



# Sustainability Transition Assessment and Research of Bio-based Products

Newsletter Issue 1

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[www.STAR-ProBio.eu](http://www.STAR-ProBio.eu)

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## STAR-ProBio in brief:

- Aims to **formulate guidelines for a common framework** promoting the development of regulations and standards that support the adoption of business innovation models and market uptake in the bio-based products sector.
- Will develop a **blueprint for sustainability schemes and tools** applicable to a large spectrum of bio-products.
- Will make recommendations for a more efficient and harmonized policy regulation framework for the market-pull of bio-products.
- Outputs will be **new and revised assessment methodologies, criteria and indicators** developed by integrating scientific and engineering approaches with social sciences and humanities.

As I see it, STAR-ProBio is a challenging journey towards sustainability. We are a group of researchers, experts and analysts sharing an interest in the transition towards a bio-based economy. We look at this transition from several angles and through different lenses, precisely because we come from rather heterogeneous areas of expertise – including green chemistry, agronomy, natural sciences as well as social sciences. This plurality of voices makes STAR-ProBio a truly interdisciplinary project which can support the European Commission in the implementation of European policy initiatives, including the Lead Market Initiative on bio-based products, the industrial policy and the European Bio-economy Strategy.

The overall goal of the project is to **formulate guidelines for a common framework** promoting the development of regulations and standards that **support the adoption of business innovation models and market uptake in the bio-based products sector**. You will agree with me that this is not an easy task, yet this makes it all the more challenging and fascinating. Blending our various expertise will allow us to **develop a blueprint for sustainability schemes and tools** applicable to a large spectrum of bio-based products and **make recommendations for a more efficient and harmonized policy regulation framework** for the market-pull of such products.

These objectives will be achieved by performing a comprehensive assessment, which looks at the three pillars of sustainability (economic, environmental and social) in a truly circular way. Hence, looking along the whole supply chain, including end of life options and indirect land use change (ILUC) effects, will allow us to assess bio-based products' sustainability in a cradle-to-cradle fashion. Proposed methodologies, criteria and indicators will be **applied to selected case studies** to illustrate benefits and impacts of bio-based products. These case studies cover a small number of bio-based products and several bio-based co-products derived from alternative feedstocks in different biorefinery scenarios. The decision to consider a limited number of value chains was based on the idea that, for integrated case studies, we should privilege the depth of the analysis focusing on the development of a robust sustainability analysis methodology rather than its width.

We are aware that these tasks and objectives correspond with high expectations at the "policy makers" level. We take this challenge with great enthusiasm and aim to do our share to promote the transition from a linear fossil-based model to a circular bio-based society!

**Project Coordinator:**  
**Prof. Piergiuseppe Morone (Unitelma Sapienza - University of Rome)**



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**WP1: Screening and analysis of existing sustainability schemes for the bio-economy**

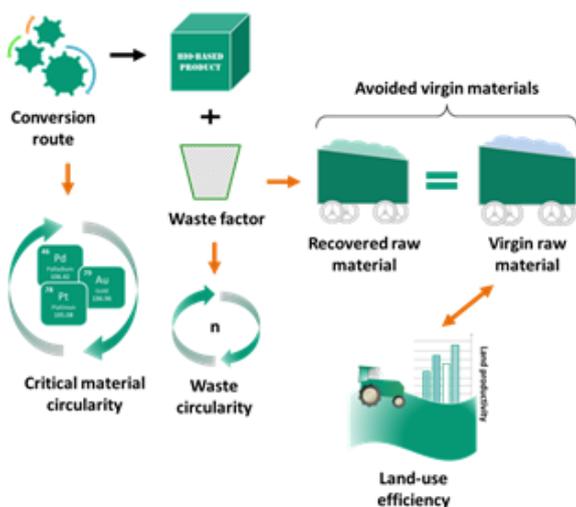
WP1 (months 1-9), led by TU Berlin, aims to identify environmental, social and economic criteria to be considered in the development of a sustainability scheme blueprint for bio-based products, to identify key stakeholders, and to select case studies, for which possible sustainability assessment tools, criteria and indicators will be proposed and assessed. WP1 work includes in particular screenings of existing certification initiatives, of standards for sustainability assessment and of database solutions as well as the selection of value chains, case studies and stakeholders for further project activities. Comprising interim results, a stakeholder workshop and webinar organized by DBFZ and TU Berlin was conducted on the 26th of October 2017. This event discussed gaps in sustainability certification and standardisation as well as options to overcome them. The workshop provided rich input for STAR-ProBio's "Report on identified environmental, social and economic criteria/indicators/requirements and related 'Gap Analysis'", which is currently in the process of completion. Two additional reports ("Mapping of relevant value chains and stakeholders" and "Overview of Case Studies and Stakeholders") are expected to be published at the beginning of 2018.

**WP2: Upstream environmental assessment**

WP2 focuses on the upstream environmental assessment (from feedstock production to upstream processing) i.e., the performance of upstream LCA for identified case studies and the development of a LCA approach to support strategic and policy decision making. To achieve these objectives, WP2 has performed a literature review of the environmental indicators considered in related studies of bio-based products. To do so, the team has reviewed 83 scientific articles assessing bio-based products, selected for their relevance in the framework of the STAR-ProBio project. The review presents in quantitative terms the environmental indicators used by this sample of literature, grouped by "clusters", which are groups of similar indicators. The WP2 partners are working on the definition of system boundaries, establishing key parameters such as functional units, assumptions and cut-off criteria. Finally, with a view to future activities, a compilation of life-cycle inventory data for feedstock production and upstream processing for the case studies will be undertaken and associated major environmental impacts will be identified, taking into account the strategic environmental indicators and impact categories selected for assessment.

**WP3: Downstream environmental assessment**

Bio-based products and bio-based value chains have been identified as one of the most promising pathways to transform into a sustainable and fossil-independent economy. The true benefits of such an approach requires transparency in terms of the embedded environmental, techno-economic and societal impacts. These three pillars of sustainability for bio-based products are determined by a number of factors, primarily: the nature of the feedstock that is transformed into the product; the technology route; and product fate post-consumption. Life cycle assessment, a robust impact-led sustainability analysis tool that enables one to envisage these impacts, also has insufficiencies, mainly with regards to limitations in addressing the circular product characteristics. WP3 has conceived some preliminary non-conventional indicators to recognise the material circularity introduced (green-design, industrial recovery, re-use and other waste management infrastructure) into a bio-based product (novel/existing). The proposed indicators will place emphasis on resource efficiency and material circularity of bio-based value chain and are as follows:



**Non-conventional indicators to highlight the circularity of bio-based products**

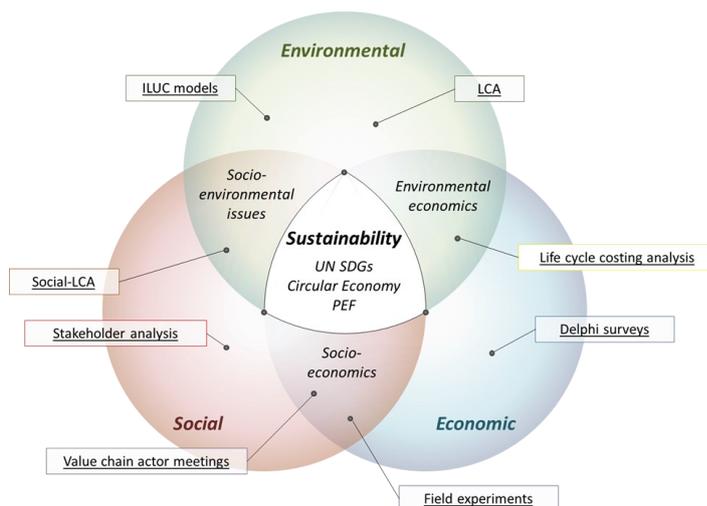
- Waste factor;
- Waste circularity;
- Avoided virgin material;
- Critical material circularity;
- Land-use efficiency;
- Functionality (Output quality services).

### WP4: Techno-economic assessment

In the framework of WP4, preliminary activities have been to define the scope of the techno-economic sustainability analysis of the alternative end of life options, for bio-based chemicals, polymers and added value products. A methodology was developed to define all the end of life options to be considered, through incorporating consideration of:

- Waste hierarchy as determined by EU legislation;
- Relevant standards and statistics referring to each end of life option;
- Current situation as presented in the literature;
- Qualitative data, such as inputs and outputs from the processes of the end of life options;

As a next step, the different scenarios for end-use of products will be analysed in terms of their techno-economic sustainability depending on their potential for further valorisation as a resource for alternative secondary value chains, and eventually for their recyclability potential, biodegradation and/or compostability in various environments and energy recovery. The scope and objectives of the development of techno-economic sustainability analysis criteria will be defined and systematic data and information for alternative sustainability indicators from sustainability analysis of bio-energy and biomass based on standards and



The three pillars of sustainability annotated with the more prominent tools and methods used in STAR-ProBio.

### WP5: Market assessment

Consumers and businesses are paying more attention to the sustainability of bio-based products, and many companies are becoming aware of what they believe their consumer’s sustainability preferences are. As a result, companies are attempting to be more transparent about the sustainability impacts of the products they put on the market. In order to investigate this behaviour, WP5 will conduct an ex-ante perspective analysis in order to identify sustainability criteria that are easily understood by consumers and relevant to their needs. Current research is devoted to the identification of consumers’ preferences in sustainability assessment schemes; the results will be used in a questionnaire for a Delphi survey conducted early next year.

### WP6: Social assessment

The objective of WP6 is to assess the social and socio-economic impacts of bio-based products, utilising the Social Life Cycle Assessment (SLCA) methodology in order to make the assessment comparable with environmental and techno-economic evaluations carried out by other WPs. During the first five months, we have been working on the identification of the most significant social items, pertaining to the bio-based products realm, upon which our impact analysis will be carried out. To this end, an in-depth review of the literature (including reports and frameworks for S-LCA applied to bio-based products) enabled us to propose a preliminary value items list (focused on health and safety, social acceptability, food security, employment, income, human rights and working conditions, gender issues and discrimination, and access to material resources and land use change) that will be validated and/or integrated in the coming months by a stakeholder analysis. Specifically, potential affected stakeholders (i.e. workers, consumers, local community, value chain actors and society) will be identified and engaged through focus groups, two workshops (in Berlin and Rome) and webinars.





### FOCUS ON WP7: ILUC risk assessment for bio-based products

**“ILUC typically occurs when traditionally grown agricultural land is turned over to biomass production for non-agriculture emerging sectors including bio-based products ...If the original objective was to improve sustainability, the final effect might be the opposite. ”**

Diego Marazza,  
University of Bologna  
(UNIBO)

The idea of replacing many everyday commodities made of fossil and non renewable resources with novel bio-based products is attractive from many angles. However, all transitions imply a trade-off: some negative effects manifest only after years have passed because of secondary, subtle interactions. WP7 oversees a potentially dangerous secondary effect known as Indirect Land Use Change (ILUC). To explain it one must consider that most bio-based products are currently made from terrestrial biological resources requiring land to grow. This is the same land used to produce food, feed, textiles and many other commodities which are indispensable or can be reduced slightly. ILUC typically occurs when traditionally grown agricultural land is turned over to biomass production for non-agriculture emerging sectors including bio-based products (vast changes usually driven by policies and economic instruments such as subsidies); it follows that agricultural land expands elsewhere to meet the existing and growing demand of crops for food, feed and other industrial products. Expansion often happens at the expense of wetlands, grasslands, pastures, forests, and other carbon rich ecosystems, which are able to store carbon and provide many ecological services to mankind. Effects can be severe, including increased greenhouse gas emissions, biodiversity loss, less infiltration and groundwater reservoir recharge, and more desertification. If the original objective was to improve sustainability, the final effect might be the opposite.

A key point is that ILUC is an effect propagated and controlled by economic forces acting at a planetary scale which are specific for any given displaced crop and production area. It depends on system behaviour, both on demand and supply side and market structure, and can be triggered by manifold causes. Changes are not forcefully negative: they can be absorbed into the system either because agriculture and industry improve on efficiency and/or because some substitution is possible at the demand level; in this case there is a system gain overall. The aim of WP7 is to develop a method to assess these effects for bio-based products, prevent them from happening and guide the system to sustainable choices. To attain such a goal WP7 has chosen to develop a risk approach. The team has designed a model representing the economic effects and the factors linking production of bio-based products with land consumption. It includes sensitivity of the price to demand changes, land availability, yields and substitution effects, and also accounts for positive factors (*i.e. limiting ILUC effects*), such as the efficient use of land and by-products and co-products.

The objective for the near future is to assess to what extent each factor included in the model exacerbates or on the contrary mitigates ILUC effects. Factors proven to be critical ones will define risk indicators. For exacerbating factors the higher the value of the indicator, the higher ILUC risk, *i.e. the likelihood that a given bio-based product will induce ILUC with negative effects*. Project partners will also develop a set of recommendations based on the indicators mitigating ILUC risk aiming to guide policy makers and channel investments. Looking at the future, the team is considering effects on sea use change. This might be relevant in the dawn of the so called blue-growth economy where algae cultivation and other marine species will play a considerable part in the bio-based economy.

### STAR-ProBio Events



**Contagious enthusiasm** are words that characterised the May 2017 **STAR-ProBio kick-off meeting**, hosted by TU Berlin.



The October 2017 first **General Assembly** gathered the STAR-ProBio project team in Rome, 2 days of cross-disciplinary discussions on how to squeeze the most **added value for the emerging bio-economy** out of the next 2.5 years of our ambitious project.

## STAR-ProBio Events

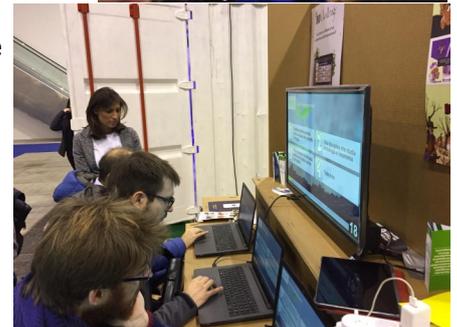
### Maker Faire Rome, 1st-3rd December 2017

Maker Faire Rome gathered together tech enthusiasts, crafters, educators, schools, universities, research institutes, artists, students, and corporations. It combined science, science fiction, technology, entertainment and business to create something totally new! Jointly with the BIOWAYS project, STAR-ProBio presented at the *Maker Faire* within the Bioeconomy Village: it was a great success! More than 15.000 attendees came to visit us over the three days and took the opportunity to learn more about the bioeconomy, bio-products and, of course, standards and eco-labels.

At **Bioeconomy Village** more than 60 bio-based products were showcased in a practical and engaging way through samples, thematic workshops and demonstrations. 50 researchers from 30 research centres, organisations and associations, companies and start-ups (among others Unitelma Sapienza, Sapienza University of Rome, Bologna University, the National Research Council, FVA New Media Research, Tor Vergata University, Eni, NOVAMONT and Frascati Scienza) engaged with the general public raising public awareness, improving knowledge on bio-based products, and promoting the benefits of the bioeconomy. The Bioeconomy Village was structured in 9 thematic areas:

- Cleaning and hygiene, personal care and cosmetics, health and biomedical
- Textile products, clothing, sports and toys
- Food packaging, disposable products for catering and events
- Biofuels and bioenergy
- Environmental bioregulation and biological sensors
- Building, construction and restoration, paintings, decorations and furniture
- Agriculture, food, nutraceuticals and fishing
- European projects
- Games area

The **Games Area**, where people played and learned at the same time, recorded hundreds of attendees throughout the three days. At the same time, several EU funded projects (ISAAC, First2run, ValoriBio, Karma2020, Biopen and Demeter), together with STAR-ProBio and BIOWAYS, presented their work in the **European Projects Area**.



### Bio-based Industries Joint Undertaking Stakeholder Forum 2017, Brussels 6th & 7th December 2017

STAR-ProBio attended this event as an exhibitor alongside more than 65 European projects who also exhibited and presented their work to scientists and representatives from the industry, SMEs, academia, research organisations and policy makers from hundreds of institutions attending the Forum. The BBI JU is a public-private partnership aiming at increasing investment in the development of a sustainable bio-based industry sector and contributing to establishing Europe as a key player in research, demonstration and deployment of advanced bio-based products and biofuels. The BBI JU organises calls for proposals to support research, demonstration and deployment activities enabling the collaboration between stakeholders along the entire value chains covering primary production of biomass, processing industry and final use.

Piergiuseppe Morone, as Project Coordinator, presented STAR-ProBio in a plenary session during the first day, for project exhibitors only. In the same day, the STAR-ProBio team had the opportunity to network with colleagues from other projects participating in the four thematic sessions on "Aquatic biomass", "Waste as feedstock", "Agri-food" and "Forest- and lignocellulosic-based biomass".

The day after, the event was open to the public and included plenary keynote speeches and high-level discussions with expert panels. The event successfully encouraged constructive and open dialogue with stakeholders and cross-collaboration.





### LUANA LADU

#### **What is your role in the project and how does your work help to reach STAR-ProBio's desired impact?**

I am the project leader at TU Berlin. We are leading the implementation of two Work Packages. The first work package is dedicated to the identification of existing gaps in sustainability assessment schemes and standards around bio-based products. The aim of this WP is to capture the view of relevant stakeholders in identifying and prioritising areas of intervention of the project. It also includes the identification of relevant case studies (from companies that produce bio-based intermediates and end products) on which the sustainability assessment tools, criteria and indicators to be built within the project will be tested. We are also leading the work package on Market Assessment, which aims to assess consumer sustainability preferences. The identified consumer preferences will be taken into consideration for the development of further sustainability assessment tools for bio-based products.



**“Success for our project means developing sustainability assessment schemes that are relevant to consumers and producers, while ensuring that new products and processes place us on a pathway towards a truly circular, climate-neutral bio-based economy.”**

Luana Ladu,  
Technical University  
of Berlin (TUB)

#### **What is the most interesting part of your job?**

I like working together with a motivated international team contributing to the establishment of an evidence-based and well managed European circular bio-based economy.

#### **Tell us a bit about your background/career path**

I am originally from Sardinia, but I conducted my studies in economics at Bocconi University in Milan and the Federal University of Bahia in Brazil. After this, I worked in the field of international development at the Inter-American Development Bank, focusing on innovation and ICT. After returning to Europe, I began working on topics related to the Bioeconomy.

#### **What is your view of the bio-based products sector/market?**

It is an interesting sector and I believe that we will be able to achieve a circular bio-based economy as an alternative to our current fossil-based society. However, it requires a process of experimentation and innovation both in technology and policy.

#### **In your opinion, what would success look like for the project?**

Success for our project means developing sustainability assessment schemes that are relevant to consumers and producers, while ensuring that new products and processes place us on a pathway towards a truly circular, climate-neutral bio-based economy.

### JANUSZ GOŁASZEWSKI



#### **What is your role in the project and how does your work help to reach STAR-ProBio's desired impact?**

Here at my university, the University of Warmia and Mazury in Olsztyn (UWM) I am Head of the Centre for Bioeconomy and Renewable Energies (the CBEO). This is an interdepartmental unit, which integrates the interdisciplinary potential of research teams from different university departments. The STAR-ProBio project has brought together scientists from 4 departments – the Faculty of Environmental Management and Agriculture, the Faculty of Life Sciences, the Faculty of Economic Sciences and the Faculty of Law and Administration. In total, 15 people from UWM are engaged in this project. As with other projects performed at the CBEO-UWM, I have initiated our involvement in this project and am now coordinating its performance.

The UWM research teams involved in the STAR-ProBio project participate in the execution of work packages WP1-4 and WP7-10, and additionally the University

of Warmia and Mazury acts as the coordinator of research tasks within WP8. My role in the project is to maintain close cooperation with the researchers performing investigations within WP1-7, as the essence of WP8 is to integrate the results of these studies, and two of the seven research tasks in WP8 comprise the project's key final outputs, i.e. (i) a suggested approach to developing the currently binding standards for certification of bio-based products, and (ii) a fast track for standardisation documents issued for bio-based products. This means that the success of the work I am doing in this project will arise from the successful performance of the research tasks by the whole consortium involved in the project.

#### **What is the most interesting part of your job?**

By being engaged in this project I have an exceptional opportunity to participate in trailblazing studies, which are comprised of the most up-to-date research initiatives in the EU and globally, and are closely associated with the formation of a future bioeconomy market, based on precise assessment guidelines for the 'bio' component in new products, as well as the creation of social trust and approval of these products. What I find most interesting in my work is that it stimulates continual development of my research interests, which encourages me to seek common ground between various research disciplines.

#### **Tell us a bit about your background/career path**

I am a graduate of agricultural studies and began my career in the field of applied statistics and information technologies in agricultural research, but later I focused on investigations connected with renewable energy, mostly orientated towards raw material production technologies and processes of generating biofuels and bioenergy, an interest which over the last decade has evolved towards biorefinery processes and multi-product generation. The STAR-ProBio project furthers my knowledge towards value chains of bio-based products, analysed from the angle of product life cycles and restitution of the environment (circular economy).

#### **What is your view of the bio-products sector/market?**

The market of commercial biobased products is already exceptionally active, and many companies traditionally oriented towards manufacturing products from non-renewable resources are reorienting their production to include biomass raw materials and processing technologies in line with the sustainable development guidelines (SDGs). Even more importantly, the number of companies whose dedicated products are bio-plastics or bio-derived fine chemicals is increasing quite dramatically. All this means that the contemporary market of bio-based products offers a specific mix of products comprising different amounts of 'bio' component, and the environmental impacts of this activity have yet to be assessed unambiguously. Consequently, we are frequently faced with situations where consumers receive false claims that a given product is eco-friendly and its production does not create a burden on the environment ('greenwashing'). What this shows is that the regulations pertaining to the 'ecological' character of products are lagging behind the dynamic changes of the industrial bio-based products market. This issue is among the most important problems we intend to tackle in the STAR-ProBio project.

#### **In your opinion, what would success look like for the project?**

The project will be successful if we are able to identify critical points in an assessment of the sustainability of bio-based products in an entire value chain and, finally, in the life cycle of a product, after which we should propose an appropriate set of standardisation activities. This is a great challenge because many regulations of this type either have recently become effective or are being developed now. Nowadays, many companies are implementing standardisation, certification or labelling procedures at different stages within the value chain of bio-based products.

A certificate ensuring that a product is manufactured in accordance with the principles of sustainable development is the main driving force of development for many companies in the domain of the bioeconomy. Our suggestions will have to be consistent with the current regulations and market practice guiding their implementation. What gaps can be found in the standardisation procedures for bio-based products, and what a uniform system of standards should look like, are the key questions we will try to answer while pursuing this project.

**“We are frequently faced with situations where consumers receive false claims that a given product is eco-friendly and its production does not create a burden on the environment ('greenwashing')”**

Janusz Golaszewski,  
University of Warmia  
and Mazury in Olsztyn  
(UWM)





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### Forthcoming events: STAR-ProBio 1st Annual Workshop

In Spring next year STAR-ProBio will be hosting its 1st annual workshop, which will be held on the 6th April during Climate Show 2018 in Geneva. This two hour workshop will provide an excellent opportunity to provide input and direction into the work of the STAR-ProBio project, as well as to find out more about the project and its outputs. The programme for the event is as follows:

- **Spotlight on STAR-ProBio** – Prof. Piergiuseppe Morone, Project Coordinator, Unitelma Sapienza, IT
  - Aim and objectives of the project
  - Key findings in Year 1
  - Expected future outputs and achievements
- **European Standards supporting the market for Bio-based Products** – tbc (CEN/TC 411 representative)
- **Panel Discussion: A vision for a bio-based economy:** Opportunities and challenges for bio-based products. – Panel convened by Prof. James Clark, Director, Green Chemistry Centre of Excellence, University of York, UK. Panel members to include representatives from: Industry; Civil Society; Policy; Academia; and the Press.
- **Next steps and Closing Remarks.**

Places are available for up to 100 participants and will be allocated on a first-come, first-served basis. To register for this event for free please visit:

<http://www.climateshow.ch/en/star-probio-registration/>

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