Optionality and systems thinking in SSbD with prospective LCA

Thomas Arblaster, Leiden University

86th LCA Discussion Forum, 25 April 2024

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement n° 101138475.
UK participants in SSbD4CheM project are supported by UKRI. CH participants in SSbD4CheM project receive funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

SSbD4CheM aim

Integrate science-based approaches and innovative technologies into a comprehensive toolbox & data management ecosystem to proactively identify and address hazards and risks, fostering the design of safer, sustainable products and processes across sectors and value chains.

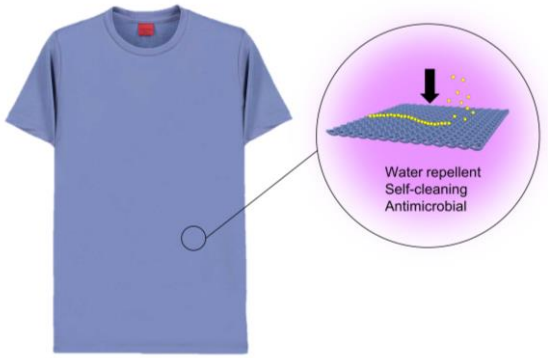
- This includes:
  - Alternative methods for safety assessment
  - Validating in-vitro tools for a variety of substances and materials
  - Assessing safety and sustainability across the product life cycle
  - International collaboration and stakeholder engagement

Funded by the European Union

UK Research and Innovation

Project funded by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

SSbD4CheM demonstrators



Apparel textiles

- **Material:** Coating PLA & PET using atmospheric plasma polymerization.
- **Investigating:** Material & energy use, by-products, and VOC emissions.

Automotive interiors

- **Material:** Thermoplastic matrix with cellulosic fillers.
- **Investigating:** VOC emissions and their impact on humans & environment.

Cosmetics

- **Material:** Nano-cellulose additive.
- **Investigating:** Impact on environment, skin, and inhalation.

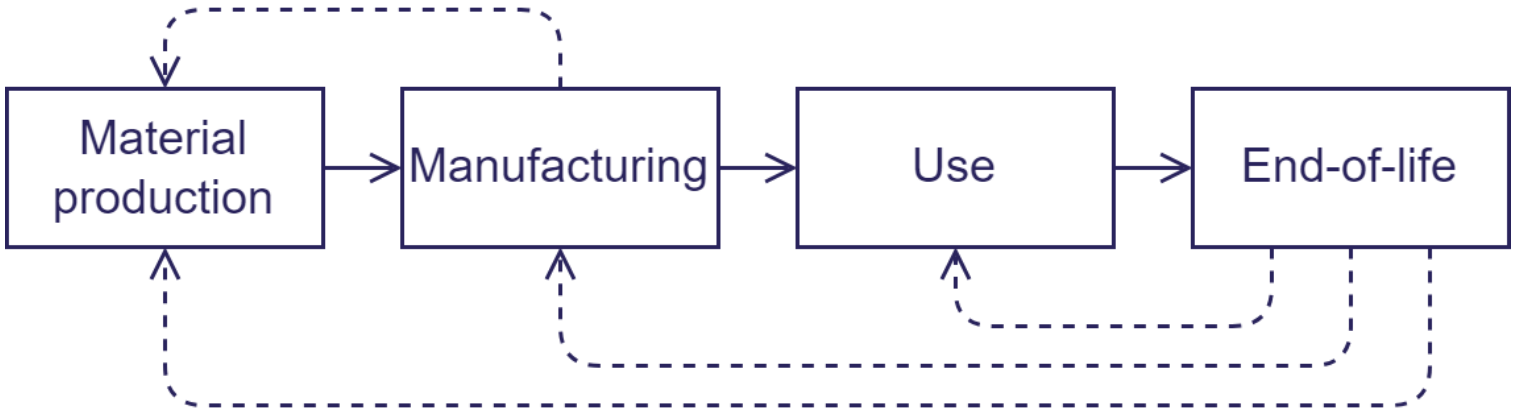
Bio-based materials & **reduced input** of (non-renewable) materials

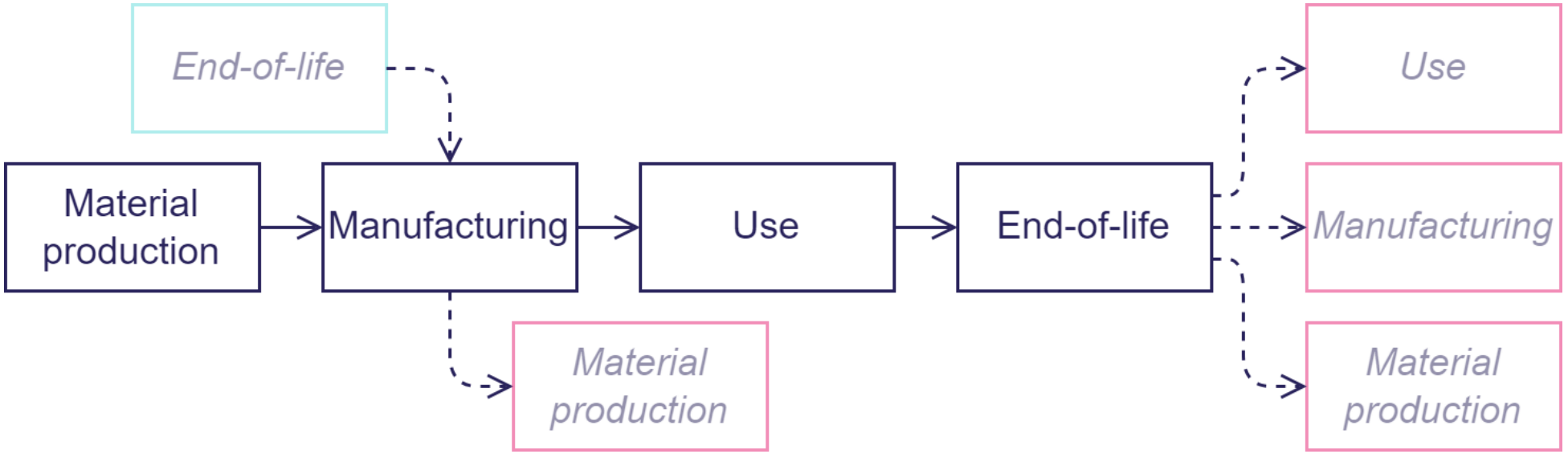
Funded by the European Union

UK Research and Innovation

Project funded by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Circularity





- Temporal delays
- Diverse value chains
- Unknown context:
  - Functions
  - Value
  - Demand
  - …
- Fitness of LCA?

Funded by the European Union

UK Research and Innovation

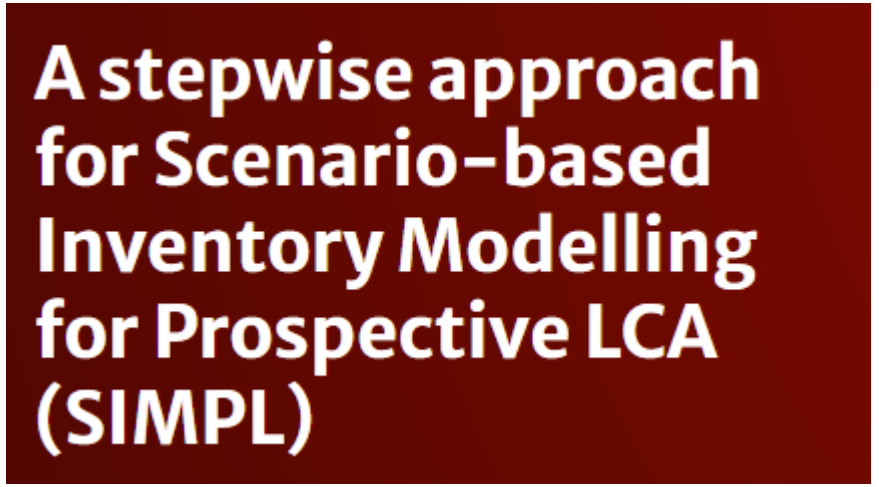
Project funded by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Systems thinking

- Beyond cradle-to-gate
- Beyond cradle-to-grave

Possible futures

- Learning, scaling, transforming
- Policy, regulation, markets
- Shifting and emerging environmental impacts



Langkau, S., Steubing, B., Mutel, C. et al. (2023)

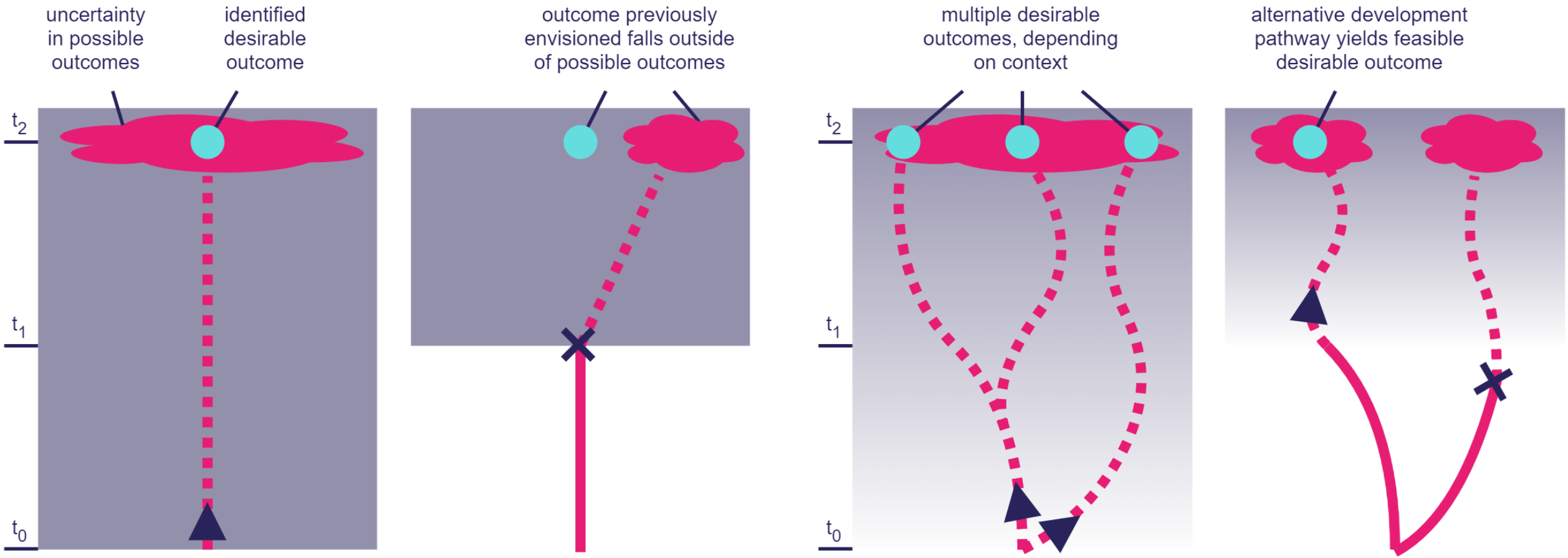
https://doi.org/10.1007/s11367-023-02175-9

Funded by the European Union

UK Research and Innovation

Project funded by

Optionality



See also:

- Teodoro, J.D., Doorn, N., Kwakkel, J. *et al.* (2022) Flexibility for intergenerational justice in climate resilience decision-making: an application on sea-level rise in the Netherlands. https://doi.org/10.1007/s11625-022-01233-9
- Wright, G., & Goodwin, P. (2009). Decision making and planning under low levels of predictability: Enhancing the scenario method. https://doi.org/10.1016/j.ijforecast.2009.05.019

Funded by the European Union
UK Research and Innovation
Project funded by

Conclusion

- To enable SSbD, prospective LCA can empower designers grappling with uncertainty:
  - Gain insight into the broader system
  - Imagine the system in diverse futures
  - Create optionality

Funded by the European Union

UK Research and Innovation

Project funded by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Project partners

THANK YOU FOR YOUR ATTENTION

Contact:

t.p.s.arblaster@cml.leidenuniv.nl

/in/arblaster/

Funding acknowledgements

Funded by the European Union

UK Research and Innovation

Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement n° 101138475.
UK participants in SSbD4CheM project are supported by UKRI . CH participants in SSbD4CheM project receive funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).