

# Financial Assessment of Material Reuse in Building Products:

Comparing cost drivers in wood, concrete, and glass reuse

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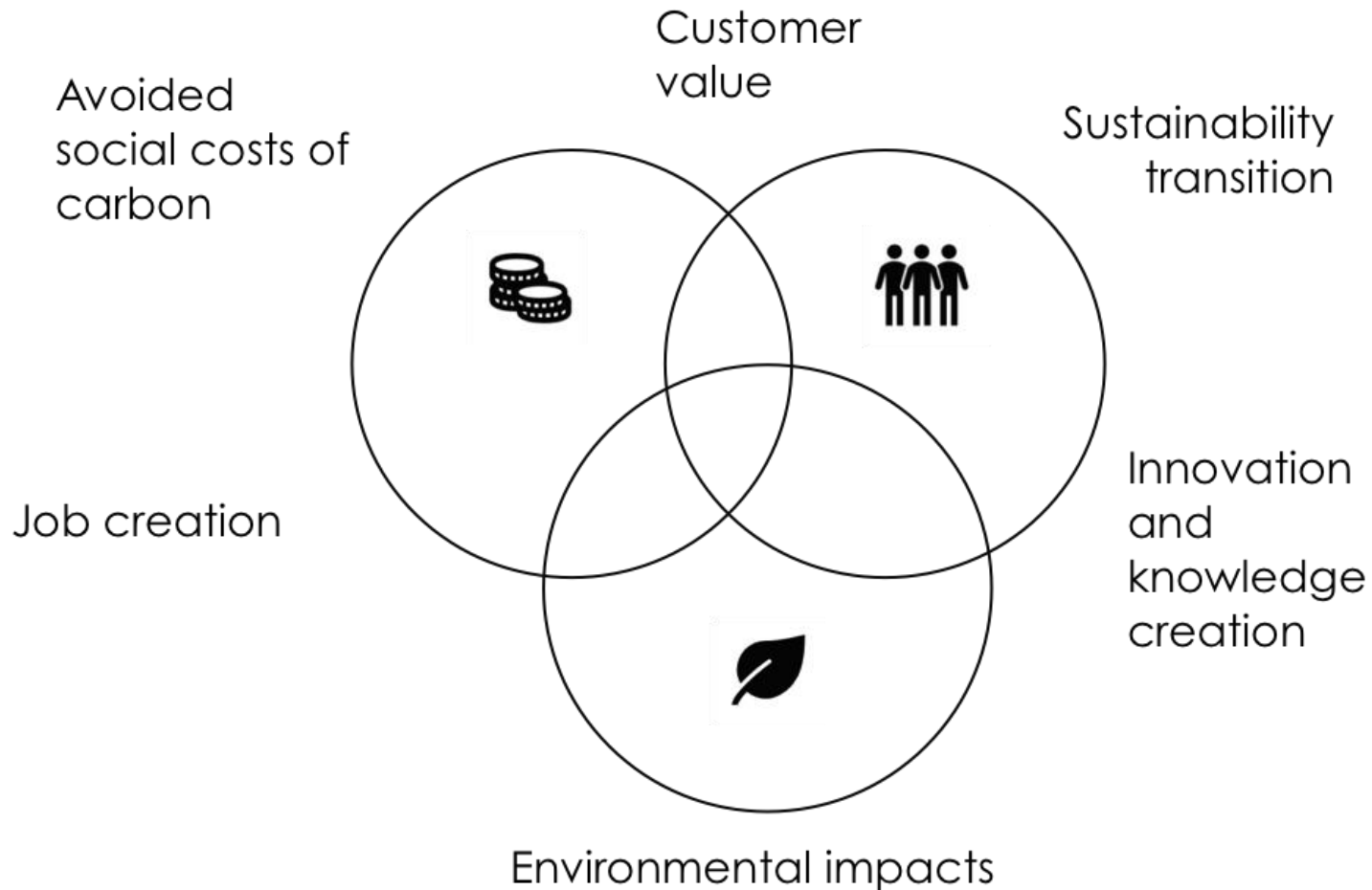


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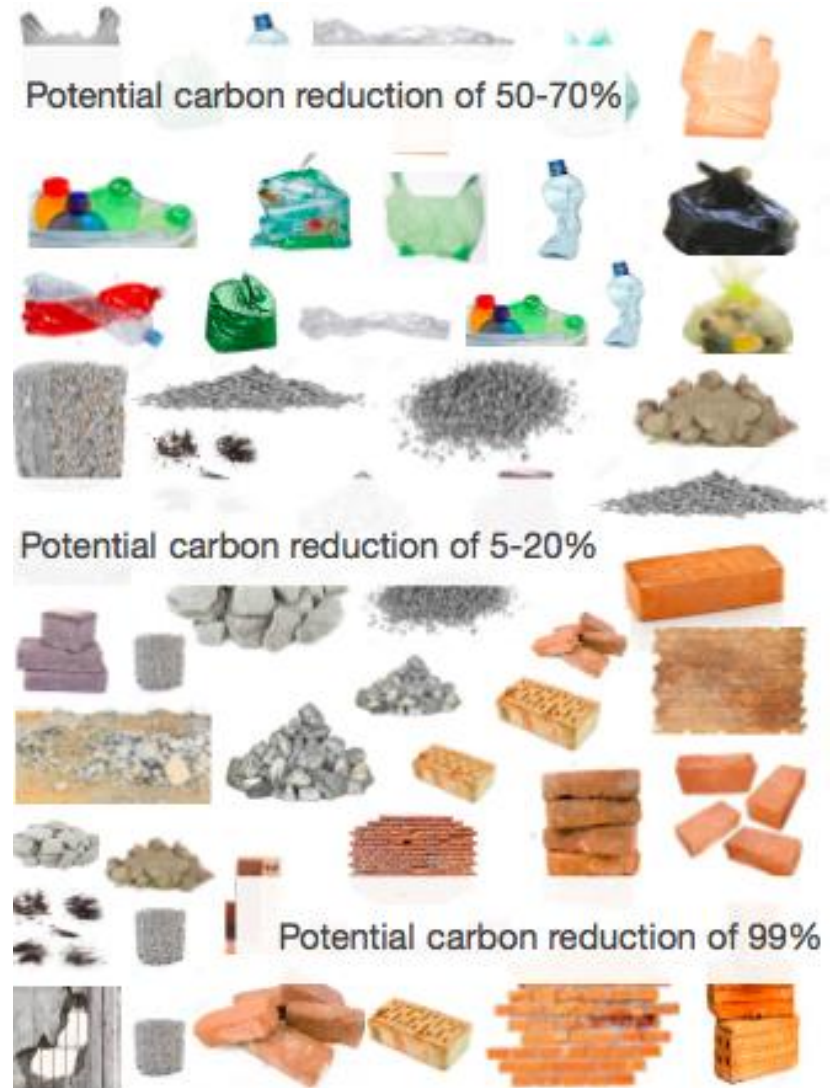
# Sustainability evaluation of a business model for material reuse



# Background

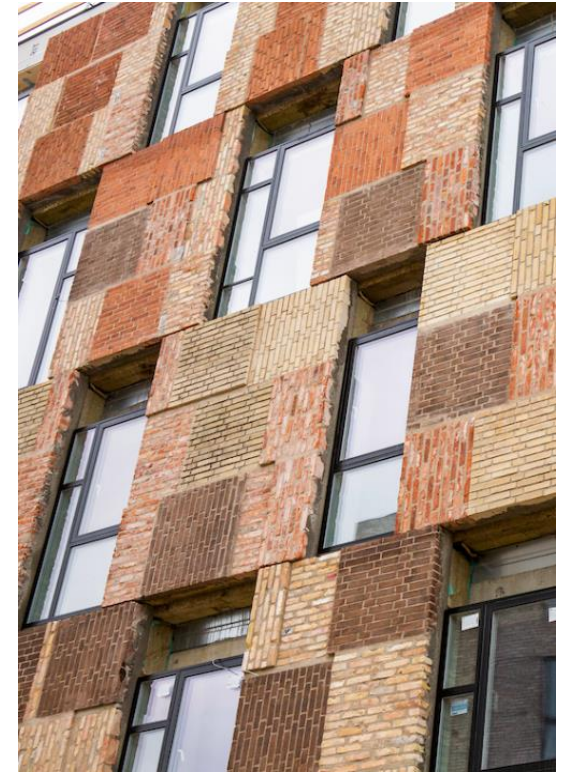
Use of secondary materials for producing building materials is one way to reduce embodied emissions of buildings (*Nußholz, Nygaard Rasmussen, Milios, 2019*)

**REF:** “Circular building materials: Carbon savings potential and the role of business model innovation and public policy”.  
*Resources, Conservation & Recycling.*  
*Special Issue: Waste for Building Materials.*



# Background

- Economic potential and business models around material reuse are emerging



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# Background

- However, many financial barriers to economic application remain (Adams et al. 2018)
  - low value of post-use materials
  - labor-intensive recovery processes

**→ reuse if often more expensive than new!**

# Background

- To help diffusion of business models for material reuse in the building sector better understanding of their financial viability is needed
- Fierce competition with linear producers



# Research objective

- advance understanding of the financial structure of reusing different end-of-life materials for building materials by presenting a cost structure analysis of three reuse solutions
- Reuse solutions developed by a Scandinavian case company for wood, glass, and concrete.



# Research question

- What are the main cost drivers of the three different materials streams and applications?





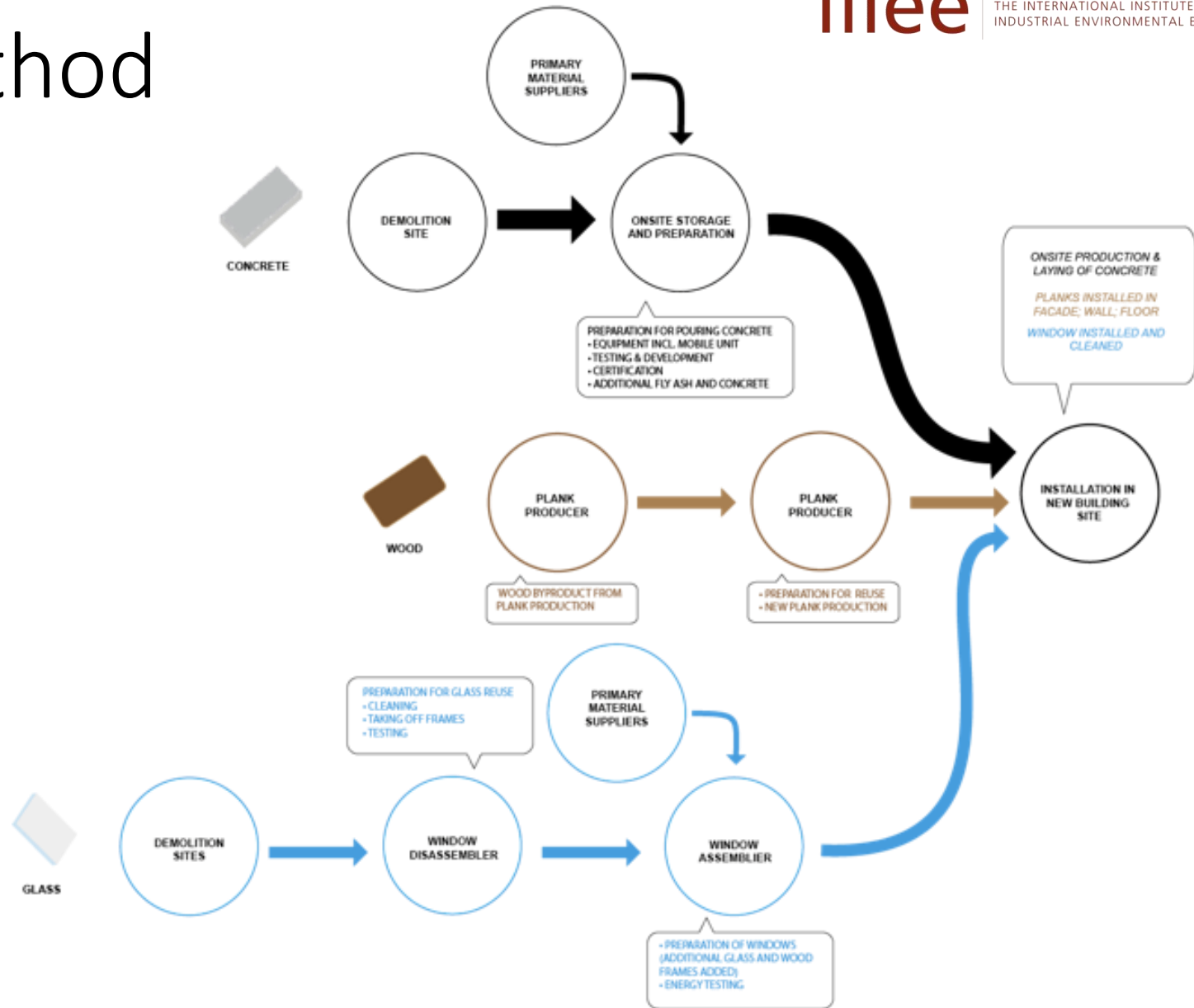
# Method

## Case study research

- A comparative case study design of a Scandinavian company that developed a business model for three commercialized reuse solutions
  - Wood for panels (By-product use)
  - Glass for windows (Material reuse)
  - Concrete for flooring and walls (Material recycling)



# Method



# Method

## Cost structure analysis

- A cost structure analysis was conducted to identify the cost associated with various value chain steps, their inputs and activities

## WHY?:

- Understanding the cost structure can indicate
  - Competitive (dis)advantages
  - Feasibility of reuse
  - Suitable policy interventions

# Method

- Organizing invoices according to production step
  - Material sourcing,
  - R&D,
  - Preparation for reuse,
  - Production, and
  - Installation.
  
- Labour costs for project management not included

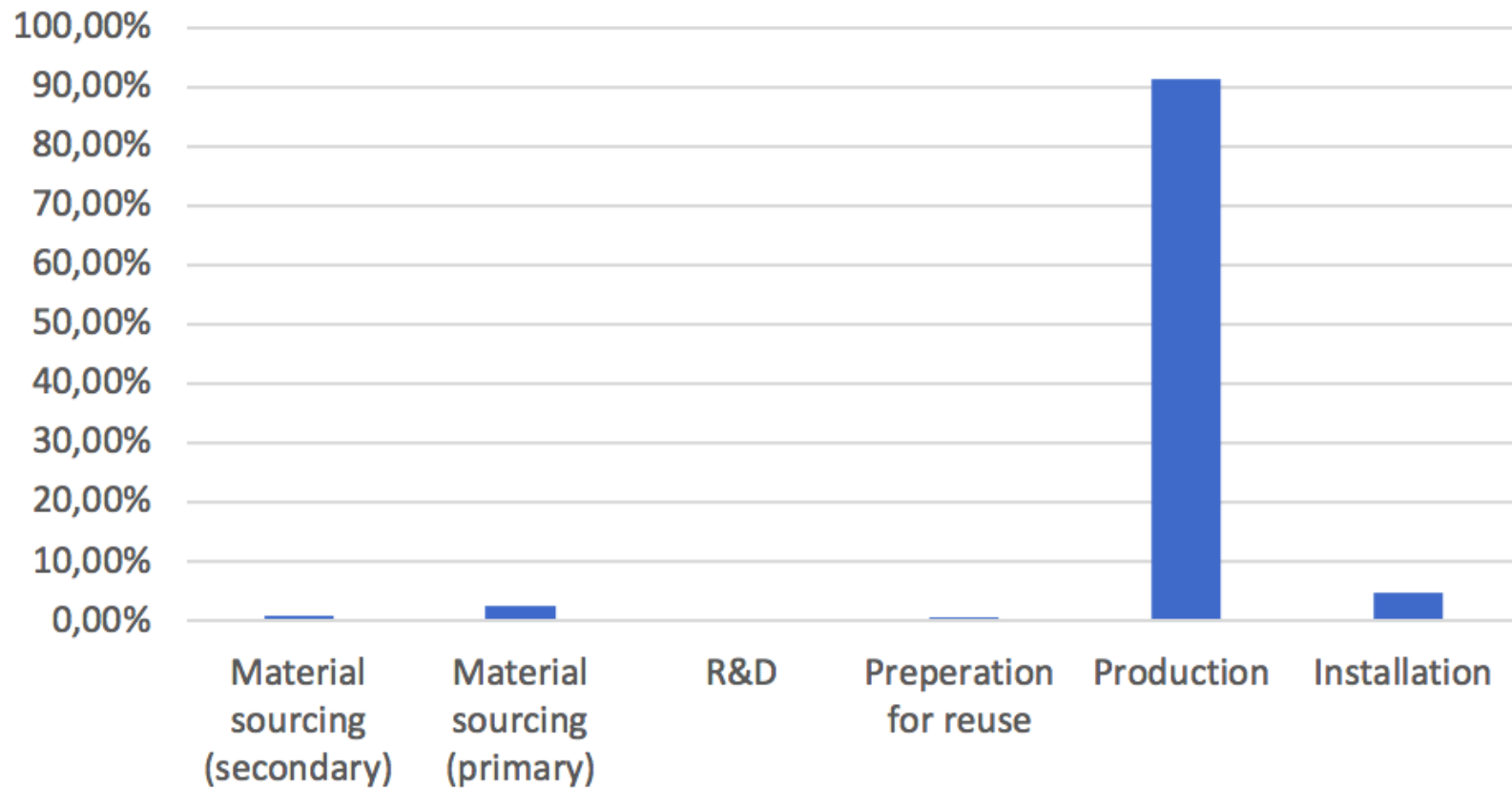
# Data collection

- Data was collected from company's accounting data and semi-structured interviews.
- Company employees were consulted to verify accurate understanding of financial data and value chains.



# Findings: Glass

## Cost Factors - Circular Window



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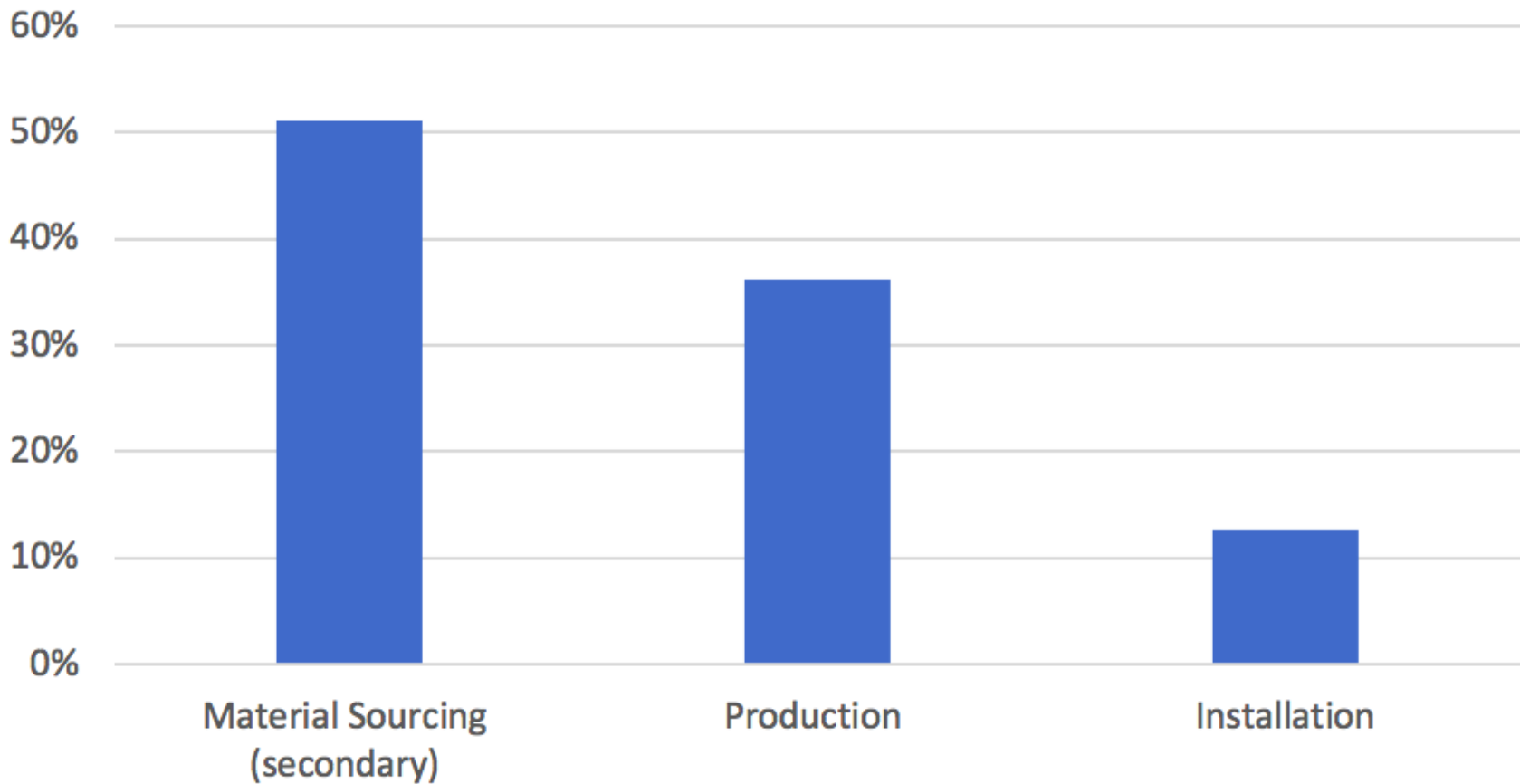


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# Findings: Wood

## Cost factors - Circular Wood Panels



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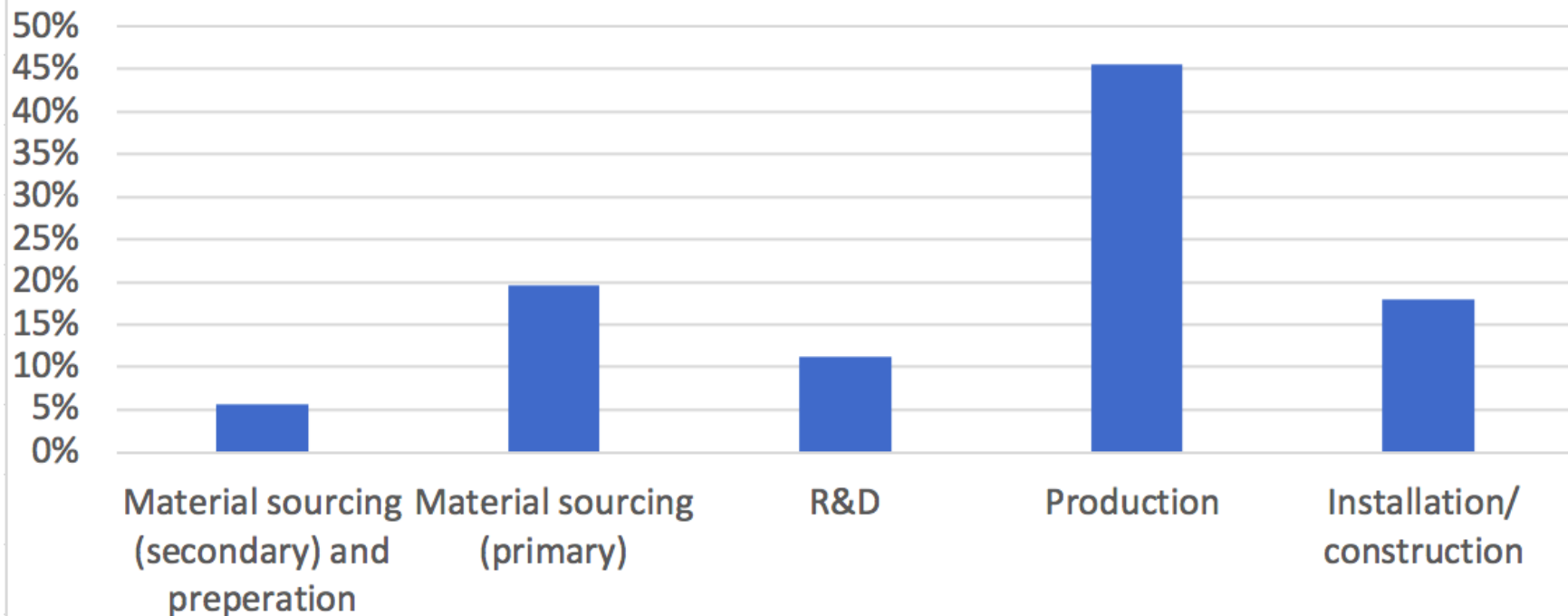
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# Findings: Concrete

## Cost factors - Circular Concrete



# Comparing cost drivers

## Similarities:

- Manufacturing was a significant share of total costs

## Differences:

- Very different costs for material sourcing
- Virgin materials can be a considerable part of costs
- Different number of production steps needed
- Legal requirements can drive costs (e.g. high R&D costs for concrete)



# Discussion and limitations

- First production line only
- In future:
  - higher efficiency
  - no start-up costs
  - no installation costs
- Limited generalizability
- No costs for project management

# Future research

- Comparison with linear value chain
- Sustainability value (environment, economy, society) disregarded
  - other value flows for other stakeholders beyond the firms' financial value



# Conclusions – So what?

- More diversified picture than common CE narrative on higher labour costs, but lower material costs
- Primary material input can be a significant cost driver
- More integrated value chains needed to be competitive (otherwise high transaction costs)
- Better understanding of competitive (dis)advantages with linear producers needed





# Thank you for your attention!

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