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Digital Twins to BIM Object Library: A Top-Down Modeling Approach

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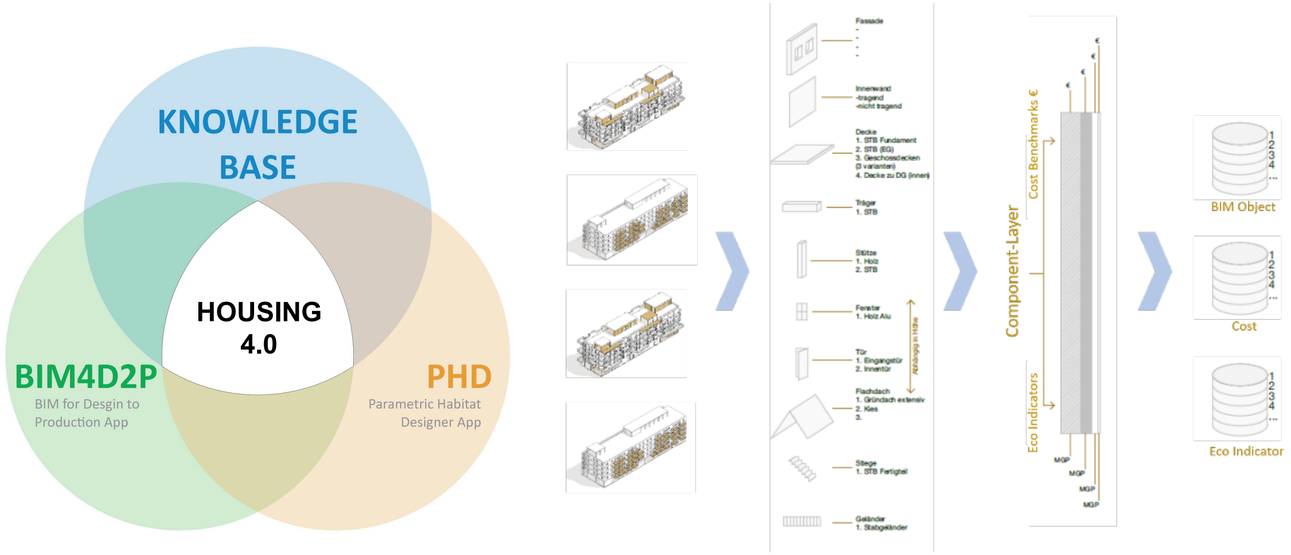
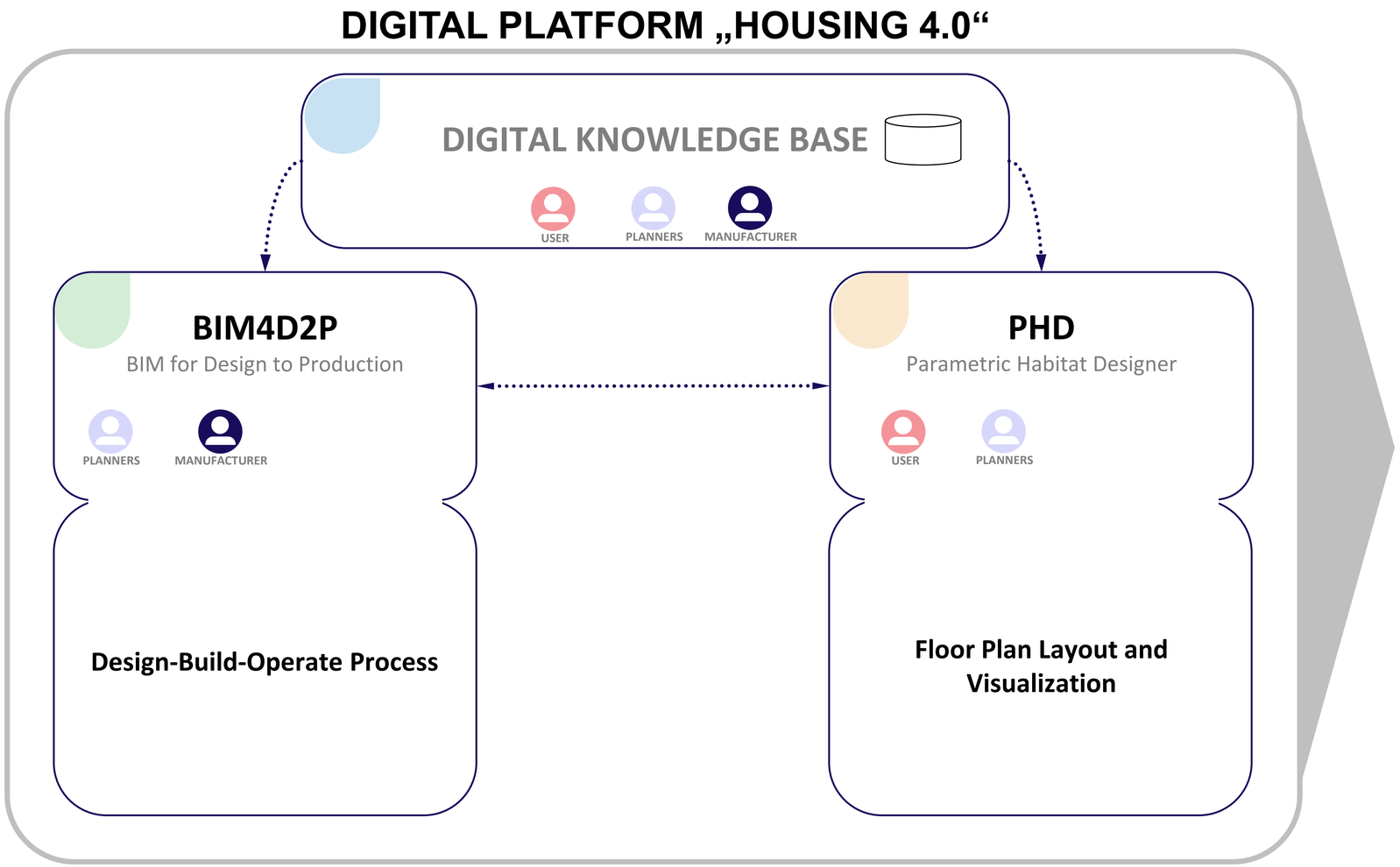
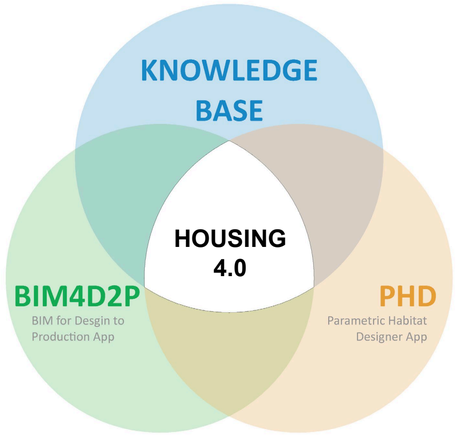


RESEARCH ENVIRONMENT





AFFORDABLE & SUSTAINABLE
MODULAR
MULTI-STOREY HOUSING

RESEARCH AIM

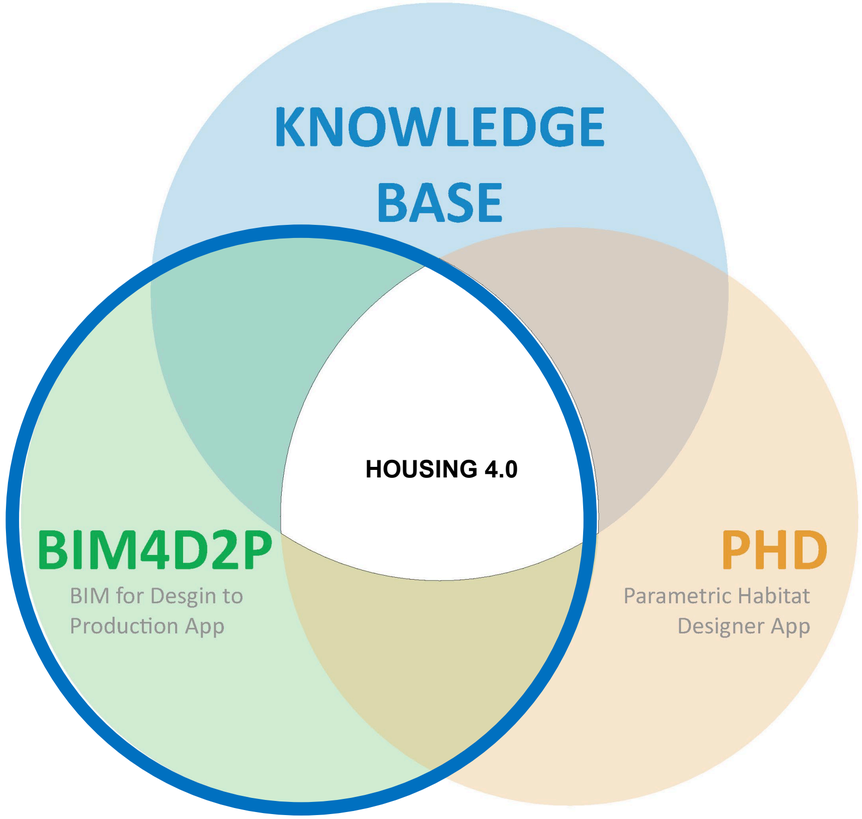
BIM4D2P
BIM for Design to Production

BIM Object Library

BIM 4 Design Guideline

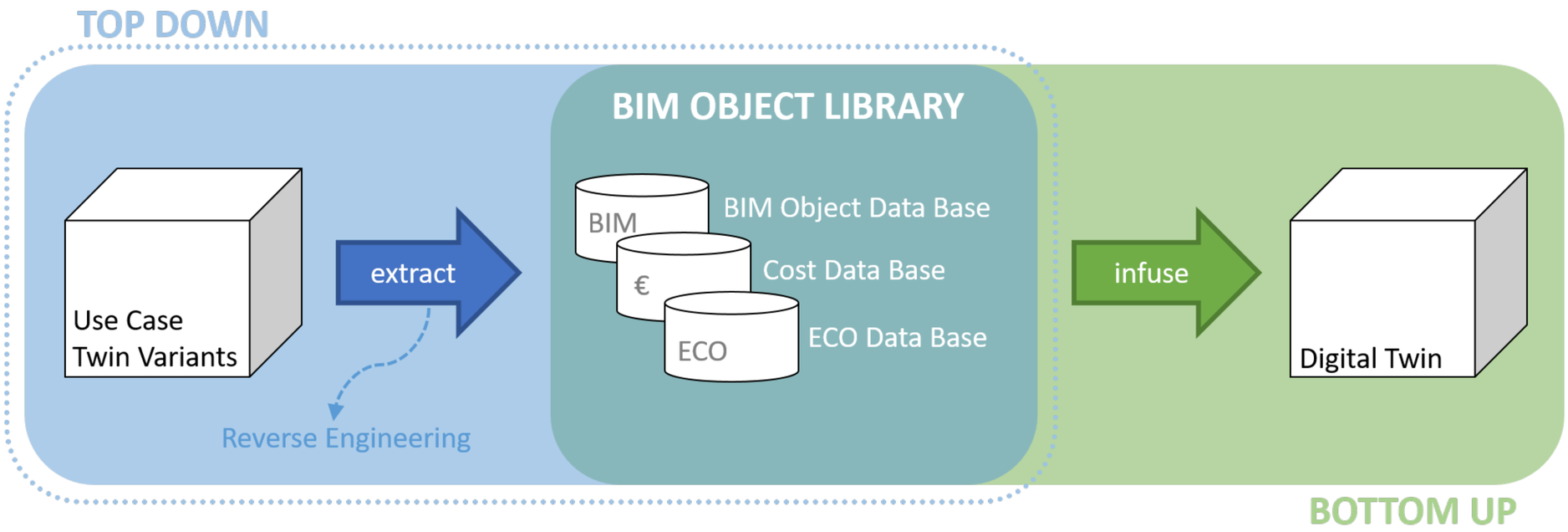
BIM 2 Production Process

Digitization of the Design-Build-Operate Process



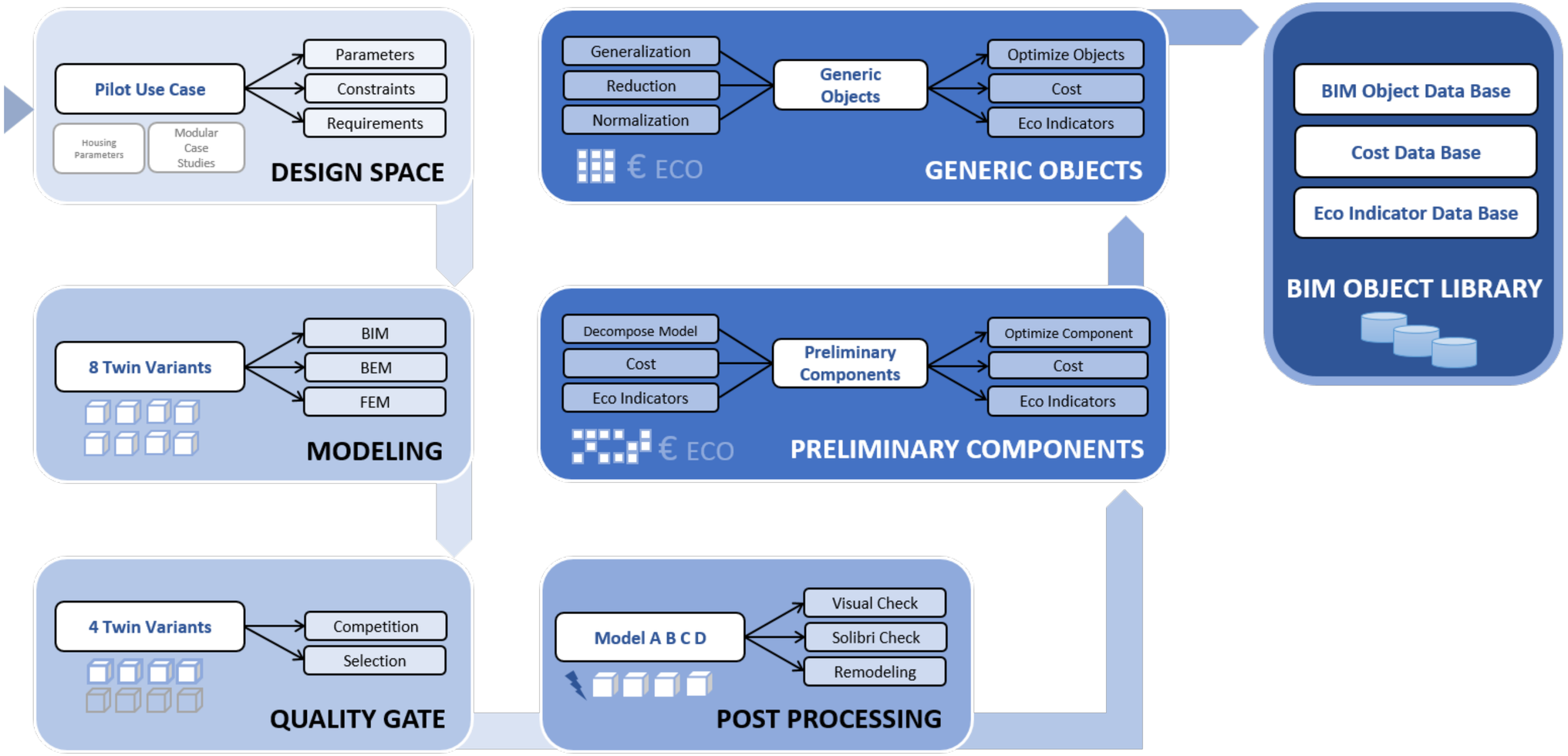
RESEARCH DESIGN

Combined Top-Down Bottom-Up Modeling Approach



RESEARCH DESIGN

Top-down modeling phases - from specific to generic data



DESIGN SPACE

Design Space Phase - Input – Method – Output

PILOT USE CASE
- 2D Plans
- Project Description
- Spatial Programm
- Tender Document

MODULAR CASE STUDIES
- Catalogue of 60 modular Housing Projects

HOUSING TRENDS
- Study on Housing Parameters and Trends

ANALYZE & EXTRACT
- Building Design & Parameters
- Apartment Units
- Construction
- Building Regulations
- User Requirements

- Modular Construction
- Modular Housing Concepts

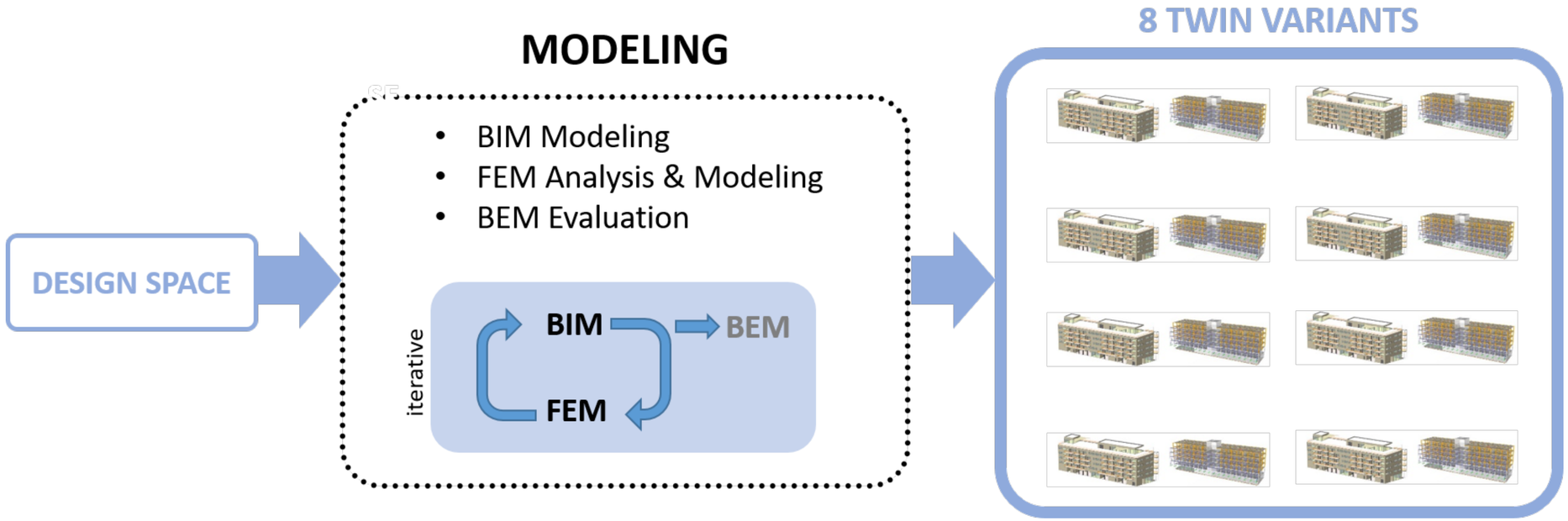
- Parameters and Trends

DESIGN SPACE
- Specific Building Parameters
- Specific Constraints
- Specific Spatial Programm & Requirements
- Parameters of Modular Construction
  - Technical, Economic, Legal
- Parameters of modular Concepts
- Parameters of modular Housing Trends

- Housing Trends

MODELING

Modeling Phase - Input – Method – Output



QUALITY GATE

Quality Gate Phase - Input – Method – Output

8 TWIN VARIANTS

QUALITY GATE

- Competition
- Independant Expert Jury
- Criteria Catalogue
  - Housing Quality
  - Degree of industrial prefabrication
  - Flexibility
  - Overall construction feasibility
- Selection of suitable Variants

4 TWIN VARIANTS

POST PROCESSING

Post Processing Phase - Input – Method – Output

4 TWIN VARIANTS

POST PROCESSING

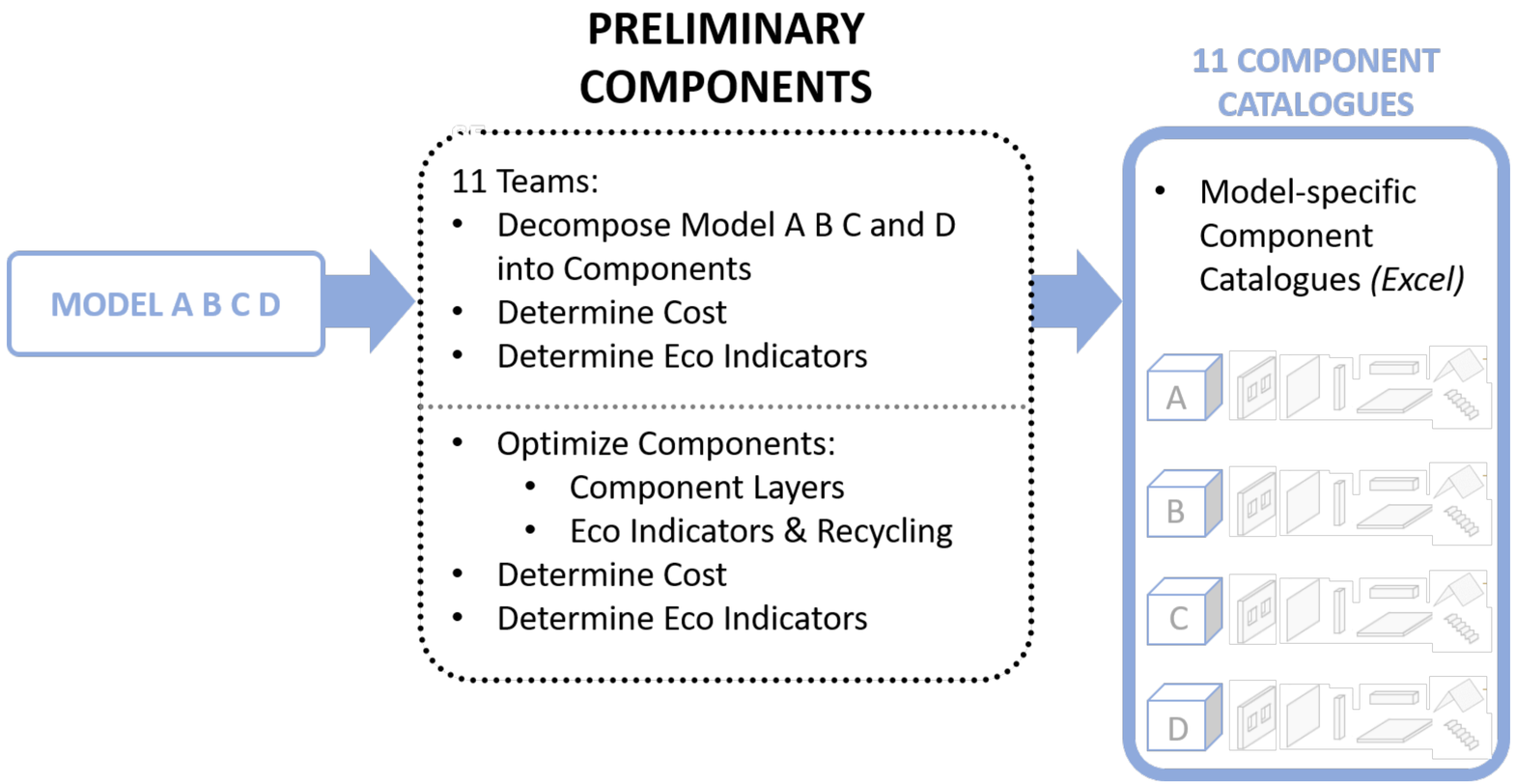
- Postprocessing the models according to the modeling quality (collisions, etc.) and correct mass and quantity evaluation:
  - Manual Check & Solibri Check
  - Remodeling

MODEL A B C D

- BIM Model
  Archicad or Revit
- IFC

PRELIMINARY COMPONENT GENERATION

Preliminary Component Generation Phase – Input – Method – Output



GENERIC OBJECT GENERATION

Generic Object Phase - Input – Method – Output

11 COMPONENT CATALOGUES

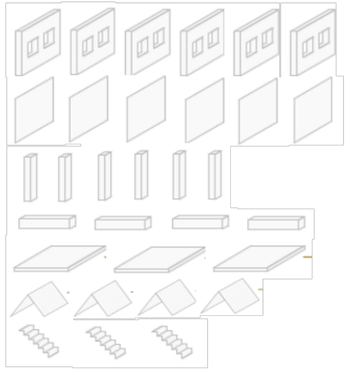
GENERIC OBJECTS

- Generalization / Cluster
- Reduction
- Normalization

- Optimize Objects:
  - Component Layer
  - Eco Indicator & Recycling
- Determine Cost
- Determine Eco Indicators

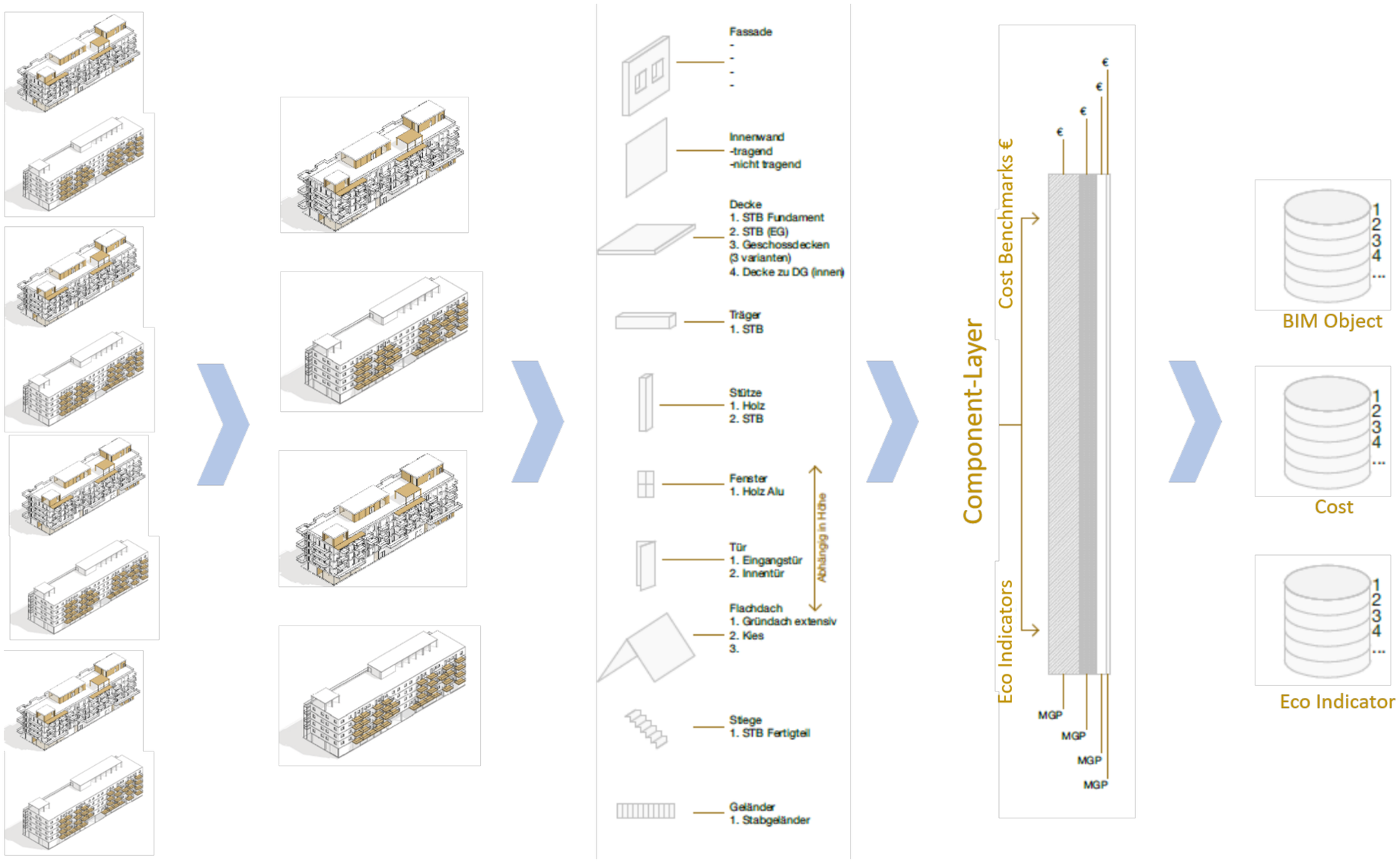
GENERIC OBJECT CATALOGUE

- Generic Object Catalogue *(Excel)*



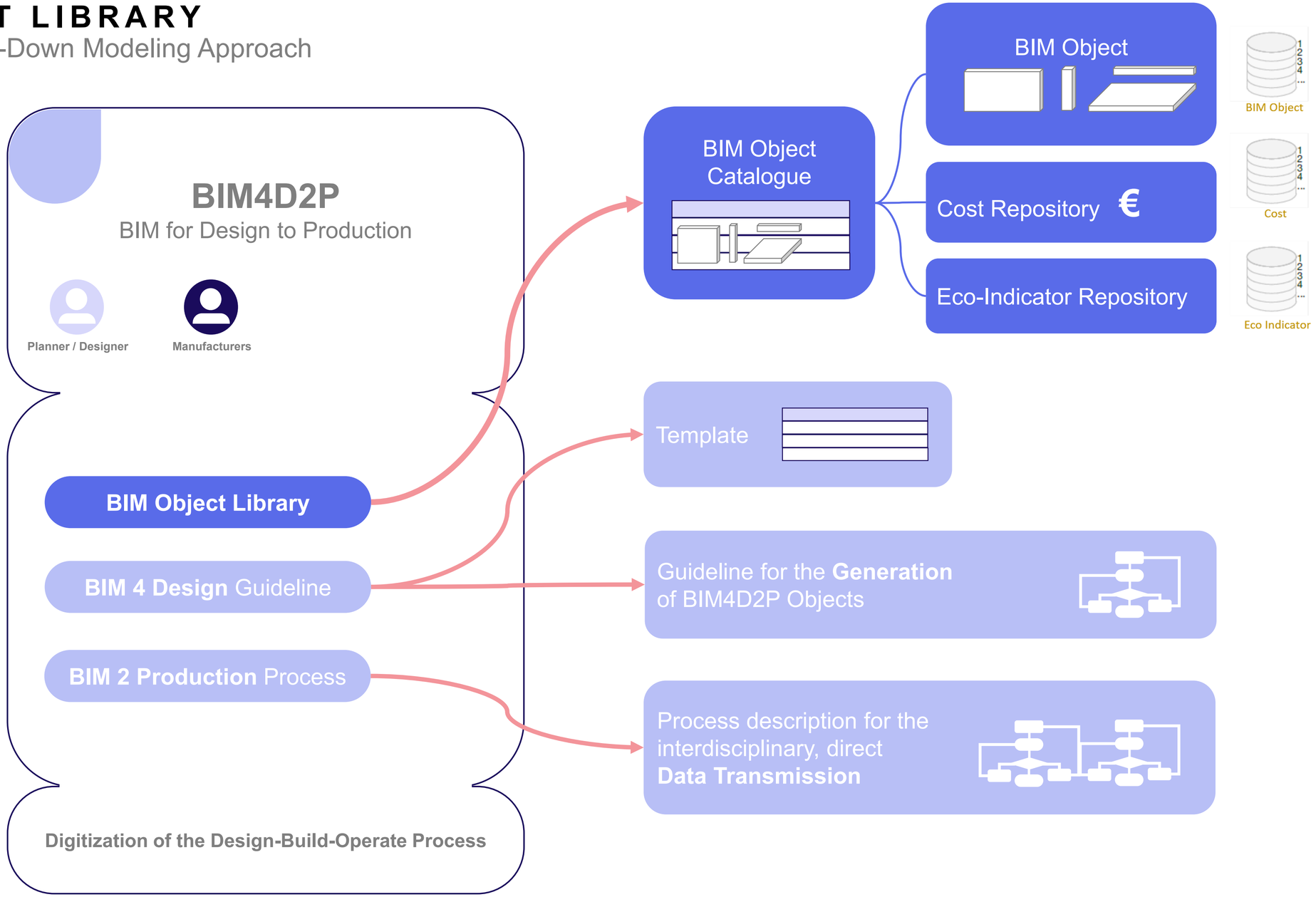
FINDINGS

Findings of the Top-Down Modeling Approach



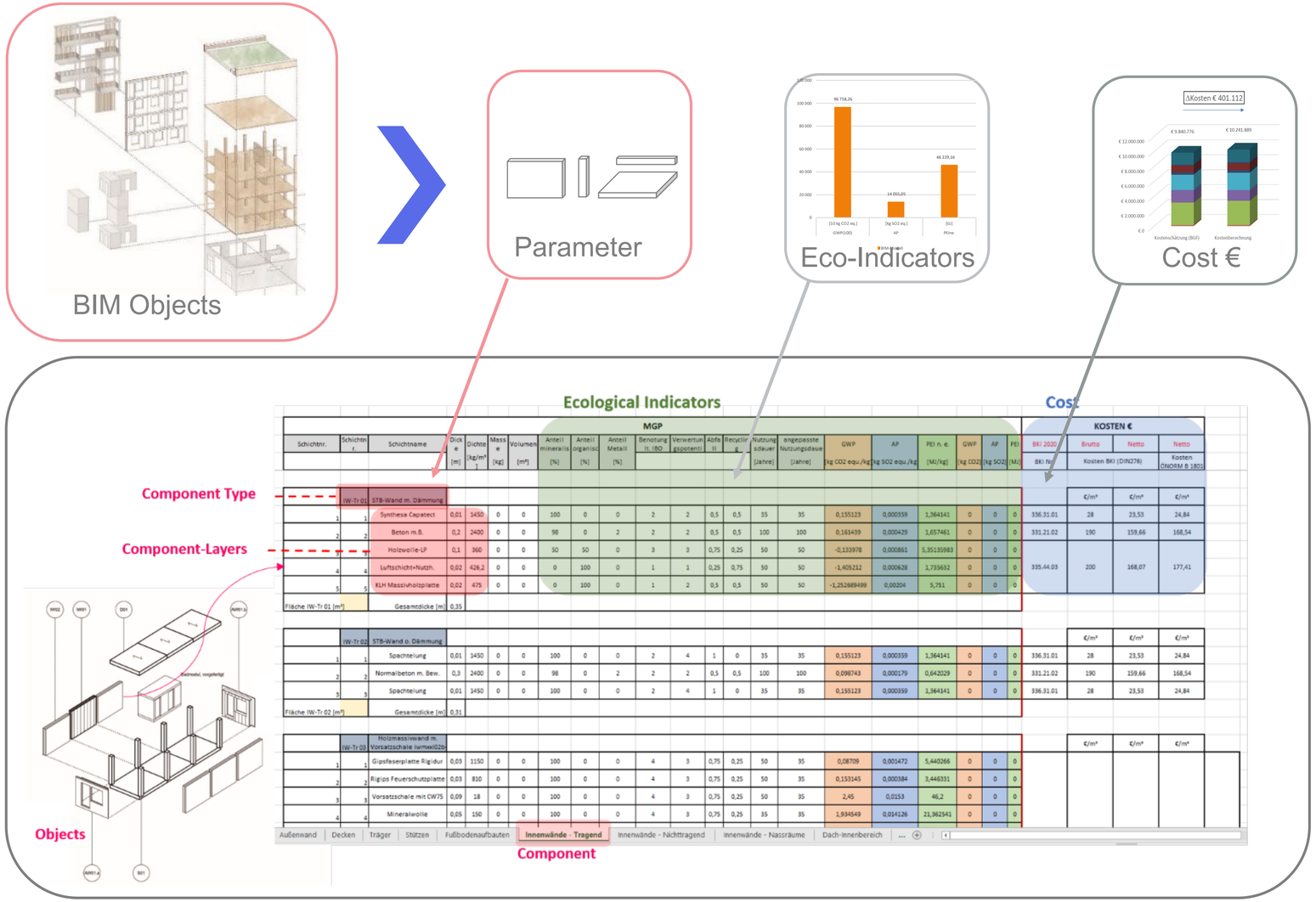
BIM OBJECT LIBRARY

Findings of the Top-Down Modeling Approach

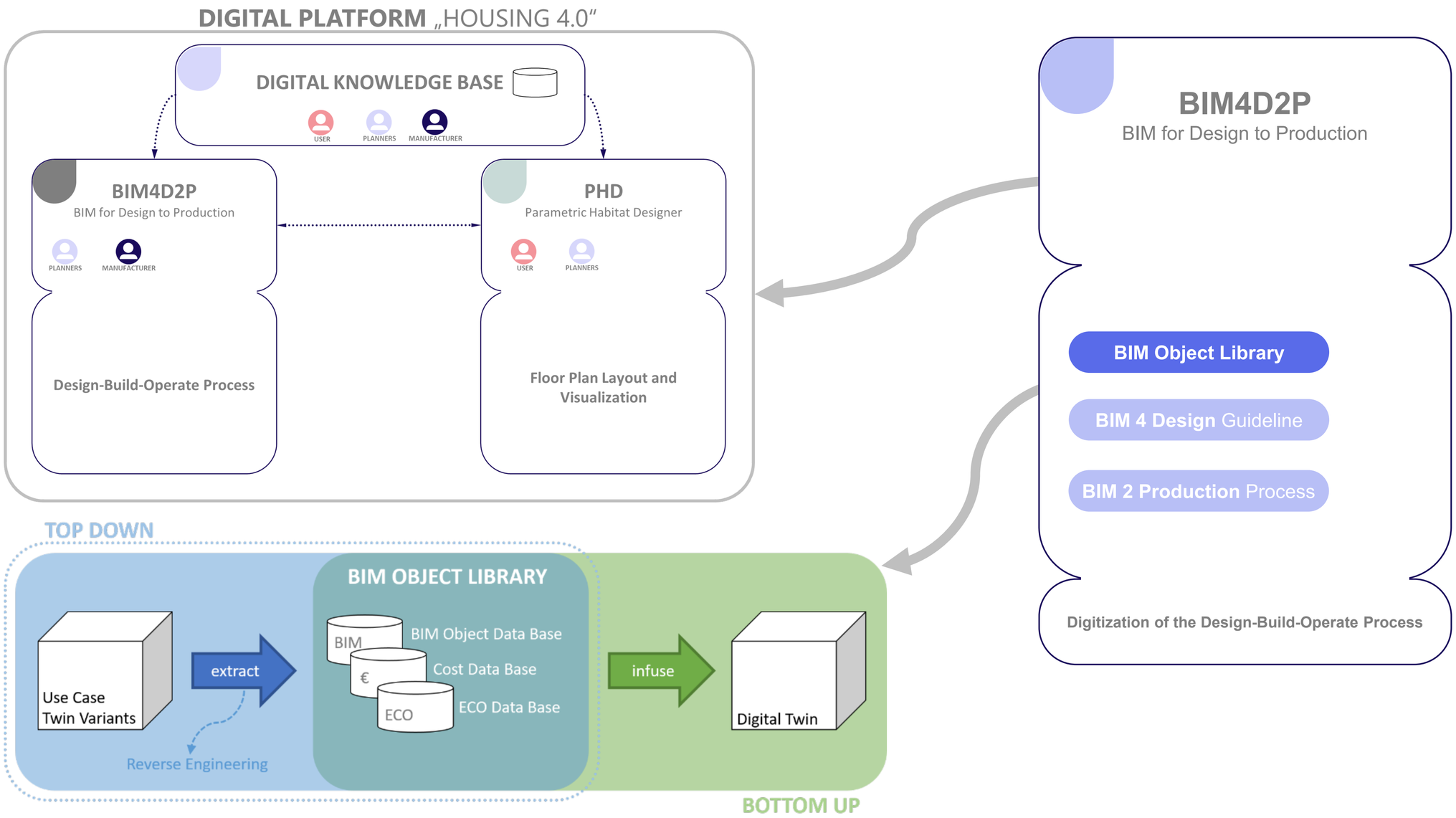
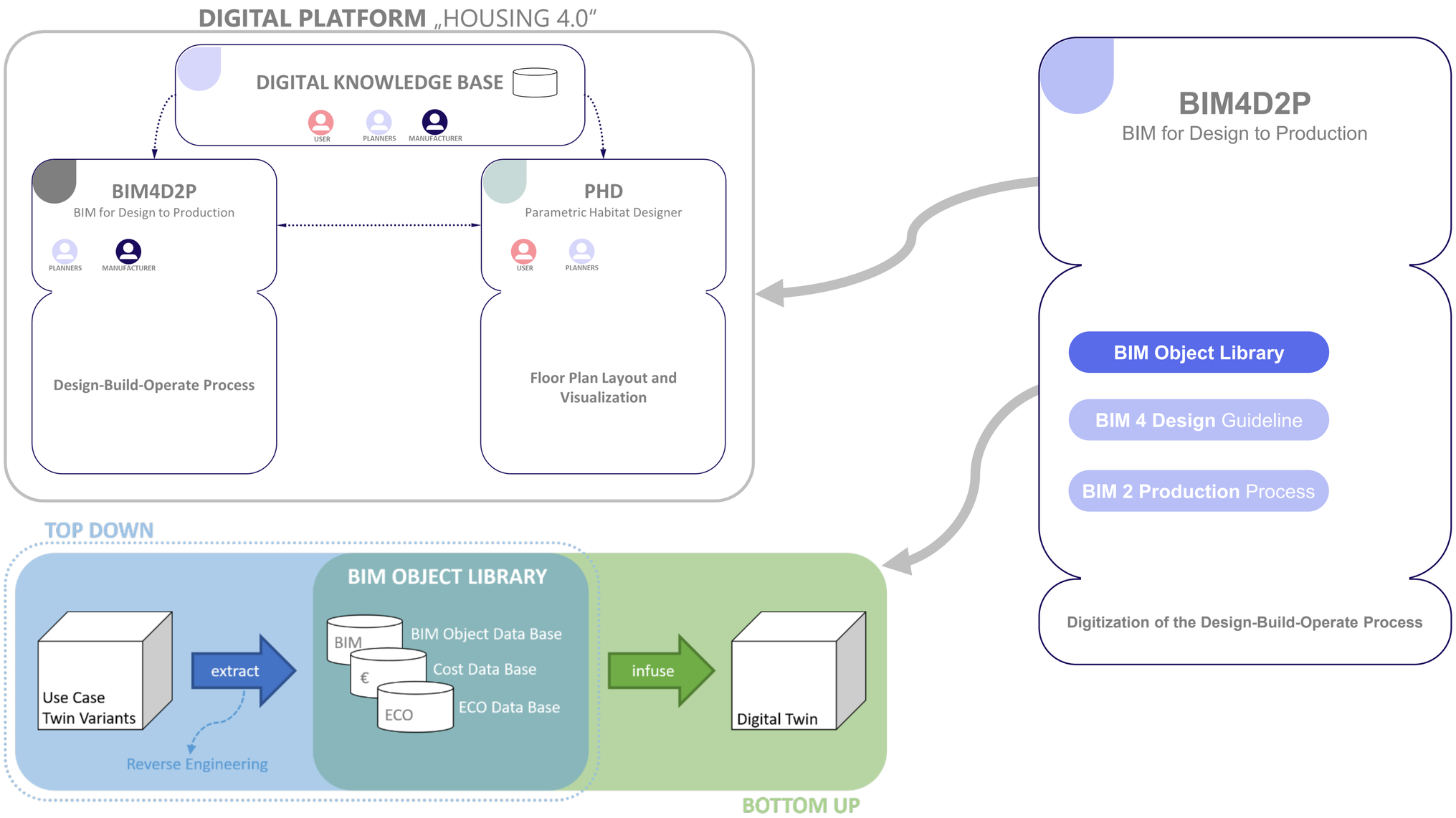


BIM OBJECT CATALOGUE

Findings of the Top-Down Modeling Approach



CONCLUSION & FUTURE OUTLOOK



CONCLUSION & FUTURE OUTLOOK