STAR ProBio

Sustainability Transition Assessment and Research of Bio-based Products

Grant Agreement Number 727740

WP8
Standards on sustainability of bio-based products - gaps and recommendations -

STAR-ProBio final virtual meeting

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Janusz Gołaszewski

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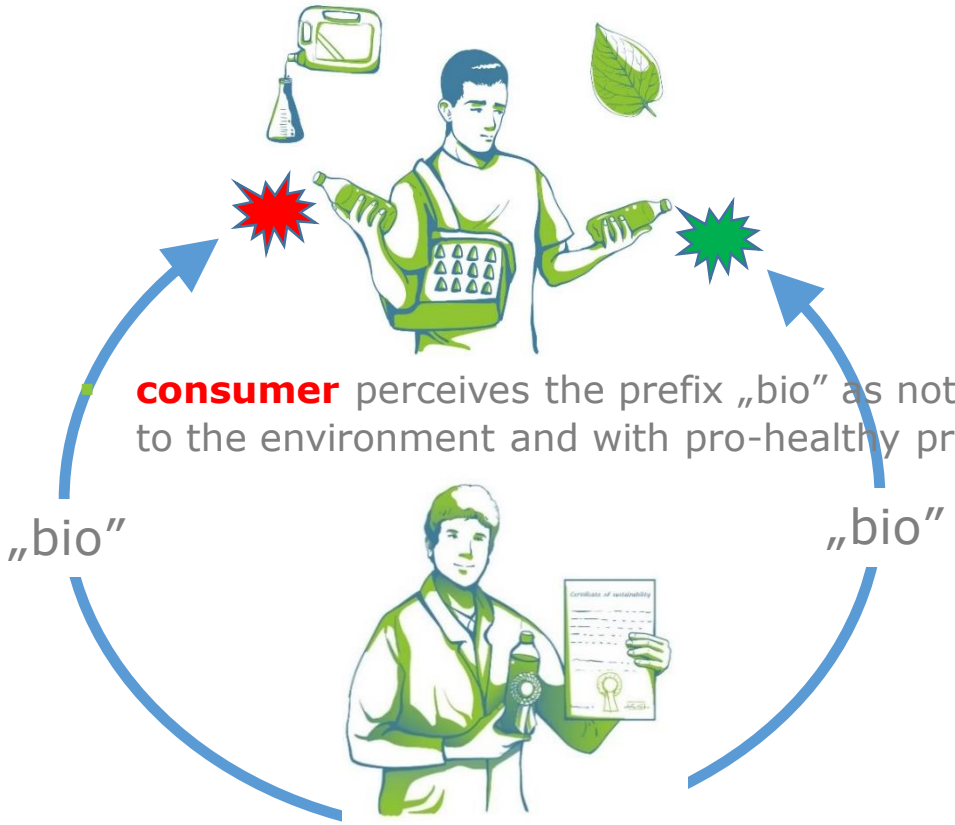
Introduction

Do bio-based products require sustainability assessment ?

- a „bio-", „eco-", „green-" product does not mean sustainable only because of the name
- avoid greenwashing
- …

Is a certified sustainable bio-based product is beneficial for a company ?

- competitive advantage
- positive brand perception
- higher revenue
- …



- **consumer** perceives the prefix „bio" as not harmful to the environment and with pro-healthy properties
- **manufacturer** perceives the prefix „bio" as a promotional economic activity

How well do bio-based products meet a set of current requirements on sustainability?

- What do bio-based products offer?
- What is the consumer's demand?

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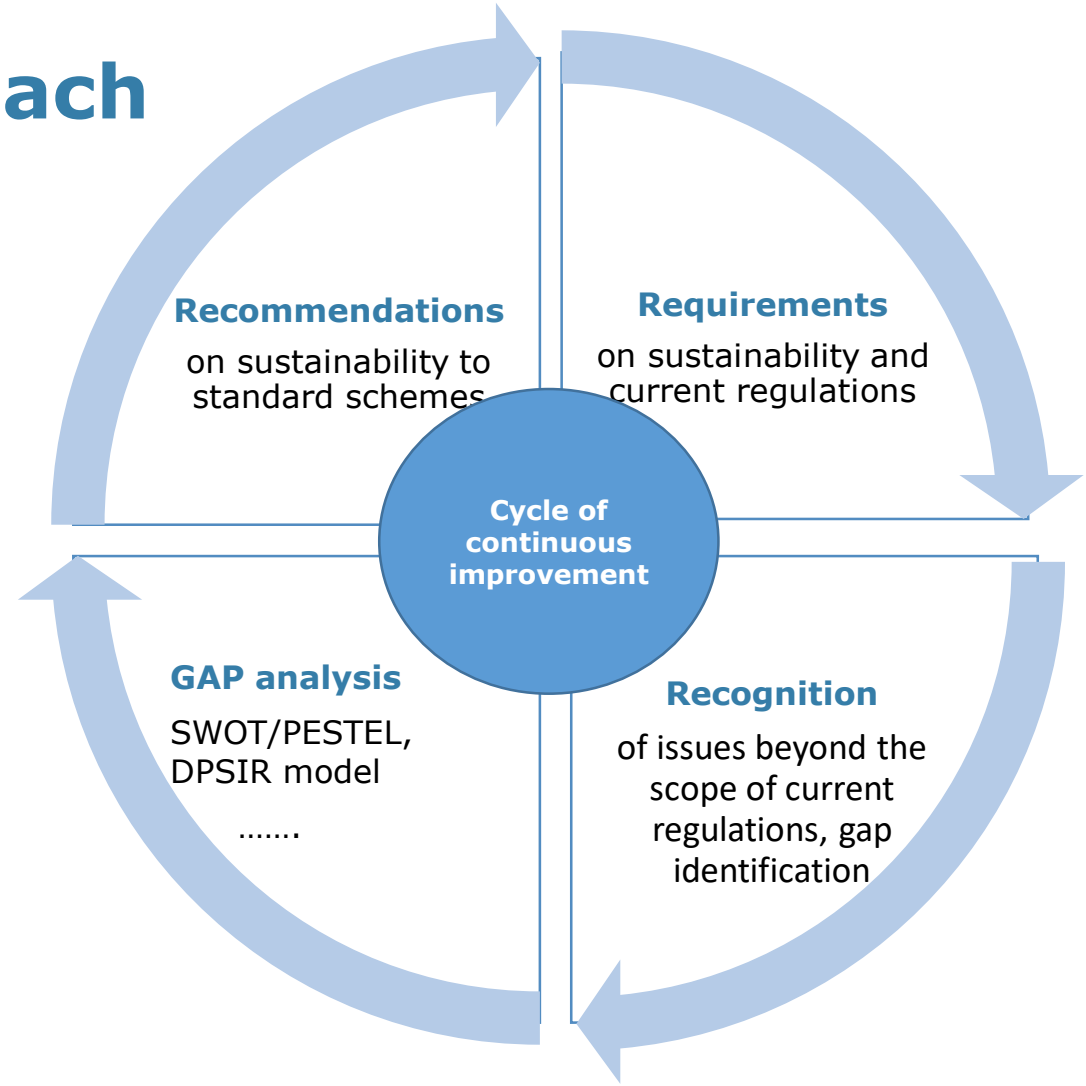
Objectives

- to screen the current sustainability schemes
- to detect underdeveloped areas
- to identify internal and external factors related to the improvement of sustainability schemes
- to provide recommendations to improve current sustainability schemes

Approach



From analysis of the current regulations on sustainability of bio-based products to recommendations for improvements

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The basis for sustainability requirements

„…There is nothing more wrong than that. What we are doing is using taxpayers' money - which means our money - to boost hurricanes, to spread droughts, to melt glaciers, to bleach corals. In one word - to destroy the world. …„

U.N. Secretary-General Antonio Guterres, Vienna, Austria. Conference on Climate Change 2019

Potential environmental, economic and social impacts related to/mitigated by bio-based products

Sustainability addressed to	Environmental implications	Economic implications	Social implications
Resources	• depletion of natural biotic and abiotic resources	• higher prices of bio-based feedstock. • potential conflict with food sector	• food insecurity • threats to standard of life and lifestyle
Land use	• destruction of natural habitats due to land use changes and biodiversity loss	• the focus on short-term profits at the cost of maintaining the long-term environmental sustainability • land grabbing	• underpinning human life support systems • threats to provisional ecosystem services
Soil	• soil degradation due to inadequate rehabilitation after intensive uptake of nutrients	• a lower profitability for farmers due to decreased soil fertility	• local communities bear off-site costs
Water	• changes in watersheds both due to water overexploitation (irrigation) and agricultural runoffs (eutrophication)	• growing demand for fresh water	• limited access to fresh water
Air	• emissions related to the use of non-renewable materials, manufacturing, and waste management	• generation of external costs	• threat to health

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CEN standards (bio-based products)

(EC Mandates M/429 (2008) M/491 and M/492 (2011)

WG1: Terminology

- EN 16575:2014 Bio-based products – Vocabulary

WG2: Bio-solvents

- CEN/TS 16766: 2015 Bio-based solvents – Requirements and test methods

WG3: Bio-based content

- CEN/TR 16721:2014 Bio-based products – Overview of methods to determine the bio-based content
- EN 16640:2017 Bio-based products – Bio-based carbon content – Determination of the bio-based carbon content using the radiocarbon method
- EN 16640:2017/AC:2017 Bio-based products – Bio-based carbon content – Determination of the bio-based carbon content using the radiocarbon method
- EN 16785-1:2015 Bio-based products – Bio-based content – Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis

WG4: Sustainability criteria, life cycle analysis and related issue

- CEN/TR 16957:2016 Bio-based products – Guidelines for Life Cycle Inventory (LCI) for the End-of-Life phase
- **EN 16751:2016 Bio-based products – Sustainability criteria**
- EN 16760:2015 Bio-based products – Life Cycle Assessment

WG5: Certification and declaration tools

- EN 16848:2016 Bio-based products - Requirements for Business to Business communication of characteristics using a Data Sheet
- EN 16935:2017 Bio-based products - Requirements for Business-to-Consumer communication and claims

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ISO standards (sustainability)

environment-related

- ISO 14040:2016 Environmental management - Life cycle assessment - Principles and framework.
- ISO 14045:2012 Environmental management - Eco-efficiency assessment of product systems. Principles, requirements, and guidelines
- ISO 14046:2014 Environmental management - Water footprint - Principles, requirements, and guidelines

other horizontal standards

- ISO/TS 14067:2013 GHG emissions: Greenhouse gases. Carbon footprint of products. Requirements and guidelines for quantification and communication
- ISO 14046:2014 Water Footprint: Environmental management. Water footprint. Principles, requirements and guidelines

bio-based energy

- **ISO 13065:2015 Sustainability criteria for bioenergy**

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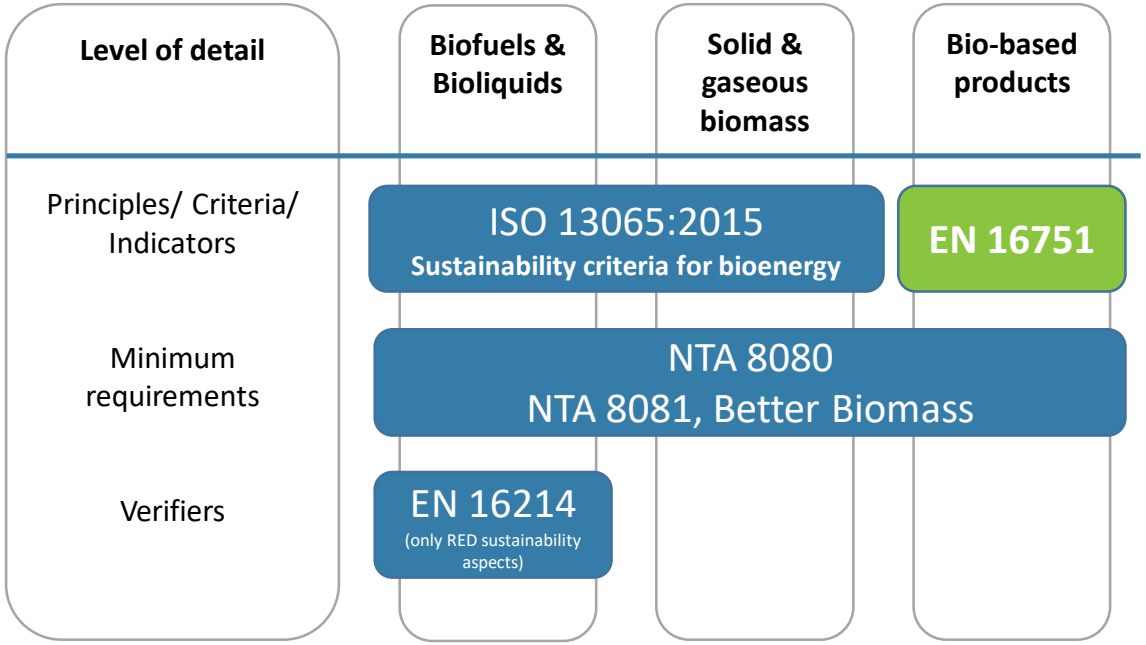
Overview of horizontal standards on sustainability of biofuels and bioliquids, solid and gaseous biomass, and bio-based products

ISO 13065:2015

Sustainability criteria for bioenergy

- specifies principles, criteria and indicators for the bioenergy supply chain to facilitate assessment of environmental, social and economic aspects of sustainability
- applicable to the whole supply chain, parts of a supply chain or a single process in the supply chain
- does not establish thresholds
- does not determine the sustainability of processes or products
- is intended to facilitate comparability of various bioenergy processes or products.



The place of bio-based products in the standards on sustainability

(Own on the basis of Willemse H. NEN, 2017)

NTA 8080:2015 (NEN)

Sustainably produced biomass for bioenergy and bio-based products. Part 1 Sustainability requirement.

- The basis to develop a certification system that offers organizations an instrument to demonstrate that they comply with the sustainability requirements of NTA 8080.

NTA 8081 (cert. scheme)

Better Biomass (cert. scheme)

- an international certification system for solid, liquid and gaseous biomass
- it consists of sustainability requirements, chain-of-custody requirements and rules for certification

EN 16214

- EN 16214-1:2012 (08-2012) Sustainability criteria for the production of biofuels and bioliquids for energy applications – Principles, criteria, indicators and verifiers – Part 1: Terminology
- CEN/TS 16214-2:2014 (01-2014) Part 2: Conformity assessment including chain of custody and mass balance
- EN 16214-3:2012 (08-2012) Part 3: Biodiversity and environmental aspects related to nature protection purposes
- EN 16214-4:2013 (01-2013) Part 4: Calculation methods of the greenhouse gas emission balance using a LCA approach

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EN 16751:2016 Bio-based products – Sustainability criteria

The scope

- it sets horizontal sustainability criteria applicable to the bio-based part of all bio-based products, excluding food, feed and energy, covering all three pillars of sustainability; environmental, social and economic aspects
- it does not address non-bio-based (fossil, mineral) parts of a product
- it can be used for two applications; either to provide sustainability information about the biomass production only, or to provide sustainability information in the supply chain for the bio-based part of the bio-based product.
- it sets a framework to provide information on management of sustainability aspects.
- it cannot be used to make claims that operations or products are sustainable since it does not establish thresholds or limits.
- it can be used for business-to-business (B2B) communication or for developing product specific standards and certification schemes.

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Method

SWOT

enumeration of factors influencing bio-based product standardization blueprint from the point of view of internal and external environments

- internal
  - strengths S
  - weaknesses W
- external
  - opportunities O
  - threats T

PEST/PESTEL

internal and external impacts that affect a company strategy in manufacturing of bio-based products; analysis extends the SWOT analysis by assigning factors as:

- political P
- economic E
- social S
- technological T
- environmental E
- legal L

SWOT analysis framework

	Internal factors	External factors
Favorable factors	**Strengths** a resource that can be effectively used to achieve its objectives	**Opportunities** favorable situations in the external environment
Unfavorable factors	**Weaknesses** a limitation, fault or defect that makes it difficult to achieve objectives	**Threats** unfavorable situations in the external environment that can be potentially damaging to the blueprint

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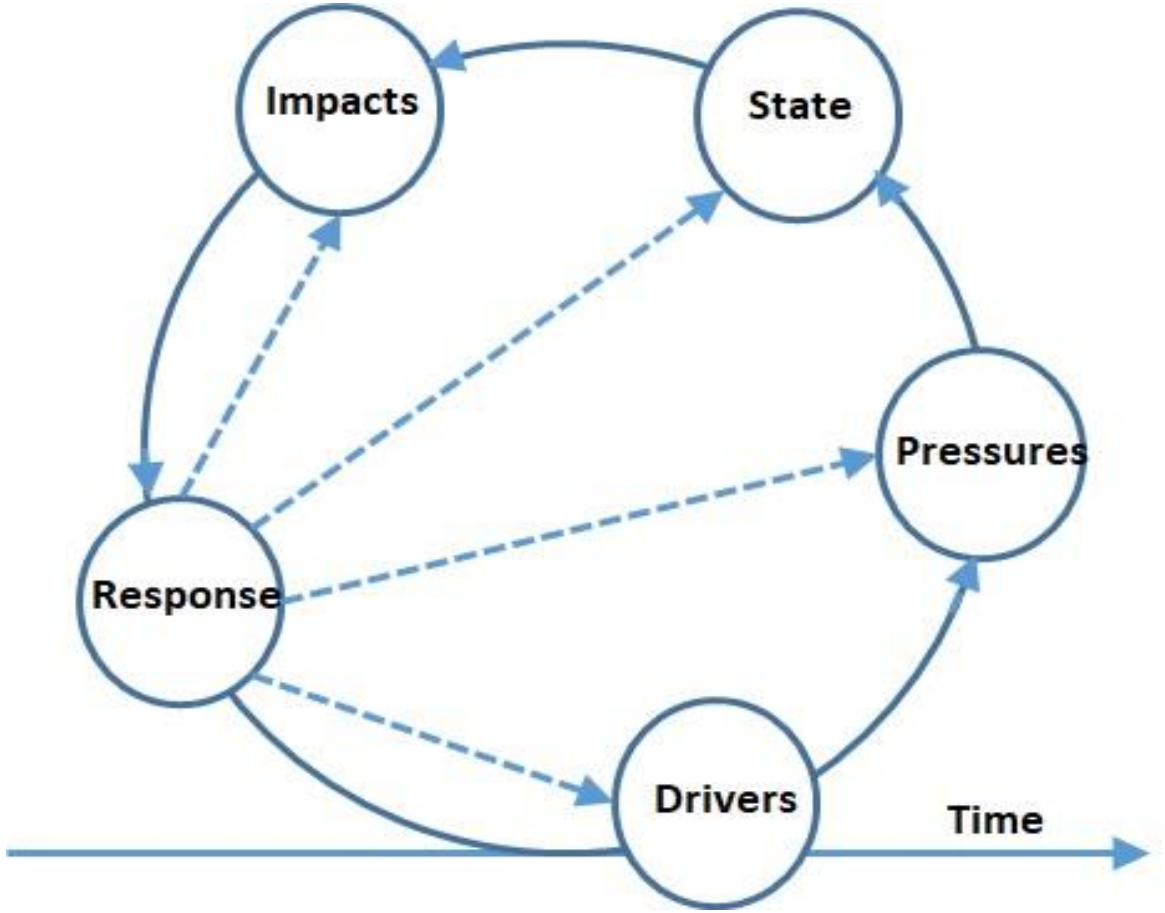
Method

Ecosystem-based DPSIR Model

The model relates human activities in the function of time to the sustainability of bio-based products through sequential analysis of causalities between

- **D**rivers/driving forces
- **P**ressures
- **S**tates
- **I**mpacts
- **R**esponses to the above



DPSIR model in application to sustainability assessment of bio-based products

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STAR-ProBio results

Actions addressed to the identified issues beyond the scope of EN 16751:2016

- providing additional assessment methods and thresholds;
- facilitating cradle-to-grave or cradle-to-cradle analyses of bio-based products;
- providing a standard to facilitate comparisons of bio-based and fossil-derived products;
- considering iLUC and related issues appropriately by standardization;
- developing standards, which provide guidance on social and economic LCA;
- creating standards for the circular economy;
- recognizing sustainability criteria for bio-based polymers and lubricants.

Gaps addressed to EN 16751:2016

1) Gaps and weaknesses in criteria and indicator sets.
2) Harmonization in criteria assessment and operationalization.
3) Legislation and consensus for minimum criteria in all BBE (Bio-Based Economy) sectors.
4) Leakage effects from EU BBE policies.
5) New innovative, inter-sectoral products.
6) End-of-Life.
7) Traceability of sustainability and certificates along the value chain.

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Gaps and weaknesses in criteria and indicator sets.

Summary of the SWOT analysis (S-strength, W-weaknesses, O-opportunities, T-threats)	
S	▪ The conventional biomass-based food and forestry sectors as well as bioenergy have well established and recognized certification schemes. ▪ Many existing criteria and indicators cover a broad range of issues which can be considered for transfer to the horizontal standard of bio-based product.
W	▪ It is difficult to reach a consensus on the criteria and indicators in the context of horizontal regulations regarding the uptake of additional indicators, availability of databases and different sectoral requirements on sustainability.
O	▪ A comprehensive set of appropriate criteria and indicators will prove sustainability and increase public confidence and market uptake of bio-based products
T	▪ The lack of comprehensive and fair criteria and indicators generates the risk that a certification scheme will not be able to show sustainability. ▪ Difficulties to fulfill requirements, to be operationalized, and to be complex enough yet understood by consumers.

Scope of the Criteria
Domain: Environmental
Reduce ILUC related GHG emissions
Reduce SO_2eq.
Reduce PM10
Reach targeted bio-based content and recyclability/ biodegradation
Domain: Economic
Promote land use efficiency
Promote tertiary resource use efficiency
Improve functionality
Reduce levelized life-cycle cost
Domain: Social
Reduce risks for negative impacts on food prices and supply

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Harmonization in criteria assessment and operationalization.

Summary of the SWOT analysis (S-strength, W-weaknesses, O-opportunities, T-threats)	
S	▪ There are numerous certification schemes and their operationalization on the market as well as different frameworks for audits exist in practice. ▪ The methodology for the key environmental impact associated with assessment of GHG emissions as well as and mitigation values are clearly specified in global and European regulations.
W	▪ Most of the criteria and indicators were developed by scientists and usually for scientific purposes, and they require time for adaptation in practice. ▪ Difficulties in public comprehension while the advanced analytics can generate a higher price of a certification process that may not be generally approved of.
O	▪ The collection and compilation of different practices of auditing frameworks provide an opportunity to develop the guidance on technicalities of the application of sustainability criteria in practice. ▪ The potential for unification of sustainability schemes to be more universal in the context of B2B market development.
T	▪ A risks can be related to focusing on the mitigation of environmental impact rather than on the optimization of production. ▪ A risk that a horizontal standard will be not considered in the certification scheme due to difficulties in methodologies and complicated assessment and operationalization of the criteria and indicators in practice.

Scope of the Criteria
Domain: Environmental
Reduce GHG mitigation thresholds or GHG emissions calculation
Eliminate annual deforestation rate
Domain: Social
Respect labour rights
Monitoring legality of sourcing
Respect land use rights

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Legislation and consensus for minimum criteria in all BBE (Bio-Based Economy) sectors.

Summary of the SWOT analysis (S-strength, W-weaknesses, O-opportunities, T-threats)	
S	▪ There is the legislative background for the formulation of general requirements for sustainability of bio-based product. There are standards, certification schemes and ecolabels public procurement systems and national policies that indicate different economic subventions via tax incentives or reduced VAT for bio-based products. ▪ The legal basis for biofuels support can be a reference for supporting of bio-based products.
W	▪ The integration of different programs related to sustainability of bio-based products and the process for combining requirements can prove to be complicated. ▪ Difficulties in the creation of integrated policy, limited implementation of sustainability requirements for bio-based products in public procurements and tax incentives in line with the EU provisions pertaining to state aid. ▪ The lack of an agreed methodological approach for the creation of such general requirements and proving sustainability.
O	▪ There are advanced regulations for sustainability of biofuel and bioenergy sectors so that bio-based products can be considered in the context of the quota system currently available for renewable energy in some EU countries, and this can greatly facilitate the integration of bio-based products with the ETS system. ▪ Stimulation of the development of a general eco-labelling scheme, social awareness on their use in public procurements, and policy-related incentives.
T	▪ Low competitiveness of bio-based products substituting fossil ones and the lack of a level playing field related to sustainability requirement across various bio-based sectors.

Scope of the Criteria
Domain: Legislation & consensus for minimum criteria in all BBE sectors
Compliance with meta-standard on sustainability
Domain: Social, Economic, Environmental
Source sustainable materials
Practise sustainable manufacturing
Promote sustainable consumption
Maintain sustainable ecosystems
Promote sustainable communities

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Leakage effects from EU BBE policies.

Summary of the SWOT analysis (S-strength, W-weaknesses, O-opportunities, T-threats)	
S	▪ Development of normative definitions on sustainability of bio-based products can benefit from positive and negative experiences associated with policies and legislation on biofuels and bioenergy. ▪ The identified key leakage effects are indirect land use change, food security and carbon debt. The effects are well recognized and the methodology of their assessment is consequently developed.
W	▪ Hard to predict because the future consequences of the present policies or decisions cannot be anticipated. ▪ The weight of leakage effects is relevant as they can account from negligible up to more the 100% of a specific indicator, such as greenhouse gas emissions. ▪ A quantified assessment is difficult to accept by the majority of stakeholders. ▪ Politicians rarely make decisions on uncertain subjects implying high stakes. ▪ Counteracting or precautionary actions are difficult because they are very often stimulated by unintentional or illegal activities.
O	▪ Reliable assessment and anticipation of leakage effects can lead to better governance on sustainability by avoiding unwanted effects. ▪ Better assessment will provide the public with a comprehensive output.
T	▪ The lack of a precise assessment of leakage effects can undermine the overall policy on sustainability and tarnish the public perception and approvals. ▪ As a result, land grabbing oriented toward short-term economic profits can evolve.

Scope of the Criteria
Domain: Leakage effects
Reduce iLUC
Avoid carbon leakage
Domain: Social
Preserve food security assuming four pillars: availability, access, utilization and stability

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New innovative, inter-sectoral products.

Summary of the SWOT analysis (S-strength, W-weaknesses, O-opportunities, T-threats)	
S	▪ There are regulations on sustainability in some sectors, thus presuming that the value of a product is contributed by sectors and the value chain integrates the sectors, the sustainability assessment should be also common. ▪ The strength of inter-sectoral products results from the synergistic outcome, mitigation of environmental burden caused by one sector by a positive impact of another one, and sharing the risks by involved sectors
W	▪ There are technological and legislative constraints including the lack of knowledge on techno-technological aspects of advanced manufacturing and the lack of unified legislation on allocation of contributions from different sectors into a common inter-sectoral sustainability aspect.
O	▪ A potential of a more efficient resource use and manufacturing by lowering and sharing costs as a result of the development of new technologies with a strong involvement of R&D sector and a lowered market uncertainty.
T	▪ Achieving the mature stage of a new technology is a long-term process. ▪ In the face of market competition cooperation between sectors can evolve into negative cooperation. ▪ A suggestion that inter-sectoral product does not exist because a final product is already an output of established cooperation along the whole value chain.

Scope of the Criteria
Domain: New innovative inter-sectoral products
Achieving maturity levels of new inter-sectoral products
Domain: Environmental
Contribute to system expansion (consequential LCA)

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End of Life.

Summary of the SWOT analysis (S-strength, W-weaknesses, O-opportunities, T-threats)	
S	▪ The WFD (2008) and CEN/TR 16957: 2017 are examples of regulations that present the waste hierarchy in the context of prioritizing methods for treatment of bio-products at their end-of-life or disposal of waste after their service life. ▪ Specialized sorting technologies enable valorization of material use and biological reintegration of waste into the C cycle. ▪ There are advanced technologies for energy generation although this solution is prioritized after material use and biological conversions.
W	▪ There are no sustainability criteria or thresholds for EoL options, such as minimum recycled content in product, implemented waste management and intended cascade use. ▪ The waste-related normative documents are not compatible, hence the implicated lack of clarity and measurements of recovery and reuse in the waste hierarchy (WFD 2008).
O	▪ The regulations on waste hierarchy and concerning the packaging sector can create awareness of the treatment of solid waste as a resource for further manufacturing and elaboration of key measures to assess waste prevention, reduction and recovery. ▪ A clear indication of the waste hierarchy facilitate policy decisions and legislation.
T	▪ Improper waste management will contribute to high impact of the EoL stage on the life-cycle product sustainability assessment. ▪ There is the lack of R&D investment and new knowledge ▪ The lack of clear legislation on waste in material management can result in a wrong selection from the hierarchy of end-of-life options.

Scope of the Criteria
Domain: EoL
Maximize percentage of waste converted to useful products
Domain: Circularity, Environmental
Enforce organic recycling
Enforce mechanical recycling
Enforce chemical recycling
Promote biodegradability
Maximize energy recovery
Reduce ecotoxicity
Reduce percent of traceable withdrawn or disposed product that undergo EoL options to End-of Waste status

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Traceability of sustainability and certificates along the value chain.

Summary of the SWOT analysis (S-strength, W-weaknesses, O-opportunities, T-threats)	
S	▪ In some sectors of bio-based products such as food, forestry and bioenergy there are credible and robust CoC regulations and the market confirms that the proved claims contribute to sustainability of biomass and bio-based products. Such circumstances facilitate integration of involved actors and implementation of good practices at any stage of a supply chain.
W	▪ Traceability is fragmented by the stages of a supply chain and covers the supply chain from resources to final products without tracing the fate of bio-based products after use. ▪ Establishing life-cycle traceability can take a long time and encounter difficulties considering the integration of stakeholders in the case of global interlinks, potential land grabbing effects, the lack of commonly accepted methods for tracking and recording sustainability, and the level of technological development.
O	▪ Traceability is a guarantee of the sustainability of bio-based products across the entire supply chain, as it limits potential misuse of certificates, incorrect sustainability claims and enhances the overall integrity of sustainability certification. ▪ Certain potential exists in regulations associated with a meta-standard that can integrate numerous registers and databases into a uniform approach, which can contribute to a more equitable share and lower costs of certification.
T	▪ Traceability and certification schemes of sustainability do not address critical points related to the whole supply chain, such as the security of natural resources. Covering all tiers of a value chain as well as life-cycle monitoring of the whole sector of a given bio-based product can be difficult to manage. ▪ The meta-standard is still just a concept, hence the methods for monitoring traceability of certification schemes across value chains require elaboration of quantitative and qualitative rules.

Scope of the Criteria
Domain: Traceaebility
Maintain index of traceability records
Optimize time of traceability
Enforce mass balance in the supply chain
Domain: Environmental
Monitor GWP100+GWPbio
Increase percentage of traceable bio-component in a bio-based product
Domain: Economic
Reduce cost of tracing sustainability and certification
Maximize value added affected by tracing sustainability and certification along the supply chain
Improve consumer perception of bio-based products
Domain: Social
Increase percent of certified companies in the supply chain
Reduce health complains per product

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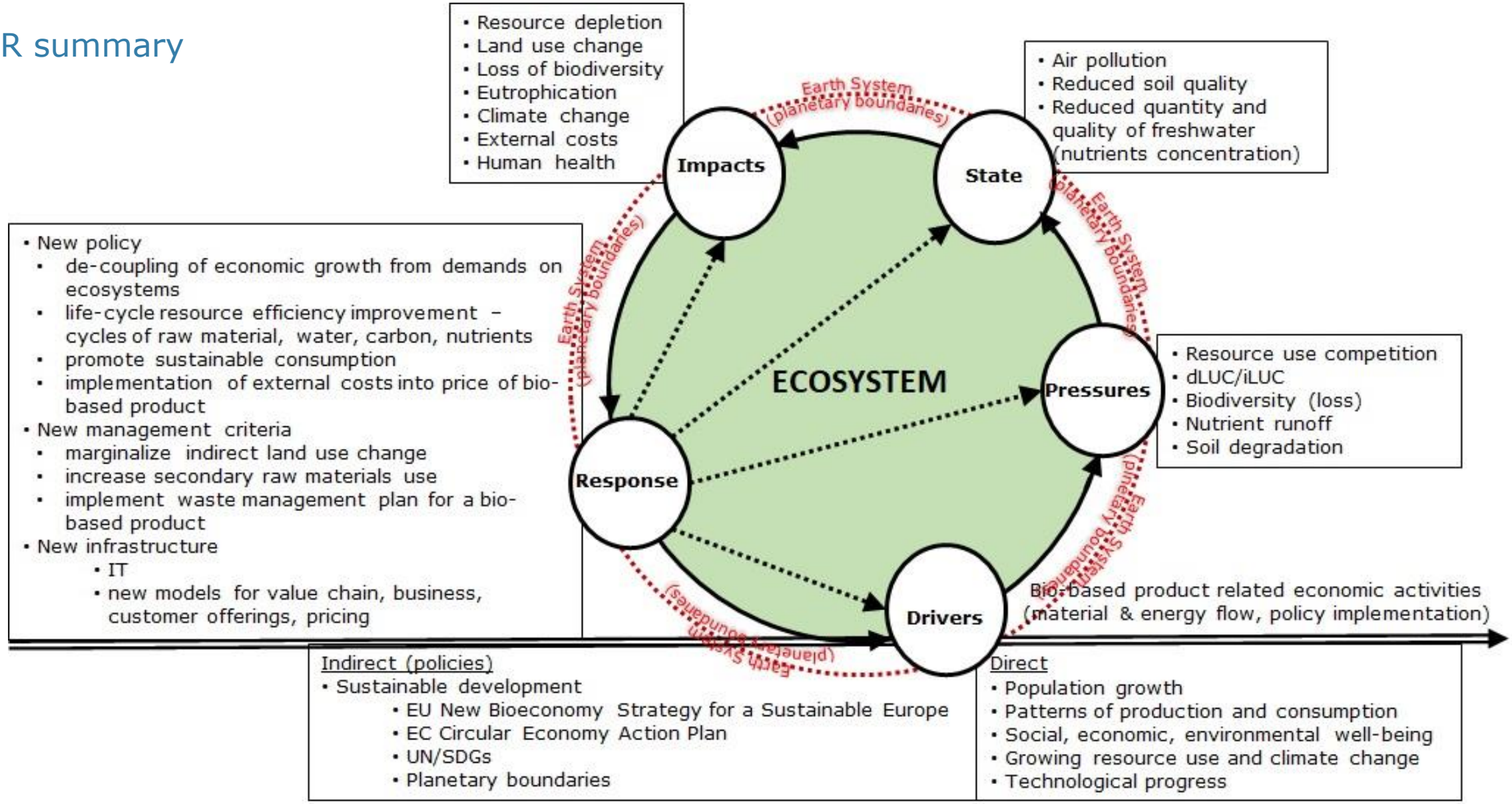
DPSIR summary



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Recommendations – DPSIR-based

- Sustainable Materials
  - are renewable and consume little amounts of the ecosystem's other renewable resources, such as carbon, water and nutrients
  - provide an opportunity for reuse, secondary use, energy recovery or decomposition
- Sustainable Consumption and Production (SCP)
  - to relate SCP with ecosystems and communities
  - to decouple economic growth from resource use
  - social responsibility
  - Sustainable Manufacturing
    - using non-polluting, energy and natural resources conserving, and economically sound and safe processes
  - Sustainable Consumption
    - building public awareness and promoting sustainable consumption, including the active involvement in EoL activities, to prolong bio-based product durability and facilitate reusability, recyclability and recoverability
- Sustainable Ecosystems
  - decoupling economic growth from environmental pressures and impacts.
  - nutrient cycling is essential for continuous supporting of ecosystems as well as to prevent the toxic accumulation.
- Sustainable Communities
  - decoupling of resource use from well-being
  - healthy and safe living and working places including access to nutritious, uncontaminated food, clean air and water.

Recommendations – connected with the identified gaps

1. Current and ongoing standardization as well as related policies like GAP, RED, WFD and the eco-design of products have to be harmonized with a resource efficiency policy.

2. Implementation of new models for value chains, businesses, customer offerings, consumer EoL approach and pricing, e.g.:

   a) development of new business models that assume selling services instead of products (impact on environment, local economy and communities)

   b) shifting tax burden from labour to resource use and eco-system services

   c) integration of environmental accounts into certification scheme

3. Levelized life-cycle costs that enable comparison between bio-based products made from different feedstock.

4. Internalization of externalities that can be negative, i.e. external costs that are associated with uncompensated social or environmental effects, or positive, i.e. external benefits that are associated with positive social and environmental effects.

5. Continuous improvement in relations of R&D development of new technologies/models for SCP.

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Recommendations

The main challenge of the STAR-ProBio was to combine the existing elements of standards (EN 16751:2016, ISO 13065:2015) with the learned lessons from the project's results into a smart and meaningful framework supporting the sustainability assessment of bio-based products.

The following were proposed:

Principles, criteria, indicators

- … a set of PCIs for sustainability pillars: environmental, economic, social and cross-cutting sustainability aspects: circularity and iLUC.

Benchmarking and reference product

- … a virtual reference product given the use of a real product cannot be achieved without close involvement and collaboration of representative economic operators.

Thresholds

- … a list of "the level of performance" specifying how each indicator should perform

Communication of sustainability

- … a "sustainability scoring" system and a scheme for the communication of the sustainability results among stakeholders

Certification blueprint

- … a blueprint for certification scheme in the form of SAT-ProBio Framework.

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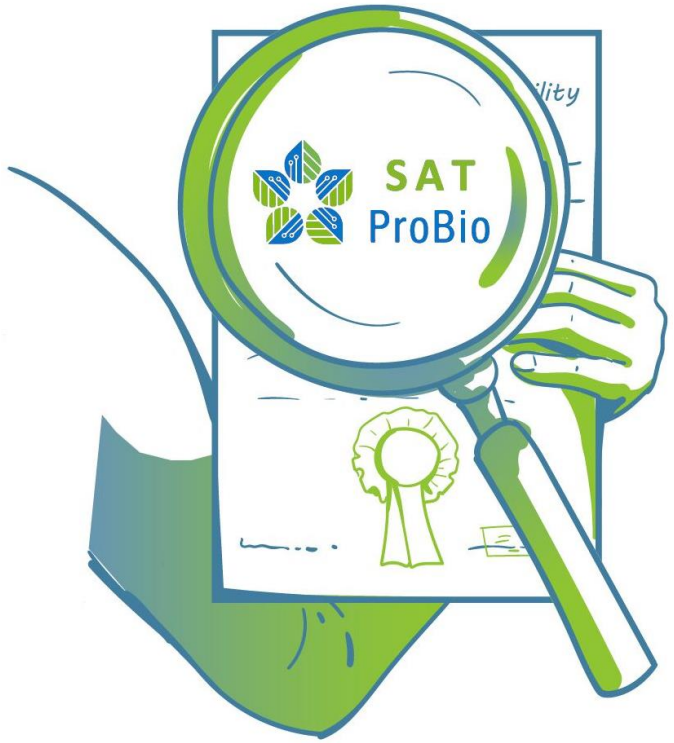
Contact

Janusz Gołaszewski

- janusz.golaszewski@uwm.edu.pl , +48 694428180

www.star-probio.eu



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