

Unleashing regional bioeconomy potential: the BioEconomy Regional Strategy Toolkit

Chapter 6

Luka Juvančič, Myrna van Leeuwen

1. Introduction

The untapped bioeconomy potential in European regions has been the main challenge of an FP7 Coordination and Support Action (CSA) project called the BioEconomy Regional Strategy Toolkit (BERST). The aim of this project is to take into account the bioeconomy potential and strategies of a range of different regions in Europe, and therefore gain understanding of the possibilities and challenges related to the enhancement of biobased economies. Its ambition is to develop a toolkit to help regions in their bioeconomy development trajectory. In addition to this, the project has attempted to assist the regions substantiate their smart specialisation strategies on regional bioeconomy potential.

The central objective of this chapter is to provide interested readers with concise information about the BERST project and guide them through the toolkit. The research themes and roadmap to the BERST project are briefly presented. This is followed by a practically-oriented presentation of three of the toolkit's components: (i) regional bioeconomy readiness check tool with a selected set of criteria and indicators; (ii) catalogue of instruments and measures enabling regional bioeconomy development; and (iii) development of regional bioeconomy profiles through a catalogue of good practices and case studies. The chapter ends by pointing out the transferable findings of the project, virtues and limitations of its key outputs, while placing special emphasis on their integration into the current platforms and activities encouraging the European bioeconomy.

The slow and uneven progress of the bioeconomy in Europe

From a broader perspective, the bioeconomy can be defined as an economy where the basic building blocks for materials, chemicals and energy are derived from renewable biological resources (McCormick and Kauto, 2013). It has been referred also as “one of the oldest economic sectors known to humanity” (EC, 2005). Indeed, according to Eurostat, the current turnover of the total bioeconomy in the EU-28 is already around EUR 2.1 trillion, providing jobs to 18.3 million people (BIC, 2016). It ranges from the primary sectors, i.e., agriculture, forestry and fishery (contributing about a quarter of total turnover) to the food and beverages sector (about a half of total turnover) and biobased industries, such as chemicals and plastics, pharmaceuticals, paper and paper products, forest-based industries, the textile sector, biofuels and bioenergy (rounding off the last quarter of total turnover). The bioeconomy is consistently growing. A constant increase in scientific knowledge and technical expertise in the use of biological processes brings with it new possibilities for industrial applications, such as biopharmaceuticals, biomaterials and green chemistry (McCormick and Kauto, 2013). It can be therefore regarded as both a driver of future economic growth and as a pathway towards sustainable development and reduced fossil-fuel dependency.

Transitioning to a resource-efficient and sustainable concept of bioeconomy is becoming the leading strategic orientation of the European economy. With this goal in mind, the European Commission has set a comprehensive strategic framework (EC, 2012) and developed a coherent approach to the bioeconomy through its programmes and instruments. It has also developed a set of

supporting institutions and policies to support the transition of European regions to a bioeconomy.

The progress seems to be rather slow and regionally uneven. In their review of regional bioeconomy strategies in Europe, de Besi and McCormick (2015) report that different strategies focus on the same key priority areas for developing the bioeconomy. These include fostering research and innovation, primarily in the field of biotechnology; promoting collaboration between industry, enterprises and research institutions; prioritising the optimised use of biomass via the cascade principle and by using waste residue streams; and providing co-funding for the development of biobased activities.

However, the bioeconomy has not yet been embedded in policy planning and implementation, nor has it been recognised as a growth opportunity in several Member States. Uneven spatial distribution and a rather clear division between the 'richer' and 'poorer' regions in devising their bioeconomy strategies spark fears that the transition to a bioeconomy will increase the gap between development levels in Europe's different regions.

Taking into account the current of bioeconomy in the prevailing part of European regions, challenges involved in the project BERST are still valid, although its active work ended in November 2015. Regions that are willing to develop their bioeconomy potential, bioeconomy industries and/or potential bioeconomy entrepreneurs and investors in the regions can still benefit from the project outputs, referred to collectively as the BERST toolkit.

The BioEconomy Regional Strategy Toolkit approach

The project was carried out by nine research and development institutes and research-management organisations (research partners) and seven regional authorities and their local stakeholder groups (regional partners) from eight European countries.¹ The orientation of this project was as practical as possible, which means that bioeconomy companies and other relevant stakeholders were closely involved in the project actions, through the regional partners. Research partners provided specialist knowledge whereas the regional partners provided the experience necessary to guide and validate the researchers' work. By providing the lessons of their experience, regional partners also made a considerable contribution to the development of generic, transferable findings.

The expected outcomes of the project were: (a) to understand the European regions' existing and potential status for bioeconomy development ('a bioregion'); and (b) to chart and boost their evolution with the instruments and mechanisms suggested by the research partners and validated by the regional partners. Additionally, this project aimed to give a boost to bioeconomy industries and/or potential bioeconomy entrepreneurs and investors in the regions, by offering them relevant information about the business potential or business possibilities as well as robust and encouraging practical examples from other regions. Finally, the ambition is to actively promote new 'smart' strategies for regional development by establishing an EU bioregion network.

The outcomes listed above were tackled with a combination of quantitative and qualitative research, upgraded with guidance and consultation of regional partners. Project work was established along the following five building blocks:

1. Determining criteria and indicators: following a thorough review, a set of economic, environmental and social criteria was designated. The criteria were used as a basis for establishing a database with indicators based on NUTS geographic levels. The indicators

¹ <http://www.berst.eu/RegionalPartners.aspx>

reflect various aspects of national/regional bioeconomy status.

2. Collection of instruments and measures: a structured database with instruments and measures for regional bioeconomy development was incorporated into a publicly available online search tool.
3. Catalogue of good practices and case studies: a catalogue was created as a result of extensive case study work. Experiences and case studies in regions developing their bioeconomy sectors were used to draw generic conclusions.
4. Regional bioeconomy profiles: profiles were developed as a synthesis of the previous steps (criteria, instruments/measures and good practices). Their robustness and usefulness was assessed by regional partners.
5. Regional bioeconomy network: The practical character of the project was ensured through the creation of a regional bioeconomy network with perennial status, addressing challenges of a stakeholder network at different levels – from regional to the EU.

Indicators and regional bioeconomy readiness check tool

To support quantitative analysis of the status of the regional bioeconomy, a set of criteria and indicators on the regional bioeconomy was identified. Criteria refer to several characteristics, including resource availability, demographics, industry mix, institutions, finance, macroeconomic trends, governance/regulation and public support. With respect to their market function, they refer to natural resources, capital, labour, innovation, consumer demand and business demand. Next, items on the list of criteria and indicators of the regional bioeconomy were assigned one of three levels of importance:

- Essential criteria, without which it would not be possible to develop bioeconomy
- Key criteria, which play a very significant role in development
- Desirable criteria, which can facilitate additional growth (sometimes in specific subsectors of the bioeconomy only), but which are not necessary for the development of bioeconomy

The bioeconomy is comprised of different sectors at different stages of the supply chain. Generally speaking, there are sectors that supply biomass, sectors that convert biomass into intermediate products and sectors that bring biobased end-products to the market. BERST distinguishes eight sectors in the bioeconomy, not necessarily distinguishing along the NACE codes²:

Table 6.1. Bioeconomy sectors in BERST.

Bioeconomy sector	Subsectors included (if more than one)
Primary biomass sectors	Arable, livestock, horticulture, fishery, aquaculture, forestry/wood
Food & feed processing	Food processing, feed processing
Construction	
Chemicals	Chemicals & polymers, biorefinery
Pulp & paper	
Textiles & clothing	
Energy	Solid energy, gaseous energy, liquid energy, co-digesting
Biotechnology	R&D services in biomass

² This required a breakdown of regional datasets up to the fourth digit of NACE nomenclature and their correspondence to BERST bioeconomy sectors.

To facilitate the quantitative analysis, available data corresponding to the criteria were identified and collected from a variety of sources and missing data were provided by BERST regional partners. These data were stored in the online BERST metabase tool (catalogue of criteria and indicators). This metabase serves as a tool that can:

- Organise the data associated with criteria, over years and over regions (up to NUTS 3 level), collected from various sources
- Facilitate the comparison of data associated with criteria across different regions
- Facilitate the comparison of data associated with criteria between regions and Good Practice regions
- Visualise the data associated with criteria by tables, figures, graphs and maps

A web-based tool³ has been developed to allow for quantitative benchmarking and comparative analysis for NUTS 2 and NUTS 3 regions of five EU Member States. By using the BERST metabase tool, the current industry mix through shares of total employment and total firms in a specific sector in a region have been compared to the national average by means of spider diagrams (Figure 6.1).

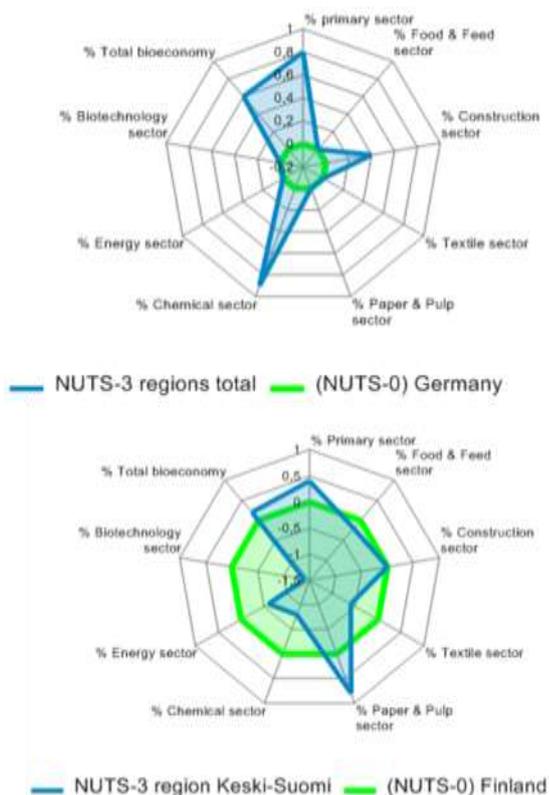


Figure 6.1. Spider diagrams comparing employment and firm structure in BERST case study regions with national averages.

Selected indicators from the BERST metabase tool comprised a (single for all regions) typology for regional bioeconomy readiness assessment. An example is presented in Figure 6.2.

³ <http://berst.databank.nl/>

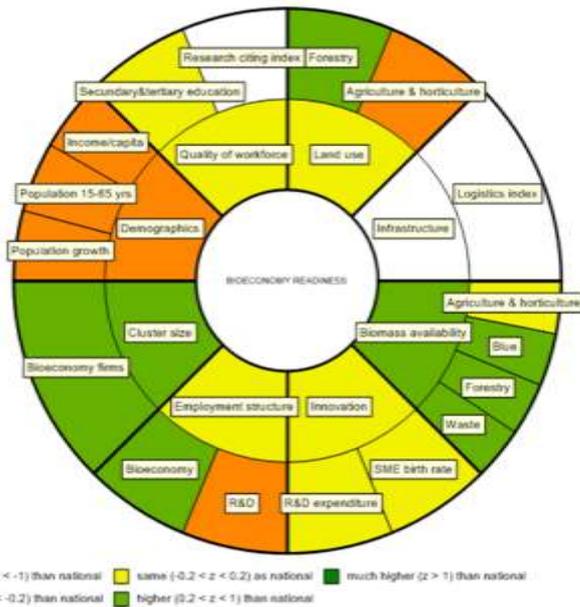


Figure 6.2. Example of a graphical presentation of regional bioeconomy readiness check.

Instruments and measures enabling regional bioeconomy development

A web-based catalogue of instruments and measures (I&Ms) was created so stakeholders can perform targeted searches for instruments and measures that support regional bioeconomy development. The catalogue can aid stakeholders in drawing up their own strategies and business plans towards developing a regional bioeconomy and to learn from and be inspired by experiences in other regions. The stakeholders for whom the catalogue is intended include regional and national policymakers and entrepreneurs from profit and non-profit organisations. Instruments and measures are broadly interpreted as any policy, law, method, mechanism, tool or action used by governments, the for-profit or non-profit sector or society as a whole to boost regional bioeconomy development.

The online catalogue tool remains active and is hosted at <https://berst.vito.be/>. The tool structure and data content was defined by VITO in close collaboration with the regional BERST partners and with a focus on data usefulness and user-friendly data mining. Populating the tool with instruments and measures was performed by regional partners, external stakeholders, VITO and consortium partners. Prior to adding the instruments and measures in the tool, VITO performed a quality check.

The catalogue contains information on actions implemented at various levels (EU, national, regional). Extensive lists of information features have been collected for each instrument or measure. These features are divided into three categories, namely key information, contact references and advanced information.

Table 6.2. Categories and features of information on instruments and measures.

Key information	Contact references	Advanced information
Short name (English)	Full name (English)	Feedstock type targeted
Country/region (up to NUTS 3)	Full name (native language)	Product type targeted
Description	Links	Value chain
Goal/aim	Responsible authority	Enterprise scale
Type (and subtype)	Contacts of responsible authority	Connection with national policies
Sector/topic targeted	Completed by	Year started/ended
Status		Budget

Four main types of instruments and measures were identified:

1. Economic/financial instruments and measures: actions that stimulate certain activities, behaviour or investments using financial support and price signals to influence the market. These include fiscal and financial policy instruments such as taxes, tax relief, grants or subsidies, feed-in tariffs and loans for the purchase or installation of certain goods and services. They also include direct public funding and procurement rules, and market mechanisms such as tradable permits.
2. Research and development support aims to support technological advancement, both direct and indirect, in technology research, development, demonstration and deployment activities.
3. Regulatory (binding) instruments cover a wide range of instruments and measures by which (mainly) a government imposes targets, obligations and standards on actors requiring them to undertake specific measures and/or report on specific information.
4. Voluntary (non-binding) initiatives refer to instruments, measures and 'actions' in a broader sense that are undertaken voluntarily either by public agencies, the private sector, NGOs, citizens, etc. Examples are strategies, roadmaps, action plans, guidelines, cluster and platform organisations, setting of indicative/non-binding targets, voluntary agreements, position papers, viewpoints, collaboration structures, etc.

The tool currently contains 790 unique instruments and measures, the majority of which (55%) originates from the national level. About 30% apply to the EU level and one sixth to the regional level. Most of the instruments and measures can be classified as economic and financial instruments or regulatory instruments. The instruments and measures appear to be widely scattered among objectives. Creating a reliable and enabling policy framework (14%) and building competitive biobased industries (12%) are the most represented. However, most of the other objectives are just slightly behind and score between 8–10%. Only the objectives related to biomass availability (5%) and learning from other regions (5%) are noticeably less represented. Instruments and measures can be related to several sectors and topics. Instruments and measures in the tool are on average related to two to three sectors and/or topics, varying within a range of one to five. Energy is the most prominent sector/topic addressed by 313 (16%) selected I&Ms, followed by environment (200 I&Ms; 10%), agriculture (148 I&Ms; 7%) and research & innovation and industry, enterprises & commerce (each 144 I&Ms; 7%).

The concept of the I&M catalogue is one of an open community, where users can freely submit additional instruments and measures. A user-friendly interface was developed that becomes available after log-in. This functionality is part of an overall strategy to complete the tool as much as possible through interaction with the target group and stakeholders. Prior to final publication in the tool, the instruments and measures first undergo a quality check.

Each account holder has a section where they can save instruments and measures in a draft version before submission. This allows the users to work on new instruments and measures in different phases, e.g., to gather more data, contact other relevant experts or have the information checked by a third party.

Lessons learnt from case study analysis and action-based learning

The qualitative part of the BERST toolkit consists of a series of eight regional case studies involving good practices and eight cases in early stages of bioeconomy development. Case studies describe the following assets affecting bioeconomy development: (i) institutional arrangements forming a cluster organisation; (ii) the actors (corporate sector, RTD institutions, government, NGOs) and their role in bioclusters; (iii) availability and supply of biomass; (iv) competitive biobased products and services; (v) funding arrangements; (vi) trends in demand for biobased

products and services, and (vi) accompanying policies and measures.

With respect to the time horizon of a bioeconomy cluster, the following three phases were distinguished:

1. Initial stage and take off: in this phase, the bioeconomy is introduced in the regional planning agenda and the policy, socio-economic and R&D landscape for its establishment and operation is created.
2. Drive to maturity: in this phase, the first competitive bioeconomy products are sold at the market. The cluster grows with the setup of new companies, cluster infrastructure (with incubator, training centre etc.) is established, and the cluster is able to attract both private and public funding.
3. Age of mature production: in this phase, the cluster is able to produce competitive bioeconomy products at an extensive scale.

By using a protocol with questions on the interaction of entrepreneurs, policymakers and knowledge institutes in each development stage of the bioeconomy cluster, narratives on the development path of the bioeconomy clusters with good practices and in BERST regions were constructed while enabling factors and barriers were identified. Statistical data, literature and interviews with key actors were used to collect information on how each bioeconomy cluster works.

In BERST, we first analysed the bioeconomy clusters with good practices. This provided a number of key findings on how actors in the cluster interacted. A subsequent analysis of the BERST regions examined extent to which the key good practices findings also apply to these bioeconomy clusters and which barriers they face in developing the cluster.⁴

In the synthesis, the development path of the bioeconomy clusters in the good practice regions was reflected through the experience of the BERST case study regions. From the analysis of the development path of the bioeconomy clusters in the good practice regions, a number of key findings emerge:

1. Active actors organise the cluster as a bottom-up process and keep it moving through intensive networking. The good practices show that a bioeconomy cluster usually starts as a partnership of R&D institutions and firms, with occasional (but not decisive) involvement of policymakers. In each of the good practices there were a number of leading actors who had the capacity (knowledge, skills and attitude) to mobilise other actors and organise the cluster as a bottom-up process. Along the development path of the bioeconomy cluster, there was a process of intensive networking with local and external actors, which enabled an efficient transfer of knowledge, products and services both, within and beyond the cluster.
2. A cluster board that takes care of the organisation of the cluster and communication. The cluster can benefit from the establishment of a cluster board, which is responsible for organising the cluster and effectively communicating with actors inside and outside the cluster. If policymakers are not involved in the cluster, the development of good working relations between them and the cluster and political commitment should be taken into account. As the needs of the actors in the cluster change over time due to changing local and global circumstances, the cluster board should adapt to these changes.
3. A cluster makes use of regional assets. Study of the good practices reveals that, as a rule, the cluster is built upon regional assets, such as a well-known university, presence of R&D institutions, strong industrial networks, a robust economic sector, active actors, a well-developed transport infrastructure, etc.

⁴ Background reports with the complete analysis of the bioeconomy clusters in terms of good practices and BERST regions (deliverables 3.1 and 3.2) are available on the BERST website (<http://www.berst.eu/Publications.aspx>).

4. A cluster starts with activities in one economic sector. The good practice regions concentrated their collective efforts on one economic sector. Due to crossovers with other sectors over time, a mature cluster covers several economic sectors.
5. Consistent funding. At first, the cluster is mainly supported by public funds, while private funds become available at later stages. Usually, at the initial stage of the cluster, public RTD funds prevail, which was especially true for the case studies, where no marketable products were available at that stage. In a few cases, private funds (mainly from the energy industry) were already available from the cluster's outset. In raising public funds in the drive to maturity stage and the mature production stage, it appears that the good practice clusters do manage to raise public funds that are related to those topics being promoted on regional, national or EU political agendas. Although funding is often project based, good practice clusters were able to ensure continuous funding.
6. The supply of biomass resources as such is not considered as a barrier for clusters with good practices, since a well-developed infrastructure enables transport from both local and external supplies. However, ensuring a continuous supply of biomass resources of a consistent quality remains a challenge, as these resources often originate from seasonal feed stocks. Moreover, as biomass resources already have several end uses, an additional demand for new bioeconomy applications creates competition for raw materials.

The BERST regions show a wide variety of cluster experiences, ranging from successful regional bioclusters, to those 'trapped' at the inception stage. Apart from the bioeconomy clusters in central Finland and Biobased Delta, the bioeconomy clusters in the BERST regions mainly suffer from weaknesses in their actors' capacities. Weaknesses and risks could be explained as follows:

1. Lack of active participation of entrepreneurs in the cluster as they doubt the value of the cluster for their business.
2. Lack of an innovation culture among entrepreneurs, which is partly related to the small scale of many firms and lack of well-trained human resources.
3. Lack of cooperation and trust among firms and R&D institutes, which hampers, on the one hand, a focus of R&D institutions on developing demand-driven technologies, and on the other hand, the adoption of innovations by entrepreneurs.
4. In a number of BERST regions, the bioeconomy clusters appear to be placed as politically-led top-down initiatives in an environment of entrepreneurs and R&D institutions which are not convinced of its usefulness and who show a low sense of ownership of the cluster. As long as public funds are available for projects, both R&D institutes and firms are ready to absorb them. However, when the projects have been completed and when no new public funds become available for the adoption project results, follow-ups hardly emerge. Consequently, the cluster risks stagnation and even disintegration.
5. Although biomass resources were available in the BERST regions from local or external supply, several BERST regions experienced difficulties in transforming these resources into new bioeconomy products. These difficulties are due to varying quality, fluctuations in the supply, collecting the supply from a large number of suppliers, and competition with other users for biomass resources.

BERST functionalities and limitations

The key purpose of the BERST project is to demonstrate how a region can fully exploit its bioeconomy potential. In keeping with this aim, BERST designed a format for a regional profile

fact sheet and completed regional profiles for seven BERST regions. The online tool (<http://berst.databank.nl/>) enables preparation of regional profiles for a number of other EU regions as well.⁵ In this way, the BERST project may contribute to supporting and further developing regional bioeconomies in the EU. The regional profiles can be used as input for further steps in developing the bioeconomy cluster by entrepreneurs, R&D actors and policymakers in a specific region. Whether these steps will indeed be taken depends on the willingness of the regional actors to further build upon the findings of the BERST project.

Additionally, research and networking efforts within BERST project also yielded transferable findings which can serve as a reference for regions/sectors in their initial development stage to link their resources, actors and institutions in biobased sectors and create vibrant regional bioeconomies.

To start with biomass supply, a regional biocluster should obviously give preference to local biomass. However, physical abundance of biomass in a region can be deceiving; bioclusters compete with established uses of biomass and, especially in the initial stages, this can result in a limited access to local biomass. In this respect, it is useful to first check availability and usability of non- or underutilised biomass and energy streams, such as by-products of the existing industrial biomass processes.

With respect to how regional bioclusters are organised, one of the key success factors lies in a strong and committed collaboration between research institutions and industrial partners. Close cooperation between research institutions and firms is a standard in good practice regions. A shared vision and inclusive governance between research institutions and industry are prerequisites for higher adoption rates of innovations and therefore committed development of regional bioclusters in the long run.

To build trust and ensure successful cooperation between research institutions and industry stakeholders in developing competitive biobased sectors, a number of barriers must be overcome on both sides. On the research side, efforts involve activities such as training in critical thinking, entrepreneurship skills and innovative research. On the corporate side, efforts are needed to increase companies' willingness to adopt innovations and encourage demand-driven strategic planning of their production.

Transitioning to a bioeconomy is a knowledge- and capital-intense process. With regard to capital, public support can play a catalyst role, particularly in the early stages of regional biocluster development. Again, as a rule, regional bioclusters in good practice regions benefit from consistent policies and long-term financing models, where public support is gradually replaced with private funding. Apart from financial support, the regional partners have assigned equal importance to other aspects of enabling policy environment, such as responsive administration, clear rules and regular networking activities.

In the end, it is also important to note the weaknesses and limitations of the BERST approach and its outcomes.

The first relates to the 'formal' (versus 'functional') regional approach. Obviously, bioeconomy clusters are not operating within strict regional (NUTS 2 or NUTS 3) boundaries. The decision to build the BERST toolkit under the 'formal' regional approach has been primarily dictated by data availability. Furthermore, NUTS 2 (and in some cases, NUTS 3) regions coincide with the territorial level of regional development planning. Information gathered with the BERST toolkit can

⁵ Currently, data on NUTS 2 and NUTS 3 territorial scales are available for regions in Greece, Belgium, Spain, the United Kingdom, the Netherlands, Slovenia and Finland.

assist regions in assessing their development potential in various aspects of bioeconomy (e.g., renewable energy, green mobility, smart biomass use).

Another limitation of the data-driven approach has to do with the objective problems of data availability and/or reliability. The standard NACE nomenclature is too vague to eliminate all ambiguity when highlighting data on bioeconomy firms. Again other data, such as research and innovation performance, does not exist. In this case, data gaps are filled with proxies, often burdened with restrictive assumptions about their linkages with the observed criteria.

And last but not least, when using the BERST toolkit, it is important to keep in mind that context is crucial. Because regional bioeconomy performance is context-specific, the general recommendation when preparing regional bioeconomy profiles is to combine quantitative analysis with thorough qualitative information gathering. This also holds true for instruments and measures: successful options are context-specific. Building regional bioeconomy strategies based on ‘machine-reading’ of the BERST toolkit outcomes would be a serious mistake. Information on good practices should be used only as an inspiration in devising new context-specific solutions.

To conclude with the future possibilities of the BERST toolkit, it should be noted that the BERST partnership is open to opportunities for stakeholders to build on their work on regional bioeconomy strategies. The current BERST output should be seen as a prototype and living tool. Resources permitting, the toolkit could be expanded to regions in other EU and EEA countries. Additionally, the visibility of BERST outputs for general public interested in bioeconomy could be improved (e.g., by enabling links to BERST from dedicated sites, such as the EU Bioeconomy Observatory). With the improvement of bioeconomy indicators (e.g., biomass availability, economic performance indicators for bioeconomy sectors, research and innovation quality indicators), the informative value of regional bioeconomy profiles would significantly improve as well as the potential for informed planning of regional bioeconomy strategies.

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