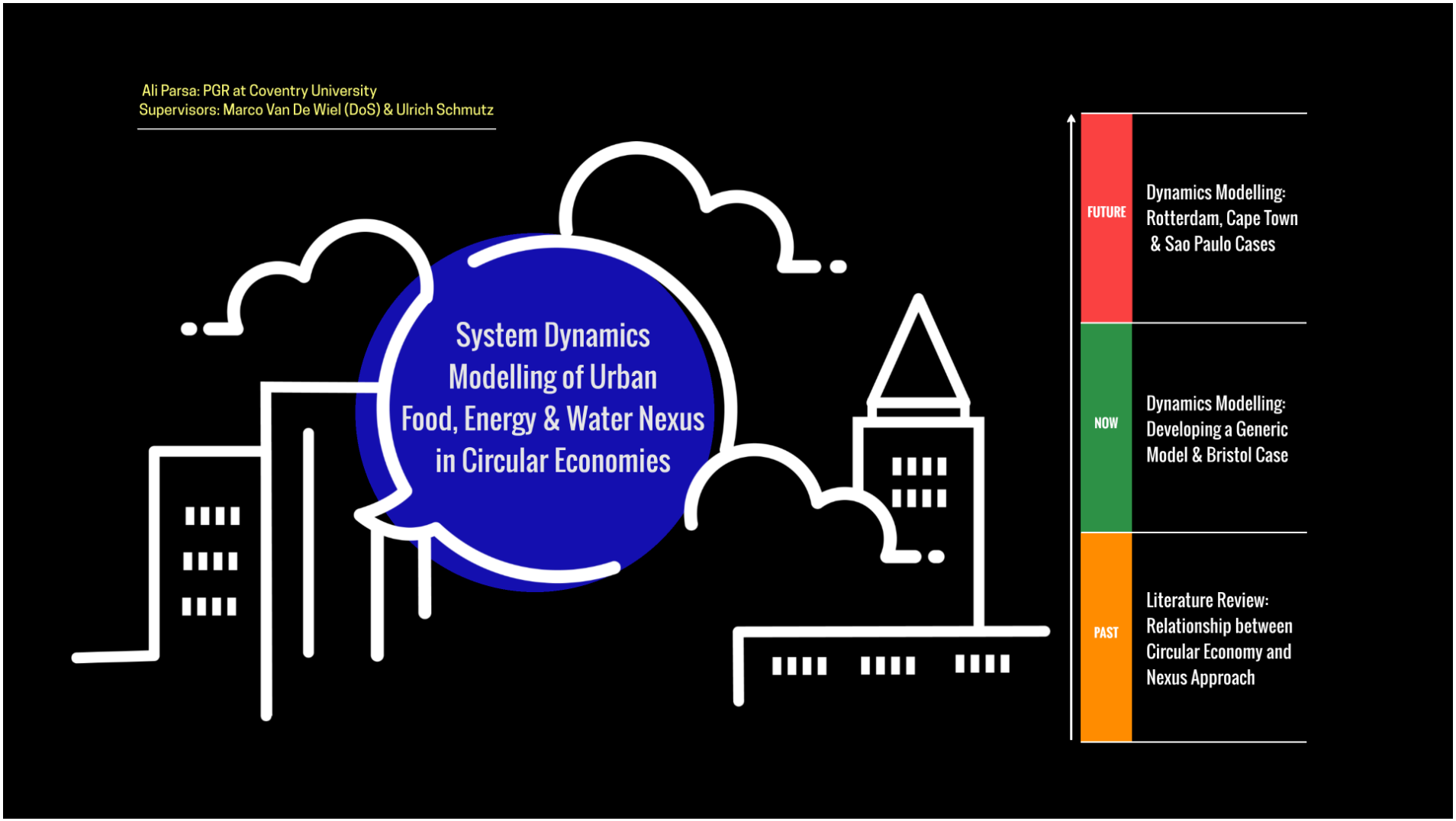
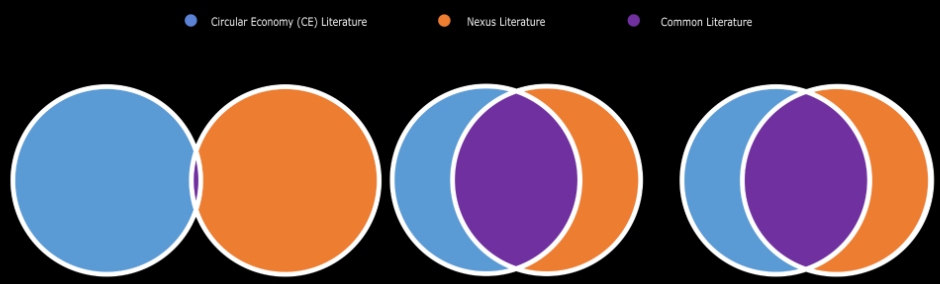

Ali Parsa: PGR at Coventry University
Supervisors: Marco Van De Wiel (DoS) & Ulrich Schmutz
System Dynamics Modelling of Urban Food, Energy & Water Nexus in Circular Economies
FUTURE
Dynamics Modelling: Rotterdam, Cape Town & Sao Paulo Cases
NOW
Dynamics Modelling: Developing a Generic Model & Bristol Case
PAST
Literature Review: Relationship between Circular Economy and Nexus Approach

Literature Review

Intersection, Interrelation or Interdependence?

Systematic Review of Relationship Between Circular Economy and Nexus Approach

1) Bibliometric Analysis



SHARED DOCUMENTS

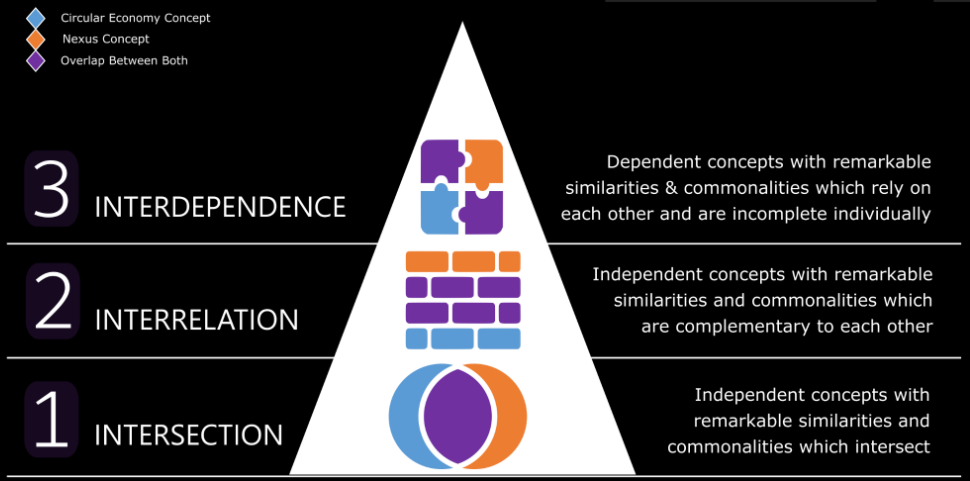
- less than 1% (57 documents) in each literature used both CE and Nexus concepts
- only one third (19 articles) of the shared documents were relevant

SHARED SOURCES

- over 50% of documents around each concept are published in 432 sources
- 8 out of top 20 relevant sources to each concept is common between both

SHARED WORDS

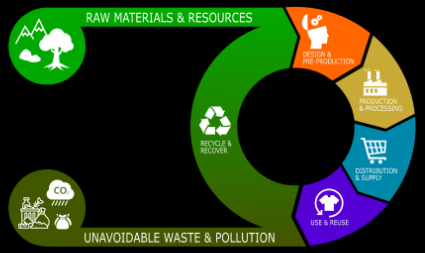
- at least 50% of most frequent words in each literature is common between both
- this rate for two random irrelevant concept is 20%



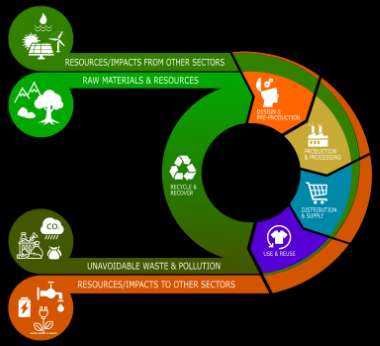
2) Thematic Analysis

An Integrated Approach to Circular Economy and FEW Nexus

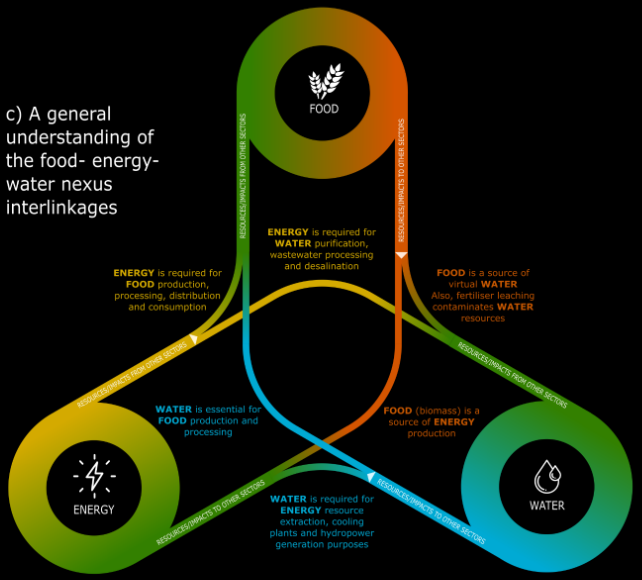
a) A lifecycle approach to circular economy



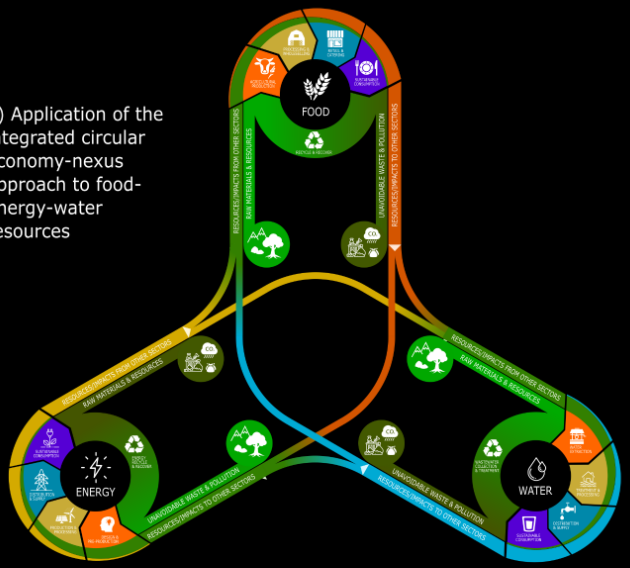
b) A novel integrated approach to circular economy and nexus thinking



c) A general understanding of the food- energy-water nexus interlinkages



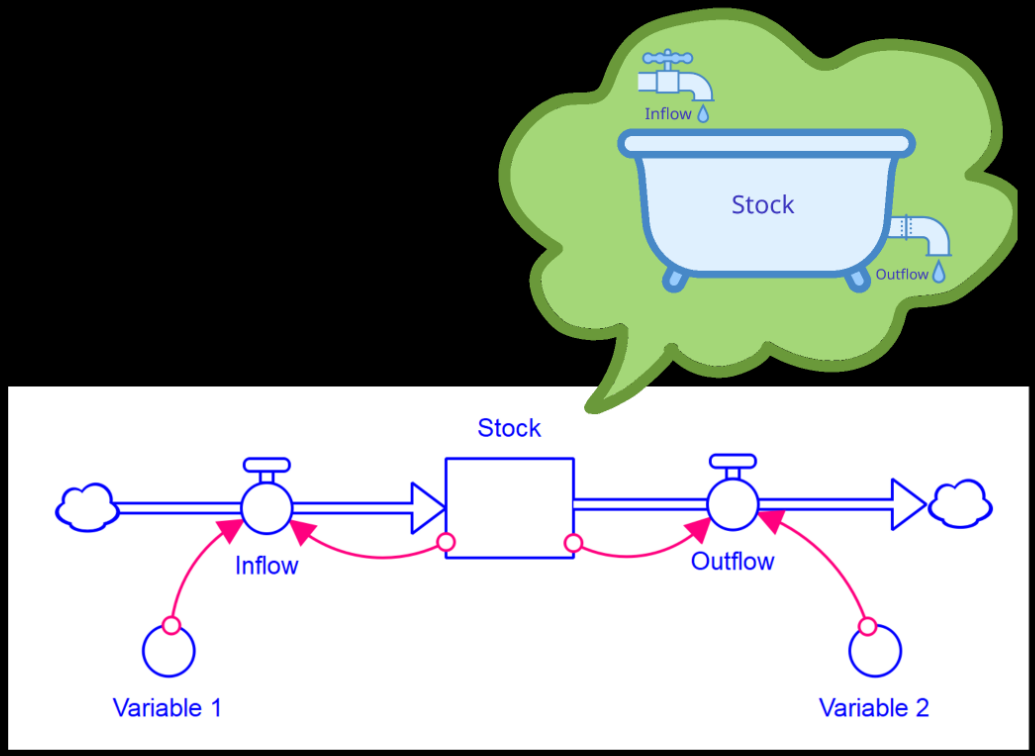
d) Application of the integrated circular economy-nexus approach to food-energy-water resources



Dynamics Modelling

System Dynamics is a method to describe, model, simulate and analyze the non-linear behavior of complex systems over time.

The building blocks of system dynamics models are: stocks, flows, variables and feedback loops.



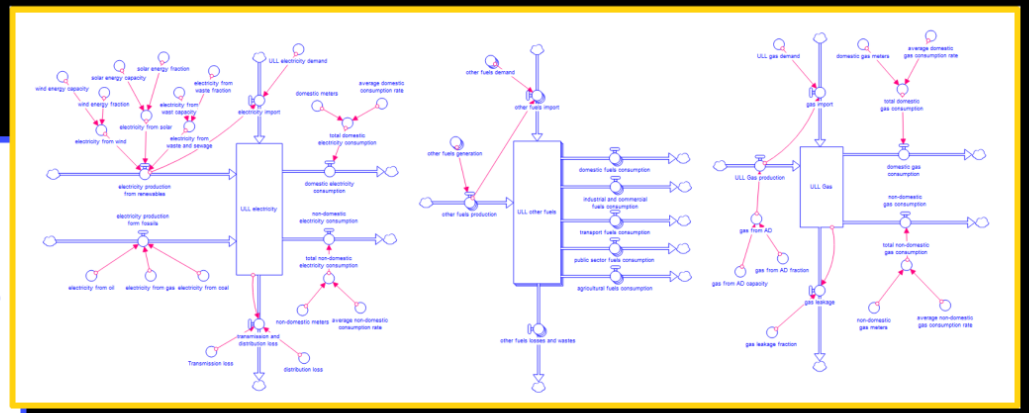
"All models are wrong, but some are useful"

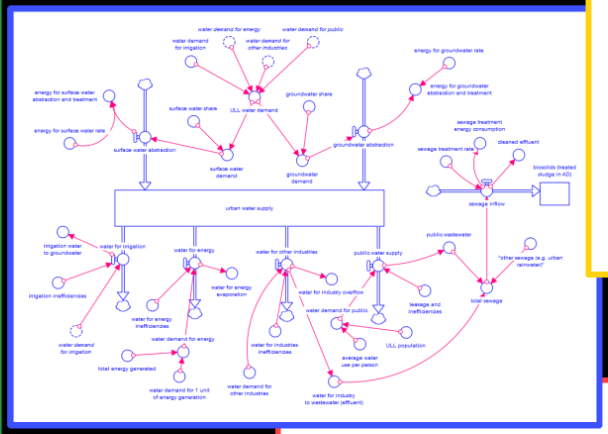
(Box and Draper 1987)

Dynamics Modelling

These modules illustrate a draft of my generic food, energy & water nexus model. The stocks and flows represent material/ energy flows within each sub-system. The red arrows (connectors) transfers information between the stocks, flows and convertors.

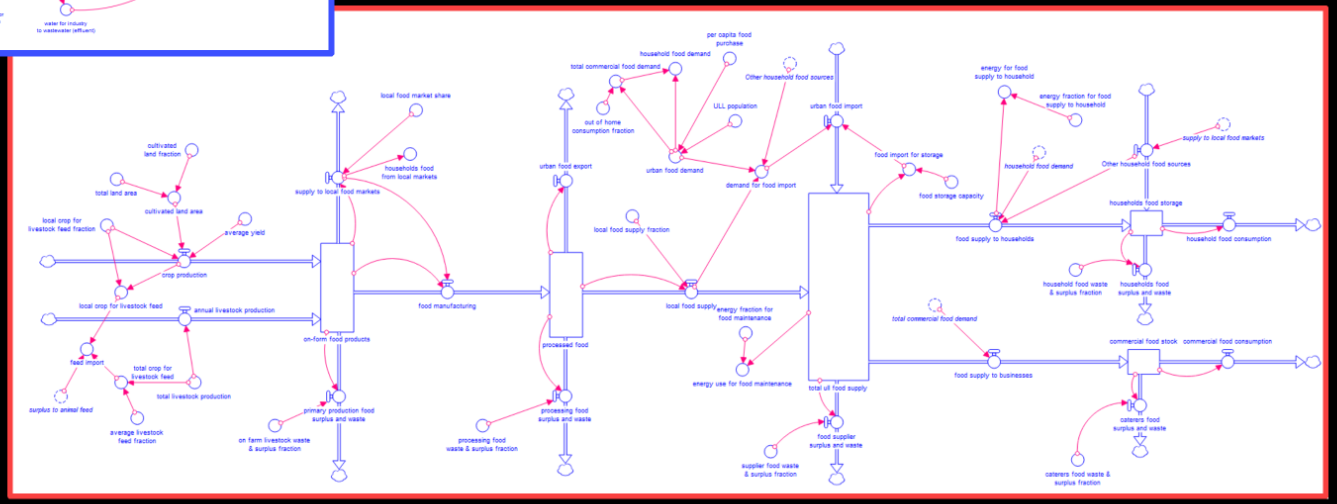
1- Energy Module





2- Water Module

3- Food Module



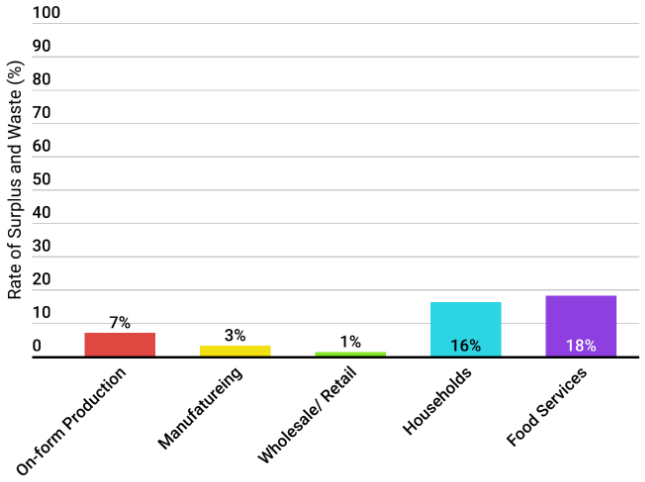
Dynamics Modelling

Preliminary findings of Bristol model suggests that:

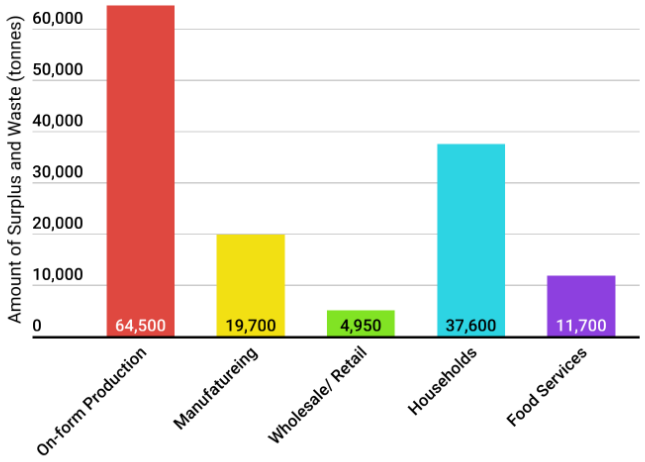
1) agricultural production generates the highest amount of food surplus and waste in Bristol, while there is no data in national and sub-national level.

2) Households produce more than half of post-farm-gate food waste with a slightly lower rate of waste production than food services.

3) Almost half of the post farm gate food waste is treated in Geneco AD plant which is significantly higher than estimated average for the UK.



Food Surplus and Waste Generation Average in the UK (WRAP)



Bristol Annual Food Surplus and Waste Estimate (modelling)

Food Waste Treatment Routes	Bristol estimates based on WRAP (tonnes)	UK estimates based on WRAP (%)	Bristol estimates based on SDM (tonnes)	Bristol estimates based on SDM (%)
Recycling (AD/ Composting)	13700	20%	32900	48%
Recovery (Thermal, Landspreading)	31500	46%	19200	28%
Disposal (Sewer, Landfill)	23300	34%	16400	24%
Total UK Food Waste (excluding on-farm)	68500	100%	68500	100%

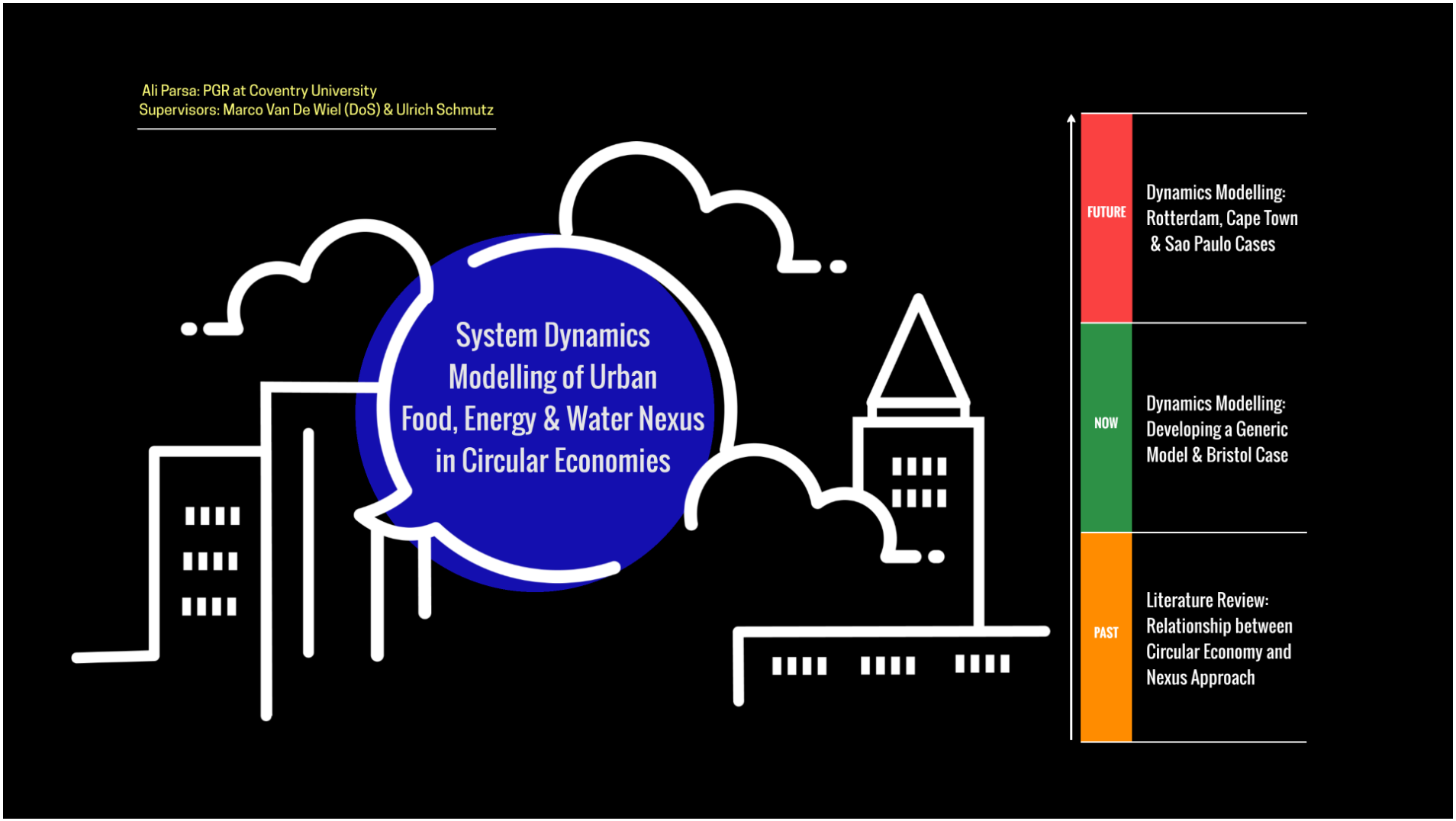
Next Steps

1) Bristol ULL

- Completing the model and intial model testing
- Interviews with Bristol Stakeholders
- Sensitivity Analysis and final adjustments
- Comparing different waste reduction & treatment routes
- Publication

2) Other ULLs

- Adjusting the model for Rotterdam, Cape Town and Sao Paulo ULLs
- Interviews with ULL Stakeholder and finalising the dynamics models
- Publication of overall results from all ULLs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