Predictive resource planning: coupling construction needs with demolition waste forecasts

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PREDICTIVE RESOURCE PLANNING:
COUPLING CONSTRUCTION NEEDS WITH
DEMOLITION WASTE FORECASTS

Elisabeth Keijzer, Jacco Verstraeten-Jochemsen, Sanne van Leeuwen, Mara Hauck, Elmer Rietveld
RESOURCE EFFICIENCY IN THE CONSTRUCTION SECTOR

- EU Waste Framework Directive: recycle/recover 70% of non-hazardous construction and demolition waste (CDW) by 2020

- Current recycling systems function insufficiently (Dahlbo et al., 2015)

- New processes & techniques could lead to:
  - Higher resource efficiency
  - Reduced environmental impact
  - Less societal impact

Predictive Resource Planning: Coupling Construction Needs with Demolition Waste Forecasts

Global resource consumption (Krausmann et al., 2009)
METHODS TO QUANTIFY

- To direct efforts and investments, we need to be able to forecast material availability and quality.

- Various methods exist for CDW quantification, e.g. (Wu et al. 2014):
  - Site visits;
  - Generation rate calculation;
  - Lifetime analysis;
  - Classification system accumulation;
  - Variables modelling.

- However, application of CDW forecasting methods is not common practice in resource management.

- Lifetime Analysis (LA) could improve forecasting and thereby create added value in terms of environment, employment and resource management.
RESEARCH QUESTION

Can we develop a reliable CDW forecasting model to be used in decision making on resource efficiency in the construction sector?
MODEL DESIGN

CDW forecasts

Urban Stock

Building profiles

Expected material demand

Materials

Building components

Lifetimes
THE CASE: TERRACE HOUSES (IN AMSTERDAM)

- The Netherlands: replacement rate of dwellings is low (0.4% = dwelling lifetime of 200 years - Mulder et al. 2015)

- Amsterdam Metropolitan Area as a case study: strategically important & architecturally diverse

- Typical Dutch dwelling: terrace house
  - 8 architectural styles/construction periods
  - 15 building components
  - 23 materials
  - 10 year period (2015-2024)
RESULTS (1): URBAN STOCK

- Urban stock of Amsterdam Area $\approx 120,000$ kton of resources

- Largest volumes:
  - Concrete (41%)
  - Brick (22%)
  - Sand-lime bricks (10%)
  - Timber (9%)
  - Cement (6%)
RESULTS (2): CDW FORECASTS

- CDW is estimated at 8000 to 9000 kton/year, based on average lifetime of building components.

- This corresponds to roughly 7% of all materials stored in the urban stock.

- Real values are influenced by more factors: e.g. less CDW due to economic circumstances.
Proof of principle: model can create a starting point for transforming waste to resources.

The variation in LA forecasts is too little to be useful in year-to-year decision making.

Model is only a prototype; improvements to be made.

Validation, testing & reviews.
RECOMMENDATIONS FOR FURTHER RESEARCH

› Complement the Lifetime Analysis methodology to incorporate economic circumstances

› Deepen, broaden and improve models
  › Connection to LCA & economic models
  › Improvements in data availability and accuracy
  › Case studies

› Development of a new generation of decision support tools

› New stimulus for product design
THANK YOU FOR YOUR ATTENTION
REFERENCES


