



## Danubionet Position Paper FOR THE DEVELOPMENT OF BIOECONOMY IN THE DANUBE REGION

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A joint effort by Central European Initiative and PANNON Pro Innovations Ltd.

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DANUBIONET is a Pilot Activity implemented in the framework of the project Danube-INCO.NET



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## Overview

The Central European Initiative (CEI) and PANNON Pro Innovations Ltd. implemented **DANUBIONET** as a Pilot Activity within the project **Danube-INCO.NET** ([www.danube-inco.net](http://www.danube-inco.net)), a Coordination and Support action funded by the EU under the 7<sup>th</sup> Framework Programme to address the EU Strategy for the Danube Region (EUSDR) in the field of Research and Innovation (R&I).

The **DANUBIONET Position Paper** aims at illustrating critical bottlenecks hindering the deployment of Bioenergy and Bioeconomy in the Danube Region, while suggesting possible countermeasures. It builds upon the results of a survey, which addressed Bioeconomy actors in a Triple-Helix perspective in order to assess their competences and *desiderata*. Furthermore, it draws from the inputs collected in the context of two Open Innovation events that allowed sensing stakeholders' expectations in a more direct, yet informal manner.

## Background

DANUBIONET Bioeconomy Capacity Building Survey was carried out in order to appraise the main challenges regarding the development of Bioenergy and Bioeconomy in the Danube Region by mapping stakeholders' knowledge and capacities, while also highlighting the critical bottlenecks.

The survey targeted stakeholders along the Bioeconomy value chains in a Triple-Helix perspective, thus addressing academia (49% of respondents), industry (22%) and policymakers (29%), with the main objective of catalysing cooperation and understanding the potential gaps. The survey was open between April and October 2016, gathering near 100 answers from the whole Danube Region (except Montenegro), while 14% of the respondents came from outside the area (Albania, Greece, Italy, Lithuania, Macedonia, the Netherlands and Poland, as well as Japan).

The relatively high number of respondents proves the interest triggered by the recent political emphasis on Bioeconomy (still somewhat theoretical in the region and often addressed non-comprehensively) and Bioenergy (functional to meeting legal obligations and only partially to promoting energy independence). This interest also indicates awareness vis-à-vis:

- a) the hard and soft measures necessary to capitalize on the comparatively high potentials,
- b) the bottlenecks that prevent the establishment of the "enabling environment" for the Bioeconomy to take off in the region,
- c) the prospects of enhanced synergies among and between stakeholders of the region.

The Position Paper builds on two subsections that highlight interventions aiming to foster:

- a) Regional Cooperation to bridge the gap in cross-cutting issues, and
- b) Triple-Helix Cooperation to sustain collaborations among different groups of stakeholders, with particular regard to market uptake and support measures.

The subsections are fed by Section I&II and Section III&IV of the Questionnaire, respectively<sup>1</sup>.

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<sup>1</sup> The **Bioeconomy Capacity Building Survey** was structured as follows:

- Section I – Capacity mapping;
- Section II – Networking and open innovation to identify bottlenecks, offers and solutions;
- Section III – Stakeholders' view on the perspectives of Bioeconomy in the Danube Region;
- Section IV – Identification of wished interventions.

Figure 1 - Radar charts: opportunities versus gaps by sector – the closer to the bull’s-eye, the less stakeholders see a factor as an opportunity (blue) or gap (orange)

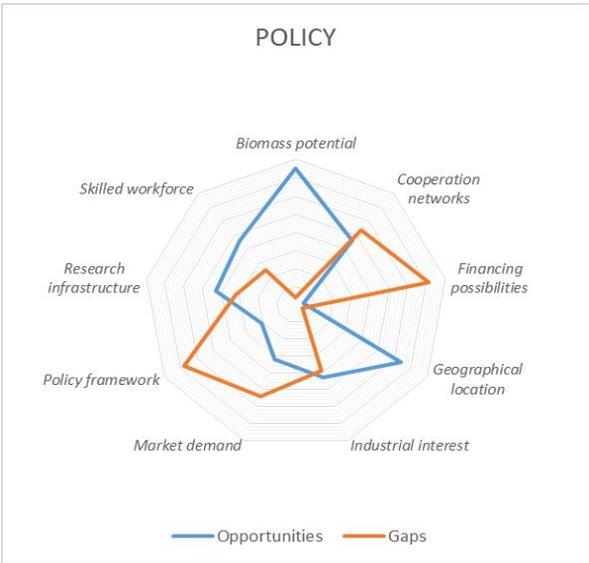
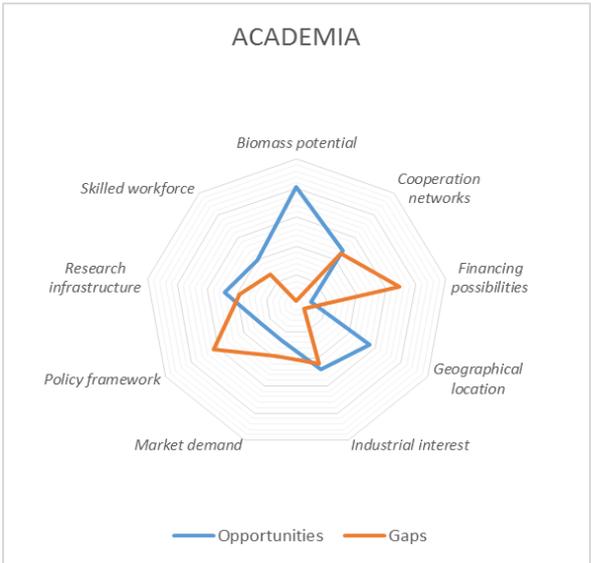
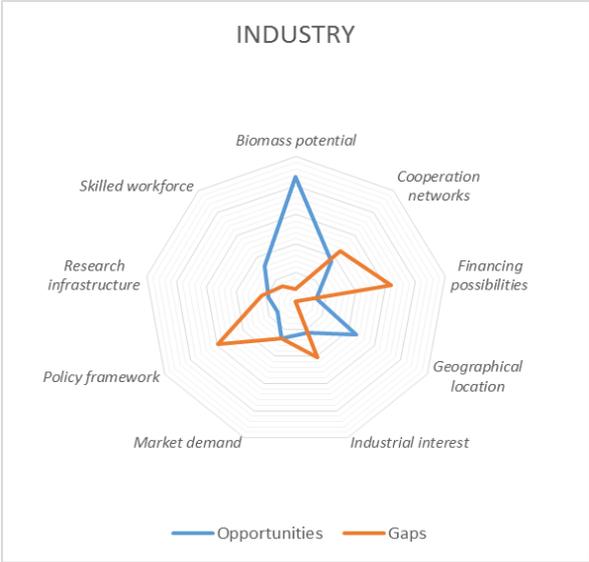
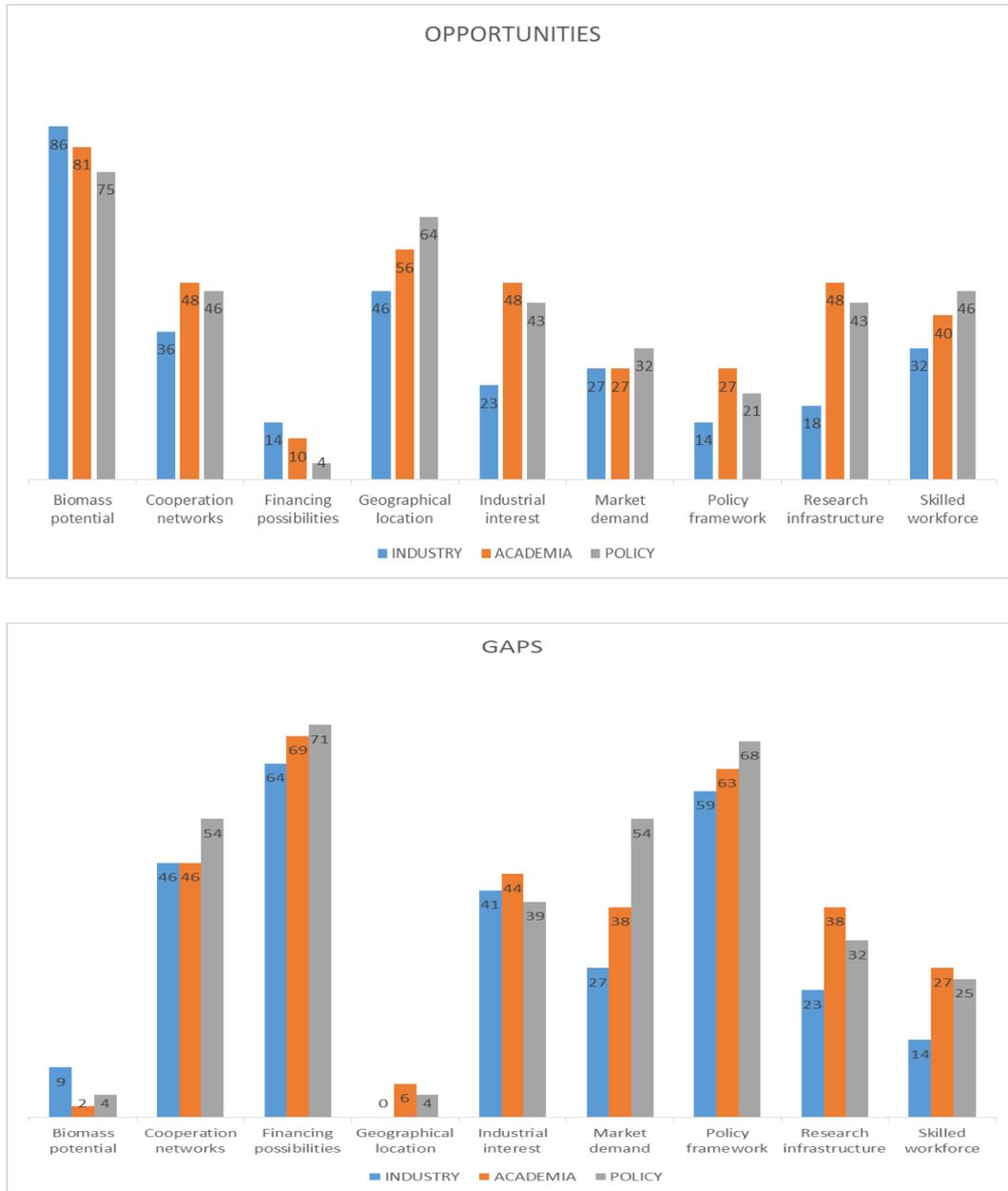


Figure 2 - Bar charts: percentage of stakeholders per sector seeing a factor as an opportunity or gap



Detailed breakdown of opportunities and gaps by sector – opp/gap percentage

|                            | Business | Academic | Public sector |
|----------------------------|----------|----------|---------------|
| Biomass potential ✓✓       | 86/9     | 81/2     | 75/4          |
| Cooperation networks ?     | 36/46    | 48/46    | 46/54         |
| Financing possibilities ✗✗ | 14/64    | 10/69    | 4/71          |
| Geographical location ✓✓   | 46/0     | 56/6     | 64/4          |
| Industrial interest ?      | 23/41    | 48/44    | 43/39         |
| Market demand ✗            | 27/27    | 27/38    | 32/54         |
| Policy framework ✗✗        | 14/59    | 27/63    | 21/68         |
| Research infrastructure ?  | 18/23    | 48/38    | 43/32         |
| Skilled workforce ✓        | 32/14    | 40/27    | 46/25         |

## Regional cooperation

Several studies point out the comparatively high biomass potential in the Danube Region in the forms of different forestry and agricultural residues. This is also reflected in the 2020 renewable energy national targets that encourage the use of biomass for energy production not considering advanced Bioeconomy purposes. In order to develop this potential to a real economic opportunity, the survey intended to understand where stakeholders see gaps and opportunities for Bioenergy and Bioeconomy development. Based on the results of the survey, we can create five categories:

### 1. *Unambiguous opportunities*: **Biomass potential and Geographical location**

The two factors on which stakeholders totally agree are endowments, not results of a purposeful progress, thus showing well the early stage of development of the advanced Bioeconomy. However, in order to exploit these resources, considerable investments are needed to build biorefineries, trigger market demand for bio-based products and guarantee the security and sustainability of long-term biomass supply through active involvement of farmers. Not surprisingly, respondents attributed the largest potential to agricultural residues, followed by industrial wastes/by-products, forestry residues and energy crops. Almost half of the respondents indicated enzymatic biorefinery of lignocellulosic biomass as the most promising pathway. This could produce advanced liquid biofuels (58%) and bioplastics (47%), which are the marketable advanced bio-based products with consensus among the sectors.

Hence, the potential is recognized and pathways can be seen but the frameworks for exploitation are not in place yet. In order to realize this potential and mobilize the biomass, with the involvement of stakeholders, policy shall develop practices and frameworks for sustainable biomass trade and logistics. Farmers and other players in the supply chain, which are practically responsible for the production and logistics of this large amount of biomass, may be not aware of the synergies, novel solutions and sustainability practices.

### 2. *Rather opportunities than gaps*: **Skilled workforce**

Setting up advanced supply chains and processing technologies require skilled workforce specialized in a variety of engineering sciences combined with knowledge on innovation and business. Stakeholders from industry are more pessimistic on this aspect. However, through cooperation of public sector institutions and academia with diverse background (i.e. engineering, business, legal, etc.), it can be possible to develop a curriculum with industry-oriented outcomes and field works.

Triple-Helix cooperation would be beneficial to develop training curricula that could adequately respond future needs for skilled workforce in the Bioeconomy. The policy shall supervise the process in order to ensure that this effort is in line with S3 and other strategies, while academia shall tailor the knowledge to the needs of the industry ensuring the highest educational standards. Awareness raising among the young and other potential beneficiaries of the trainings shall be envisaged.

### 3. *Equidistant*: **Industrial interest, Cooperation networks and Research infrastructure**

While in the previous two categories there was an agreement between the sectors, this category includes factors where the perception highly depends on the sector of the respondents. As a result, near the same number of stakeholders considers such factors as gaps, as many as opportunities.

The total figure shows that research infrastructure is an opportunity; however, the industry rather considers it as gap. This might owe to the fact that industries are unaware of research infrastructures present in the region, or that they do not recognize them as useful for industrial purposes. Both cases indicate lack of cooperation, where the first step could be defining common objectives and then find the complementary research infrastructures. Enhanced cooperation between industry and academia could also lead to a more rational exploitation of research facilities and equipment.

Policy and academia shall make efforts to promote and further strengthen research infrastructures at national level, while fostering inter-regional cooperation in a S3 perspective. Appropriate funding and support schemes, complementary to those provided by the European Commission, shall be developed by policy, with the support of industry, thus paving the way for the establishment of PPPs. Academia shall dialogue with industry in order to better respond to industrial needs.

Interestingly, the industry itself declares that industrial interest is a gap, rather than an opportunity (however, one must consider that this sector category contains also consultancy companies and other entities, not having relevant infrastructures), while academia sees (or wants to see) industrial interest. Nevertheless, industrial interest is key to develop, test and scale solutions and their integrations into processes and supply chains. If any in place at all, current mechanisms to match demand and offer between industry and academia are clearly insufficient, notwithstanding the declared openness to cooperate.

Events of regional scope to highlight research streams and results shall be organized, together with brokerage/match-making sessions in which industry and academia could meet in a facilitated way.

#### 4. *Rather gaps than opportunities*: **Market demand for advanced bio-based product**

Respondents consider market demand for advanced bio-based products as a gap. Remarkably, industry seems to be less pessimistic than academia or policy. On the other hand, all sectors ranked market demand very low in the next section, meaning that it is not perceived as a priority both in the case of industry and academia (limited contribution possible), but less so in the case of policy, which seems unaware of its potential role in fostering the uptake of bio-based products.

Market demand could be supported with convergent measures (e.g. support schemes, quotas, etc.); to this end, the policy shall be sensitized, while academia shall provide fact-based impact assessments (environmental, but also economic and cross-sectoral). There are multiple ways to do this without breaching the competition law. An example is the more restrictive legislation on the packaging of retail goods with the inclusion of environmental externalities to reduce pollution and waste and to increase the biodegradable fraction, resulting in a reduction of GHG emissions while at the same time promoting new value chains.

#### 5. *Unambiguous gaps*: **policy framework and financing possibilities**

While many countries in Europe and globally have dedicated Bioeconomy strategies, these are missing in the Danube Region, with the exception of Austria and Germany. Usually, Biomass is addressed by several other sector strategies (e.g. energy, agriculture, forestry, rural development and innovation). This provides a fragmented and not necessarily coherent landscape and vision for the Bioeconomy at national level, which is further complicated when the scope grows to the level of the Danube Region.

In order to boost the development of a sustainable and robust bio-based economy, several ministries and agencies shall enhance cooperation in order to secure sustainable exploitation of biomass feedstocks and govern competition between end-uses. That may call for the establishment of specialized inter-ministerial working groups that shall closely interact with academic and industry players. From the macro-regional perspective, a joint working group among different EUSDR Priority Areas would be highly beneficial.

While most of the stakeholders have the perception that financial resources are missing, there is a wide spectrum of financing opportunities available at EU, macro-regional and national level. This might owe to insufficient information, or to a negative attitude presuming that access to finance is

hindered by objective hurdles (real or assumed lack of excellence, limited experience and know-how), or subjective interferences.

Notwithstanding the substantial competition for funds globally and at EU level – especially in R&D, less in deployment – the Danube Region has a comparatively low number of applications. Policy and academia shall support the industry in developing quality proposals, also by organizing training seminars and coaching opportunities in order to build competences and support the exchange of specific know-how.

In order to bridge this gap, the policy shall facilitate the interaction between industry and financial institutions in order to: (a) raise awareness of the industry on available financial support; (b) build capacities to successfully apply for funding; (c) inform investors about the difficulties encountered by industries and advocate for better tailoring of programmes to the needs of the Danube Region (e.g. sizing of projects, co-financing rates, etc.).

Interestingly, some stakeholders feel that nothing is missing in the Danube Region to become competitive in the European Bioeconomy landscape. That could indicate that the development could happen anyway, yet it could be accelerated through harmonized actions.

The analysis of Section IV of the survey reinforces the above findings. Respondents were asked to rate a set of interventions in a scale of 1-5, with 1 as less beneficial and 5 as most beneficial. 28 interventions were placed into 7 categories according to the Technological Innovation System (TIS)<sup>2</sup>. The averaged values deliver a factual and objective evaluation of the Bioeconomy situation and transition in the Danube Region. Noteworthy, it is rather a preliminary diagnosis (i.e. where to start) to help find and discuss the exact routes to undertake. The highest-rated interventions are shown in the table below.

| Most urgent interventions                  |   |        |
|--|---|--------|
| Category                                   | Intervention  | Rating |
| <i>Resistance to change and legitimacy</i> | <i>Ensure continuity of policy</i>                                    | 4,29   |
| <i>Resistance to change and legitimacy</i> | <i>Build investor confidence in the Bioeconomy</i>                    | 4,20   |
| <i>Resource mobilisation</i>               | <i>Provide access to financial support</i>                            | 4,13   |
| <i>Resource mobilisation</i>               | <i>Stable feedstock supply</i>  | 4,06   |
| <i>Resource mobilisation</i>               | <i>Ensure competitive feedstock costs</i>                             | 4,06   |
| <i>Knowledge exchange</i>                  | <i>Develop regional networks or clusters</i>                          | 4,06   |
| <i>Knowledge exchange</i>                  | <i>Further academia to business collaboration</i>                     | 4,05   |
| <i>Knowledge development (R&amp;D)</i>     | <i>Establish knowledge of best conversion routes for biomass type</i> | 4,04   |
| <i>Guidance of search</i>                  | <i>Boost engagement with policy makers</i>                            | 4,03   |
| <i>Market formation</i>                    | <i>Champion utilisation of local resources</i>                        | 4,02   |
| <i>Resistance to change and legitimacy</i> | <i>Raise public awareness of bio-based products</i>                   | 4,02   |
| <i>Resistance to change and legitimacy</i> | <i>Promote demonstration of technologies and products</i>             | 4,02   |

Two interventions included in the category “**Resistance to change**” are the highest-rated, thus reinforcing the need for a Bioeconomy vision and strategy. The interventions here refer to measures on how to counteract resistance to change. The TIS suggests the creation of advocacy coalitions that can function as catalysts to create an enabling environment, overcome vested interests and also facilitate cooperation. Advocacy coalitions put a new technology on the agenda, lobby for resources and a favourable tax regime, and by doing so create legitimacy for a new technological trajectory.

Category of “**Resource mobilisation**”, including all resources, both finances and human capital, is also highly rated with 75% of its interventions in the top 5. That coincides with the industrial need on biomass

<sup>2</sup> <http://www.innovation-system.net/what-is-tis/>

trade both by means of stability and cost competitiveness, and with the general perception about the lack of financial resources. An innovative, new sector such as the Bioeconomy can only develop if the allocation of sufficient resources takes place in a timely manner.

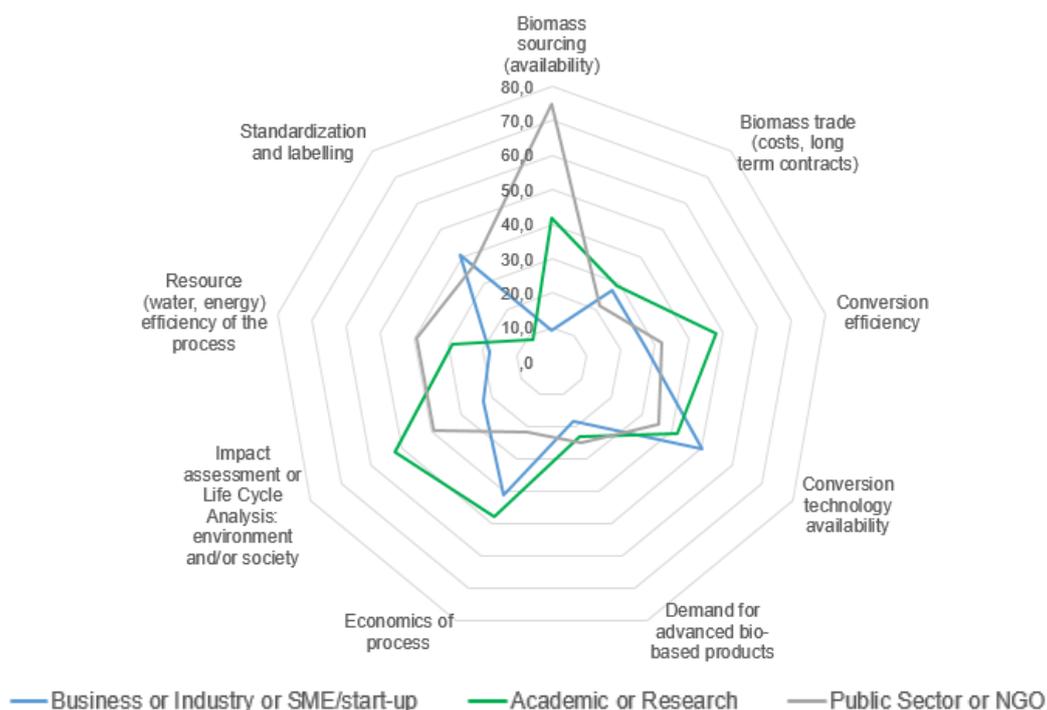
The other top interventions resonate well to the earlier findings and reinforce measures for effective and practice-oriented cooperation along the Triple-Helix, as well as to enhance industrial interest with focus on the main bottlenecks of industrial players: conversion technology and labelling.

### Triple-Helix cooperation

The Danube Region is accounted for large un-tapped biomass potentials. Several initiatives have and are investigating the actual availability of biomass, particularly sustainable lignocellulosic feedstocks, in order to provide decision-makers with robust data that are expected to pave the way to actual deployment. However, quantitative evidence *per se* is not enough to convert potentials into investments. The analysis of responses to the DANUBIONET Bioeconomy Capacity Building Survey shows that a series of gaps can be bridged by applying soft measures and through an enhanced multi-disciplinary approach.

Creating novel supply chains entails multiple challenges that are additional strains for the investor: for this reason, we opted to analyse the results of the survey from the perspective of industry in a “solution versus bottleneck” mode. The results will be used to promote a step-by-step result-oriented approach to help players in the supply chain apply sustainability practices, and facilitate market uptake of bio-based solutions. Bottlenecks and solutions were ranked according to the number of stakeholders that voted for them.

Figure 3 – Bottlenecks versus solutions: the closer to the bull’s-eye, the less stakeholders see it as a bottleneck or can provide solution or support for the given field



## Conversion technologies

Industry ranked this factor as 1<sup>st</sup>, while both academia and policy evaluate as moderate (4<sup>th</sup> ranked) their capacity to support the industry in relation to availability of advanced conversion technologies. Even though several conversion paths reached high TRL<sup>3</sup> in recent years, their large-scale demonstration is missing due to integration into supply chains and markets, economics of process, as well as process engineering and optimization. Thus, the availability of technological solutions has not yet been paired by deployment, which remains relatively low, especially when it comes to advanced biofuels and materials. This, however, is likely to be attributable to unresolved policy outlook, as well as to financing.

In order to facilitate joint developments, approaches on assessment on the maturity and industrial reality of technologies (including scale-up and other engineering considerations), as well as methods and considerations for business evaluation must be harmonized between industries and academia. Whereas the moderate interest of academia and policy might be justified, a better understanding of the assumptions of each group of respondents would help addressing part of the non-technical barriers to deployment. The policy shall steer this consolidation process.

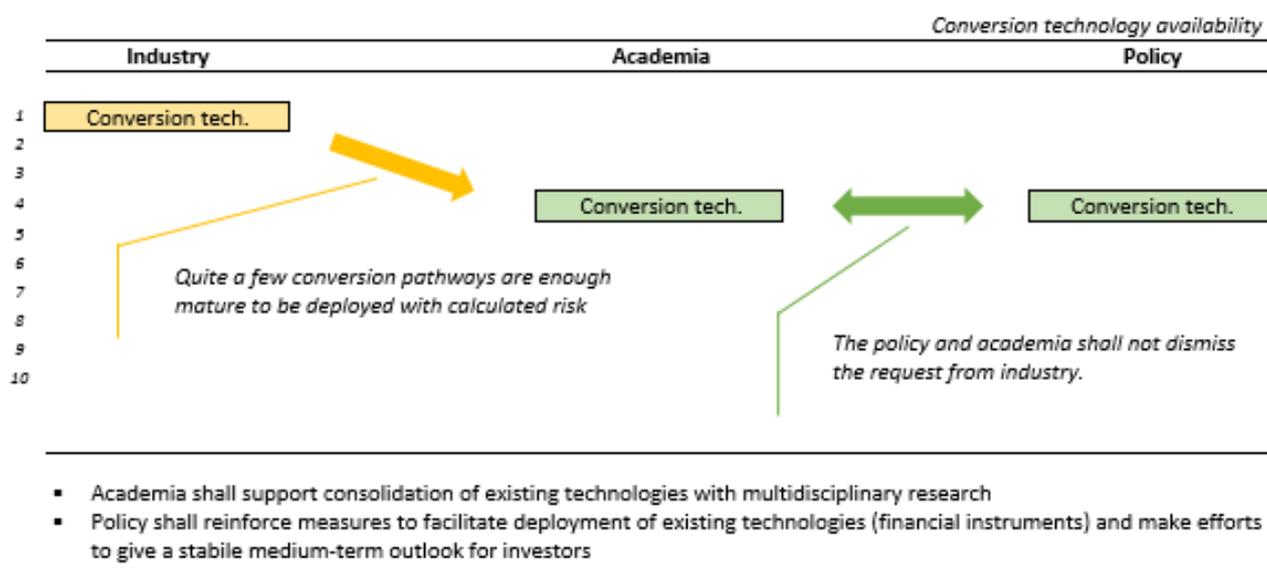


Figure 4 – Ranking of conversion technology availability

## Optimization

There is a perfect match between the needs of industry and the capacities that academia is willing to deploy when it comes to optimization and enhanced process engineering (2<sup>nd</sup> ranked for both sectors). Apparently, industry would benefit in terms of cost-reduction and improved efficiency, while for the academia, the consolidation of production processes would allow capitalizing on research and getting precious feedback from real-life application. In order to ensure stability of the value chain and thorough optimization, however, this effort shall be fundamentally interdisciplinary, as it cannot rely solely on technical improvement.

Typically, public schemes support R&I, upscaling and market uptake. However, the specificity of the Bioeconomy (a landscape, populated by a few giants – the agro-food sector, forestry and pulp & paper – and a growing number of niche players that, regardless of their actual size and market share, need to be supported to evolve from advanced start-ups into robust industry) would require this topic to be addressed by policy as well, for instance with dedicated support schemes (de-taxation of investments), but also with soft measures (creating opportunities for academia-industry exchange) and favouring open innovation. Conversion efficiency ranked medium-high as well; not unexpectedly, academia

<sup>3</sup> Technology Readiness Level, a scale to rate the maturity and status of technology development.

demonstrated to be keen in contributing to address this bottleneck, whereas the policy is not in the position to support the fine-tuning of technologies. Improving conversion efficiency, in our view, should be encompassed in the broader optimization efforts/needs.

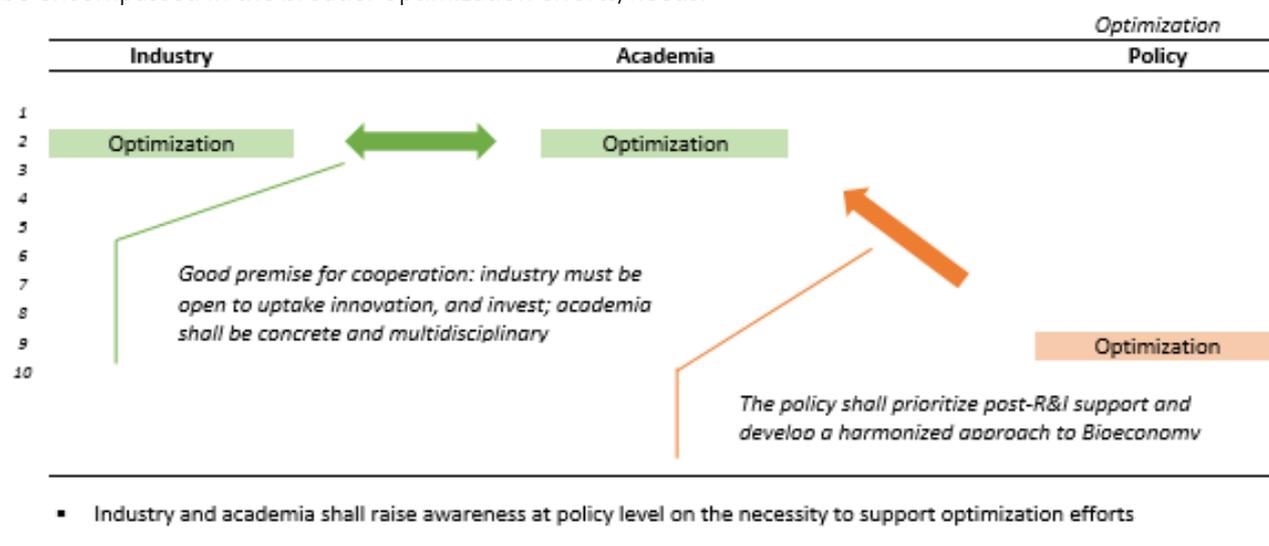


Figure 5 – Ranking of conversion technology efficiency

### Standardization and labelling

Standardization ranks high in industry concerns (3<sup>rd</sup> ranked), which demonstrates to be aware of the potential of a robust marketing framework for bio-based products. Businesses may perceive the labelling as a communication channel towards consumers to convey the added value of the product (i.e. bio-based, sustainable, greener alternative), while standards could help define a common understanding for the certification processes. Respondents from the policy appreciate this point (4<sup>th</sup> ranked), which implies openness to support industries’ efforts. In our opinion, the policy cannot drive the process, but shall facilitate and monitor, in order to ensure transparency and consumers’ rights. Academia is not interested in this issue: nonetheless, it should be summoned to partake and bring in fact-based information and technical support in a multidisciplinary perspective.

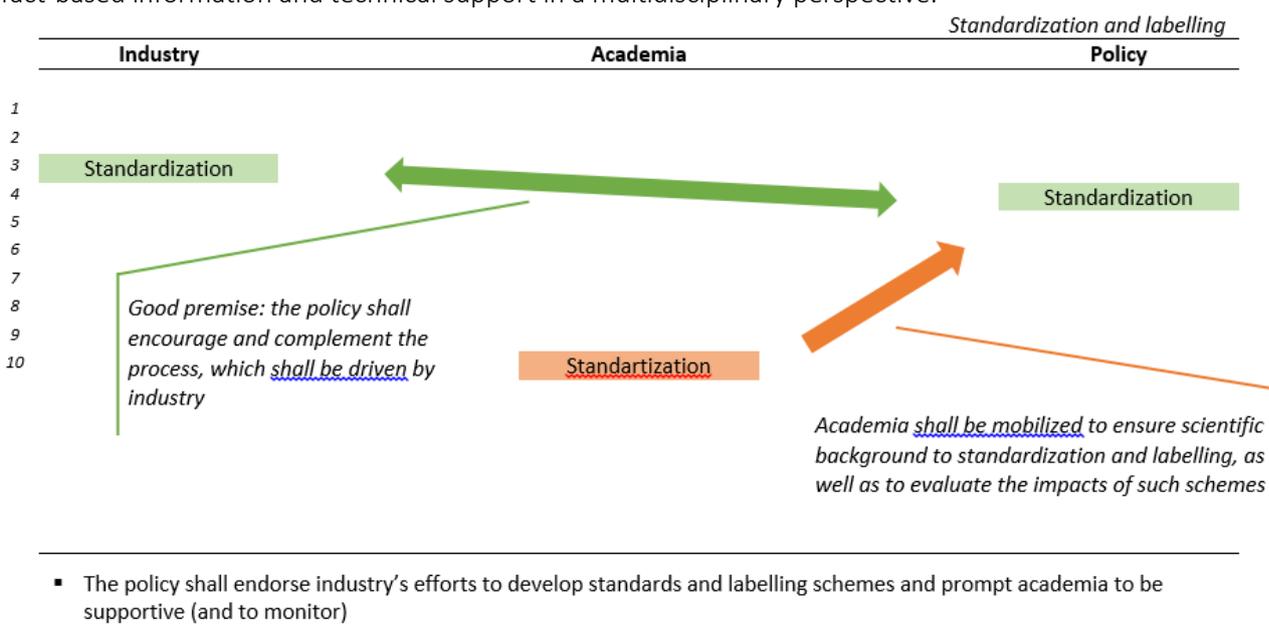
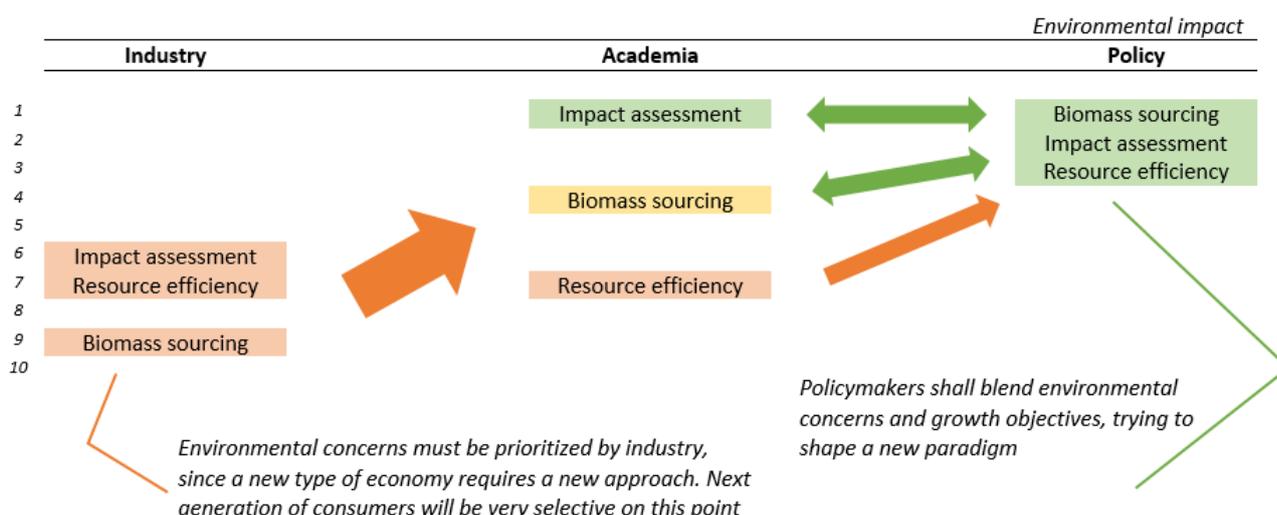


Figure 6 – Ranking of standardization and labelling

## Environmental impact

Issues related to potential environmental impacts are of least interest for the industry, which is not surprising. Alike, the prominence of these aspects for both policy and academia testifies of a persistent 'ideological divide' between a certain tendency to over-regulate and the strive for total de-regulation. Provided that the approach is innovative and pro-active, the policy has a rare opportunity to shape a new socio-economic paradigm from its very early stage. This would require an inclusive and participatory policymaking process, open to academia, businesses and the civil society. Interestingly, businesses do not see biomass sourcing/availability as a bottleneck in line with the high biomass potential; however, public sector ranks first this topic when more focus should be put on biomass mobilization. More than a quarter of the businesses sees biomass trade (mobilization), a key element in supply chain, as a bottleneck.



- The policy is in the position to shape a new virtuous paradigm pivoting on resource efficiency. The necessity to involve academia in this process is apparent, whereas the involvement of industry is less straightforward but must be pursued.
- Awareness shall be raised in industry that regulation and clear boundaries are not necessarily detrimental for the businesses, while they might be the necessary pre-condition to prosper.

Figure 7 – Ranking of sustainability and environment related aspects

## Market demand

Interestingly enough, the industry does not consider the demand for advanced bio-based products as a particularly challenging issue (7<sup>th</sup> ranked), which testifies of an increased permeability of the market to this kind of products. Matching this attitude, the policy and academia are even less focused on the topic. It shall be noted, however, that implementing targeted measures could further foster the demand for bio-based products (e.g. specific norms concerning the packaging, such as the use of recyclable and biodegradable shoppers, not to mention mandatory blending of biofuels, or green public procurement etc.). Hence, policymakers' awareness shall be risen in order to ensure full appreciation of the potential leverage effect of specific policies.

## Conclusions

Even though there are some mismatches, the demand-solution approach shows there is room for improvement through the promotion of academia-industry cooperation.

To raise awareness, build capacity and stimulate the market for bioenergy and bio-based products, the more effective involvement of biomass related industries is inevitable. Industrial symbiosis<sup>4</sup> could be successful to foster the conversion of biomass by-products into both high added value products and energy. Based on this principle, promoting biomass-for-energy through the creation of local biomass markets could be the first step towards the development of closed-loop systems through enhanced cooperation between companies.

*A critical step in the development of new technologies is their performance in real industrial conditions. Apparently, respondents from the Danube Region appreciate the potentials of industry-driven research: 52% respondents from academia have infrastructure or equipment relevant for the industry, and 42% own know-how that is mature to be implemented in industrial settings. On the other hand, 50% respondents from industry declared their availability to provide an industrial site to pilot a new solution, 46% would test a new product and 27% would provide feedstock/by-product for investigation in technology options to convert it to added value products. In line with these figures, 77% of the businesses expressed interest for the open innovation approach.*

Based on the Bioeconomy Capacity Building Survey the following conclusions can be made:

1. **To facilitate deployment, cooperation between academia and industry shall be fostered**  
Facilitation is needed to exploit the potentials of academia-industry cooperation. Challenge-based matchmaking and brokerage focusing on industry needs could prompt collaborations. A dedicated S3 transnational public-private competence platform could be considered an appropriate tool.
2. **To build investors' confidence, a stable policy outlook shall be developed**  
To elaborate a vision, long-term strategies and specific objectives, the establishment of inter-ministerial Bioeconomy working groups shall be promoted in countries of the Danube Region. Similarly, a Bioeconomy working group shall be promoted within the EUSDR so to bridge between different Priority Areas (primarily PA2-PA7-PA8, but also PA6-PA9-PA10). This action could lead to formulating Bioeconomy strategies at national and regional level.
3. **To sustain market uptake, bio-based products shall be quality controlled, standardized and labelled**  
Standardization efforts shall be undertaken to stabilize the demand and optimize value chains. Circularity requires that consumers are reassured on the safety of bio-based materials and the use of bio-based products in e.g. the food chain. To this end, industry shall prompt the definition of labels, while the policy shall envisage the introduction of certification schemes and quality controls.
4. **To exploit potential socio-economic impacts, a new generation of skilled workers shall be trained**  
Bioeconomy curricula shall be developed to foster professional education. In order to adequately respond to the needs of industry and contribute to overcoming non-technical barriers, curricula shall be developed in close cooperation with industry and under the supervision of policy.
5. **To boost deployment in the Danube region, awareness on financing options shall be risen**  
Financing opportunities are available globally and in the Danube Region, through multiple channels (which might be confusing) for both R&D and deployment. Some instruments are tailored specifically for countries that are also part of the EUSDR. Industries shall be more proactive and open to adapt to constraints deriving from the use of public money. Academia and policy shall support industries by dedicated training and coaching to enhance project development capacities.
6. **To ensure long-term sustainability, a regional quantitative biomass assessment shall be performed**  
This would provide fact-based information to potential investors and create a sound framework for biomass mobilization and trade. Assumptions could be underpinned by test fields and cases to represent suitability of a feedstock type, including aspects of logistics and storage to secure industrial, all-year round operation with development of multi feedstock portfolios.

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<sup>4</sup> This approach is part of the circular economy vision where waste streams of one industry are considered as feedstock for another.

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**Central European Initiative (CEI)** is a regional forum for intergovernmental cooperation. It encompasses 18 Member States covering a large portion of Europe and overlapping with most of the Danube Region. Serving as an institutional platform for political, economic, scientific and cultural cooperation, the CEI is also particularly active in promoting project-oriented activities through its funding schemes and through participation in EU projects. Fostering Bioenergy and Bioeconomy in Central, Eastern and South-Eastern Europe is one of CEI priorities, as agreed by its Member States and outlined in its Plan of Action.

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