Governance of circular bioeconomy transitions in the agri-food waste system: Perceptions and Strategies

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Abstract

Governance of circular bioeconomy transitions in the agri-food waste system: Perceptions and Strategies
The case of Reunion island

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1- Introduction

Circular economy (CE) is a concept that is gaining an increasingly important place in public policies at the European (e.g. The Europe Action Plan for the Circular Economy as part of the European Green Deal, 2020) and national levels (eg. In France Loi Garot, 2016). Even if the evidence remains vague (Giampietro and Funtowicz, 2020), the promise of reducing environmental impacts and contributing to economic development through circularity seems to appeal agri-food waste system stakeholders' attention (Leipold et al., 2021). Consequently, we observe collective and individual initiatives emerging at different scales (suppliers, farmers, local authorities, etc.). Faced with these major changes, we conducted a study to explore stakeholders' perceptions of the circular bioeconomy (CBE- circular economy applied to the agri-food waste system *via* biomass uses) and to characterize the strategies underlying CBE innovation initiatives.

2- Methods

To this end, a comprehensive approach combining the Multi-Level Perspective (MLP) framework (Geels, 2020) with territorial governance (Pachoud, 2022) analysis was used to address CBE ideal, material, and institutional dimensions. Both stakeholder perceptions of the CBE concept associated to the 9R principles in Kirchherr et al. (2017) framework and the limitations of its operationalization were analyzed. Together with the diversity of CBE innovation initiatives that have emerged and the role of public stakeholders in their promotion. A stakeholder mapping, 44 semi-structured interviews, and a participatory workshop gathering 30 agri-food waste system stakeholders were conducted.

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3- Results

Analysis of the ideal dimension revealed that the reference framework surrounding the concept of CBE remains ambiguous, particularly its implementation at territorial scale. All the stakeholders surveyed said that they had heard of the concept of circular economy or CBE, although they did not necessarily associate them with each other. Six of the 9R principles in Kirchherr et al. (2017) framework about the role of CBE were mentioned by the stakeholders. Rethink" was the most frequently mentioned. The principles of "Reuse," "Recycle," and "Recondition" were the least frequently mentioned. The analysis of the stakeholders' representations also revealed very few explicit mentions of the term biomass in their definitions.

Analysis of the material dimension revealed 40 innovation initiatives, grouped in three main strategies representing the main pathways of transition: (i) replacing imported materials by local or more renewable alternatives; (ii) increasing the consumption of local food; and (iii) enhancing circularity through the expansion of organic matter recycling. Strategy (i) focuses on innovation initiatives supported by both public and private stakeholders. Agricultural cooperatives are exploring alternatives to imported materials, such as establishing a 'fodder bank' to store locally produced fodder for dry-season use. Renewable wood pellets have replaced coal for electricity generation, and horticultural practices are shifting towards local compost as a substitute for imported peat. Innovation initiatives in strategy (ii) aims to change consumers' eating habits by promoting the consumption of local products. These initiatives, often led by public stakeholders, include awareness-raising actions such as school and community gardens, waste sorting, and tasting of traditional Creole vegetables. Territorial food projects, organized by local authorities, also encourage the use of local produce in school. Private stakeholders contribute by creating local outlets for direct meat sales, reducing intermediaries, transport, and packaging. Additionally, a label has been introduced to promote locally produced meat. Finally, strategy (iii) focuses on enhancing territorial circularity by valorizing local organic matter through anaerobic digestion and composting units. Key stakeholders, including livestock cooperatives and waste treatment sectors, drive innovations to manage livestock effluents, such as composting and separating pig slurry phases.

Analysis of the institutional dimension highlighted the role of public action in supporting the emergence of CBE innovation initiatives. The State, through the Regional Environmental, Planning, and Housing Agency (DREAL Reunion), coordinated the creation of a 'Roadmap for a Circular Economy,' with 50 measures to reduce resource consumption and waste by 2030. Regional and local authorities manage European and national funds, financing innovation initiatives and supporting research to build locally adapted knowledge. Local public stakeholders also promote consumer behavior change and create regulatory frameworks that encourage recycling and alternative solutions for managing livestock effluents. Starting in 2024, a new requirement for source separation of organic waste will further push stakeholders to adopt circular bioeconomy solutions

4- Discussion and Conclusion

Firstly, findings provide a perspective that contrasts with studies emphasizing the significant role of niches in innovation processes (e.g., (Geels, 2020)). In fact, in the agri-food waste system of Reunion Island, transitions through a CBE are primarily driven by stakeholders embedded in dominant sociotechnical regimes rather than niche innovations. These stakeholders leverage well-established networks and oligopolistic market structures on the island to rapidly secure and establish innovations (Hermet & Rochoux, 2014). Moreover, inter-professional plant and livestock organizations play a pivotal role by supporting innovation initiatives, mediating between public and private sector needs, and providing technical solutions and funding. Niche stakeholders outside these networks often face delays or abandon projects due to limited access to resources and support. These findings highlight the importance of networks in enabling innovation and align with transition geography studies that emphasize their role in stabilizing niche innovations.

Secondly, in the literature, initiatives of CBE have generally been identified at the sectoral level, but rarely or not at territorial scale (Kalmykova et al., 2018). The originality of the territorial approach allowed us to trace the pathways of transition through the CBE by integrating the specificities of Reunion Island. Then, as highlighted in the work of Allain et al. (2022), stakeholders recognize circular bioeconomy as a useful concept for rethinking the territory. However, the contours of its operationalization to collectively engage the transitions of agri-food waste systems remain unclear. Thus, the main challenge faced by transitions through CBE in agri-food waste systems is the co-construction of a territorial governance that will enable greater coherence among the various components of the regimes.

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