BIO CIRCULAR CITIES

Exploring the circular bioeconomy potential in cities

State of the art of biowaste production and management in the pilot areas

Public summary

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Exploring the sustainability of bioeconomy supply chains in a Life Cycle Thinking perspective

This is the public summary of the confidential report "State of the art of biowaste production and management in the pilot areas" which results from the work carried out within the Biocircularcities project to explore the sustainability of bioeconomy supply chains in a Life Cycle Thinking perspective. If you are interested in accessing the complete report, please address your request to contact@biocircularcities.eu. Find out more on the Biocircularcities pilot territories on https://biocircularcities.eu/live-from-pilots/.

The report "State of the art of biowaste production and management in the pilot areas" provides an overview of the current biowaste management systems, including both municipal separately collected biowaste and mixed waste, in the three pilot territories involved in the project, namely Metropolitan Area of Barcelona (MAB), Province of Pazardzhik (PP) and Metropolitan City of Napoli (MCN). The aim is three-fold:

- map the main biowaste producers and biowaste management systems;
- select three biowaste management chains (one in each pilot area) to be further analysed, and;
- identify the relevant stakeholders involved in the biowaste management chains and their interests and perspectives.

The biowaste chains were selected also based on the results of the first local Living Labs reached through the suggestions of the involved local stakeholders. The selected chains represent either streams associated to significant quantities (as it is the case for municipal biowaste in the MAB pilot), challenging to manage (biowaste from agro-forestry sector in the PP pilot), or unexplored valorisation chains (such as biowaste from agro-industrial sector in the MCN pilot). The three biowaste chains are very diverse from each other, with the aim of providing a range of case studies and a greater replicability at European level.

For each selected biowaste chain, a Business as Usual (BaU) and an alternative scenario have been defined. The alternative scenarios have been selected keeping in mind that they have to represent an application of circular bioeconomy, in compliance with the requirements of the Bio-Based Industries Joint Undertaking (BBI JU) call.

The biowaste prevention measures as well as circular strategies are the starting point to improve the waste management and to comply with the EU directives. Therefore, the proposed alternative scenarios also consider:

- the potential implementation of prevention measures to decrease the biowaste generation;
- an improvement in waste collection (voluntary separate collection in open containers versus collection via smart bin and/or door-to-door), and;
- the implementation of circular patterns based on biowaste valorisation.

Metropolitan Area of Barcelona

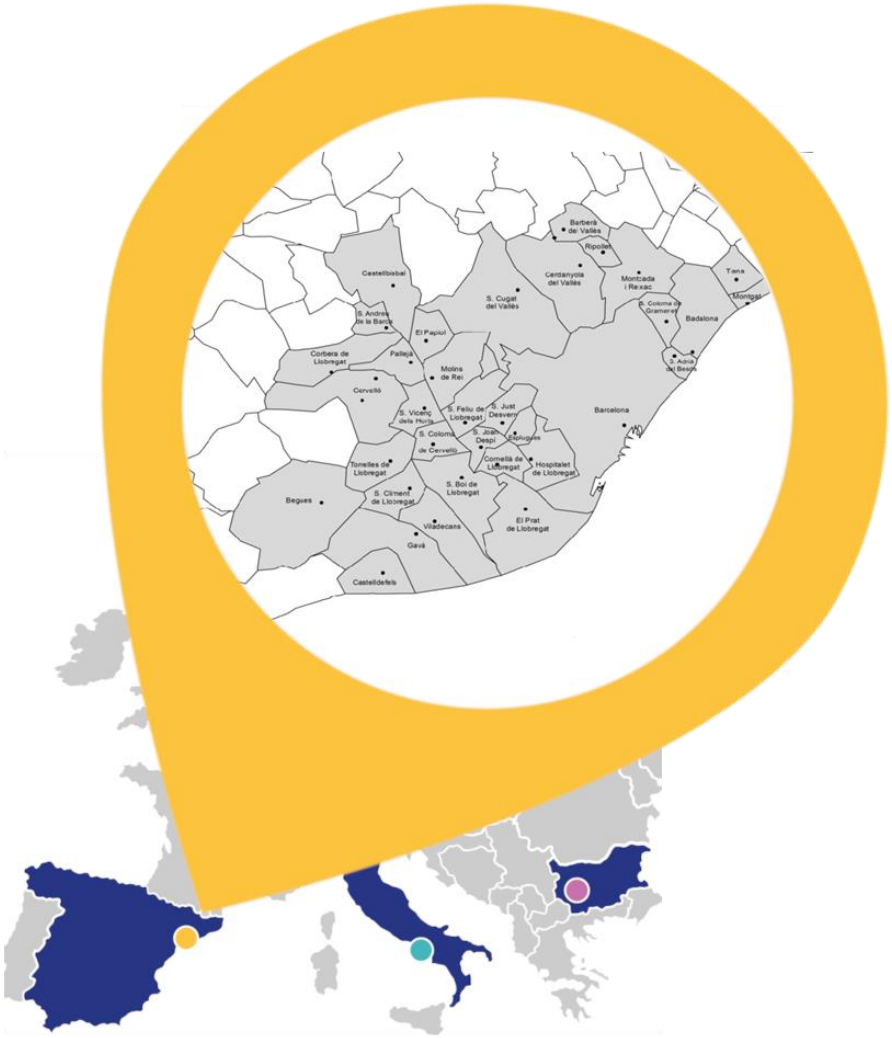

Figure 1 Metropolitan Area of Barcelona with its constituent 36 Municipalities

Current situation: in 2020, the separate collection represented 37.6% of the total waste, whereas the rest was collected as residual waste. Additionally, 1.7% of the waste was directly sent to landfill, while the waste recycled and sent to Mechanical Biological Treatment (MBT) represented about 25% and 61%, respectively. Out of the 453,480 tonnes of municipal biowaste generated annually, 184,284 tonnes are collected, and 176,974 tonnes are treated in the Metropolitan area. In 2020, the impurities in biowaste amounted to about 16% w/w. Anaerobic digestion and composting were the most common treatments for separately collected biowaste.

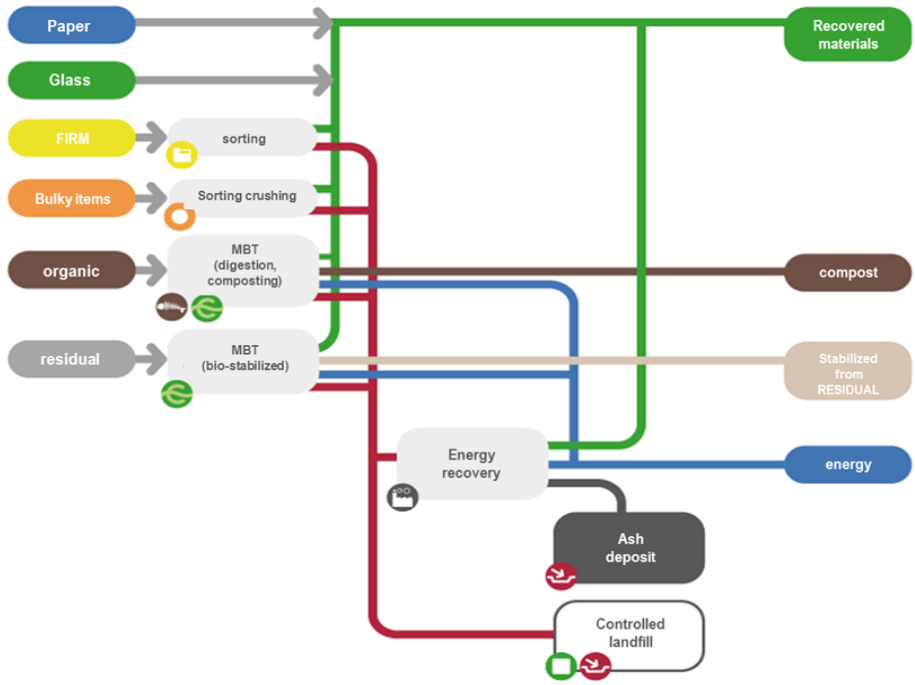

Figure 2 Type of treatment flow chart for the main fractions (including biowaste). Source: AMB

The selected biowaste chain is the organic fraction of Municipal Solid Waste (MSW), which is also the most significant biowaste stream in terms of quantities. The BaU scenario includes the following steps: (i) current voluntary biowaste separate collection in open street containers, (ii) transport and (iii) treatment of separately collected biowaste, consisting in an anaerobic digestion with production of biogas and post composting, in a local facility (ECOPARC 2).

The alternative scenario includes the following steps: (i) alternative biowaste separate collection (e.g., smart street containers and/or door-to-door collection) of MSW biowaste (whose amount is supposed slightly reduced, thanks to the introduction of prevention measures), (ii) transport and (iii) treatment to produce biomethane (by upgrading biogas from current anaerobic digestion) to be injected in the national grid or biosolvents.

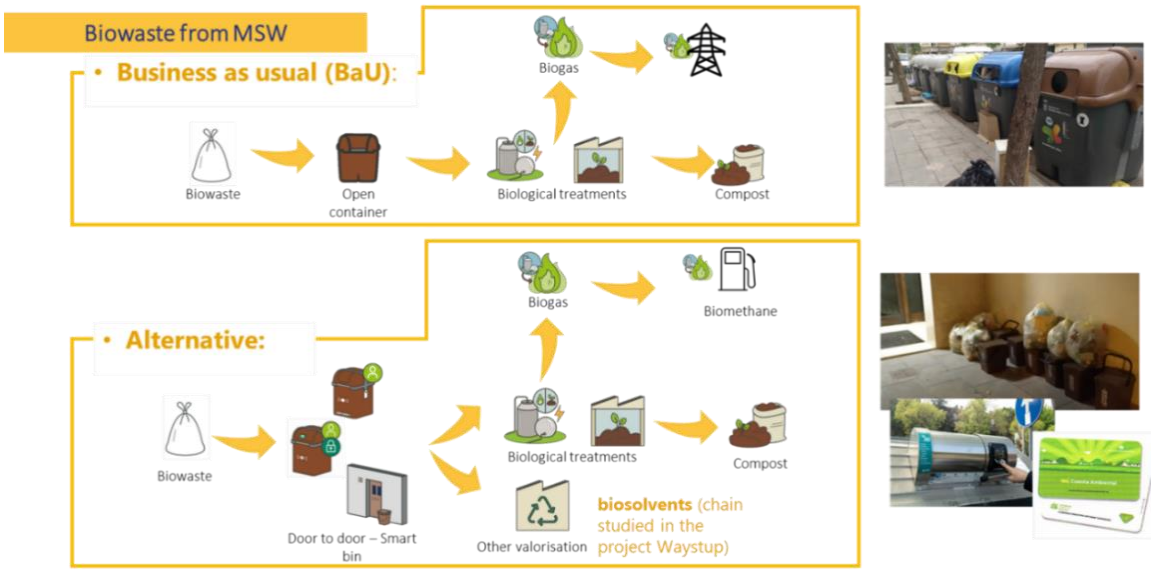

Figure 3 Biowaste chain selected in the MAB pilot

Province of Pazardzhik

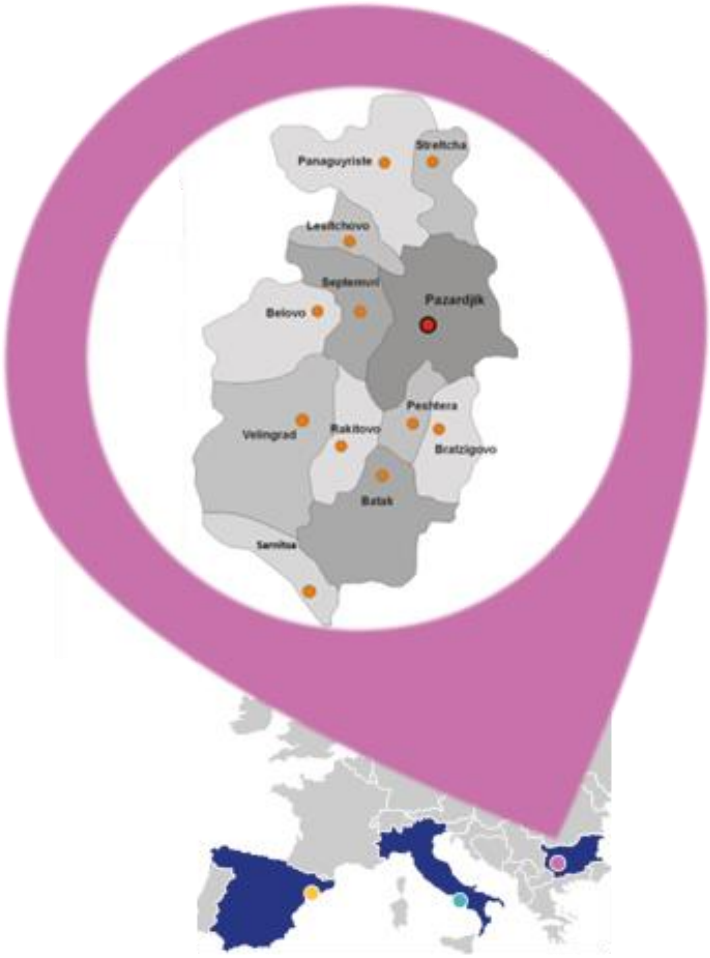

Figure 4 Map of the Province of Pazardzhik

Current situation: in 2019, the MSW amounted to 93 kt of which 85% was directly sent to the landfill, 12% was pre-treated for composting (4 kt) or for material recovery (7 kt), while the separate collection of municipal waste was only 3%. The Province of Pazardzhik represents a typical rural region 55% covered by forests. In 2017, the total wood residues amounted to 73,000 tonne/year, of which around 60% were used for energy purposes (pellet production), less than 5% was destined to composting and 35% remained in forests unused, causing frequent fires.

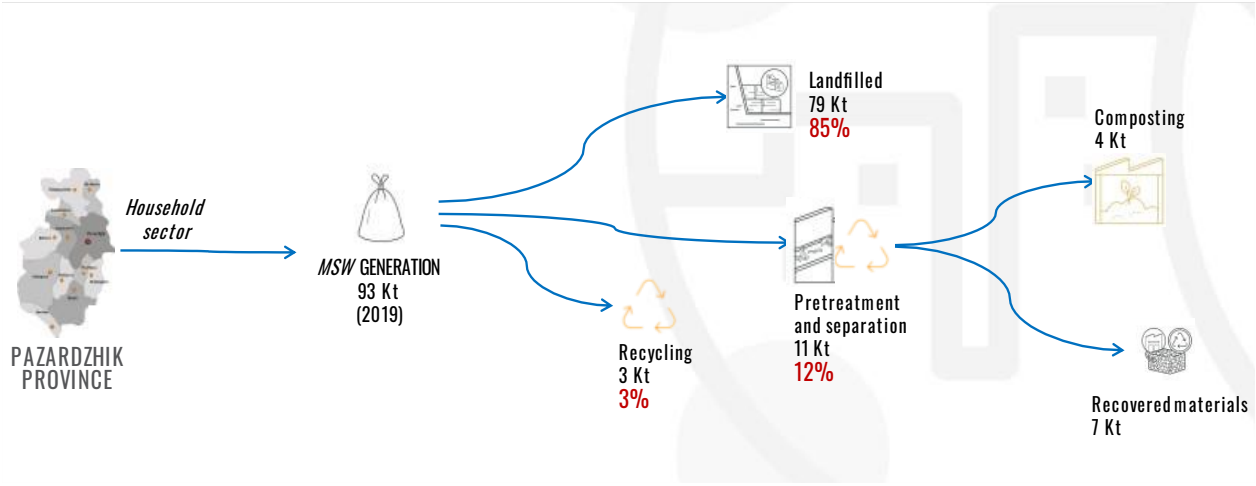

Figure 5 MSW management in the PP

The selected biowaste chain is one of the most challenging biowaste streams, the unrecovered forestry residues, which requires urgent changes in its management. The BaU scenario includes the following steps: (i) transport (if any) of the biowaste (both forestry residues and wood processing waste), and (ii) its disposal in the forests.

The alternative scenario includes the following steps: (i) collection and transport of biowaste (both forestry residues and wood processing waste), and (ii) energy valorisation (e.g. CHP plant) or/and lignocellulosic valorisation (e.g. production of biochemicals). It is important to underline that the lignocellulosic valorisation is the main option, but it will be also compared to the energy recovery option, in order to evaluate the environmental and economic performance of both alternative scenarios. The necessity for such a comparison was highlighted by the involved stakeholders during the first Living Lab.

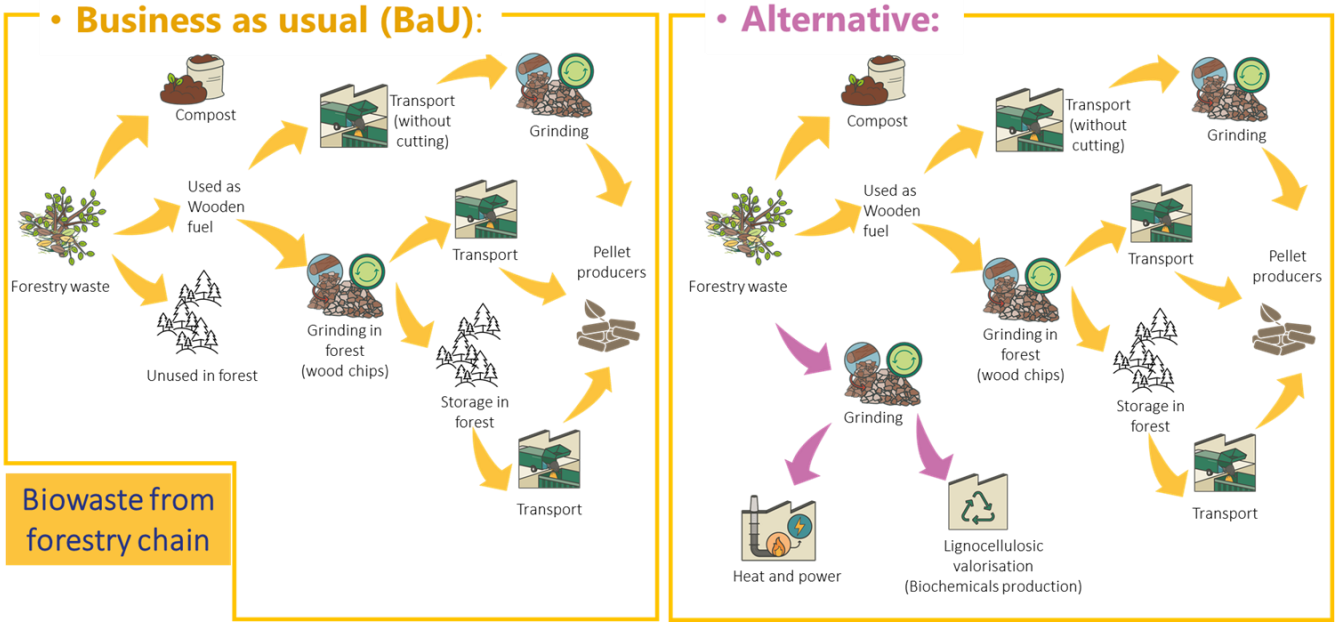

Figure 6 Biowaste chain selected in the PP pilot

Metropolitan City of Napoli

Figure 7 Metropolitan City of Napoli with its constituent 92 Municipalities

Current situation: in 2019, the average separate collection rate was 47% (representing 696,906 tonnes), while the residual waste represented 782,183 tonnes. The selectively collected biowaste was about 20% of the total municipal waste, amounting to 302,909 tonnes. Biowaste was first sent to storage platforms (8.5%) or directly delivered to anaerobic digestion (64.5%) or to composting (27%) plants. However, due to the insufficient local biowaste treatment capacity, more than 60% of the source separated biowaste was treated outside the region.

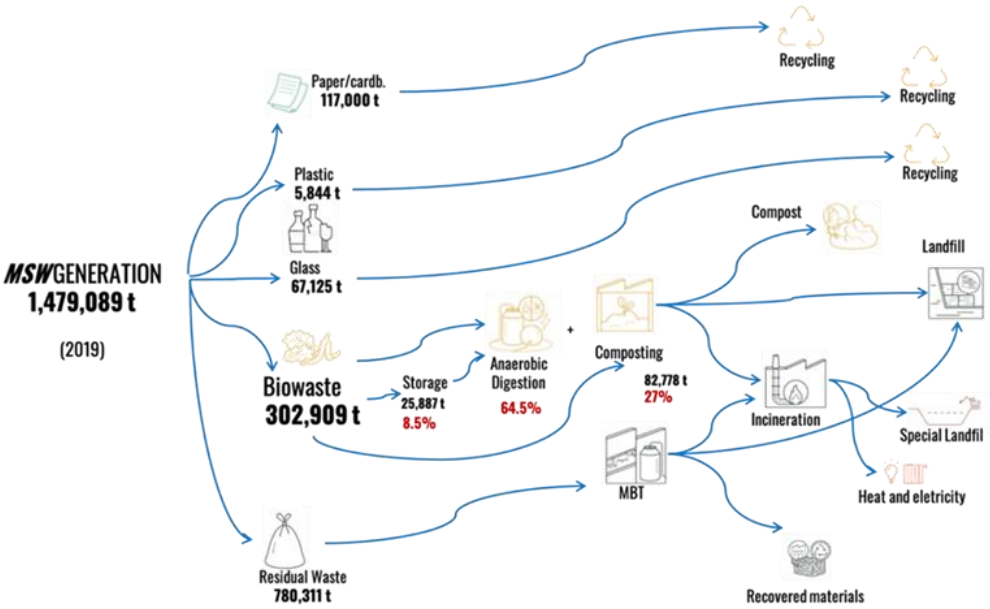

Figure 8 Schematic flow diagram of the current MSW management system in the MCN pilot

The selected biowaste chain is an unexplored stream from agro-industrial chain. In particular, biowaste from coffee chain was selected for further investigation, due to the novelty of the process and the possibility of using primary data from local industries. The BaU scenario includes the following steps: (i) collection and transport of the biowaste (coffee silver skins) from a coffee agro-industrial company in MCN, (ii) storage, (iii) transport from storage place to treatment facilities and (iv) current biological treatments.

The alternative scenario includes the following steps: (i) collection and transport of coffee silver skins from the investigated agro-industrial company to the new conversion facilities, (ii) conversion process to produce added value products (e.g. bio-chemicals, nutraceutical bioproducts etc.).

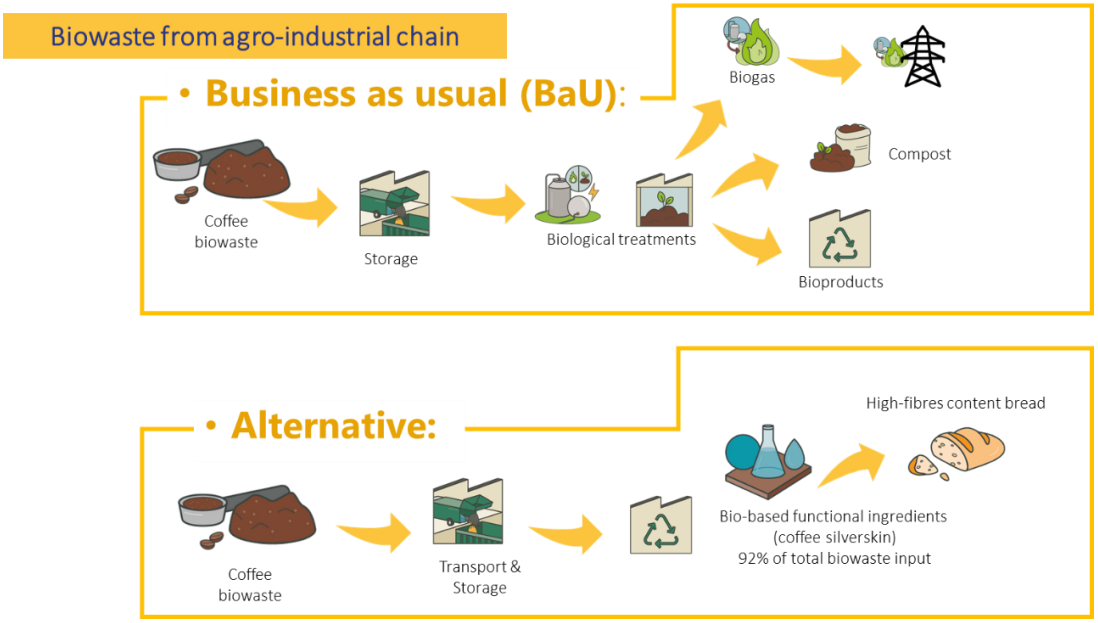

Figure 9 Biowaste chain selected in the MCN pilot

What's next?

Following this first analysis, the environmental and economic performances of the current (BaU) selected biowaste chains will be evaluated and compared to the performances of alternative solutions, according to the Life Cycle Thinking methodology. It will enable partners to identify the best option for biowaste management in the pilot chains according to the local context, and elaborate recommendations for biowaste prevention, valorisation and management optimization. The production of added value products such as biosolvents, biomethane, bionutrients biochemicals, bioenergy or other bioproducts, in a circular bioeconomy perspective, will be explored in these recommendations.

The investigation of the three identified biowaste chains and the stakeholder's engagement will foster the implementation of similar circular bioeconomy strategies in other EU territories.

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