TECHNISCHE UNIVERSITÄT DRESDEN

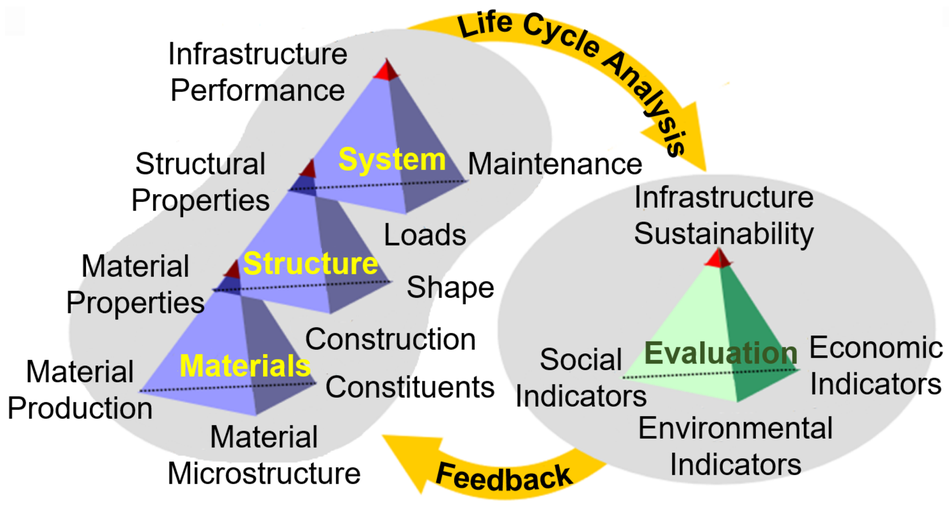
DFG GRK 2250 – Mineral-bonded composites for enhanced structural impact safety

Isabela DE PAULA SALGADO – Doctoral Project C2/II

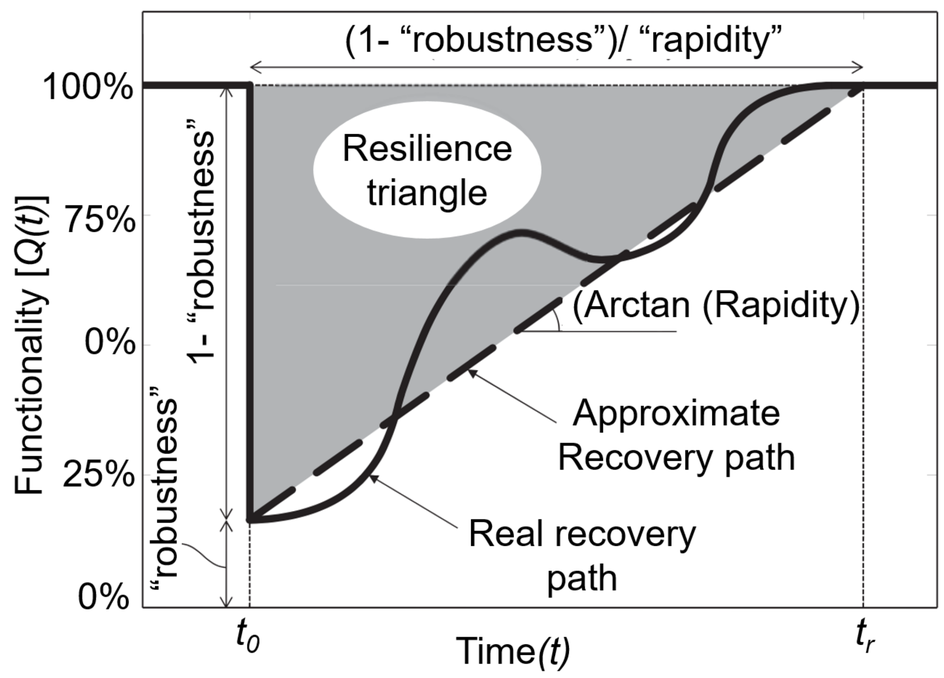
ANALYSIS AND EVALUATION OF THE SUSTAINABILITY AND RESILIENCE OF NOVEL MINERAL-BONDED COMPOSITES

1 STATE OF THE ART

- Identifying and quantifying environmental impacts through Life Cycle Assessment (LCA)
- Taking into consideration the multi-dimensionality of resilience and different methodologies (qualitative and quantitative) to operationalize it in engineering systems
- Addressing the complementary relationship and interdependencies between sustainability and resilience



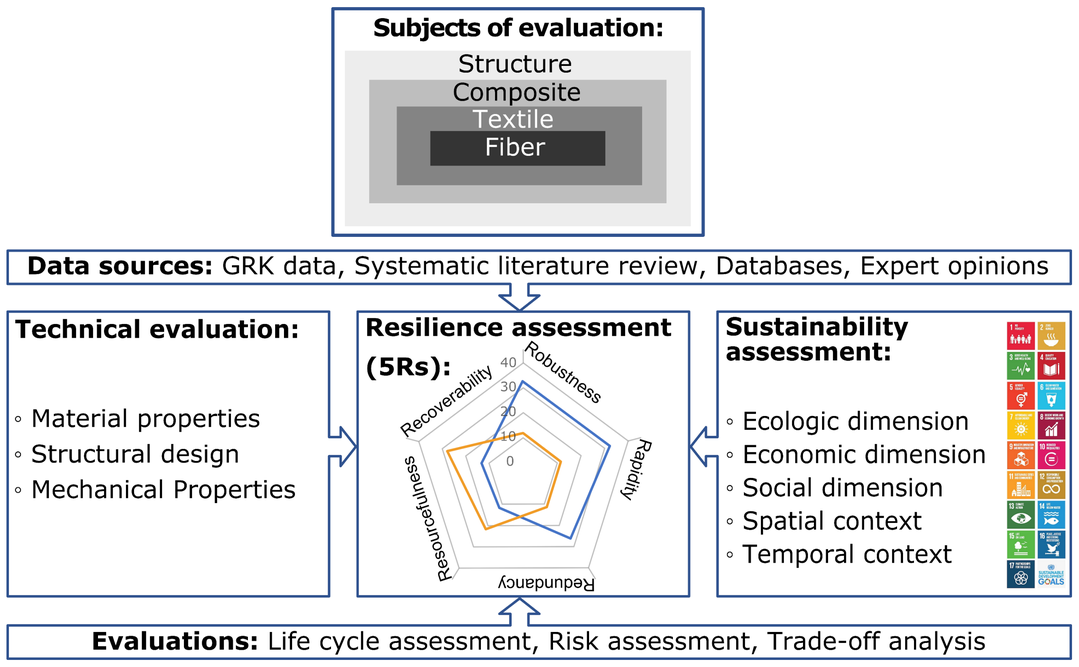
Integrated framework for materials' design
M. LEPECH. Durability of SHCC (2011)



Resilience triangle
P. BOCCHINI et al. Infrastructure Systems (2014)

2 OBJECTIVES

- Map the state of the art on resilience of engineering structures and its inherent correlation with sustainability
- Assess the environmental impacts and resilience of mineral-bonded composites under different scenarios
- Contribute to the development of a methodological approach by integrating economic and social data into a holistic evaluation
- Integrate colleagues into scientific work and apply life cycle thinking to the projects‘ progress
- Adopt the resource nexus approach (Water-Soil-Waste-Energy interdependencies) to resources' management



Research overview

3 CONCEPTS

- **Delphi survey:** ranking method-metric, open questions (e.g. on materials, performance, impact and handling issues). Basis for selection of common performance factors for all levels of observation
- **Systematic literature review**: qualitative and quantitative analysis of data with a methodological evaluation
- **Life cycle assessment**: iterative process with a data quality approach (e.g. pedigree matrix). Use of tools such as standards (e.g. ISO 14040), software (e.g. GaBi), journals and expert opinions. Mechanical safety, reliability, serviceability and durability are taken into consideration
- **Additional methods for sustainability assessment:** life cycle costing (LCC), social life cycle assessment (S-LCA). A trade-off analysis can be performed
- **Workshops and interviews:** relevant data, integration with the team and connection to the project's framework
- **Resilience assessment:** risk analysis, probability of disturbance (e.g. extreme events), rate of recovery

4 PLANNED COLLABORATIONS

- H. LE XUAN (A1/II): evaluation of the environmental impacts and economic feasibility of the textile structure in different scenarios
- M. POPA (A2/II): integration of data on the micro-level (e.g. type of fiber, sizing and mechanical behavior) for sustainability assessment
- M. BEIGH (A3/II): LCA of the new binder system with limestone calcined clay and comparison of performance results with projects A1/II (fly ash replacement) and A5/II (macro level)
- F. BRACKLOW (A5/II): macro-level case study for LCA and resilience evaluation