Sustainable Circularity

K. Berger [a], R. J. Baumgartner [a], M. Weinzerl [b], J. Bachler [b], J. P. Schöggl [a] (2021): Digital battery passports as supporting tool for sustainable battery life cycle management

[a] *Christian Doppler Laboratory for Sustainable Product Management enabling a Circular Economy, Institute of Systems Sciences, Innovation and Sustainability Research, University of Graz*
[b] *AVL List GmbH*

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Outline

- Introduction
- Methods
- Results
- Conclusion and further outlook

Introduction (I)

- Push of powertrain electrification is projected to lead to an increase in demand for respective traction batteries (e.g., Mayyas et al. 2019, Rafele et al. 2019)
- Due to such batteries containing in general critical raw materials (e.g., lithium, cobalt, natural graphite) the pursuit of sustainable product management efforts is of interest (e.g., Mayyas et al. 2019, Rafele et al. 2019)
- Such efforts can be in general supported by conducting sustainability assessments (e.g., environmental and social life cycle assessment) (cf. Ellingsen et al. 2017, Saidani et al. 2019)
- This said, lack of high-quality (real-time) data is one of the current challenges (e.g., Ellingsen et al. 2017, Saidani et al. 2019)

Introduction (II)

- Digital product passports = unique for each product and contains respective value chain and life cycle data (Lemos 2020)
- Digital battery passports may resume a supporting role of sustainable battery management (cf. Honic et al. 2019)
- Dynamic environmental and social life cycle assessment based on real-time data as one potential use case of such a tool (cf. Heinrich and Lang 2019)

RQ: *What kind of data should a digital battery passport's underlying information model contain to support life cycle assessments and decisions of electric vehicle traction batteries?*

Contribution

- A conceptual information model of a digital battery passport of an electric vehicle traction battery in the context of sustainable product management*
- A foundation of a comprehensive information model of a digital battery passport

*)*Sustainable product management = product management, which aims to minimize respective negative social and environmental impacts along a product's entire life cycle, whilst pursuing value chain loop-closing pathways to increase a product's circularity performance.*

Methods

- The concept was developed by
  - a stakeholder mapping according to the supply chain oriented process of identifying stakeholders (Fritz et al. 2018)
  - a systematic literature review according to PRISMA (Moher et al. 2009)
  - developing a preliminary conceptual digital battery passport (Berger et al. 2021) by compiling and grouping identified data points considered relevant by preceding steps
  - a concept validation carried out by industry experts via an online focus group workshop series (three workshops, total n = 22)
  - (on-going) follow-up interviews with industry experts

Results (I)

- Conceptual information model of a digital battery passport
- Consisting of 4 main information categories
- Comprising 6 information levels with respective sub-information categories

Results (II)

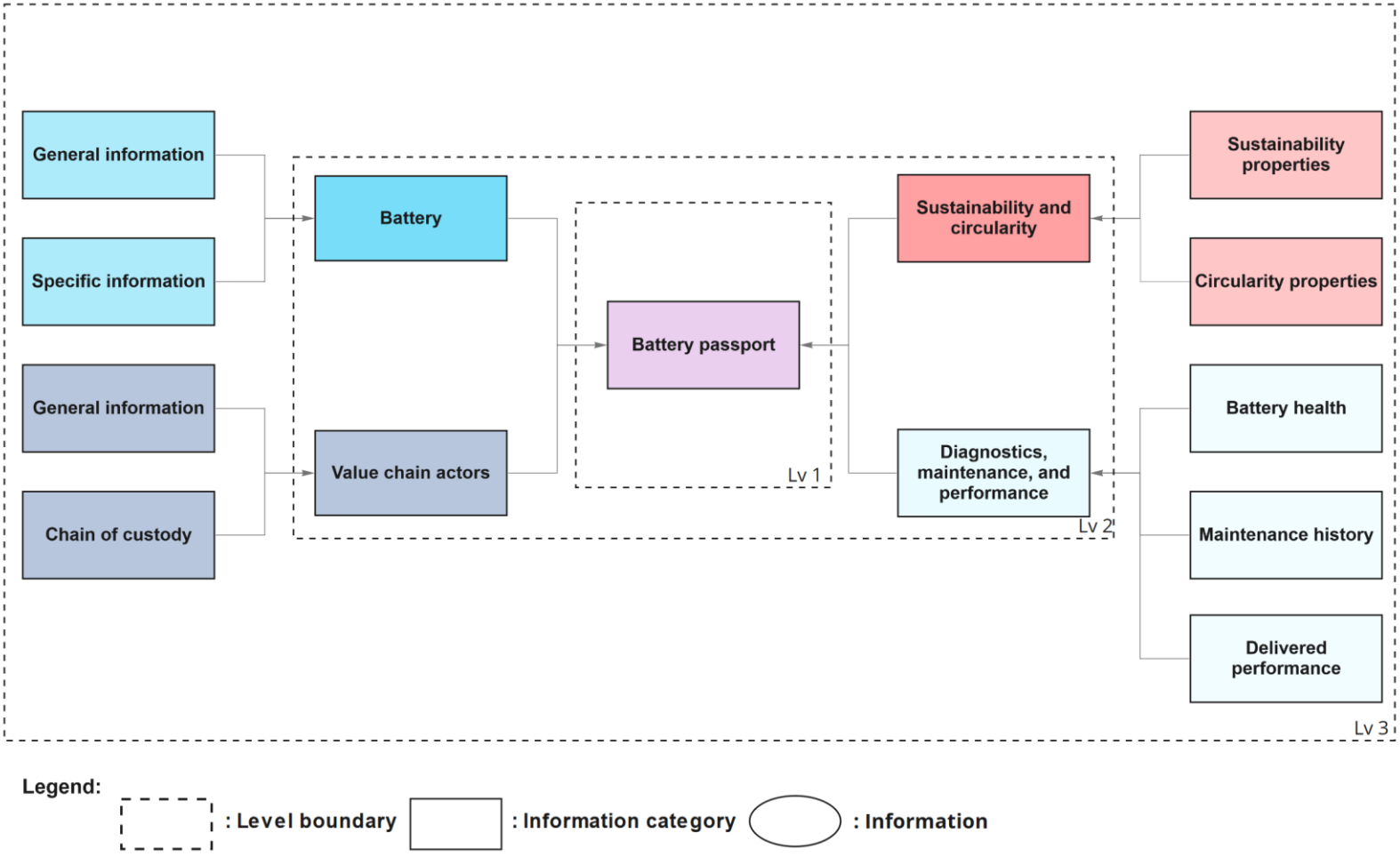

Figure 1: Preliminary conceptual information model of a digital battery passport (own depiction)

Conclusion and further outlook

- Digital battery passports have the potential to resume the role as valuable data source in the context of sustainable product management along the entire product life cycle
- To resume this role, appropriate data has to be provided by such a tool, thus an understanding is needed with respect to passport users, as well as their potential use cases
- Next research steps comprise further concept validation via on-going follow-up interviews
- The validation process will aim to identify, validate and understand
  - data needs and requirements
  - data availability and accessibility
  - use cases
  - implementation barriers for a digital battery passport

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Authors

Katharina Berger

PhD researcher
Christian Doppler Laboratory for Sustainable Product Management enabling a Circular Economy
Institute of Systems Sciences, Innovation and Sustainability Research

Rupert J. Baumgartner

Full Professor and Head of the Christian Doppler Laboratory
Christian Doppler Laboratory for Sustainable Product Management enabling a Circular Economy
Institute of Systems Sciences, Innovation and Sustainability Research

Martin Weinzerl

Project Manager Industry 4.0
AVL List GmbH

Authors

Johann Bachler

Coordinator Global R&D
AVL List GmbH

Josef-Peter Schöggl

Postdoc
Christian Doppler Laboratory for Sustainable Product Management enabling a Circular Economy
Institute of Systems Sciences, Innovation and Sustainability Research