Understanding the local embeddedness of CBE initiatives to design regional CBE policies: the example of Occitanie.

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Abstract

Context and objectives

The bioeconomy is a multi-faceted political issue for governments: sovereignty of production sectors (energy, manufacturing, agriculture); technological innovation capacity; ecological transition (preservation of natural resources and biodiversity); regional planning and local development. Over the last few years, the notion of circular bioeconomy (CBE) has emerged, designating a bioeconomy based on the "cascading" principle (Jarre et al., 2020; Stegman et al., 2020).

The EU is one of the most ambitious regions with respect to the subject and has adopted a global policy associated with funding instruments to support it. The guidelines embodied in the European CBE policy reflect the overall representation of the bioeconomy by the EU, strongly focused on the objective of mobilizing biomass from different sources and sectors and supporting biotechnological innovations and biorefineries to increase the value of biomass (De Besi and McCormick, 2015; Vivien et al., 2019). As a member state, France also supports CBE with national policies and instruments that contribute to designing a policy framework for implementing CBE in French regions. The primacy given by those policies to technological research and biomass availability suggests a bioeconomy based on a specific and single innovation and development dynamic around biotechnology and a key role of biomass as development factor.

However, some studies show the existence of a diversity of bioeconomies (Nieddu et al, 2014; Benoit, 2021; Donner and de Vries, 2023). This refers to a diversity of technologies used (Nieddu et al, 2014), innovation patterns (Benoit, 2021; Birch, 2009) and business models (Donner and de Vries, 2023). It is associated (as within circular economies) with a diversity

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of needs as regards resources (including biomass, support, collaboration) and with a diversity of spatial patterns and territorial embeddedness. By focusing on biomass and biotechnologies, regional policies may be based on a limited understanding of CBE dynamics, their basis and what can they bring to local economies. This is particularly the case in regions where biotechnologies and the biorefinery industry are relatively limited but where other sectors may support CBE.

The objective of the communication is thus to propose a framework for portraying the diversity of CBE initiatives within a region and understanding its different dynamics and patterns.

Material and methods

Data collection and analysis is carried out using a mixed method research design.

For the quantitative part, a digital survey that consists in analyzing 23 digital platforms dedicated to the recovery of biomass or waste was first conducted. Then, a telephone survey among regional institutional actors and, at the departmental level, among chambers of agriculture, chambers of commerce and industry.

The structure of the database is divided into two sub-sections:

- Data relating to the project leader (date of creation of the project owner, company size, legal status, project launch date, activity sector, location and size of the municipality where the project is based).

- Data relating to type of activity (type of raw material, valorisation yield, core technology, number of target markets, degree of maturity of the initiative, type of innovation). In the second subsection of the dataset, we used Nieddu et al. (2014)'s collective productive heritages typology to characterize the technological profile of each project. We have adapted it by extending it to the mechanical technology involved in the circular and cascading model (Hildebrandt et al., 2017). This variable is called "Extended Technological Heritage" (ETH).

The data collected from 183 initiatives each filled in on 26 variables, were the subject of a Correspondences Factor Analysis (CFA) on 17 variables (with maximum 15 modalities) to study the proximities between the characteristics of the initiatives identified and deduce a typological classification by Ascending Hierarchical Classification (AHC) using Modalisa software (KYNOS), version 9.

Qualitative inquiries were then carried out for each type of initiative obtained with H.A.C. The 13 interviewed cases (Appendix 5) studied were selected on the basis of diversity within each type in terms of category of bioresource exploited, age, sector and location. The objective was to collect information from CBE project leaders about the initiative's trajectory, local support, business model and other elements of the local / regional context. Each interview was recorded and then transcribed. The corpus was then analysed by theme using thematic method classification.

Results

The HAC reveals 4 types of initiatives. The FAC then allowed us to characterize the types according to common variables.

"*Biotech R&D initiatives*" (type B) first reflects the existence of start-ups focused on research and second the technical experiments conducted by distilleries on other valorisation of by-products strategies.

"*Methanization units*" (type C) use radical thermal deconstruction of animal and plant co-products with the objective of producing energy (biogas for electricity and heat) and agricultural inputs (digestate used as a fertilizer).

"Artisanal agro-industrial initiatives" **(type D)** reflect the growth of local projects aimed at creating a wider network of biobased stakeholders or a renewed industrial dynamic focused on non-food uses (materials).

Initiatives aiming to broaden agricultural value chains **(type A)** is a more heterogeneous category. It mostly involves various products for professionals (animal feed, chemical products and other substances, essential oils, alcohol, packaging, cleaning products, etc.) and – but much less frequently – private customers (mostly herbal products: dyeing, cosmetics, healthcare).

Each of the four classes of initiatives is dominated by one or two particular collective heritages (Nieddu, 2014) ranging from the use of radical biotechnological deconstruction technologies to the mechanical deconstruction of bio-resources. Although there are some biotechnologies and biorefineries, many activities strongly relate to the agricultural sector (especially in types A and C), a key economic sector in Occitanie. More than a creation of brand-new activities by new stakeholders, most of the 183 initiatives appear to be diversification activities of existing economic stakeholders and idiosyncratic changes in local value supply chains. They are thus embedded in existing innovation dynamics and value-chains as pointed out by Benoit (2023) and Birch (2009) and relate to sector-specific innovation patterns (Wilde and Hermans, 2024).

The spatial distribution of the initiatives also reveals different geographical patterns according to the category.

Although a robust characterization of CBE spatial patterns in Occitanie would require further research, we can at least distinguish some specific characteristics in terms of location according to CBE type, especially for types B, C and D (Figure 4). This reflects the territorial and sectoral embeddedness of CBE initiatives. In line with what is highlighted by Chembessi et al. (2024), Gonçalves et al. (2022) and Veyssière et al. (2022), proximity to material and immaterial resources is important for all the projects. But the degree and nature of their requirements vary from one type to another. The logic of location of these activities seems to strongly reproduce the spatial divide in innovation geography between urban and rural areas and the role of specialization and agglomeration externalities. It is particularly visible in type D (artisanal agro-industrial initiatives) where CBE initiatives are based on the historical specialization of some medium-sized towns in textile and leather activities.
From an operational perspective, our results provide an alternative method for assessing regional CBE dynamics compared to the NOBR (National Observatory of Biomass Resources) results based on biomass assessment.

Keywords: Bioeconomy, cascading, producive heritage, spatial patterns, embededness