

BRANCHES

Boosting RurAl bioeconomy Networks following multi-actors approaCHES

Deliverable

D4.3 Workshops on regional development factors that support bioeconomy

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Executive summary

This document presents the reports of regional workshops for the prioritisation of factors enabling innovation ecosystems for the regional bioeconomy development in BRANCHES regions. Including enabling the development, adoption and adaptation of innovations and innovative practices, such as those collected in Work Package 2 and 3 of the BRANCHES Project. The workshops were conducted for the regions of Northern Finland (FI), Ebro Valley (ES), Central Germany (DE), Warmia & Mazury (PL) and Central Italy (IT) in 2023. The key results show a top 5 prioritisation of the factors for each region, which provides also a glimpse onto the key focal areas for innovative practices under development to tackle regional bioeconomy challenges. While all of the regions count with different conditions, not only geographical and climatic, but also at the level of bioeconomy development, some prioritized enabling factors were common. For instance, the importance of regional available resources and access to them, the effect of individual and institutional actors and the initiatives they bring forward, and the existence of sufficient conditions for long-term planning. Further details about the workshop results have been condensed in the regional chapters of this report.

1. Introduction

Moving from deeply entrenched fossil-based economic systems to circular and bio-based systems is one of the key strategies to get closer to the decarbonisation goals and attainment of sustainable development goals (SDGs), not only in Europe but in both the Global North and South. The systemic transformation intended with the movement towards a bio-based economy need to address the issues of prosperity, fair and just development particularly so that nobody is left behind, and greater environmental positive effects with circular and closed-loop resource utilisation for a greater efficiency and with greater carbon savings. Regional and local areas are at the centre of this transformation and it is intended for them to receive first-hand the benefits of it.

Local actors, which include feedstock producers and owners, as well as small and medium companies, regional service providers, knowledge centres and many other are important participants in the development of regional bioeconomy. They are initiators and promoters of novel approaches in bio-based value chains. Innovative approaches and the actors furthering innovation in the regions are great catalysers for change and to mobilize the regional economies. Through social, political, and technological innovation they enable the bioeconomy transformation. However, what makes the innovation and its supportive systems thrive in a region? And what can be learned from different types of regions and their regional bioeconomies about their innovation ecosystems and their possibilities for improvement? In search of responses to those questions, we pursued to identifying and acknowledge which factors are key to enable innovation, in particularly in for the regional bioeconomy. As well as, to identify the most important of those enabling factors and in which way are they impacting the development, adoption or adaptation of innovative practices. For that, we focalized in the five selected regions in BRANCHES, namely Northern Finland (North Ostrobothnia, Kainuu and Lapland), Ebro-Valley in Spain (Aragon and Catalonia), Central Germany (Saxony, Saxony-Anhalt and Thuringia), Warmia and Mazury in Poland and Central Italy (Tuscany, Umbria, Marche, Lazio and Abruzzi).

For this, we have identified from the literature key factors enabling innovation and innovation ecosystems. These encountered factors have been then applied for the analysis of innovation ecosystems at regional level and targeted towards the development of regional bioeconomy. Under the premise, that innovation ecosystems are dynamic and evolutionary systems promoting innovative practices in a specific context of analysis. Likewise, understanding innovations as coming from the collaboration, mutual learning, the inter-disciplinary and transdisciplinary exchange of available knowledge towards a common issue or barrier. In this case, targeting challenges in the development of regional bioeconomy and with it the advance of its value chains (established or under development). At regional level and with the support of sectorial and technical partners in the project, each of the regions has consulted in a workshop format their regional stakeholders about the most important enabling factors. This has resulted in, (1) a discussion about the enabling

factors found in the literature with suggestions received by workshop participants to make the factors more understandable or comprehensive, (2) the top prioritized enabling factor for all the regions with a reasoning for their selection, (3) conclusion and recommendations from regional stakeholders, for the improvement of the prioritised factors, which contribute to improving innovation ecosystems of the regions. The workshops and the prioritisation of the factors have been carried out in a structured process, so that it allows us to look at commonalities in the selection of the regions, as well as differences due to regional specificities and the value chains they have placed focus on.

The reached results are an indicator towards focal areas that will enable a stronger and adaptable innovation ecosystem in the regions. Structural changes can be taken in order to enhance the identified factors, such as the capacities of regional actors to share and disseminate knowledge, long-term planning and collaboration between actors, among others. Likewise, to strengthen the capacity to adapt to the local context and apply innovations that might not have been developed in the region but have generated good results in other communities and areas. Noting, that the regional bioeconomy development requires not only cutting-edge technologies, but also innovative services and cooperation models along the value chain, as well as social initiatives and novel forms to promote ecological protection.

In this deliverable, we summarize the key insights from the regional workshops on the prioritisation of regional determinant factors that enable the development, adoption and application of bioeconomy innovative practices. These make part of the regional analysis carried out in BRANCHES regions to identify current regional innovation models. On the final deliverable of WP4, these results will be utilised together with the regional SWOT and TOWS analysis for the definition of recommendations per value chain and per region.

2. Identification of factors enabling innovative practices for regional bioeconomy development

A literature review was the starting point, including scientific publications and EU reports on the topic. For scientific publications, Scopus and Google scholar were used, with the following terms:

- Regional innovation systems, influencing factors, enablers
- Regional bioeconomy, novel practices, technology adaptation
- Factors influencing innovative technologies, bioeconomy, innovation transference
- Determinants, absorptive technological capacities, bioeconomy, indicators

Based on the titles and abstracts of the results a pre-selection of 101 results was made, including project results and other reports. A final selection of 27 publications was made for the identification of key regional determinant factors to the regional innovation environments for bioeconomy.

Table 1. Thematical focus of the revised publications during the literature review.

Thematical focus	Publications revised
Factors for successful innovation ecosystems in the bioeconomy (incl. applicability/adaptability of existing innovations)	18
Factors enabling sustainable bioeconomy development	9

From the literature review, relevant aspects that contribute to the innovation ecosystems in the regions were first identified and used to design a questionnaire (see Annex I.) directed towards the technical and sectorial partners in BRANCHES. The questionnaires, were used as a form of understanding better sectorial and structural trajectories experienced in each region and to discuss about potential future factors influencing the innovation development. These trajectories have been found in the literature to be determinant for bioeconomy sub-sectors, which might facilitate the path towards their defossilisation and in general their transformation, given the existent infrastructure and accumulated knowledge available. The interviews, took about one hour each and were carried out separately with one Technical Partner (TP) and one Sectorial Partner (SP) of each region between November and December 2022.

Finally, a long list of factors was consolidated from the literature review and shared with all the WP4 partners to be utilised in their prioritisation workshops. An online meeting was held in February 2023 to explain the process of prioritisation and available materials with a follow-up meeting in May 2023. Indications for the structure of the workshop, to reach a top five prioritisation out of the long-list of factors and a template to report on the results was also facilitated.

3. Report on the validation and prioritisation of enabling factors

3.1 Determinant factors that enable innovations for regional bioeconomy development.

The complexity of bioeconomy systems requires actors in regional bio-based value chains to adapt according to its demands. Product or processes innovations [1] are mechanisms used to deal with the challenges of transitioning towards a sustainable bioeconomy. However, to be able to steer the transformation from fossil-based systems towards bioeconomy systems, societies need to place emphasis not only in technological types of innovation, but also social, political and environmental

ones [2]. Now, knowing which factors are critical for the development, adoption and adaptation of diverse types of innovations to boost regional bioeconomy development and which environments foster their development is of importance to respond best to the identified transition challenges. It is also important, to understand what actions and support is required to improve the success of innovative practices and their dissemination [3].

For this aim, factors enabling innovations and innovative practices in diverse regional bioeconomy models were explored, represented by the five regional cases selected in BRANCHES, under the following understanding of innovation ecosystems:

“An innovation ecosystem is the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors.” [4]

The fact that each region is different and that the challenges they face in establishing their value chains are framed in the regional specific conditions and the accompanying innovation environments [5], makes it interesting to look at the prioritisation of its influencing factors. Looking at results in different regions can shed light on exemplary practices to successfully enable the regional innovation practices, actors, institutions and relationships to bring forward bioeconomy.

It is evident that a basic factor influencing bioeconomy and innovation development is the *availability and access to renewable resources*. The resources and the capability to access them are determined in part by the climatic and geographical conditions of a region, as well as by the historical development of traditional agriculture and forestry sectors. Transforming these resources into viable bio-based products requires concerted action among *actors*, such as feedstock owners and producers, industries, research & academia, consumers and policy. Thus, the *agency* of these actors, that is the capacity to act towards the development of bioeconomy in the region, and more concretely towards tackling the challenges in their value chains is also a key factor that influences innovation. The *networks and collaborations* among the actors involved in the innovation ecosystem, refer to the flows of information, established cooperation in Research and Development (R&D) and with the industry or other types of cooperation among actors of the value chain to exchange knowledge, and towards reaching the final customer and improving the end of life of the created product. As mentioned by Pyka (2017), this type of (eco)systems are dynamic and characterised by a co-evolutionary nature, which makes them enormously complex. Therefore, *coordination* and *adaptive management* of the innovation ecosystem are required to reach sustainable regional bioeconomy development, in particular to impulse purposeful interactions, cross-fertilisation between different knowledge silos and to develop new knowledge and competences [2].

Other factors influencing innovation and its ecosystems towards the regional bioeconomy development at national and regional level are listed and shortly described in Table 2. The short

description of each factor, includes concepts taken from the literature review, as well as additions to the descriptions, in order to be adapted to bioeconomy related aspects. The factors listed, were identified as influencing and facilitating factors to the establishment, applicability or adaptability of innovations (practices, technologies, services, sectoral or social initiatives) in the region.

TPs and SPs in the project were asked to prioritise these factors with stakeholders from their selected region, reaching a **Top 5** most impactful factors enabling innovation towards the regional bioeconomy development based on:

- Innovative activities (e.g. new practices, technologies, value chain formation, supply chain efficiency, among others) and,
- Other activities that support the transformation of the region towards a more sustainable (bio)economy. (e.g. decarbonisation efforts)

For this, it was recommended to have a clear understanding among all participants of “regional bioeconomy development” in the region. In each region this might look different according to the currently set of direct and indirect bioeconomy goals and ambitions. These goals can be those directly mentioned in policy documents or regional strategies (dedicated regional bioeconomy strategies) or indirectly among several other position or opinion declarations and other regional stated priorities (agriculture, forestry, energy, regional development, innovation, environment and circularity).

Table 2. Long-list of factors enabling innovations and innovation ecosystems for the regional bioeconomy. Results from the literature review.

Code	Long list of factors	Short description
EF-1	Actors and their actions (agency)	Companies, policy makers, R&D institutions, consumers, etc and the initiatives that they bring forward towards a transformation to bioeconomy in the region.
EF-2	Networks and collaborations	Actors connected for mutual learning & for knowledge development to explore sustainable transition towards bioeconomy. Interaction among networks.
EF-3	Coordination model	The forms in which collaborations among actors or between networks of actors are organised.
EF-4	Availability of regional resources	Availability and accessibility of raw materials in the region.

EF-5	Local infrastructure	Physical and digital infrastructure available in the region for the development of bioeconomy activities (innovation, development and scalability), such as well-developed transport systems, access to utilities, access ICT. It related to the necessary infrastructure for the key bioeconomy sectors in the region (e.g. wood and paper, agro-food, livestock, fisheries, waste recovery). As well as, for industries utilising the available resources, such as bioenergy, bioplastics, construction, textiles, biochemicals and other material uses.
EF-6	Institutional infrastructure	The presence of institutions (administrative, academia & research, and other supporting institutions) creating an organise structured to govern and support the development in the region (it might be seen specifically for its bioeconomy development).
EF-7	Innovative financial instruments	Instruments that permit the development of innovation in new areas brought by bioeconomy.
EF-8	Access to capital	To firms or other private actors (e.g. start-ups) boosting innovative bioeconomy innovative concepts.
EF-9	Policy model	"How policies are developed and implemented" to support bioeconomy innovations and activities.
EF-10	Legal conditions	The legal framework that can facilitate firms' activities, innovation and dissemination in bioeconomy activities.
EF-11	Social acceptance	Public perception of bioeconomy activities
EF-12	Knowledge and transfer of knowledge	The existence and development of knowledge to support the bioeconomy activities in the region and its transference between R&D institutions and industry.
EF-13	Sectoral structures	Existing structures of support and coordination within established sectors in the region. (e.g. Forest cluster, chemical clusters, etc.)
EF-14	Socio-economic trajectories	Historical trajectories of socio-economic development in the region that impact their current development (e.g. low population density, historical development of certain sectors)
EF-15	Technological development	Technology development in the region with regards to bioeconomy activities. Including the creation and promotion of lighthouse projects, understood as a model project for the regional bioeconomy that serves as example for other similar endeavours.
EF-16	R&D activities	Existence of bodies that support the creation and transference of knowledge such as universities, testing centres, technological parks, research institutions. Their activities might include technological assistance to entrepreneurs, establishment of scientific networks with the regional industry, development of pilot plants, among others. This might include the existence of an innovation culture in the region.

EF-17	Long-term planning	Stability of policies and instruments to support necessary activities and coordination among actors for the transition towards bioeconomy. These include R&D, and other knowledge development activities, learning plans, development of skilled workforce, strengthening value chains, establishment of networks among actors of the bioeconomy, cross-fertilisation among knowledge silos, among other knowledge transfer activities.
EF-18	Social capital	The built links between people, sustained by shared norms, values, trust and social relationships, which allow for cooperation and the capability to organise themselves for a common mutual benefit (for development).
EF-19	Human capital (Skills and education)	Available skilled workforce, particularly on the bioeconomy strategic areas in development and with a key potential to transform the regional economy (e.g. skills on required technological process, on new machinery, efficient use of resources, logistics, distribution, etc.)
EF-20	Adaptive management	Given the intricated dynamics of innovation systems, and their co-evolutionary nature, the transformation towards a sustainable bioeconomy demands for adaptive management, particularly of the interactions and mutual learning processes for cross-fertilisation between knowledge fields, and for the development of competences.

3.2 Validation and prioritisation per region

After the regional workshops in BRANCHES regions, the prioritized Top 5 factors to facilitate the innovation ecosystems linked to their regional bioeconomies are as shown in Figure 1.

We can identify only one common factor among all of the five regions that carried out the prioritisation, namely the availability of regional resources (EF-4). While legal conditions (EF-10) has also been prioritized by three regions (Warmia and Mazury, Ebro-Valley and Central Germany). The long-term planning (EF-17) has also commonly been identified as important by the actors of the Ebro-Valley and Central Germany. Likewise, the actors and their agency (EF-1) has been selected as important by Northern Finland for the forest sector and Central Germany for the bio-based chemical sector. The prioritised factors give a glimpse of the aspects that regions would like to concentrate the most. For instance, in the Northern Finland region the sectoral structures in place (EF-13) that could support the forest sector together with the access to capital (EF-8) are relevant to enable innovation in their forest-based value chains. On the other side, it is interesting to look at the results of the Ebro Valley region, which selected institutional infrastructure (EF-6) and legal conditions (EF-10) as the most relevant factors for the development, adoption and adaptation of innovations towards their regional bioeconomy. Based on the interviews with the SPs and TPs in the project, these two factors have been validated as critical, and make the difference in the level of

development of the bioeconomy between the administrative regions of the Ebro Valley (Aragón and Catalonia).

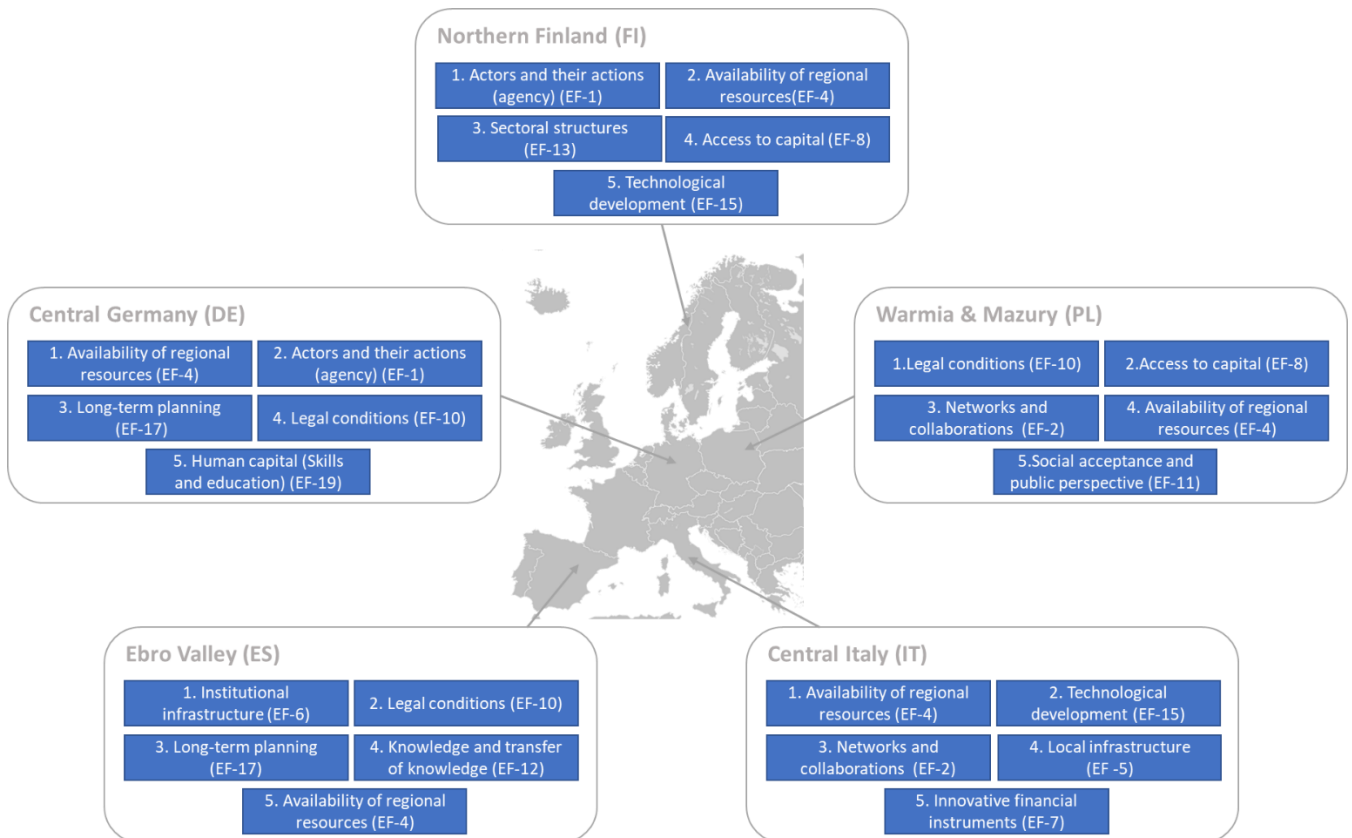


Figure 1. Selected Top 5 factors in BRANCHES regions, as enabling or influencing the innovation ecosystems for the regional bioeconomy development.

In Central Germany, the actors enabling innovation and promoting bioeconomy initiatives, as well as the networks in which they engage have been the motor for the regional bioeconomy and continues to be an area to support and reinforce. Networks targeting specific sub-sectors of the bioeconomy or emerging value chains have been a priority in recent years. Although, the technological development is important, it is an area in which the region is well positioned and have invested considerable resources. However, it has been strengthening the importance of a clear understanding of the pathways towards more circular and sustainable regional industries with well-established goals and long-term planning (EF-17), which have the capacity to influence tangible and intangible regional infrastructure, access to finance and with it also technological development and spin-offs from R&D activities. Finally, to keep building skills in the regional workforce (EF- 19) for highly technical processes and value chains is a factor of current priority.

The prioritisation in Warmia and Mazury reinforces the aspects previously identified in their SWOT analysis, the existence of a legal framework (EF-10) that support the bioeconomy activities and with it all possible structures involved, for instance R&D institutions and their activities and, industrial and technology development with light-house projects, among others. Access to capital (EF-8), goes hand in hand with the legal framework, which might support the introduction of financial incentives for bioeconomy activities, and market measures such as subsidies or taxing. However, access to capital, includes also the frameworks for accessing to loans and public funding directed towards the infrastructure and projects advancing the bioeconomy technologies and value chains as well as the collaboration among actors. Finally, in Central Italy, technological development and local infrastructure in rural activities are place among the most important factors, together with innovative financial instruments that enable these advances for feedstock production.

In the following, the detailed reports of each of the workshops and activities conducted for the prioritisation of the drivers that enable innovation in the regional bioeconomy are presented. This includes the main rationale for the selection of these factors, as expressed by regional stakeholders.

Northern Finland - Finland

For the prioritisation of the identified determinant factors which influence or facilitate the establishment, applicability or adaptability of innovations for the forest bioeconomy in Northern Finland, MTK (The Central Union of Agricultural Producers and Forest Owners) organised the workshop, inviting the Finnish project partners involved in the WP4. The workshop was conducted on the 19 June, 2023 with the participation of two representatives of LUKE (Natural Resources Institute Finland), one participant from VTT (Technical Research Centre of Finland) and two participants from MTK. Participants were asked to do a preliminary prioritising themselves prior to the workshop to an online excel sheet. The workshop started by each describing and reasoning the preparatory work they had done for the prioritisation. The individual prioritisations were fairly similar in terms of results, therefore the group proceeded by counting averages for each factor, and based on the mean values, concluded with the prioritisation. The following table presents the Top 5 enabling factors for the Northern Finland region and the reasoning for their selection.

Table 3. Top 5 factors selected as key enablers of the regional innovations systems in Northern Finland's Bioeconomy.

Priority position (1=highest, 5=lowest)	Factor name	Reasoning behind the selection of this factor
--------------------------------------------	-------------	-----------------------------------------------

1	EF- 1. Actors and their actions (agency): Companies, policy makers, R&D institutions, consumers, etc and the initiatives that they bring forward towards a transformation to bioeconomy in the region.	Actors/companies who have skills, interest and capital, enough know-how – potential market prospect. Policy makers also important, have potential to promote regional bioeconomy development.
2	EF-4. Availability of regional resources: Availability and accessibility of raw materials in the region.	Quantity, quality, cost, long term accessibility, local acceptance, suitable for prospected industrial processes. Short-term and long-term prospects for availability of raw material. Property rights for land-owners and alternative land use prospects affect availability.
3	EF-13. Sectoral structures: Existing structures of support and coordination within established sectors in the region. (e.g. Forest cluster, chemical clusters, etc.)	Integration into existing infra and industry, cooperation with existing structures, support from them and building on them. R&D potential in the region. The importance of ensuring the security of supply.
4	EF-8. Access to capital: To firms or other private actors (e.g. start-ups) boosting innovative bioeconomy innovative concepts.	Enough own capital and/or investors, longer term perspective, regional investment support. Funding for R&D regionally. Profitability of the sector increases investments.
5	EF- 15. Technological development: Technology development in the region with regards to bioeconomy activities. Including the creation and promotion of lighthouse projects, understood as a model project for the regional bioeconomy that serves as example for other similar endeavours.	Enough know-how within the region and cluster, cooperation with research and development organizations. Education and research support technological development, recognizing additional investment potential boosts development.

Conclusions of the workshop of importance to consider for the implementation and adoption of innovative practices in Northern Finland are:

- More communication is needed for up-to-date information on a respected platform. This could help with the challenge of coordination, increase competition, and raise awareness. Open information could be used, for example from within forest owners. Communication of "successes" (Knowledge dissemination) and cooperation in the sector

would contribute to a positive atmosphere - making the good visible. At the same time, it could help to reach compromises.

- Exploiting abundant raw material potential for new higher value-added products to improve profitability. Now the new investments are mainly for bulk products, like pulp and lumber. Additional investments are needed to refine bulk material for higher value products.
Diversification of wood and forest use - development of different sources of income is important for forest owners. Market is still underdeveloped, e.g. for green transition, renewable energies and their increase have great potential. Regional forestry programs and regional land-use plans to help, but investors are also needed for the region. Once new land use business opportunities are recognized, it is easier to start finding investors to make it happen.
- It is fundamental to invest in the public road network (tackling investment debt). Major regional investments require increased regional public funding to support growth. When the risks and lacks are known and numbered, it can be included for discussion with the regional funding.
Long distances increase costs so much that transport chains cannot operate profitably. Weakening infrastructure affects timber availability, maintenance of infrastructure is important. In addition, poor infrastructure increases fuel use.
- Challenges regarding employees in rural areas and small cities of Northern Finland. Attractiveness of the sector needs enhancement.
- R&D can be targeted to solve the main problems in the supply chains. This will also require public investments to impulse the R&D activities and collaboration with forest sector partners.
- There has been a lack of regional and sufficiently far-reaching scenario analysis and regional economic research. Tackling this would provide a basis for discussions with organizations and stakeholders, open new business opportunities and help to start new projects.

Ebro Valley - Spain

The prioritisation of determinant factor enabling innovation in the Ebro-Valley was organised by the two partners in the project, AVEBIOM and Fundación CIRCE, divided in these two stages:

- STAGE 1 (21 April, 2023): workshop with multiple profiles of key actors in the Ebro Valley area (regions of Catalonia, Aragon, Navarra and la Rioja)
- STAGE 2: (Aug-Sept 2023): internal work to refine the workshop contributions and obtain the prioritisation of the Enabling Factors (EFs)

This methodology allowed to combine several project actions, and to bring attention of the Ebro Valley key stakeholders about the rural bioeconomy and the action lines to be set in place. The show-case visit and the combination of several project speeches provided a great framework, and attracted multiple actors. Additionally, it allowed to establish a preliminary structure of an emerging collaborative initiative for knowledge transfer on bioeconomy in the Ebro Valley. During the workshop, the EFs were not presented and discussed. The methodology, following the indications of WP4 for the TOWS workshop and some recommendations for the selection of EFs were discussed among organisers. An external expert, anthropologist and consultant, moderated the discussion, in form of “fish-bowl debate”, with two concentric circles, being the inside one where the participants were occupying the free seats to provide the contributions. The prioritisation of factors was not therefore executed there, as this exercise with 50 participants would have required more time and constrained the participation.

This first stage was combined with a second stage, where the organisers from the participating initiatives had to review the prioritisation factors and proceed to select individually the most relevant, according to the discussions hold during the workshop, and to their own expertise. This stage intended to take place in May-June 2023 but was delayed due to the lack of availability of some of the organisers, and the constraints associated to the 2023 Spanish national elections period. Therefore, the process was postponed until August-September 2023. Table 4 presents the Top 5 enabling factors for innovation ecosystem in the Ebro Valley region and the reasoning for their selection.

Table 4. Top 5 factors selected as key enablers of the regional innovations systems in the Ebro Valley’s bioeconomy.

Priority position (1=highest, 5=lowest)	Factor name	Reasoning behind the selection of this factor
--------------------------------------------	-------------	-----------------------------------------------

1	<p>EF-6 Institutional infrastructure: The presence of institutions (administrative, academia & research, and other supporting institutions) creating an organisation structured to govern and support the development in the region.</p>	<p>A structured central governance organization of the entire process, including all actors: public administration, R&D and the business sector. But also, society and their representatives. Not talking on a conjunctural project or initiative, but a long-term structure to energize and expedite transfer and adoption of innovations on bioeconomy. It has been a general agreement this is the most relevant enabling factor.</p>
2	<p>EF-10. Legal conditions: The legal framework that can facilitate firms' activities, innovation and dissemination in bioeconomy activities.</p>	<p>Legal barriers are identified as a usual factor hindering bioeconomy: new products, new treatments, condition of end of residue, applicability of products in new markets, etc. Therefore, establishment of a legal framework that facilitates the implementation of biobased initiatives and does not generate legal barriers was identified as crucial.</p>
3	<p>EF-17. Long term planning: Stability of policies and instruments to support necessary activities and coordination among actors for the transition towards bioeconomy.</p>	<p>Long-term planning is linked to policy. It means having a common long-term vision among the key actors. With a long-term institutional infrastructure, and with long-term policies. This implies legal framework is pre-adapted to facilitate future envisioned developments and value chains. It habituates a permanent structure and culture of collaboration among organizations committed to R&D and the different actors. Likewise, facilitate the supporting mechanisms (also financial) that have to accompany the process.</p>
4	<p>EF-12. Knowledge and transfer of knowledge: The existence and development of knowledge to support the bioeconomy activities in the region and its transference between R&D institutions and industry</p>	<p>The existence of knowledge is crucial. Not meaning necessarily availability of local technologies, which is also further enabling, but the fact that local knowledge transfer actors are aware of the alternative and innovative paths towards new approaches and opportunities in circular bioeconomy. And the fact that the knowledge transfer is programmed (EF-6) and sustained in time (EF-17). No active actions in knowledge transfer have been discussed in workshops to lead to slow and isolated cases of innovation. The contrary, the active transfer, is a key facilitator.</p>
5	<p>EF-4. Availability of regional resources: Availability and accessibility of raw materials in the region.</p>	<p>When thinking of circularity, large amount of resources mean, relevant amount of underutilised by-products and organic residues. This embrace both sides, the need of treatment and adequate management, together with the opportunity. Areas where this potential is relevant are more easily triggering the adoption of innovative practices in rural areas.</p>

Main conclusions from the workshop's discussion are:

- In respect of the enabling factors, and how they influence the development and adoption of innovative practices in the region it has been agreed among panellists that the promotion of the rural bioeconomy must initially have a common long-term agenda. The establishment of networks and markets for these goods cannot be a one-time issue, but rather a sector in itself, self-sustaining and generating wealth.
- In the discussions held in the first workshop (stage 1), it was stated that adoption requires active actors, not only the adopters, but the different key actors in the process of adoption. The networks for innovation are usually present in the territory, usually orientated to agri-food sector, though as well to farmers and foresters to some extent. The fact that in terms of circular bioeconomy and innovation in rural areas the adoption of innovative practices remains a slow process, has been discussed. It was agreed that it plays a fundamental role and need of executive tools and context from the government sphere, to trigger new initiatives through concrete tools and actions for the development of the bioeconomy.
- Furthermore, it was agreed that for new bio-commodities, there is in general challenges to overcome regarding the legal aspects, uncertainty for real demand or acceptance by the agents at the value chain, both the potential users and the final consumers.
- For a specific case of innovation of local developers in a rural area, long-term policies and a solid transfer network that works continuously is essential. This is the difference between being alone and having to solve every single issue on own resources, own risk, own decisions, with a limited vision. The selected factors address institutional infrastructure, long term strategy, active networks, for example. The transfer agents would transfer the ideas, the benefits in the usual framework of dialogue offered by the network structure in the area. The actors, who in the long term already know what it means to innovate, or know neighbouring innovators, would make decisions to adopt new practices more easily and quickly.
- A solid and long-term strategy, and a well governed boosted and directed institutional infrastructure, is key to face challenges related to the modification of the legal framework and in providing the financial instruments. All this will lead to greater confidence in this economic model among key actors in the bioeconomy value chain and encourage them to invest in projects of this nature. In terms of awareness and social perception, it is necessary to promote acceptance not only among potential consumers, but horizontally among primary producers, regulatory agents and the general public.

Central Germany – Germany

For the prioritisation of the factors enabling innovation for the bioeconomy in Central Germany, two stages were taken:

- First, the workshop with NTN stakeholders on the 23 May, 2023: The workshop followed a multi-actor approach and involved several expertise areas on the bioeconomy.
- Second, the final selection of the most relevant factors for the region Central Germany, based on the interview findings and the bioeconomy strategy paper for the region, adopted in 2022: This constitutes the final stage, in which partners participating in the WP4 finalized the selection of most relevant factors in the region.

During the Workshop in May, two purposes of the project were included, on one side the presentation of innovative practices in the bioeconomy to support the knowledge dissemination activities in BRANCHES. On the other side, the long list of factors was presented, and the goals of the prioritisation exercise. To facilitate the discussion in the online workshop, the whole group was divided randomly in two groups, which were tasked with the same activity, namely to identify the Top 5 factors that enable innovation activities (adoption, adaptation and development) in the regional bioeconomy. Groups were numerated as 1 and 2 to distinguish their results and comment at the end of the workshop.

The results of the prioritisation in group 1 are:

1. EF-2. Networks and collaborations
2. EF-4. Availability of regional resources
3. EF-10. Legal conditions
4. EF-12. Knowledge and knowledge transfer
5. EF-8. Access to capital

For the 5th factor, there was a tie between the factors EF-3 Coordination model, EF-17 Long-term planning and EF-8 Access to capital. After a run-off vote, EF-8 Access to capital is chosen. Participants in this group concluded and suggested that EF-3 can be considered as part of EF-1, while EF-17 would also be better named "security of planning" and can be considered as part of EF-10.

The rationale for the selection of these factor and their effects on the regional bioeconomy were discussed. Thus, the availability of regional resources is essential for value chains and defossilisation and sustainability in the region. The legal framework is decisive for residual materials. However, a word of caution was raised that these should fit, otherwise they cannot be used, for example in the

chemical industry. Knowledge and knowledge transfer and networks and cooperation affect all three main factors mentioned before. In particular, knowledge is crucial for new innovations, while networks are most important for opening up new value chains. Finally, stakeholders in this group mentioned the importance of access to capital for the development of innovation and bringing them to market.

The results of the prioritisation in group 2 are:

1. EF-1. Actors and their actions (agency)
2. EF-2. Networks and collaborations
3. EF-4. Availability of regional resources
4. EF-7. Innovative financial instruments
5. EF-19. Human capital (Skills and education)

Participants in this group consider indispensable the will of all bioeconomy actors and the activities they promote EF-1, for innovation and to strengthen implementation. EF-2 Networks and collaborations is an essential factor for communication targeted to innovations and improvements in value chains. Likewise, to promote access to information for all actors interacting in the innovation ecosystem. Exploiting the existing potential of regional resources – EF 4, with the sustainability goals as guiding horizon is relevant and with it the strengthening of regional value chains. EF-7 Innovative financial instruments are considered also as essential for the success of innovative projects and as incentives for defossilisation of the regional economy. Finally, the human capital available in the region and with it, the available skills are vital also to promote innovation.

In a second stage, the organisers from the NTN workshop review the prioritisation factors and proceed to select the most relevant for the Central Germany region. This, using also as reference the workshop’s discussions, strategic documents of the region and mentioned goals for innovation development (Strategy paper for the Bioeconomy – Metropol region Central Germany, 2022), and also based on their knowledge of the region. The following table presents the Top 5 enabling factors for the innovation ecosystem in Central Germany region and the reasoning for their selection.

Table 5. Top 5 factors selected as key enablers of the regional innovations systems in the Central Germany’s bioeconomy.

Priority position (1=highest, 5=lowest)	Factor name	Reasoning behind the selection of this factor
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1	EF-4. Availability of regional resources: Availability and accessibility of raw materials in the region.	The region counts with important agriculture and forestry resources, while also having a great opportunity to exploit the by-products of the well-developed regional food industry, to be used in bio-based value chains. It is then important to facilitate access to the available biomass, quality requirements, and close-loops that require getting better at re-integrating in other cycles the by-products of food processes and residues from agriculture and forestry activities.
2	EF-1. Actors and their actions (agency): Companies, policy makers, R&D institutions, consumers, etc and the initiatives that they bring forward towards a transformation to bioeconomy in the region.	Leading institutions in the region and people working in them have been very important to bring forward the bioeconomy development. Strengthening the collaboration between policy, industry and technical facilities in the region with R&D institutions is essential, under a common goal.
3	EF-17. Long-term planning: Stability of policies and instruments to support necessary activities and coordination among actors for the transition towards bioeconomy.	As a previous coal-mining region, it is imperative to keep transforming the sectors that support the regional economy. Bioeconomy is an important tool to use the agriculture and forestry resources, by-products from the food industry, which is strongly represented towards regional green growth. Looking at the long-term development, it is key to think about recycling of products (e.g. CO ₂ flows) towards a circular bioeconomy and establishing collaborations with other federal states and other EU countries.
4	EF-10. Legal conditions: The legal framework that can facilitate firms' activities, innovation and dissemination in bioeconomy activities.	Legal conditions are closely linked to EF-17 Long-term planning. Facilitating a framework that creates stability for a diversity of actors. First, for raw material producers in order to have a secure supply, that is essential for any bioeconomy activity in the region (incl. the considerations about imports and exports of biomass). Also, for investors and technology developers, the necessary infrastructure and stable policy frameworks.
5	EF-19 Human capital (Skills and education): Available skilled workforce, particularly on the bioeconomy strategic areas in development and with a key potential to transform the regional economy (e.g. skills on required technological process, on new machinery, efficient use of resources, logistics, distribution, etc.)	The region counts with already a good offer of universities and training offers in agriculture and forestry resources, chemistry, renewable energy, and other key topics of relevance for the bioeconomy. However, this is still subject to improvements, in order to extend the training offers to all of the three administrative regions in the Central Germany and it is crucial to strengthen the vocational training.

Main conclusions from workshop's discussion are:

- The desire for political support and perseverance with regard to projects is particularly evident. Topics should also be thought of in a more holistic way. In this way, tourism can also be addressed or new resources can be used.
- On the practitioners' side, more influence on political decisions is desired. In addition, more associations should be formed, as these have more impact. Also, better use should be made of existing resources and opportunities. Practitioners often need the support of the public sector to be able to be effective themselves.
- To leverage existing resources, infrastructure and institutions already present in the big cities of the region, namely Halle, Leipzig, Zeitz and Dessau which it counts since 2022 with a new applied science institute, the Center for the transformation of the chemical sector. This responds to a pressing need of the chemical sector to keep transforming towards a green, circular and biobased chemical production.
- Something that is crucial in the region is the Relationship between EF-1 Actors and their agency and EF-3 coordination model. The region is quite strong in its technological capacities, the existent infrastructure and key actors driving forward the bioeconomy development. It is however essential to focalise in having a coordination among all the tangible and intangible resources of the region. For instance, having a regional institution with the mandate to holding the overview of the region and also advising role to a diversity of bioeconomy practitioners. This could support more purposeful technology implementation in the region. That is, investing in technologies that fit to the regional capacities and resources. This coordination role should also include supporting purposeful networks, and collaboration between actors.
- A common understanding about the transformation towards bioeconomy and paths to implement the bioeconomy goals still need to be further develop and this might take several years. This is however essential to establish supporting legal frameworks and the secure conditions to reach the intended goals. This relates to long-term planning and coordinated actions that help synergize applied R&D activities with socio-economic regional needs. That should result in investments in the R&D projects that are not isolated from the sectorial, socio-economic and biological realities of the region.

Warmia and Mazury – Poland

In order to prioritize the determinant factors which, influence or facilitate the establishment, applicability or adaptability of innovations for the bioeconomy sector in the Warmia and Mazury region, workshops were organized in March 2023. This event was jointly involved by the University of Warmia and Mazury and the Warmia and Mazury Agricultural Advisory Center. 38 people representing various interest groups took part in the workshops. This group included, among others: farmers, inhabitants of rural areas, agricultural advisors, entrepreneurs, scientists. The meeting was preceded by a presentation of examples of good practices in the area of bioeconomy already implemented in the region. In this way, the meeting participants, especially those whose knowledge of the bioeconomy was limited, were introduced mainly to the assumptions of this economic model. Meeting participants were asked to indicate factors supporting and limiting the development of the bioeconomy in the region. Then, the collected information was grouped to create a list of determinants.

The next step aimed at prioritizing factors was the use of elements of the MoSCoW method. The MoSCoW method is a four-step approach to prioritizing which project requirements – in this case, the development of the bioeconomy in the region. MoSCoW is a prioritisation technique for helping to understand and manage priorities. The letters stand for: must have, should have, could have, won't have this time. The list of factors was sent to 6 experts who were asked to group the factors according to the categories indicated in the method. Then, the feedback obtained from experts was analysed and the 5 most important factors were selected. Also, the final prioritization is the result of the analysis of experts' responses.

Table 6. Top 5 factors selected as key enablers of the regional innovations systems in the Warmia and Mazury's bioeconomy.

Priority position (1=highest, 5=lowest)	Factor name	Reasoning behind the selection of this factor
1	EF-10. Legal conditions: The legal framework that can facilitate firms' activities, innovation and dissemination in bioeconomy activities.	In the development of the bioeconomy, the regulations established at the national level, which determine the legal framework for the implementation of projects in the field of bioeconomy, are primarily important.
2	EF-8. Access to capital: To firms or other private actors (e.g. start-ups) boosting innovative bioeconomy innovative concepts.	One of the most important factors determining the proper development of the bioeconomy is access to a system of financial support for activities related to, for example, introducing bioproducts to the market. At the stage of conducting research and introducing new (innovative) technologies, the bioeconomy must have access to various

		sources of financing. Various types of subsidies are of great importance in financing, especially for new solutions.
3	EF-2. Networks and collaborations: Actors connected for mutual learning & for knowledge development to explore sustainable transition towards bioeconomy. Interaction among networks.	The integration of the scientific and economic communities allows for more effective commercialization of scientific research results.
4	EF-4. Availability of regional resources: Availability and accessibility of raw materials in the region.	Biological resources are considered to be the basic factor influencing the development of the bioeconomy. In the process of using these natural resources, it is very important to maintain their appropriate condition and sustainable use. The possibilities of developing broadly understood bio-business are largely influenced by the quantity, quality and appropriate allocation of natural resources.
5	EF-11. Social acceptance: Public perception of bioeconomy activities	Literature sources indicate that the level of awareness of the principles of functioning of the bioeconomy in many EU regions is low. The consequence of the lack of awareness is the low acceptance for implementing new solutions in the area of bioeconomy.

The workshop drew together participants from various areas of regional economy and allowed for a great degree of interaction among the participants. Workshop offered an opportunity to share knowledge and experiences.

Main conclusions from workshop's discussion are:

- The bioeconomy is becoming more and more popular. This is primarily due to its interdisciplinary nature.
- Appropriate market regulations and institutional changes are necessary, along with adapting national law in order to more efficiently implement bioeconomic initiatives.
- The fundamental factor influencing the development of the bioeconomy is access to renewable natural resources. Natural conditions are extremely important in locating the bioeconomy in a given area, as well as in choosing leading specialties. Natural capital,

including all forms of the ecosystem and natural resources, is important in the development of the bioeconomy in the region.

- Investments in the area of bioeconomy are also inextricably linked with financial capital. The investor may rely on his own funds or seek external support. Due to the innovation and novelty of the implemented solutions, investments in this sector are often expensive and carry a certain risk. To increase the effectiveness of investments undertaken in the field of bioeconomy, professional advisory support is extremely important, which is one of the guarantees of the effective implementation of undertaken investments.
- The bioeconomy requires better cooperation between different stakeholder groups. Many promising research results remain untapped due to lack of knowledge and barriers institutional between scientists, innovators, producers, and end users, society. They can make this gap bridge knowledge transfer networks, knowledge and technology brokers, and social ventures as part of broader stakeholder initiatives.

Central Italy – Italy

The information here reported is based on the close collaboration with the Board of Directors of the "GESTA" Association¹, established in 2022 to promote sustainable development in the rural sector in Abruzzo (Central Italy Region). For the prioritization of the factors, interviews were conducted during a workshop held in Abruzzo on August 16, 2023 and subsequent follow-up phone calls. The idea was to achieve results as compatible as possible with the outcomes of the Practice Abstracts (PAs) conducted by the Italian team. This approach was all the more beneficial as relationships with the representatives of the stakeholders described by the PAs already existed.

Thus, four managers - Paride Tudisco (President), Antonello Liberatore (Vice President), Caterina Ariosto (Councillor), Nello Alfonsetti (Councillor) were chosen for central Italy. Following that, phone-calls were performed individually with each of the representants.

The assumption was that these experts could provide the most valuable insights on topics already dealt with by the PAs. This proved to be a fruitful approach, as the representatives were thus able to immerse themselves immediately in the topic and the discussion.

¹ GESTA is the acronym for the Italian "Gestione Eco-Sostenibile del Territorio in Abruzzo (Eco-Sustainable Territory Management in Abruzzo).

Table 7. Top 5 factors selected as key enablers of the regional innovations systems in the Central Italy's bioeconomy.

Priority position (1=highest, 5=lowest)	Factor name	Reasoning behind the selection of this factor
1	EF-4. Availability of regional resources: Availability and accessibility of raw materials in the region.	In terms of woody biomass, residues from forestry and agriculture (pruning, orchards removals, straw, etc.) are the most common. In some cases, regionally available raw material (that until this moment eventually was seen as waste, e.g. roots from orchards...) is even considered the triggering aspect from which the whole business idea started.
2	EF- 15. Technological development: Technology development in the region with regards to bioeconomy activities. Including the creation and promotion of lighthouse projects, understood as a model project for the regional bioeconomy that serves as example for other similar endeavours.	E.g. an ORC device is a highly developed technical instrument. In some cases, the entrepreneur depends on the technical equipment of potential customers, e.g. a pellet market can be established only if the customers have suitable plans (dedicated stoves).
3	EF-2. Networks and collaborations: Actors connected for mutual learning & for knowledge development to explore sustainable transition towards bioeconomy. Interaction among networks.	Required (low-cost) energy sources, e.g. from wood waste, agriculture, livestock, silage etc. for the generation of a product with added value are often available only within pre-established networks. In other cases, a cooperation with R&D institutions is necessary, e.g. to produce (high-value) fertilizers from (low-value) combustion ashes. In other cases, a cooperation between actor and machine manufacturer is essential for the profitable (i.e. mechanized) realization of the business idea etc.
4	EF-5. Local infrastructure: Physical and digital infrastructure available in the region for the development of bioeconomy activities (innovation, development and scalability), such as well-developed transport systems, access to utilities, access ICT.	An important aspect, especially for the valorisation of the forestry economy, concerns the forest road infrastructure: i.e. forest roads, skid trails and landings. These can facilitate the production of biomass for energy use, as well as support firefighting and sustainable tourism, thus avoid the depopulation of mountain areas.
5	EF-7 Innovative financial instruments: Instruments that permit the development of innovation in new areas brought by bioeconomy.	As a matter of fact, some bioeconomy businesses need initial financial support, in order to be profitable at a later stage.

Main conclusions from the interaction with stakeholders and ranking of the enabling factors are:

- Especially after the energy crisis in 2022, to decrease dependencies on imported energy sources, and to promote the local and regional production of renewable fuels, should be a priority for the future. Besides, enhancing autarchic strengths, this might give rise to a series of bioeconomy businesses.
- There is little question that technology and sophisticated technological systems in many cases, are a key factor for a profitable operation of a business in the context of bioeconomy. Another word that might be stressed in this connection, is mechanization. This requires a strong focus on research activities, the establishment of tech parks etc. To adopt innovative technologies is desired, but by nature such technologies often are not well-known. Thus, their benefits must be divulged in order to boost implementation and business opportunities. This requires dissemination to local stakeholders, but also political action. Another powerful instrument to foster acceptance are public grants.
- To have the right partner is often a critical necessity. E.g. in the form of joint ventures, networks for the successful commercialization of agricultural crops, contracts with wood suppliers etc. A strong focus on this aspect should be dedicated in any business plans.
- In addition to physical infrastructure (roads, water collection basins, woodworking platforms, etc.), digital infrastructure ones also play an important role, especially with regards to making available to the various stakeholders of a territory (companies and administrations) dedicated Geographic Information Systems (GIS) with databases that include workable to estimates of biomass availability to be exploited for multiple uses.
- In some cases, public grants are indispensable. This applies specially to sectors that are promising on the one hand but poorly recognized on the other hand, such as gasification activities. Under such circumstances, targeted assistance is needed.

4. Conclusions

The identification of determinant factors for the innovation ecosystems in the regions, in this case, towards boosting their regional bioeconomy, is an approach to understand the complexity of bio-based and circular systems at regional and national level in the EU. Furthermore, the factors identified and prioritized represent significant areas towards the establishment of a rich and dynamic innovation environment in the regions. Even more, its prioritisation by stakeholders, helped to point out to the necessities of regional actors when engaging with innovative technologies and/or value chains, such as those collected in WP2 and WP3 of the BRANCHES project. Therefore, it contributes to identify areas of action to boost the regional bioeconomy and other actions to assist stakeholders who actively support its development.

Some of the identified factors, which were prioritised as key enablers, were already highlighted in the policy analysis carried out for the selected regions [6]. The creation of long term-certainty, here EF-17, for companies in the region was identified as crucial but also not yet sufficiently supported in the political frameworks. An unsecure regulatory and policy framework due to changes after governmental periods as well as a lack of policy coherence can cause investment uncertainty.

On the other hand, changes in the legal framework (EF-10) are necessary to facilitate the market entrance of new products, to establish a fairer competition of bio-based solutions compared to conventional products and to enable the sustainable use of new resources. The highest rated political and legislative obstacles were vague, not measurable policy goals, uncertainty due to frequent regulatory changes and too many policies with conflicting goals. This suggests that legislation needs to be adapted, but a balance between new legislation and giving the perspective of long-term stability for the bio-based industry is important.

Access to capital (EF-8) is closely linked to the long-term planning and was also often named as obstacle in the policy analysis. One solution can be financial instruments like subsidies and funding schemes. But also, the implementation of a green public procurement policy can support (local) bio-based industries by creating a demand for their products also in the longer term. Another hurdle is, that in some cases, there already exist funding possibilities but complicated and long administrative processes make them difficult to access.

The availability of regional resources (EF-4) is named in most of the region as key enabling factor. There already exist good policy practice examples enabling the use of regional resources in a sustainable way like forest strategies or support schemes for certain resources. But future policies must be open also to new (sustainable) resources or new uses like value chains based on rest streams, insect biomass or also biochar, which is currently hindered by the legal background.

An efficient way to enable the bioeconomy highlighted in the policy analysis is to create a bioeconomy strategy at the regional level. This process can create a vision for the future of the region and in this way raise public awareness of the topic. Setting strategic goals and a time frame can create a kind of certainty for companies that there will be demand for their products/services in the future. The goals of the strategy can initiate new funding possibilities e.g. for R&D and in this way create knowledge in the region and strengthen the institutional infrastructure. Financing pilot plants can bridge the knowledge transition between research and industry, which is often times burdensome. In addition, the strategy development process would ideally be based on collaboration and communication between regional government, industry and research stakeholders and help stakeholders get to know each other (EF-1). Another example of a good policy practice was also the creation of an information hub for bioeconomy, which brings together different actors and facilitates the transfer of knowledge.

Further utilisation of these results will take place during the definition of recommendations in deliverable 4.4, which will bring together all analysed information in WP4 and for the main value chains and main feedstocks represented by the BRANCHES regions.

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Annexes

WP4 – Regional development models – T4.3

Questionnaire: Regional determinant factors for regional bioeconomy development

Date/ Time:	
Country/Region:	
Partner:	
Interviewer:	

Objective: to identify determinant factors (enablers) that have supported the bioeconomy development in each region considered within BRANCHES project. More in detail, to identify which factors influence or facilitate the applicability or adaptability of new innovations (practices, technologies, services) in the region. Finally, the interview looks towards the future of the region and intends to identify if there are additional factors (enablers) required for the mid-to long-term development of regional bioeconomy.

The bioeconomy development up to date

How would you describe the development of the bioeconomy / or the transition towards bioeconomy in the region so far?

- Along which sectors? Or with which new sectors? - which actors have played a role? Type of innovations? Measures that have supported it? Etc.

What has facilitated the transition towards bioeconomy in the region?

- Which of these enablers/factors have come from the national level? The regional level? Or the local level?

Have there been critical actors to this transition?

- Whom?
- Which actions from these actors would you say have been supportive and which hindering?
- Are there national and regional institutions that have played a key role to the bioeconomy development?

The regional bioeconomy development – towards the future

How do you see the future development of the regional bioeconomy? Sectors, resources, value chains, cooperations, technologies, infrastructure?

Are there additional factors (enablers) necessary to attain that future picture of the regional bioeconomy?

Which specific aspects are necessary for the generation, adoptability and adaptability of innovations in the regions?

How would you quantify the impact of the following enabling factors for the development of the regional bioeconomy (on a scale from 0 to 10)?

Environment and resources

- Socio-cultural conditions
- Technological development
- Availability of regional resources (biomass, biowaste)
- Intangible regional resources (e.g. knowledge development and knowledge dissemination)

Actors and initiatives of actors

- Networks in the region and collaboration among regional actors (companies, R&D institutions, consumers)
- R&D activities
- Initiatives promoted by regional actors (by companies, R&D institutions, consumers)
- Creation and promotion of lighthouse projects

Infrastructure

- Institutional infrastructure (supporting bodies or institutions)
- Physical local infrastructure (for logistic, for value chain development)

Policies and regulations

- Legal conditions
- Investment conditions
- Long-term planning