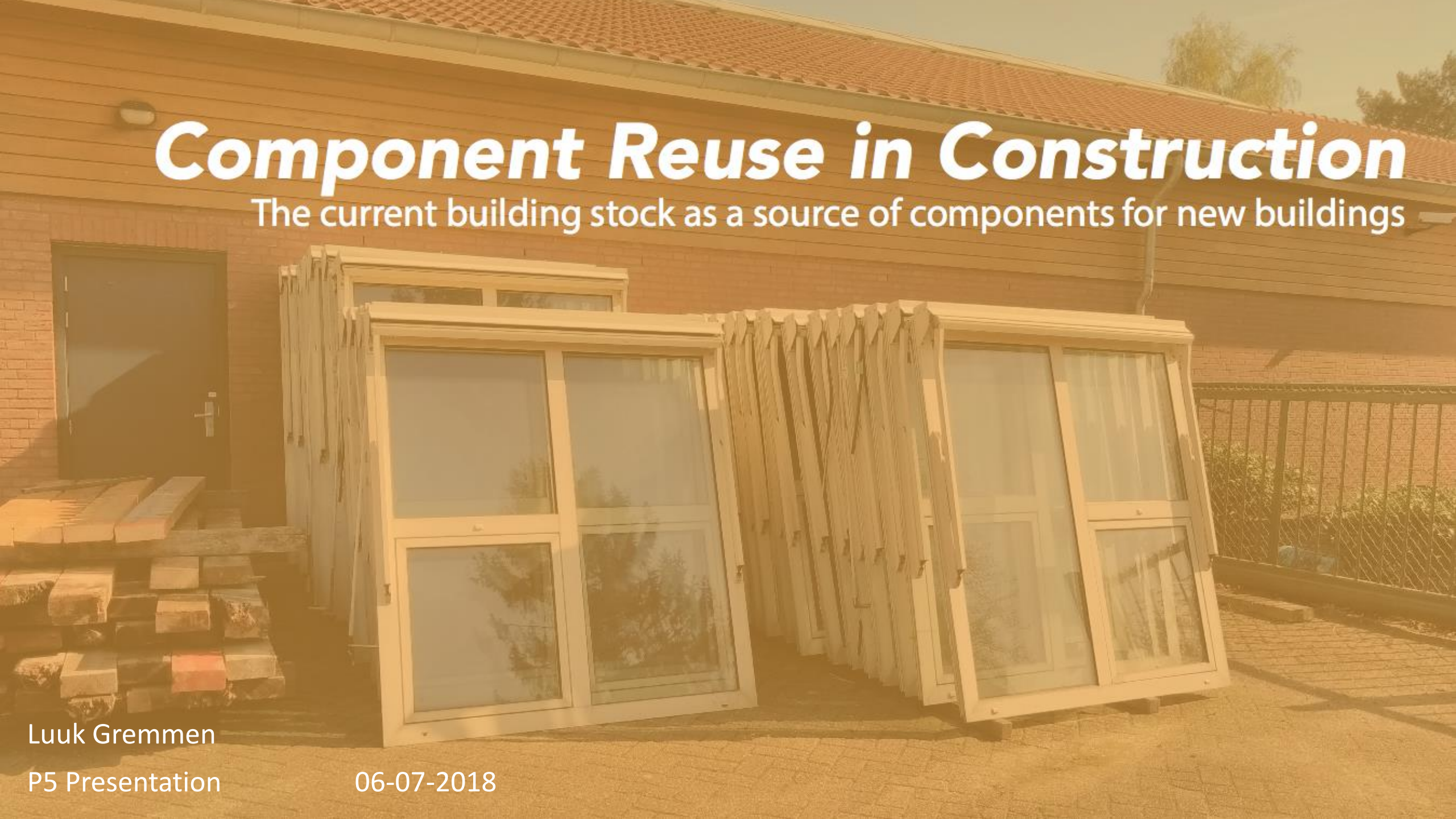


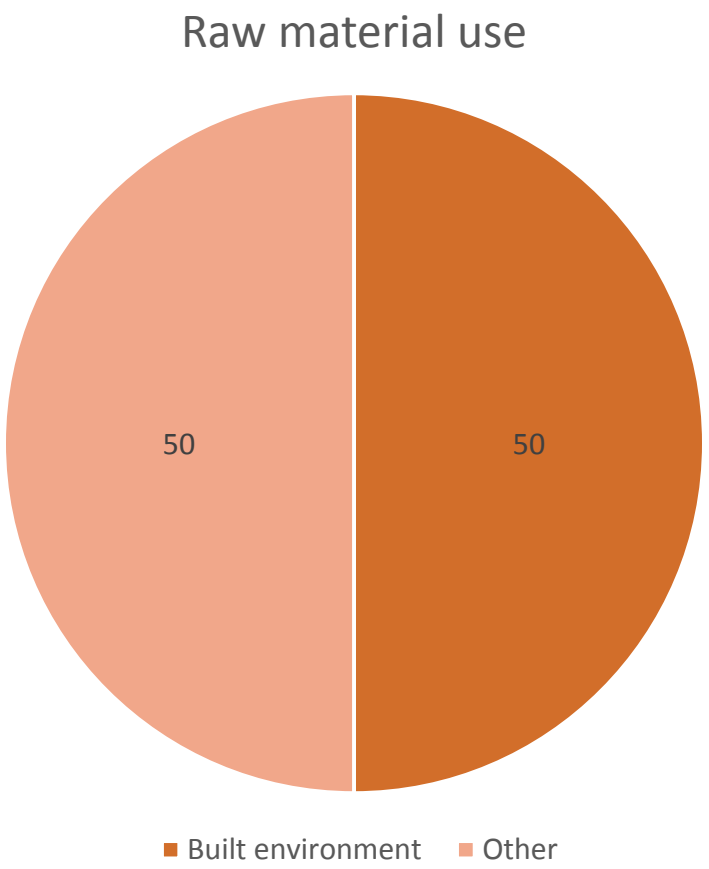
Component Reuse in Construction

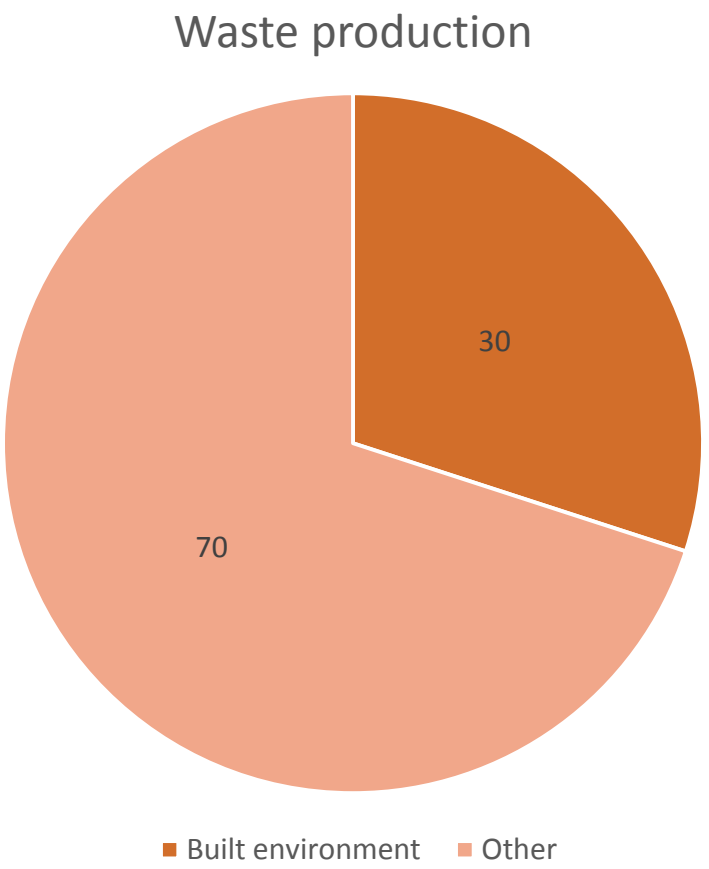
The current building stock as a source of components for new buildings

Luuk Gremmen

P5 Presentation 06-07-2018

The built environment is responsible for:





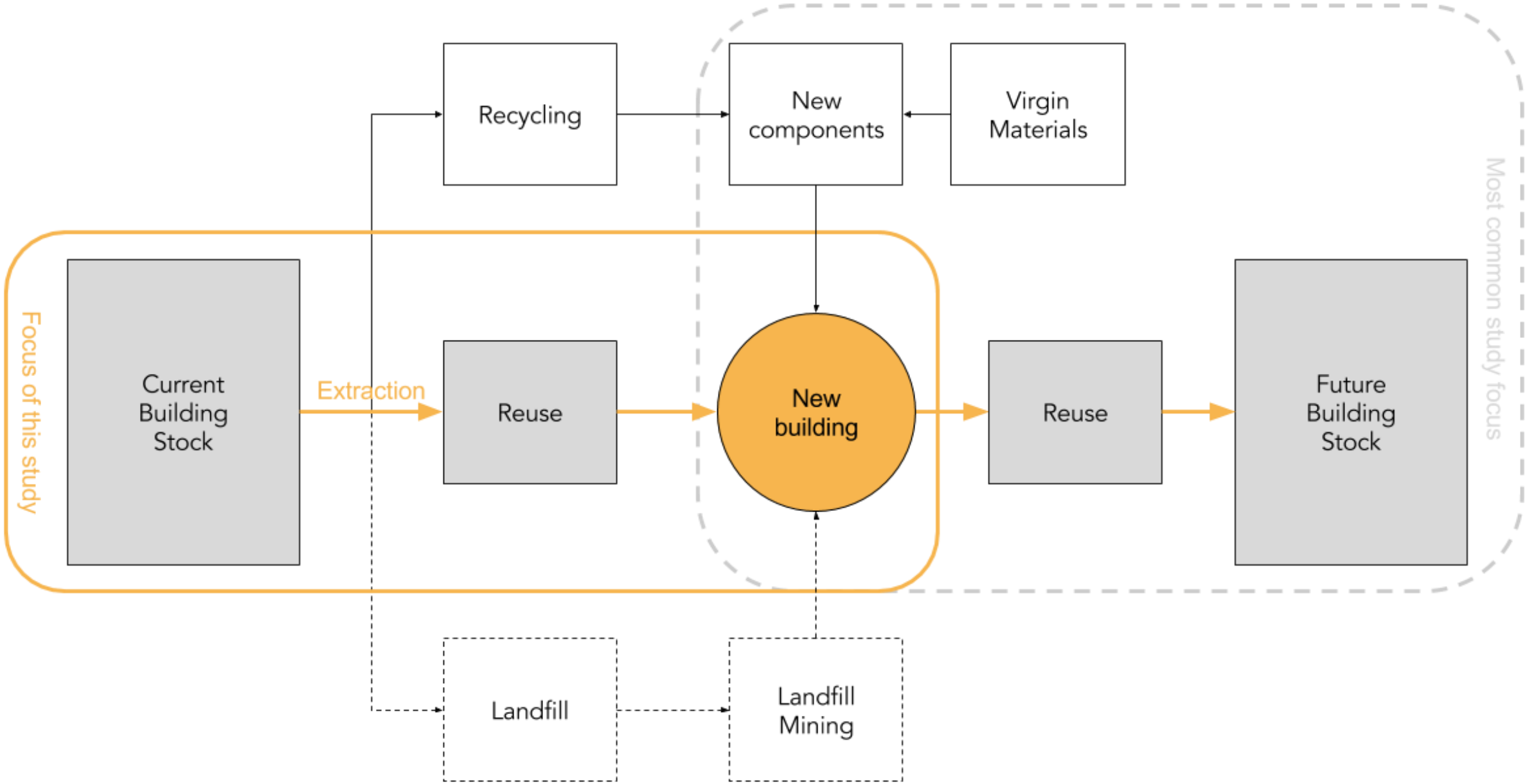
(Uihlein & Eder, 2009)

CE in the Construction Industry

Wide awareness among actors in construction industry (Adams, Osmani, et. al., 2017)

Mainly focused on:

- Construction waste minimisation and recycling. (Adams, Osmani, et. al., 2017).
- Material passports (BAMB, 2016)
- Construction of new circular buildings (Rijkswaterstaat, 2015)
- Design for Deconstruction (DfD) (Adams, Osmani, et. al., 2017).

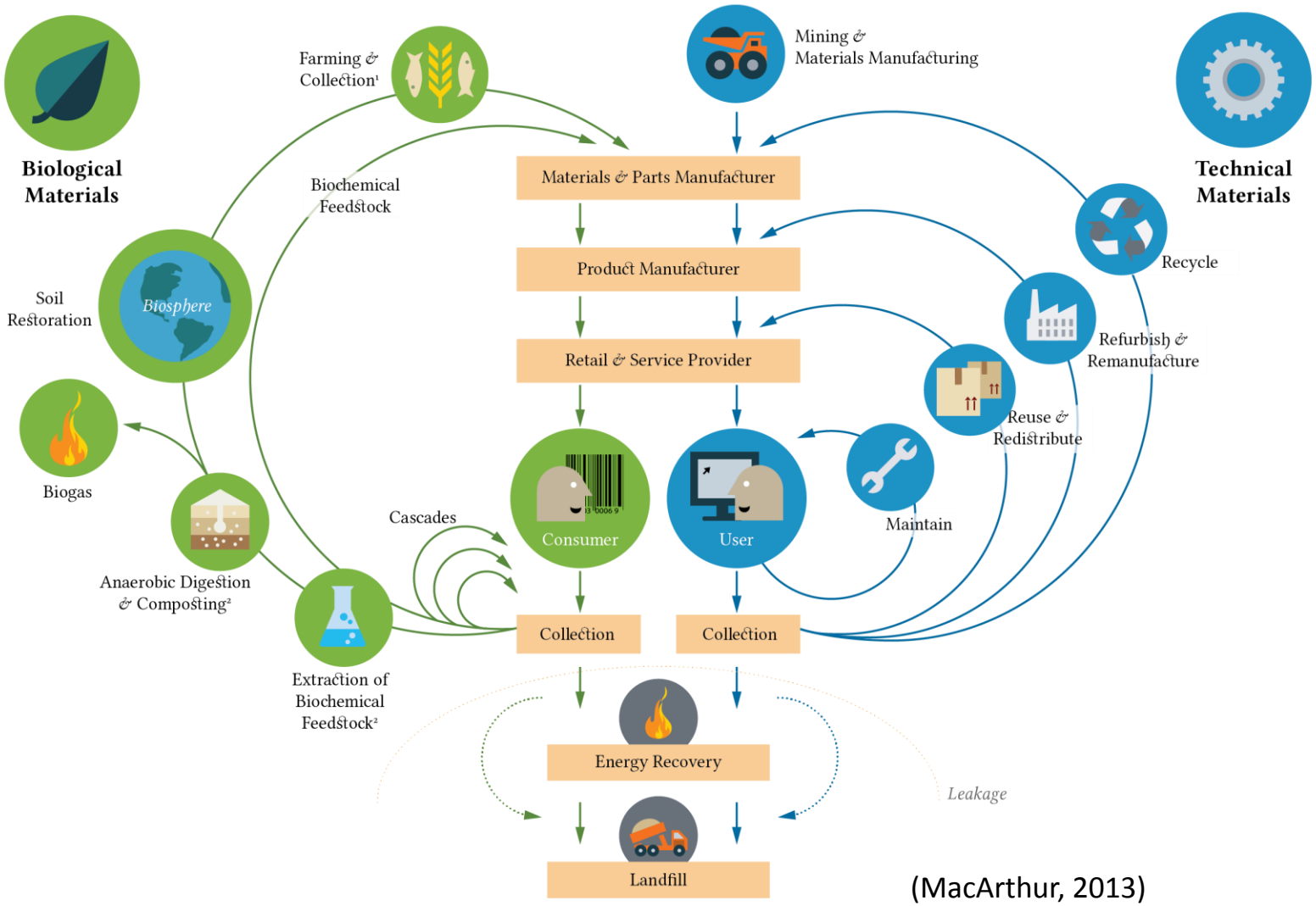

Recycling
New components
Virgin Materials
Most common study focus
Focus of this study
Current Building Stock
Extraction
Reuse
New building
Reuse
Future Building Stock
Landfill
Landfill Mining

Why circular demolition?

Reuse	Recycling	
Reclaim and reuse components in their current state, save embodied energy	Reduces components to material level destroying embodied energy and emitting new CO2 in the process	
	High value	**Low value**
Use a reclaimed door as door in a new building	Melting steel beam to acquire new steel	Crushing bricks and concrete for use as foundation for roads
		>95% of recycling in construction

Around 70 per cent of the environmental impacts of the average new construction product arise from the energy needed to make it, reusing a product saves that energy. (Kay & Essex, 2009)

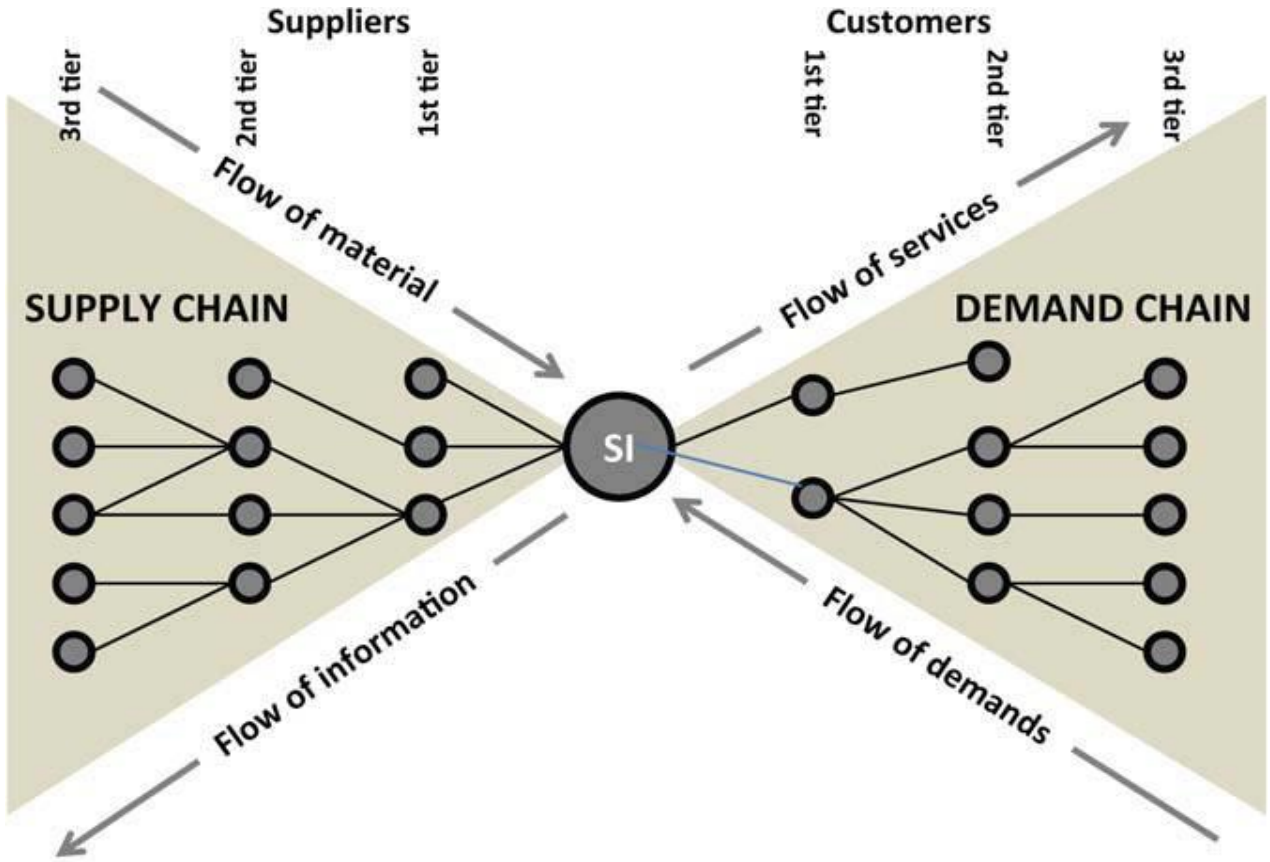
Why circular demolition?



(MacArthur, 2013)

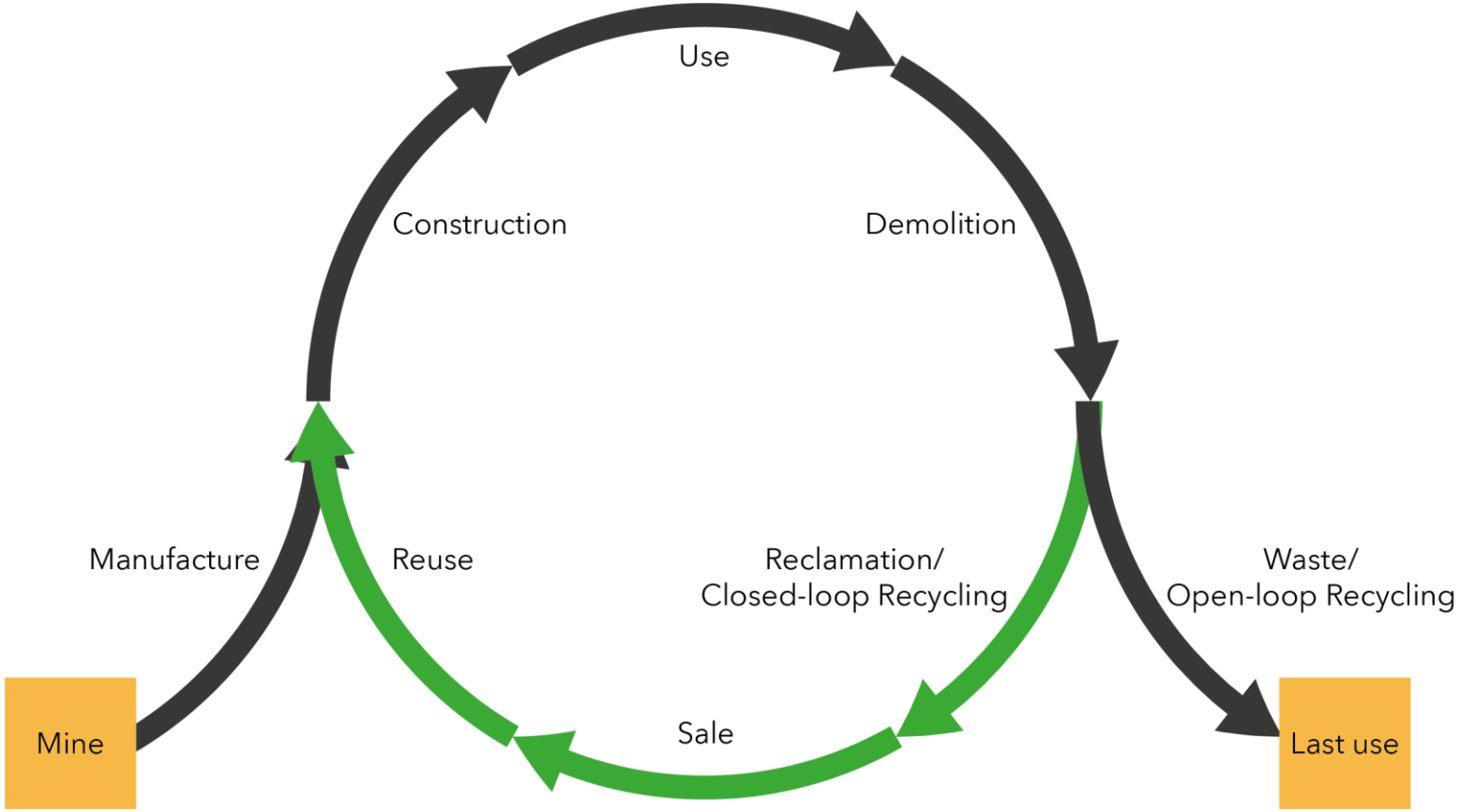
Supply chains in the construction industry

- One-off projects
- Temporary organisation
- Made-to-order
- Convergent towards single product
- Information flows in one direction



(Segerstedt & Olofsson, 2010)

Supply chains in the construction industry



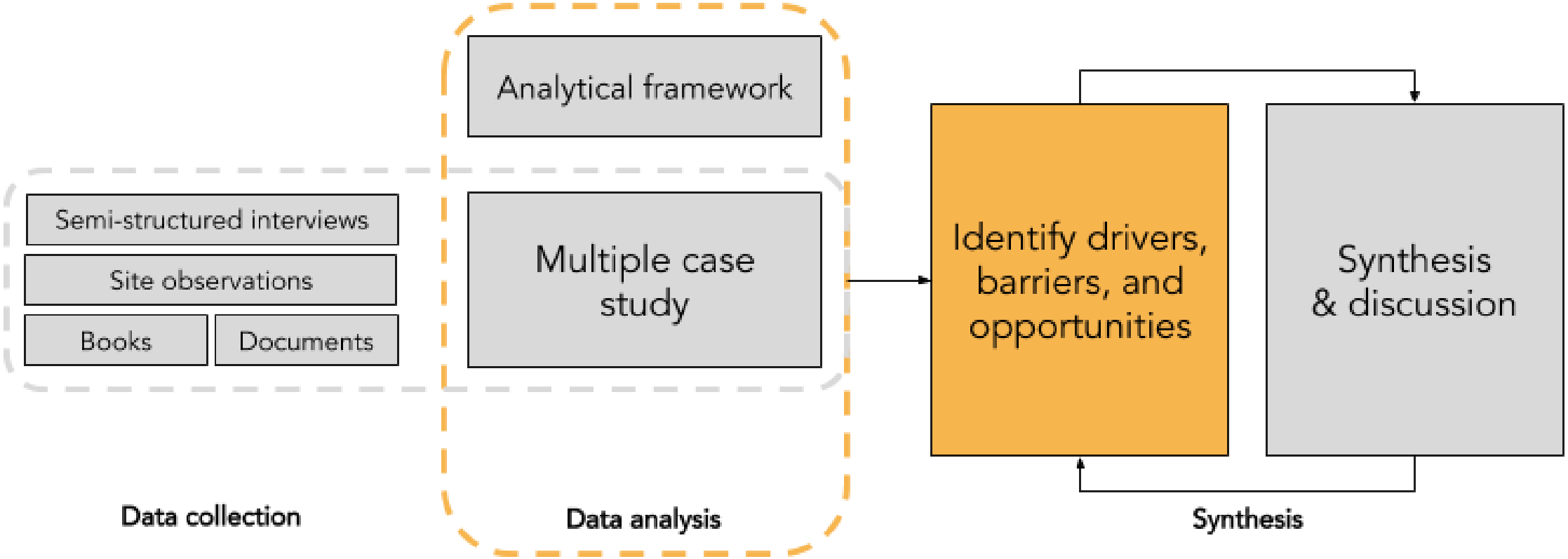
Research question

What are the current drivers, barriers, and opportunities for circular demolition and the integration of component reuse into new buildings in the Benelux?

Methodology

Methodology

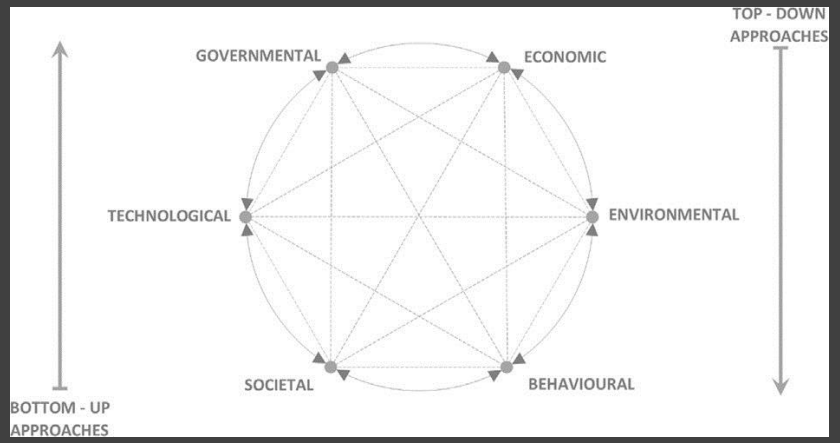
- Literature review
  - Establish state of research and find drivers, barriers, and opportunities to compare with cases
- Multiple case study
  - Instrumental case studies exploring two settings for component reuse
- Analytical framework
  - Analysis of findings and theory based on collected data and analytical framework


Analytical framework
Semi-structured interviews
Site observations
Books
Documents
Multiple case study
Identify drivers, barriers, and opportunities
Synthesis & discussion
Data collection
Data analysis
Synthesis

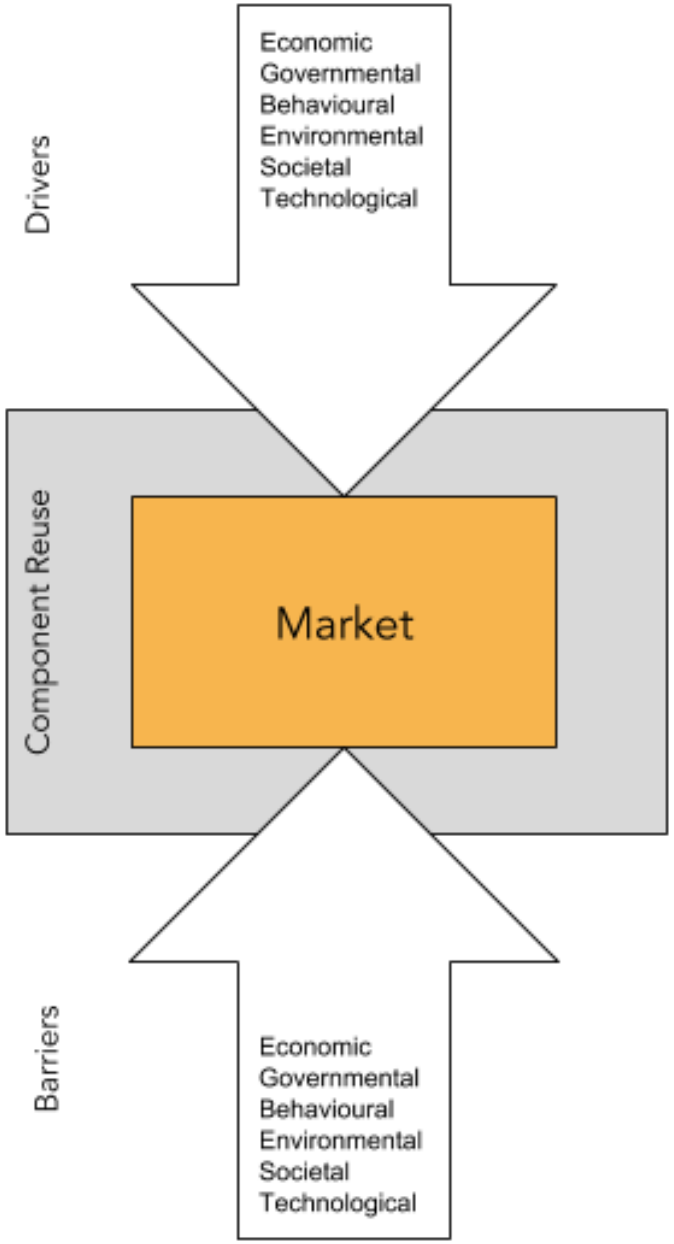
Secondary Research Questions

1. What can current cases reveal about the drivers and barriers of reclaiming building components from existing buildings?
2. What can current cases reveal about the drivers and barriers of integrating reclaimed components into new buildings?
3. Which opportunities for component reuse can be found in current cases?

Analytical Framework

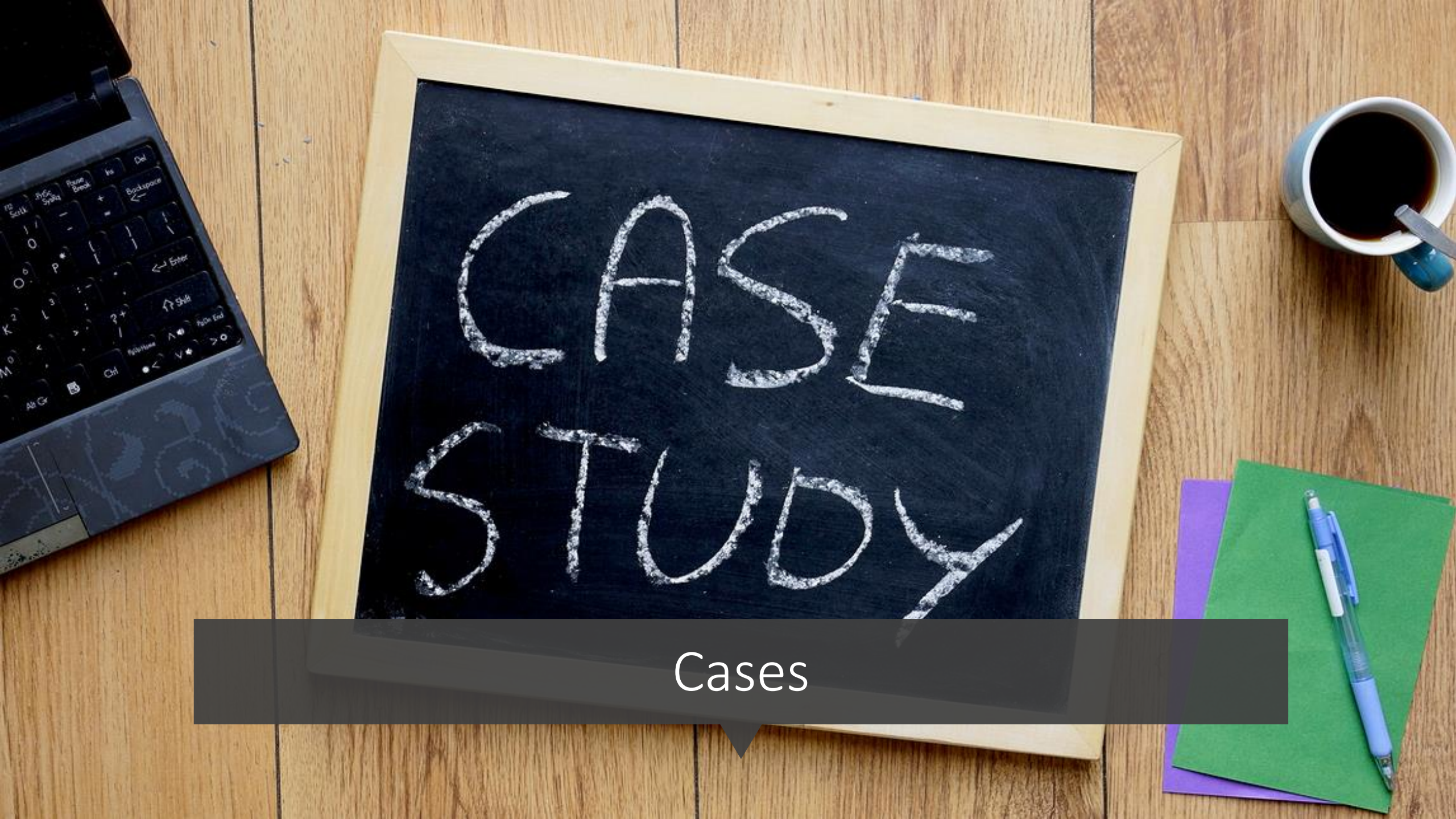


(Pomponi & Moncaster, 2016)



Operationalisation of the six dimensions

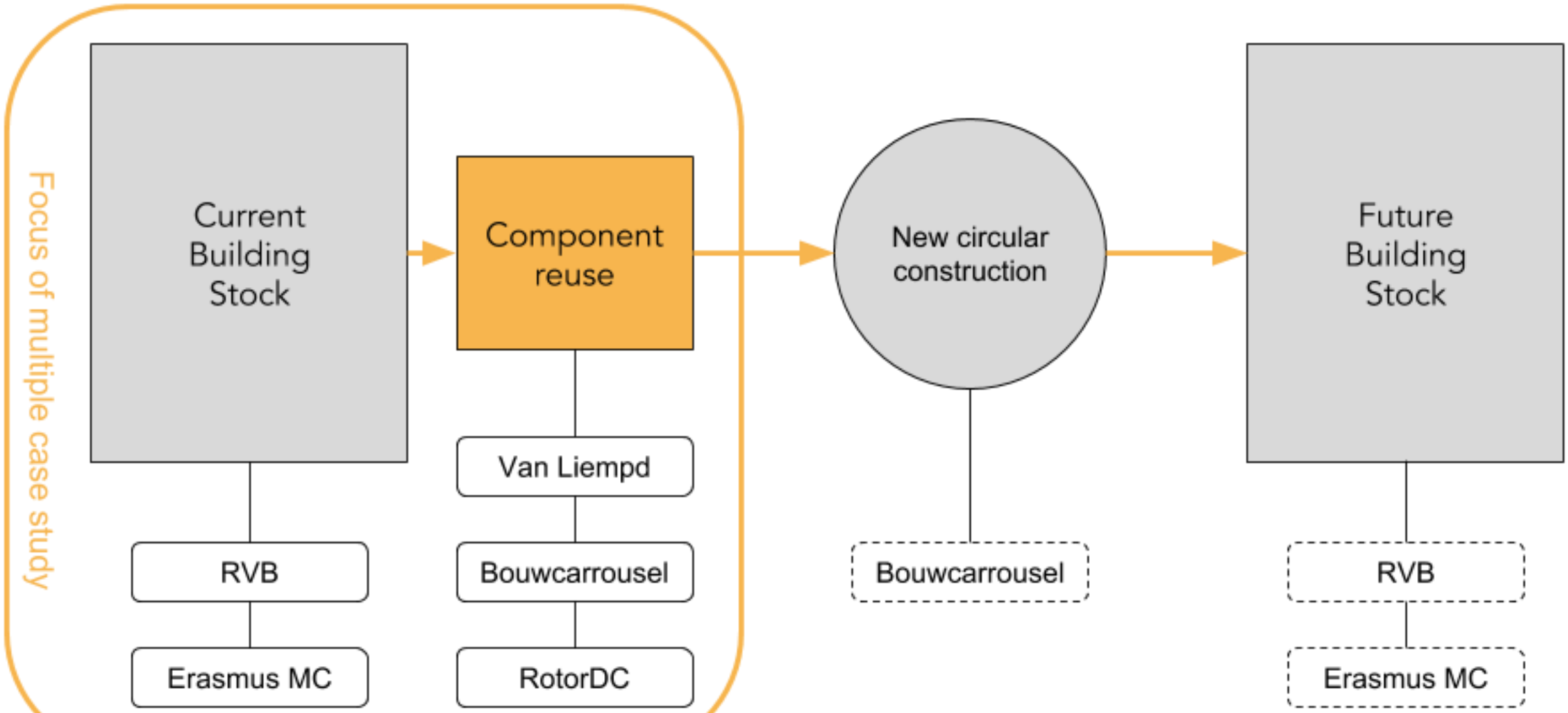
Operationalisation of the six dimensions		
	Definition	**Notes**
Economic	justified in terms of profitability.	Profitability of one company No individuals.
Governmental	Any form of policy instated by a governing body to encourage or discourage component reuse.	- The governing body can also be the board of a company. -This does not include the government acting as a client.
Behavioural	Behaviour by individuals that is not caused by economic motives.	Employees don't share in the profit of their company therefore drivers or barriers leading back to employees are considered to be behavioural.
Environmental	Drivers and barriers primarily based on the moral wish to minimise environmental impact.	Economic motives are usually secondary for this dimension.
Societal	Relating to the current way that society works.	-In this case current workings of the construction industry -Including inertia in existing supply chains.



Cases

Options for circular supply chains in the construction sector

- Circular Demolition Companies (facilitator)
- Portfolio Mining (client – supply/demand)
- Collection and dissemination of information availability of materials (facilitator)
  - Material passports
  - Pre-demolition audits
  - Listing services (marktplaats)
- New (Circular) buildings (client – demand)

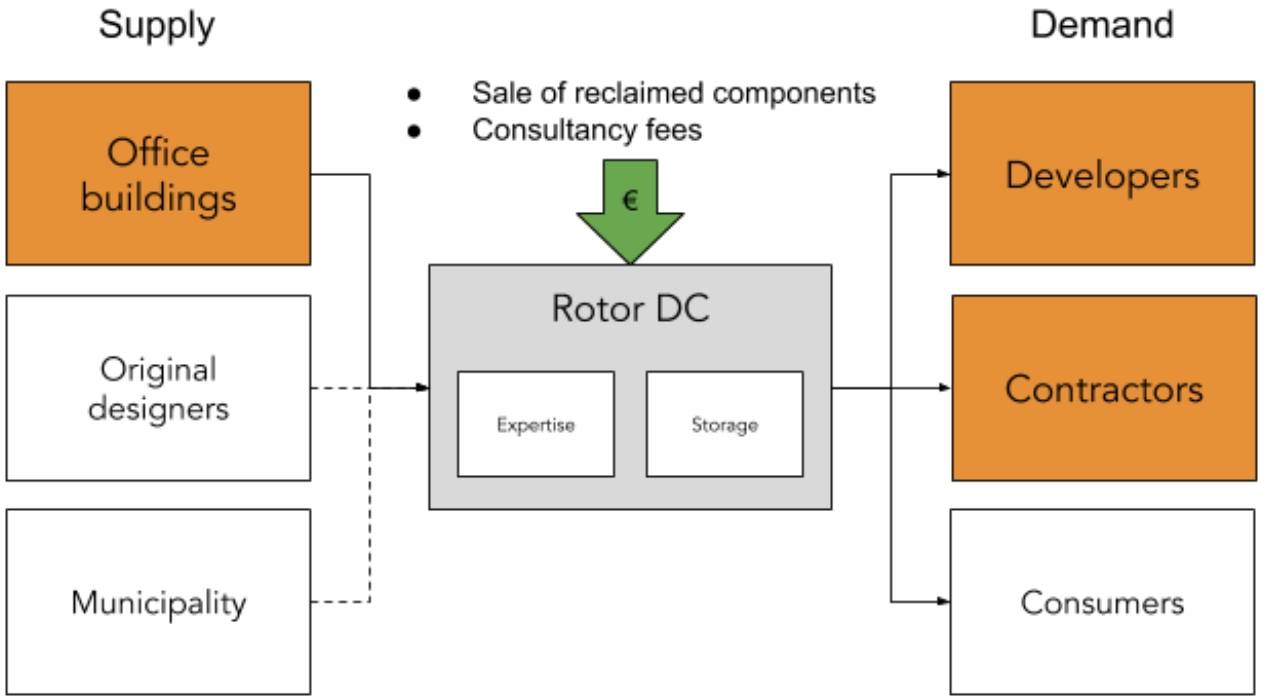

Focus of multiple case study
Current Building Stock
Component reuse
New circular construction
Future Building Stock
Van Liempd
RVB
Bouwcarrousel
Erasmus MC
RotorDC
Bouwcarrousel
RVB
Erasmus MC

Cases

Rotor DC

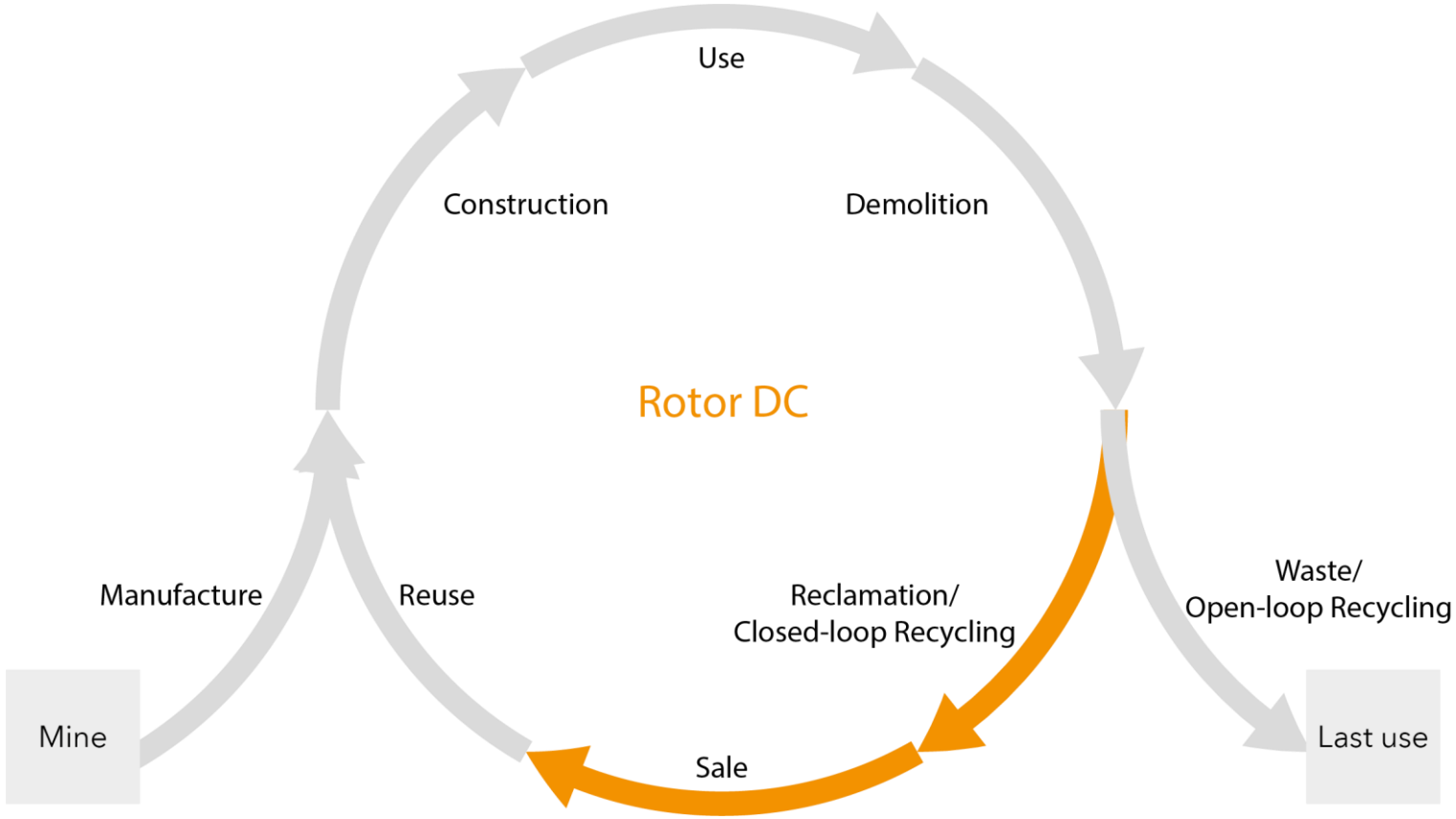
Rotor DC

- Waste minimisation
- Uncertainty of demand



Rotor DC

Company providing consultancy services, stripping of components, and sale of reclaimed components.



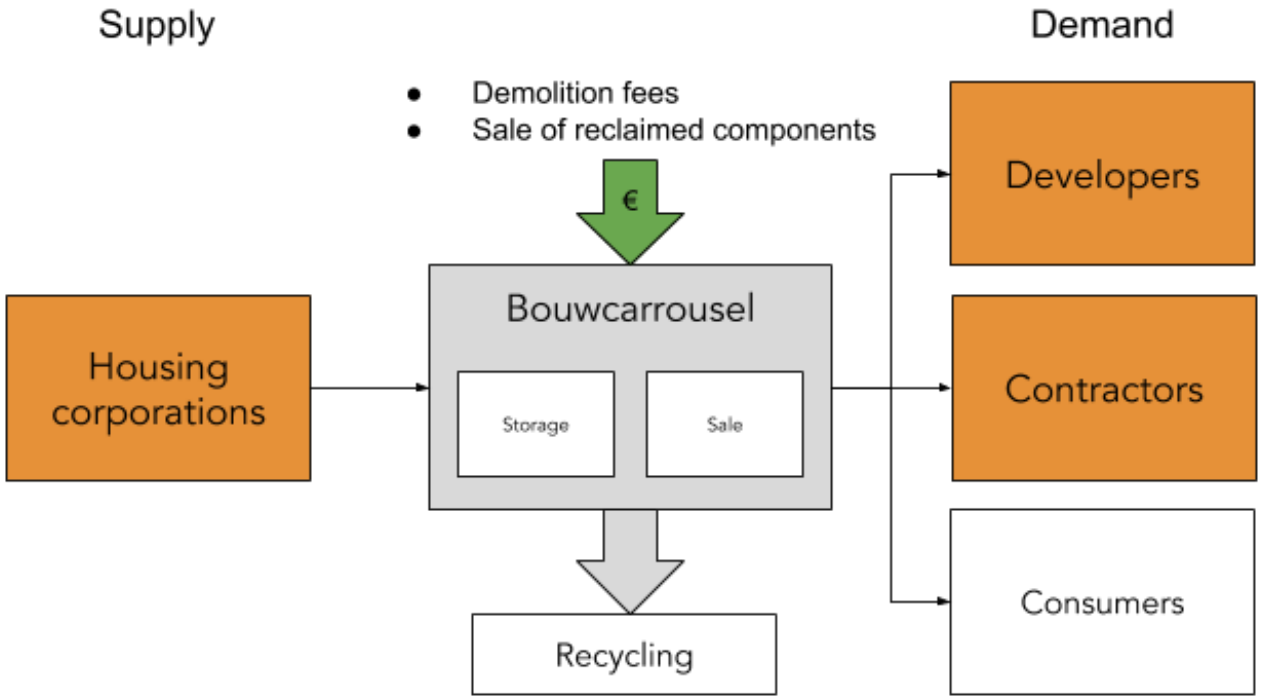
Rotor DC

Company providing consultancy services, stripping of components, and sale of reclaimed components.

Bouwcarrousel

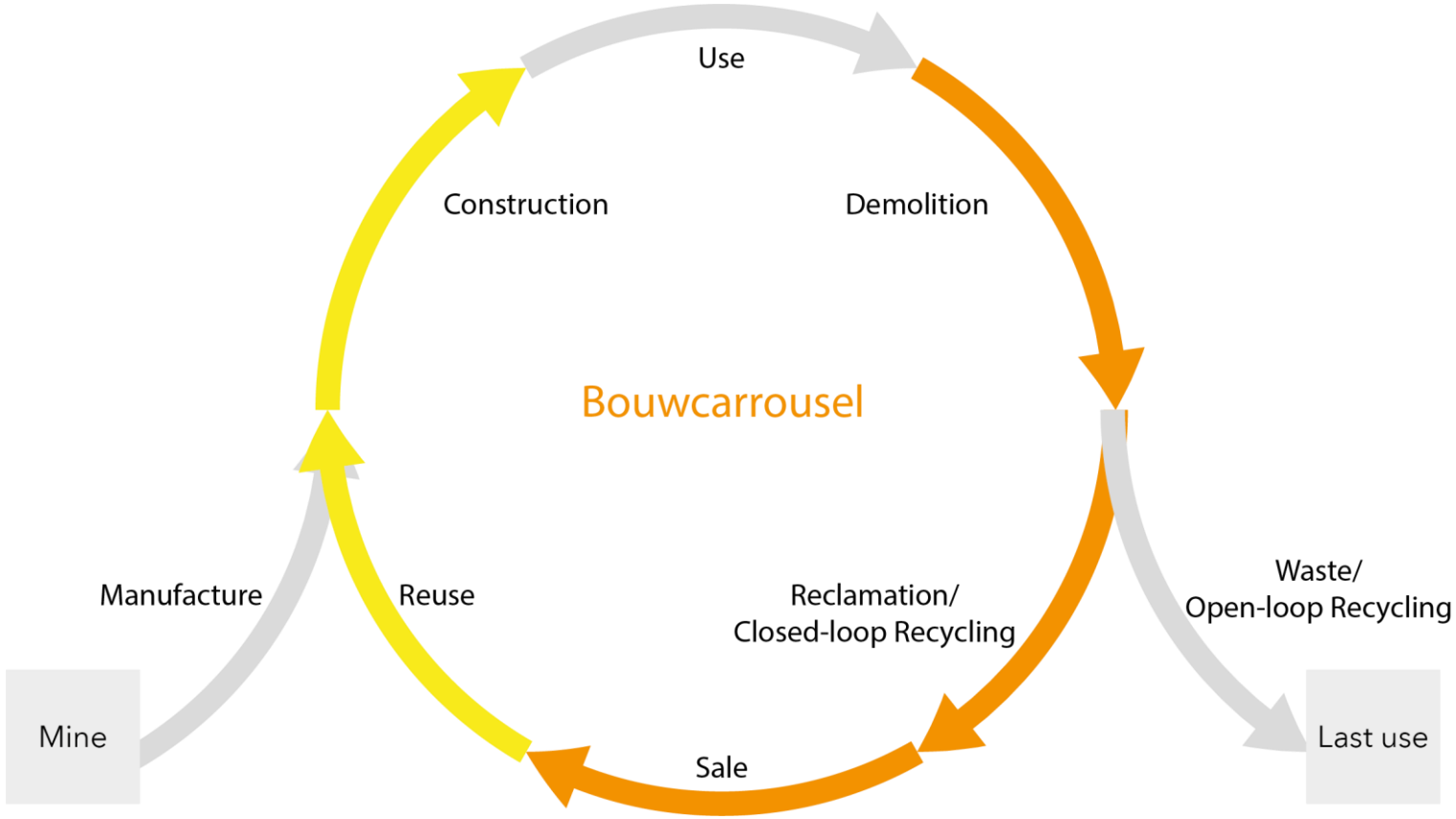
Bouwcarrousel

- Personal enthusiasm for environment
- Lack of demand for reclaimed components



Bouwcarrousel

Company providing circular demolition services and resale of components.



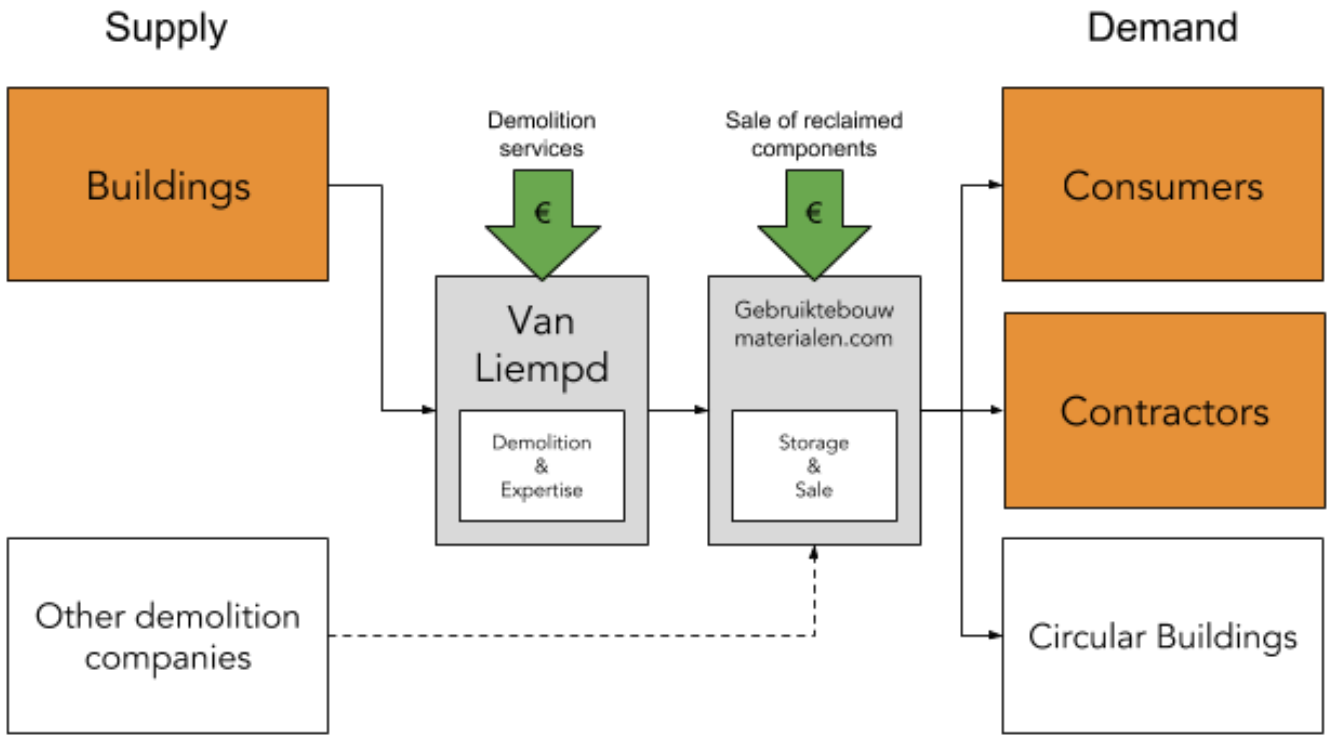
Bouwcarrousel

Company providing circular demolition services and resale of components.

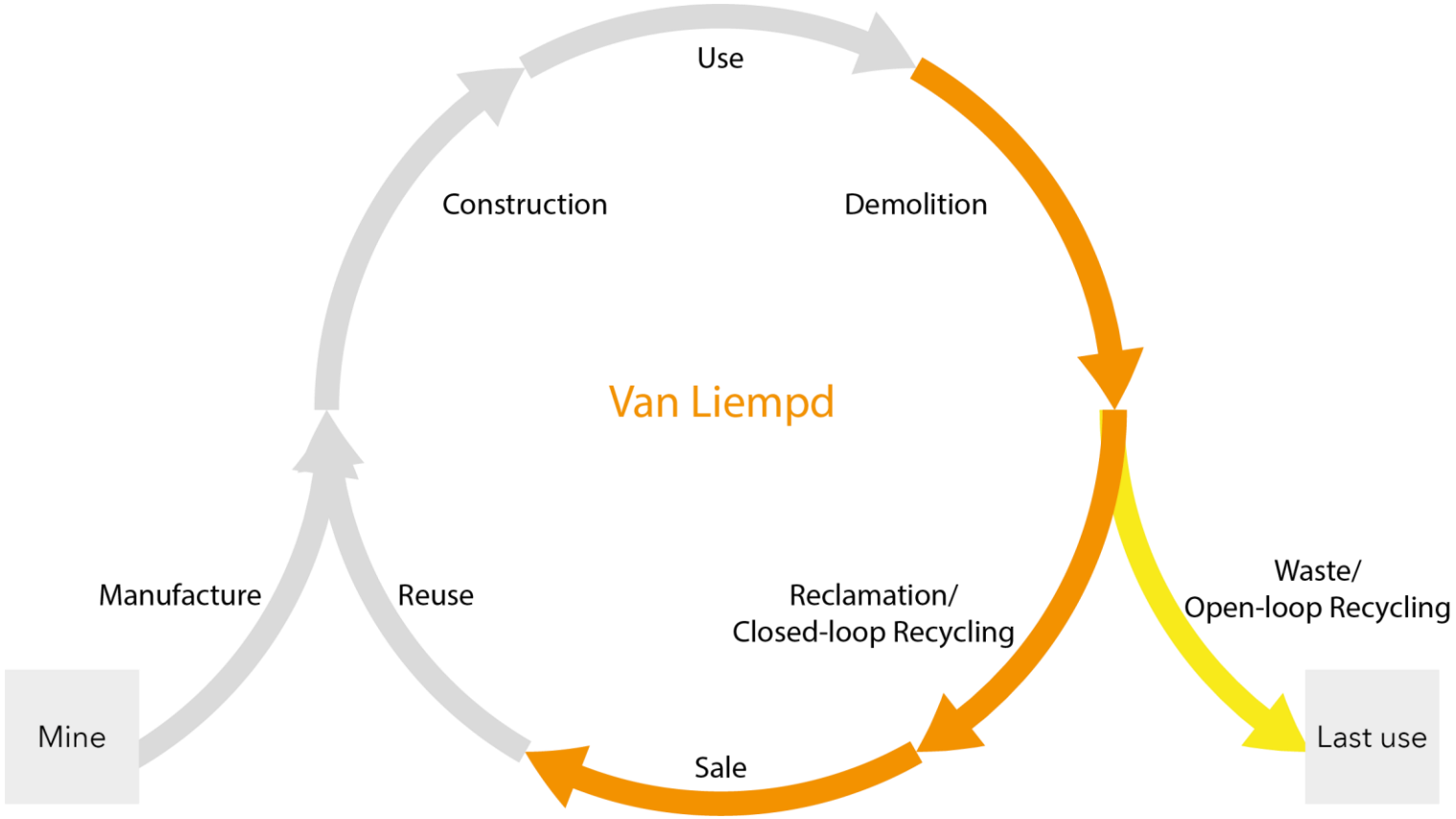
A. Van Liempd Demolition Company

A. Van Liempd Demolition Company

- Player in the market for traditional demolition



A. Van Liempd Demolition Company

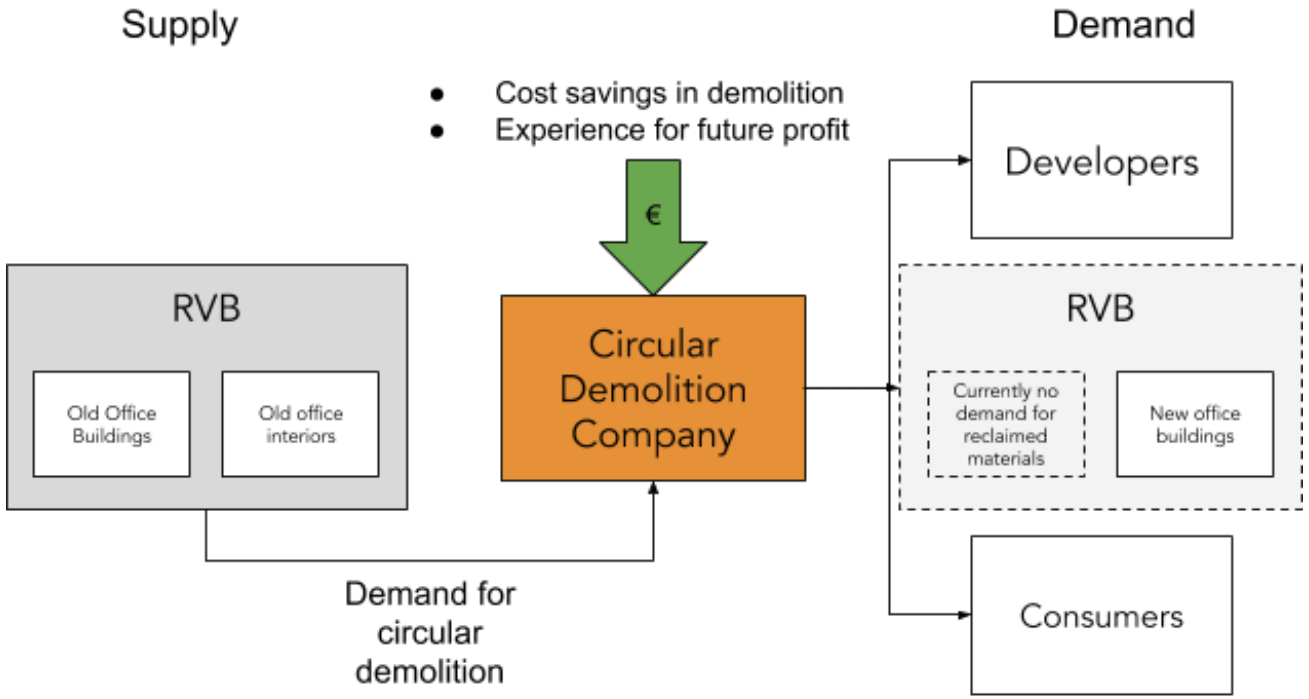


A. Van Liempd Demolition Company

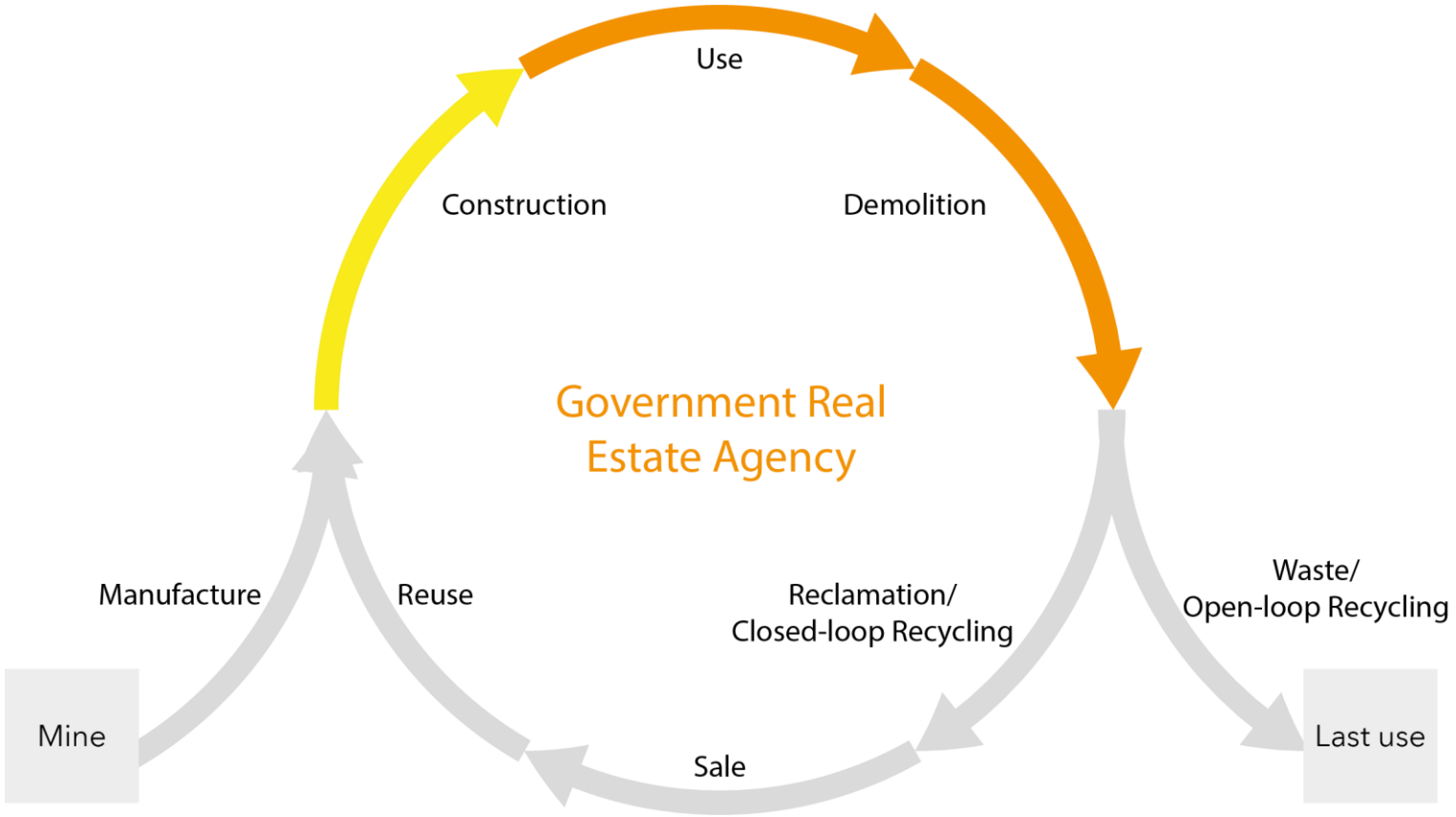
Government Real Estate Agency

Central Government Real Estate Agency (RVB)

- Governmental legislation
- No ambition to use reclaimed components
- Material passport pilot (EPEA)

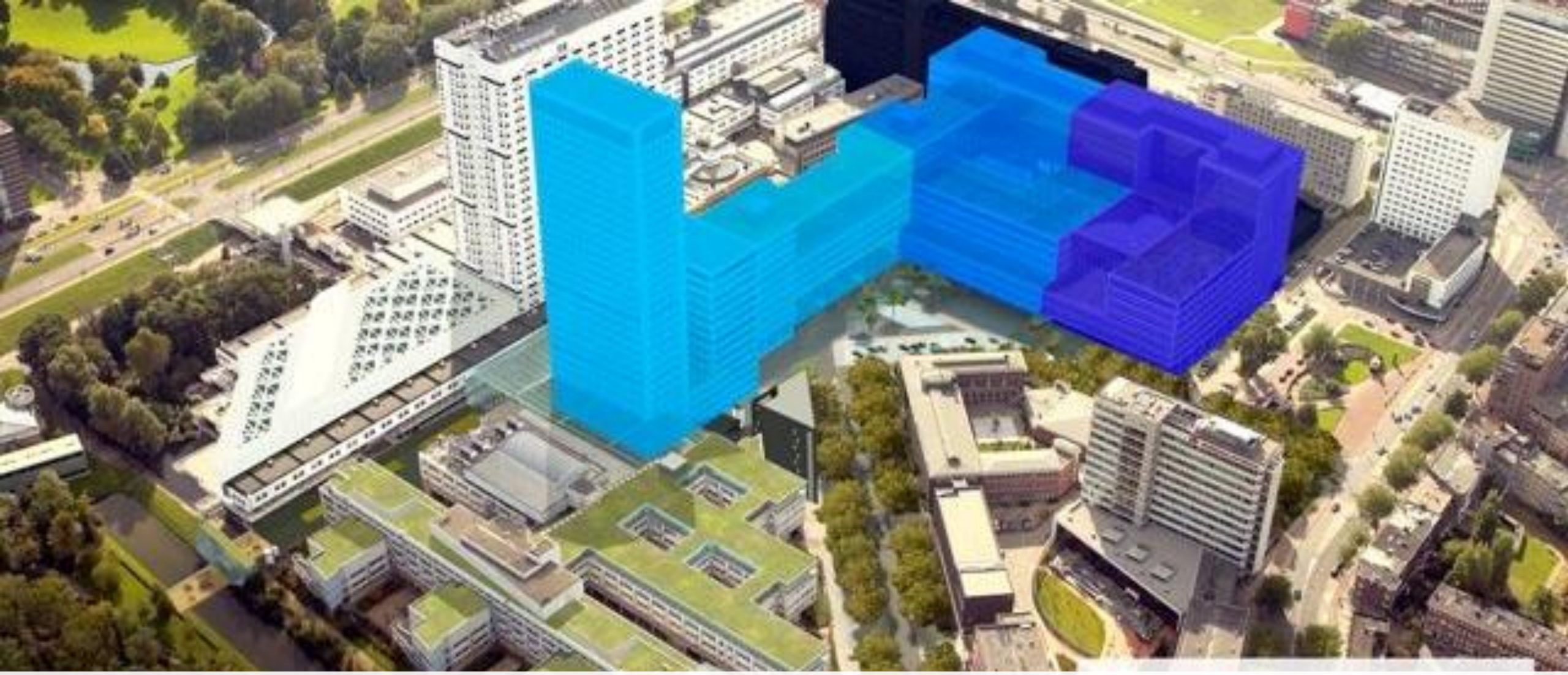


Government Real Estate Agency



- Pilot project for circular demolition.
  - Van Liempd
  - Buro BOOT
  - EPEA

Government Real Estate Agency

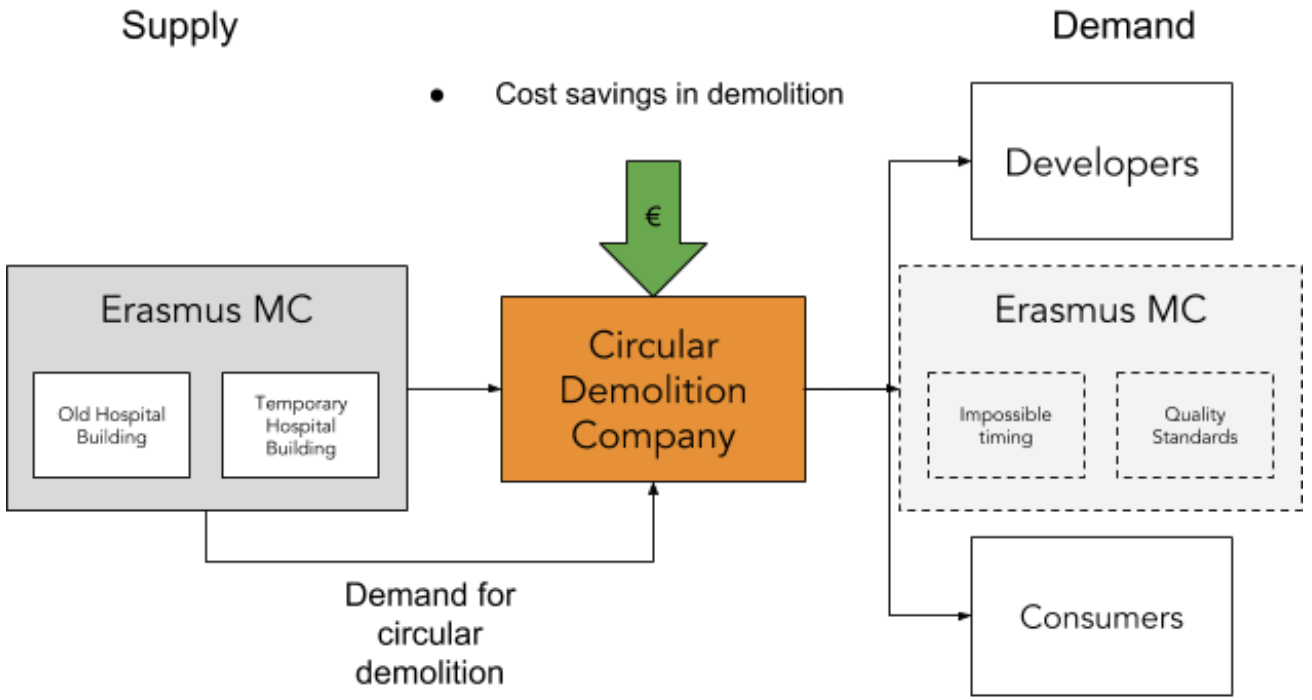


Erasmus MC

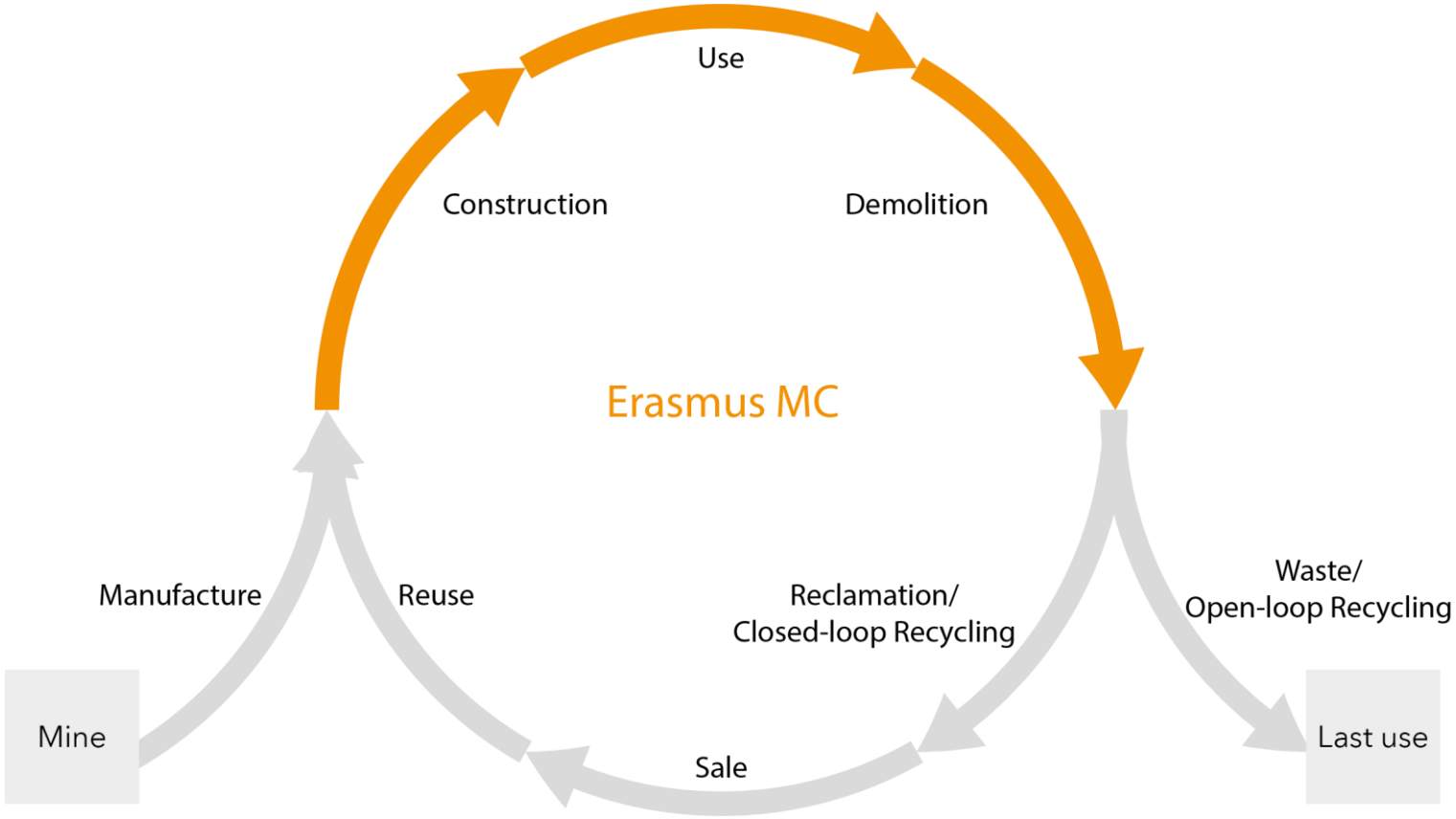
Erasmus MC

- Personal enthusiasm
- Lack of experience

- 1. Safety
- 2. Cost savings
- 3. Social role in society



Erasmus MC



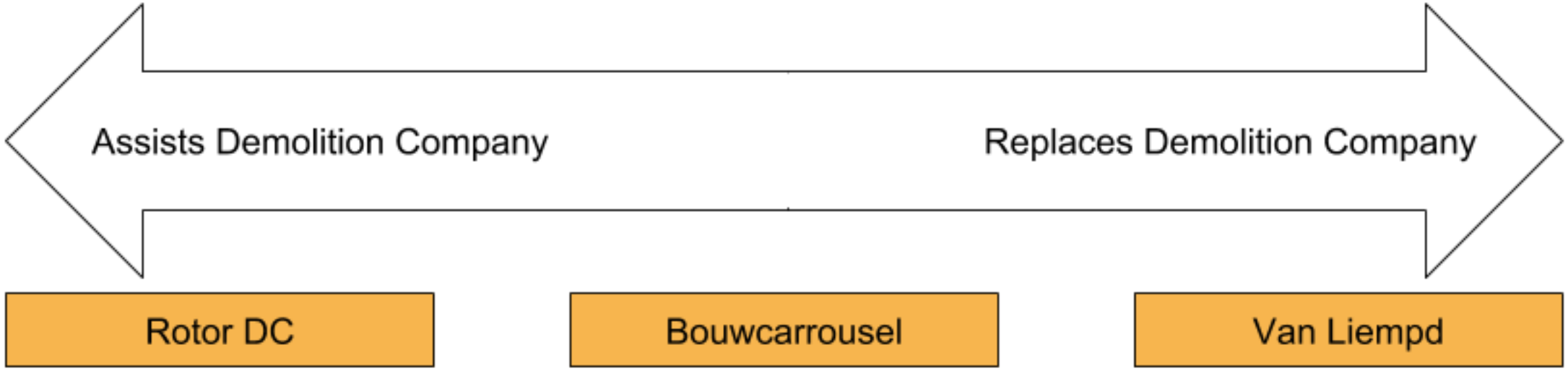
- Giant circular demolition project
  - Tender ongoing
  - Madaster

Erasmus MC

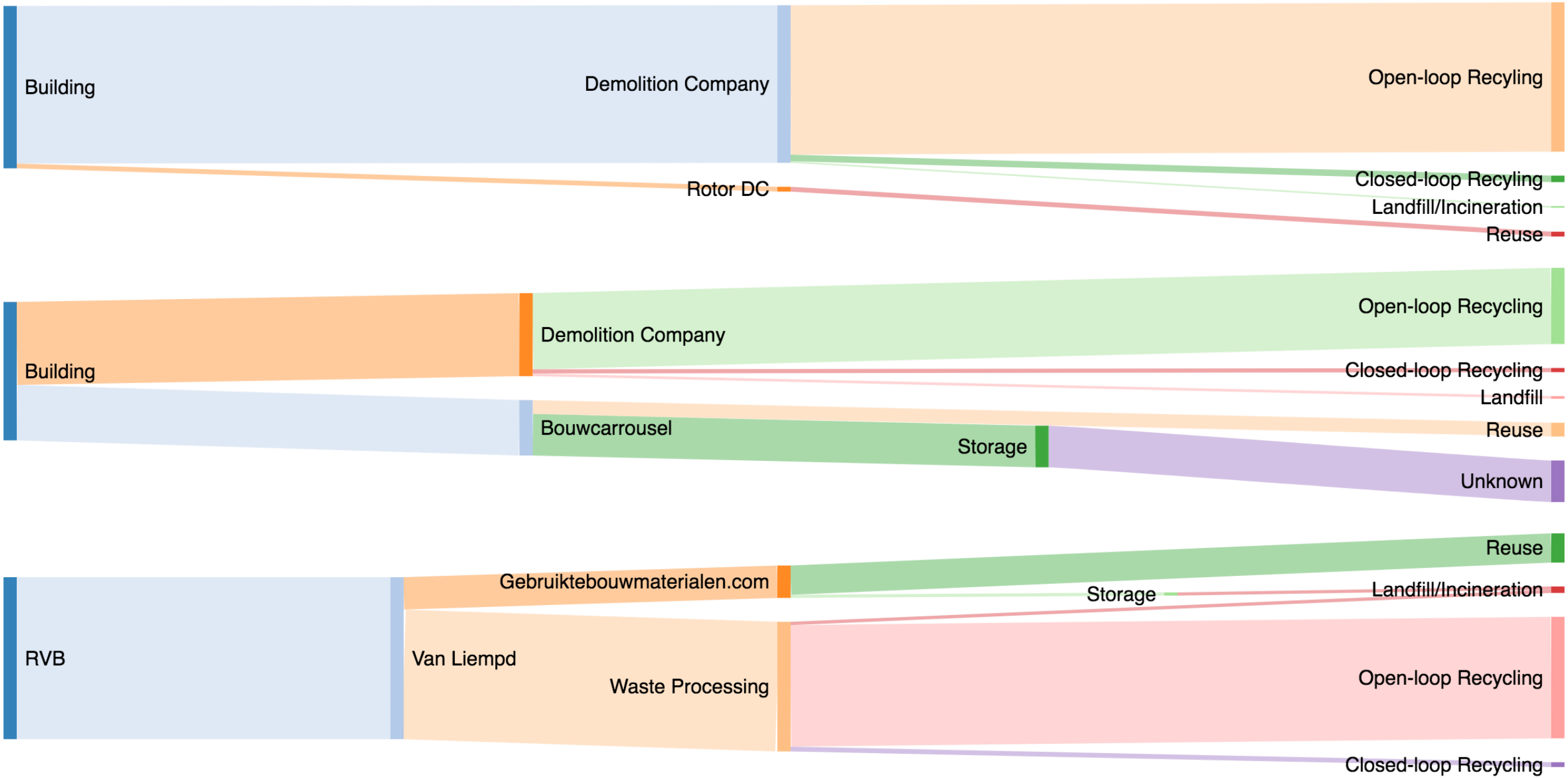
Findings

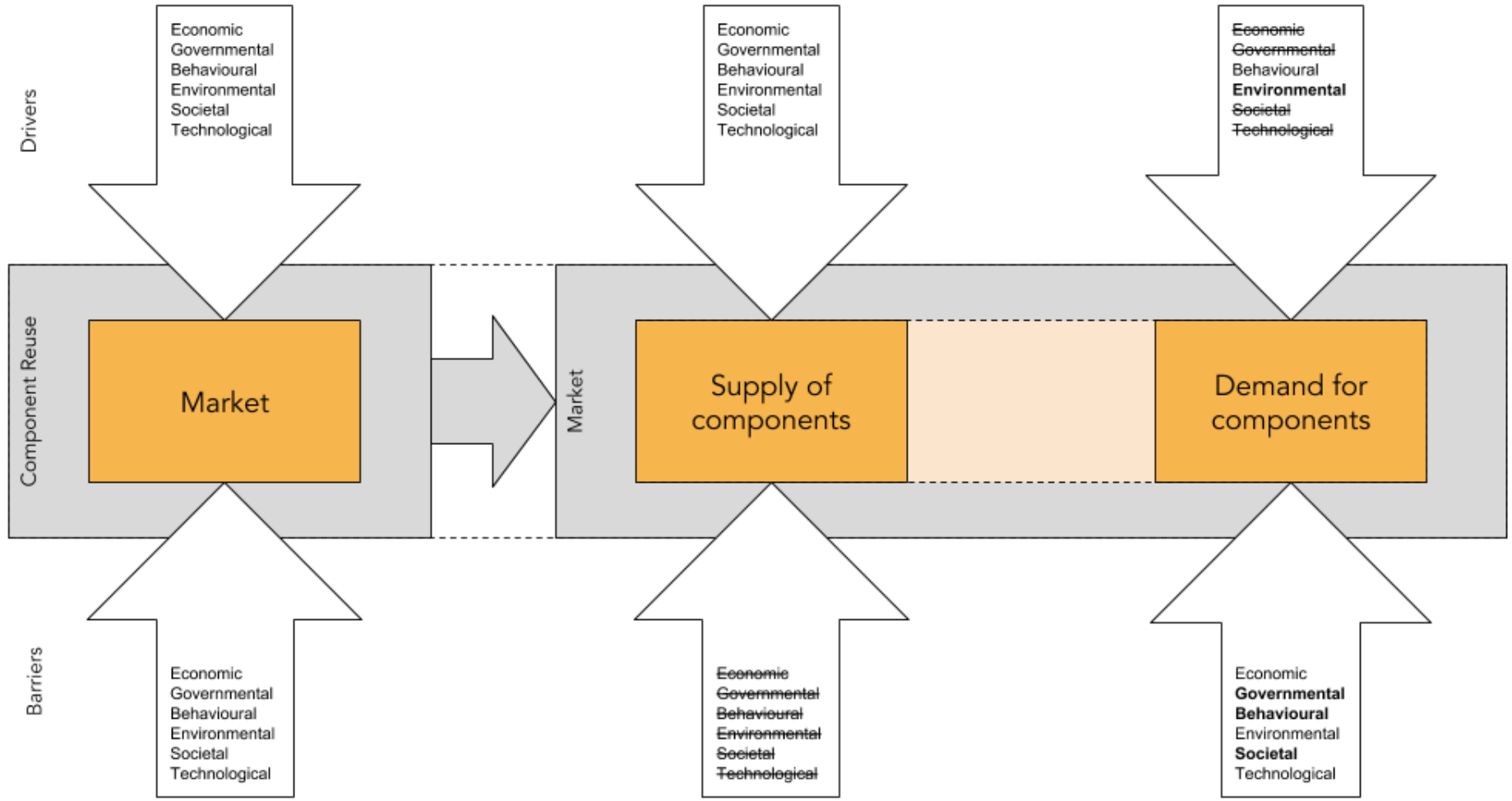
Comparison

Van Liempd	**Bouwcarrousel**	**Rotor DC**
Facilitator (circular demolition)	Facilitator (circular demolition)	Facilitator (circular demolition/consultancy)
	Rijksvastgoedbedrijf	**Erasmus MC**
	Company	Project



Cross Case Analysis




Drivers
Economic
Governmental
Behavioural
Environmental
Societal
Technological
Component Reuse
Market
Market
Supply of components
Demand for components
Economic
Governmental
Behavioural
Environmental
Societal
Technological
~~Economic~~
~~Governmental~~
Behaviour
Environmental
~~Societal~~
~~Technological~~
Barriers
Economic
Governmental
Behavioural
Environmental
Societal
Technological
~~Economic~~
~~Governmental~~
~~Behavioural~~
~~Environmental~~
~~Societal~~
~~Technological~~
Economic
Governmental
Behavioural
Environmental
Societal
Technological

What can current cases reveal about the drivers and barriers of reclaiming building components from existing buildings?

Drivers

- Environmental
- Governmental: Waste minimisation policies
- Societal: Company policies adapted values on waste minimisation
- Economic: Saving costs on demolition

Barriers

- Economic: Lack of demand
- Economic: Lack of supply

What can current cases reveal about the drivers and barriers of integrating reclaimed components into new buildings?

Drivers

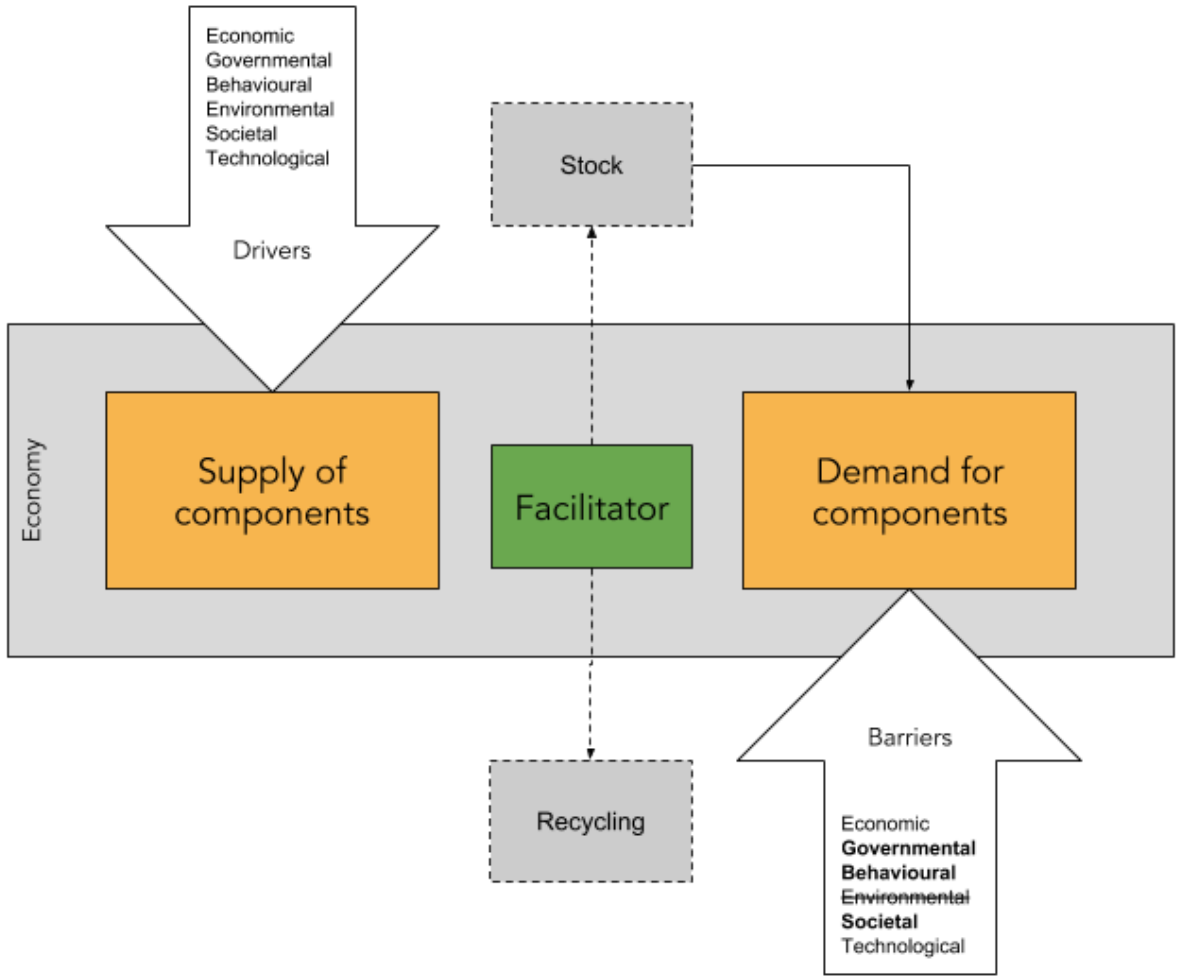
- Environmental

Barriers

- Behavioural: Perceived lower value
- Organisational: Lack of communication between supply and demand
- Technological: Quality control
- Governmental: Lack of regulations

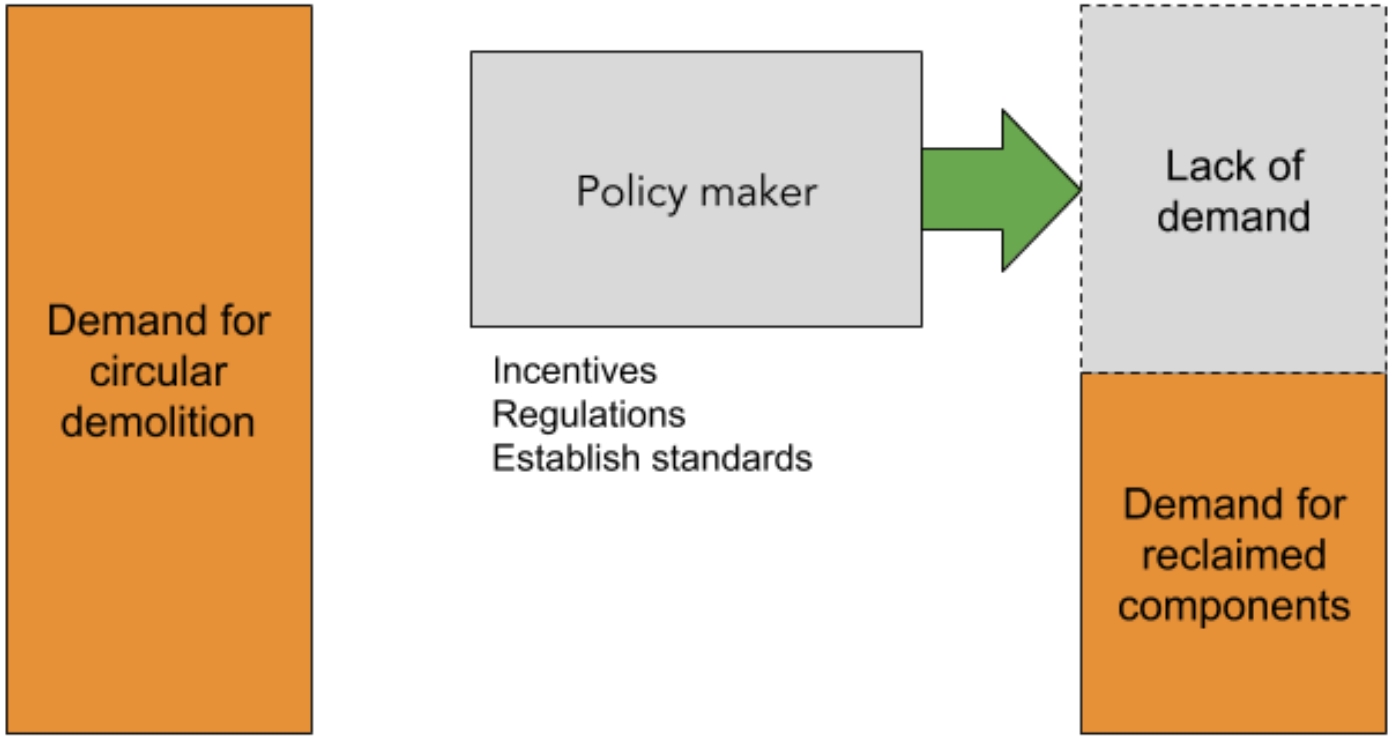
Opportunities for Entrepreneurs

- Demand for circular demolition
- Low demand for reclaimed components
- Stocking strategy

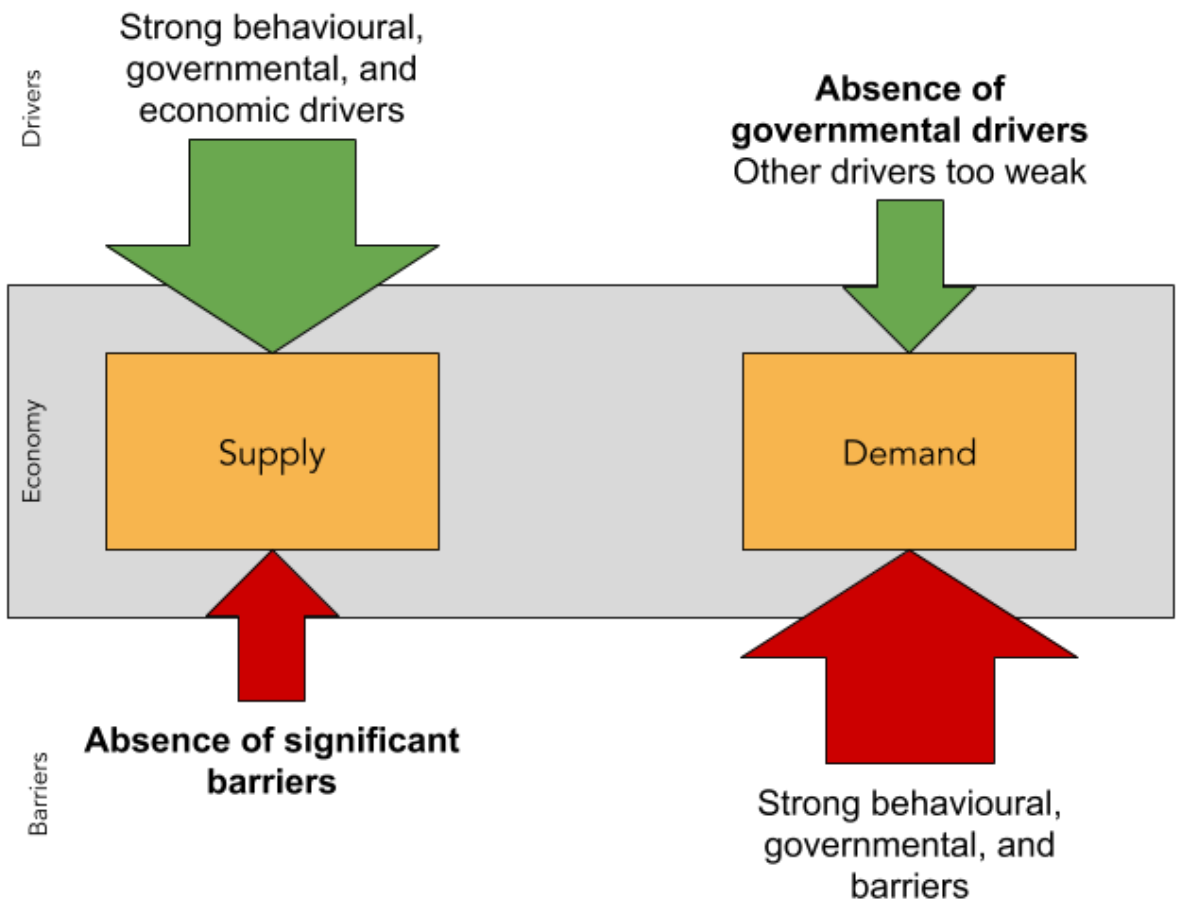


Opportunities for Policy Makers

- Lack of incentives for component reuse
- Lack of standardization, becomes a barrier



Conclusion


Drivers
Strong behavioural, governmental, and economic drivers
Absence of governmental drivers
Other drivers too weak
Economy
Supply
Demand
Barriers
Absence of significant barriers
Strong behavioural, governmental, and barriers

Conclusion

- Mismatch between supply and demand of reclaimed components
- Behavioural shift is needed to increase demand for reclaimed components
- Policy makers can provide incentives for component reuse
- Entrepreneurs can fill the gap in demand for circular demolition but will need a strategy to with components with low demand

Further research

- Research for demand of reclaimed components among larger number of companies
- Further explore specific opportunities
- Development of standardised method for identification of components and their value

Luuk Gremmen

P5 Presentation

06-07-2018

Thanks for listening!

References

1. ABN (2014). Circulair Bouwen, Het fundament onder een vernieuwde sector. Technical report, ABN AMRO.
2. Adams, K. T., Osmani, M., Thorpe, T., & Thornback, J. (2017, February). Circular economy in construction: current awareness, challenges and enablers. In *Proceedings of the Institution of Civil Engineers-Waste and Resource Management* (Vol. 170, No. 1, pp. 15-24). Thomas Telford Ltd.
3. Corbin, J. and Strauss, A. (1990). Grounded theory research: Procedures, canons and evaluative criteria. *Zeitschrift für Soziologie*, 19(6):418–427.
4. Ravetz, J. (2008). State of the stock—What do we know about existing buildings and their future prospects? Energy Policy, 36(12), 4462–4470.
5. Engelken, M., Römer, B., Drescher, M., Welpe, I. M., & Picot, A. (2016). Comparing drivers, barriers, and opportunities of business models for renewable energies: A review. Renewable and Sustainable Energy Reviews, 60, 795–809. https://doi.org/http://dx.doi.org/10.1016/j.rser.2015.12.163
6. Enserink, B., Hermans, L., Kwakkel, J., Thissen, W., Koppenjan, J., & Bots, P. (2010). Policy Analysis of Multi-Actor Systems. Lemma.
7. Kay, T., & Essex, J. (2009). Pushing Re-use: towards a Low-carbon Construction Industry. Internet: Http://Www. Bioregional. Com/Files/Publications/Pushingreuse. Pdf [Feb., 2012].
8. Pomponi, F., & Moncaster, A. (2016). Circular economy for the built environment: A research framework. Journal of Cleaner Production, 143, 710–718.
9. Rijkswaterstaat. (2015). *Beleidsverkenning Circulaire economie in de Bouw. Een perspectief voor markt en overheid*.
10. Segerstedt, A., & Olofsson, T. (2010). Supply chains in the construction industry. *Supply Chain Management*, *15*(5), 347–353. https://doi.org/10.1108/13598541011068260
11. Uihlein, A., & Eder, P. (2009). Towards additional policies to improve the environmental performance of buildings. *European Commission, JRC-IPTS, EUR*, *23775*.
12. Walker, W. E. (2000). Policy Analysis: A Systematic Approach to Supporting Policymaking in the Public Sector. Journal of Multi-Criteria Decision Analysis, 9, 11-27.

Drivers and Barriers

	Governmental		**Economic**	
	Supply	*Demand*	*Supply*	*Demand*
D	Zero waste goal		Profit	Profit
B		Tender Rules Tax system Liability	Limited Supply Price of transport Price of storage	Limited Demand
	Environmental		**Behavioural**	
	Supply	*Demand*	*Supply*	*Demand*
D			Demand for circular demolition	
B	Health risks	Energy efficiency		
	Societal		**Technological**	
	Supply	*Demand*	*Supply*	*Demand*
D	Company policy		Online database	
B				

			Van Liempd	Bouwcarrousel	RotorDC	RVB	ErasmusMC	Notes
Drivers	Governmental	*Zero waste goals*			I	I		
		Subsidies for cirular initiatives			I			Belgium
	Economic	*Short term profit (cost savings)*	*I*	S		I	I	
		Long term profit (experience/sale)		I		I		
	Environmental	*Resource efficiency*	*I*	I	I	SE	SE	
		Taking care of the environment	*S*	S	S	P	SE	While 'environment' is a very broad definition, this reason is mentioned universally as a driver.
	Behavioural	*Company policy*			I	I	SE	
		The human factor		I	W		I	
		Demand for circular demolition	*I*	I	I	W	O	RVB and ErasmusMC show demand for circular demolition
	Societal	*Corporate image*				I	I	100% of the corporations
		Role in society				S	I	
	Technological	*Online sales platform*	*W*	W	W	W		Facilitator rather than driver
			Van Liempd	**Bouwcarrousel**	**RotorDC**	**RVB**	**ErasmusMC**	
Barriers	Governmental	*Tender Rules*	*I*		I	I		
		Unclear regulations		P		I	I	
	Economic	*Extra costs of demolition*		S				
		Time constraints for deconstruction					I	
		No demand for reclaimed components	*I*	I	P		I	RVB did not experience this because they outsourced the sale of components
		Price of transport and storage		P	P		SE	
		Matching supply and demand	*I*	I	I	I	SE	ErasmusMC main topic of the seminar
	Environmental	*Health risks*		S	I		I	
	Behavioural	*No demand for reclaimed components*	*I*	O	I	O	I	In there twice, this one is more about perception
		Perceived lower quality of reclaimed components	*I*	I	O	I	I	RotorDC acknowledges this by only focussing on the select components that do have demand
		Architectural freedom				I		Only explicitly mentioned by RVB
	Societal	*Traditional procurement methods*		I	I	I		
		Lack of experiece					I	
		Lack of transparancy				SE	I	Both RVB and ErasmusMC embarked on partnerships to improve this
	Technological	*Quality control*		I	I	I	I	
		Requires knowledge of materials in the design phase			I		I	
		Lack of supply chain integration		I			I	
		Extra complexity in supply chain			I	I	P	
			Van Liempd	**Bouwcarrousel**	**RotorDC**	**RVB**	**ErasmusMC**	
Opportunities	Governmental	*Regulations for reuse*	*I*		I			
		Willingness to engage in projects			I	I		
	Economic	*Portfolio mining*			I	P	SE	Makes matching supply and demand even harder due to limited demand side
	Environmental							
	Behavioural							
	Societal	*Unused potential (lack of transparancy)*	*I*	I	I	I		There is more demand than is utilised
		Different procurement practices						
	Technological	*Standardisation of quality testing*		I	P			

SE = Mentioned in seminar
I = Mentioned in interview without prompting
P = Mentioned in interview after prompting
S = Mentioned in secondary information
O = Observation
W = Mentioned on website