Sustainability Transition Assessment and Research of Bio-based Products

Grant Agreement Number 727740

Integrated Assessment Tool (IAT)

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Online

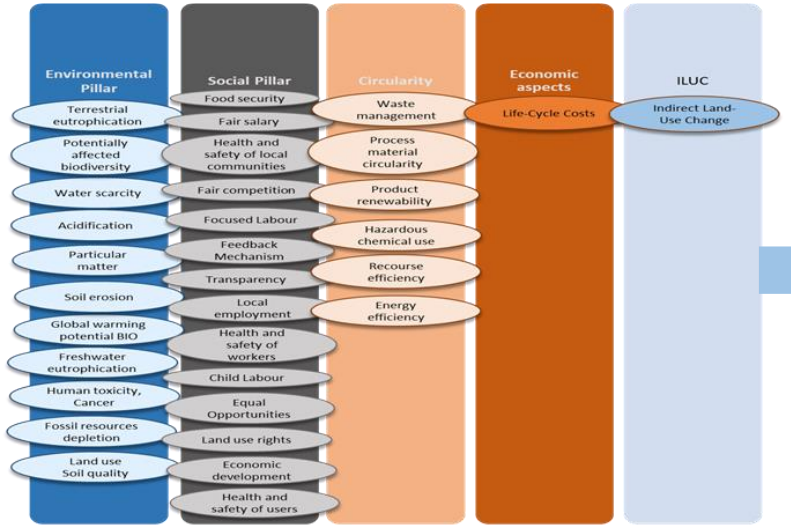
April 28th, 2020

Funded by the EU H2020 Programme

SAT-ProBio Blueprint

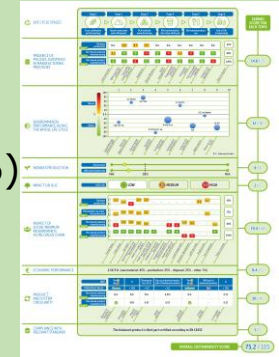
STAR-ProBio Workpackages

"Areas of concern" for the sustainability assessment of bio-based products

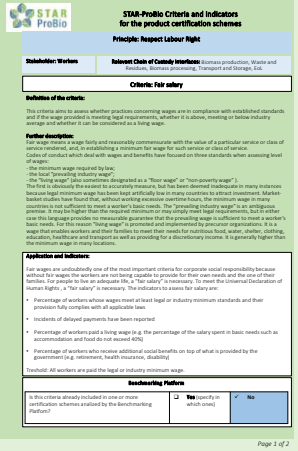


Derivation of Principles, criteria and indicators for the sustainability assessment of the bio-based products

Interpretation and integration based on the existing standards (e.g EN 16571:2016) to be used internally by **companies**



Homogenization and Representation based on certification approach for **product certification schemes**



SAT-ProBio assessment framework blueprint

Integrated Assessment Tool (IAT)

Sustainability Certification Tools (SCT)

www.STAR-ProBio.eu

What is IAT and why ?

- IAT is a methodological guidance for conducting an integrated assessment of bio-based products from a life cycle perspective encompassing social, environmental, economic and circularity aspects.
- IAT enables companies to perform internal sustainability assessments of their bio-based products for eco-design, benchmarking, and sustainability qualification purposes, also in respect to the achievement of 10 SDGs;

- IAT is accompanied by a threshold and scoring systems that allow to quantify "*how well*" a bio-based product performs compared to an "ideal performance".
- IAT has a strong focus on applicability and business relevance making it a flexible and effective tool for supporting the transition towards sustainable production and consumption within the bio-economy sector.

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IAT concept

24 Principles

1. Mitigate climate change
2. Promote good air quality
3. Conserve and protect water resources
4. Protect soil quality and productivity
5. Promote efficient use of energy resources and prevent depletion of non-renewable energy resource
6. Promote positive and reduce negative impacts on eco-systems and biodiversity
7. Minimize the impacts on Human Health
8. Reduce to a zero indirect Land-Use Change (ILUC) risk
9.Promote responsible use of high concern materials
10. Promote use of renewable materials
11. Promote the use of material circularity. Minimize the use of virgin raw materials and maximize the recyclability of end products
12. Promote responsible waste management
13. Promote efficient use of energy
14. Promote the use of renewable energy sources
15. Promote the minimisation of life cycle costs associated with the entire value chain
16. Respect Labour Rights
17. Respect health and safety of end users
18. Promote consumer satisfaction
19. Promote transparency
20. Respect of health and safety of local communities
21. Promote local development
22. Respect land use rights
23. Respect Food Security
24. Promote fair competition in the market

Metrics and methodologies

cen
European Committee for Standardization
Comité Européen de Normalisation
Europäisches Kommitee für Normung

ELLEN MACARTHUR FOUNDATION

JRC
EUROPEAN COMMISSION

ISO
International Organization for Standardization

Global Reporting Initiative™

48

IAT Indicators

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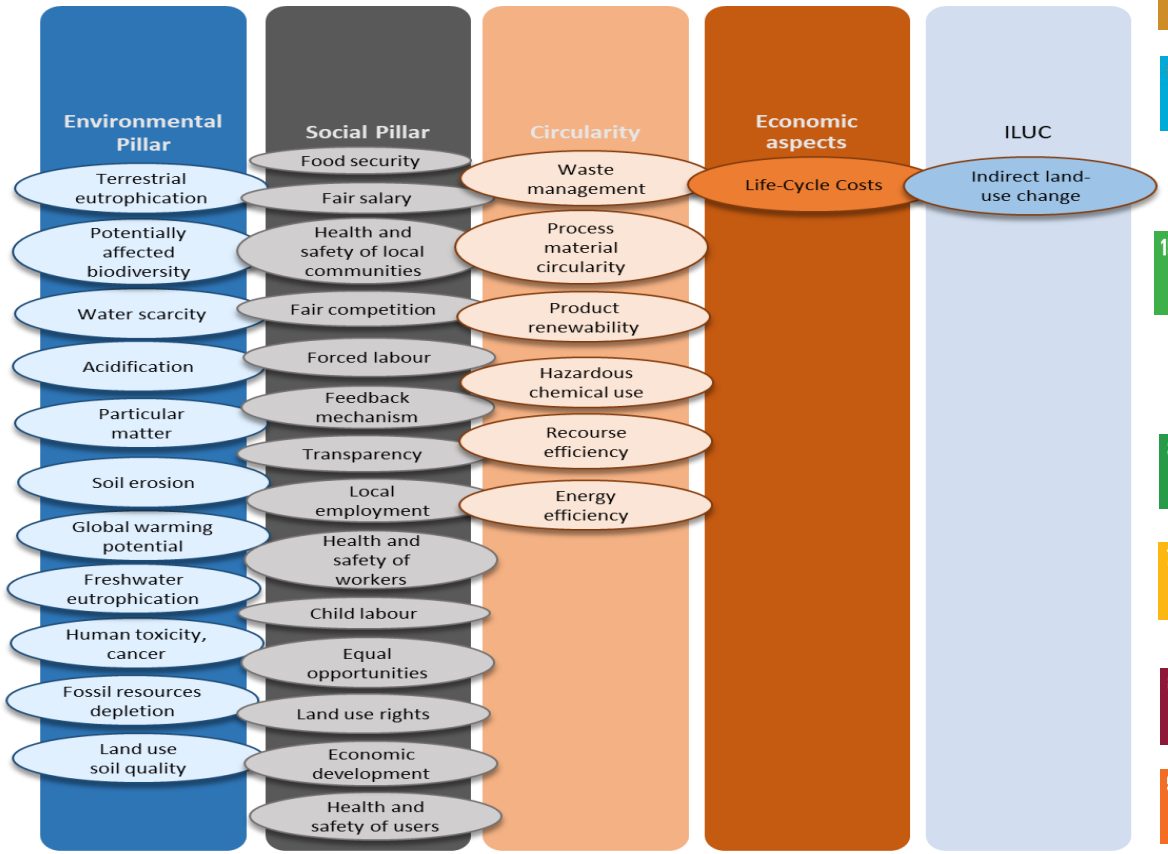
Areas of protection and SDGs' targets addressed by the IAT

Sustainability Pillars



Target 13.2 Integrate climate change measures into national policies, strategies and planning

Target 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air water and soil in order to minimize their adverse impacts on human health and the environment.

Target 12.2. By 2030, achieve the sustainable management and efficient use of natural resources

Target 12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

Target 12.6 Encourage companies, especially large and transnational companies, to adopt Sustainable practices and to integrate sustainability information into their reporting cycle

Target 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

Target 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

Target 15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

Target 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services [...]

Target 15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems

Target 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

Target 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix

Target 7.3 By 2030, double the global rate of improvement in energy efficiency

Target 8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms

Target 8.5. By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

Target 8.8. Protect labour rights and promote safe and secure working environments for all workers [..]

Target 9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

Target 9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries

Target 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers [...] including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.

Target 2.c Adopt measures to ensure the proper functioning of food commodity markets [...]

Target 10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard

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The IAT Matrix elements

- **Indicator (48 of which 18 quantitative)**

- Principle
- Criteria
- Sustainability pillar the indicator belongs to
- Link with the SDGs targets
- Type (qualitative or quantitative)
- Life cycle stage/s where the indicator is applied
- IAT threshold (i.e. «ideal performance» or stakeholder expectations)
- Comparability with fossil products

	Principle	Criteria		Indicator	life cycle stages (see figure 4.1)	IAT threshold (i.e. expectations)	Type	Comparability with fossil
ENVIRONMENTAL	Mitigate climate change	The economic operator provides information on how greenhouse gas (GHG) emissions associated with their operations are managed	1	Describe procedures taken to identify and minimize GHG emission and/or potential impacts on climate change in relations to their operations.	Stage 3,4	The applicant company (stage 4) and bio-based material manufacturing companies (stage 3) should have in place specific procedures, policies or initiatives addressing GHG emissions	Y/N	√
			2	The applicant (stage 4) provides the "Cradle to grave" Global Warming Potential (GWP) of the bio-based product, determined through LCA analysis (i.e. GWP bio) (MAJOR MUST)	Stage 1-6	The GWP "Cradle to grave" of the bio-based product has to be below the value of the Reference Product (RP) [2]		√
ILUC	Reduce to a zero indirect Land-Use Change (ILUC) risk.	The economic operator provides information on its strategies adopted to reach a "low ILUC risk" level	21	The applicant (stage 4) provides ILUC risk for the bio-based product determined according to "ILUC Risk Tool"	Stage 1-4	Minimize the indirect Land-Use Change (ILUC) risk.		NO
PRODUCT AND SYSTEM	Promote responsible use of high concern materials	The economic operator provides information on how hazardous chemical is addressed	22	Describe measures taken to avoid, reduce or find greener alternatives to the use of substances of very high concern (SVHC) through a screening of the product's raw materials against substances on the hazardous chemical databases, SINLIST and SUBSPORT.	Stage 3,4	High concern chemicals are not allowed to be used. The applicant company (stage 4) and bio-based material manufacturing companies (stage 3) should have in place specific procedures, policies or initiatives addressing safety aspects regarding chemicals embedded in the products they produce.	Y/N	√
ECONOMIC	Promote the minimisation of life cycle costs associated with the entire value chain	The economic operator provides information on the life cycle costing	33	Describe measures taken to reduce the environmental-life cycle costs	Stage 3,4	The life cycle costs should be minimised. The applicant company (stage 4) and bio-based material manufacturing companies (stage 3) should have in place initiatives to reduce the costs associated with the life cycle of the bio-based product	Y/N	√
			34	The applicant (stage 4) provides the Environmental Life Cycle Costing (LCC) of the bio-based product	Stage 1-6	The environmental LCC "Cradle to grave" of the bio-based product has to be below the Reference value (not defined yet)		√
SOCIAL	Respect Labour Rights	The economic operator provides information on how the issue of forced labour is addressed [4]	35	Describe measures taken to safeguard rights relating to forced labour including prohibiting policies, evidences, incidents and corrective action plans and a plan-do-check-act process in place to raise awareness on the topic (MAJOR MUST)	Stage 1-4	Forced labour is not allowed (i.e social minimum requirement). The applicant (stage 4), bio-based material manufacturers (stage 3), biomass producers (Stage 1) and raw materials producers (Stage 2) have to have in place formal policies, procedures or initiatives addressing forced labour and evidences that such incidence do not occur.	Y/N	√
		The economic operator provides information on how the topic of child labour is addressed	36	Describe measures taken to address child labour, including prohibiting policies, evidences (such as records on worker's age), incidents and corrective actions plans and a plan-do-check-act process in place to raise awareness on the topic (MAJOR MUST)		Child labour is not allowed (i.e social minimum requirement). The applicant (stage 4), bio-based material manufacturers (stage 3), biomass producers (Stage 1) and raw materials producers (Stage 2) have to have in place formal policies, procedures or initiatives addressing child labour and evidences that such incidence do not occur.	Y/N	√

IAT description in D8.2 Blueprint of sustainability certification schemes for bio-based products
http://www.star-probio.eu/wp-content/uploads/2017/04/D8.2_SAT-ProBio-blueprint_final-report_3-scalone.pdf

How does it work ? Example for the environmental pillar

Principle: **Mitigate climate change**

Criteria: The economic operator provides information on how greenhouse gas (GHG) emissions associated with their operations are managed

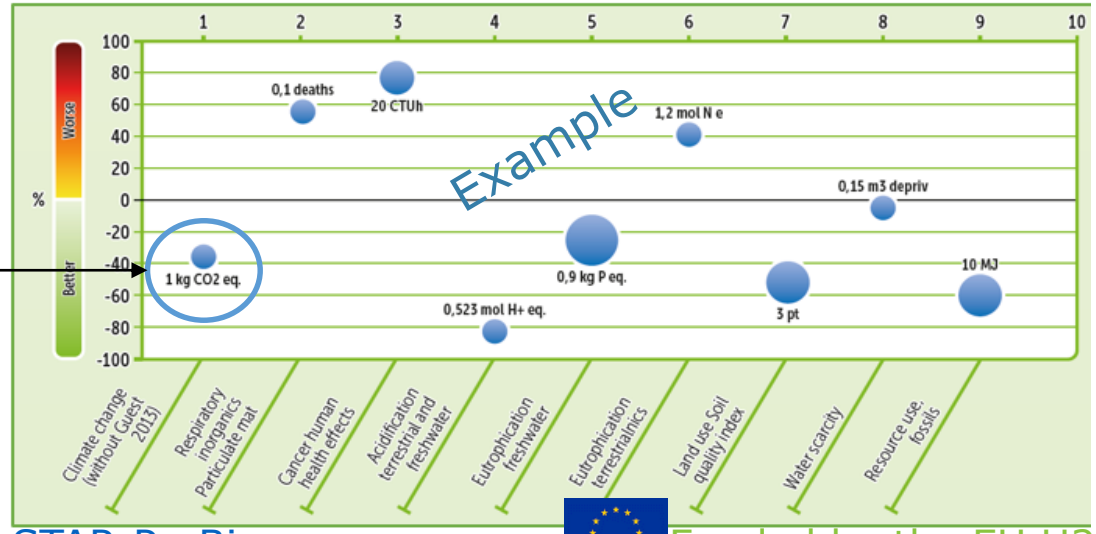
Indicators:
(Qualitative) 1. Describe procedures taken to identify and minimize GHG emission [..]
Threshold: measures in place

(Quantitative) 2. The applicant* provides the "Cradle to grave" Global Warming Potential (GWP) of the bio-based product
Methodology: "Cradle to grave" Life Cycle Assessment (LCA)
Threshold: the GWP of the bio-based products has to be below the value of the Reference Product

*bio-based product producer

Goal 13. Take urgent action to combat climate change and its impacts

Target **13.2** Integrate climate change measures into national policies, strategies and planning



LCA threshold (Reference Product)

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How does it work ? Example for the social pillar (1/2)

Principle: **Respect Labour Rights**

Criteria: The economic operator provides information on how fair salary is addressed

Indicator:
(Qualitative) Provide information regarding the salary of workers [..]

Method: Specific questionnaire with yes/no approach (Annex of IAT)

Threshold: All workers are paid the legal or industry minimum wage

Q: Do you have policies for ensuring fair salaries ?
A: Yes or No

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Target **8.7** Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms

Biomass Production (Stage 1)

Biomass supplier	A	B	C
Volume representativeness	65%	20%	15%
Answers [Y=1 N=0]	1	0	1
Partial result	1*0,65	0*0,2	1*0,15
Total result	0,65+0+0,15 = **0,8**		

Example

- Weighted average value for «**fair salary**» for **Stage 1**

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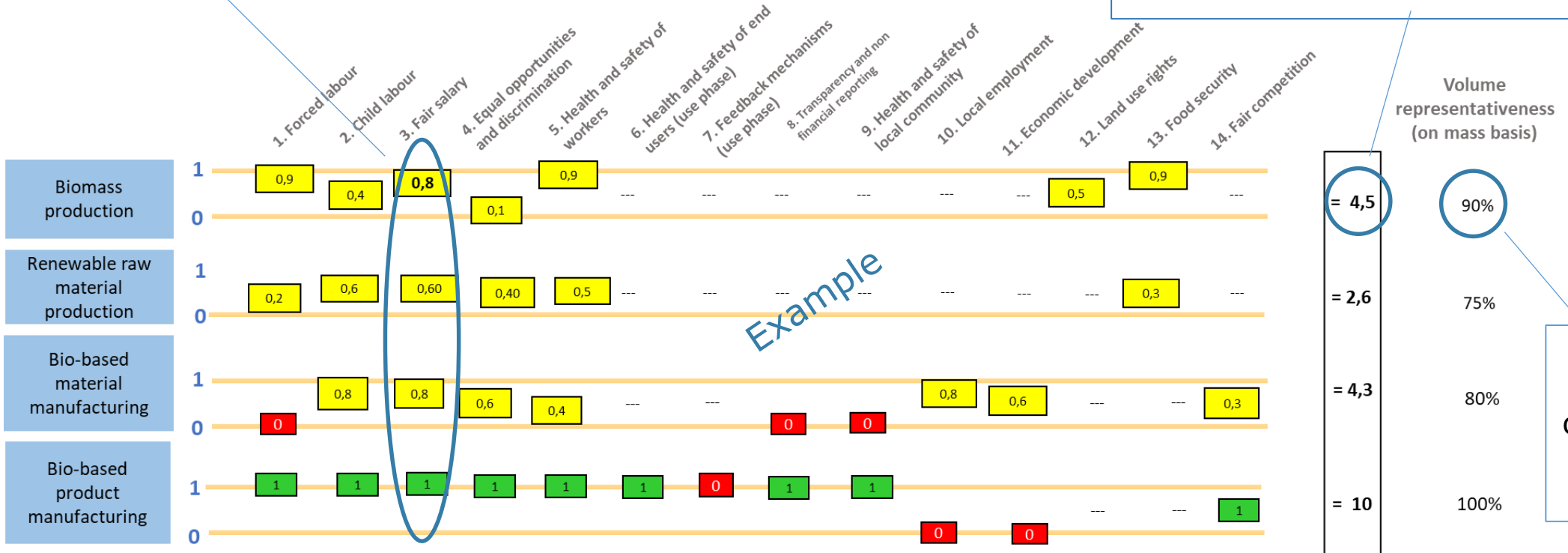
How does it work ? Example for the social pillar (2/2)

From the previous slide

Total score for each stage $= \sum_{k=0}^{14} \left(\bar{a}_k\right)$



Coverage of the economic operators that have been assessed

Maximum total score obtainable = **37**
(i.e. all the economic operators have collaborated and they all have the required policies

= no polices in place

= Required polices are partly present

= All required policies are present

Total score = 20,4

Ideal performance

Current performance

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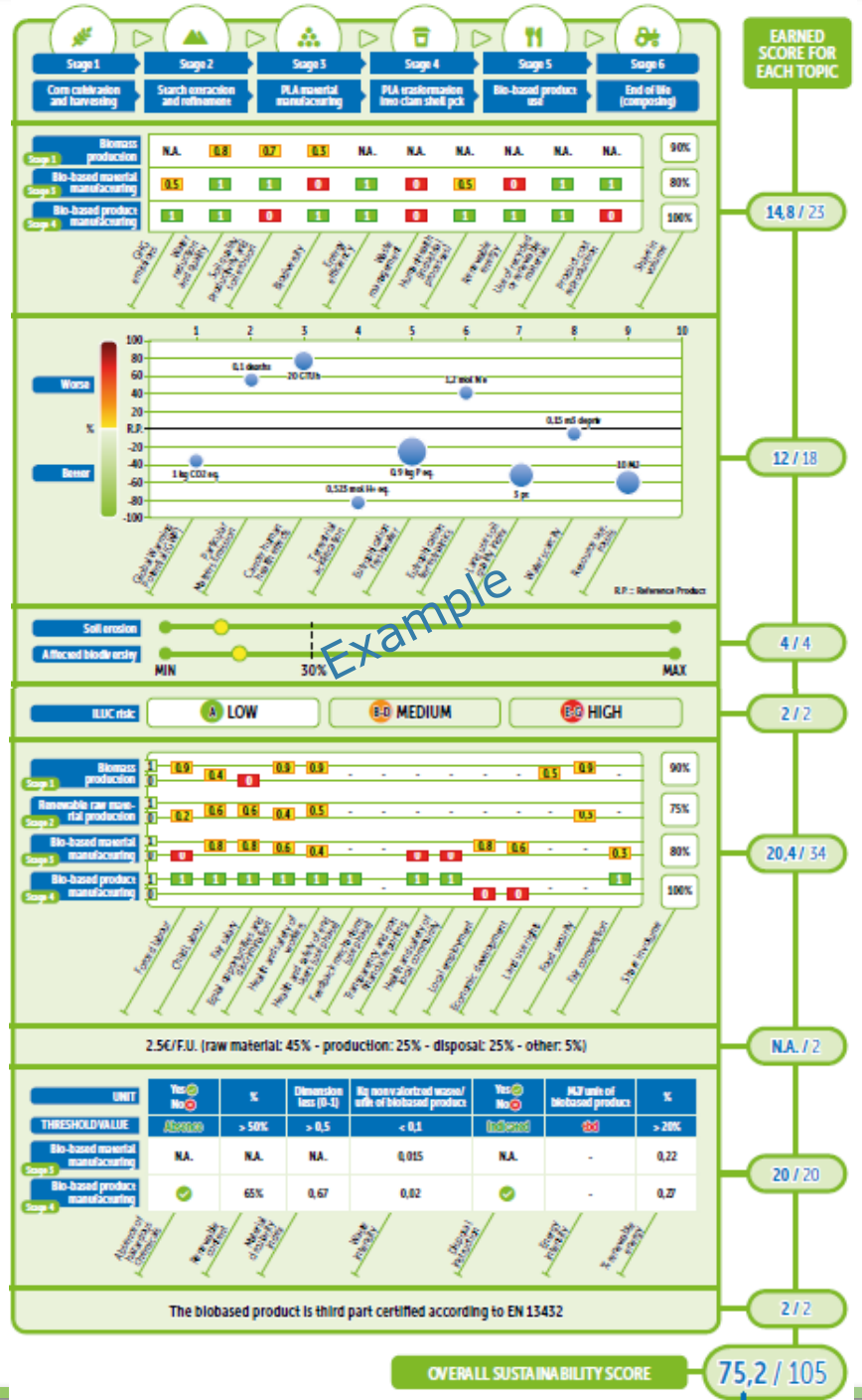
Format for the communication of IAT results

1. Product value chain scheme
2. Policies
3. Life Cycle Analysis
4. Soil erosion and affected biodiversity
5. ILUC
6. Social aspects
7. Life Cycle Costing
8. Circularity
9. Relevant product certification

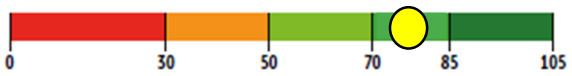


General rule

- If a qualitative indicator passes the threshold it gets 1 point
- If a quantitative [..] it gets 2 points
- All indicators (**48**) have the same weight

LEGEND

Red: weak performance (action urgently needed)
Orange: low performance (action needed)
Light green: good (minor action needed)
Medium green: very good (minor action needed)
Dark green: outstanding



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Conclusions

- IAT provides a meaningful and clear picture of the sustainability performance of a bio-based product
- The threshold system of IAT allows to determine “how well” the bio-based product performs in comparison to an “ideal performance” represented by (I) the presence of specific policies, (II) a specific target (e.g. minimum renewable content), (III) a reference scenario (e.g. LCA thresholds) or (iv) a minimum requirement (e.g. social aspect)
- The methodologies and metrics of the IAT derive from internationally standards, guidelines and best practices used in the sustainability accounting field
- Multipurpose tool for supporting the transition towards bio-based economy: (i) sustainability qualification in respect to 24 sustainability principles and to the achievement of 10 SDGs and 23 SDGs targets, (II) hotspot analysis, (III) benchmarking and (IV) eco-design initiatives

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IAT: Lessons learned (1/2)

Integrated Assessment tool

- IAT provides a meaningful and clear picture of the sustainability performance of a bio-based product representing a reliable tool for supporting the transition towards bio-based sector, nevertheless, its integral application could entail excessive costs for SMEs.
- IAT requires an effective collaboration of the economic operators along value chain for the completeness and the reliability of the assessment.
- The simplicity of the questionnaire is, f.e. an important aspect to get a reply from the economic operators.
- One of the most challenging aspects is the availability of public representative data about the Reference Products (RP) for the LCA analysis (this is also the case for the PEF). Consistencies among LCA models could represent an issue as well.
- Due to the high variability of bio-based products, it is quite unlikely to define a unique IAT structure suitable for all bio-based product categories. However, the IAT framework can be easily adapted to the specificities of the product category.
- As for any disclosure, potential confidentiality and reputational issues could represent constraints for the dissemination of the IAT results, outside the enterprise (B2B and B2C communication). Policy makers should effectively support companies that are interested in applying sustainability assessment schemes and qualifying their bio-based products.
- The presence of existing certification schemes like ISCC Plus or RSB guarantee the fulfilment of many indicators requested by the IAT.
- Stakeholder engagement activities (surveys, working groups, webinars, etc.) are fundamental for (i) building consensus and (ii) improving the tool (e.g. setting reliable thresholds values, targets as well as for improving the proposed scoring system).
- There are trade off among some indicators (e.g. LCA indicators with circularity ones).
- Social aspects represent the most important section of IAT in terms of score availability (i.e. 14 indicators investigated for four life cycle stages slide 10)

IAT: Lessons learned (2/2)

Application of the IAT to the case studies

- The LCA profile as well as ILUC, soil erosion and affected biodiversity of the bio-based case studies are heavily sensitive to the biomass type, origin and agricultural practices (high specificity). Consequently, we recommend to apply IAT using, as much as possible, primary data.
- Due to confidentiality issues only a limited amount of information was made available by the company (LCA analysis was fully based on internal elaboration of AUA based on literature research).
- The analyzed bio-based products showed an ameliorative profile for GWP and NRER and a pejorative trend for those LCA impact categories strictly linked to the agricultural phases compared to the Reference Product (RP). Nevertheless, the comparison is not very meaningful due to the fact that the RP is 100% fossil based and that at least 4 out of 9 impact categories were not so sensitive to fossil-based raw material value chain. Further key issues regarding comparability between fossil and bio-based polymers in LCA are provided in [ ] and [ ].
- The observed uncertainty for water scarcity and human toxicity cancer LCA impact categories resulted quite high (1-2 order of magnitude) making the assessment weak for decision purposes (e.g. eco-design). Further improvement or alternative metrics might be needed.
- Circular economy principles are greatly met by the bio-based product thanks to its high renewability and possibility to be recovered through mechanical or biological recycling, highlighting the great potentialities of bio-based products.
- Also the presence of formal engagements (policies) regarding sustainable production of biomass, the respect of human rights and other social aspects is well recognizable among the analyzed companies of the bio-based sector.

[1] https://docs.european-bioplastics.org/publications/pp/EUBP_PP_LCA_as_a_basis_for_policy_formulation.pdf

[2] http://bio-based.eu/download/?did=185422&file=0

Publications

- STAR-ProBio (2019), STAR-ProBio Deliverable D8.1, [Gołaszewski J., Razza F. 2019. STAR-ProBio. Deliverable D8.1: Recommendations concerning current sustainability standards associated with bio-based products and amendments to current standards of bio-based products]. http://www.star-probio.eu/wp-content/uploads/2017/04/D8.1_Recommendations-concerning-current-sustainability-standards-associated-with-bio-based-products-and-amendments-to-current-standards-of-bio-based-products.pdf

- STAR-ProBio (2020), STAR-ProBio Deliverable D8.2: Blueprint of sustainability certification schemes for bio-based products http://www.star-probio.eu/wp-content/uploads/2017/04/D8.2_SAT-ProBio-blueprint_final-report_3-scalone.pdf

- F. Razza, C. Briani, T. Breton, D. Marazza - Metrics for quantifying the circularity of bioplastics: the case of bio-based and biodegradable mulch films - Resource, Conservation and Recycling Volume 159, August 2020, 104753 https://www.sciencedirect.com/science/article/abs/pii/S0921344920300756?dgcid=author

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Acknowledgements

Janusz Gołaszewski (UWM)
Piergiuseppe Morone (UNITELMA)
Vincent Rossi (Quantis)
Camara Salim Iana (USC)
Kadambari Lokesh (UoY)
Apostolis Koutinas (AUA)
Dimitris Ladakis (AUA)
Stefan Majer (DBFZ)
Matthias Grill (AgroVet)
Sergio Ugarte (SQ Consult)
Mathilde Crepy (ECOS)
Diego Marazza (UNIBO)
Eva Merloni (UNIBO)
Simone Wurster (TUB)
Alexandra Gottinger (TUB)
Alassandra Novelli (Novamont)
Claudia Castelli (Novamont)

This project is funded by the European Union's Horizon 2020 Research and innovation action under grant agreement No 727740 with the Research Executive Agency (REA) - European Commission.
Duration: 36 months (May 2017 – April 2020).
Work Programme BB-01-2016: Sustainability schemes for the bio-based economy

STAR ProBio