LOGICELL

A REVERSE LOGISTICS NETWORK DESIGN FOR DISCARDED FURNITURE IN THE NETHERLANDS

WHY

The Dutch government has the ambition to establish a circular economy in 2050. Emphasizing the need for circularity, the Transition Agenda for Consumer Goods outlines goals for 2050, requiring furniture to meet the highest standards of recyclability and disassembly. A report for the European Environment Bureau estimated that 10 million tonnes of furniture is disposed of in the EU annually. Therefore, environmental impact of furniture production and transportation should be addressed through increased reuse. To encourage reuse, a reverse logistics network for discarded furniture in the Netherlands should be established.

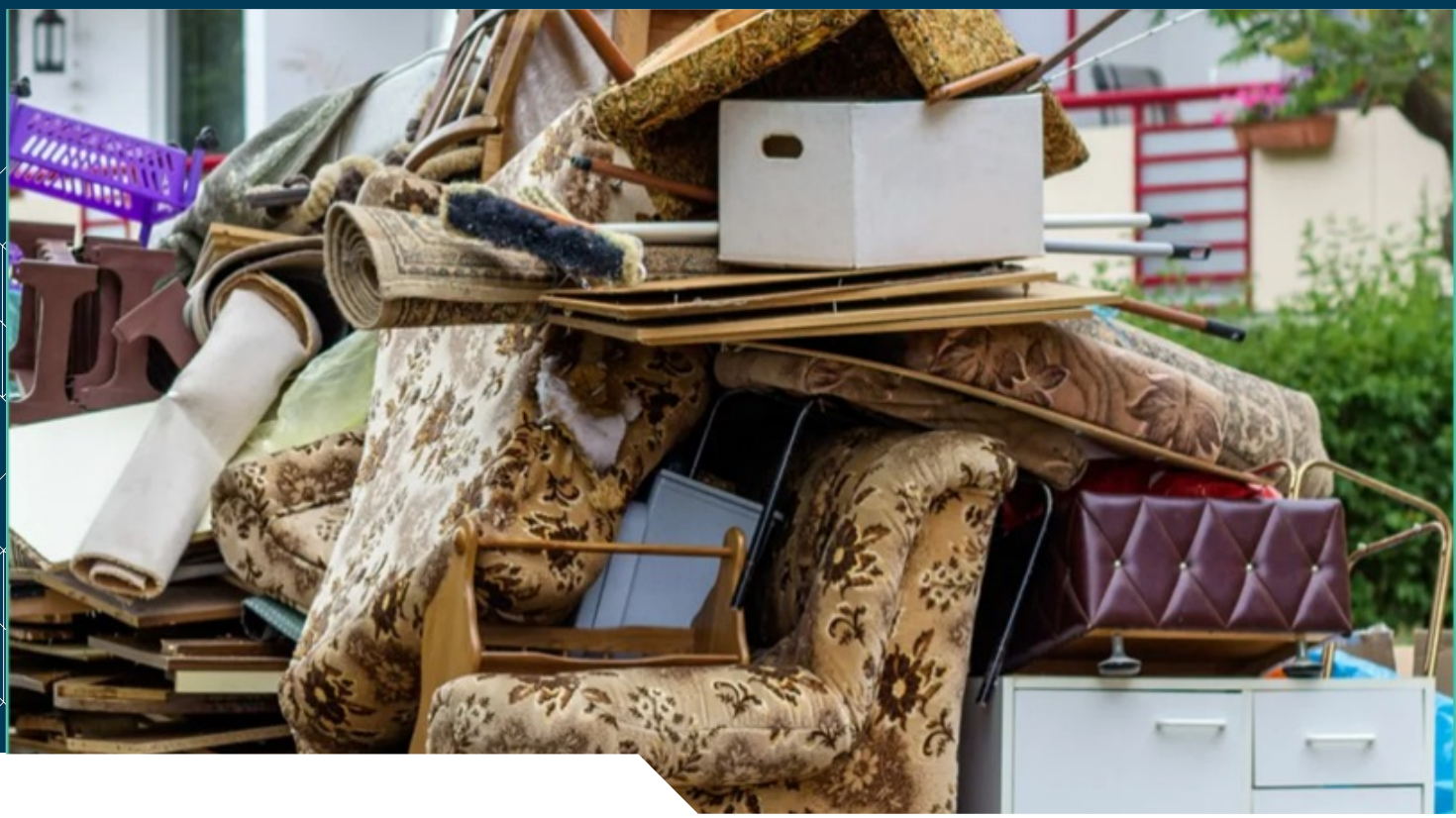
No current reverse network for discarded furniture exists and the implementation can be challenging since furniture is characterised by variations in size, weight, materials and quality. Furniture experiences a decline in lifespan which is influenced by material quality and consumer taste. Data on discarded furniture is scarce and literature on the reverse logistics of furniture is limited. Existing studies primarily focus on general industries, e-waste, and manufacturing.

WHAT

The aim of this study is to introduce and assess network design for the reverse logistic system for the reuse of discarded furniture in the Netherlands. Both costs and emissions are considered and optimised using a mathematical programming model. A nationwide system involves the repair and reselling of furniture to new consumers to encourage reuse. The high variety of (second-hand) furniture (size, weight, form, material and quality) makes the implementation of such a network costly.

This research addresses the scarcity of research on reverse network design specifically for furniture, providing insight into opportunities and bottlenecks for the implementation of such a system. In addition, the current volume and flow of discarded furniture is estimated.

This study aims to support ongoing discussions about the potential of reuse in the furniture sector, also aiming to identify scenarios for the furniture sector to reach the 50% emission reduction targets set by European law (see also reusealliance.nl).



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HOW

The research focuses on assessing potential network designs for reverse logistics of discarded furniture. An optimization model is used to optimise the network in Figure 1. Discarded furniture is collected at the collection centre where it is inspected and transported elsewhere. Furniture that has reached the end of its life cycle is typically incinerated at a waste incineration plant. If repair is necessary, the furniture is transported to a local repair after which it is transported to the storage centre. If the item of furniture at the collection centre is determined to be in excellent condition, the furniture can directly be transported to a storage centre. Ultimately, furniture is transported from the storage centre to the retailer.

Decisions to be made are the locations and size of the storage centres (central, decentral, or mixed system) and network flow of the furniture. The model is solved and optimised for two objectives: (1) cost minimisation and (2) carbon emission minimisation. A trade-off between the two objectives is found through the ε-constraint method. Five scenarios with different rates of direct reuse, repair and incineration are considered.

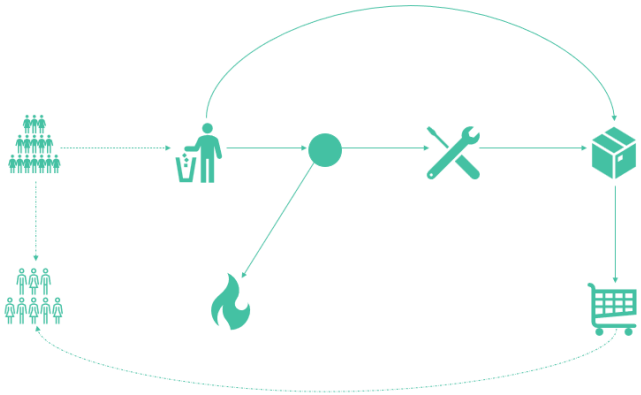

Figure 1: Reverse network design for discarded furniture

RESULT

This study presents a reverse network design for the reuse and repair of discarded furniture in the Netherlands. The developed mathematical modelling approach is used to assess several logistics systems (central, decentral and mixed) and reuse scenarios with different rates of direct reuse, repair and incineration. The model's findings show that incineration of furniture proves to be more cost-effective than repair. However, a shift from incineration towards direct reuse can reduce costs. Furthermore, the promotion of furniture reuse will be crucial in achieving the environmental impact reduction targets set by the sector.

The study highlights repair costs as the primary expense in the context of furniture reuse. While initially transportation costs were emphasised as the major bottleneck, the findings demonstrate that their contribution to overall costs is relatively small. Therefore, a disparity between perceived challenges and actual cost drivers is identified, which calls for policy intervention to reallocate the responsibility of costs from discarded furniture. Furthermore, policy measures should prioritise the promotion of direct reuse and strategies to limit repair costs.

Project Details

This infosheet summarizes the MSc thesis project of Marilène van Reenen, as part of the Management, Economics and Consumer Studies programme at Wageningen University.

LogiCELL

This project is part of the LogiCELL project, a collaboration between Wageningen University, the Amsterdam University of Applied Sciences, Het Groene Brein, AMS – Amsterdam Institute for Advanced Metropolitan solutions, and a range of other partners.
The project focuses on the role of logistics in the circular economy. The project works on (1) the design of networks behind circular supply chains, and (2) the efficient and effective planning and control of the underlying material flows.

More information?

More information on the LogiCELL project can be found at https://www.dinalog.nl/project/logicell/.

Have a challenge related to logistics in the circular economy that would be relevant for the project? Follow the QR code and let us know!

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