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New circular business models for urban solid biowaste valorisation

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The collection and treatment of urban solid biowaste in general is challenging, due to several reasons such as the volumes and heterogeneity of biowaste, the organisation of logistics for the waste collection, or the land access for waste treatment facilities. The separation of biowaste from other waste also represents a major problem. In Europe for example, about 86 million tonnes of biowaste were produced in 2017 (whereof 60% were food waste and 35% garden waste), but only 43% (37 million tonnes) were collected separately (Brussels & Van Der Linden, 2020). In France, most of the biowaste consists of garden waste, which is collected in waste disposal centres. Currently, only 175 cities representing 6% of the French population offer separate collection schemes for households' biowaste. France is thus still far away from its objective to separate urban biowaste and ensure its recovery instead of landfill, as targeted in the law against waste and for circular economy.¹ As urban biowaste treatment and valorisation remains a major challenge for many French local authorities, several private start-up businesses have emerged in this domain. Our objective was to identify the different types and value propositions of these new business models, and to understand the enablers and barriers of their development.

The business model concept has become very popular in the past years, in practice as well as in management research linked to sustainability, circular economy and resource efficiency (Nußholz, 2017). A business model describes how a firm operates and how it creates value for its different stakeholders (Casadesus-Masanell & Ricart, 2010). A bioeconomy business model converts biomass from agriculture, food production and forestry into various new value-added products (bioenergy, biofertilizers, biomaterials or food ingredients), by using circular strategies such as recovering, recycling, upcycling and cascading the biomass (Donner et al., 2022). The implementation of a circular bioeconomy business model can be challenging, due to internal organisational, technical or financial, but also external legal or market factors. On the other hand, valorising biowaste may offer new business opportunities and options for economic, environmental and/or social value creation.

As methodology, case studies were done on 18 start-up businesses dealing with urban biowaste, and located in different cities across France. Semi-structured interviews were conducted mainly with the enterprise managers in June and July 2022, via telephone or online conference tools, and lasting between half and one and a half hour. The interview guide included questions about the origin and development of the company, its value proposition, customers, customer relationships, distribution and communication channels, key partners, activities and resources, costs and revenue streams, stakeholders involved, circularity impacts, general trends and drivers, institutional elements and lessons learned. All interviews were recorded and transcribed, and then analysed according to the main themes.

Four major types of start-ups could be identified: a first most common type whose principal activity is the collection and valorisation of biowaste via composting; a second type whose biowaste valorisation is the central value proposition, through vermicomposting or biogas production by anaerobic digestion; a third type who is rather focusing on the development and support of composting activities for example with trainings or awareness creation campaigns; and a fourth type whose main activity is the sale of technical solutions (software tools, composters, micro-biogas plants) for the management of biowaste. Most of the companies are dealing with biowaste of professionals, as at present, the management of household waste is still a competence of local authorities. Results also show that local, small-scale and customer-oriented value propositions are important, such as waste collection within a limited geographical area, often by bikes or e-vehicles, collection schemes corresponding to the individual customers' needs, or transformation close to the city centres. Next, as illustrated in table 1, some of the enabling factors of the start-ups are the current need for soil amendment and energy, the

¹ <https://www.ecologie.gouv.fr/loi-anti-gaspillage>

general awareness of environmental issues leading to an increasing demand for these types of activities, the quality of the products or services offered, and the public regulation for biowaste separation and collection. Among the barriers, customers play a crucial role as they are in general still difficult to identify and hesitant to pay for biowaste collection. Other hindering factors are related to costs and revenues, as for example the small amounts of compost produced do not generate much incomes and most often are given away for free, while the initial costs for starting a business or the investment costs for technologies are rather high, and public support sometimes difficult to find. Moreover, there is competition from established (large-scale) companies.

Table 1. Main drivers and barriers for start-ups valorising urban biowaste

Enablers	Barriers
Need for soil amendment and energy production	Customer profiles difficult to identify
Awareness of environmental issues	Difficult to convince customers to pay for collection
Quality of the product or service	Compost that is not financially valuable
Regulation for biowaste	High investment costs, difficulties in finding fundings
	Competition from major market players

To conclude, despite their potential to create multiple economic, environmental and social value, most of the recently developed small-scale business models dealing with urban biowaste in France still have difficulties to enter the market or are not yet financially viable, but depend on public financial support. In the future, the regulation for biowaste separation and collection of individual households will most probably create more demand but also more competition. Developing partnerships might be a solution for jointly responding to future calls for tenders from communities. As our insights are based on explorative cases from only one country, it would be interesting to perform a large-scale survey among start-ups for urban biowaste valorisation in Europe to develop sound business and policy recommendations.

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