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**Citation (APA)**

Tschavgora, E. (2025). Accelerating Circular Transitions in the Airport waste system: A Systemic Design Approach. In *Proceedings of the 16th International Sustainability Transitions (IST) Conference 2025, 24-26 June, 2025. Lisbon, Portugal*

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# Accelerating Circular Transitions in the Airport waste system: A Systemic Design Approach

Norwegian airports are working towards becoming circular by 2030, driven by regulatory requirements and internal sustainability goals (International Civil Aviation Organization, 2019). Achieving this transition involves accelerating structural changes to promote circularity within internal production and passenger consumption. To foster this transition, this research focuses on an empirical study of the waste management system of a Norwegian airport. The aim is to increase the waste separation rate while simultaneously reducing the residual waste sent to incineration.

Due to the variety of system actors an airport provides a unique opportunity to co-develop interventions accelerating sustainability goals. A systemic design (SD) approach, which combines systems thinking and design (Bijl-Brouwer & Malcolm, 2020), has been considered promising. Through this interdisciplinary approach, the roles, views and behaviours of different system actors in promoting circularity within the airport's waste system were analysed and translated into the development of a local waste-hub.

## Methodology

A mixed-method approach was followed over a two-year period in collaboration with key actors. An initial analysis of waste streams and their root causes was conducted, using the Baseline Circular Airports Method (BCAM)(Van Der Tuin-Rademaker et al., 2024). Activities included co-creation workshops, material flow mapping (Turner et al., 2018), and contextual observations to identify leverage points (Meadows, 1997), such as the waste generated by the operational activities of commercial units.

This study details the intervention developed during a six-month period targeting waste logistics of commercial units through co-creation techniques such as surveys, interviews, and workshops. The intervention developed local waste-hubs, employing a Pay-As-You-Throw (Dijkgraaf & Gradus, 2009) approach (Van der Helm., 2024). A one-month pilot tested the local waste-hub at the airport's international D-Gate with seven commercial units.

To evaluate the pilot, a comparative study was conducted between a baseline and a pilot phase. Baseline data was collected one week before the pilot, analyzing the separation rate and weight of a randomized waste bag sample (n=100). During the pilot phase, an additional 100 bags were sampled at the waste-hub. Supplementary data was gathered through employees and manager interviews (n=17), alongside tracking of waste disposal frequency, time stamps, and weight.

## Results/Discussion

Initial findings demonstrate the impact of the waste-hub:

- **Enhanced Recycling Rates:** Waste separation accuracy improved, reducing residual waste and contamination in recycling streams.
- **Structural Adjustments in Commercial Units:** Businesses adapted their waste procedures, with some changes persisting beyond the pilot.
- **Employee Awareness and Engagement:** Direct involvement increased accountability and encouraged sustainable behavior.

In addition to the case-specific insights, this study emphasizes the roles of business actors in accelerating sustainability transitions. It offers broader contributions to the discourse through insights on the impact of targeted interventions that drive structural and behavioral change. Furthermore, the study highlights behavioral, financial, and structural tensions within the airport context that challenge circular transitions, which offer transferable lessons to related contexts.

Finally, the research has generated broader insights regarding the application of SD through interdisciplinary and mixed-method approaches in interventions aimed at circular transitions. Actor-focused techniques within an SD setting have provided valuable insights into how different actors navigate socio-political, socio-cultural, and socio-economic challenges in the process of adopting circular strategies.

## References

- Bijl-Brouwer, M. van der, & Malcolm, B. (2020). Systemic Design Principles in Social Innovation: A Study of Expert Practices and Design Rationales. *She Ji: The Journal of Design, Economics, and Innovation*, 6(3), 386–407.  
<https://doi.org/10.1016/j.sheji.2020.06.001>
- Dijkgraaf, E., & Gradus, R. (2009). Environmental activism and dynamics of unit-based pricing systems. *Resource and Energy Economics*, 31(1), 13–23. <https://doi.org/10.1016/j.reseneeco.2008.10.003>
- International Civil Aviation Organization. (2019). Circular Economy. [Online] Available at: <https://www.icao.int/environmental-protection/Pages/CircularEconomy.aspx>
- Meadows, D. H. (1997). Leverage Points: Places to Intervene in a System. *Whole Earth*, 1.
- Turner, M. E., Airport Cooperative Research Program, Transportation Research Board, & National Academies of Sciences, Engineering, and Medicine. (2018). *Airport Waste Management and Recycling Practices* (p. 25254). Transportation Research Board.  
<https://doi.org/10.17226/25254>
- Van der Helm, T. (2024). Creating a sustainable and centralised internal waste logistics system for Oslo Airport.
- Van Der Tuin-Rademaker, A., Tschavгова, E., Van Maaren, C., Solis, S., Campisano, S., & Van Dam, S. (2024). Transforming waste management methods: A Dutch Airport's journey toward a circular economy through baseline measurements and strategic priority setting. *Frontiers in Sustainability*, 5, 1356041. <https://doi.org/10.3389/frsus.2024.1356041>