Nada Bendahmane

Development of sustainability indicators for mineral and metallic resources in the building sector: The MiMOSA method

MINES Saint-Étienne
Une école de l'IMT

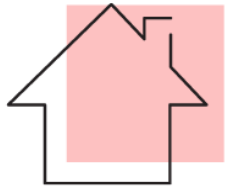
CSTB
le futur en construction

EVS
Environnement Ville Société

The building sector

1.6 t/m²

1.2 t/m²



50% of all extracted material in the EU

35% of the EU's total waste generation

46 million tons of waste every year in France

93% non-hazardous mineral waste

The circular economy is a promising way to optimize the management of mineral and metal resources in the building sector.

Alliance HQE , 2019
Ministère français de la transition écologique, 2020

Introduction

Mining and quarrying activities have a significant environmental impact

There is a decrease in the reserves of natural resources

The building sector is a big consumer of mineral and metal resources

The building sector is a major producer of waste

The circular economy is a promising way to optimize the management of mineral and metal resources in the building sector.

The building sector stakeholders need tools to better identify the challenges of mineral and metal resources and enable their optimal use in a circular economy approach

Is the consumption of mineral and metal resources of a given building project sustainable?

Sustainable consumption

Excessive consumption

Mineral and metal resource consumption of a given building project

MiMOSA

Mineral and Metal absOlute Sustainable Assessment

Requirements

- Assessing sustainability in an **absolute** rather than relative way
- Integrate the materials issued from the **circular economy**
- Consider the **spatial scale adapted** to each material
- Take into account the **temporality of the availability** of the materials issued from the circular economy and their **quality**

Hypothesis

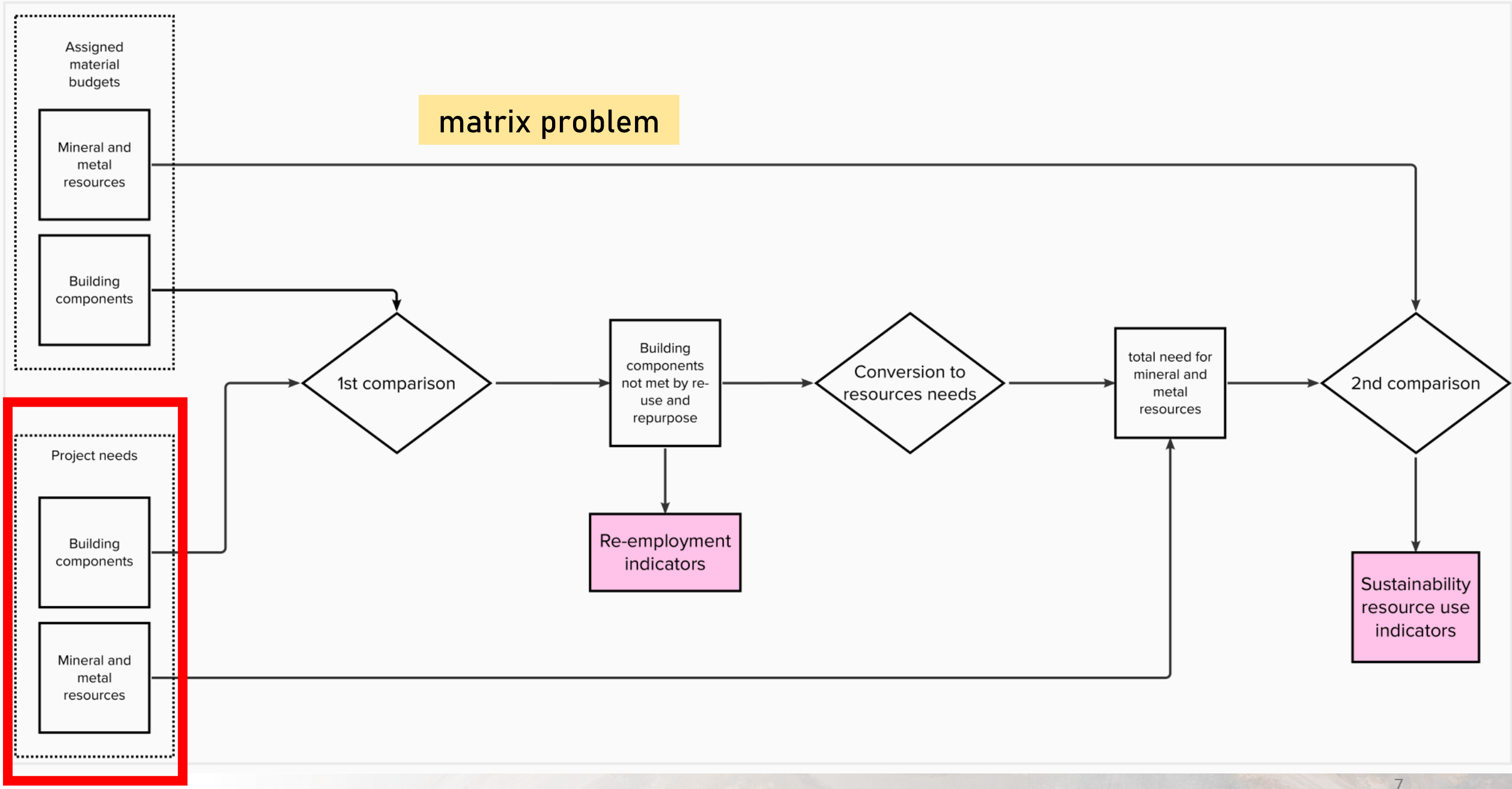
- **Strong sustainability** approach
- **Zero natural extraction** for all the activity sectors
- A sustainable material use is the one **limited to the materials issued for reuse, repurpose and recycle**
- Assigning **equal importance to all resources** by developing indicators for each of them

➢ **Measure the efforts** needed to reach a total circular economy.
➢ Identify the **main obstacles of the deployment of the circular economy** in the building sector

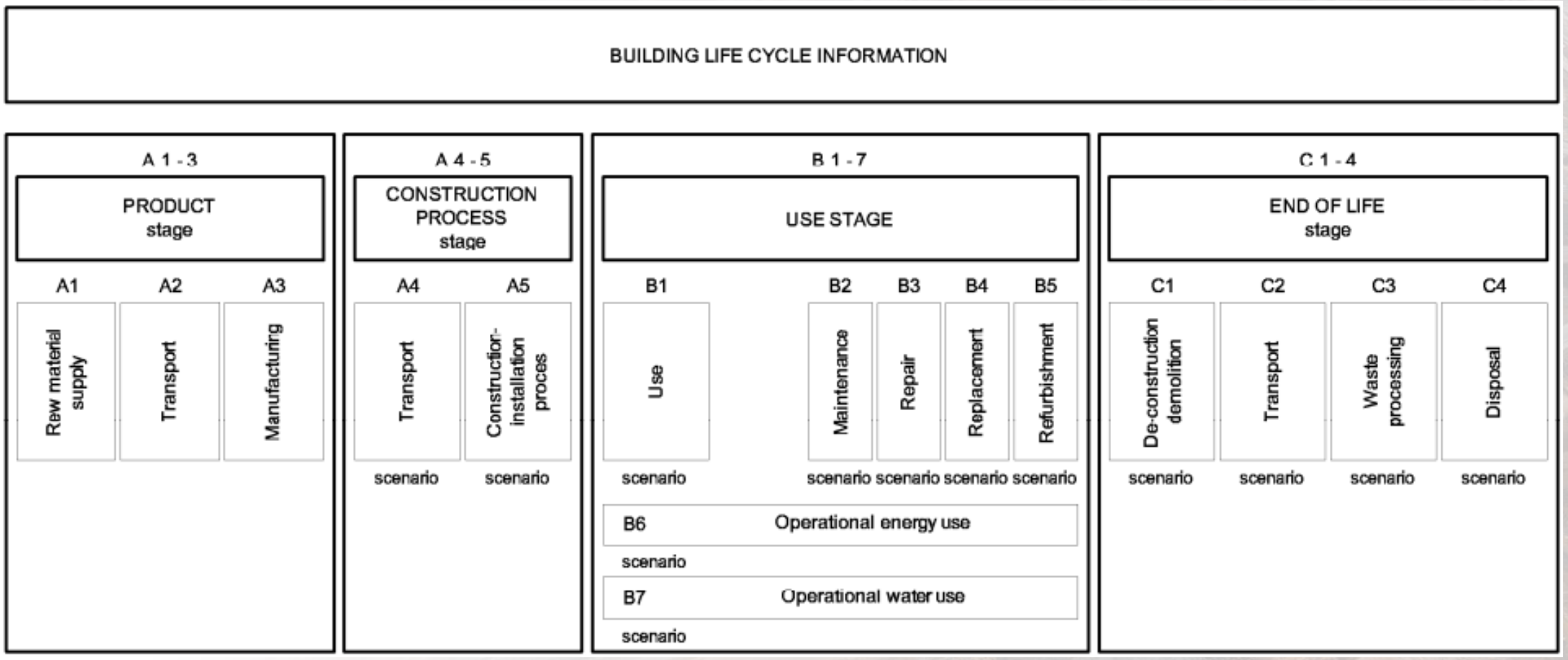
Two nomenclatures are considered:

- Nomenclature of construction products and building equipment

- Nomenclature of mineral and metal resources

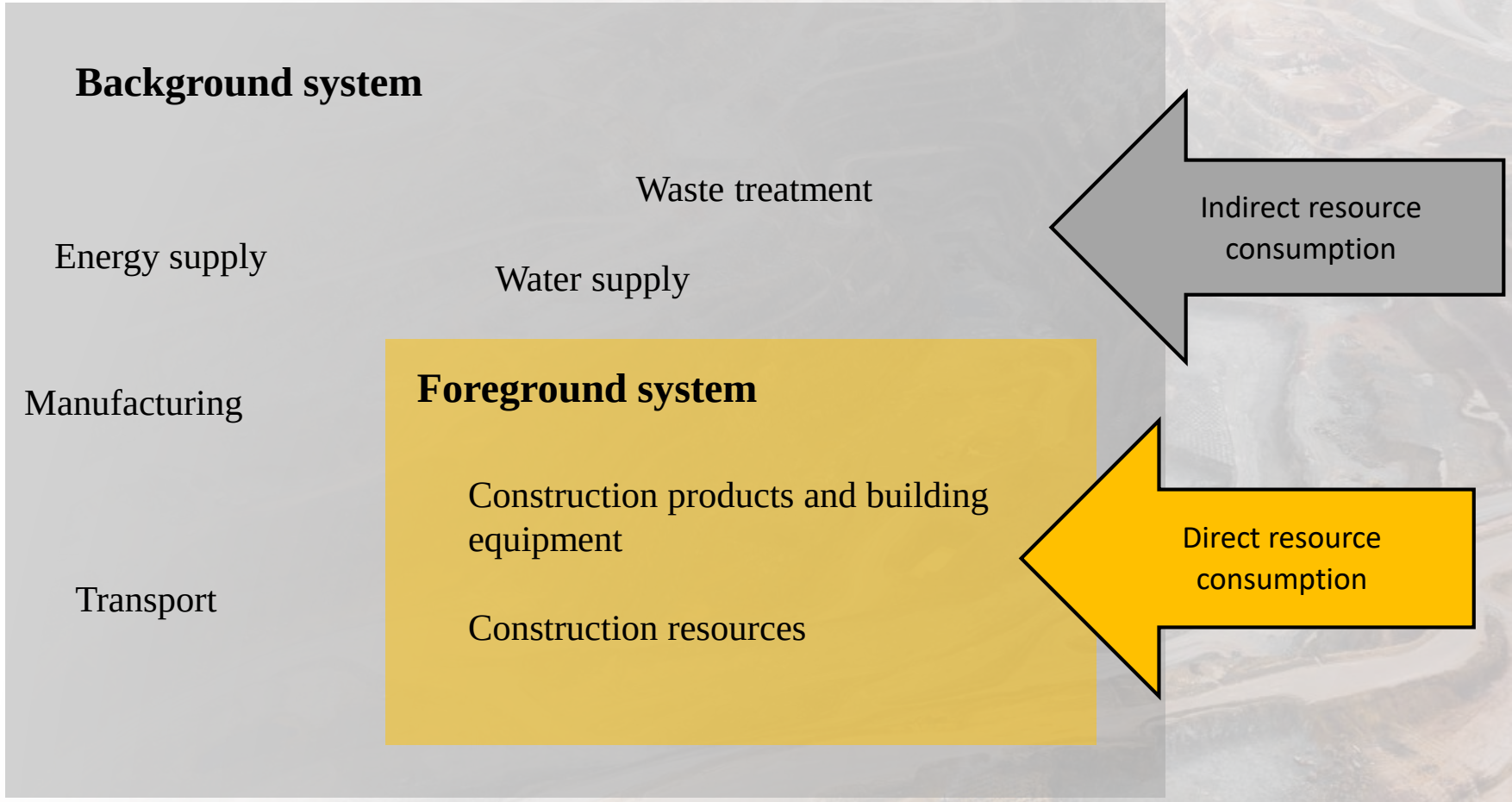

matrix problem
Assigned material budgets
Mineral and metal resources
Building components
Project needs
Building components
Mineral and metal resources
1st comparison
Building components not met by re-use and repurpose
Re-employment indicators
Conversion to resources needs
total need for mineral and metal resources
2nd comparison
Sustainability resource use indicators

Project needs

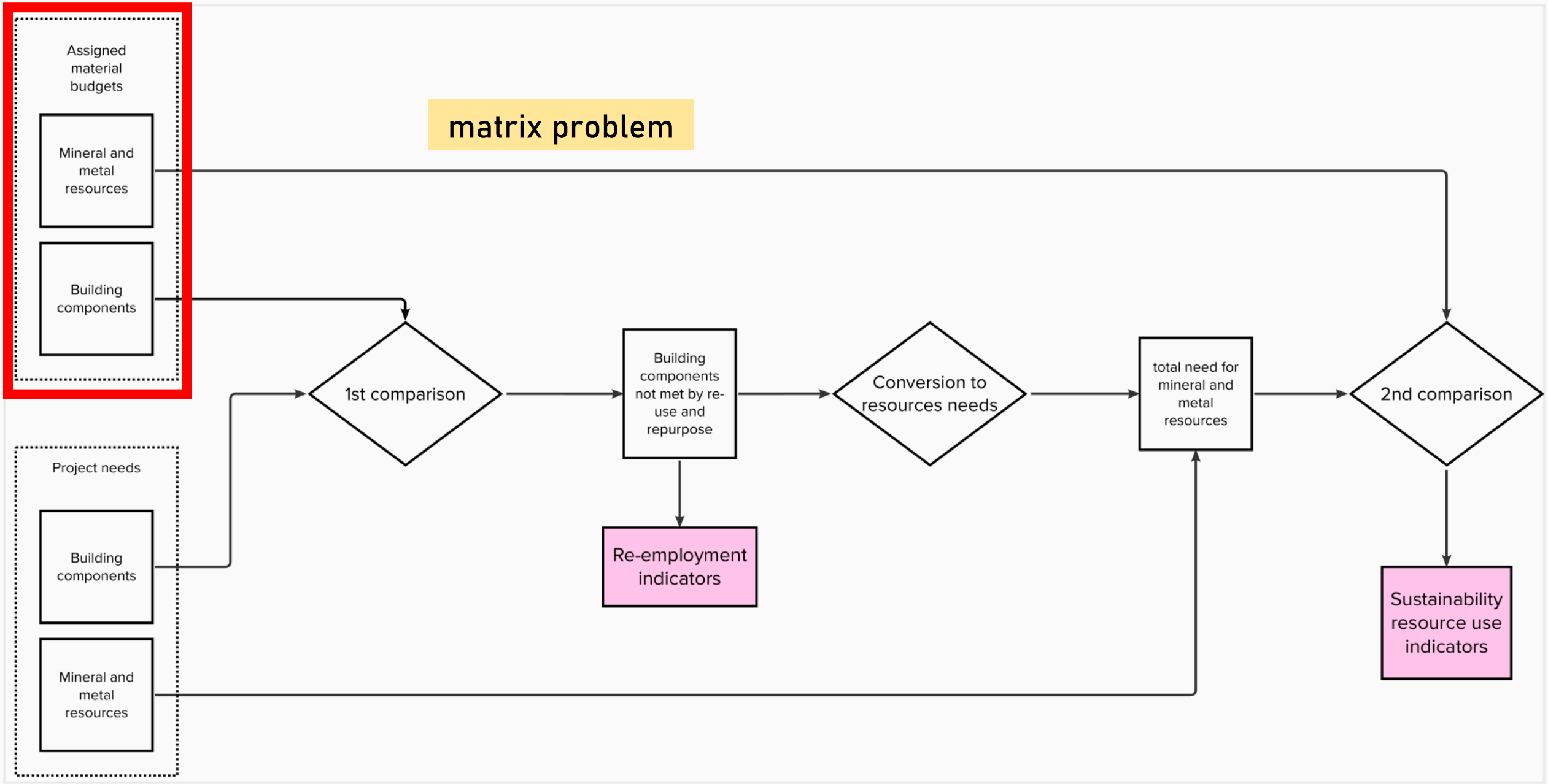


NF EN 15978 Sustainability of construction works Assessment of environmental performance of buildings

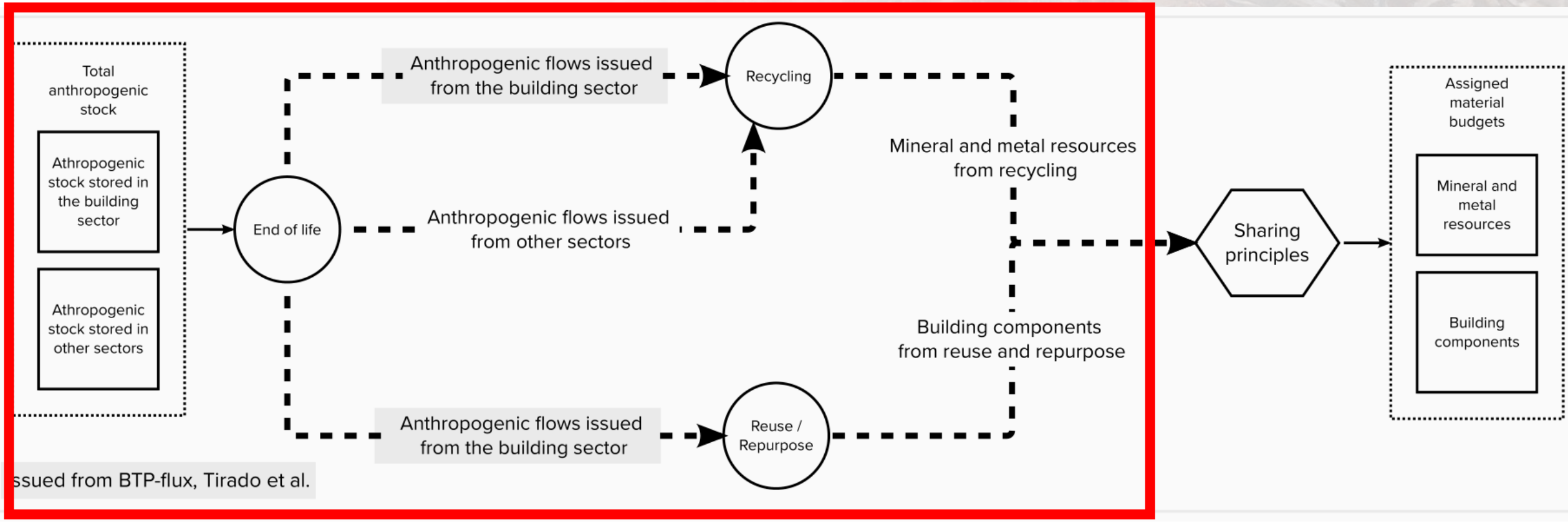
Project needs



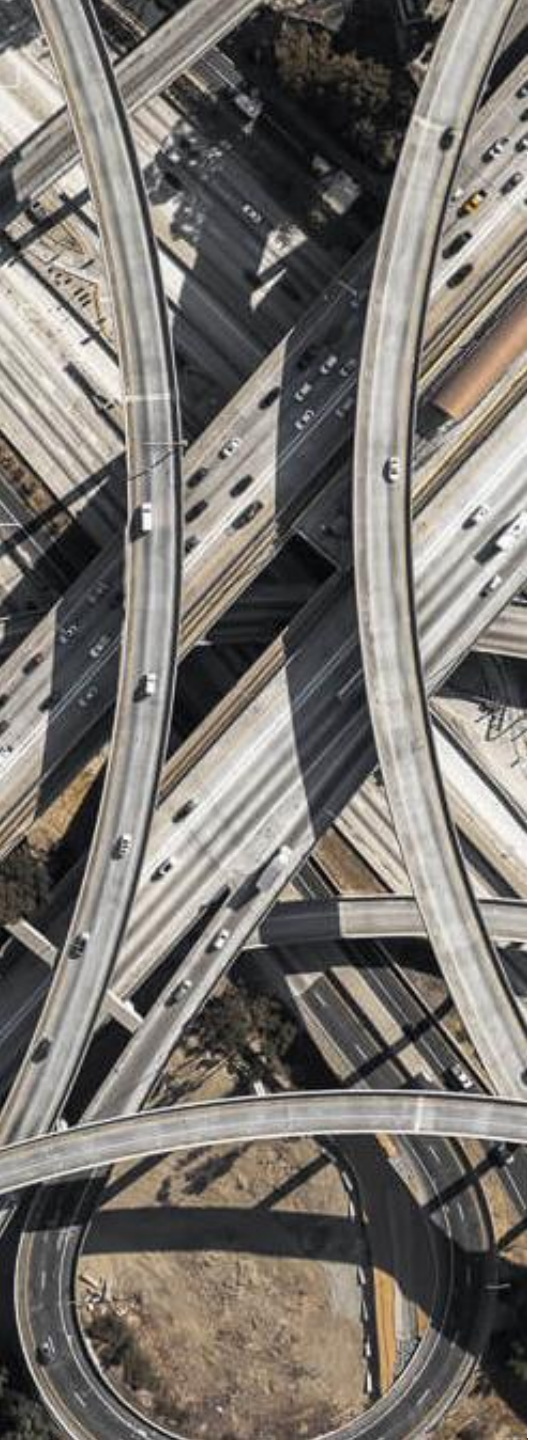
matrix problem



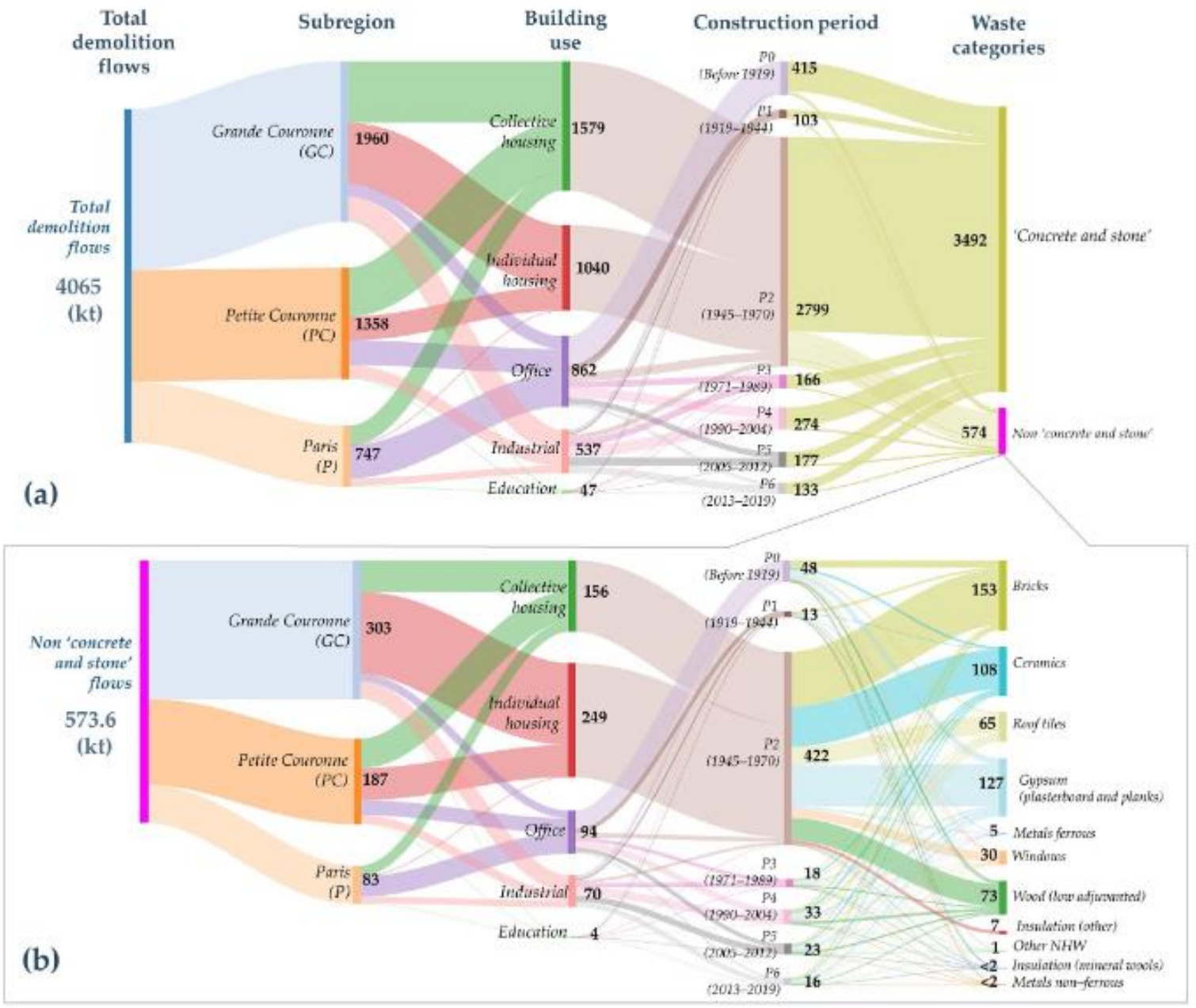
Assigned material budgets



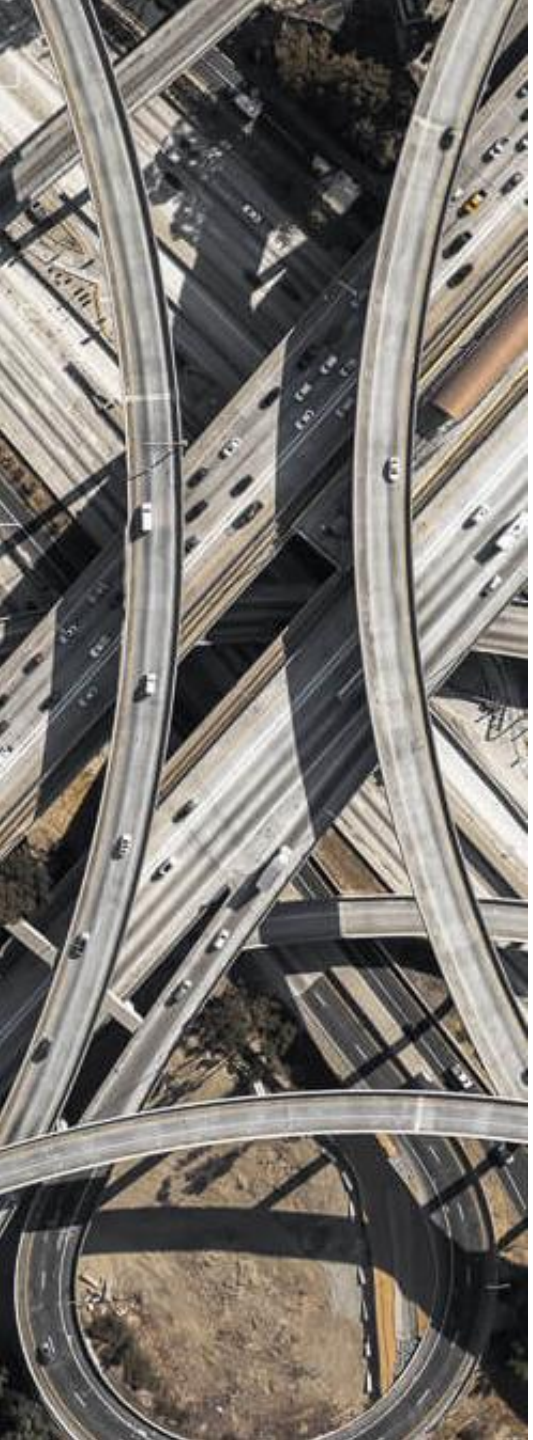
Identification and quantification of the flows issued from reuse, repurpose and recycling from the building sector



BTPflux



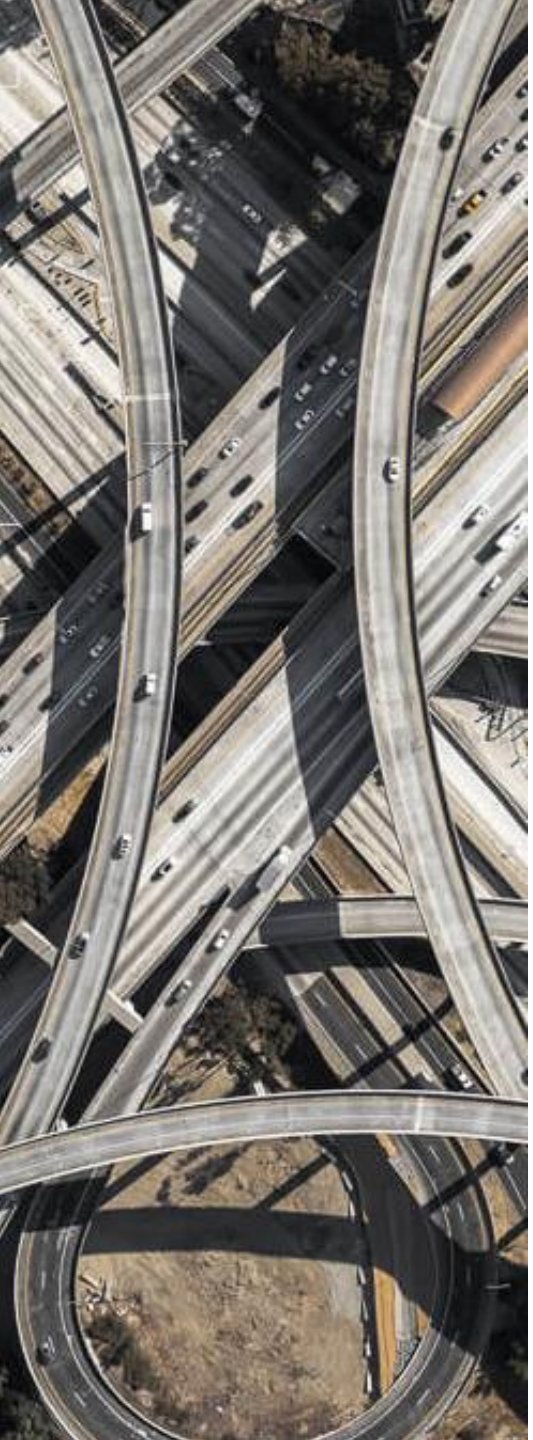
le-de-France building material flows by waste categories. Tirado R. et al., 2021



- The flows are aggregated and expressed by waste category and not in the nomenclatures of the MiMOSA method

Sarah Clavier internship

IW: bricks
IW: ceramics
IW: concrete and stone
IW: roof tiles
NHW: gypsum plasterboards and planks
NHW: insulation mineral wools
NHW: insulation other
NHW: metals ferrous
NHW: metals non ferrous
NHW: windows
NHW: wood low adjuvanted
Other NHW



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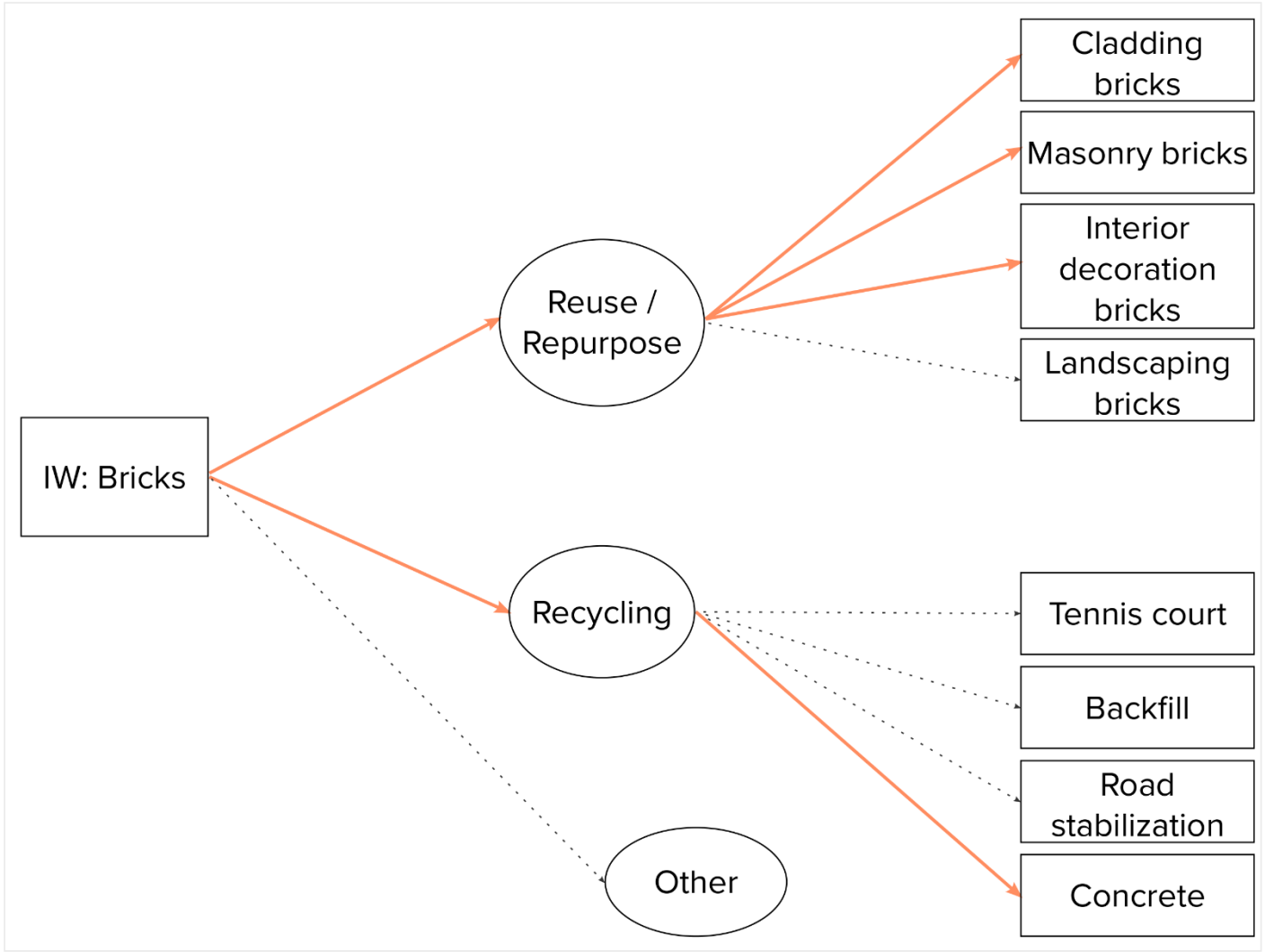
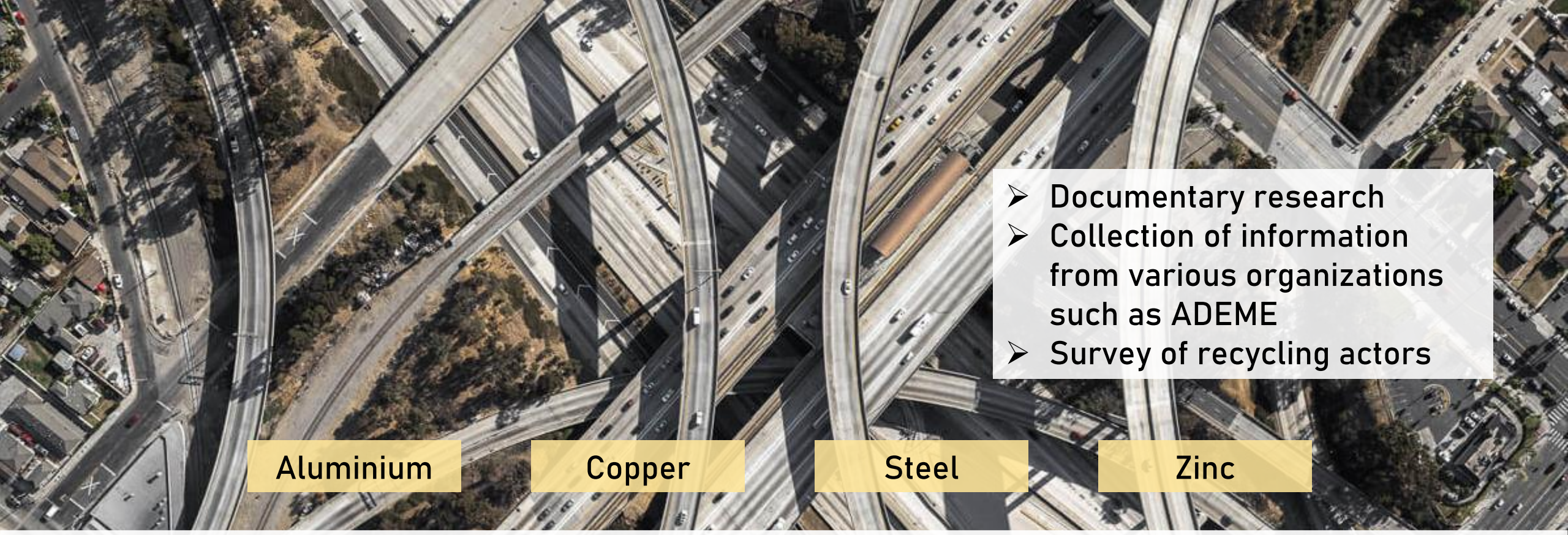
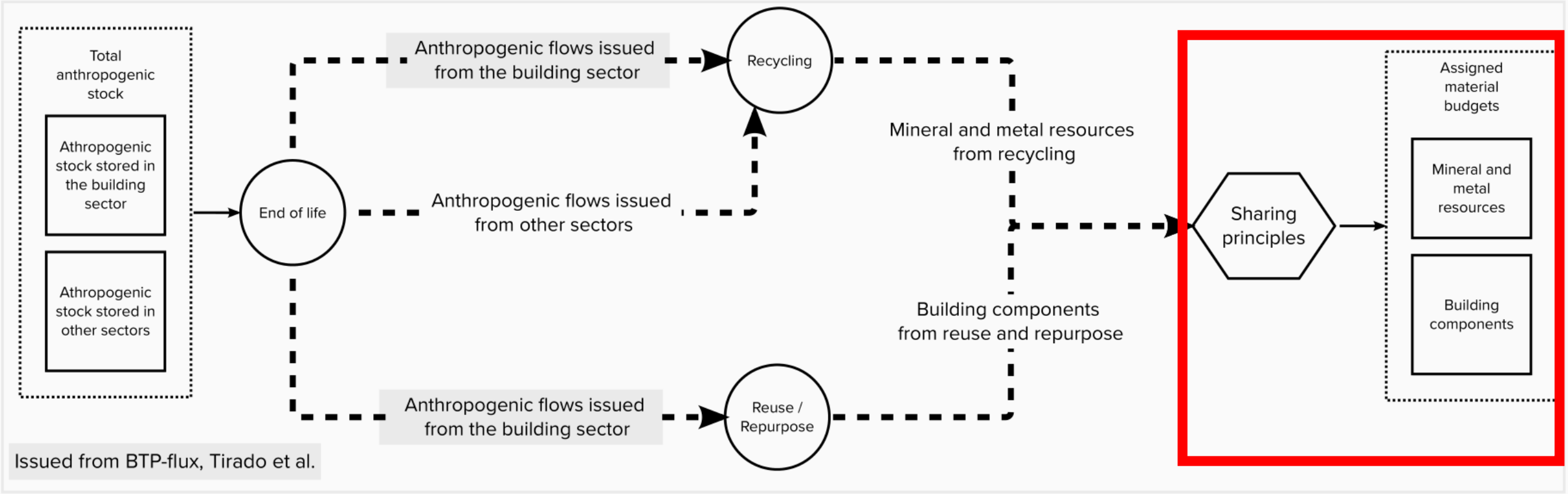

IW: Bricks
Reuse / Repurpose
Recycling
Other
Cladding bricks
Masonry bricks
Interior decoration bricks
Landscaping bricks
Tennis court
Backfill
Road stabilization
Concrete



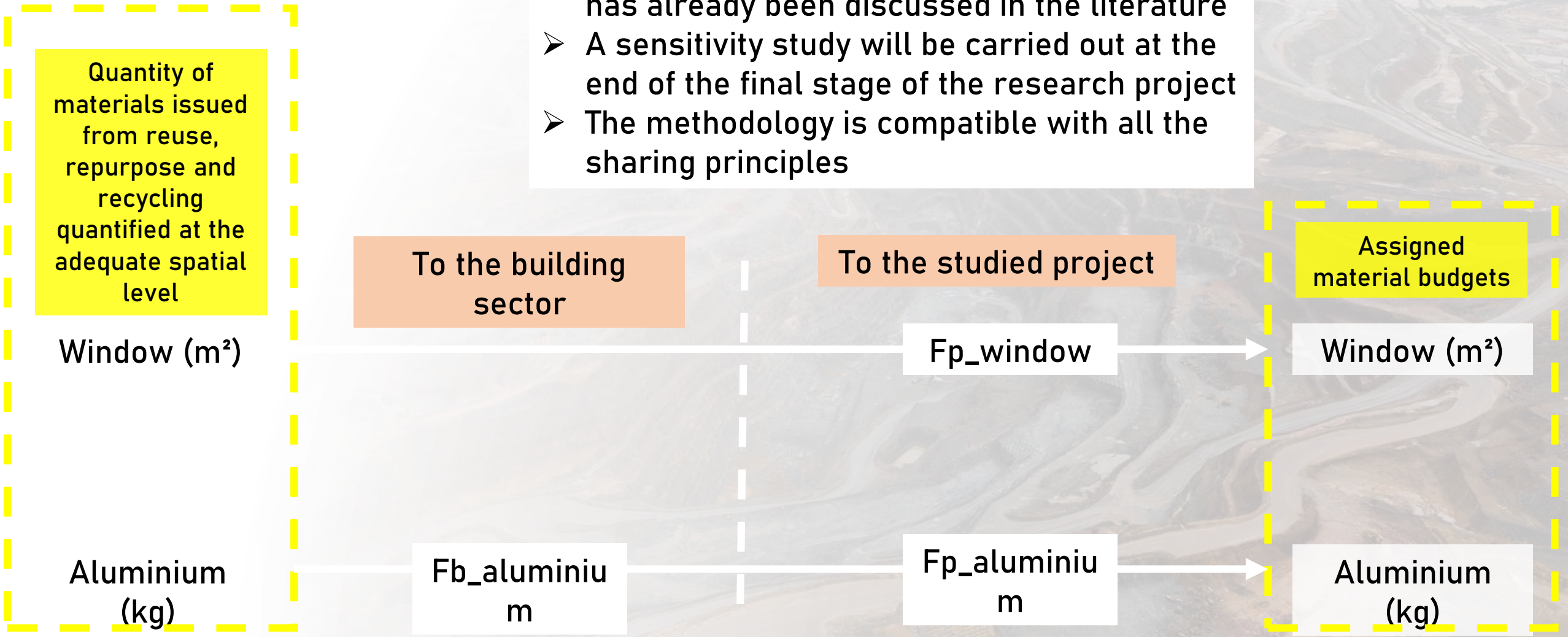
- Documentary research
- Collection of information from various organizations such as ADEME
- Survey of recycling actors

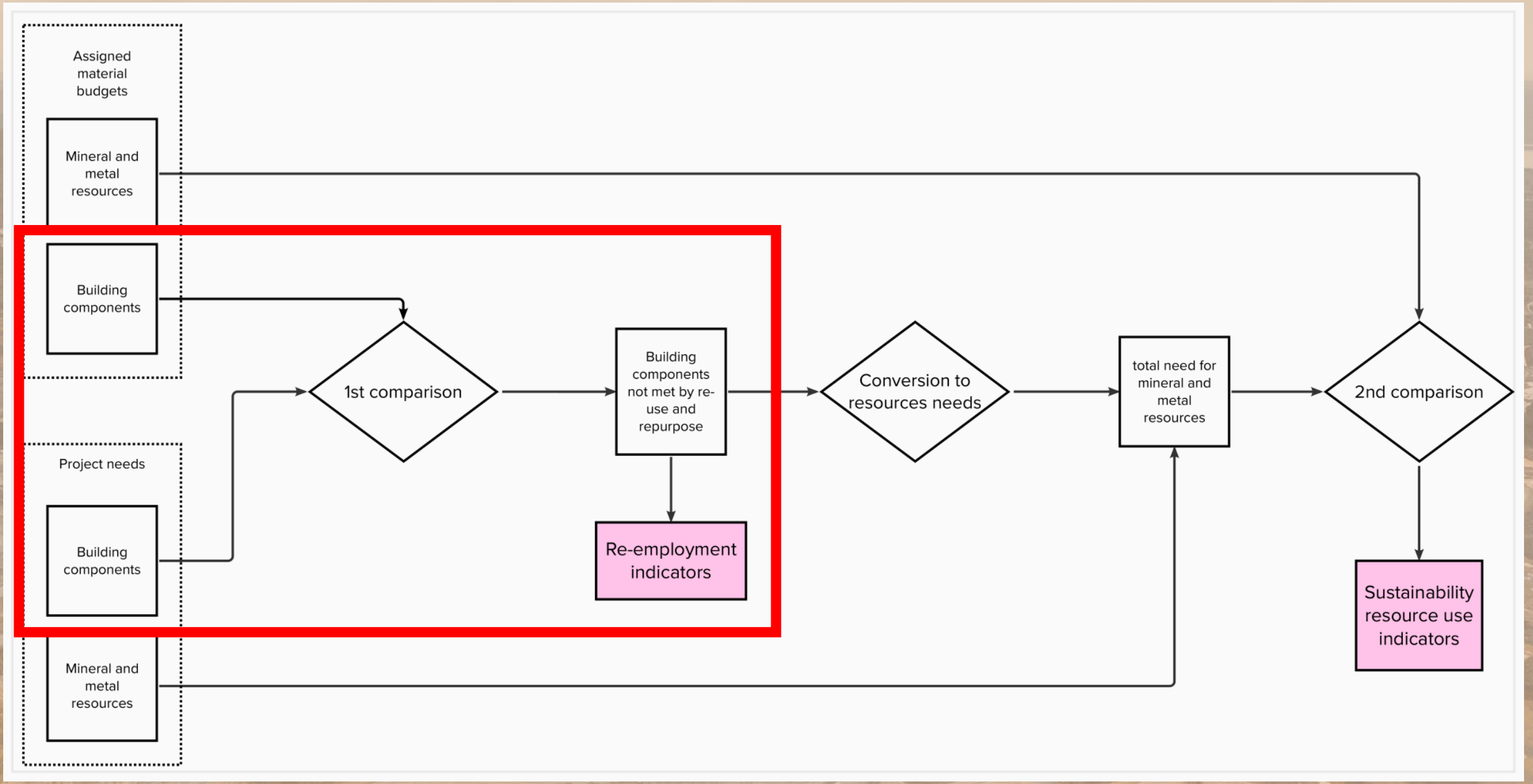
Aluminium | Copper | Steel | Zinc

Identification and quantification of the flows issued from recycling from the other sectors


Total anthropogenic stock
Athropogenic stock stored in the building sector
Athropogenic stock stored in other sectors
End of life
Anthropogenic flows issued from the building sector
Recycling
Anthropogenic flows issued from other sectors
Anthropogenic flows issued from the building sector
Reuse / Repurpose
Mineral and metal resources from recycling
Building components from reuse and repurpose
Sharing principles
Assigned material budgets
Mineral and metal resources
Building components
Issued from BTP-flux, Tirado et al.

- The choice of the sharing principles is more a matter of ethic and political choices and has already been discussed in the literature
- A sensitivity study will be carried out at the end of the final stage of the research project
- The methodology is compatible with all the sharing principles

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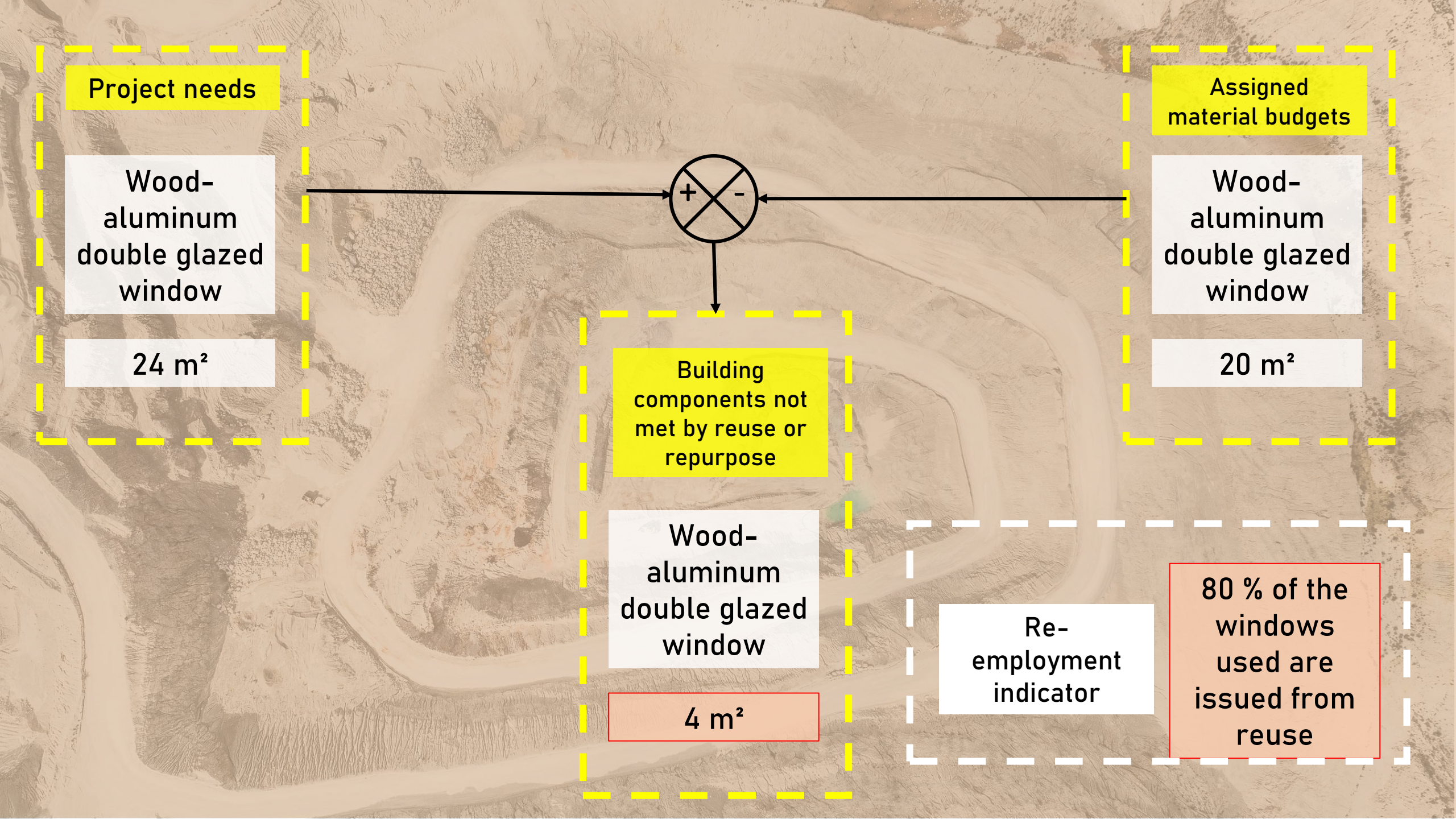
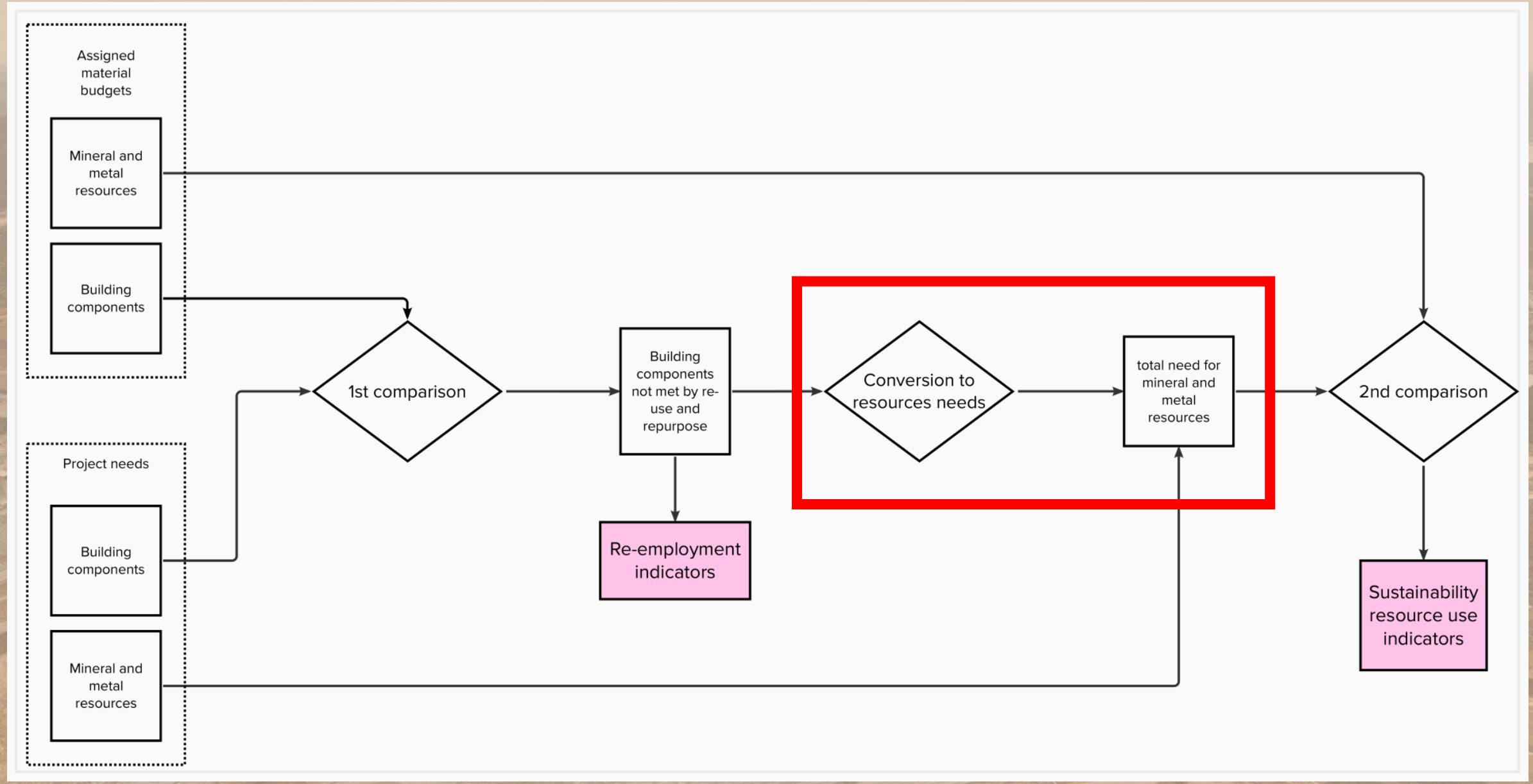
Sustainability resource use indicators


Project needs
Wood-aluminum double glazed window
24 m²
+
-
Assigned material budgets
Wood-aluminum double glazed window
20 m²
Building components not met by reuse or repurpose
Wood-aluminum double glazed window
4 m²
Re-employment indicator
80 % of the windows used are issued from reuse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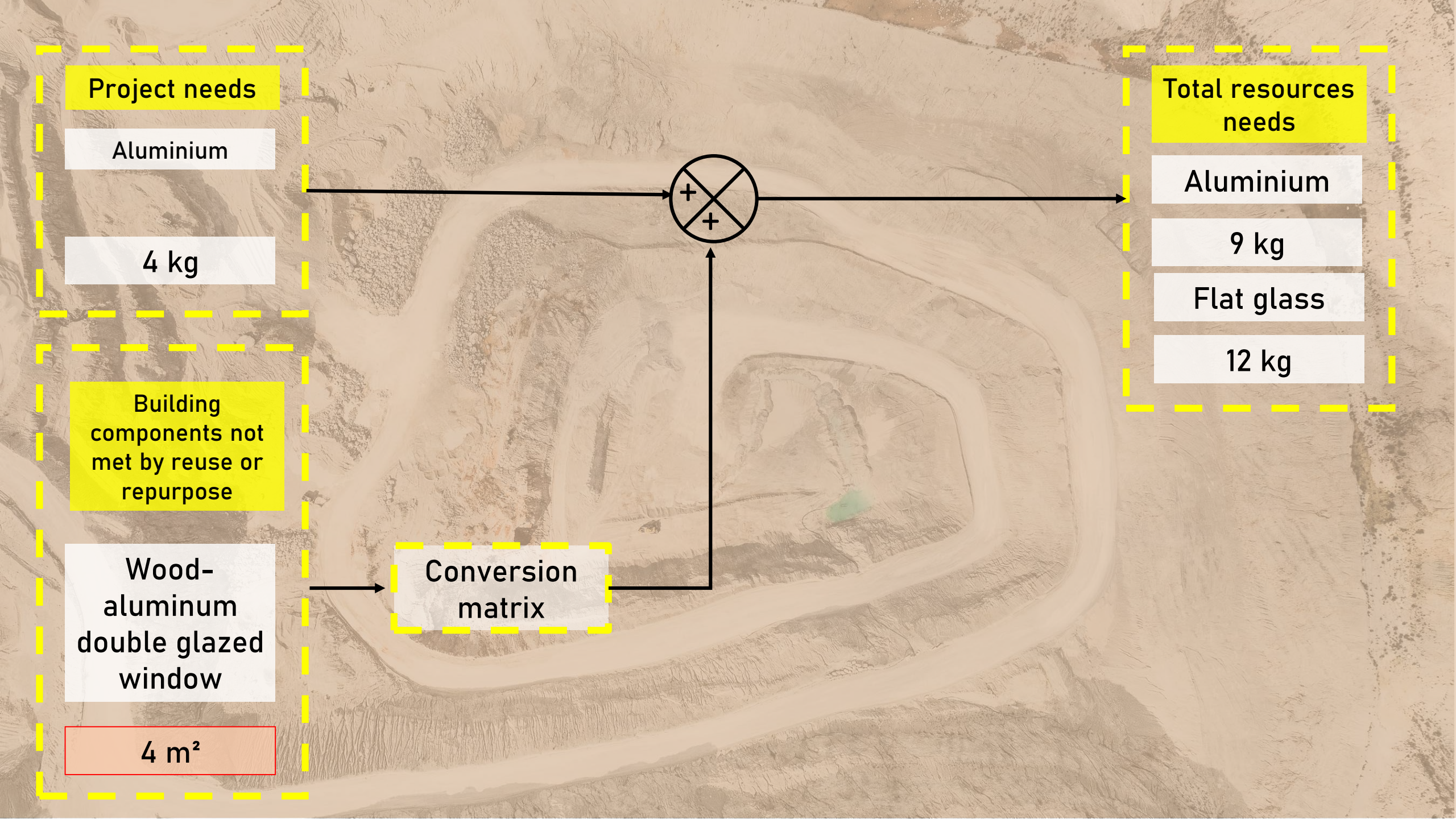
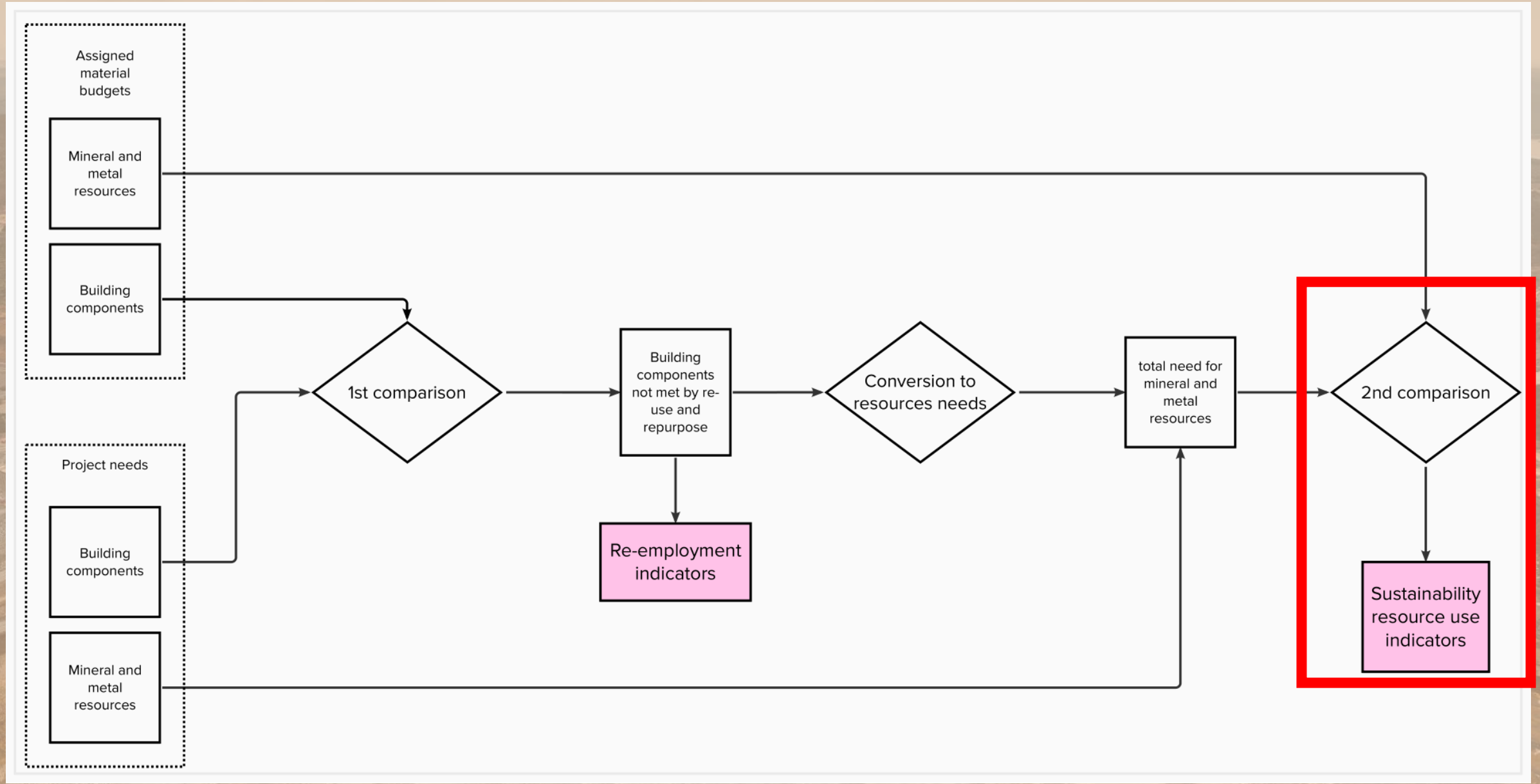

Project needs
Aluminium
4 kg
Building components not met by reuse or repurpose
Wood-aluminum double glazed window
4 m²
Conversion matrix
Total resources needs
Aluminium
9 kg
Flat glass
12 kg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Sustainability resource use indicators

Total resources needs

Aluminium

9 kg

Flat glass

12 kg

Is

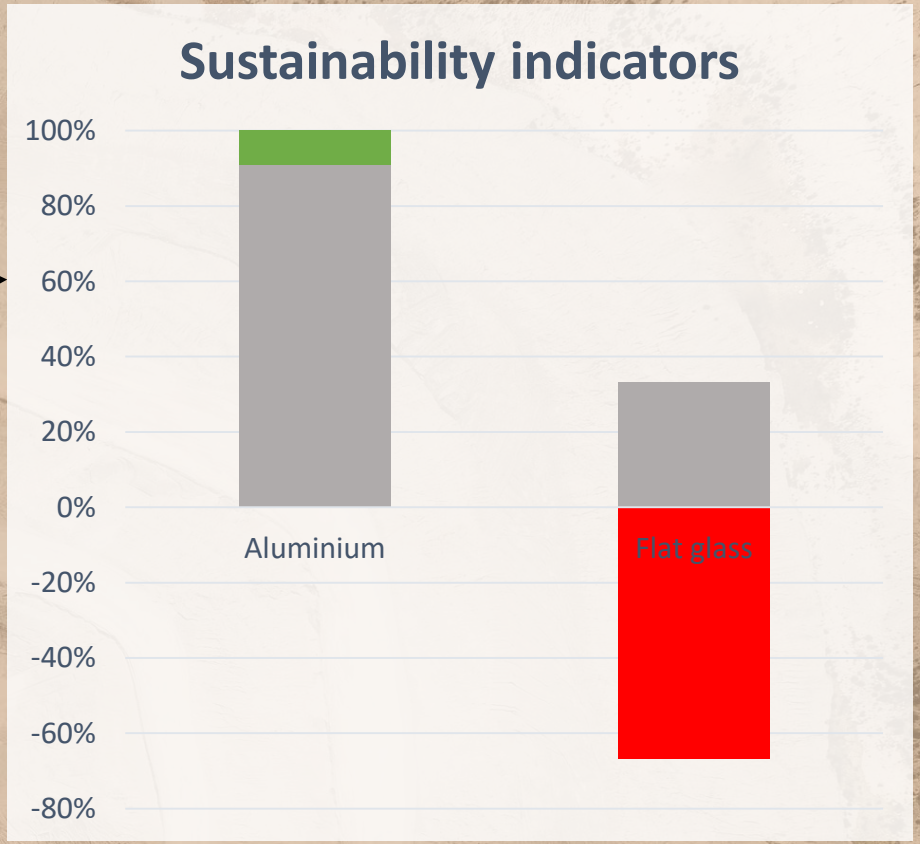
Assigned material budgets

Aluminium

10 kg

Flat glass

4 kg



Conclusion

- The operationalization and the validation of the method will be done through a case study which will relate to two collective housing in Ile-de-France, one whose principal material is the concrete and the other one the wood

- Future work:
  - Complete the quantification of circular economy flows issued from the building sector and from the other sectors
  - Identify the sharing principles to assign the material budgets
  - Apply the methodology to the case study
  - Carry out a sensitivity study related to the sharing principles chosen and the parameters estimated to overcome the lack of data

Thank you

Photographs: Tom Hegen