

25th anniversary
annual INCOSE
international symposium
Seattle, WA
July 13 - 16, 2015



A Novel Methodology for the Application of Middle-Out, Model-Based Systems Engineering Techniques for City Waste Management Systems Development

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Infrastructure BUsiness models, valuation
and Innovation for Local Delivery



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The Waste Hierarchy

Preferred Environmental Option



Reduce

e.g. Food packaging;
reuse of plastic bags

Re-use

e.g. Repairable
appliances

Recycle

e.g. Designing for
recycling

Energy Recovery

e.g. heating;
electricity generation

Disposal

e.g. aggregates,
landfill

Least preferred Environmental Option

Waste Hierarchy
(www.slwp.org.uk)

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	The Business?	Advantageous combinations of variables?	Guiding principles for execution?
How is value created?			
Who is value created for?			
What is the source of competence?			
How are things positioned strategically?			
How is value captured?			
What are time/size/scope ambitions?			

Achieving sustainability through the business model

Morris et al, 2005, The entrepreneur's business model: toward a unified perspective

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Birmingham's Waste Management Infrastructure

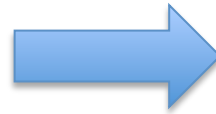
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Requirement

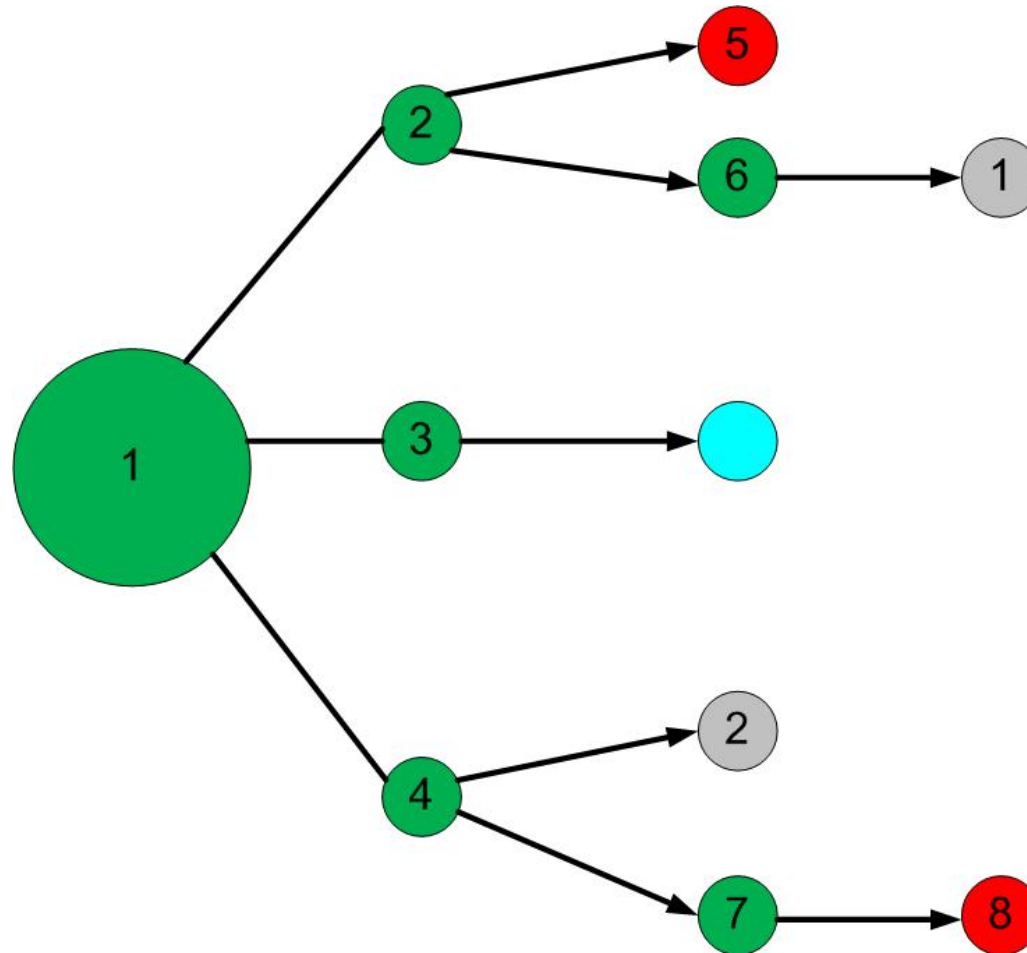
To integrate current waste infrastructure in a sustainable way that can act as a foundation and testbed for innovation.



Solution

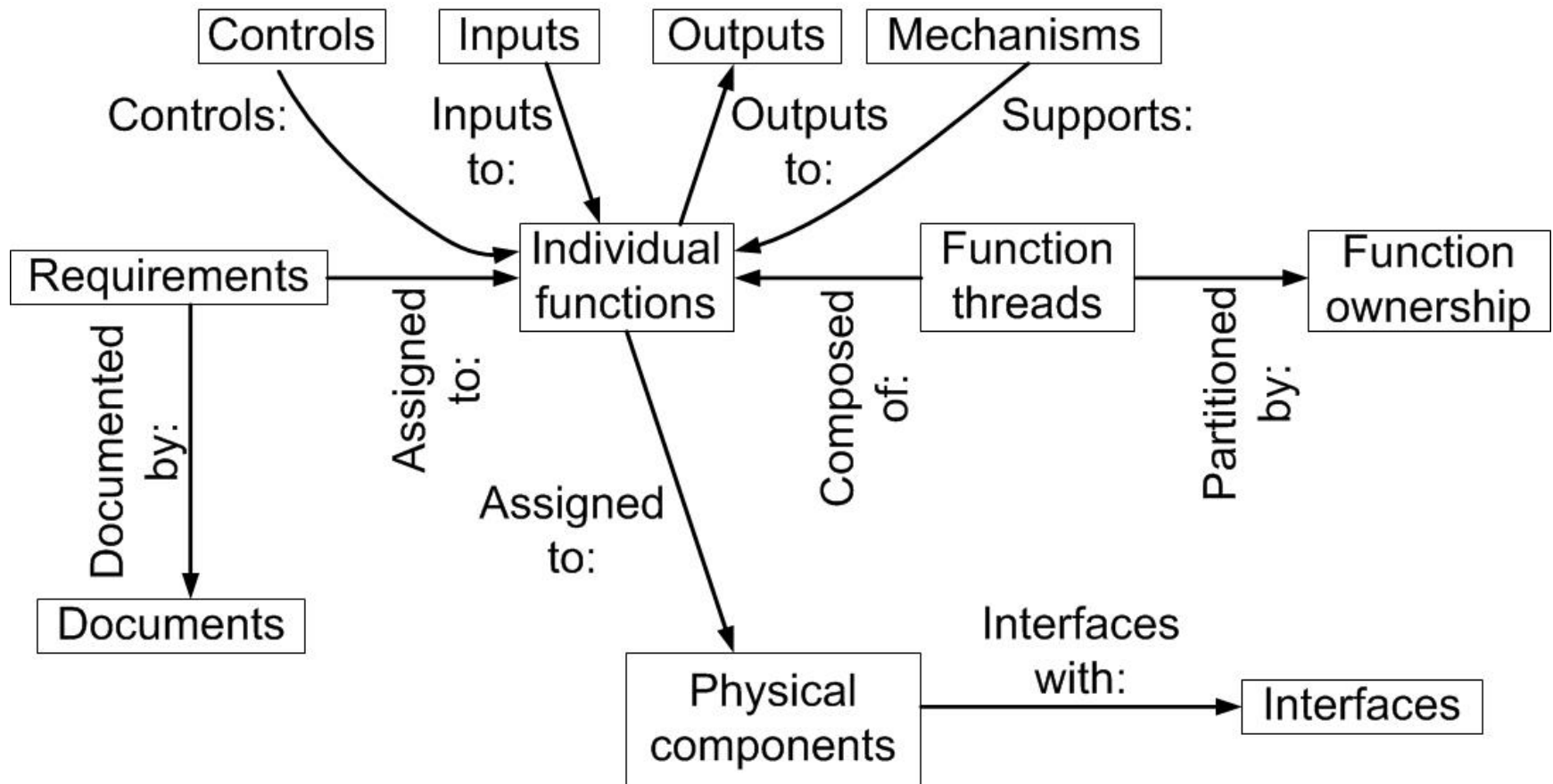
Models of the existing waste management infrastructure

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Modelling methodology – Stage 1

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Modelling methodology – Stage 2

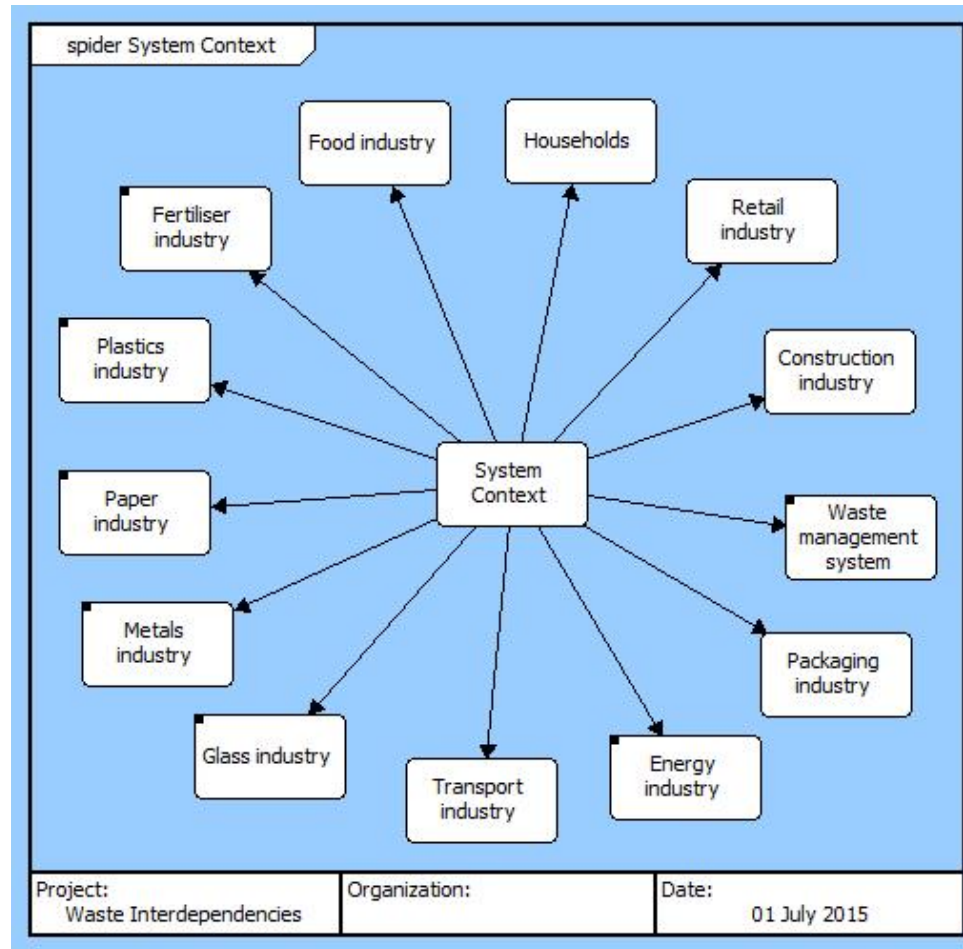
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Reverse engineering the waste system

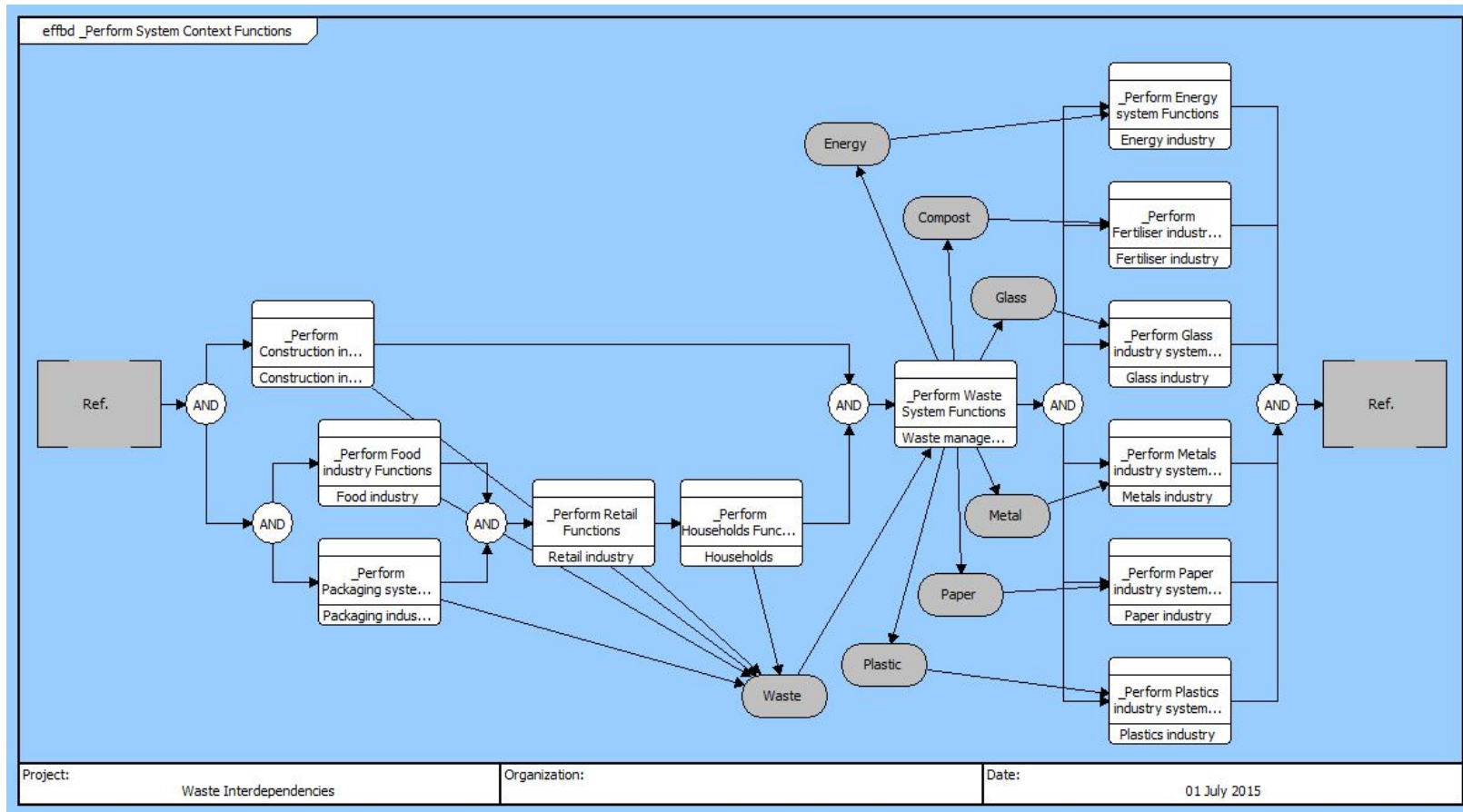
- The methodology appears to produce objective and repeatable system models; but,
- Waste documentation is scattered and not well cross-referenced;
- Documentation is not system-oriented; data elicitation requires care;
- Disconnect between higher level documents (policy and strategy) and operational procedures.

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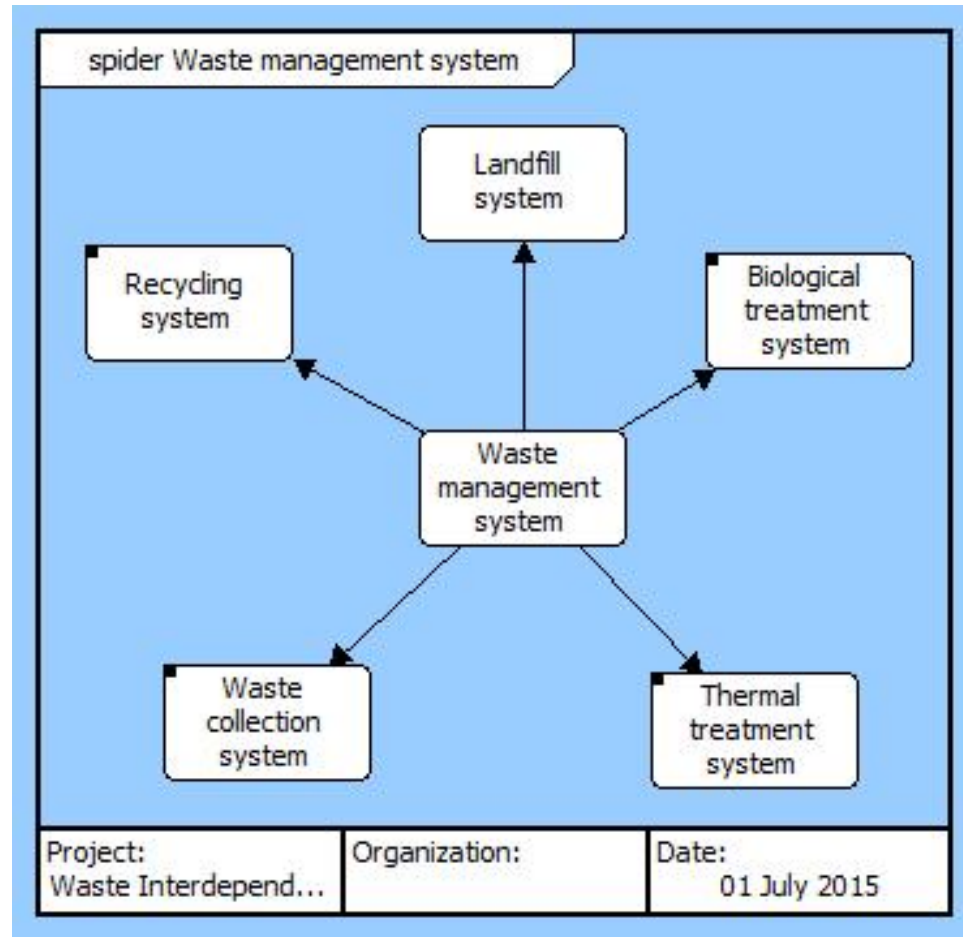
Waste model:
System-of-systems level

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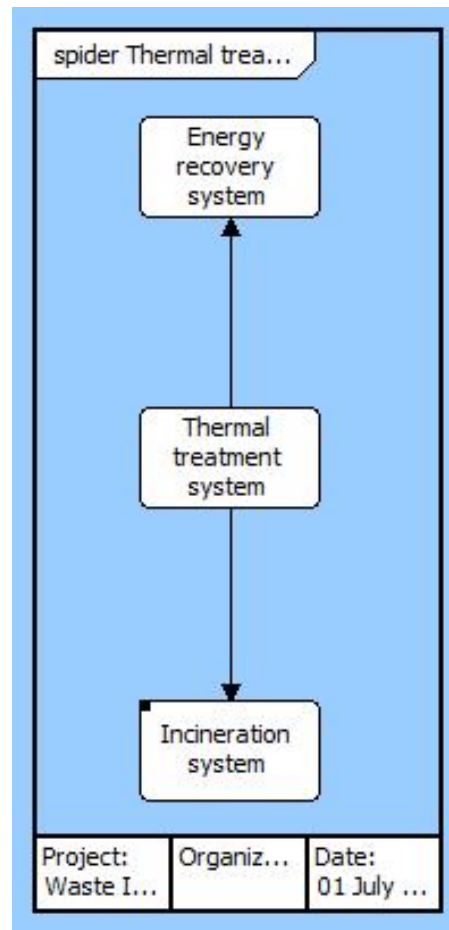
System-of-system inputs and outputs:
identifying infrastructure interdependencies.

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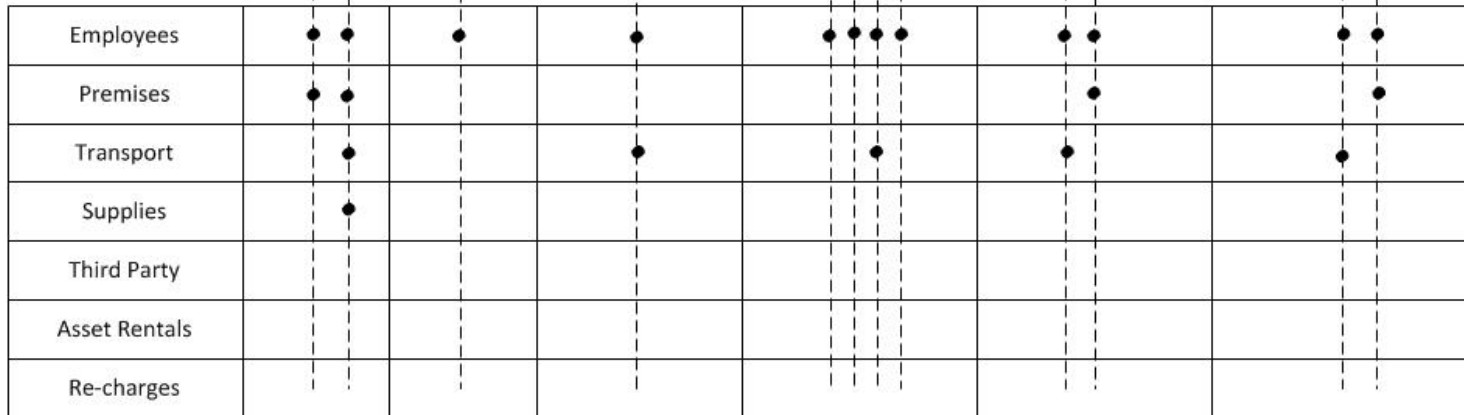


Waste model: System level

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Waste model: Sub-system level

The logo for INCOSE's 25th anniversary. It features a circular emblem with a blue globe in the center, overlaid with a white grid of latitude and longitude lines. The globe is encircled by a grey ring. The text "TWENTY-FIFTH" is arched across the top of the ring, and "ANNIVERSARY" is arched across the bottom. The word "INCOSE" is written in large, bold, black capital letters across the middle of the emblem, with the year "2015" in a smaller font centered below it. A registered trademark symbol (®) is located to the right of the emblem.

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Future research

- Complete the waste model plus models for other critical infrastructures;
- Explore the socio/technical interface based on Weaver's view of complexity:
 - Organised complexity: a sizable number of variables, interrelated into an organic whole
 - Disorganised complexity: very large number of variables, individual behaviour erratic or unknown, however, system as a whole has analysable average properties

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Thank you for listening

Acknowledgements:

Vitech Corporation, Blacksburg, Virginia, United States.

Engineering and Physical Sciences Research Council,
United Kingdom.

Economic and Social Research Council, United Kingdom.

Fleet and Waste Management, Birmingham City Council.