

Environmental impacts of innovative sustainable agri-food value chains: rights, duties and potentialities of Life Cycle Assessment

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CONTEXT & OBJECTIVE

Life Cycle Assessment (LCA) is often used to assess and claim sustainability of food innovations. By using LCA iteratively it can also serve as tool for eco-design. At the same time, lack of knowledge of the methodology by the stakeholders can lead to:

- Overestimate its abilities (e.g. to deal with an issue the method is not designed for)
- Underestimate its capacities (e.g. using it as a posteriori validation rather than including it during the development)

Using 3 case studies, we confronted the first results of the LCA to the initial thinking and expectations of the stakeholders. In regards with this confrontation, we expose:

- The next steps for the use of LCA in the following of the development of the innovations
- The eventual necessity to complement LCA with other methods, tools or indicators



CASE STUDIES OVERVIEW

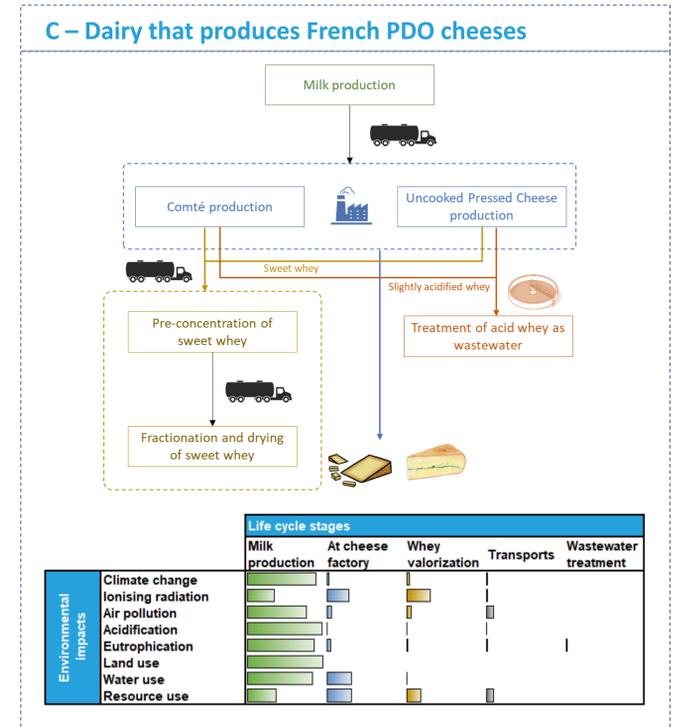
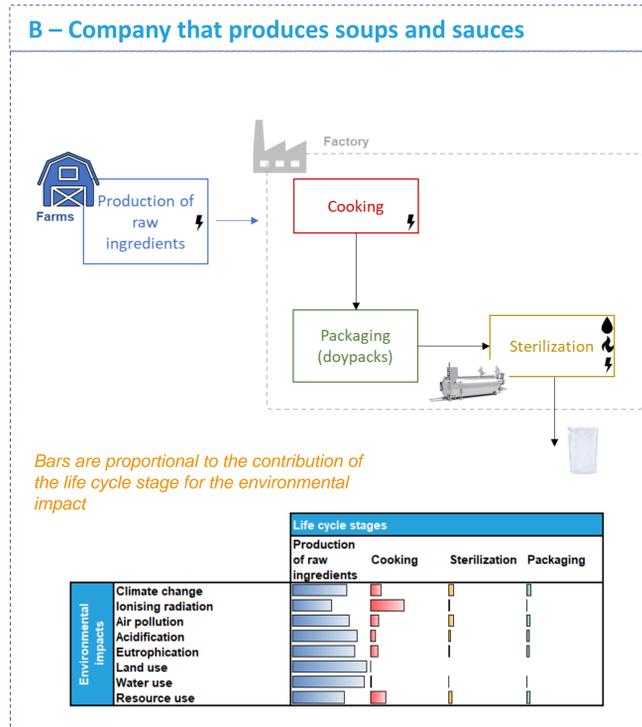
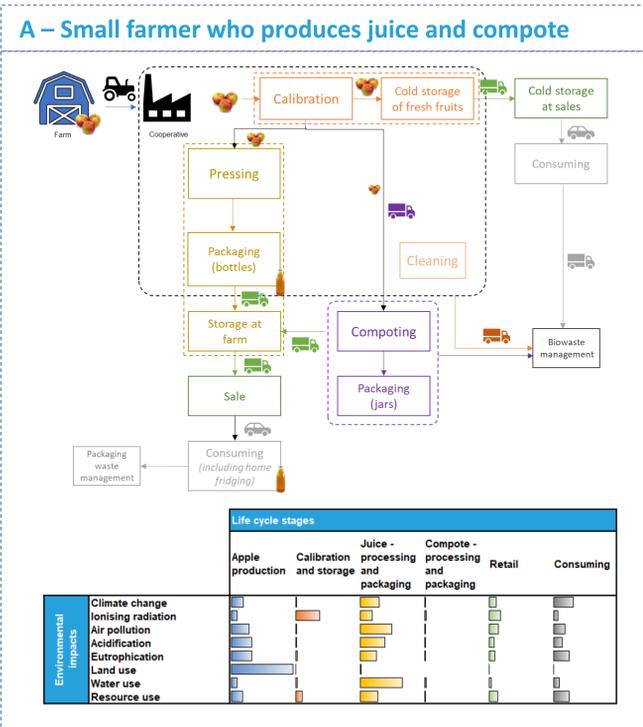


Innovation: design of a packaging machine for small and mid-size actors in the food sector
Technical objectives: packaging of liquids or mashed products adapted to small actors, meeting high hygienic standards
Environmental a priori: less energy and water consumptions than regular systems, and sustainable packaging material leading to less environmental impacts
Current situations: (A) Small-scale (small farmer who produces apple juice and compote) and (B) Large-scale (company that produces soups and sauces)



Innovation: a new fermented whey-based drink
Technical objectives: valorise whey wasted in small dairies to produce a new drink distributed with a zero-waste strategy
Environmental a priori: reduction of the environmental impacts by avoiding the treatment of whey
Current situation: (C) Dairy that produces French PDO cheeses (mainly Comté and Morbier)

LCA RESULTS FOR THE CURRENT VALUE CHAIN



ARE LCA RESULTS FOR THE CURRENT VALUE CHAINS CONFIRM THE A PRIORI ENVIRONMENTAL POTENTIALS?		
YES	NO	
Process and packaging highly contributes to environmental impacts, confirming the potential interest of the machine	Environmental impacts are mostly due to the production of raw ingredients and the initial expectations of the machine (less energy, water and new packaging) will not change that	LCA shows very low impacts related to wastewater treatment (of water and acid whey) then the valorisation of the acid whey is not a major lever to reduce the environmental impacts of the value chain
CAN THE INNOVATION HELP WITH THE IDENTIFIED ENVIRONMENTAL ISSUES?		
YES (MAYBE!)	NO (BUT!)	
Let's prove it by assessing the environmental impacts of future value chain (following different implementation scenarios)	To investigate: some ingredients can be added to bring back a function removed by the process (e.g. texture). By preserving ingredient properties, can the machine help to modify the recipes (especially remove the impacting ingredients)?	The innovation will not modify the environmental impacts of the value chain. But (1) this should be complemented by other methods as LCA struggles to reflect local issues (e.g., eutrophication) and (2) this could slightly evolve in time (if sweet whey is also valorised into drink)
HAS THE INNOVATION OTHER SUSTAINABILITY BENEFITS?		
YES (PROBABLY!)		
Different options are investigated making the innovation not only environmentally sustainable (e.g., machine shared between farmers, crowdfunding to equip the farmer, machine installed in a workshop for disable people)	The machine could be notably used to develop recipes based on locally produced ingredients benefiting to local producers and local economy. Also, working on recipes could bring to more nutritional products.	The drink will be developed locally, where the whey is produced, by a local producer and sold in local organic shops this providing social and economic value creation. LCA will help to eco-design the new value chain (process and retail)

CONCLUSION AND RECOMMENDATIONS

Innovators can have environmental a priori at the beginning of a project that their innovation will improve sustainability by reducing environmental impacts. Providing first LCA results can help to:

- (1) confirm the initial thinking then valid the potentiality of the innovation;
- (2) deny the initial thinking but reveal new opportunities;
- (3) deny the initial thinking (at least within the scope of the LCA).

Contradictions between initial expectations and first LCA results can come from a lack of knowledge of the methodology.

- To anticipate the contradictions, we recommend to involve LCA at the early stage of the innovation and work iteratively.
- When innovations aim to develop more sustainable value chains, we recommend to include the value chain in the perimeter of the LCA. If environmental impacts are a priority, this will verify that the innovation makes sense for the particular value chain. If other sustainability dimensions are targeted, this will control that the innovation does not compromise the environment.
- For the full picture, we recommend to use LCA results as a part of an overall sustainability assessment (including social and economy dimensions) making use of multicriteria analysis.