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Emerging collaborative circular bioeconomy business models in France

M. Donner¹, H. De Vries²

¹ INRAE, UMR MOISA, 2 Place Pierre Viala, 34060 Montpellier, France

² INRAE, UMR IATE, 2 Place Pierre Viala, 34060 Montpellier, France

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Presenting author email: mechthild.donner@inrae.fr

The need for more resource-efficient and resilient production and consumption systems has been acknowledged at the 2015 Paris Conference on Climate Change (COP21). The conference agreement has led to the law n° 2015-992 for Energy Transition and Green Growth in France. Thereafter a national bioeconomy strategy has been developed. A key characteristic of this strategy is its participatory approach. This concerns multi-actor collaborations involving different stakeholders (enterprises, public actors, NGO's, academics, and citizens) in the decision-making and implementation of projects (French Ministry of Agriculture, Food and Forestry, 2018). The 2017-2018 French Roadmap for the Circular Economy follows similar approaches targeting seven interrelated pillars (ADEME)¹: (i) sustainable procurement, eco-design, industrial and territorial ecology, and functional economy (ii) responsible consumption and extension of the life of products and (iii) recycling and energy recovery, at the end-of-life.

In the transition for a circular bioeconomy in France, collaborative business models for valorising local agricultural resources are important. A circular business model concept links circular economy and resource efficiency while striving for sustainable outcomes (Nußholz, 2017). A bioeconomy business model converts biomass into various new value-added products such as bioenergy, biofertilizers, biomaterials or food ingredients (Donner *et al.*, 2022). Combined circular bioeconomy business models are confronted with barriers and risks. These include the dependence on public subsidies, policies and laws, investment costs, a need for cooperation and collaboration, and price competitiveness of its products (Donner *et al.*, 2021; Salvador *et al.*, 2022). However, novel circular bioeconomy business opportunities emerge in all industrial sectors; this is stimulated by consumers' demands for local, green and recycled products (Hansen, 2016).

We explored what kind of innovative circular bioeconomy business models exist in France, based on agrifood resources, and particularly targeting territorialized approaches. An online review of initiatives on the francophone internet platform 'www.economiecirculaire.org', created by the French National Institute of Circular Economy and the International Centre for Resources and Innovation for Sustainable Development (CIRIDD), provided a set of 44 initiatives of circular business models. These were analysed according to a conceptual scheme of a game developed by De Vries *et al.* (2021).

The results highlighted different types of business models, mostly micro-firms (22 out of the 44 cases), small (12 cases) and medium-sized enterprises (8 cases), and only two large companies. Nearly all circular bioeconomy (waste and by-product valorisation) activities of the enterprises (41 out of 44) started in the past decade, hence reflecting the public attention to the circular economy in this same period. In most cases, biomass is converted into biofuels, biogas, compost or biofertilizers (28 cases). In 9 cases, added value in food is created, while in 7 cases in biomaterials (7 cases). It became apparent that a lot of enterprises collaborate with public partners. These are local municipalities, regional governments, development agencies and chambers of trade, or ADEME. Other initiatives show private-private partnerships, including big service companies for waste collection, large industrial partners from their target markets or with nearby smaller businesses such as farmers, restaurants, bakeries, breweries, hospitals, gardeners or supermarkets. In case high added-value products are the aim, that require scientific evidence, research institutes are involved. Occasionally, citizens and consumers participate, especially when dealing with local composting.

From our analysis, we extracted that the most important enablers are organisational and spatial in nature. Here, geographical proximity of actors, local cooperation and resource handling are dominating factors. Other crucial factors are local institutional support, general environmental trends and consumers behaviour, hence

¹ <https://expertises.ademe.fr/expertises/economie-circulaire>

environmental, social and cultural in nature. Barriers are in particular technical and logistic problems, as well as economic, financial and marketing factors.

Our conclusion is that various collaborative and context-specific business models for exploiting biomass resources should co-exist to advance the circular bioeconomy in a territory; hereby, initial public financial support is often imperative. Then, the territorial small initiatives – providing food, energy and other bio-based materials – may contribute at a long term to local sustainable development and to an increased resilience of rural and urban territories and their actors.

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