UPCYCLING AND DFD
–
LCA OF BUILDINGS EMPLOYING CIRCULAR DESIGN STRATEGIES

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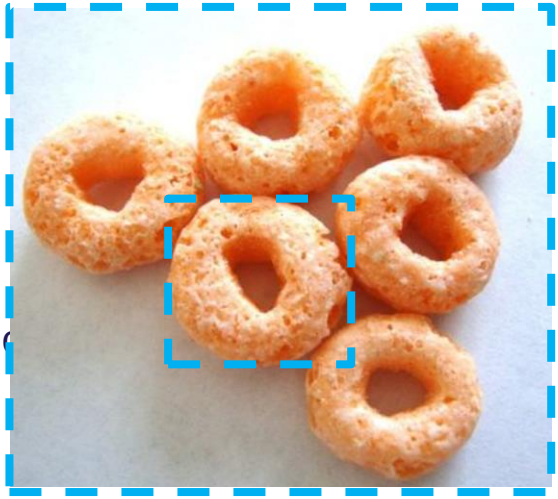
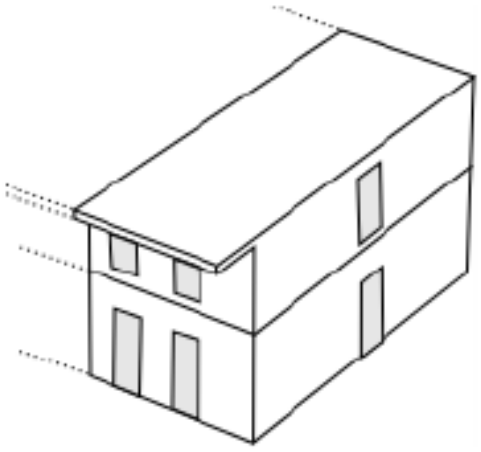
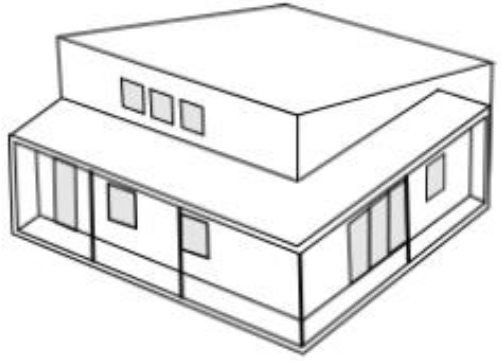
Motivation



- Upcycling and DfD: Two popular strategies employed in current building design
- Assessing the two different strategies with produ focus as outlined in EN 15804/15978
- Life cycle assessment as an evaluation tool
  - Flow of materials/components (all loops)
  - Single products/buildings (loop-by-loop)

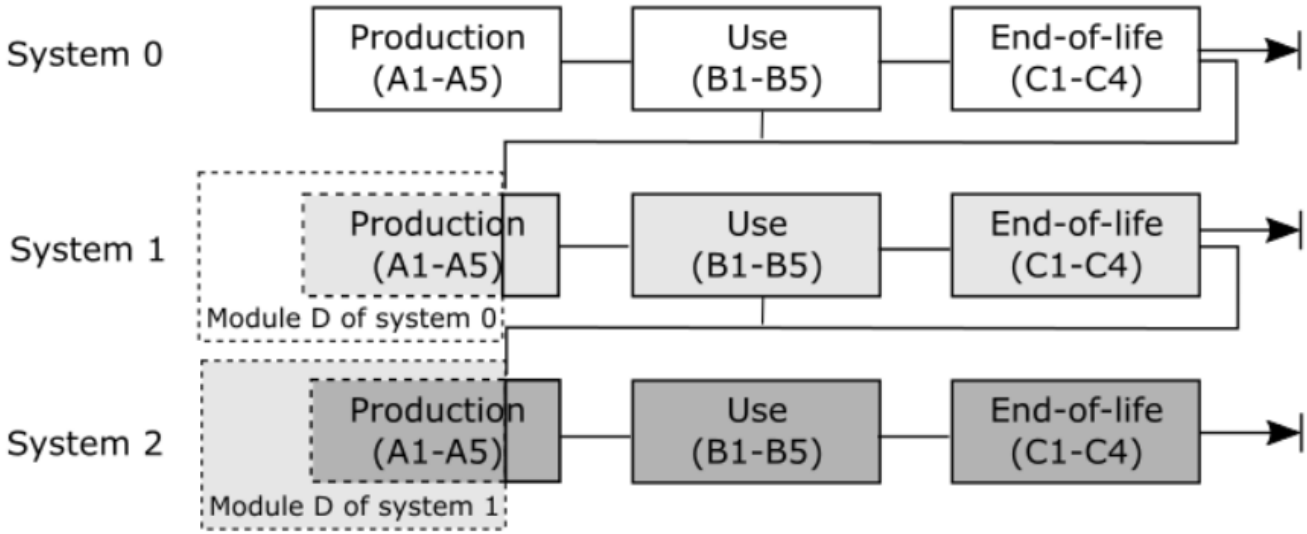
The buildings!





A first view of results

The allocation!



The assumptions!

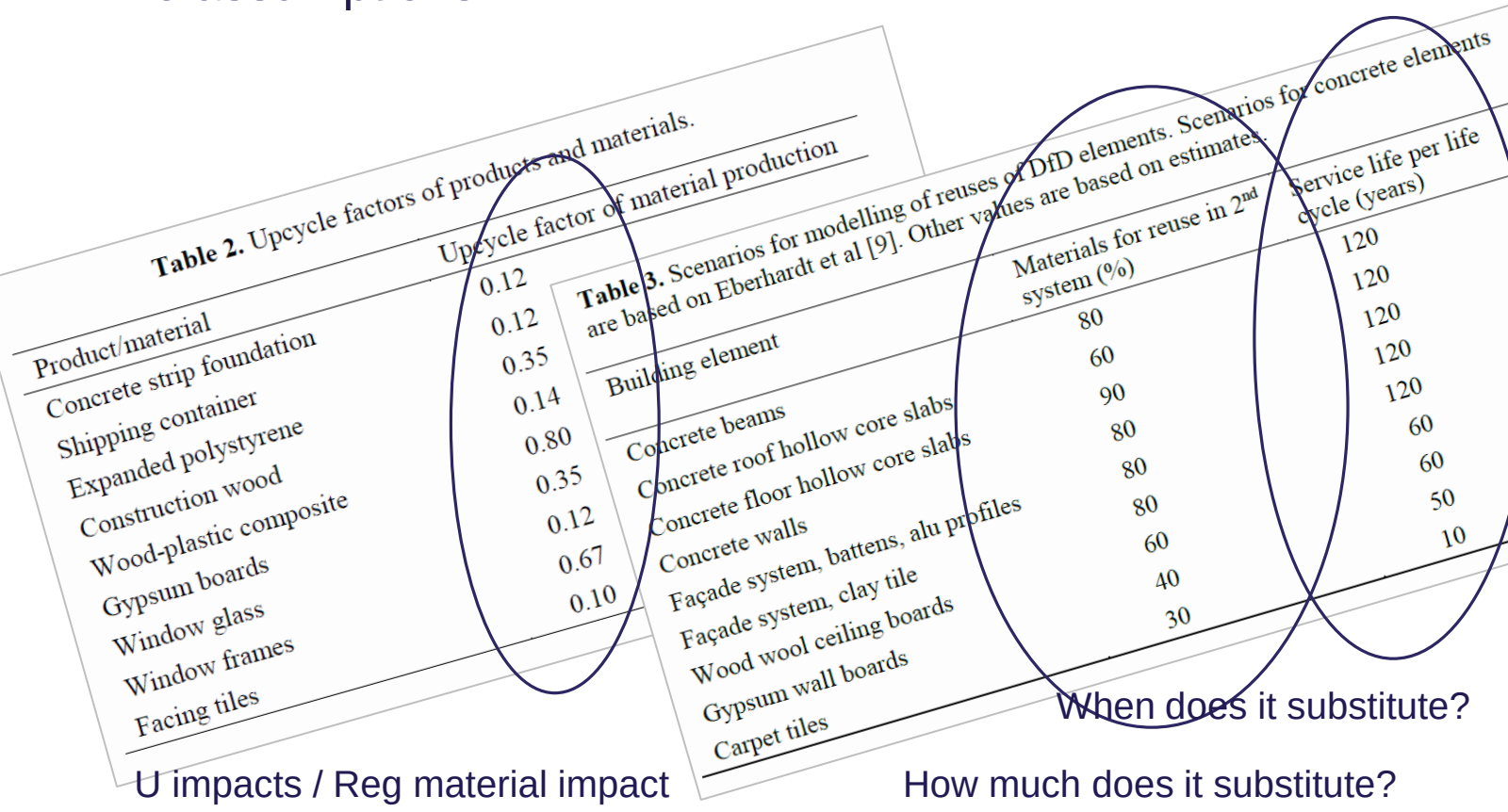


Table 2. Upcycle factors of products and materials.

Product/material	Upcycle factor of material production
Concrete strip foundation	0.12
Shipping container	0.12
Expanded polystyrene	0.35
Construction wood	0.14
Wood-plastic composite	0.80
Gypsum boards	0.35
Window glass	0.12
Window frames	0.67
Facing tiles	0.10

Table 3. Scenarios for modelling of reuses of DfD elements. Scenarios for concrete elements are based on Eberhardt et al [9]. Other values are based on estimates.

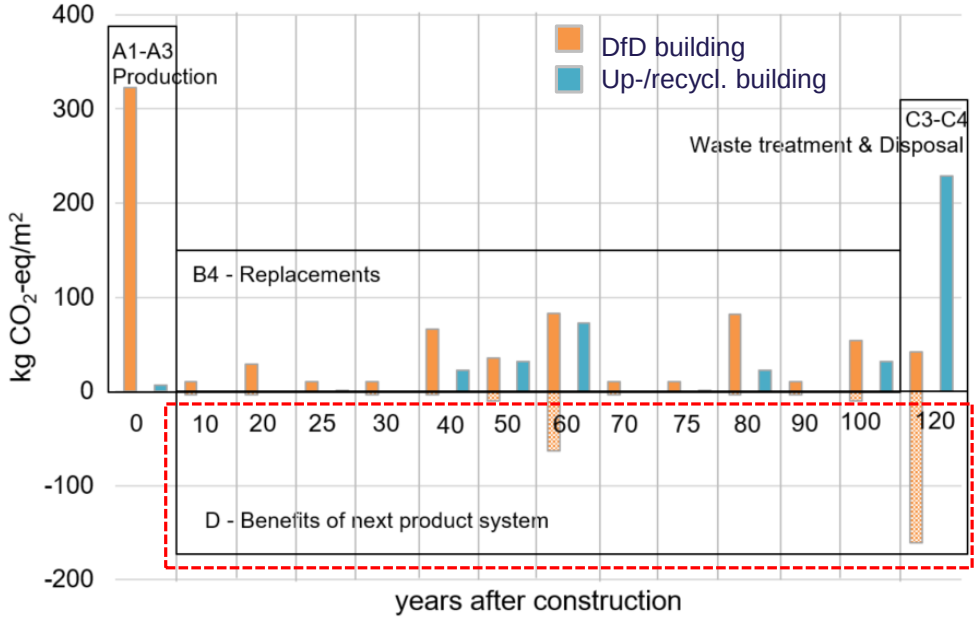
Building element	Materials for reuse in 2nd system (%)	Service life per life cycle (years)
Concrete beams	80	120
Concrete roof hollow core slabs	60	120
Concrete floor hollow core slabs	90	120
Concrete walls	80	120
Façade system, battens, alu profiles	80	60
Façade system, clay tile	60	60
Wood wool ceiling boards	40	50
Gypsum wall boards	30	10
Carpet tiles		

When does it substitute?

U impacts / Reg material impact

How much does it substitute?

Back to this



GWP in kg CO_2-eq/m^2/year

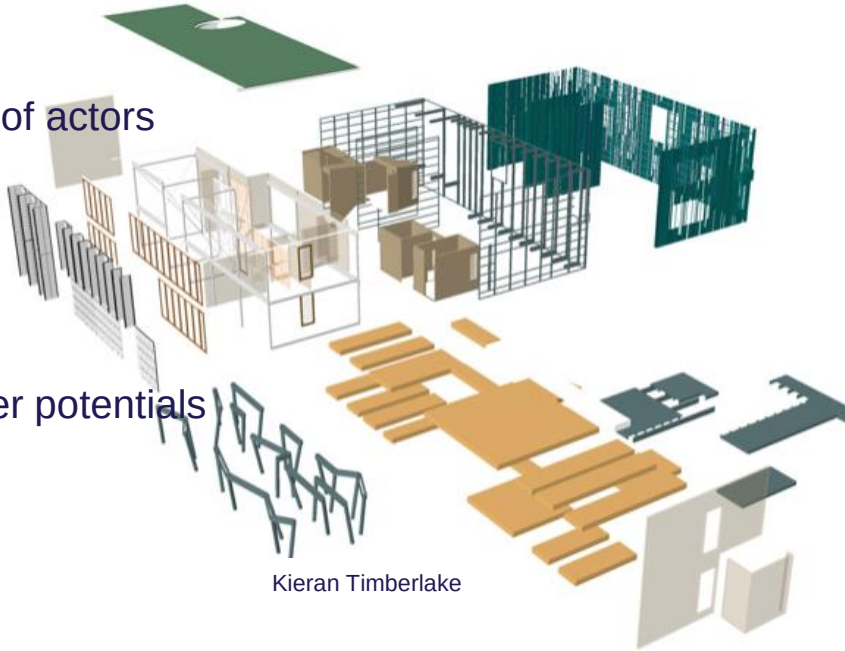
Upcycle building	3.6
DfD building	6.7 (-2.4)

- Focuses on immediate impacts rather than potential benefits
- Encourages recycling as an input to rather than as an output of a system

This is not meant to discourage DfD!

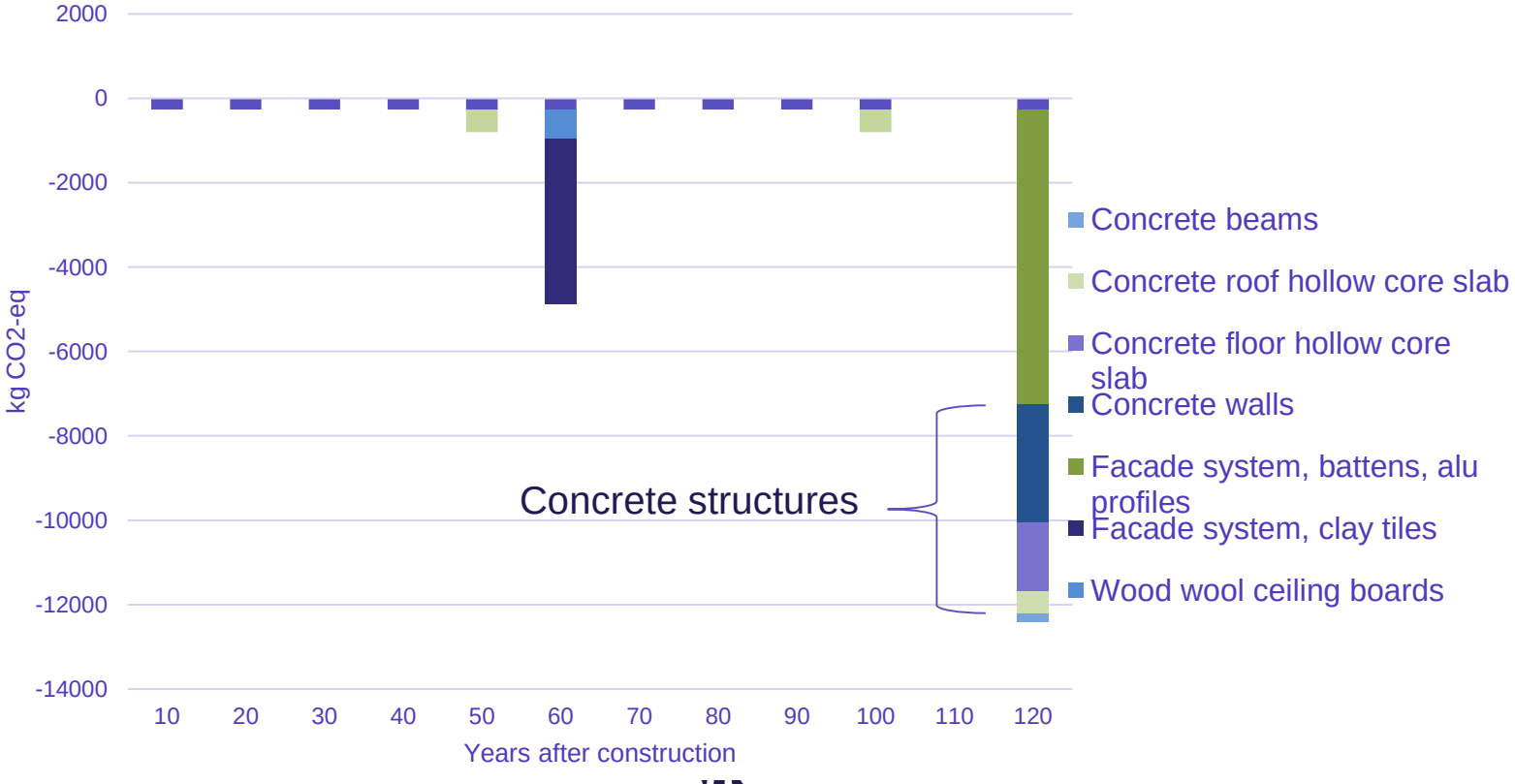
- This is a product perspective!
- Not in this model: advantages in terms of
  - Maintenance and repair
  - Adaptability
  - Engagement from a large set of actors

- DfD benefits when…?
- Identifying materials with the larger potentials



Kieran Timberlake

DfD case - details



Further research

- Modelling of up-/recycled materials
- Combining strategies
- Comparing with other allocation approaches
- More impact categories