

Dynamic Performance Assessment of the construction and demolition waste recovery policies

Dr. Ibrahim Motawa

School of the Built Environment, Heriot-Watt University, Edinburgh, UK

i.a.motawa@hw.ac.uk

Agenda

- Background
- CDW Legislations
- Analysis of policies impact
- The aim of this study
- The current stage of the study

Background

- Governments are developing policies and strategies to optimise the economic and social impacts of waste whilst, Businesses are developing operational practices to comply with such interventions
- The focus of waste management moved from environmental protection to embrace social (e.g. health and safety) and economic concerns (e.g. natural resources management, adequate infrastructure, profitability of enterprises, etc.)
- Waste management practices are tied to policies, institutional settings, financial mechanisms, technology selection, and stakeholders participation

Background

- The Waste Framework Directive (WFD) sets the obligations for member states on the collection, transport, recovery and disposal of waste. Few targets have been set regarding municipal waste and the construction and demolition waste to be recycled; and also regarding systems for separate collection is established
- The reduction of the present levels of waste generation and the increase in energy and materials recovery become the most important requirements for environmental waste management practices
- Criteria and procedures are set for the acceptance of waste at landfills to minimise pollution to air, water and soil from various industrial sources

CDW Legislations

Different policies of the UK Government have been initiated to improve the recovery of the Construction and Demolition Waste (CDW).

- Waste Framework Directive (2008/98/EC) transposition
- Hazardous Waste Regulations 2005
- Environmental Permitting Regulations 2010 and subsequent amendments apply the on-going requirements of the Landfill Directive (1999/31/EC)
- European List of Wastes (Decision 2000/532/EC)
- Waste producer's responsibility
- Site Waste Management Plan Regulations 2008 (till 2013)
- Landfill Tax

Waste management plans (WMP) and Strategies

- **Waste Management Plan for England** (Defra), 2013
- **Zero Waste Plan** – The Scottish Government, 2010
- **Construction and Demolition Sector Plan** - Welsh Assembly Government, 2012
- **Delivering Resource Efficiency** – Department of the Environment (Northern Ireland), 2013

Waste Prevention Plans

- **Prevention is better than cure** (England) – Defra, 2013
- **Safeguarding Scotland's Resources** – The Scottish Government, 2013
- **Towards Zero Waste – One Wales: One Planet** - Wales
- **The Waste Prevention Programme** - Northern Ireland

Analysis of the policies impact

- “While there are some figures about CDW in the UK, accurately quantifying CDW is challenging due to the relatively high level of uncertainty”,

*Construction and Demolition Waste management in United Kingdom,
Deloitte Limited UK - V3 – December 2015*

- Various models have been developed to analyse the impact of these policies which are comprising variables related to technology, economic, society, and climate.
- There is a need to consider the multidisciplinary aspect of CDW recovery and simulate its complexity.

Aim

- As a socio-technical problem, this research aims to develop a System Dynamics (SD) model to analyse CDW recovery policies considering the interrelationships among the influential variables.
- The SD model is proposed to utilise the hard and soft data incorporated in the CDW processes with due cognisance to the inter-dependencies of variables that are involved in addition to mental judgement of the experts and industry practitioners
- The proposed model can be used to test the effectiveness of each initiative based on the most recent statistics released and provide policy makers with a decision making tool upon which different scenarios regarding CDW recovery policies can be tested before implementation.

Fundamentals of System Dynamics

- SD is a method that ‘deals with the time-dependent behaviour of managed systems with the aim of describing the system and understanding through qualitative and quantitative model, how information feedback governs its behaviour, and designing robust information feedback structures and control policies through simulation and optimisation’, Coyle (1997)

CDW generation data

Sources and stakeholder consultation

- Environment Agency
- Zero Waste Scotland
- Natural Resources Wales
- Welsh Government
- Defra
- Mineral Products Association
- Scottish Environmental Protection Agency
- Chartered Institute of Wastes Management
- Constructing Excellence in Wales
- Department of Environment, Northern Ireland
- Northern Ireland Environment Agency
- Environmental Services Association
- National Federation of Demolition Contractors
- Construction Products Association
- UK Contractors Group
- Resource Association
- Green Construction Board/ Strategic Forum for Construction Waste Subgroup
- DRIDS (Demolition and Refurbishment Information Datasheets)
- Sector Resource Efficiency Action Plans (REAPs).

CDW generation data

- There are a number of industry datasets for CDW; which include:
 - BRE SMARTWaste benchmarks
 - UK Contractors Group
 - National Federation of Demolition Contractors (NFDC)
 - Constructing Excellence KPI's
 - BRE's Green Guide to Specification
 - WRAP data
 - Reclamation data – the BigRec survey

CDW generation data

Construction practice and sources of construction waste:

- Design changes: blueprint error, detail error, design changes;
- Procurement: shipping error, ordering error;
- Handling of materials: Improper storage/deterioration, improper handling (off-site and on-site);
- Operation: Human error (by crafts men or other labourers), equipment malfunctions;
- Residual: Leftover scrap, un-reclaimable non-consumables;
- Others

SD modelling

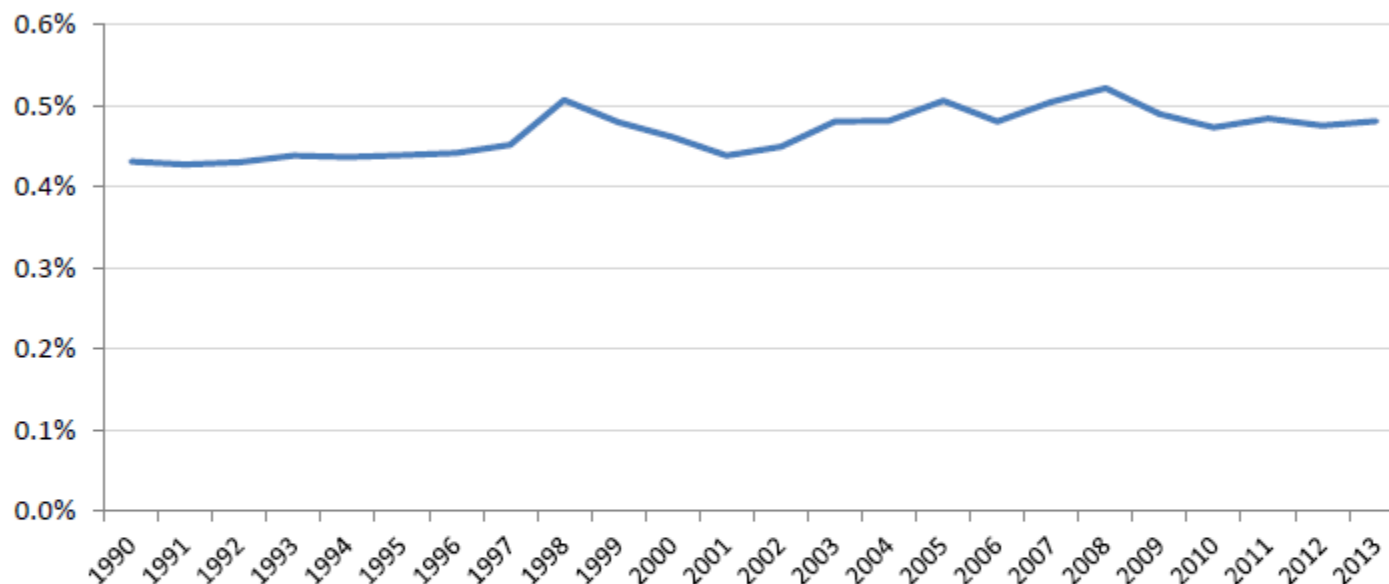
1. Problem Articulation

- To allow the efficiency within the economy to be assessed, and to provide an insight into the link between waste arisings and the environmental impacts associated with the generation of waste for a given level of economic activity, it is required to measure the amount of waste produced per unit of economic activity. For construction and demolition waste this will be measured in waste arisings (million tonnes) per unit Gross Value Added (GVA) in constant price (volume) terms
 - Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector. In order to compare waste arisings in physical terms with GVA, the estimates will need to be converted into constant price (volume) terms using an appropriate deflator

SD modelling

1. Problem Articulation

Figure 6.1: GVA of the waste sector as a percentage of the economy, UK, 1990 – 2013

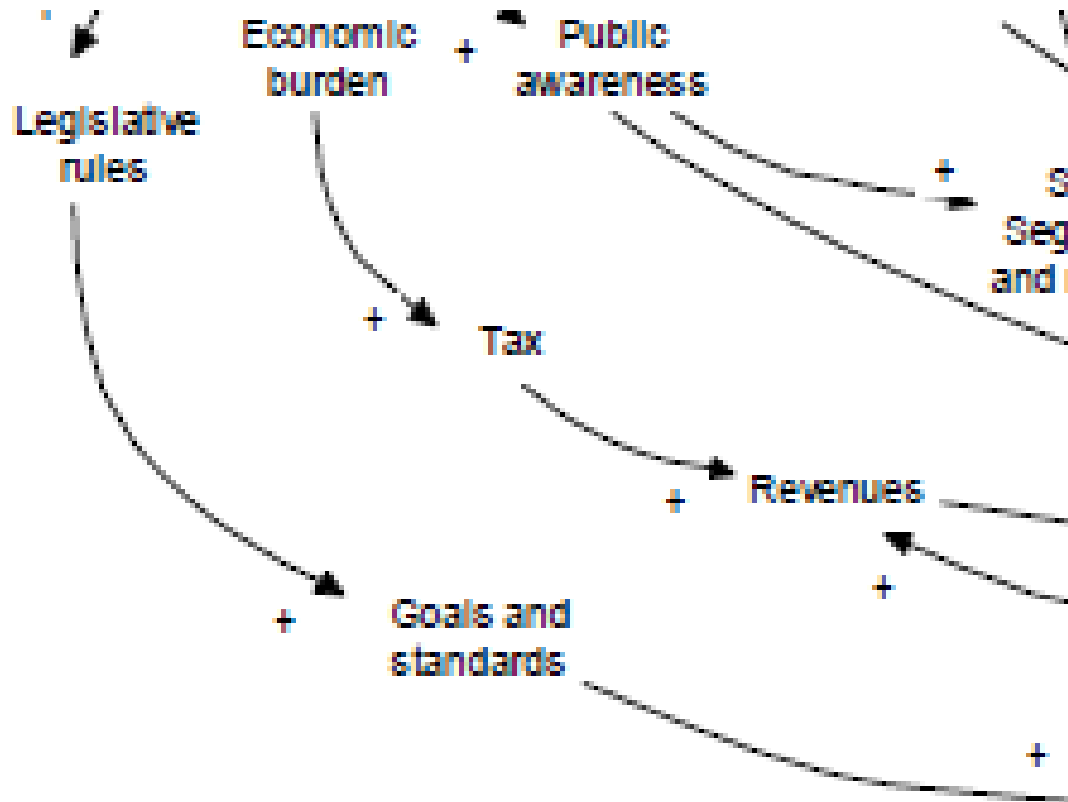


In SD modelling:
Reference mode

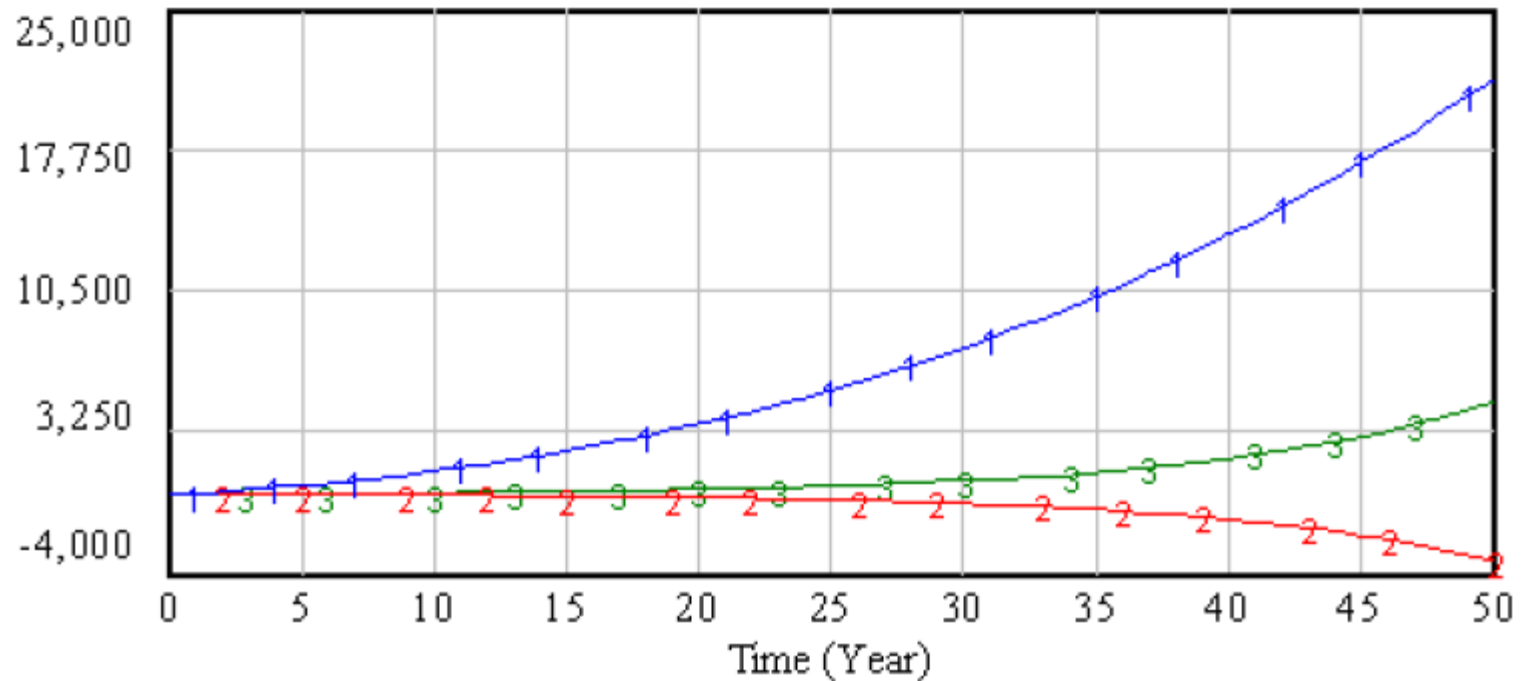
- Figure 6.1 uses the chain volume measure of GVA. This measure already takes price fluctuations into account.
- In 2013 the GVA that the waste sector generated showed a slight increase (0.48 per cent of the economy's GVA).

SD modelling

2. Formulation of the dynamic hypothesis



Examples of results



Revenue

Tax

Waste generation

Thanks

Questions??