University of Stuttgart
Institute for Acoustics and Building Physics
Department for Life Cycle Engineering (GaBi)

Sustainability of innovative urban surfaces

A new approach of assessment

Overview

- Introduction
- State-of-the-art of sustainability assessment methods
- Methodological approach
- Conclusion and outlook

Introduction

Leistner *et al*. 2018:

- design of urban surfaces is important for, e.g., environmental quality in cities, resilience of cities to climate change
- urban surfaces have considerate building physical and sustainability related potential
- innovations are essential for realising this potential

→ Sustainability assessment of innovative urban surfaces

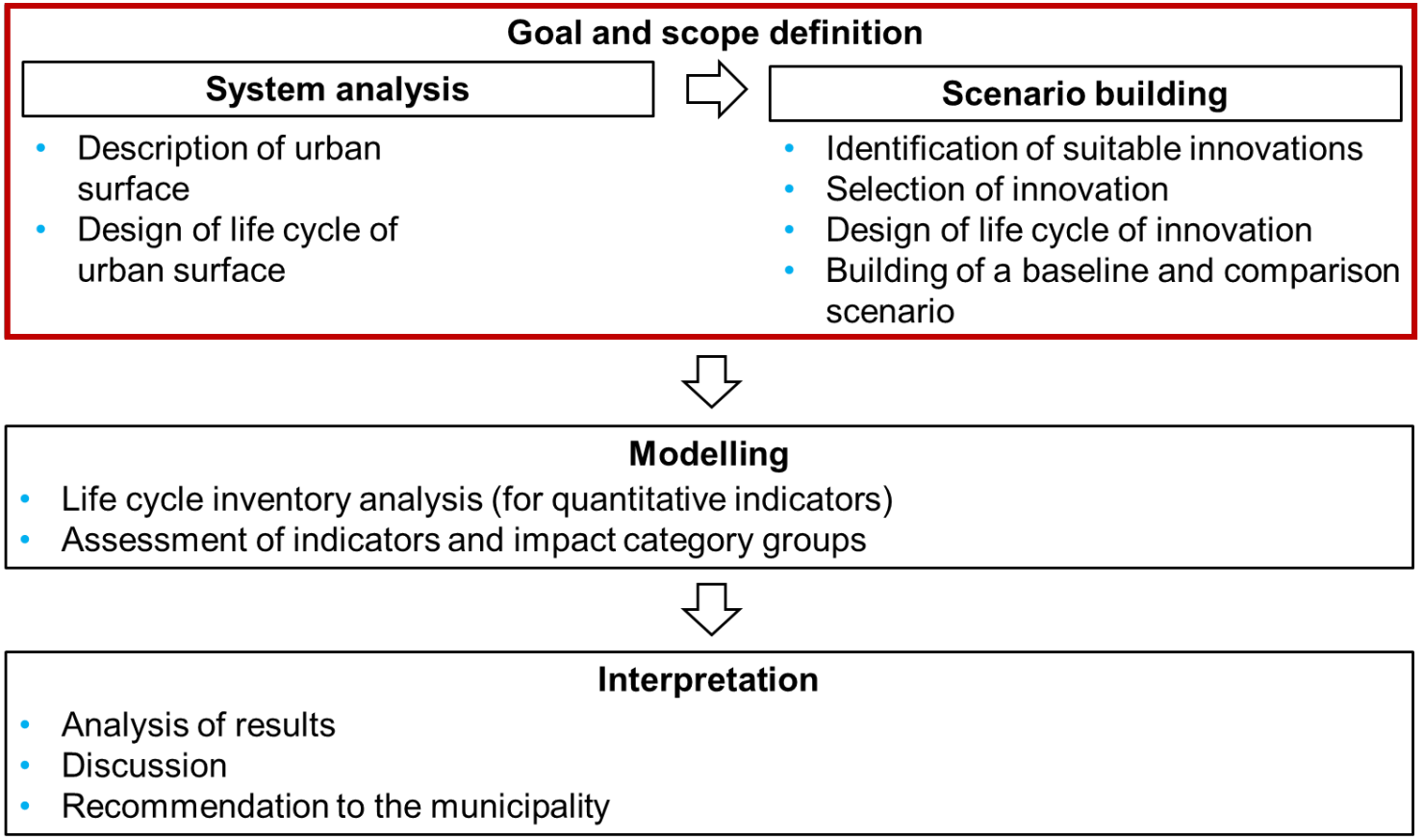
State-of-the-art of sustainability assessment methods

Challenges in assessing innovations in the field of urban surfaces:

- Multitude of processes occurring during use phase of an urban surface
- Multitude of requirements are placed on urban surfaces
- Potential impacts in all three dimensions of sustainability
- Definition and categorisation of urban surfaces and innovations

Methodological approach

Sustainability assessment system of urban surfaces



Based on (Maier *et al.* 2016) and (Wang *et al.* 2018).

Methodological approach

Definition and categorisation of urban surfaces

Urban surfaces: surfaces that interact in public outdoor spaces within an urban context, e.g.,

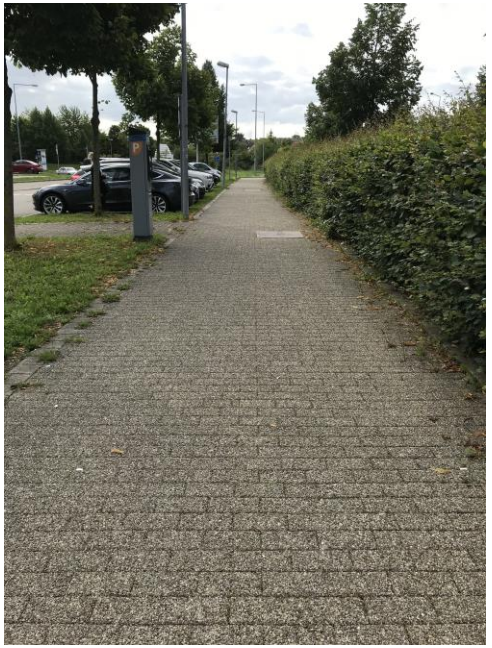
streets

(Photo: 27.09.2018)

public parks

(Photo: 05.01.2018)

walkways



(Photo:18.08.2019)

Methodological approach

Definition and categorisation of urban surfaces

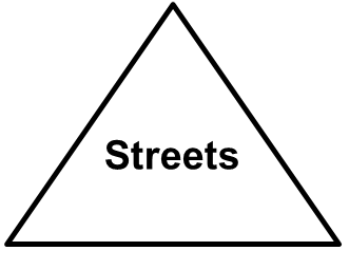
(Photo: 27.09.2018)

Material:

- Asphalt
- Cobblestone
- Concrete

Requirements:

- Safety
- Usability
- Durability



Function:

Space for movement of non-pedestrian traffic

Methodological approach

Urban surfaces, management processes and input/ output flows

Urban surface category	Subcategories	Management processes	Input flows	Output flows
Green spaces	Public parks, playgrounds	Fertilising, weeding	Water, fertiliser	Green waste
Traffic areas	Streets, cycleways, pavements	Cleaning, winter service, modernisation	Gritting salt, water	Dust
Building spaces	Roofs, facades	Cleaning, watering	Water	Green waste
Barriers	Stone walls, noise barriers	Repair, replacement	Stones, wooden slats	Rubble

Methodological approach

Assessment of urban surfaces

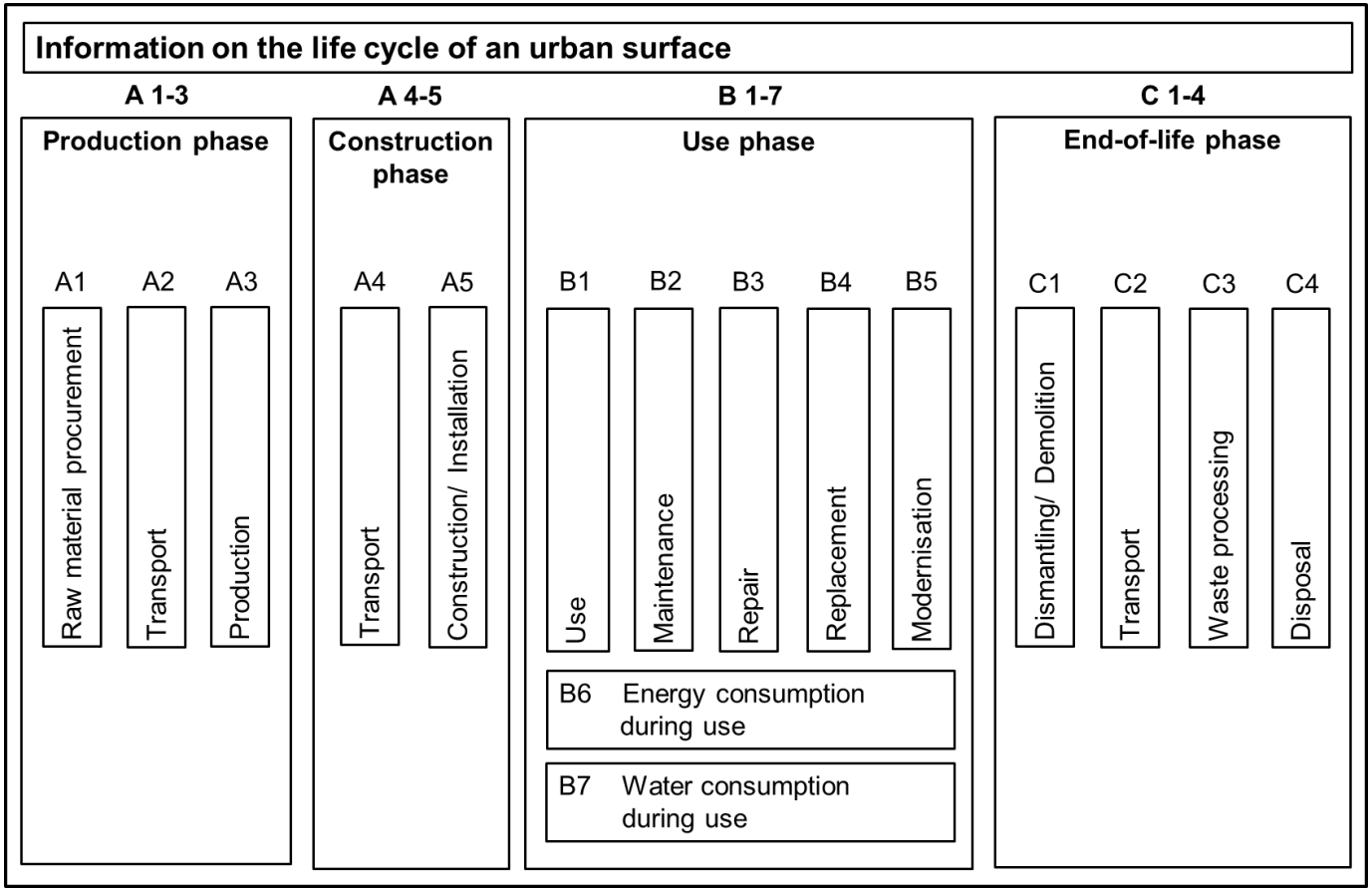
Quantification:

- Functional equivalent in accordance with DIN EN 15978
- Example:

  Providing 1 m^2 of street for 1 year that meets its functional and technical requirements, reference unit [m^2a]

Methodological approach

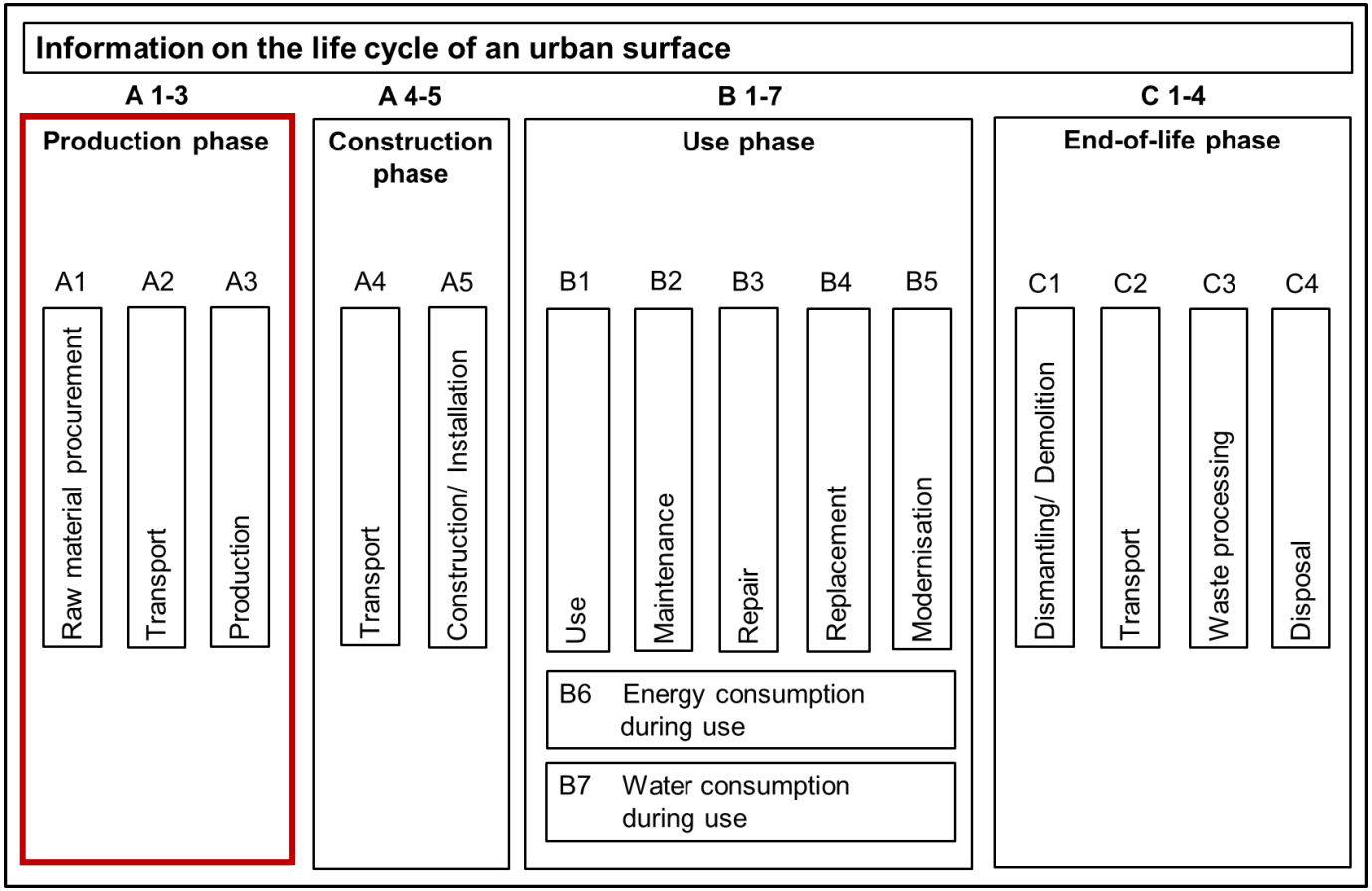
Life cycle of urban surfaces



Based on DIN EN 15978:2012-10

Methodological approach

Life cycle of urban surfaces



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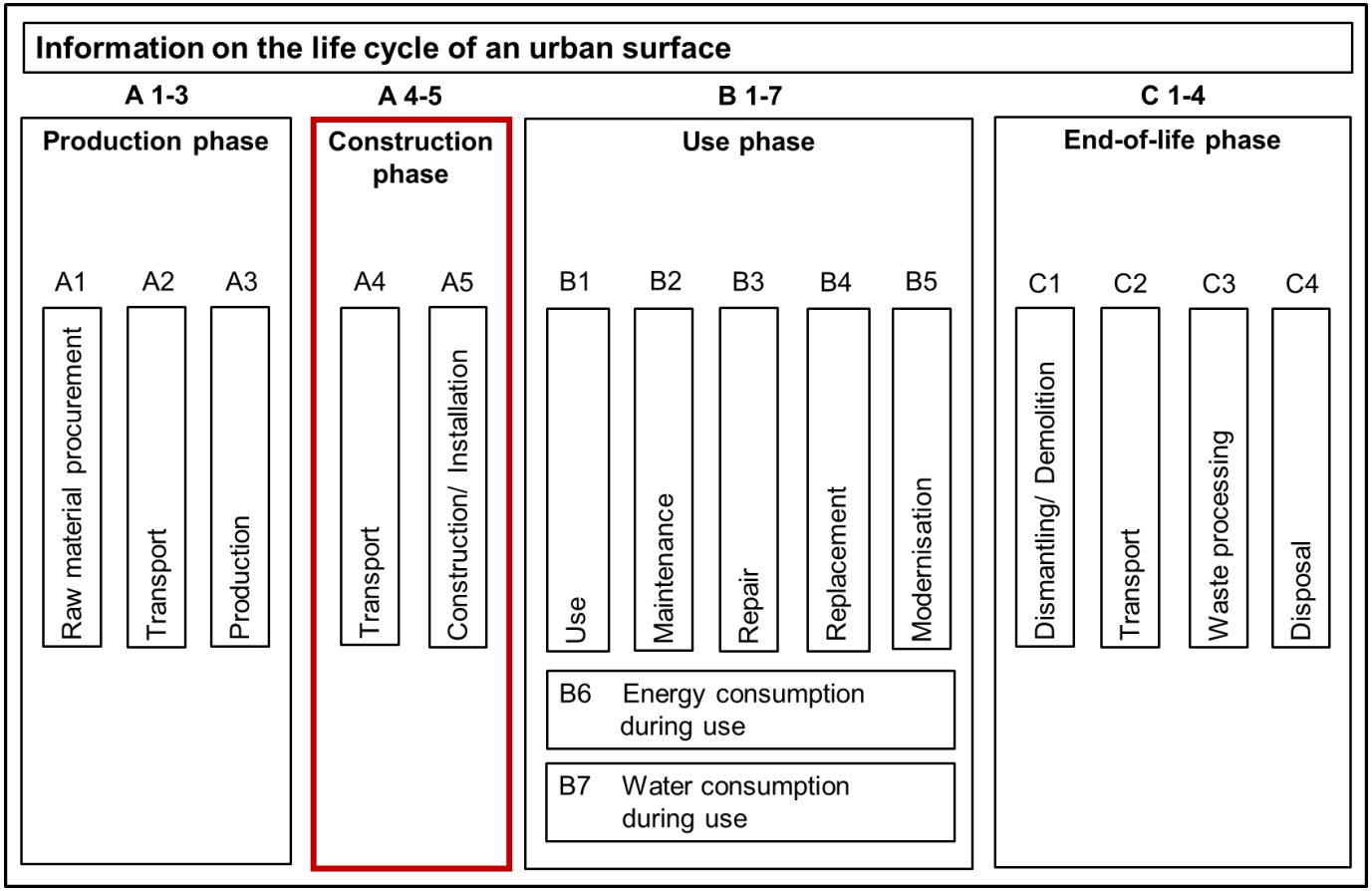
Methodological approach

Life cycle of urban surfaces



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Methodological approach

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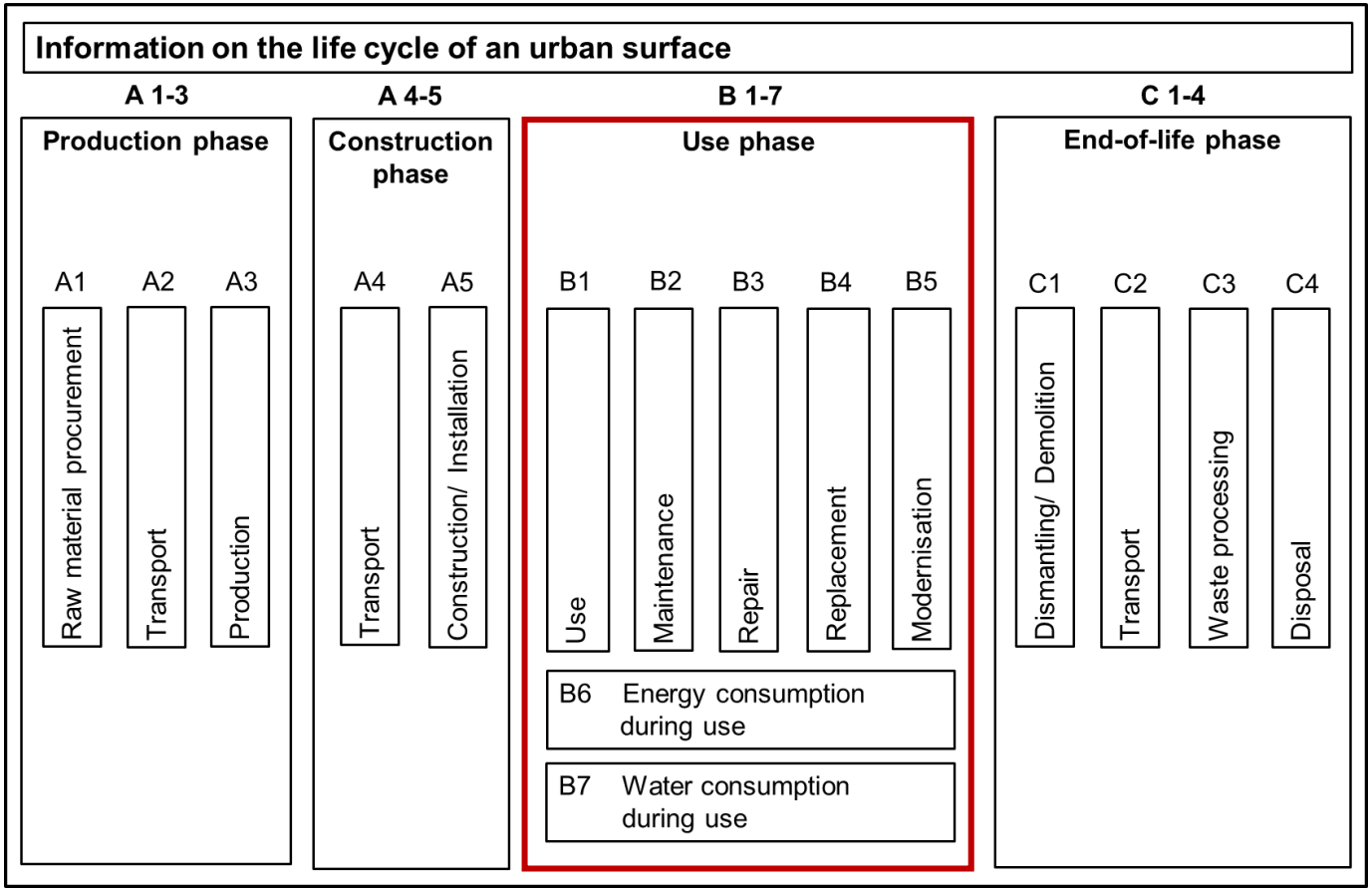

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Methodological approach

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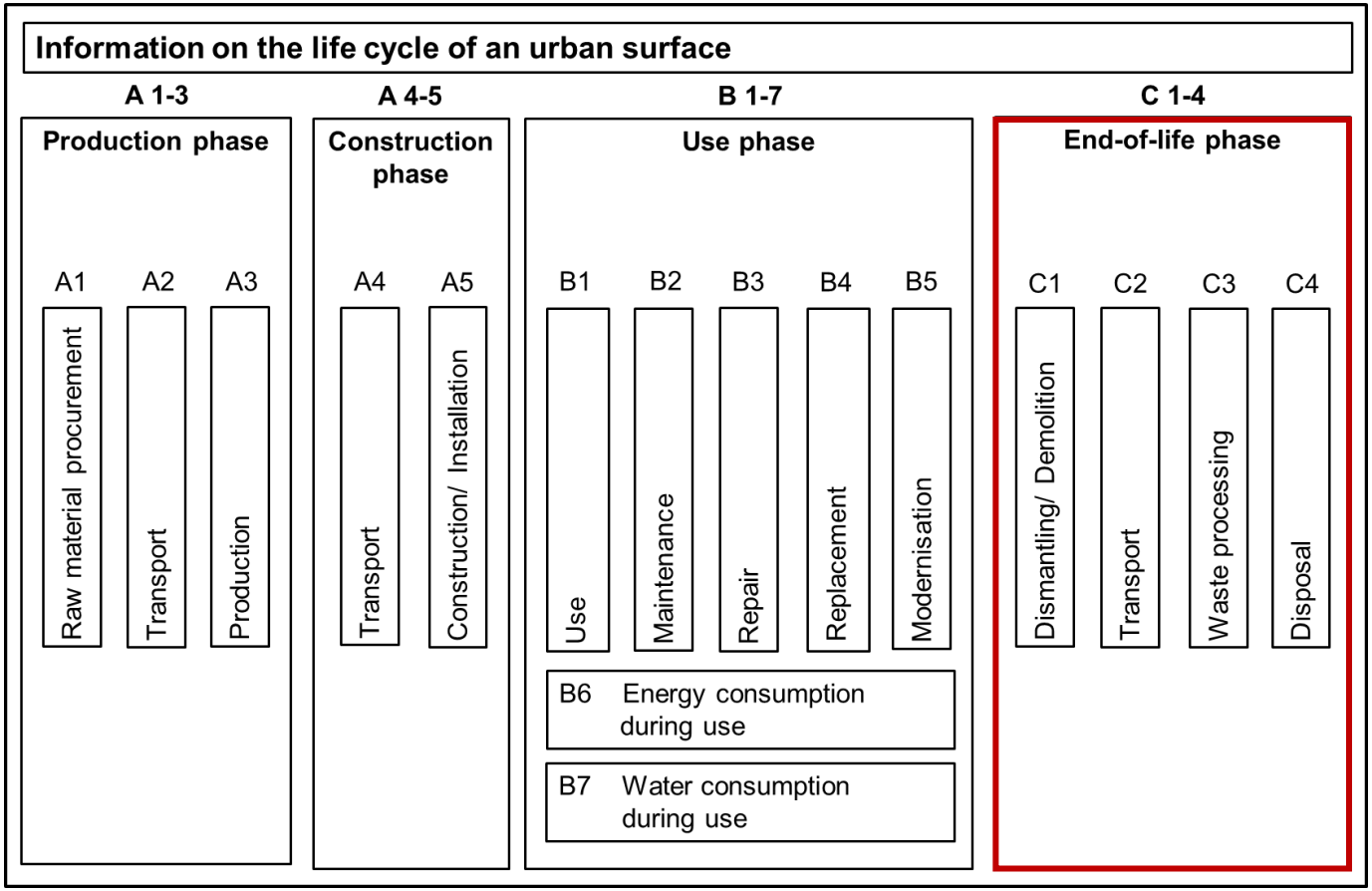

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Methodological approach

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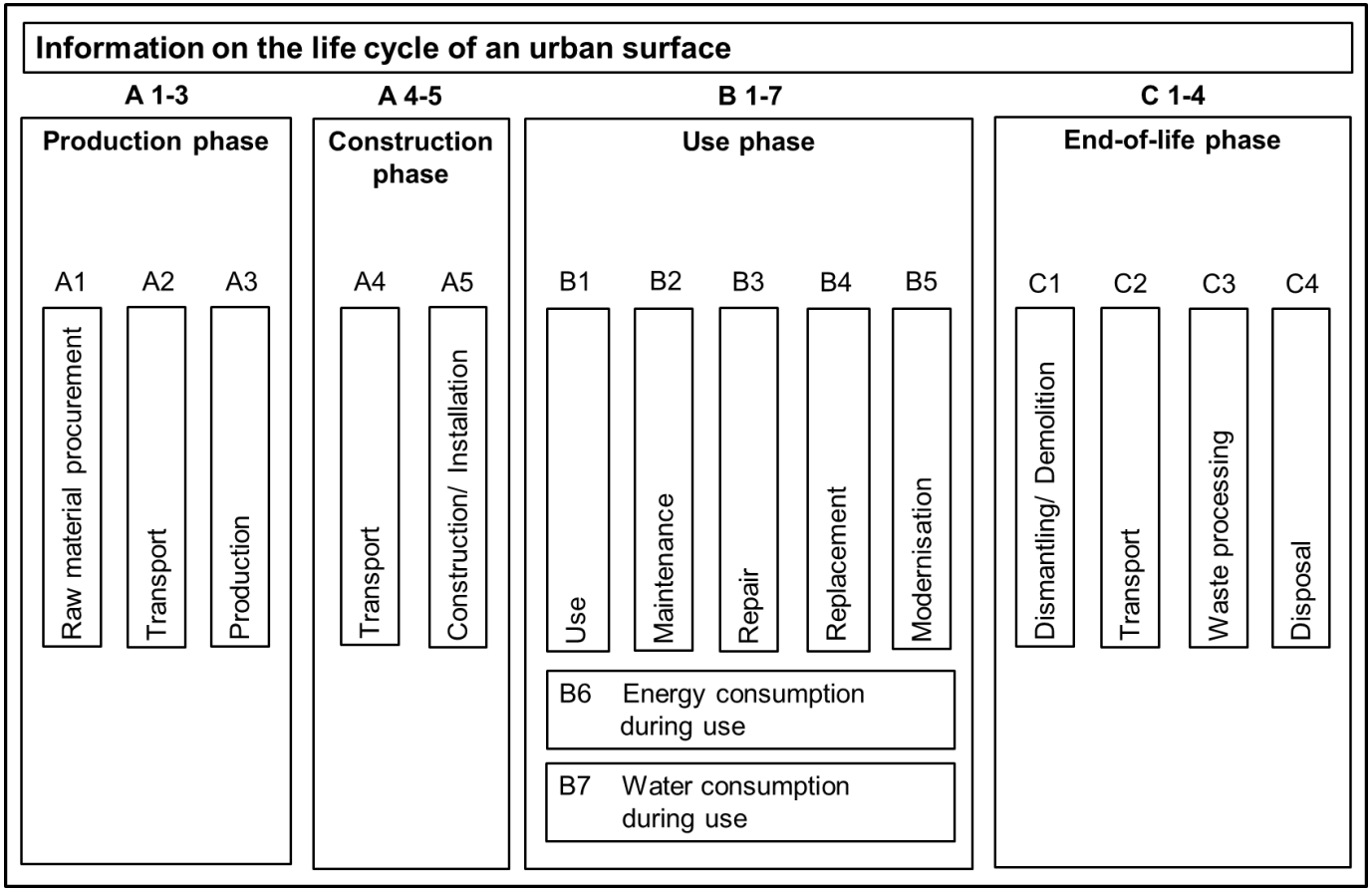

Based on DIN EN 15978:2012-10

Methodological approach

Innovations in the field of urban surfaces

Definition of innovation (based on Rogers 1983):

- idea, practice or object that has the potential to optimise urban surfaces, and
- is perceived as new by the municipality

Type of innovation	Examples for streets
Innovative surface material	Sound-absorbing surface material
Innovative machine/ technology	Innovative street cleaning machine
Innovation regarding management process	Innovative weeding process

Methodological approach

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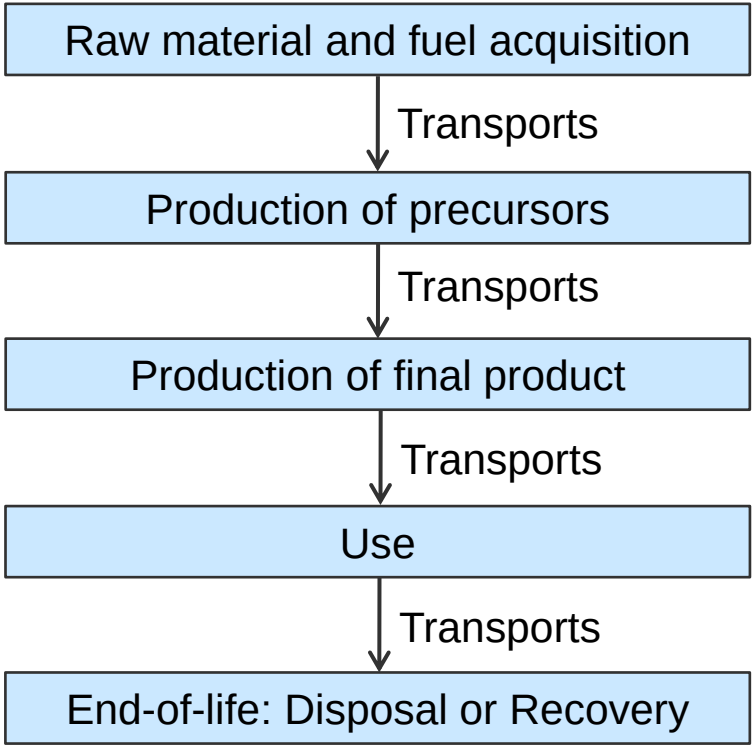
Methodological approach

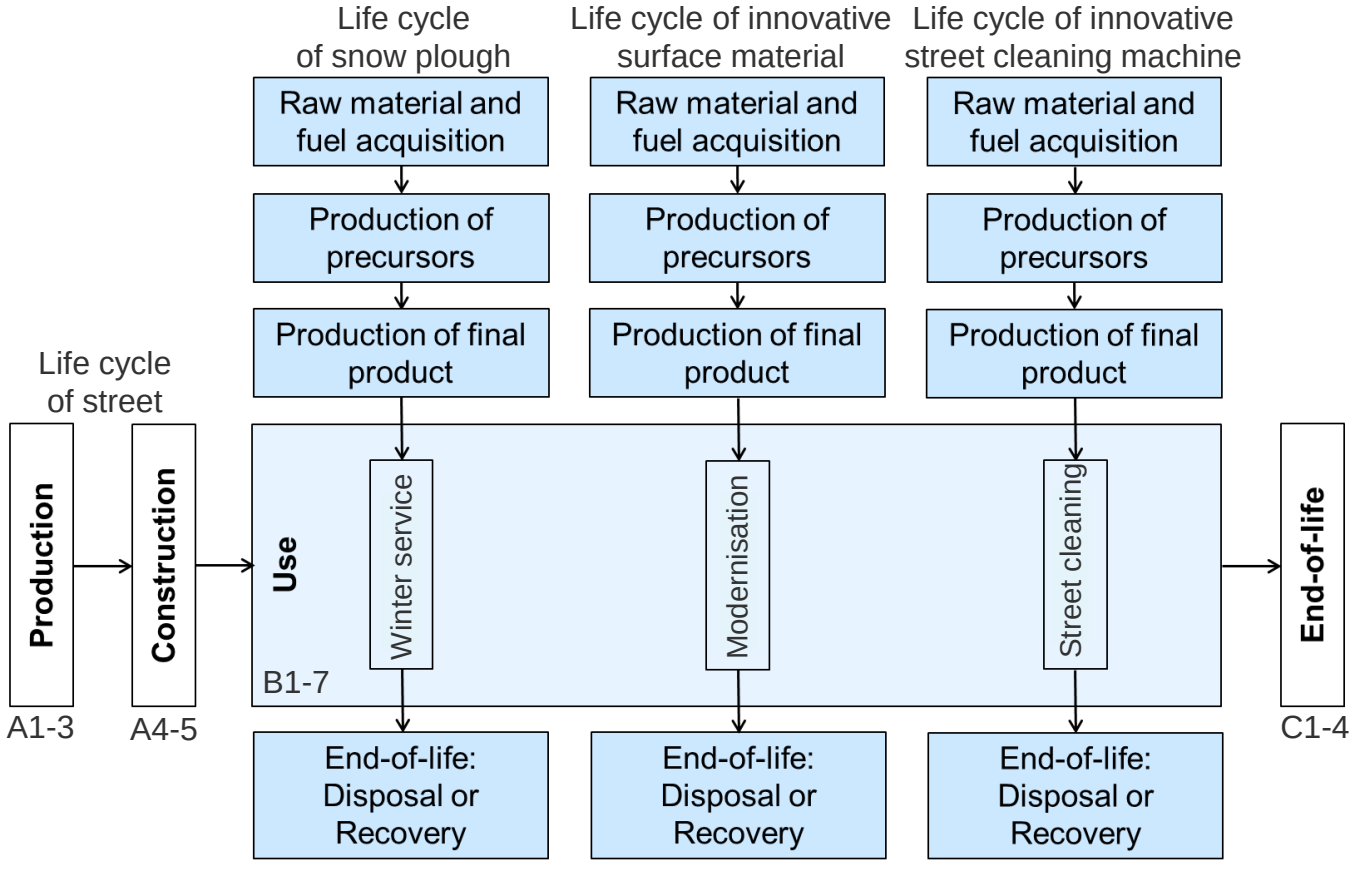
Life cycle of product innovations



In accordance with ISO 14040:2009-11

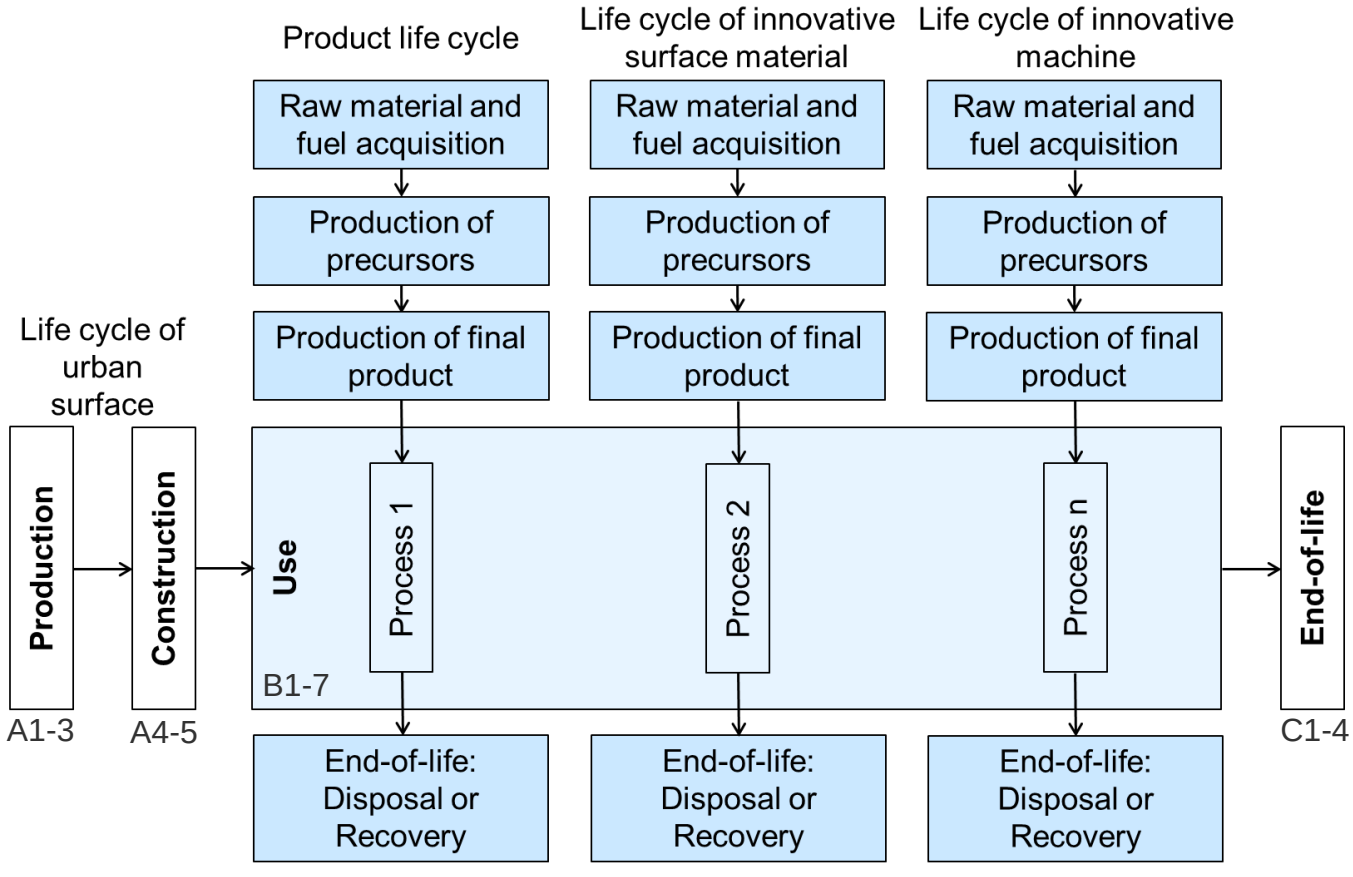
Methodological approach

Interactive life cycle scheme – **example: Street**



Methodological approach

Interactive life cycle scheme - **general**



Methodological approach

Sustainability assessment system of urban surfaces

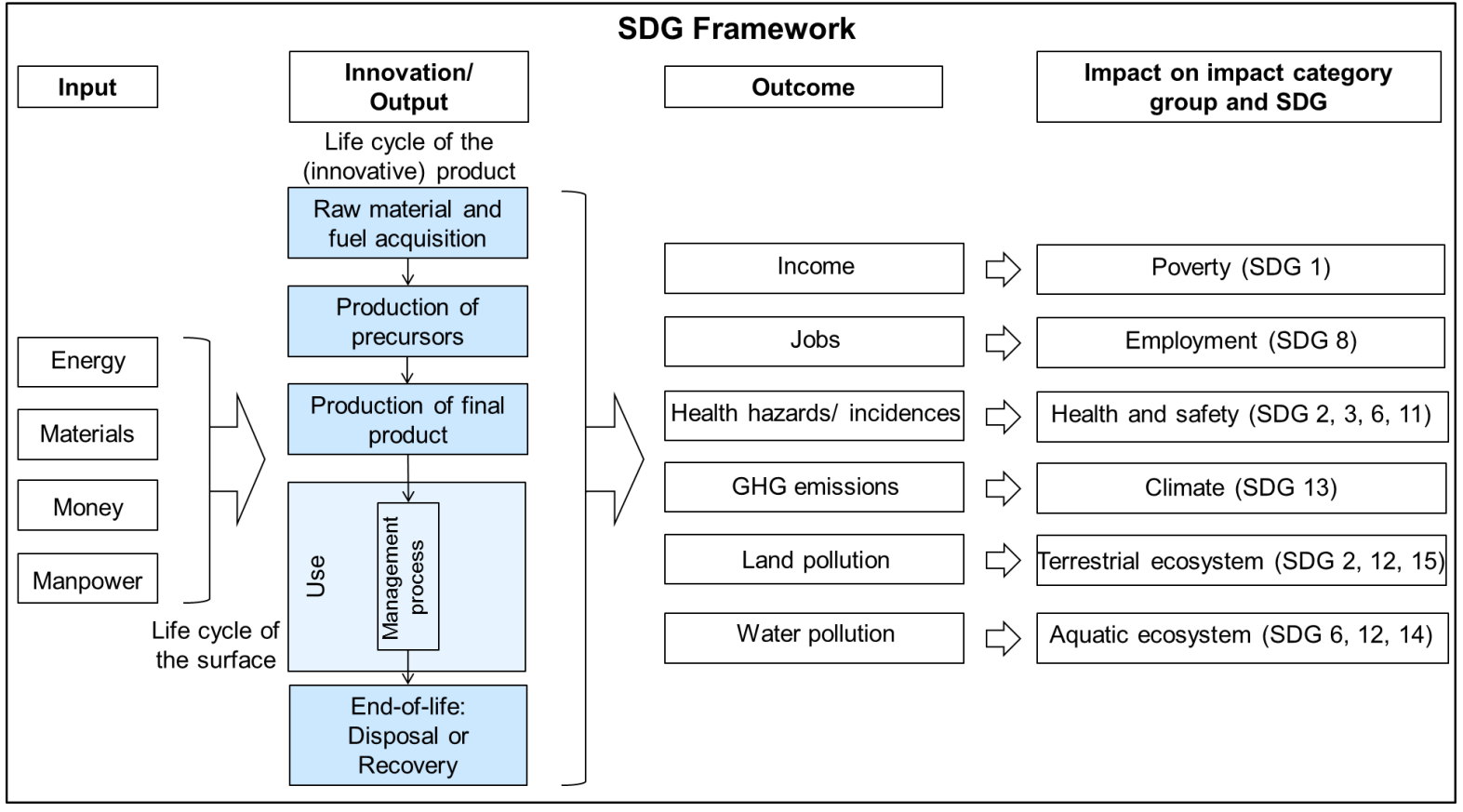
Methodological approach:

- Operationalises Life Cycle Sustainability Analysis (LCSA) Framework
- Uses Life-cycle thinking
- Uses indicators based on the Sustainable Development Goals (SDGs)
- Based on methodologies by (Maier *et al.* 2016) and (Wang *et al.* 2018)

➢ Decision support for municipalities

Methodological approach

Life cycle scheme embedded in the assessment system



Adapted from (Maier S 2016)

Conclusion and outlook

- **Starting point for sustainability assessment of innovations in the field of urban surfaces**
- **Challenges:**
  - Process innovations
  - Innovations that change the functions of an urban surface
  - Data availability (municipal level)
- **Next steps:**
  - SDG-based indicator system
  - Application to case study

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Thank you!

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