30th Annual INCOSE international symposium

Virtual Event
July 20 - 22, 2020

Paper 130, Session 2 Track 3: Roodt* & Dempers

# Addressing Challenges of the Circular Economy using Model-Based Co-Creation and Systems Design

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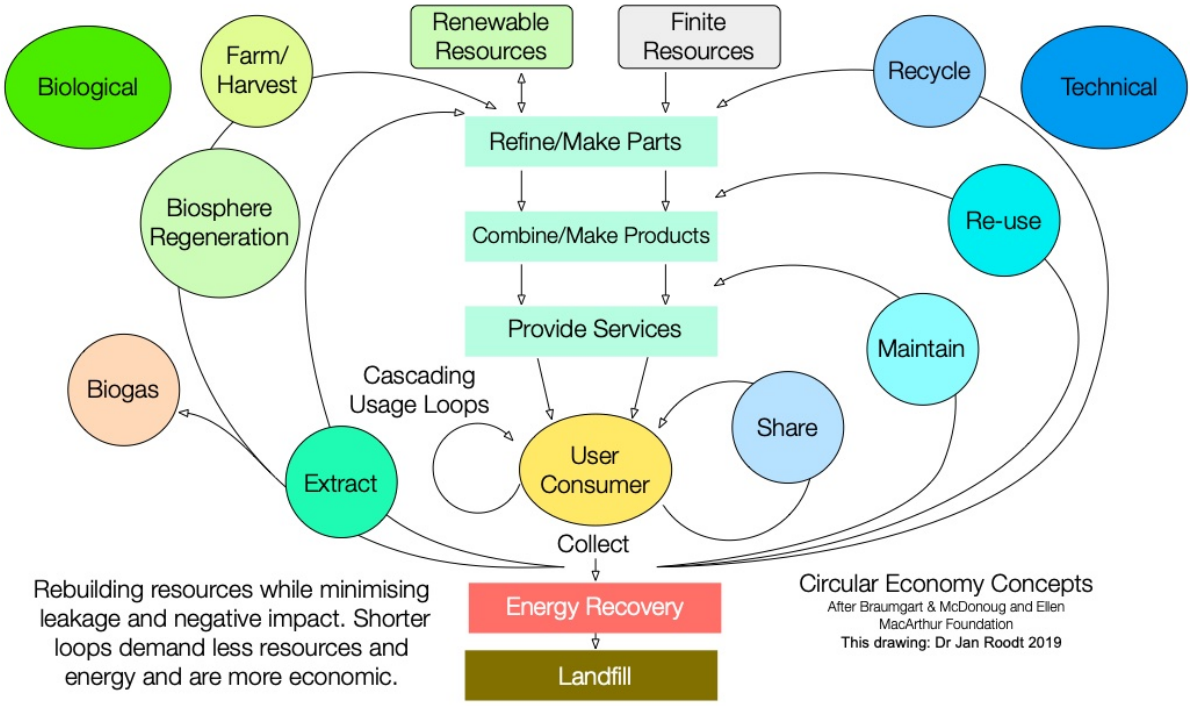
# Outline of the Presentation

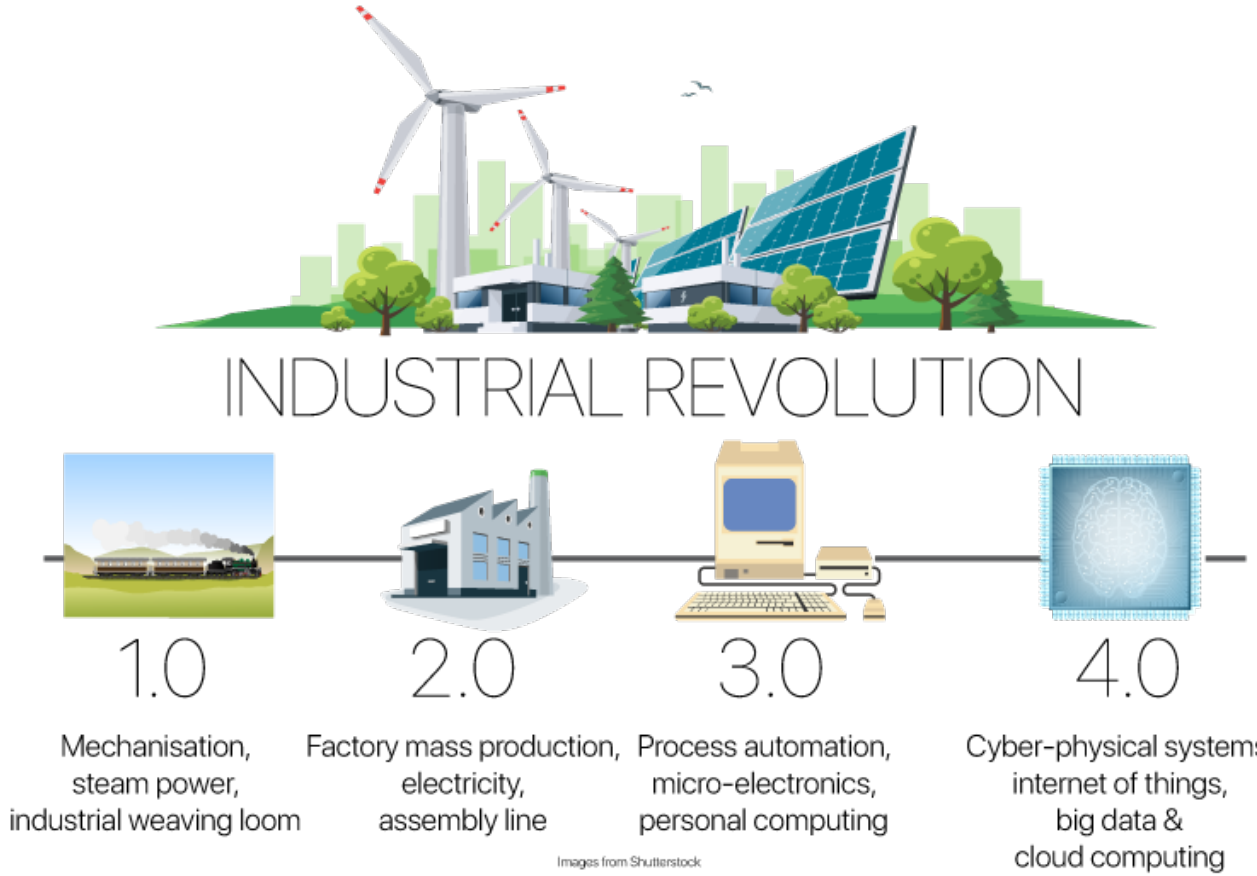
- The Circular Economy
- Credible Models of Complex Systems
- Approach to Addressing Challenges of the Circular Economy – A Reference Model Approach
- BioHub
- Discussion and Conclusion

# Circular Economy



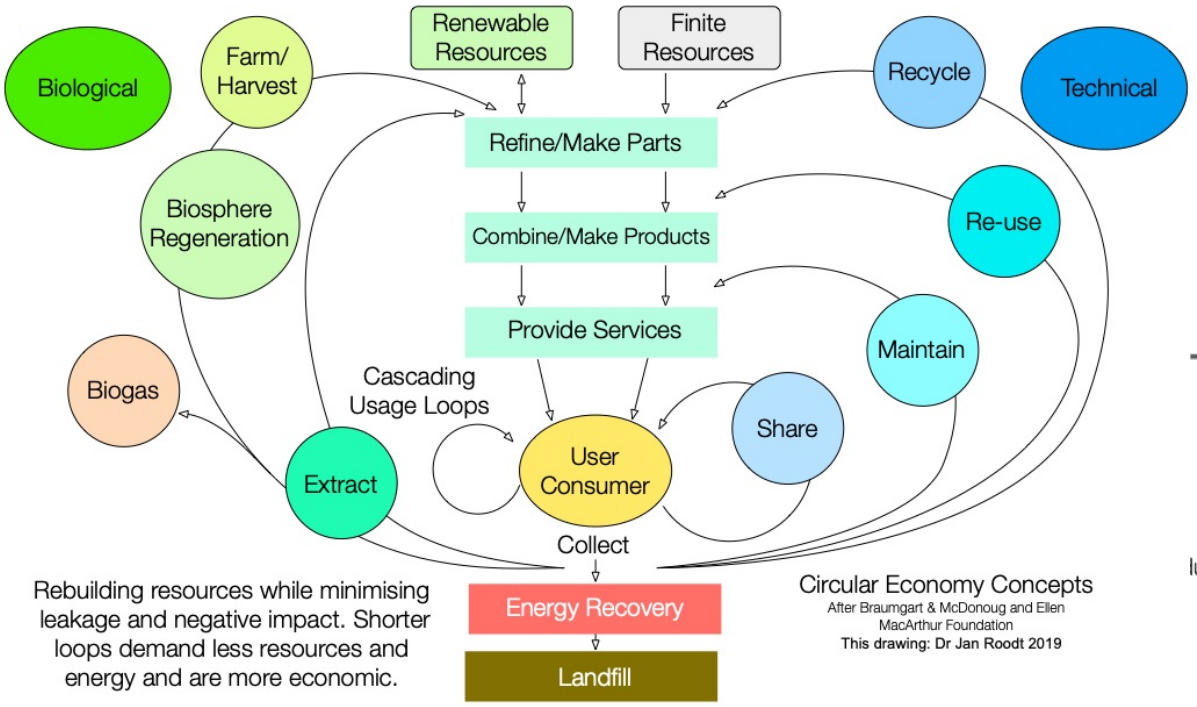

- Cradle-to cradle
- Willing partners
- Community participation
- Self-sustaining operations
- **Co-creation & co-ownership is key**

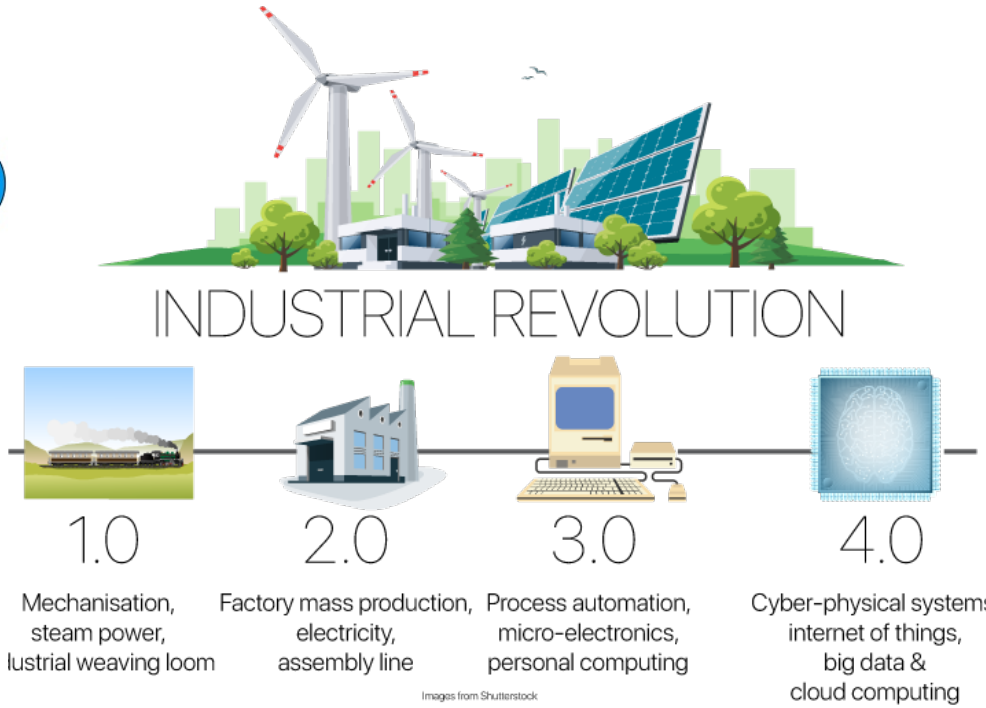
# Industry 4.0




- Pull of application
- Tech push
- AI, VR, AddMan, Robotics, IoT
- Societal impact
- **Utility to move away from take-make-waste is key**

# Circular Economy & Industry 4.0



# The Challenge of Complex Enviro-Technical Systems

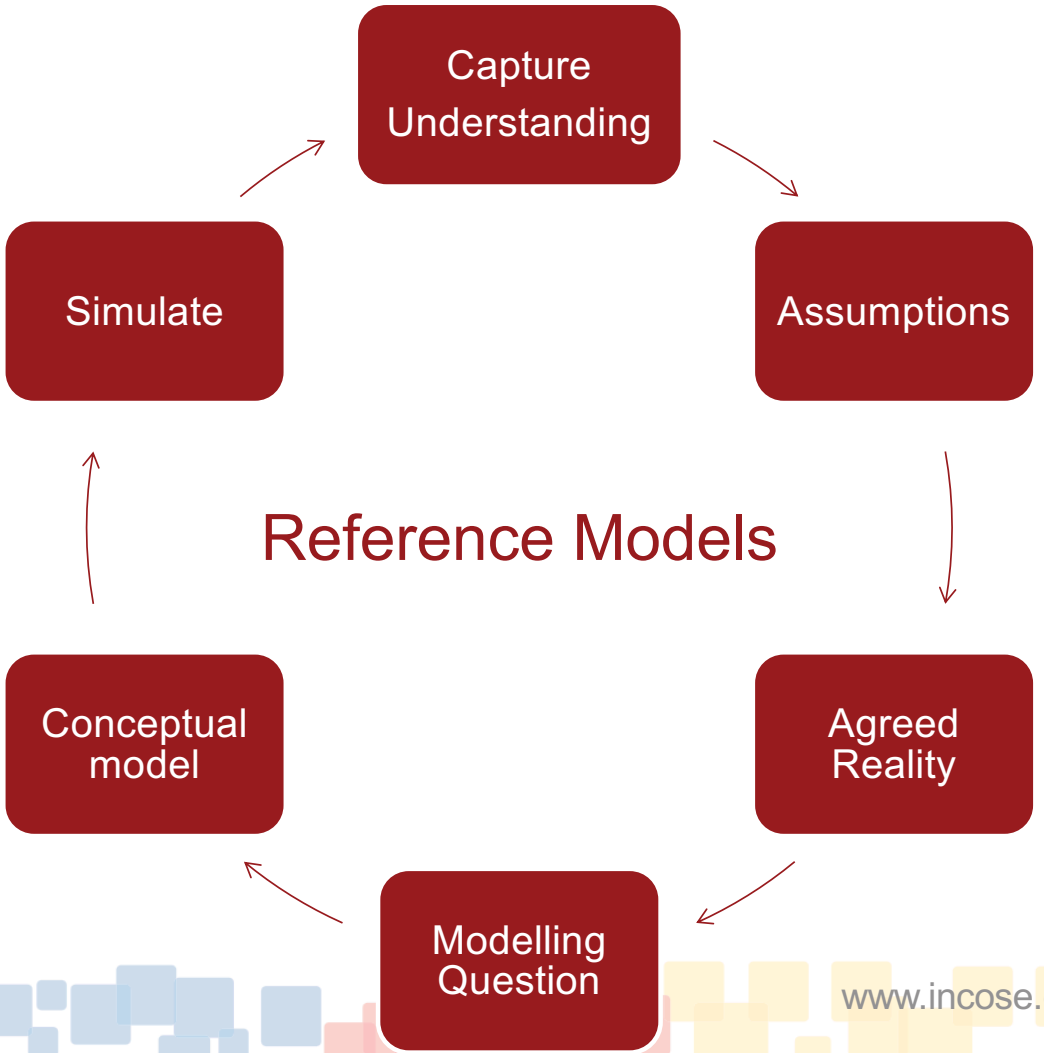
## Challenges of Complexity

1. Cyclical and recursive systems
2. The past is not the future
3. Irreducible
4. Emergent and open

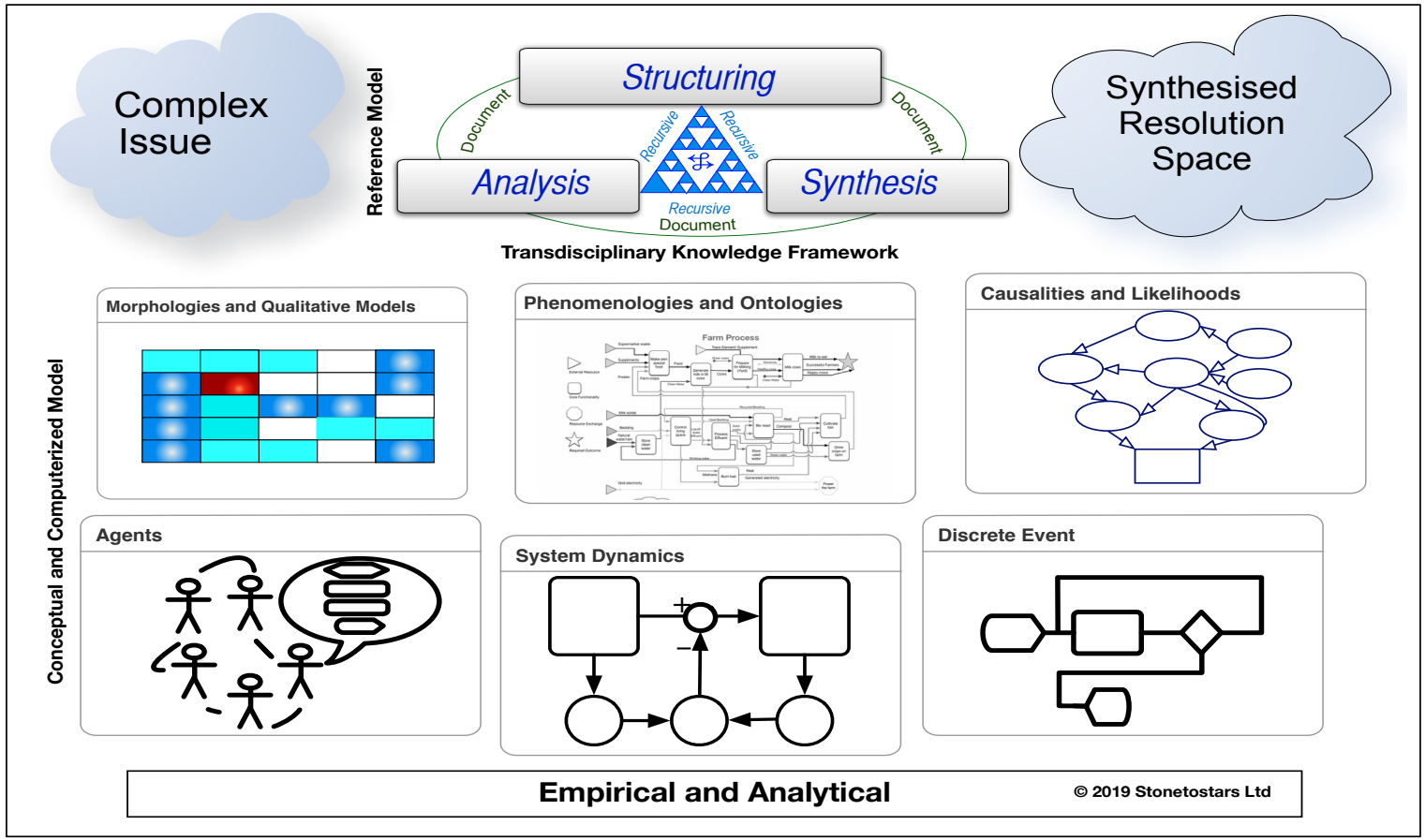
**BUT**

1. No option but to try
2. MBSE done right may offer help

# A Reference Model and Co-Creation Approach



# Complexity and Models



# Challenges of the Circular Economy

## Challenges

1. Cyclical Systems
2. Temporal and Spatial Boundaries
3. Economies of Scale
4. Technology Lock-in
5. Governance
6. Fluid Societal Views

# BioHub

## Context

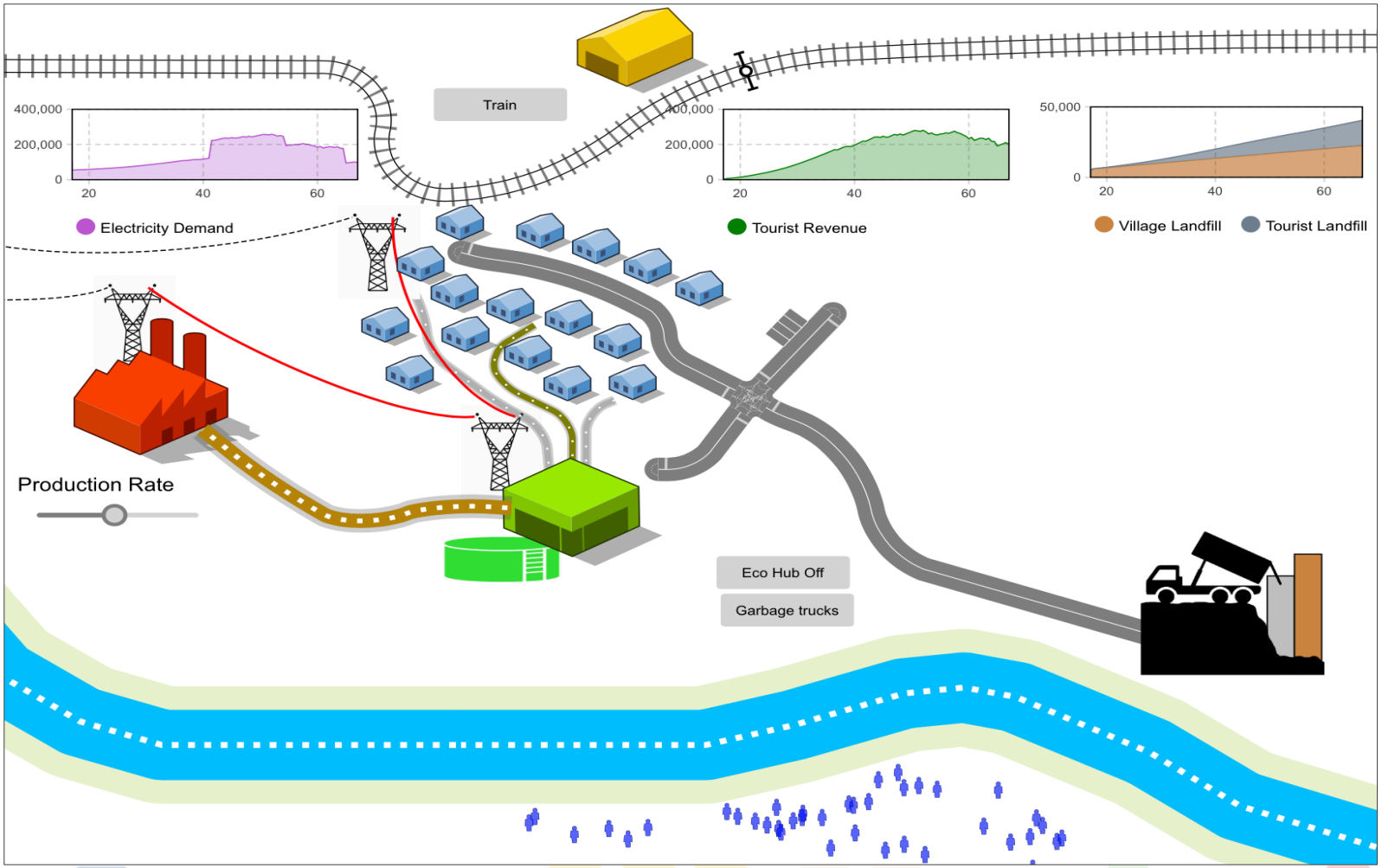
- Sustainability Goals
- Zero Carbon
- Regional Councils & Society

## Method

- Online Design Thinking
- Concept Co-Creation

# BioHub Reference (Development)

# BioHub Discussion Starter Concept Model

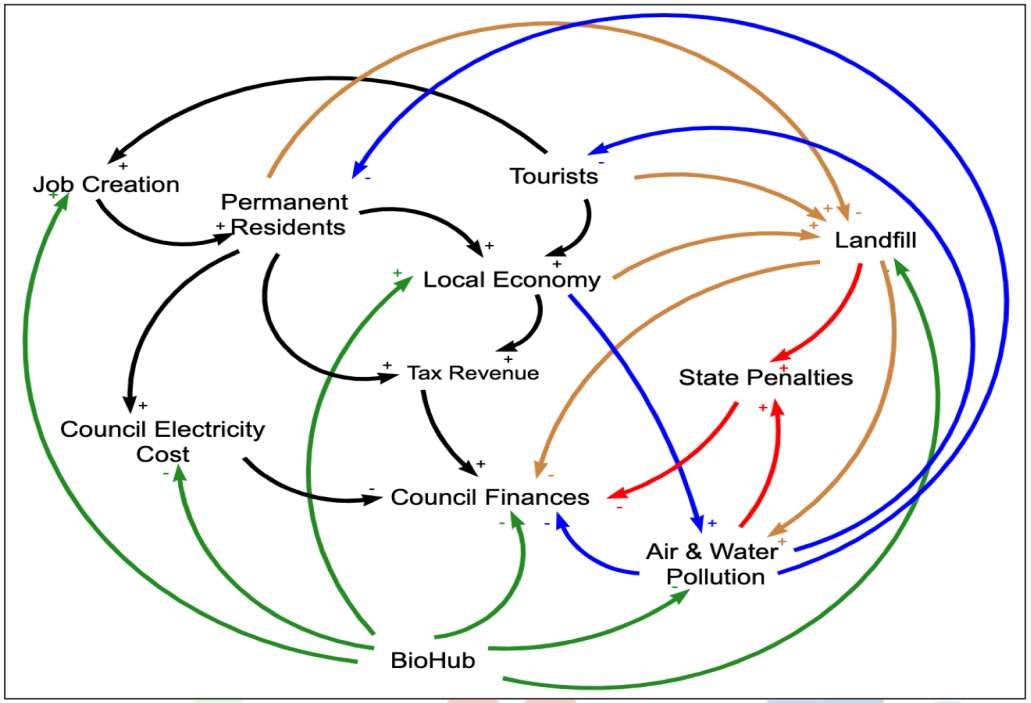


# Discussion & Conclusion

## Feedback and Focus Groups

- Actions and delayed Consequences
- Benefit of dynamics
- Emergence
- Cost never came up
- Measures of Effectiveness
- Sceptics
- Current & Future Work:
  - Regional specific
  - Include finance
  - Cloud server
  - Concept of co-creation using reference model concept tested – positive outcome
  - Shared with students

## Financial Extension



# Biography

**Clemens Dempers** obtained a MSc in Physics at the University of Natal and is a registered professional Physicist. Since leaving the University, he has founded a number of software and consulting companies. He is interested in multi-paradigm data science and modelling & simulation of complex systems, and how these methodologies can enable better decision making. Clemens has been involved in a number of consulting projects, in South Africa, Botswana, India, New Zealand and Finland. He is currently enrolled in a PhD at University of Pretoria with the Industrial Engineering department.

**Jan Hendrik Roodt** is actively involved in the entrepreneurial space in New Zealand. His company launched a wine appreciation app for iOS recently. Commercial projects focus on Industry 4.0, the Circular Economy and environmental regenerative practice. Jan holds a PhD in Engineering Science and MSc in Physics. He leads transdisciplinary professional practice Master and Doctoral studies at several academic institutions in New Zealand and is an active member of the Institute of Information Technology Professionals of New Zealand, the IEEE (Systems Council), the International Council on Systems Engineering (INCOSE), and holds DARPA coin 1313.

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