Identifying drivers of laundry practices and their role in microfibre emissions: A systems science approach

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INTRODUCTION

- Textiles released an estimated 290 tonnes of microfibres in the Netherlands in 2022, with laundering of clothes as a major pathway to surface waters.
- Household microfibre release is shaped by psychological, behavioural and demographic drivers.
- Existing studies often examine individual cause-and-effect relationships under controlled laboratory conditions, with limited attention to real-world household practices.
- A systems-level model is needed to connect demographics, purchasing, laundry behaviour, wash conditions, and eventual microfibre release.

OBJECTIVE

- Develop a qualitative causal loop diagram of the interacting demographic, psychological and behavioural drivers of household microfibre release.
- Examine empirical associations in citizen science data to support, challenge or validate links identified in the qualitatively identified causal relationships.

METHODS

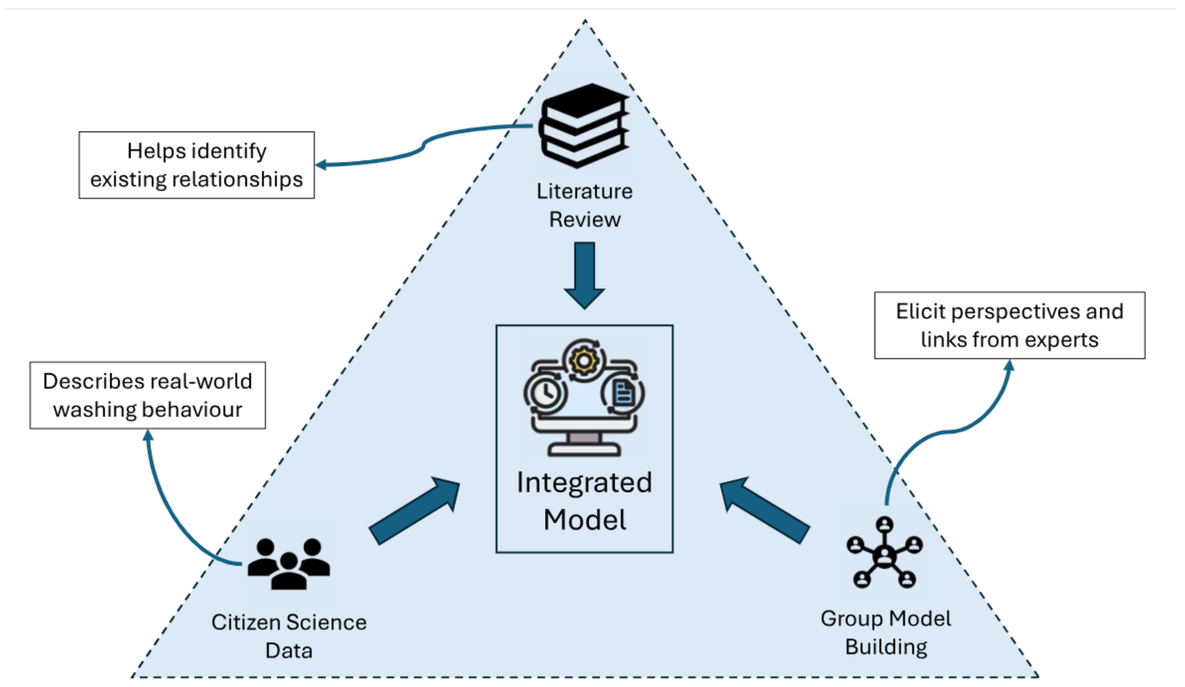


Figure 1. A Triangulation approach is used to identify key drivers for developing an integrated causal model *(adapted from Uleman et al., 2024).*

WHAT IS GROUP MODEL BUILDING?

- Group Model Building (GMB) is a participatory method in which participants jointly map key linkages, causal mechanisms, and feedback loops.
- In this study, seven participants were provided literature-informed variable cards to identify, refine, and add relationships between household demographics, laundry behaviour, wash conditions, and microfibre-release outcomes.

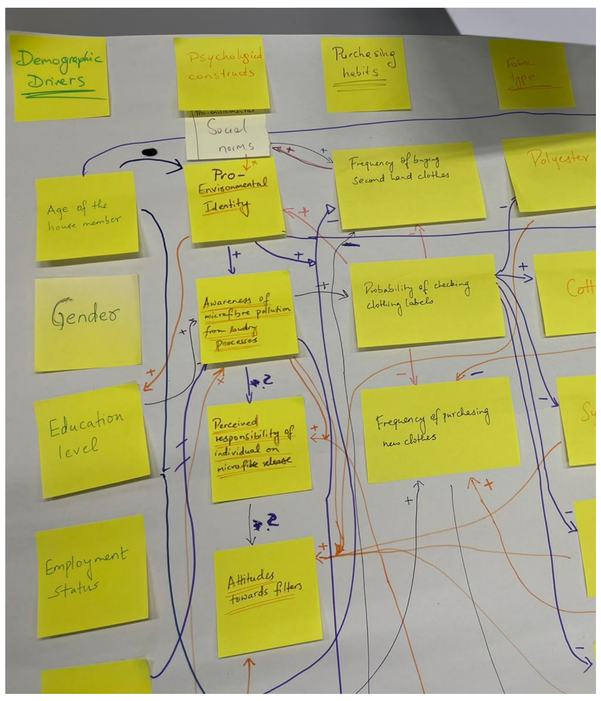


Figure 2. Linkages being made during the Group Model Building session using sticky notes and flipcharts, before exporting it into the Kumu software.

PRELIMINARY RESULTS

Drivers of microfibre release identified during the group model building session

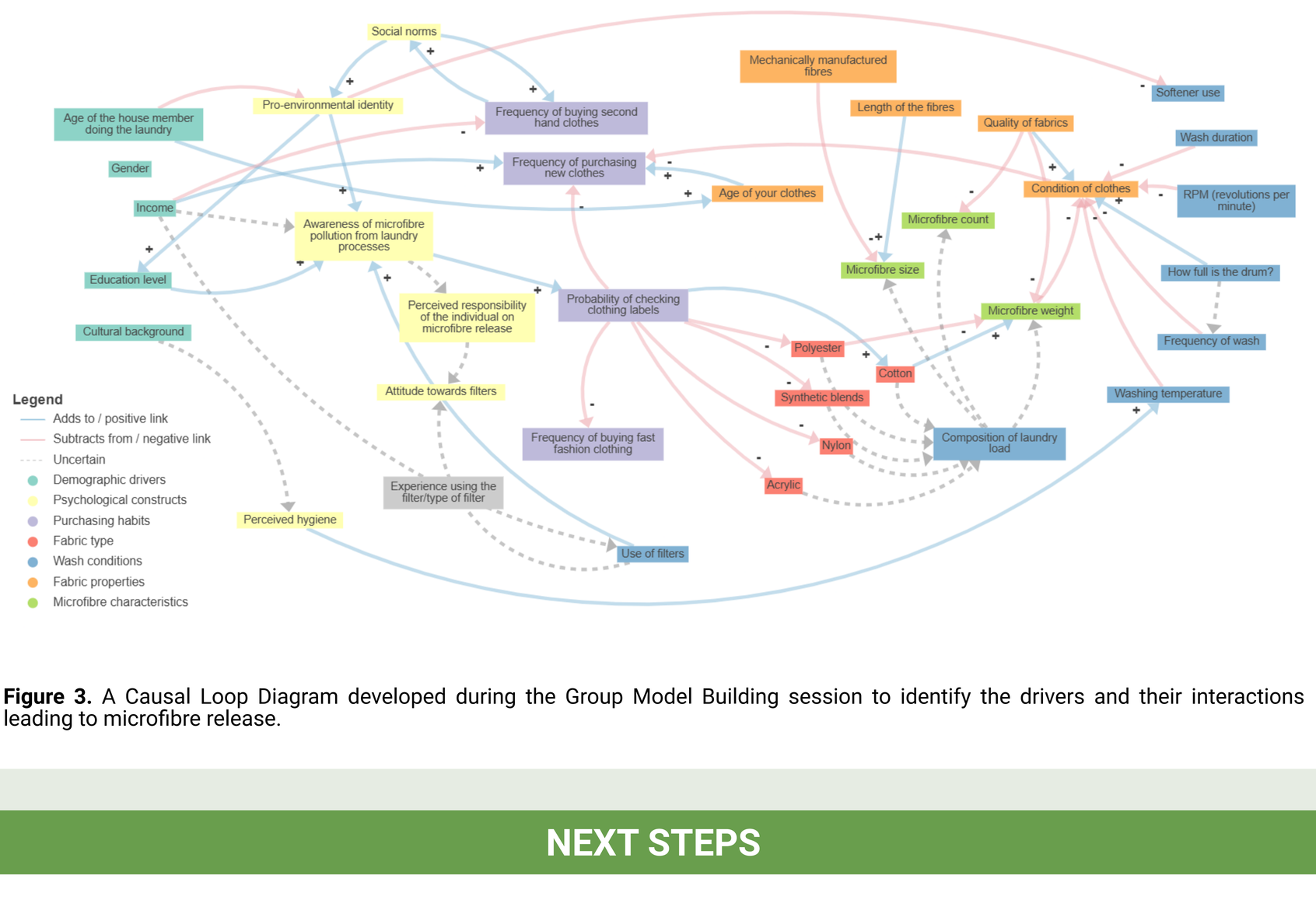


Figure 3. A Causal Loop Diagram developed during the Group Model Building session to identify the drivers and their interactions leading to microfibre release.

NEXT STEPS

- Triangulate proposed linkages across the literature review, Group Model Building, and citizen-science analyses.
- Identify convergent and priority drivers of household laundry-related microfibre release.
- Translate the qualitative systems map into a quantitative emission model to estimate microfibre release under different household practices and scenarios.

REFERENCES

1. Uleman, J. F., Luijten, M., Abdo, W. F., Vyrastekova, J., Gerhardus, A., Runge, J., Rod, N. H., & Verhagen, M. (2024). Triangulation for causal loop diagrams: Constructing biopsychosocial models using group model building, literature review, and causal discovery. *Npj Complexity*, *1*(1), 19. https://doi.org/10.1038/s44260-024-00017-9
2. Crielaard, L., Uleman, J. F., Châtel, B. D. L., Epskamp, S., Sloot, P. M. A., & Quax, R. (2024). Refining the causal loop diagram: A tutorial for maximizing the contribution of domain expertise in computational system dynamics modeling. *Psychological Methods*, *29*(1), 169–201. https://doi.org/10.1037/met0000484
3. Quik, J. T. K., Hids, A. R., Mellink, Y. A. M., & van Bruggen, A. R. (2026). *Possibilities for reducing microplastics emissions from textiles. A dynamic probabilistic material flow analysis study on clothing and footwear aimed at the Netherlands*. RIVM. https://dx.doi.org/10.21945/RIVM-2025-0152

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