

Background

Driven by the concept of economic growth, humanity is actively pushing the limits of the planetary boundaries that could lead to abrupt and irreversible environmental changes. One prominent example is the prevailing "take-make-waste" approach whereby natural resources are extracted, products are manufactured, and then discarded, assuming the infinite availability of resources. A transition to a circular economy is proposed to depart from this unsustainable model. Despite increased attention towards CE for its benefits for sustainable development, practical implementation remains challenging.

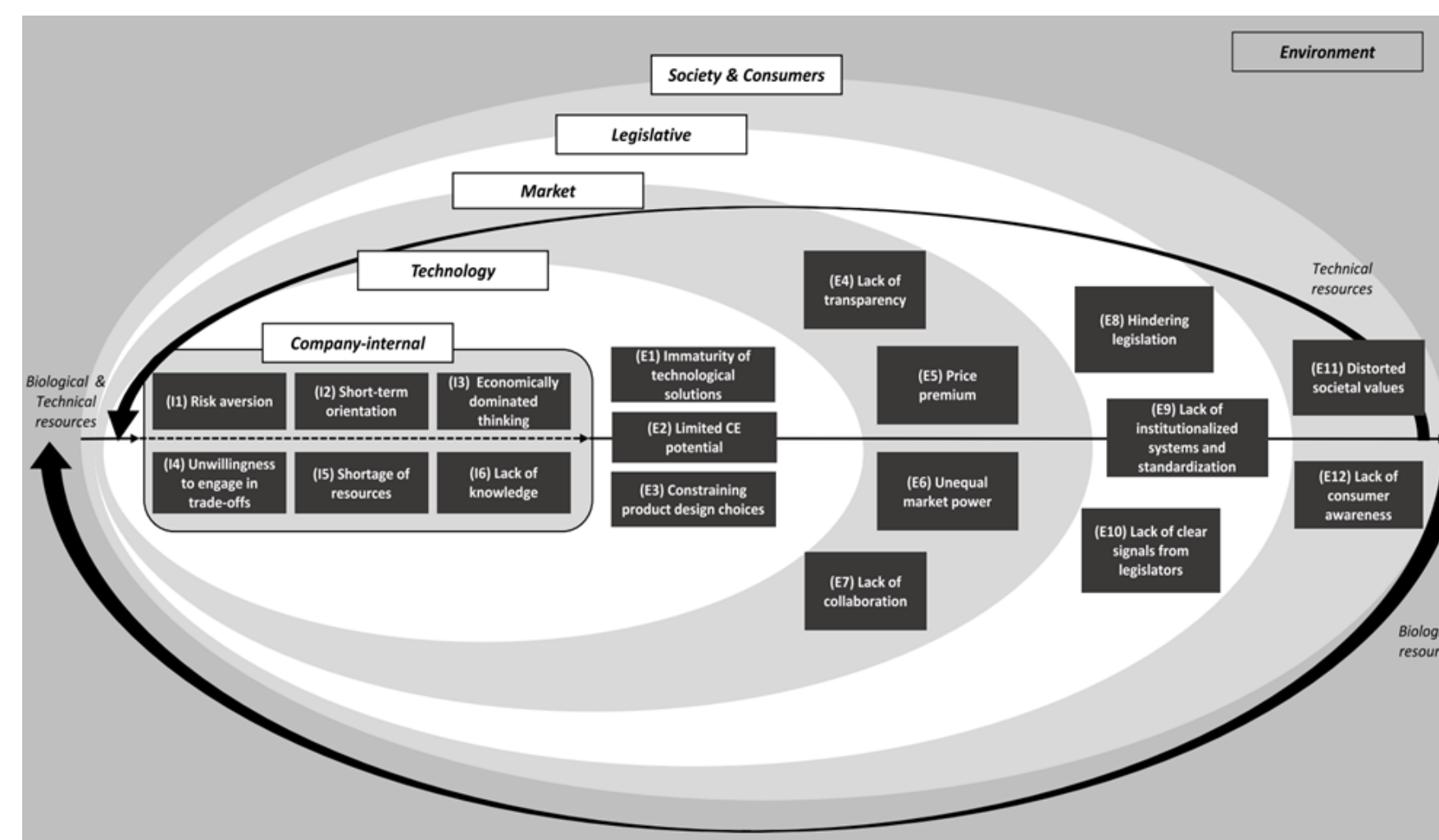
Recent literature has identified barriers to CE implementation, emphasising the need for sector-specific analysis. Hence, this study explores what barriers hinder the CE implementation craft beer industry in the Netherlands. The choice of this industry is justified by its rapid expansion since 2003, with over 900 microbreweries currently operating. Additionally, the production process of beer is water and energy-intensive, generating significant waste, both biological and technical. Moreover, as small- to medium-sized businesses, craft breweries face unique challenges compared to larger producers when adopting CE practices. While the impact of an individual craft brewery may seem small, the collective impact on the environment is noteworthy.

Objective

To investigate the barriers that hinder the implementation of a CE in the craft beer industry in the Netherlands and categorise them under the applied framework, guided by the research question: *What are the sector-specific barriers to adopting circular economy practices in the craft beer industry?*

Framework

This study adopts a framework for the barriers to a CE in the context of SMEs, which classifies the barriers into internal and external under the thematic levels – company-internal, technology, market, legislative and society and consumers (Takacs, 2022). The complete framework illustrates how organisations are embedded in the external environment and how the different levels of barriers to implementing CE are interconnected. Internal barriers influence each other and are also influenced by external barriers. While the external barriers are interwoven and impact one another



Methods

To answer this research question, a qualitative multiple-case study approach was chosen. Six semi-structured interviews were conducted, five with craft beer representatives and one water expert involved in institutional work within the craft beer industry. The interview questions were based on the applied framework. The interviews were recorded and transcribed, which allowed to undertake first a within-case analysis to identify themes specific to that case, followed by a cross-case analysis to find similarities and differences across the concepts and subthemes that emerged from the single cases.

Results

Barriers to implementing CE in the craft beer industry in line with the adopted framework

1. Company-internal Barriers

- *Risk aversion* - perceived risk associated with implementing circular solutions and lack of openness to changes.
- *Short-term orientation* - investment reservations due to significant investment with returns either too distant in the future
- *Economically dominated thinking* - implementing CE is pursued only when financial viability exists.
- *Unwillingness to engage in trade-offs* - hesitance to implement practices that can affect product taste.
- *Shortage of resources* - due to the small-scale nature of the businesses, there is a shortage of financial and human resources.
- *Lack of knowledge* - on whether a CE practice is sustainable and how to implement certain practices.

2. Technology Barriers

- *Technical immaturity* - technology does not exist for the scale of craft brewing, technology solutions are not convenient or practical for small-scale production and technology implementation is constrained by the built environment.
- *Limited circular potential for utilising by-products* - too low/high quantity of biological by-products, which decompose fast.
- *Constraining product requirement* - consistent taste makes the use of organic ingredients and residual streams challenging.

3. Market Barriers

- *Misleading information* - greenwashing claims from suppliers and competitors.
- *Price premium* - high-cost sustainable ingredients and technology, but low-cost externalising (ex. waste disposal)
- *Unequal market power* - big market players set product standards and drive price pressures.
- *Lack of up- and downstream collaboration* - limited offering of organic ingredients, supplies not designed for CE.

4. Legislative Barriers

- *Hindering legislation* - rainwater and spent grain are not classified as products, which makes their use challenging.
- *Lack of clear signals from legislators* - due to the prevalence of draughts in the country, more companies will need to communicate the water use and how to reduce it. However, this has yet to be communicated widely.

5. Society and Consumers Barriers

- *Distorted social values* - convenience and cheapness challenge CE.
- *Consumer behaviour* - preferences (consistent taste), perceptions (beer in cans is poor quality), willingness to pay and lack of awareness.

Drivers to implementing CE in the craft beer industry

- *Industry Collaboration* - openness to disseminate information and willingness to collaborate
- *Presence of institutionalised systems* - nationwide deposit system for the collection and reverse logistics of packaging (aluminium cans and glass bottles).

Discussion and Conclusion

The findings reveal that the barriers to implementing CE in the craft beer industry align with the applied framework, with the exception of the unexpected findings of drivers. Furthermore, sector-specific and context-specific differences are present on a conceptual level, such as "Consistent taste" as a constraining product requirement to implement the incorporation of residual streams in the brewing process. In addition, the applied framework proposes that the barriers influence one another, which is also observed within the craft beer industry.