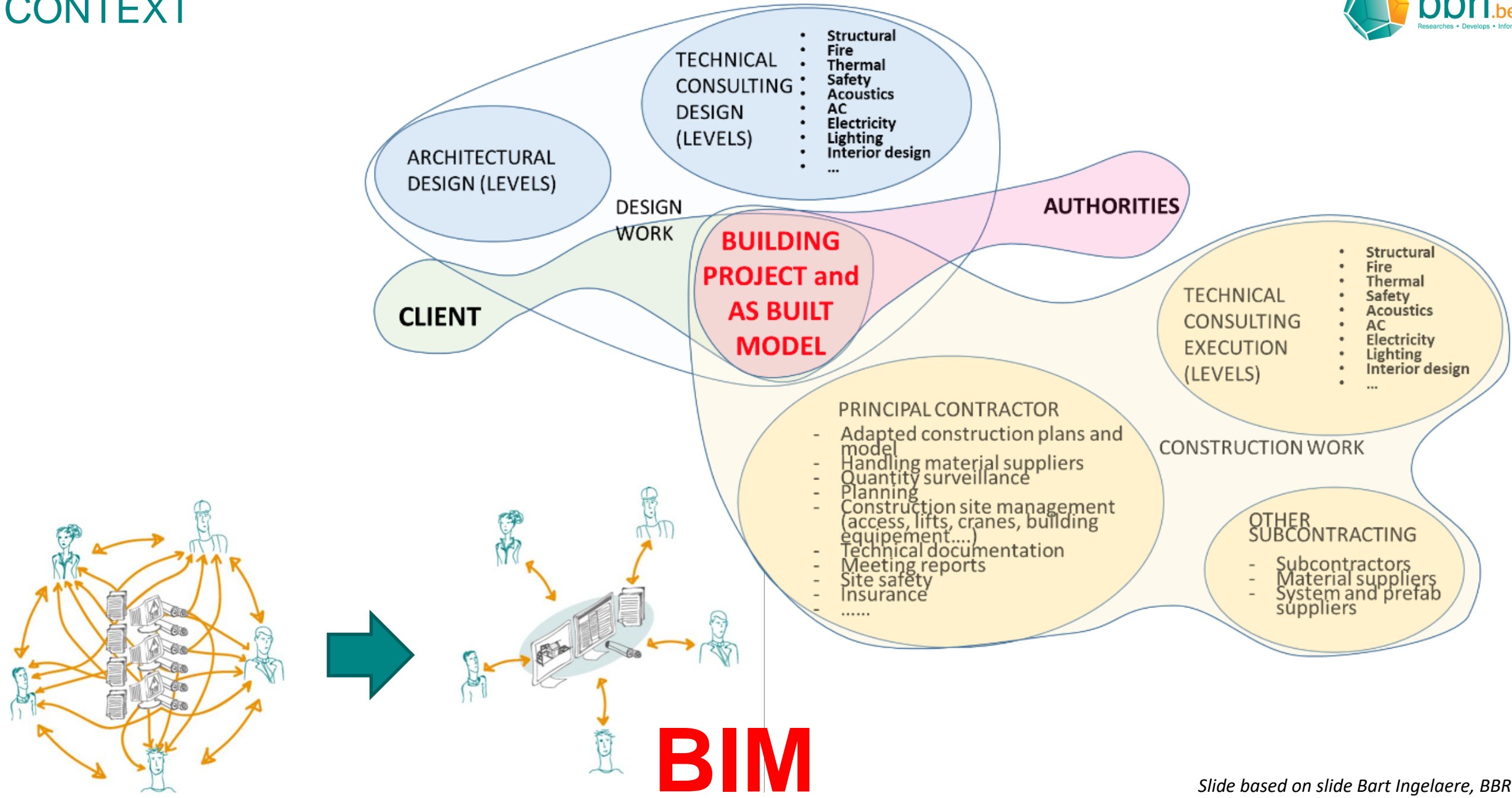


SUSTAINABLE BUILT ENVIRONMENT D-A-CH CONFERENCE 2019– GRAZ, 11-13 SEPTEMBER 2019

IDENTIFICATION AND COMPARISON OF LCA-BIM INTEGRATION STRATEGIES

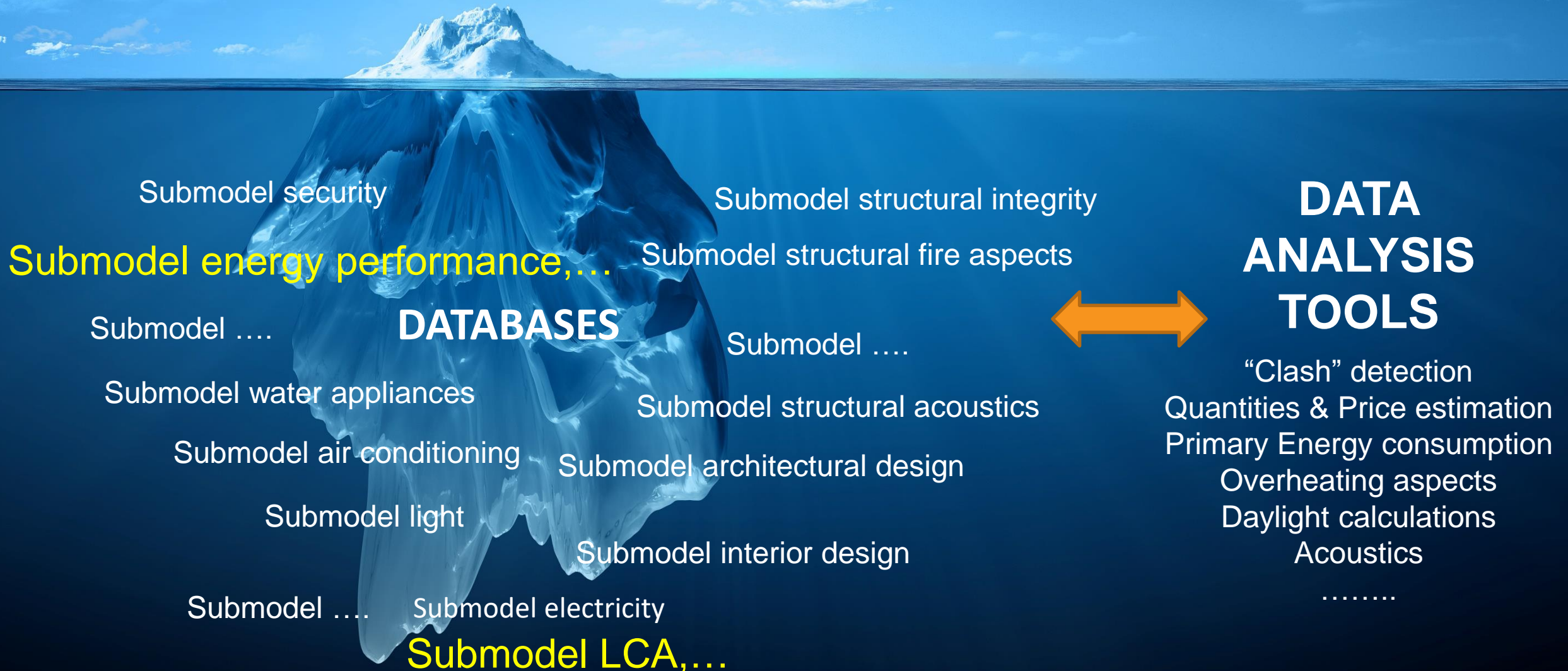
RUBEN DECUYPERE | LISA WASTIELS

SUSTAINABLE DEVELOPMENT BELGIAN BUILDING RESEARCH INSTITUTE



Slide based on slide Bart Ingelaere, BBRI

3D or 4D visual representation Assembled BIM



Goal of research

- Identify **feasible workflows** for LCA analysis based on BIM models
- Provide guidelines for **structuring LCA data** for use in BIM workflows

Approach

- Following up on normalisation work BIM and LCA
- Screening of existing tools and methods
- Focus group discussion with BIM and LCA experts from construction sector
- Cases

Concept **LCA profile**

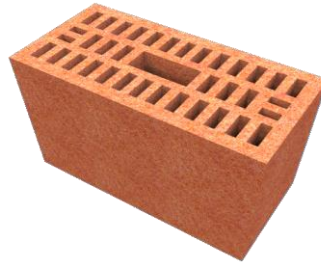
=

LCA data for a certain *material* type or *combination of materials*



- represented through set of environmental indicators

- Generic set
- EPD (Environmental Product Declaration)
- Combination of both



WORKFLOWS FOR INTEGRATION OF BIM AND LCA

Main strategies for integration

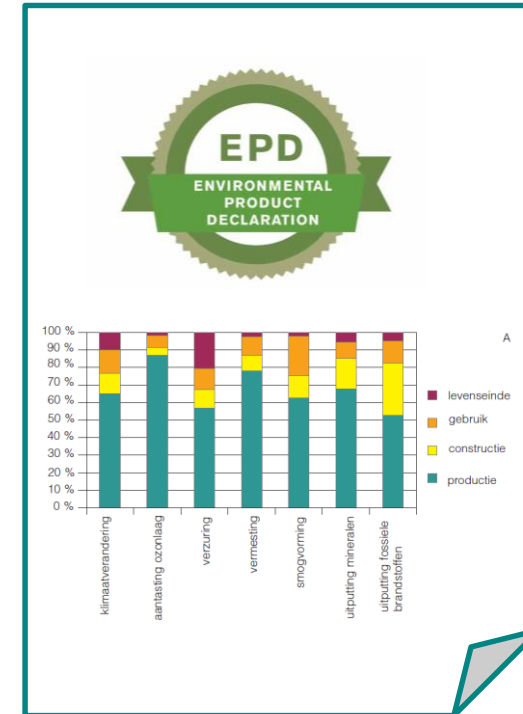
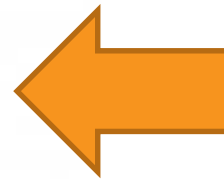
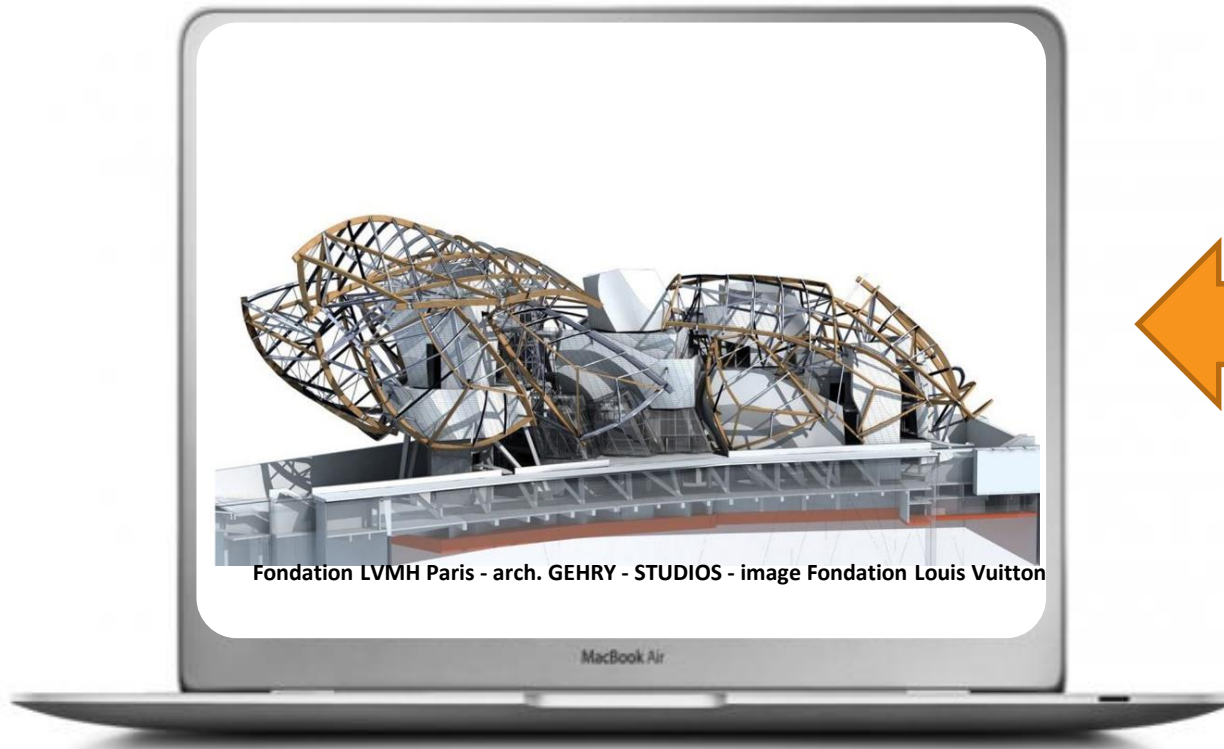
1. Geometrical and material information to specialized LCA



WORKFLOWS FOR INTEGRATION OF BIM AND LCA

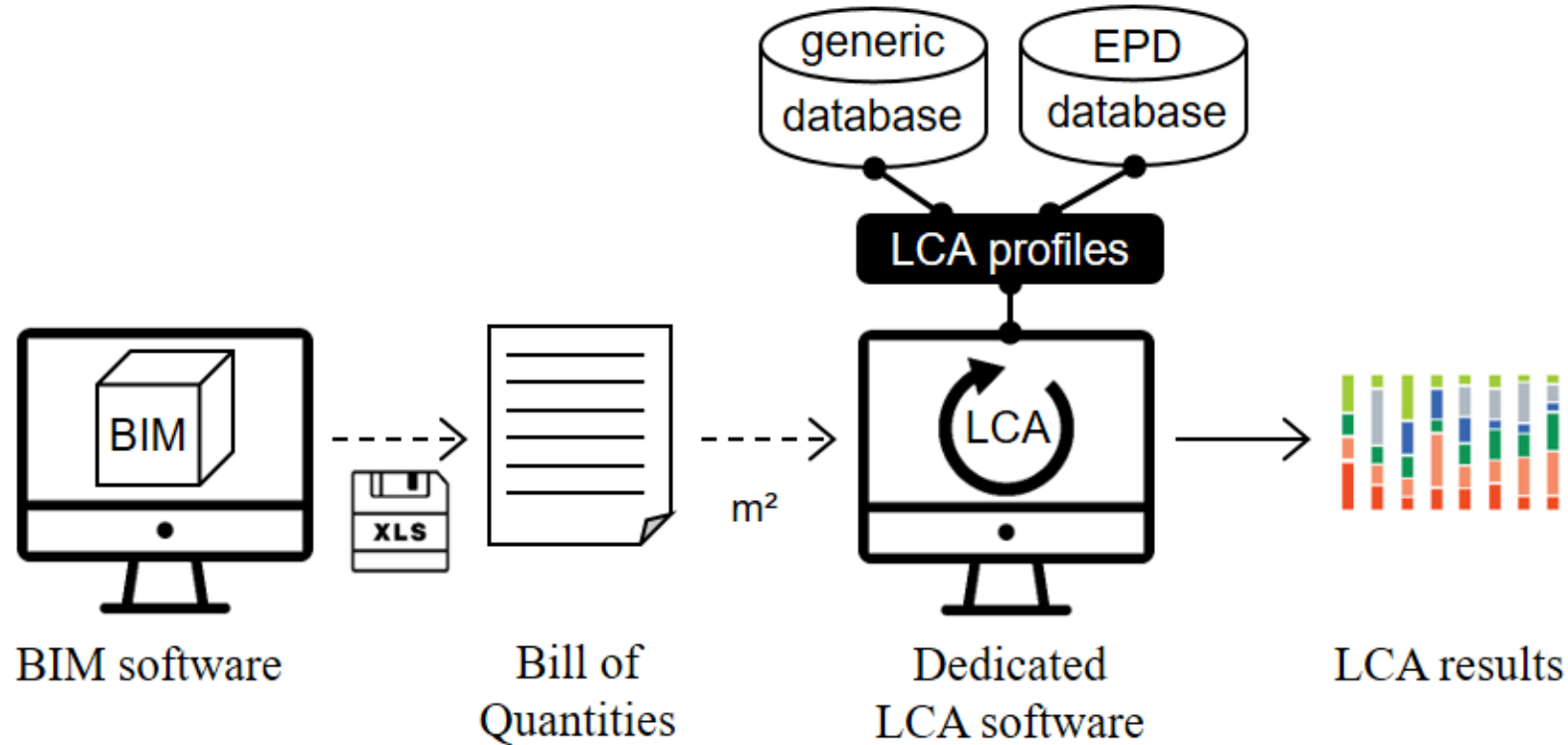
Main strategies for integration

1. Geometrical and material information to specialized LCA
2. Adding LCA data to the BIM model



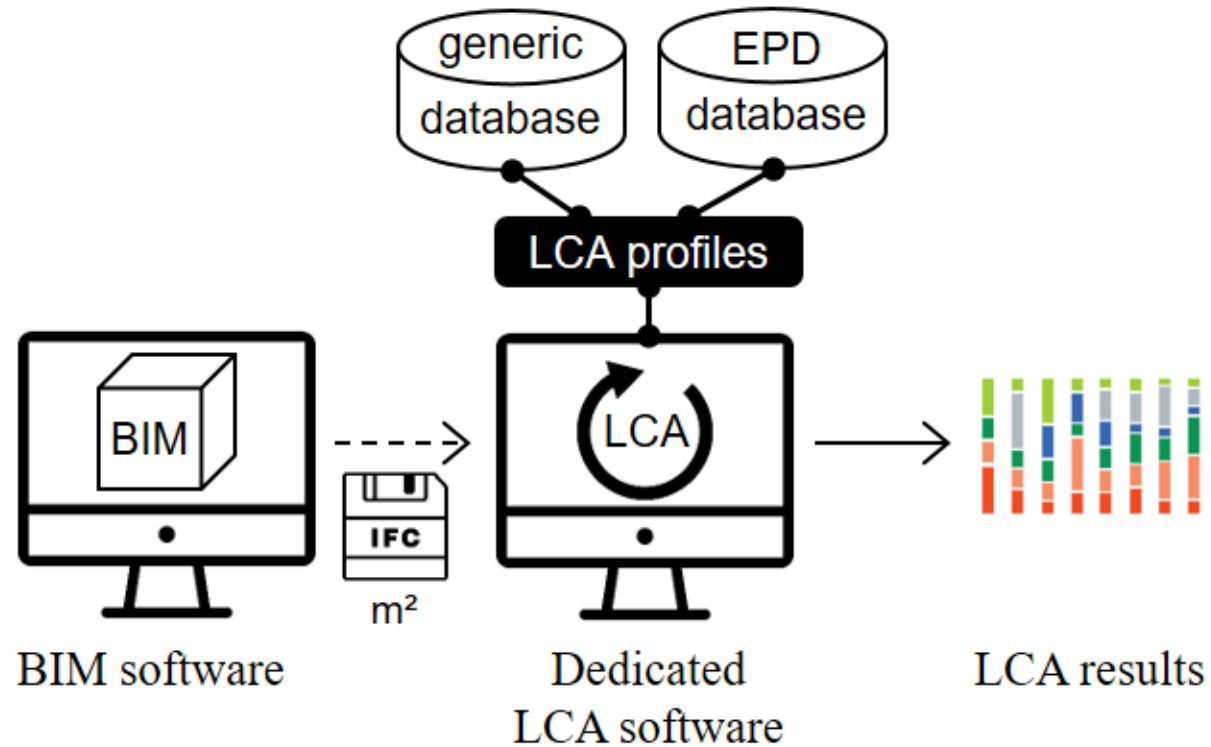
WORKFLOWS FOR INTEGRATION OF BIM AND LCA

Strategy 1: Bill of quantities export



WORKFLOWS FOR INTEGRATION OF BIM AND LCA

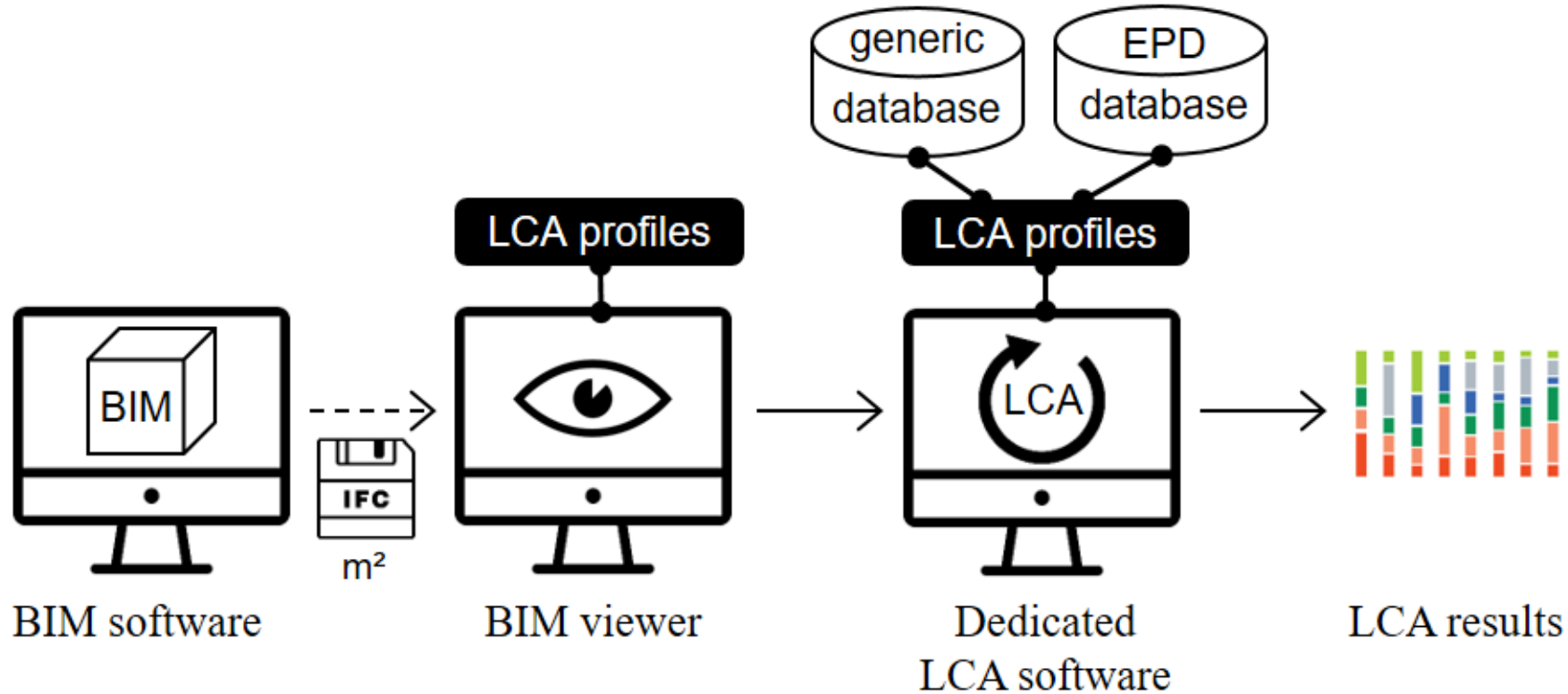
Strategy 2: IFC import of surfaces



e.g. **totem**
CREATE | EVALUATE | INNOVATE

WORKFLOWS FOR INTEGRATION OF BIM AND LCA

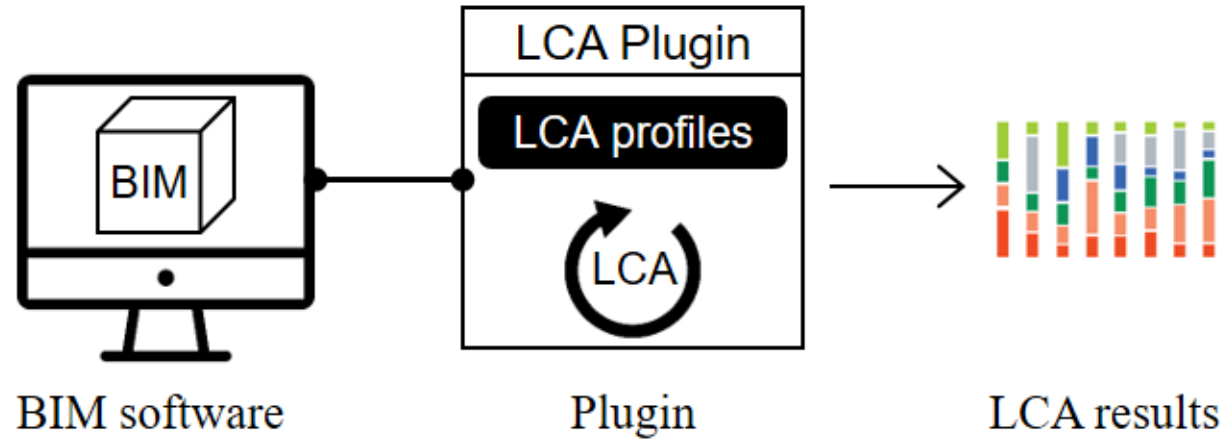
Strategy 3: BIM viewer for linking LCA profiles



e.g.  eveBIM

WORKFLOWS FOR INTEGRATION OF BIM AND LCA

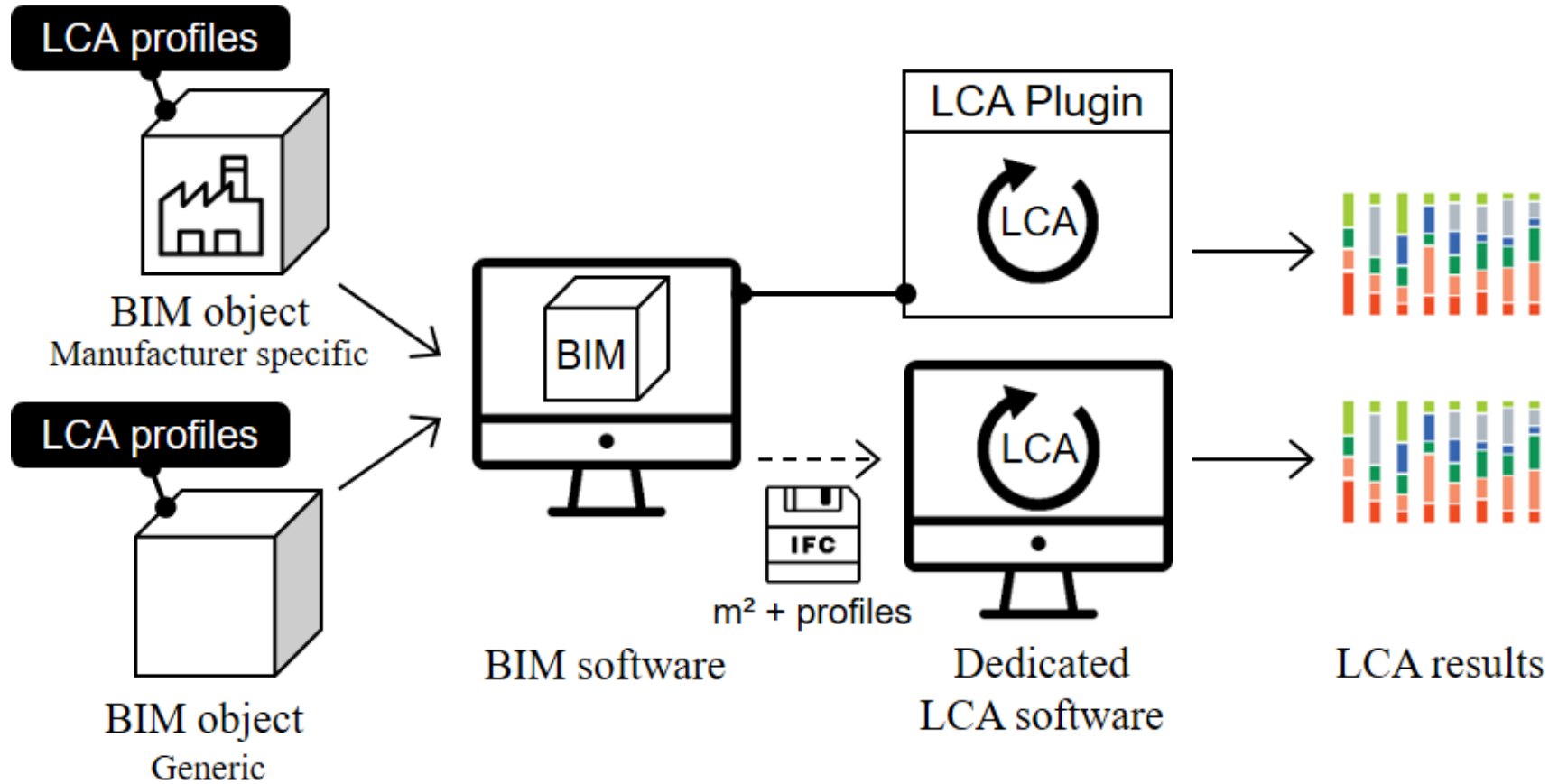
Strategy 4: LCA plugin for BIM software



e.g. One Click 
tally[®]

WORKFLOWS FOR INTEGRATION OF BIM AND LCA


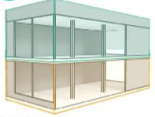
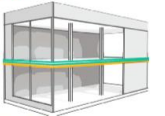
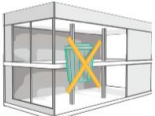


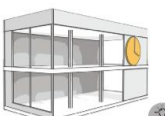





Strategy 5: LCA enriched BIM objects



Objective of the LCA study

- Structural works
 - LCA in early phases feasible, due to low variety in used materials
 - Architecture / Early design
 - LCA on building element rather than building level
 - Technical installations
 - Too complex?
- Conflicting **modelling conventions** for different disciplines / phases
- Different **levels of detail** for different disciplines / phase

ELEMENTNIVEAU

 <p>Overeenkomstig de bouwkundige functie</p> <p>Gebruik de overeenkomstige bouwkundige functie voor elementen (bv. vloer als 'vloer').</p> <p>Exporteer naar correcte entiteiten (bv. IfcSlab).</p> <p>[5.4.2.1]</p>	 <p>Per verdieping</p> <p>Modelleer elementen per verdieping indien ze effectief zo gebouwd zullen worden en ken ze aan de juiste verdieping toe.</p> <p>[5.4.2.2]</p>
 <p>Opdelen van elementen</p> <p>Deel elementen op volgens homogene eigenschappen (functie, uitvoeringsvolgorde ...).</p> <p>[5.4.2.3]</p>	 <p>Wijzigen in plaats van verwijderen</p> <p>Wijzig het element (indien mogelijk) bij een gewenste aanpassing zonder functiewijziging, in plaats van het te verwijderen. Zo blijft dit element identificeerbaar en traceerbaar.</p> <p>[5.4.2.4]</p>
 <p>Intersecties</p> <p>Vermijd dubbele elementen of intersecties van elementen.</p> <p>[5.4.2.6]</p>	 <p>Sparingen en openingen</p> <p>Gebruik sparingscomponenten opdat sparingen telbaar zouden zijn en beheerd zouden kunnen worden.</p> <p>Exporteer naar de entiteit IfcBuildingElementProxy, met PredefinedType = PROVISIONFORVOID.</p> <p>[5.4.2.7]</p>
 <p>Toestand van elementen</p> <p>Maak afspraken over het toewijzen van verschillende toestanden (nieuwe toestand, bestaande toestand, afbraak ...) aan elementen.</p> <p>Exporteer naar de eigenschap Status bij de Property Set van de entiteit.</p> <p>[5.4.2.8]</p>	 <p>Indicatieve elementen[®] ('dummy')</p> <p>Maak afspraken rond de aanduiding van indicatieve elementen (dummy-elementen).</p> <p>[5.4.2.9]</p>
 <p>Identificatie van elementen</p> <p>Gebruik een gemeenschappelijk classificatiesysteem, naamgeving en/of nummering en het juiste type voor elementen.</p> <p>Maak gebruik van correcte Attributes, Property Sets en Classification.</p> <p>[5.4.3.1]</p>	 <p>Materiaal</p> <p>Voorzie de elementen van een materiaalbeschrijving.</p> <p>[5.4.3.2]</p>
 <p>Gewenste informatie</p> <p>Maak afspraken rond de te verwachten LOD-niveaus en voorzie de gewenste eigenschappen bij de elementen.</p> <p>Gebruik zo veel mogelijk de standaard-eigenschappen (Property Sets).</p> <p>[5.4.3.3-5.4.3.5]</p>	 <p>Hoeveelheden berekenen</p> <p>Maak afspraken rond het berekenen van hoeveelheden van de elementen aan de hand van bouw-informatiemodellen.</p> <p>Gebruik zoveel mogelijk de standaard-hoeveelheden (Quantity Sets).</p> <p>[5.4.4]</p>

[®] Element dat in een deelmodel slechts ter illustratie weergegeven wordt.

State of play

- BIM is the new way of working and efficiently exchanging information in the construction industry
- Environmental performance (LCA) becomes part of “general” building assessment
- Practitioners want to use LCA, but **integration and use must be “easy”**

Types of integration in practice

- **Notions of LCA** → Gaining insights in environmental performance based on available data and models
 - OVERALL BUILDING ASSESSMENT: basic check in BIM environment (cfr. EPBD)
 - SPECIFIC MATERIAL CHOICES: basic comparisons within the BIM environment (cfr. BIM objects with manufacturer data)
 - **LCA expert assessment** → Performing detailed assessment for environmental optimisation
 - Consider effects of different assumptions, compositions, ...
 - Need for expert LCA environment but with easy transfer of data on building composition
- Different needs depending on goal of integration
- Need for more insights on needs throughout the design and construction process

Identification and comparison of LCA-BIM integration strategies

L Wastiels and R Decuypere

2019 *IOP Conf. Ser.: Earth Environ. Sci.* **323** 012101

<https://doi.org/10.1088/1755-1315/323/1/012101>

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SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL PERFORMANCE | **BELGIAN BUILDING RESEARCH INSTITUTE**

This research has been made possible thanks to the Federal Department of Economy (FOD Economie), the Belgian standardisation body (NBN) and the FEDER Living Lab project (European Fund for Regional Development and Brussels Capital Region)

