Infrastructure expansion, waste generation and EU policies on Circular Economy in Samothraki, Greece:

An island's dilemma

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INTRODUCTION

For the Greek island of Samothraki, the EU recovery and recycling targets for construction and demolition waste seem currently far out of reach.

For many island communities dealing with waste represents one of the major challenges towards a local sustainable development (Eckelman et al. 2014). The EU Waste Framework Directive (2008/98/EC) demands from EU member states a 70% recovery and recycling rate for construction and demolition waste (CDW) by 2020. With the implementation of the 2018 Circular Economy (CE) package the significance of recycling and reuse even increased (European Commission 2016; 2018).

The present study introduces a case about the small and remote Greek island Samothraki that due to numerous reasons is currently far away from meeting these targets. Since the construction of a new port in the late 1960s, the island experienced an unprecedented era of infrastructure expansion accompanied by new and complex challenges regarding CDW. With no proper management system for CDW in place, material output was so far used for backfilling or simply dumped illegally somewhere on the island or into the sea.

Buildings and infrastructure provide important services to society and depending on their lifetimes can shape material demand and waste generation for a long time due to inherent path dependencies (Fishman et al. 2015; Haberl et al. 2017). By applying a dynamic bottom-up stock modelling approach (Tanikawa et al. 2015; Stephan and Athanassiadis 2018), this study aims at establishing a comprehensive analysis of drivers and quantities for resource consumption and CDW generation on the island of Samothraki for buildings and infrastructure from 1971 to 2016.

RESEARCH OBJECTIVES

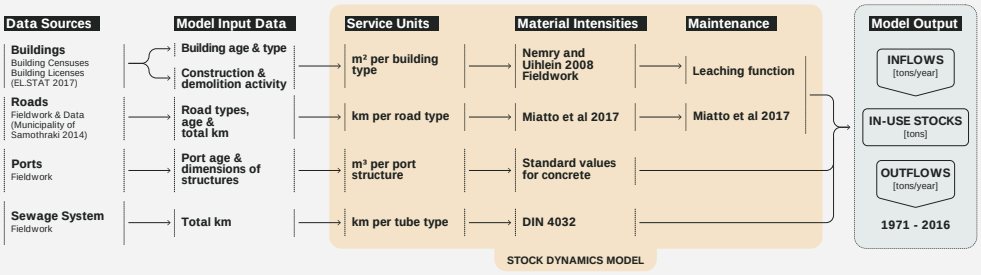
ISLAND SOCIAL METABOLISM
Using dynamic stock modelling as a path towards adequate MFA accounts

EU RECYCLING TARGETS
Showing that different regions within the EU require different solution sets

CIRCULAR ECONOMY
Advising local authorities in the implementation of a Circular Economy strategy

MATERIAL AND METHODS

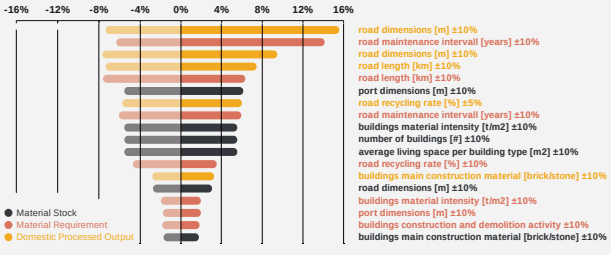
Stock driven bottom-up dynamic MFA model



The applied stock dynamic model is based on the concept that the lifestyle of the population is manifested in the temporal, spatial and qualitative characteristics of in-use stocks (Müller 2006). The model operates with service units, associated material intensities and a maintenance function for buildings and roads. Important cornerstones of the model were assessed through qualitative interviews with local stakeholders.

UNCERTAINTY

One-at-a-time sensitivity analysis



15 parameters were tested with a ±10% factor while the recycling rate of roads was tested adding and subtracting 5% to the total amount of recycled materials that are allowed to be included in a new bituminous layer. Results show that road dimensions, maintenance interval and length have the largest influence on the model output data.

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preliminary results

FINDINGS

Cumulative flows of construction minerals from 1971-2016

MFA indicators: Imports, domestic extraction (DE), domestic material consumption (DMC), manufactured capital, net addition to stocks (NAS), total material output (TMO), recycling and direct material output (DPO)

EU RECYCLING TARGETS
With a recycling rate of 13%, Samothraki is currently far away from meeting the EU WFD or CE targets.

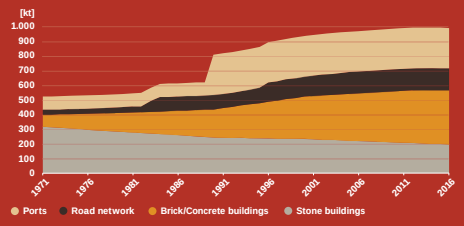
INFRASTRUCTURE EXPANSION
2-fold increase of the local material stock of buildings and infrastructure lead to a 3-fold increase and new qualities of CDW.

MODEL APPLICATION
The stock driven bottom-up dynamic modelling approach applied in this study has proven to be a suitable tool to overcome data shortages on a low spatial level.

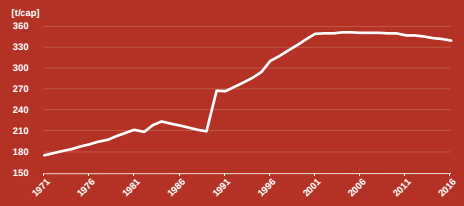
CONSTRAINTS
Island and region-specific constraints impede the implication of effective recycling and recovery measurements in the near future.

THE WAY FORWARD
As local recycling and recovery options are limited, local authorities are advised to apply measurements for the substitution of environmentally problematic construction minerals.

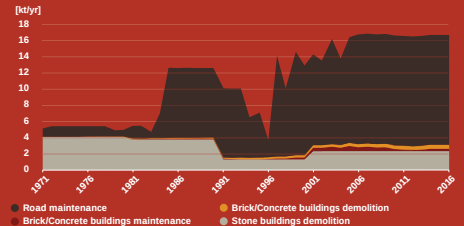
Material stock development per building and infrastructure type



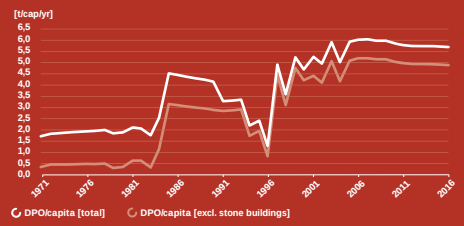
Material stock development per capita



DPO from demolition and maintenance of buildings and roads



DPO per capita and DPO per capita excluding stone buildings



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