EU's updated Bioeconomy Strategy (European Commission, 2018a) is meant to contribute to higher level EU objectives of achieving a resource-efficient and sustainable economy. Such an economy is meant to reconcile various demands: for sustainable agriculture and fisheries, food security, and the sustainable use of renewable biological resources for industrial purposes. It is meant to do this while ensuring biodiversity and environmental protection.

The Bioeconomy Strategy focuses on three key aspects:

- Developing new technologies and processes for the bioeconomy.
- Developing markets and competitiveness in bioeconomy sectors
- Pushing policymakers and stakeholders to work more closely together.[2]

[2] See https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy, accessed on 5 February 2020.

Its development and delivery is also meant to contribute to ensuring a coherent approach to the bioeconomy across several EU programmes and instruments such as the Common Agricultural Policy, the Common Fisheries Policy, Horizon 2020, European environmental initiatives such as energy and climate targets and the Circular Economy (and its Action Plan), the Blue Growth initiative for the marine sector and the European Innovation Partnership on Sustainable Agriculture.

The Strategy features a list of relevant strategies and policies relevant to the sectors supplying and using biomass, along with overarching or cross-butting strategies and policies. The strategies and policies relevant to "sectors" identified as the main users of biomass are organised according to food and nutrition security; energy; and bio-based industries.

In this report we focus on the bio-based industries as STAR-ProBio has not addressed bio-based products for energy and we exclude food and nutrition as this does not imply a transformation of bio-based products for its material use.

Turning to bio-based industries the Strategy identifies the potential to provide environmental benefits to the "defossilisation" of major industries such as the chemical industry (e.g. plastics) and the construction sector (non-renewable materials such as steel and concrete being replaced by wood and its composites). Both of these sectors use considerable amounts of resources and the Strategy recognises the lack of data preventing the assessment of the impacts of the bioeconomy. Specifically: "…information is still scarce on how much biomass is available and can be mobilised sustainably, how much is being used and for which purposes, and how the increased pressure on natural resources can be reconciled with environmental, economic and social sustainability in Europe and globally." (European Commission, 2018a, p.32).

For the **chemical and petrochemical industries**, biomass is used as a raw material and the sectors are already interested in replacing fossil-based materials with bio-based ones as part of its decarbonisation aims. A 2015 estimate by the European Chemical Industry Federation (CEFIC) on organic raw material use in the sector is 77.7 megatonnes, with 10% of this (7.8 megatonnes) being of renewable origin. Materials used were carbohydrates (sugar and starch), vegetable oils, natural rubber and bioethanol, as well as animal fats, chemical pulp, tall oil and glycerol (European Commission 2018a, p.44).

The **construction sector**'s potential for replacing of energy-intensive, non-renewable materials (such as cement and concrete) with wood has already been identified as a major source of greenhouse gas emissions reduction.

Other identified sectors for the use of bio-based products, are those issuing from the circular use of materials through processing of side-streams, residues and wastes include bio-textiles, bio-polymers, chemicals and bio-plastics. If the chemical and petrochemical industries (including plastics) and the construction sector are excluded from this list – since they are addressed specifically above – then this leaves just **bio-textiles** as another potential sector.

Furniture and packaging, particularly in relation to local supply through the forestry sector, and **cosmetics and textiles**, in relation to use of marine bio-based products, are also identified as potential sectors.

In summary, the sectors identified by the Bioeconomy Strategy as relevant for the "defossilisation" of the economy, and that should be the minimum covered by the proposed co-regulation framework, are:

- Construction.
- Chemicals.
- Plastics.
- Textiles.
- Furniture.
- Packaging.
- Cosmetics.

4.3 Target policy instruments and options for implementation

In relation to bio-based products, it is the European Green Deal (EGD, European Commission, 2019b) the most likely policy that can drive change. The EGD includes a section on "Preserving and restoring ecosystems and biodiversity" where it outlines intended EU actions such as a Biodiversity Strategy, a Farm to Fork Strategy and a new Forest Strategy. The EGD builds up on work already done on the European Ecolabel, green public procurement, standards and the Product and Organisation Environmental Footprints.

Bioeconomy in the EGD features particularly in relation to products, and focuses on availability of reliable and comparable environmental performance information. It also focuses on the development of new sustainable biorefineries. So, in terms of identification of products to be addressed, the EGD has a narrow focus purely on chemicals and plastics replacement through biorefineries. Because of this narrow focus, an overarching co-regulation framework should instead adopt the longer list of sectors and products identified in the Updated Bioeconomy Strategy.

Looking at potential horizontal mechanisms capable of addressing or being applied to several products, the European Green Deal already anticipates a new Circular Economy Action Plan (CEAP) which is meant to address resource-intensive sectors such as textiles, construction, electronics and plastics. The new (CEAP) features two relevant policy instruments for the implementation of the proposed co-regulation framework:

- A Sustainable Product Framework initiative to ensure that products are designed for sustainability and circularity and for reduced environmental and social impacts throughout their lifecycle.
- A mandatory product related information legislative proposal.

4.3.1 EU Sustainable Product Framework Initiative

This initiative will target priority products with high impact. Those targeted priorities include construction and textiles products. The initiative is also meant to support the EU's Biodiversity Strategy objective of significantly reducing the negative impacts of production and consumption patterns on biodiversity through the inclusion of biodiversity aspects. The co-regulation framework addressing sustainability aspects of bio-based products could be established within this initiative.

The Framework initiative is to set minimum requirements that prevent unsustainable products from being allowed on EU markets. It will be supported by other tools such as clear overarching principles to guide policymaking for products, a European

Circular Dataspace bringing data sets and databases together, and electronic passports for the collection of and easier access to various aspects of product information.

To date, descriptions of product aspects to be addressed build upon existing efforts under the Ecodesign Directive. Through "material efficiency" efforts in relation to energy-using products, product requirements address durability and repairability. Although relevant to bio-based materials and products, these aspects can be considered relevant to a wide range of products regardless of whether or not they are made partly or wholly of bio-based materials.

Therefore, the sustainability standards and certification schemes could easily be integrated into the EU Sustainable Product Framework Initiative particularly given overlapping objectives and functionality. Compliance with future Initiative product requirements relating to bio-based materials or products could be proven through those sustainability standards and certification schemes, including the SAT-ProBio tools (STAR-ProBio, 2020).

4.3.2 Mandatory product information provision

The CEAP also includes the description of a mandatory product related information legislative proposal, under the heading of "Empowering consumers and public buyers". Such consumer information is to be clear, correct and relevant, and the intention is to require companies to substantiate their claims on environmental performance using Product and Organisation Environmental Footprint[3] (PEF/OEF) methods.

As with the Sustainable Products Framework initiative, biodiversity is to be addressed in relation to information collection and communication by better integration of biodiversity aspects into the PEF and OEF methods.

Sustainability standards, labels and certification schemes, including the SAT-ProBio tools (STAR-ProBio, 2020) could potentially satisfy a number of these aims and objectives.

4.4 Options for implementation

The co-regulation framework addressing sustainability aspects of bio-based products could be established within the EU Sustainable Product Framework Initiative. Regardless of the final design, the different policy tools contributing to the objectives of the targeted framework can establish mandatory or voluntary sustainability requirements as identified in section 3.3.

Below we consider several options from the perspective of mandatory or voluntary requirements.

[3] The European Commission's programme on Product and Organisation Environmental Footprint stems from its 2008 Sustainable Consumption and Production Action Plan and develops a harmonised methodology for the calculation of the environmental footprint of products and organisations including carbon. See https://ec.europa.eu/environment/eussd/smgp/policy_footprint.htm, accessed on 11 February 2020.

4.4.1 Sustainability criteria – binding or voluntary?

Various EU policy tools exist that feature mandatory or voluntary sustainability criteria, and these can provide evidence of effectiveness of performance against political objectives.

Mandatory sustainability criteria

The nature of the reasons for biodiversity loss and the unsustainable use of biological resources is to be at least partially addressed by the Sustainable Product Framework initiative which will include mandatory sustainability criteria. Legally-based sustainability criteria are essential to achieve a level playing field across companies within a sector and between sectors: everyone is required to meet criteria if they are to respect the rules of the game. They are also required to ensure that the criteria apply regardless of the provenance of the bio-based materials – whether from European Union member state sources or beyond. However, it is not yet clear what form the product legislation will take, nor the specific criteria or how bio-based elements will be addressed.

Mandatory sustainability criteria are most likely to provide the most effective legal framework to ensure sustainability of bio-based materials production and use since the sustainability criteria is based in a legal framework. This does not necessarily lead to respect of the requirements, as we shall see in the section on verification, but it provides the strongest governance support to require market actors to comply with the requirements and for that compliance to be verified – the legal basis provides the strongest type of incentive to play the rules of the game and to check that those rules are being respected.

The EU Timber Regulation aims to ensure that timber and timber-related products on the European market are legal (WWF, 2019). In doing so, the Regulation, which entered into force in 2013:

- Prohibits the placing on the EU market of illegally harvested timber and timber products.
- Requires EU traders to exercise 'due diligence'.
- Facilitates the traceability of timber products by requiring economic operators in the wood supply chain to keep records of their suppliers and customers.

In certain sectors like forestry, the risk of illegal practice is high, while the environmental or social impacts of such illegal practice is massive (high climate and ecosystems impacts of cutting down forest or non-respect of land use rights). In such cases, it makes sense to make sure that economic operators in a value chain manage these risks responsibly by choosing credible suppliers: this is what is understood as 'due diligence'. Although the implementation of due diligence requirement is slightly different from the implementation of sustainability requirements, the EUTR often translates in proving risk management through the implementation of certified best practices (NEPcon, 2020).

The Ecodesign Directive (European Union, 2009) provides another good example of mandatory criteria which it sets on "energy-related products" from fridges and dishwashers to taps and showers and game consoles to help meet the EU target of 20% energy efficiency by 2020. Specific legislation is developed per product group setting out energy efficiency performance requirements. These requirements have been recently extended to include "material efficiency" aspects such as durability, repairability, and access to spare parts. These product requirements are to be met in order for a product to be placed on the EU market, and technical documentation is to

be provided to national market surveillance authorities for verification (see analysis in the verification section below).

The Restriction of Hazardous Substances Directive (European Union, 2003) applies since 2003 to electrical and electronic equipment (EEE), requiring that several hazardous substances be substituted by safer alternatives. Linked to the WEEE Directive, it includes provisions for the creation of collection schemes for the public to return e-waste rather than disposing of it in their household rubbish container. Specific electronics cannot be placed on the market if they contain more than a limited percentage of the specific hazardous substances, unless that use is part of an agreed exemption.

Voluntary sustainability criteria

Several existing EU policy tools have voluntary sustainability criteria, and here we will focus on EU Green Public Procurement (GPP), the European Ecolabel, an option in the Ecodesign Directive, and the Renewable Energy Directive.

The Renewable Energy Directive explicitly lists sustainability criteria for biofuels and bioliquid: currently, these are prohibition to produce biomass for biofuels and bioliquids on high carbon stock land and high biodiversity areas, and a min. 50% GHG reduction target compared to their fossil counterpart. The revised RED widened the sustainability requirements, adding the need to prove that low ILUC risk practices were observed if high ILUC risk feedstocks were used and tightening the GHG reduction criteria for new production facilities. Formally, the sustainability criteria laid down in the Renewable Energy Directive are voluntary: biofuels manufacturers placing products on the EU market can choose to comply with the criteria or not. However, if they do not comply with the sustainability criteria, Member States cannot claim these biofuels as contributing towards their mandatory national Renewable Energy Sources Targets. In order to achieve their national targets, EU Member States can freely choose their strategy. In practice, national strategies widely rely on fiscal and financial incentives and other carbon taxes that are binding to the voluntary sustainability criteria established by the RED. The RED has been an extremely powerful instrument to push the demand for biofuels and bioliquid complying with the sustainability requirements listed in EU law: in 2013 already, a total of 86.5% of the EU's biofuel consumption was certified (CE Delft, 2015) and over 99% in 2017 (EU Observer, 2019). For the specific case of the EU RED, voluntary sustainability criteria have been as effective as if they would have been mandatory.

Another type of voluntary sustainability criteria example is found in the EU GPP and Ecolabel Frameworks. EU GPP criteria are developed to help facilitate public authority integration of criteria in their procurement processes and to harmonise approaches taken if this is desired. The Ecolabel develops mandatory criteria to be met by organisations applying for the voluntary label, so the criteria remain voluntary for anyone wishing to place a product on the market.

GPP criteria have been developed to date for 20 product groups including furniture. The GPP approach is to develop two types of criteria: core criteria addressing key environmental impacts and suitable for use by any authority; and comprehensive criteria that address key environmental impacts that might require additional verification.

A brief look at the furniture background document and criteria document show that the background document addresses chemicals aspects such as formaldehyde emissions, coating formulation restrictions and REACH Candidate List substance reporting (substances of very high concern), and design and durability such as

durable upholstery coverings, design for disassembly and repair, product warranty and spare parts, and extended warranty periods. Other proposed criteria, but not included in the recommended criteria for EU GPP are **sourcing of sustainable timber for furniture production**, recycled plastic content and minimum **durability** requirements (European Union, 2017a).

Contrary to the RED, the idea behind the sustainability criteria set by the EU Ecolabel is to identify the 10-15% best performers in a product category: it is meant to be a policy instrument flagging very good environmental performance, and driving the demand accordingly. The RED sustainability criteria are mainstream enough to work as a supply harmonisation instrument: with over 99% of biofuels on the EU market complying with the sustainability criteria, the latter cannot be used to distinguish best performers (Sattman 2018).

Despite an indicative (non-binding) target of achieving 50% GPP by 2010, a 2012 study on monitoring and uptake of GPP in the EU showed that around half of that target had been achieved (26% of the last contracts signed included all EU core GPP criteria) (European Union, 2012). As a product group with a high bio-based material use potential, furniture was identified as one of four product groups for which GPP performance was "significantly" lagging behind, at below 20% uptake.

Interestingly, after more than a decade of discussion on making GPP mandatory, the European Commission looks set to take that decision: the new Circular Economy Action Plan proposes minimum mandatory green criteria and targets for public procurements in key sectors, and mandatory reporting on GPP will be phased in.

The Ecodesign Directive also merits some attention here because of the inclusion in the legislative approach and text of the possibility of industry choosing to develop **voluntary agreements** in place of mandatory product regulations. This option was included because it was thought that self-regulation may achieve Ecodesign policy objectives more quickly or more cheaply. The agreements need to fulfil specific criteria of the Ecodesign Directive (Annex VIII) which include openness of participation, added value, representativeness, quantified and staged objectives, involvement of civil society, monitoring and reporting, cost-effectiveness of administering a self-regulatory initiative, sustainability and incentive compatibility (European Union, 2009) but their use has so far been limited to games consoles and imaging equipment (printers) (The Policy Partners, 2017).

4.4.2 Verification – 1st party or 3rd party? Mandatory or voluntary?

The legal basis of the majority of EU product-based legislation is the one so-called "New Approach".

The New Approach, despite its name, is not new. It dates back to 1985 and is a single market concept that streamlines technical harmonisation and standardisation according to product requirements in product-based legislation such as toys, cars, electronics, and cosmetics (for example, which could be partly or wholly made with bio-based materials). The Approach is designed in such a way that the product-specific legislation sets out product "essential requirements" that are harmonised at EU level (as the legislation is a Directive, Member States can transpose the legislative elements as it sees best, but the "essential requirements" must be done in an EU harmonised way). The product technical specifications to meet the "essential requirements" are prepared through harmonised EU standards. A manufacturer of the product in question can then choose whether the ensure conformity with the "essential requirements" by using these harmonised standards or other standards or tools. The CE mark placed on the product by the manufacturer therefore serves as a

"presumption of conformity" with the relevant "essential requirements". Prior to this system, third-party assessment was needed to prove conformity, but this was proving too heavy a system to maintain within an increasingly single market situation (European Commission, 2000).

The "New Approach" to product legislation hence allows an easier creation of an internal market by placing responsibility for compliance with essential requirements on an economic actor placing a product on the market.

The New Approach is supported by the "Global Approach" to certification and testing as a means of showing conformity assessment or verification. Taking a modular approach, conformity assessment types differ according to the stage of development of the product, the type of assessment involved (e.g. document-based checks, quality assurance), and the assessor (first, second or third party). The list of potential conformity assessment approaches are: manufacturers' internal design and production control activities; third party type examination combined with manufacturers' internal production control activities; third party type or design examination combined with third party approval of product or production quality assurance systems, or third party product verification; third party unit verification of design and production; or third party approval of full quality assurance systems. So, the EU can choose from a number of verification systems, as considered appropriate.

Who verifies?

An economic operator placing a product on the market and providing proof of conformity (or making that information available if it is requested) is considered first-party verification. Third party verification is when a separate, independent body verifies the economic operator's conformity.

The New Approach-based policy tools rely on first party verification (also referred to as self-declaration) which is backed up by national market surveillance authority (MSA) verification. We consider MSA in more detail below.

Third party verification systems are used in existing EU policy tools, from the European Ecolabel and the Timber Regulation to RED II.

Mandatory verification

Mandatory verification can take various forms, from the Renewable Energy Directive use of recognised certification to the Timber Regulation integration of independent certification schemes as evidence of due diligence exercised by economic operators.

This scenario is most likely to provide the most effective legal framework to ensure sustainability of bio-based materials production and use since the sustainability criteria and evidence of their compliance by market actors is based in a legal framework. This does not necessarily lead to respect of the requirements, as we shall soon see, but it provides the strongest governance support to allow market actors to comply with the requirements and for that compliance to be verified – the legal basis provides the strongest type of incentive to play the rules of the game and to check that those rules are being respected.

Placing requirements and verification at the product level (in addition to activities further 'upstream' such as biological resource management and bio-based materials production) brings governance to the national level, where compliance checks are in theory more aligned with other market governance infrastructure such as environmental permits, taxation, etc. This facilitates the integration of these requirements into other governance measures.

These offer opportunities to learn from existing legislation and implementation frameworks to ensure that effective regulatory decision-making is backed up by high market compliance. Such a scenario would be most interesting for bio-based materials and products having a high risk of land use change, of negative impacts to local communities (from land-grabbing, illegal activity on local lands, forced displacement, etc.) and resulting from illegal logging.

Voluntary verification and market surveillance

The New Approach aims at developing the EU Single Market. As such, in order to facilitate placing on the EU market of products and their trading, manufacturers self-declare that their products are complying with all applicable legislation. Products traded are policed by national market surveillance authorities. As has been shown in the market surveillance activities for electronics, compliance with legal requirements remains a weakness in the system. A Horizon 2020 Energy Efficient Product market surveillance compliance project (Eepliant, 2017) analysed several products that are regulated by both the Ecodesign Directive (for energy efficiency in the use phase) and the Energy Label (an A-G rating system of energy efficiency, and a public communication tool).

Market surveillance authorities (MSAs) are meant to verify compliance of regulated products, yet for the two products having product requirements in the form of regulations – heaters and light emitting diodes (LEDs) – compliance was extremely low. Over 50% of LEDs tested were non-compliant for packaging information as well as technical documentation, and only 14% were fully compliant. For heaters, 100% of the technical files examined were non-compliant although all the products tested were compliant with Ecodesign requirements within the tolerances permitted. Not all the tested heaters complied with energy labelling requirements.

The European Commission, in a 2019 memo explaining new Energy Labels for some products (European Commission, 2019c), identified an estimate of 10-25% of products on the market not being fully compliant with energy efficiency labelling regulations, leading to a potential energy savings loss of 10% specifically due to non-compliance.

The 2017 EU Energy Label Regulation (European Union, 2017b) also introduced a product registration database (EPREL) where products need to be registered by manufacturers and importers, providing detailed technical documentation required for compliance control activity. This is a means of streamlining market control activity and assisting in more efficient and effective market surveillance.

A 2020 European Court of Auditors report on Ecodesign and Energy Labelling (European Court of Auditors, 2020) highlighted reduced contribution to energy efficiency due to non-compliance by manufacturers and retailers (alongside significant delays in the regulatory process). Recommendations included various means of facilitating MSA cooperation to help address the issue of non-compliance.

Another report on market surveillance presents results of product testing across numerous national MSAs (Prosafe, 2019). Several MSAs tested different products in the same categories, with the following results on non-conformity levels of tested products: 88% of baby carriers and 87% of cots, 58% of electric toys, 58% of electrical hair care products, and 14% of impact drills. Some of these are due to unclear standards wording, but the figures remain surprising.

Assessing the performance of such "presumption of conformity" through non-mandatory verification is not easy, but the EU's Rapid Alert System for Non-Food Consumer Products (RAPEX) can help provide some insights. RAPEX allows the quick

exchange of information between EU and EEA Member States and the European Commission (and now the UK as well) about products that pose a risk to the European public's health and safety. It is linked to the EU's General Product Safety Directive (GPSD) which is a New Approach Directive that addresses different health and safety issues. Based on the CE marking "presumption of conformity" the GPSD requires that a manufacturer or distributor must inform the relevant competent national contact if it discovered that one of its products on sale is dangerous. National market surveillance authorities are also charged with checking the safety of products on the market, applying sanctions when necessary, and taking appropriate measures such as product recalls or ordering the withdrawal of a product from the market. These are often the same market surveillance authorities as those for the Ecodesign and Energy labelling products mentioned in the previous section.

According to the 2018 RAPEX Annual Report (European Union, 2019), there were 2254 alerts in the year and the most notified products were toys (31%); motor vehicles (19%); clothing, textiles and fashion items (10%); electrical appliances and equipment (8%), and cosmetics (7%). Despite toys being produced for children, considered 'vulnerable groups', the highest risks in the notified toy products were for high levels of chemicals, as well as choking potential. Motor vehicle risks were injuries due to defective parts. However, 2254 alerts in a year is very low considering the millions of products on the EU market, but this does not represent only those products not respecting EU legislation requirements. Rather it most likely reflects the self-regulation of manufacturers and importers needing to inform national market surveillance authorities of identified risks, coupled with the under-resourcing of these surveillance authorities and the minimal percentages of testing of products compared to the total amount on the market.

According to European Parliament magazine: "Too many Member States are turning a blind eye to the import of unsafe products into Europe - favouring profit over the protection of European consumers. The failure of market surveillance in Europe, along with Member States' inability to properly enforce safety legislation specifically designed to protect their citizens, is a scandal." (Parliament Magazine, 2019)

Given the low level of compliance of many products and the similarly low level of product testing and control by national market surveillance authorities, a non-mandatory verification option might be considered for bio-based materials and products with low risk levels of environmental and social impacts and which are legislated through existing policies such as waste management. Such bio-based materials and products could be those derived from recycling processes (such as from construction and demolition and household waste).

4.4.3 Institutional organisation

Given the multi-issue aspects of the European Green Deal's and the Circular Economy Action Plan's objectives and priority areas, the options for implementation above appear best served by DG Environment leadership and oversight. Given the systemic approaches needed to ecological emergencies in order to build (stronger) synergies, and the strong links needed to economic and market transformation, there is an obvious need for close collaboration with other DGs particularly CLIMA, ENER and GROW. TRADE is also crucially important for sustainable sourcing, and the need for policy coherence.

4.5 STAR-ProBio sustainability tools

A significant number of well-developed and relevant sustainability assessment standards and certification schemes exists within the different sectors of the bioeconomy. Several of these standards and certification schemes could be recognised by the proposed co-regulation framework. However, there is a number of potential gaps regarding sustainability principles, criteria and indicators within these schemes. And that makes difficult to suggest specific tools.

Instead of specific recommendations, the STAR-ProBio project proposes that the targeted policy instruments adopting co-regulation recognise the **SAT-ProBio tools** (STAR-ProBio, 2020) for determining the most adequate standards and certification schemes for each bioeconomy sector.

The overarching goal of the SAT-ProBio framework is to support industrial, political and R&D stakeholders of the bioeconomy in sustainability assessment and certification of bio-based products. Specifically, the SAT-ProBio framework provides:

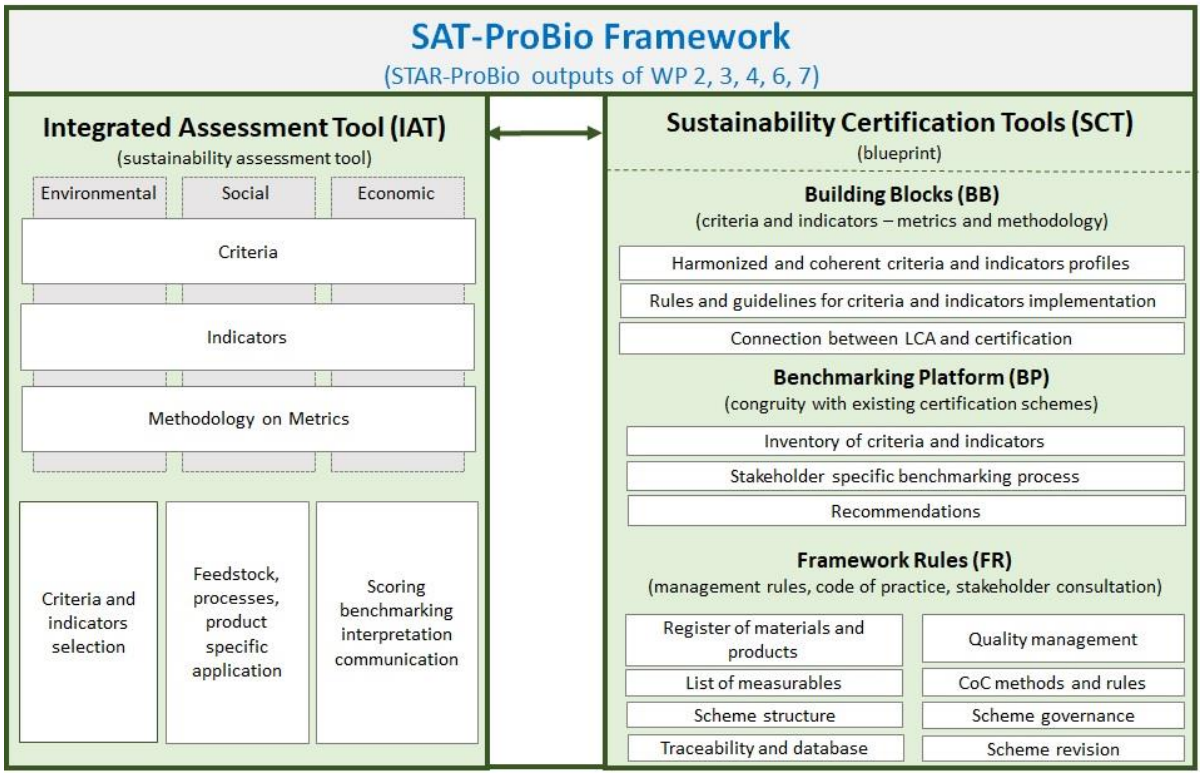
- A methodology and guidance for companies to assess sustainability aspects of bio-based products and services throughout the entire life-cycle, based on STAR-ProBio criteria and indicators [4], demonstrated in a specific case study.
- The benchmarking platform for identification of a common denominator between existing sustainability certification schemes; it shall give information about mutually agreed certification schemes and their products, provide service to stakeholders of the bioeconomy and shall ensure a long-term communication amongst stakeholders, facilitating future developments of existing frameworks and schemes.
- A set of harmonized factsheets presenting the STAR-ProBio criteria and indicators together with description and methodologies for quantification.
- A guidance through a set of rules for the management of the bio-based product certification solution; they include the selection of system boundaries, the allocation rules of by-products, the selection rules of relevant criteria and indicators, the collection of representative actual data for the assessment and other important aspects to trace and document sustainability along life cycle supply chain.

The SAT-ProBio framework is composed of two self-contained smart tools to be used as an integrated framework or separately, in application to a specific area of sustainability (Figure 2):

- Integrated Assessment Tool.
- Sustainability Certification Tool.

[4] STAR-Probio criteria and indicators were developed by technical work packages of STAR-ProBio project: WP 2 (upstream LCA), WP3 (downstream LCA), WP4 (techno-economic), WP6 (social), WP7 (land use); available in deliverables: www.star-probio.eu

Figure 2: The smart tools of SAT-ProBio framework



4.5.1 Integrated Assessment Tool (IAT)

The Integrated Assessment Tool provides a methodology for companies to both qualitatively and quantitatively assess environmental, social, economic, circularity and ILUC aspects of sustainability of bio-based products and services throughout the entire life-cycle. It enables companies from bio-based industries to conduct internal sustainability assessments of their products for benchmarking, eco-design and sustainability qualification purposes. It lends itself as basis for further developments like the tuning of environmental labels aiming at supporting well-informed decisions, thus increasing the market of qualified and more sustainable bio-based products. Accordingly, the IAT allows organizations to investigate what are the "interactions" of bio-based product on a wide range of sustainability areas, enabling them to identify areas of improvement, benchmarking and, thanks to the communication format, to be more transparent with the different stakeholder groups. Specifically, the implemented scoring system allows for determining how well a bio-based product performs compared to an "ideal performance".

The IAT covers a set of 24 principles, 32 criteria and 48 indicators followed by relevant metrics and methodologies as well as management rules on the application. A full description of the IAT is presented in (STAR-ProBio, 2020).

Figure 3: Areas of protection within sustainability pillars

The areas of sustainability aspects (Figure 3) were assessed according to existing and STAR-ProBio developed methodologies:

- Life Cycle Assessment (LCA) methodology for quantitatively tackling aspects related to the environmental pillar, which have been integrated with a set of qualitative indicators to better define the context and the commitment of economic operators compared to the areas of protection.
- Soil erosion (RUSLE method) and affected biodiversity (JRC method) associated to the biomass production.
- A tool for identifying ILUC risks for the bio-based product under assessment.
- Social Life Cycle Assessment (S-LCA), based on the methodology reported in the Handbook for Product Social Impact Assessment.
- Environmental Life Cycle Costing (E-LCC), related to the economic assessment of the life cycle costing (LCC) of a bio-based product.
- Circularity principles and metrics.

In the context of applicability by stakeholders, the IAT was tested within the PLA packaging case study. The test results enable to identify weaknesses, limitations and areas for improvement.

Use of IAT results

IAT has a strong focus on applicability and business relevance, and seeks finding a compromise between applicability of the tool by companies and the coverage of sustainability impact categories for each area of protection [5]. Furthermore, the proposed tool combines system approach with product approach.

[5] A cluster of the underlying themes of concern for the stakeholders that the assessment centres on i.e. Human wellbeing, Ecosystem quality and Resources

4.5.2 Sustainability Certification Tool (SCT)

The Sustainability Certification Tool (SCT) is a blueprint integrating three smart tools, which establishes links to existing activities in the product certification landscape:

A **Benchmarking Platform (BP)** to benchmark participating certification schemes, identify their common denominator and propose a mechanism for self-improvement, including a process for helping each participating scheme to identify gaps their gaps and necessary improvements in their **Framework Management Rules (FR).** The Benchmarking Platform would also aim at including those criteria and indicators identified and developed by STAR-ProBio in their recommendations as relevant for the sustainability of bio-based products. To do this, findings of STAR-ProBio Technical Working Packages have been translated into a set of criteria and indicators named **Building Blocks (BB).** Building Blocks are represented in factsheets designed to facilitate the transfer of STAR-ProBio results for its use by certification schemes.

A full description of the SCT is presented in (STAR-ProBio, 2020). A summary of the different elements of the SCT is presented in the following paragraphs.

Benchmarking Platform

Since early stages of the project, STAR-ProBio partners reflected on what certification tools would be more useful to the sector. A tool for promoting the development of a new certification scheme would put this new scheme in competition with the multiple voluntary certification schemes already available on the market. STAR-ProBio partners concluded that it was best to develop a tool that could fulfil a twofold objective:

- Mutual recognition by participating certification schemes of each other's criteria, indicators and rules of management, in order to identify gaps and start a process for improvement.
- Provide guidelines for the development of new certification schemes and improvement of non-participating certification schemes.

This tool has been named the Benchmarking Platform (BP) for certification schemes. This tool requires the voluntary participation of existing certification schemes, and their commitment to engage into the continuous improvement of their systems. It is recommended that the Benchmarking Platform becomes a fully dynamical instrument driven by participating certification schemes and the stakeholder's board. Therefore, participating schemes will have a key role in establishing the Benchmarking Platform and taking part in its governance.

The STAR-ProBio project has chosen this approach because several existing sustainability certification schemes for biomass and processed biomaterials, in particular those schemes operating under the EU RED certification, have cumulated valuable experiences during the many years they operate globally. Some of these certification schemes have already invested comprehensive expertise and efforts in order to broaden their scopes to new sectors in the bio and circular economy. However, most of these efforts are not harmonised yet.

The application of a benchmarking methodology intends to identify a minimum (basic) set of requirements any existing or new certification scheme should meet, and a set of additional requirements for improvement. In that sense, the Benchmarking Platform can be seen as a tool that allows the benchmarking and mutual recognition of each other's criteria and indicators by participating schemes.

The benchmarking of participating schemes will result in labelling them with a performance level:

- Basic (approved).
- Advanced.
- Excellent.

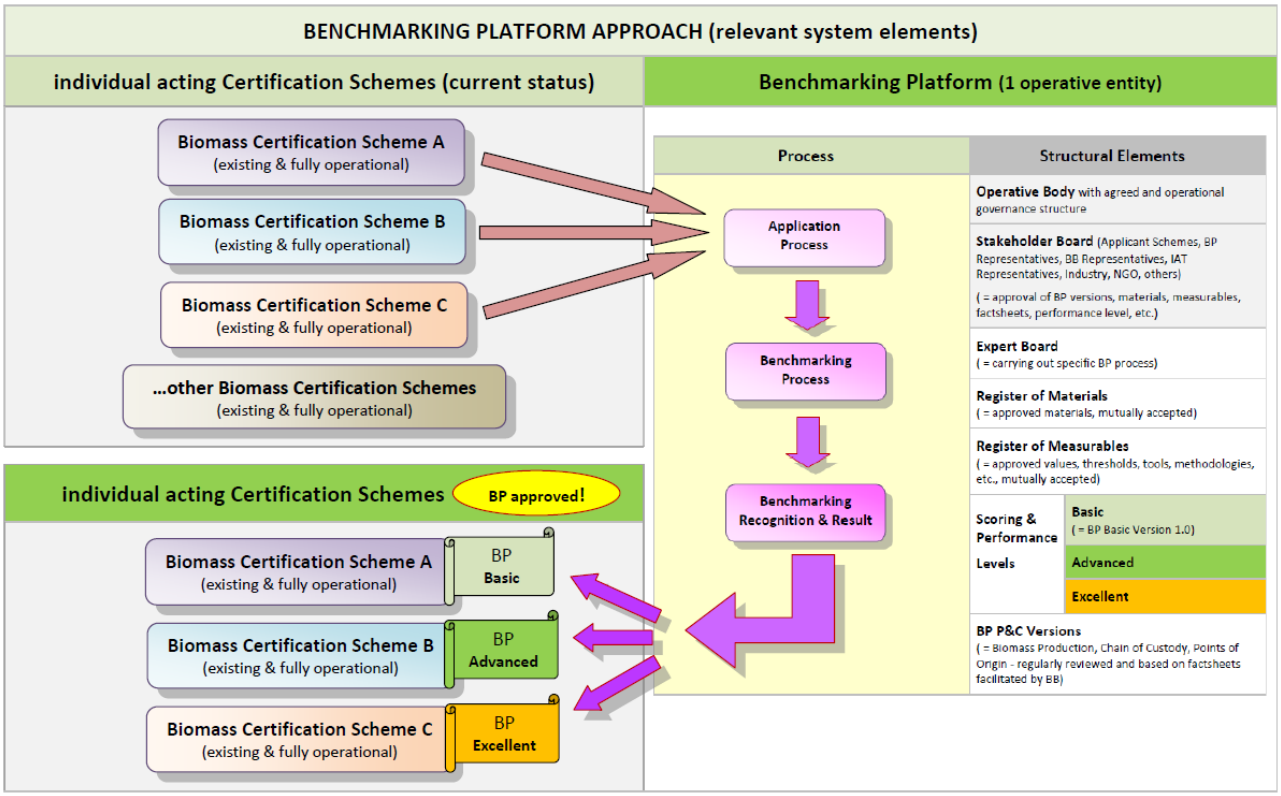
The idea behind the SCT tool is that "Approved" certification schemes aim at the recognition by the European Commission as accepted sustainability assessment tool for demonstrating compliance with sustainability criteria established in any EU legislation.

The Benchmarking Platform aims to facilitate debate and possibly the start of cooperation between the participating certification schemes. A consultation process with a stakeholder's board, organised by the Benchmarking Platform, will advise participating schemes on gaps resulting from the benchmarking, and on requirements for improvement.

The process carried out by the Benchmarking Platform, as well as its structure are illustrated in Figure 4. The Benchmarking Platform is managed by an Operative Body. Certification schemes interested to participate of the Benchmarking Platform send an application to this Operative Body. The benchmarking and scoring are conducted by the Experts Board. Recommendations for improvement are done through a consulting mechanism with a Stakeholders Board.

Another essential element of the Benchmarking Platform is that the results shall be made publicly accessible and explained in a transparent manner. This task is the duty of the Operative Body and of all participating certification schemes.

Figure 4: Structure of the Benchmarking Platform



The benchmarking methodology of the BP follows the general principles established by ISEAL Alliance in its *ISEAL Alliance Sustainability Benchmarking Good Practice Guide*[6], and it is designed to compare participating certification schemes according to:

- The "nature" of the criteria, indicators or more generally, control points[7] included in the schemes (Biomass Production and Supply Chain Level).
- The operation and governance or scheme management approach (System Level).

Table 1 includes a first set of control points for the benchmarking at Biomass Production & Supply Chain Level. Table 2 includes a list of essential Certification System Elements for the potential Benchmarking Platform at a System Level. This initial set of benchmarking criteria is identical to elements in the GSSI Benchmark Framework[8] with the addition of mass balance for the criteria of Chain-of-Custody options and requirements.

[6] Available at https://www.isealalliance.org/benchmarking

[7] Control-points should be understood as a brief format of the Sustainability Principles and Criteria used by certification schemes. Control points are used by auditors to determine whether the auditee's performance is complying with the respective requirements.

[8] Version 1.0, October 2015 (GSSI – Global Sustainable Seafood Initiative)

Table 1: Control points benchmarked at Biomass Production & Supply Chain Level

Criteria	Sub-criteria	Example	APPLICABILITY		
			Depends on Supply Chain elements	Location of scheme user	
				EU	Non-EU
Legal compliance	National compliance	Set of national legislation	No	✓	✓
	EU compliance	e.g. Cross Compliance, Reach, etc.		✓	?
	Compensating criteria – Non-EU	Corresponding EU legislation		✓	?
Good practices	GAP, GMP, etc.	Multiple	No	✓	✓
Management system and record keeping	Multiple	Multiple		✓	✓
Internal assessment	Multiple	Multiple		✓	✓
Risk assessment	Multiple	Multiple		✓	✓
Sustainability	Social	Multiple		✓	✓
	Environmental	Multiple			
	Economic	Multiple		✓	✓
Traceability & Chain of Custody	Multiple	Multiple		✓	✓
Declarations & claims	Multiple	Multiple		✓	✓
Alignment with international norms & guidance	Multiple	Multiple		✓	✓
Add-on elements	Supply Chain element	GHG, smallholder, recyclability, EoL, etc	Yes	✓	✓

Table 2: Potential Benchmarking Platform System Requirements

Scheme governance	Governance	● Legal status ● Impartiality ● Operating procedures ● Transparency of governance ● Governance complaints ● Governance participation
	Scope and objectives	● Scheme scope ● Scheme objectives
	Non-discrimination	● Openness ● Market access
	Scheme integrity - monitoring program	● Internal review
Scheme management	Logo use and claims	● Claims policy ● Relevant claims ● Claims-making requirements ● Logo management ● Certificate content management ● Minimum verified/measurable percentage-based claims

Standard setting & maintenance	Standard setting body	● Standard setting body ● Central focal point
	Standard setting procedures	● Standards development and maintenance procedure ● Work program ● Terms of reference ● Decision making process ● Complaints Standards review and revision ● Proposals for revisions ● Record keeping
	Participation and consultation	● Public summary ● Balanced participation ● Public consultation ● Public announcement ● Stakeholder consultation ● Transparency comments received ● Comment management
	Standards content	● Standards content ● Relevance of standards content ● Local applicability
	Standards accessibility	● Standards availability
	Transition period	● Informing enterprises of transition ● Transition period for compliance
Accreditation	Accreditation	● ISO-17011 compliance ● Non-discrimination ● Specified requirements ● Transition period accreditation body – competencies ● External review ● Organizational transparency ● Office audit ● Field audit
Certification	Certification process	● ISO-17065 compliance ● Fee structure ●Certification cycle ● Surveillance Assessment methodology ●Termination, suspension, withdrawal ● Multi-site certification ● Audit reports ● Stakeholder input ● Non-compliances ● Site audit ● Transparency on certified entities ●Transparency on audit reports ● Notification of changes ● Timeline for corrective action
	Auditor competence	● Auditor competence ● Requirements for technical knowledge ● Technical knowledge ● General auditing skills ● Scheme specific knowledge assessment ● Scheme specific knowledge maintenance ● Knowledge maintenance
Chain of Custody	CoC options & requirements	● Segregation ● Mass balance ● Enterprises to be audited ● Records for traceability ●Sub-contractors ● Auditing methods and frequency ● Non-conformity/corrective actions ● Audit report ● Record keeping ● Multi-site Chain of Custody audit ● Multi-site Chain of Custody ● internal verification

Framework Rules

A crucial issue in the systems requirements set by certification schemes is up to what extent and how exactly criteria and indicators shall be inspected, and what kind of evidence are mandatory. Supply chains for bio-based materials and bio-based products usually have multiple regions of origin. Different regions have different levels of vulnerability to sustainability issues. More vulnerable regions will require certification schemes with more stringent system requirements. Those system requirements refer to the governance and management rules of certification schemes. For achieving an optimal performance level, system requirements of certification schemes must sufficiently ensure adherence to sustainability principles, criteria and indicators, and how effectively criteria and indicators are assessed and measured in practice. System requirements determine the credibility of a certification scheme. Those management rules include:

- The rules on the audit system, including among others: audit procedures, sampling requirements, verification procedures, quality requirement for auditors, and sanctions for non-compliance.

- The management system, including the level of transparency and accessibility of information, the level of stakeholder engagement, and the availability of a complaint system.
- Accreditation, membership or recognition by official organizations or government bodies.
- The rules for the affiliation and rules for cross-acceptance of certificates from other certification schemes.

Participating schemes in the Benchmarking Platform are expected to meet and preferably exceed the rules established in the Framework Management Rules adopted by the Benchmarking Platform. Full guidelines for those management rules are given in (STAR-ProBio, 2020).

Building Blocks

The Building Blocks (BB) module aims at organising STAR-ProBio criteria and indicators according the general logic of a product certification approach and to prepare their coherent and uniform presentation. Consequently, the Building Blocks module can help to address gaps which have been identified by the Benchmarking Platform as result of the comparison of existing schemes with the STAR-ProBio principles, criteria and indicators. The STAR-ProBio criteria and indicators have been sourced from different methodological approaches and perspectives (e.g. LCA and non LCA based such as iLUC, social aspects and circularity) are represented in 36 factsheets (STAR-ProBio, 2020) organised around principles listed in Table 3.

Table 3: Inventory of environmental, social and techno-economic principles collected from the STAR-ProBio Work Packages

Environmental	**Circularity**	**Social and techno-economic**
- Minimize global warming potential. - Minimize the indirect impacts on natural lands OR pressure on agricultural land. - Promote the positive and reduce the negative impacts on ecosystems and biodiversity. - Protect soil quality and productivity. - Conserve and protect water resources. - Promote good air quality. - Minimize the emission of chemicals. - Promote the prevention of non-renewable energy resource depletion.	- Limit the use of high concern materials. - Promote efficient use of material resources and the prevention of resource depletion. - Promote the renewability fraction of products. - Promote the efficient use of energy. - Promote the efficient use of water. - Promote Circularity and End of Life options.	- Respect Labour Rights. - Respect health and safety of end users. - Promote consumer satisfaction. - Promote transparency. - Respect of health and safety of local communities. - Promote local development. - Respect land use rights. - Respect Food Security. - Promote fair competition in the market. - Sustainable Manufacturing – Techno-economically sound manufacturing. - Sustainable Alternative End-of-Life Routes – Techno-economically sound EoL options

Use of SCT results

Participating certification schemes can use the results of the SCT tool for the mutual recognition of each other's criteria, indicators and rules of management, in order to identify gaps and start a process for improvement. The process for continuous improvement aims at achieving the Advance or Excellent Performance Level. This will entail:

- Developing principles, criteria and indicators (Control Points) as advised by a Stakeholders Board to achieve the Advanced or Excellent Performance Level. Criteria and indicators defined by the Building Blocks Factsheets should be considered for the additional set.
- Implementing recommendations regarding scheme governance and management rules as established by the Framework Management Rules set by the Benchmarking Platform.
- Elaborating factsheets for new criteria and principles developed by the Benchmarking Platform can be used to this effect.
- Paying attention to continuously evolving EU legislative framework as identified by the Benchmarking Platform for scheme permanent adaptation.
- Updating the certification scheme with compensatory framework for certification activities outside the EU.

Non-participating certification schemes and developers of new certification schemes can use the results of the SCT to check if their schemes meet the requirements for a Basic Performance Level. In case they do not meet the minimum requirements for a Basic Performance Level, they can plan for using results to fill-in the gaps and improve the criteria, indicators and system requirements (governance and management rules) of their schemes. The results of the benchmarking will also serve as guidelines for the development of certification schemes addressed to those bio-based products not yet covered by existing certification schemes.

Benchmarking results under this approach can also be used by companies to understand, to which extend their bio-based products would be compliant with existing certification schemes.

4.6 Mechanism for the recognition of sustainability assessment tools

A pre-condition for effective verification of sustainability criteria for bio-based products is that assessment (such as certification or other types of assessment) is applied to all steps in the supply chain. The experience gained by the use of sustainability certification schemes for compliance with the European Renewable Energy Directive (RED) and EU Timber Regulation has shown that it is important a certain level of homogenised approach among certification schemes. This homogenised approach is more evident when in practice the certification schemes already operating in the market have different approaches related to the scope of sustainability criteria and indicators they cover, their rules on the audit system, including among others: audit procedures, sampling requirements, group auditing,

verification procedures, quality requirement for auditors, sanctions for non-compliance, management systems, accreditation requirements, etc.

The Renewable Energy Directive gave a mandate to the European Commission (EC) to recognise certification schemes for their use to show compliance of different bioenergy products with sustainability requirements that it established. Certification Schemes aiming at being recognised by the European Commission must have their system requirements assessed by a specific EC approved Assessment Protocol. This has been the first experience for homogenising system requirements with the help of EU regulation. It has become clear that 10 years of sustainability certification for some bioenergy products has led to a more effective harmonisation of certification schemes.

The proposed co-regulation framework should include a mechanism for the approval or recognition of assessment tools (certification schemes, sustainability standards, labels) by the European Commission. Once recognised/approved, economic operators can use those sustainability assessment tools to verify the sustainability of their bio-based within the level of compliance set by specific sector regulation.

It is proposed that DG Environment is in charge of a recognition procedure at the European Commission in a similar way DG ENER recognises voluntary certification schemes for biofuels and biomass for energy purposes under the RED. This recognition procedure should be based on technical evaluation of the sustainability assessment tool. The evaluation is an iterative process in which the applicant is requested to solve the issues found during the process. If the assessment tool passes the technical evaluation, DG Environment can start an Inter Service consultation with other Directorate Generals for their co-approval of the assessment. Once the Directorate Generals have approved the evaluation, DG Environment is to start a consultation process (called comitology process) with a Member States' Advisory Committee. This Advisory Committee comprises representatives of all EU Member States. The Advisory Committee votes its approval, though the result of this voting is not binding for the European Commission. Once this process is finished, DG Environment makes its recommendation to the European Commission for the adoption of a formal Decision for the recognition of the sustainability assessment tool for a specific period of time. Further modifications to the assessment tools must follow a similar approval/recognition process.

The proposed recognition procedure should take into account the recommendations made by the European Court of Auditors to the EU system for the certification of sustainable biofuels (European Court of Auditors, 2016), in particular:

- Ensuring appropriate governance and transparency of voluntary schemes.
- Supervision by the Commission mainly for checking that the operations of the recognised assessment tools comply with the standards presented for recognition.

The official recognition of the SCT Benchmarking Platform would help harmonising certification schemes for bio-based materials and products and it is an opportunity to made them engage into continuous improvement to reach higher performance levels while keeping a level playing field among participating certification schemes..

5 Policy recommendations

The EU's European Green Deal has a headline objective of transforming the EU into "a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use" (European Commission, 2019b). This objective is broadly aligned with the "sustainability scenario" found in the Global Resources Outlook 2019 produced by UNEP's International Resource Panel (IRP) focusing on extraction and use of natural resources, greenhouse gas emissions and protection of terrestrial biodiversity (IRP, 2019).

However, whereas the IRP resource efficiency policy package aims to reduce global resource extraction and use, the EU's EGD talks only of resource efficiency without stating an aim of **reducing resource use**. The new Circular Economy Action Plan sets out activities to achieve "climate neutrality by 2050 and decoupling economic growth from resource use", providing more ambition than what is found in the EGD, although continuing to steer away from explicit resource use reduction. Such an underlying objective would need to be integrated into the EDG, as a higher level of EU strategies. In the meantime, it also needs to be integrated into the Bioeconomy Strategy and subsequent actions relating to specific sectors or uses of biological resources.

Given the urgency and frequency of the global ecological and social emergencies of climate heating and biodiversity and habitat loss, our recommendations are based on the assumption of the need for the EU to achieve absolute reductions in its resource use whilst decoupling from production and consumption levels and their related negative impacts.

The following policy recommendations serve as starting points that can be taken during the current European Commission and European Parliament mandates to set up a co-regulation framework under the European Green Deal and under the EU Sustainable Product Framework initiative, and in line with existing headline EU policy objectives.

5.1 Set more concrete goals and paths in strategies and framework policies

The development of public strategies and other efforts to stimulate the bioeconomy in the EU have been driven by objectives of achieving technological leadership to drive tangible improvement in Europe's social, economic and environmental welfare (European Commission, 2018a). However, current strategies many times are short in concretising goals and paths for achieving a sustainable bioeconomy. The following recommendations are made:

1. ***EU policy to set target resource efficiency and resource use reduction***

   EU headline political objectives on climate, biodiversity, industry, bioeconomy, circular economy need to include a **target on absolute resource use reduction** to guide subsequent actions, policies and legislation towards this ambition and ensuring synergies with other environmental objectives.

The **EU Plastics Strategy** already includes the objectives of reducing use of plastic and its environmental impacts - these need to be more strongly prioritised in future actions through the Strategy and in relevant sectoral actions. Further reflection is needed on the value of promoting bio-polymers or bio-plastics against the important back-drop of reducing production and consumption and their impacts and therefore use of bio-based materials and products for **short-lived products** such as packaging, cosmetics, cleaning products, etc.

The **EU Timber Regulation** due diligence mechanisms have proven to be effective in increasing control over wood supply chains, although implementation should be more harmonised. Mandatory due diligence could be one of the starting points of a sustainable (bio-based) product policy

2. ***The EU's Bioeconomy Strategy to further define sustainability for bio-based products***

   The EU Bioeconomy Strategy supports the establishment of an innovative and low-carbon economy that replaces fossil raw materials with biological ones, therefore, promoting resource efficiency and contributing to a more sustainable economy. However, the EU Bioeconomy Strategy needs to more strongly **prioritise the sustainable use of biological resources** to avoid increasing pressure on these resources and on land use, and avoiding indirect land use change. This must also include the introduction **of cascading use of biomass** into the heart of the Strategy.

   The EU's bioenergy agenda has driven the wider development of bio-based products, yet until now sustainability criteria for biomass feature solely in the EU's Renewable Energy Directive. Similar sustainability criteria are needed for other significant sectors with a potentially high demand for bio-based products including construction products and buildings.

   Biomass being a resource shared for the production of food, products and energy, there is a need to ensure coherence across the various biomass related sustainability criteria, to avoid conflicting objectives and market distortion as well as confusion on the part of producers, procurers and the public.

3. ***The Bioeconomy to go beyond a cradle to gate approach and provide more clarity on the use phase and end-of-life management***

   Policy objectives need to contribute to extend of the lifetime of a product, promote its reuse and clearly state a preference for organic recycling over energy recovery. The EU's waste hierarchy applies too specifically to certain bio-based products, and could further develop organic recycling within the hierarchy. There is also a need to develop more clarity on how to manage the co-existence of similar bio- and fossil-based products (their identification, collection, sorting, recycling).

4. ***The EU's product policy to better account for bio-based products***

   The 2018 Bioeconomy Strategy highlights the importance to better link bio-based products with EU product policy instruments such as the EU Ecolabel, Green Public Procurement or the Product Environmental Footprint. EU product policy instruments provide the framework to move from the resource-based focus of the Bioeconomy Strategy (focusing on the use of

biomass for food, products and energy) to a life cycle approach of products, making much easier the bridge to circular economy.

The new Circular Economy Action Plan also addresses bioeconomy aspects through product policy, reducing carbon and environmental footprints, and integrating implementation of the Bioeconomy Action Plan through circularity in production processes.

The push towards a sustainable bio-based economy requires to create consumer awareness of and trust in bio-based products, by providing consumers with appropriate information on their characteristics. Provision of information to empower consumers and public buyers also features in the new Circular Economy Action Plan, and these actions could supplement existing communications delivered in relation to the EU Ecolabel and other national/regional ecolabels such as the Nordic Swan or the German Blue Angel.

5.2 Prioritise sectors and products

The revised EU Bioeconomy Strategy maintains a generic approach to increasing the use of bio-based materials and products while not prioritising uses in specific product groups. The new Circular Economy Action Plan, through its sustainable product policy initiative could contribute more specificity to this ambition, and through more detailed product requirements. There is still a need for EU policy to **prioritise sectors** where substitution of fossil-based materials with bio-based ones has the greatest impact, respecting cascading use of biomass. The following recommendations are made:

1. **Horizontal sustainability principles to be developed through the sustainable product policy framework initiative should include specific criteria** for biological resources/bio-based materials and products, which can be modified according to sector or use.
2. **Sectoral strategies, policies and legislation to have clear biological resources targets, supporting cascading use of biomass and sustainability criteria**. The four sectors using the highest amounts of plastic are packaging, building and construction, automotive, electrical and electronic.[9] All of these sectors already feature legislation into which use reduction targets, sustainability criteria and cascading use of biomass could be introduced.

5.3 Specify sustainability requirements and methodologies

There is still a long way to harmonise sustainability requirements and assessment tools for bio-based materials and products across relevant sectors. The following recommendations are made:

[9] According to PlasticsEurope Market Research Group (PEMRG) and Conversio Market & Strategy GmbH an "other" grouping has significant percentage of overall plastics use and this includes appliances, mechanical engineering, furniture and medical. All, apart from mechanical engineering, are already addressed by EU legislation into which plastics use reduction and bio-based materials sustainability criteria could be integrated.

1. **Develop horizontal approaches across policy instruments.**

   Criteria-based tools such as green public procurement, the European Ecolabel, the Ecodesign Directive and the Sustainable Product Policy Framework initiative should develop horizontal approaches to bio-based materials, reflecting cascading use of biomass, reduced resource use, and their use in substitution of fossil based materials for durable products (avoiding packaging, cosmetics, cleaning products, etc.).

2. **Implement a minimum biomass content together with sustainable biomass production criteria.**

   Most bio-based products are only partly bio-based. The introduction of minimum bio-based contents per product category is an efficient instrument to encourage the use of renewable resources. In addition to that, sustainability criteria for biomass production ensure that the raw materials used have a limited impact on the environment. This combination of criteria ensures that first, a known and significant part of a bio-based product is actually bio-based and second, that this bio-based content was produced sustainably. While claims such as 'made from plants' can be misleading for consumers who may think that products are fully bio-based and have a limited impact on the environment, green claims should only be allowed when combining minimum bio-based content with sustainability criteria for biomass.

3. **Further embed LCA in EU policy development and implementation as important decision-making tool.**

   The life cycle assessment (LCA) methodology helps to provide information about a product's ecosystems, health and resource impacts, identifying hot spots where significant impacts are made and therefore where intervention is needed most. Its integration into EU policy development is uneven across policy areas, and more formally integrated into some EU product policy mechanisms such as the Product and Organisation Environmental Footprints (PEF and OEF). Despite the integration of LCA into policy development, selection of LCA-based policy options remains a political decision, particularly as trade-offs between impacts require prioritisation of activity and as thresholds or limit values imply categorisation of the impacts.

   For bio-based products it is a key priority to revise LCA methodology to no longer view incineration of such products as beneficial for their energy recovery. Cascading use of bio-based materials and products to ensure the optimisation of their use is completely undermined by this LCA methodology. It is also important to continue explore the possibility of comparing the environmental footprint of bio-based products with fossil-based ones, notably by developing data on the impact of fossil resources use.

4. **Make sustainability criteria product specific where needed.**

   While certain sustainability criteria may apply to bio-based products as a whole (e.g. production of biomass), others need to be product specific. This is notably the case for criteria measuring the impact of a product's use stage and its end of life. We note for instance that biodegradability may be a key feature for certain products such as mulch films, and not relevant for other product types such as insulation.

5. **Explore a multi-criteria approach for a 'fuller' treatment of sustainability.**

   Instead of making use of several single issue labels to assess the sustainability of bio-based products, the use of existing Type I ecolabels (such as the EU Ecolabel) should be prioritised as they are already well-known, make very easy the identification of a good performer on the market, and are so comprehensive they limit the risk of false/misleading claims.

5.4 Introduce the use of sustainability assessment tools in a co-regulative framework for the market uptake of the broader bio-based materials and products

Establishing a co-regulation framework as proposed in this report requires preparatory work at policy design level. Two recommendations are made in particular to this end:

1. **Accelerate the path for more coherence between different EU policy mechanisms applicable to bio-based materials and products.**

   A patchwork of approaches to requirements on bio-based materials and products has been identified: the RED has strengthened sustainability criteria and PEF is beginning to become more detailed on some bio-based products product categories, while a harmonised update could be made to the EU Ecolabel's requirements, and GPP guidance. Centralisation of preparation of criteria for the Ecodesign Directive, the Ecolabel and GPP has been implemented.

   A harmonised approach to integration of requirements on bio-based products is also needed, not just for products made primarily from bio-based materials but also to potentially integrate bio-based plastics as preferable to fossil-based ones when there is enough proof of their high environmental performance. These requirements include sustainable production of the biomass, sustainable sourcing, and cascading use in end-of-life management to avoid automatic incineration. Such requirements are also an opportunity to develop an EU approach to the issue of biodegradability and the need to avoid increased littering activities. Work currently underway on EU Product Policy to support the circular economy should better integrate sustainability considerations of bio-based products.

2. **Initiate the debate for achieving more coherence between legislation and private mechanisms such as certification schemes and standards.**

   Since the development of sustainability criteria in the Renewable Energy Directive, standards have been created that set out similar sustainability criteria for non-RED-related products (including for biomass more broadly). More clarity for market players and public and private users (consumers, companies, authorities, etc.) would be helped through an assessment of where updates and revisions are needed in conventional regulation and private mechanisms such as certification schemes, and of how to integrate them as a sign of conformity.

   In this regard, the EC recognition of a tool and procedure such as the STAR-ProBio's SCT Benchmarking Platform would be of great help for further

harmonising certification schemes, making them evolve along the dynamic EU legislative framework affecting bio-based materials and products. Moreover, the EC recognition of the STAR-ProBio's SCT Benchmarking Platform is an opportunity to make participating certification schemes engage into covering a larger scope of sectors and products, and continuous improvement to reach higher performance levels while keeping a level playing field among participating certification schemes.

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Annex: Inventory of bioeconomy policy documents on EU and EU member state levels

Table 4: Analysed sample of overarching BE policy elements with relevance for sustainability assessment. The BE sectors are coded as follows: BEn: Bioenergy; F: Forestry; Fo: Food; CP: Chemicals and Plastics; M/P: Materials/Products; C: Construction; T: Textiles; P: Pharmacy; Fe: Feed. Sustainability dimensions are coded as followed: En: Environmental; Ec: Economic; So: Social; + stands for "included"; - stands for "not included"

Identifier	Policy title	Geographical relevance	Type of document	Mandatory	Effective date	Affected BE sectors	Influence on industry	Specific targets/goals	Targets/goals measureable	Addressed sustainability dimensions	Sustainability criteria incorporated	Certification explicitly mentioned	Direct links to certification	Certification appropriate instrument
1	2015 Circular Economy Strategy (Action Plan)	EU	Action plan	no	2015	all	no	-	-	En So	-	+	-	-
2	Bioeconomy Development in EU Regions Mapping of EU Member States' / Regions' Research and Innovation Plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy for 2014 - 2020	EU	Report	no	2017	all	no	-	-	En	-	-	-	-
3	Bioeconomy Regions in Europe	EU	Report	no	2017	all	no	-	-	En	-	-	-	-

4	Building the Single Market for Green Products Facilitating better Information on the Environmental Performance of Products and Organisations	EU	Strategy	no	2013	all	no	+	+	En	+	+	+	+
5	EU Forest Strategy	EU	Strategy	no	2013	all	no	+	-	En Ec So	+	+	+	+
6	EU Strategy for Plastics in the Circular Economy	EU	Strategy	no	2018	CP	no	+	+	En	+	+	+	+
7	Good Practice Guidance on the Sustainable Mobilisation of Wood in Europe	EU	Guidance	no	2010	F	no	+	-	En Ec	-	-	-	-
8	Guidance on unfair Commercial Practices - Extract on Misleading Green Claims	EU	Guidance	no	2005	all	direct	-	-	-	-	+	+	+
9	Innovating for Sustainable Growth - A Bioeconomy for Europe (Bioeconomy Strategy)	EU	Strategy	no	2012	all	no	+	-	En Ec So	-	+	+	+
10	Promotion of Sustainable Mobilisation of Wood	EU	Strategy	no	2007	BEn, F	in-direct	+	-	En	+	+	-	+
11	Action Plan on Renewable Raw Materials	AT	Action plan	no	2015	F, C, T, CP, P, M/P	no	+	-	En Ec	+	+	-	+
12	Bioeconomy in Flanders	BE	Action plan	no	2014	all	no	+	-	En Ec So	+	+	-	+
13	Biorefineries Roadmap	DE	Roadmap	no	2012	BEn, F, Fo, Fe, CP, P, M/P	no	+	-	-	+	+	-	+
14	Forest Strategy 2020	DE	Strategy	no	2011	F	no	+	+	En Ec So	+	+	+	+
15	National Policy Strategy on Bioeconomy	DE	Strategy	no	2014	all	no	+	+	En Ec So	-	+	+	+

16	Plan for Growth for Water, Bio and Environmental Solutions	DK	Growth plan	no	2013	all	in-direct	+	+	En	+	+	-	+
17	The Spanish Bioeconomy Strategy 2030 Horizon	ES	Strategy	no	2016	F, Fo	no	+	+	En So	-	+	-	+
18	Finnish Bioeconomy Strategy	FI	Strategy	no	2014	all, emphasis on F	in-direct	+	+	En	-	-	-	-
19	A Bioeconomy Strategy for France	FR	Strategy	no	2016	BEn, F, Fo, CP, M/P	no	-	-	En	+	+	-	+
20	Energy Transition for Green Growth Act	FR	Action plan	no	2016	BEn	no	+	+	En	-	+	-	-
21	National Action Plan for Green Public Procurement	FR	Action plan	no	2014	BEn, C, Fo, T, CP, M/P	direct	+	+	-	-	-	-	+
22	National Strategy of Ecological Transition towards Sustainable Development 2015-2020	FR	Strategy	no	2014	all	in-direct	+	+	En	-	+	-	+
23	National Environmental Technology Innovation Strategy 2011-2020	HU	Strategy	no	2012	BEn, C, Fo, Fe	in-direct	+	+	En Ec So	-	+	-	+
24	Renewable Energy Republic of Hungary - National Renewable Energy Action Plan 2010 2020	HU	Action plan	no	2010	BEn	direct	+	+	En	+	+	+	+
25	Action Plan for the Environmental Sustainability of Consumption in the Public Administration Sector	IT	Action plan	no	2006	all	no	+	+	En	+[10]	+	+	+
26	Bioeconomy in Italy	IT	Strategy	no	2016	all	no	+	+	Ec So	-	+	+	-
27	Towards a Model of Circular Economy for Italy	IT	Report	no	2017	F, C, Fo, CP	no	-	-	En So	+	-	-	+

[10] Incorporation of FSC®/PEFC certification scheme as a whole

28	A Circular Economy in the Netherlands by 2050	NL	Strategy	no	2016	all	in-direct	+	+	En Ec So	-	+	+	+
29	Strategy for a Green Society	NL	Strategy	no	2013	all	no	+	-	En Ec So	-	-	-	+
30	Green Growth Commitment	PT	Strategy	no	2015	all	in-direct	+	+	En	+	+	+	+
31	Swedish Research and Innovation Strategy for a Bio-based Economy	SE	Report	no	2012	Fo, T, CP, P, M/P	no	+	-	En	-	+	+	+
32	UK Bionergy Strategy	UK	Strategy	no	2012	BEn	in-direct	+	-	En Ec So	+	+	+	+

Table 5: Analysed sample of regulatory BE policy elements with relevance for sustainability assessment. The BE sectors are coded as follows: BEn: Bioenergy; F: Forestry; Fo: Food; CP: Chemicals and Plastics; M/P: Materials/Products; C: Construction; T: Textiles; P: Pharmacy; Fe: Feed. Sustainability dimensions are coded as followed: En: Environmental; Ec: Economic; So: Social; + stands for "included"; - stands for "not included"

Identifier	Policy title	Geographical relevance	Type of document	Mandatory	Effective date	Affected BE sectors	Influence on industry	Specific targets/goals	Targets/goals measureable	Addressed sustainability dimensions	+ Sustainability criteria incorporated	+ Certification explicitly mentioned	+ Direct links to certification	+ Certification appropriate instrument
33	Commission Decision of the EU Ecolabel for textile products (2014/350/EU)	EU	EC Decision	no	2014	T, M/P	in-direct	-	-	En So	+	+	+	+
34	Commission Decision of the EU Ecolabel for wood-, cork- and bamboo-based floor coverings (2017/176)	EU	EC Decision	no	2017	M/P	in-direct	-	-	En So	+	+	+	+
35	Directive 2008/56/EC on Marine Strategy Framework	EU	Directive	yes	2008	Fo, M/P	no	-	-	En	+	+	+	+
36	Directive 2008/98/EC on waste	EU	Directive	yes	2008	All	direct	+	+	En	+	-	-	+
37	Directive 2009/28/EC on Renewable Energy (RED)	EU	Directive	yes	2009	BEn	in-direct	+	+	En	+	+	+	+
38	Directive 2015/1513/EU on indirect land use change	EU	Directive	yes	2015	BEn	direct	+	+	En Ec So	+	+	+	+

39	Directive 94/62/EC on packaging and packaging waste	EU	Directive	yes	2015	CP, M/P	direct	+	+	En	-	-	-	+
40	Regulation (EC) No 1069/2009 on Animal by-products	EU	Regulation	yes	2009	BEn, Fo, Fe	direct	-	-	En	-	-	-	-
41	Regulation (EC) No 1830/2003 on genetically modified organisms (GMO)	EU	Regulation	yes	2003	All	direct	-	-	En	-	-	-	+
42	Regulation (EC) No 1935/2004 on Food Contact Materials	EU	Regulation	yes	2004	Fo, CP, M/P	direct	-	-	-	-	-	-	-
43	Regulation (EC) No 761/2001 on Eco-management and Audit Scheme (EMAS)	EU	Regulation	no	2001	All	in-direct	-	-	En Ec So	+	+	+	+
44	Regulation (EU) No 995/2010 on European Timber (EUTR)	EU	Regulation	yes	2010	BEn, F, C, M/P	direct	+	-	En	+	-	-	+
45	Decree on Public Procurement of Wood Products	DE	Ordinance	yes	2011	F, C, M/P	direct	+	+	En Ec So	+	+	+	+
46	Renewable Energy Sources Act (EEG)	DE	Ordinance	yes	2017	BEn	in-direct	+	+	-	+	+	-	+
47	A Resource Opportunity - Waste Management Policy in Ireland	IR	Policy	no	2012	BEn, F, C, T, CP, M/P	no	+	+	En	+	+	+	+
48	Delivering our Green Potential	IR	Policy statement	no	2012	BEn, F, Fo, Fe, CP, P, M/P	in-direct	+	+	En	+	-	-	+
49	National Programme for Waste Reduction	IT	Policy	yes	2017	C, Fo, Fe	no	+	+	En	+	+	-	-
50	Hoofdlijnennotitie Biobased Economy (BBE)	NL	Policy	yes	2012	All	no	-	-	En	+	+	+	+