CECAN Webinar:

Participatory Systems Mapping for Policy Evaluation

Wednesday 31st March 2021, 13:00 – 14:00 BST

Presenters: Pete Barbrook-Johnson & Alexandra Penn (facilitated by Helen Wilkinson)

Welcome to our **CECAN Webinar.**

All participants are muted. Only the Presenters & CECAN Host can speak. The webinar will start at **13:00 BST.**

Pete and Alex will speak for around 40 minutes and will answer questions at the end.

Please submit your questions at any point during the webinar via the Q&A box in the Zoom webinar control panel.

Today's webinar will be recorded and made available on the CECAN website.

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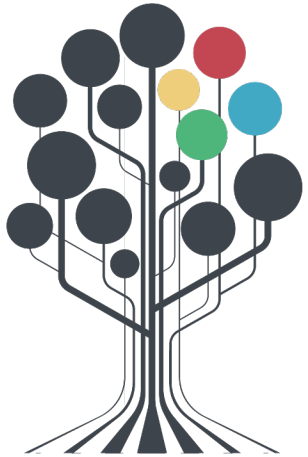
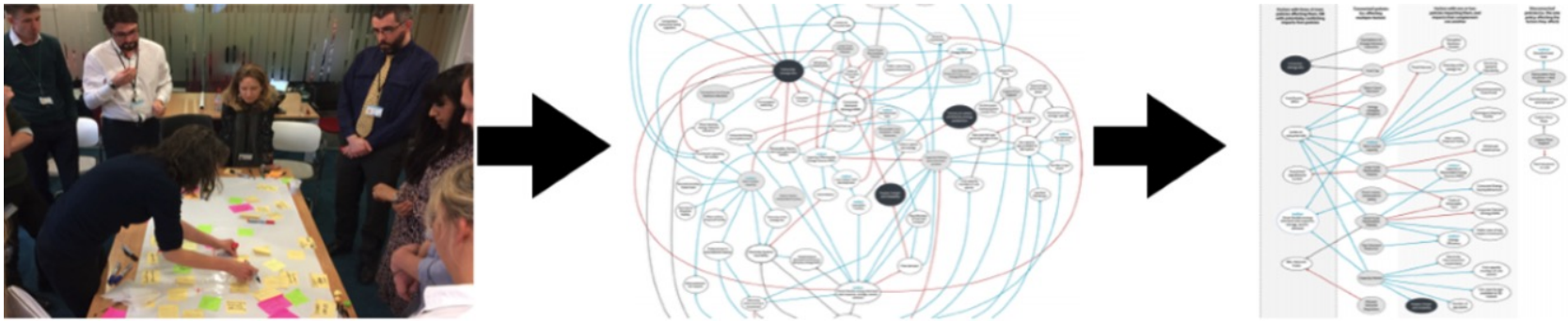


CECAN webinar: 1.00pm 31 March 2021



Participatory Systems Mapping for policy evaluation

Dr Pete Barbrook-Johnson and Dr Alex Penn
Centre for the Evaluation of Complexity Across the Nexus
www.cecan.ac.uk

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UNIVERSITY OF SURREY

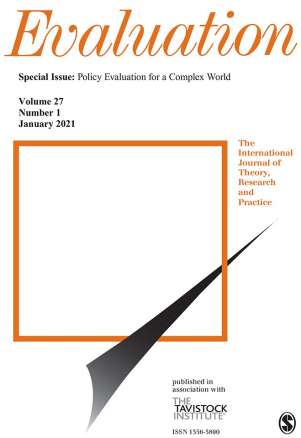
UNIVERSITY OF OXFORD

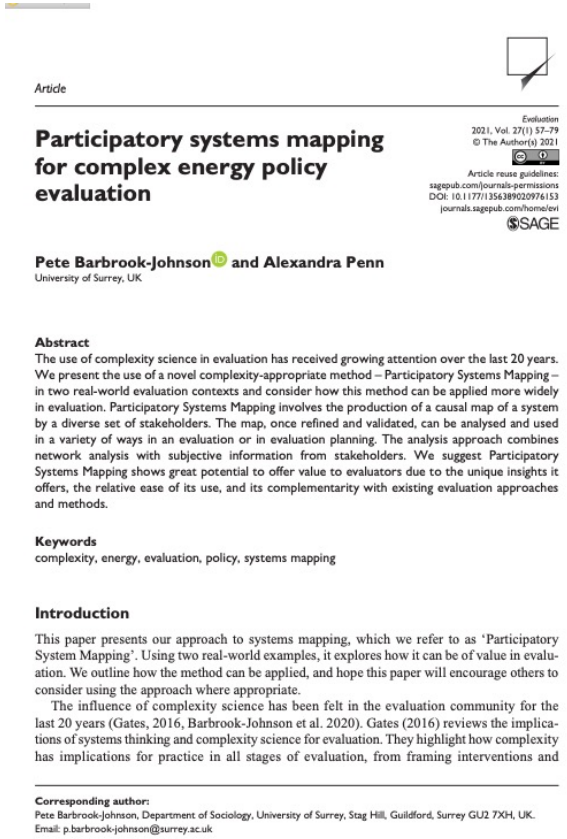
Institute for New Economic Thinking AT THE OXFORD MARTIN SCHOOL

Dione Hills (1948 - 2021)

Overview

- PSM for policy evaluation
  - Related approaches
  - Our approach
  - Using it in energy evaluation
  - What next?
- Systems mapping book





Article

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Participatory systems mapping for complex energy policy evaluation

Pete Barbrook-Johnson and Alexandra Penn
University of Surrey, UK

Abstract
The use of complexity science in evaluation has received growing attention over the last 20 years. We present the use of a novel complexity-appropriate method – Participatory Systems Mapping – in two real-world evaluation contexts and consider how this method can be applied more widely in evaluation. Participatory Systems Mapping involves the production of a causal map of a system by a diverse set of stakeholders. The map, once refined and validated, can be analysed and used in a variety of ways in an evaluation or in evaluation planning. The analysis approach combines network analysis with subjective information from stakeholders. We suggest Participatory Systems Mapping shows great potential to offer value to evaluators due to the unique insights it offers, the relative ease of its use, and its complementarity with existing evaluation approaches and methods.

Keywords
complexity, energy, evaluation, policy, systems mapping

Introduction

This paper presents our approach to systems mapping, which we refer to as 'Participatory System Mapping'. Using two real-world examples, it explores how it can be of value in evaluation. We outline how the method can be applied, and hope this paper will encourage others to consider using the approach where appropriate.

The influence of complexity science has been felt in the evaluation community for the last 20 years (Gates, 2016, Barbrook-Johnson et al. 2020). Gates (2016) reviews the implications of systems thinking and complexity science for evaluation. They highlight how complexity has implications for practice in all stages of evaluation, from framing interventions and

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Special issue of *Evaluation* ‘Policy evaluation for a complex world’

- Editorial
- ‘Don’t panic’: bringing complexity thinking to UK gov
- Commissioning and complexity
- Participatory system mapping for evaluation
- Systems-based ToC
- Diagnostic evaluation with simulated probabilities
- Case-based modelling for evaluation

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PSM for policy evaluation

- Basic premise
  - We want better recognition of complexity and systems in evaluation
  - But this can be hard, expensive, not useful
  - How can we do it in a practical, useful and easy way?
    - Turn ‘overwhelming complexity’ into ‘actionable complexity’
    - Connect to tried and tested approaches and tools of evaluation

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Related approaches

Table 2. Overview of related methods and appropriateness.

Method	Model construction	Analysis	When most appropriate?
Participatory Systems Mapping	Brainstorm 'factors' in the system and connect them. Flexible, stakeholder-driven approach with light-touch facilitation on map structure.	Combine network analysis with information from stakeholders to pull out 'submaps'. Build narrative and generate new questions.	When emphasis is on stakeholder engagement, stakeholder ownership of model, and ambition is to include as much complexity as possible. Not when quantification or simulations wanted.
Theory of change mapping	Define 'inputs', 'activities', 'outputs', 'outcomes' etc, and connect them. Practice varies widely on how this is done.	No analysis typically conducted.	When well-tested method wanted to discipline and inform an evaluation. Not when analysis wanted, not when 'full-complexity' view wanted.
Bayesian Belief Network	Defining conditional probabilities between events or outcomes. Map construction strongly facilitated to ensure map structure allows quantitative analysis to be done.	Quantitatively assess the map to assess potential contribution of different events to an outcome	When quantitative assessment of contribution wanted. Not when inclusive and 'full-complexity' view wanted.
Causal loop diagrams	Define variables and their relationships, connect them using feedback loops as starting points. Sometimes uses other system motifs or metaphors (e.g. tragedy of the commons, no fast feedbacks) to focus construction. Process strongly facilitated to ensure map structure consistent with method. Much map construction performed by facilitators outside workshops	Sometimes converted to System Dynamics models to run simulations of potential futures, or counterfactual pasts. Qualitatively used to visualise complexity and identification of potential system levers or causal cascades	When feedback loops of particular interest, when conversion to simulation may be of interest, when inclusive whole system view wanted, but with more emphasis on a 'tidy' model over stakeholder ownership of model.
System effects	Maps built by individuals, and then combined in an aggregated map.	Network analysis focussed on describing nodes in the network and finding those with interesting properties.	When stakeholder-driven maps wanted, but workshops not possible. When an inclusive approach wanted.

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Participatory Systems Mapping

Invited participants collaboratively construct a simple causal model of their system, its components and drivers and their interdependencies

- Overview of *whole system*, emphasizes *interactions*
- Collective understanding – process/discussion
- Captures diverse stakeholders' knowledge & perspectives
- Captures qualitative & quantified, works where data unavailable
- Build in intuitive and flexible way
- Large inclusive maps
- Bespoke process design
- Meaningful, usable analysis & insights

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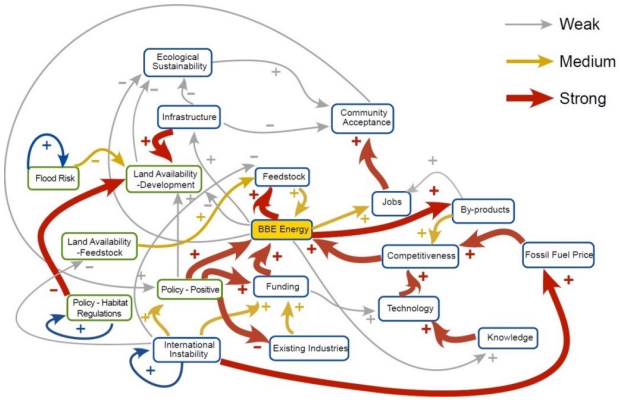
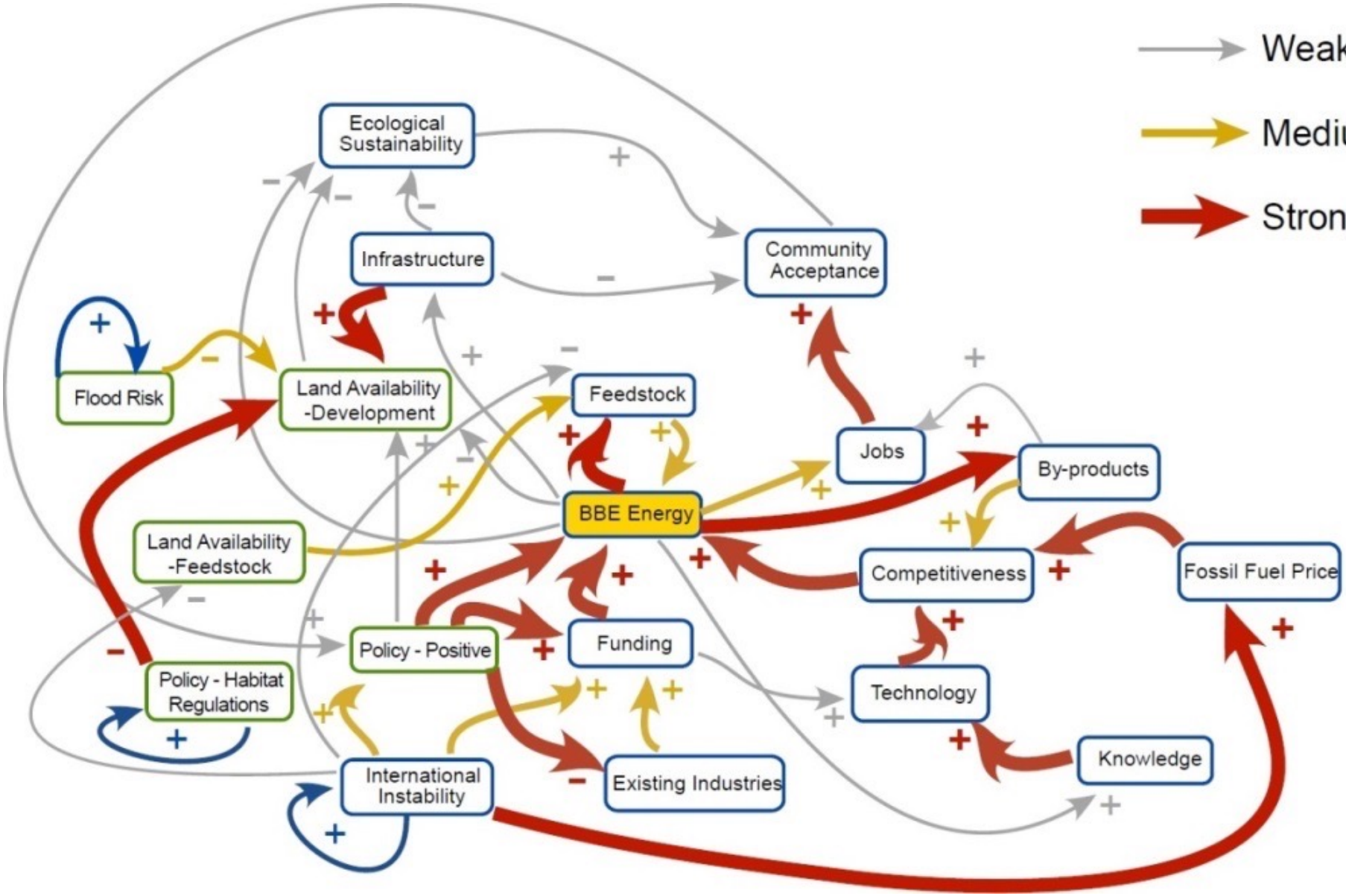
Participatory Systems Mapping

- Nodes -> Factors
  - Variable in some sense
- Edges -> Causal connections
  - Positive, negative, complex, unclear
- Process of building
  - Define focal factor(s)
  - Brainstorm what influences that, and what it influences
  - Consolidate and discuss
  - Build out from focal factors
  - Directed prompts
- Collect additional information
  - Controllability / interventions
  - Importance, and to who
  - Vulnerable to change
  - Anything else you want




Weak
Medium
Strong
Ecological Sustainability
Infrastructure
Community Acceptance
Flood Risk
Land Availability -Development
Feedstock
Jobs
By-products
BBE Energy
Land Availability -Feedstock
Competitiveness
Fossil Fuel Price
Policy - Positive
Funding
Policy - Habitat Regulations
Technology
Knowledge
International Instability
Existing Industries

Analysis

- Overwhelming complexity -> actionable complexity
- Submaps are
  - Subsections of the network
  - Define a factor as starting point based on
    - Stakeholder suggested -> important, controllable etc.
    - System suggested -> network analysis
    - Context-driven -> ToC, C-M-O
  - Create submap based on key questions
    - What influences/influenced? Levers? Risks? Trade-offs? Interactions? Constraints? Context?
    - Upstream or downstream “causal flow”, ego networks
    - unions and intersections, all paths

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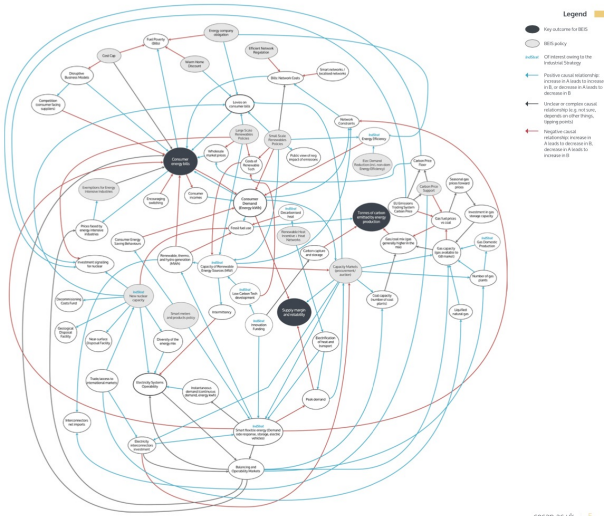
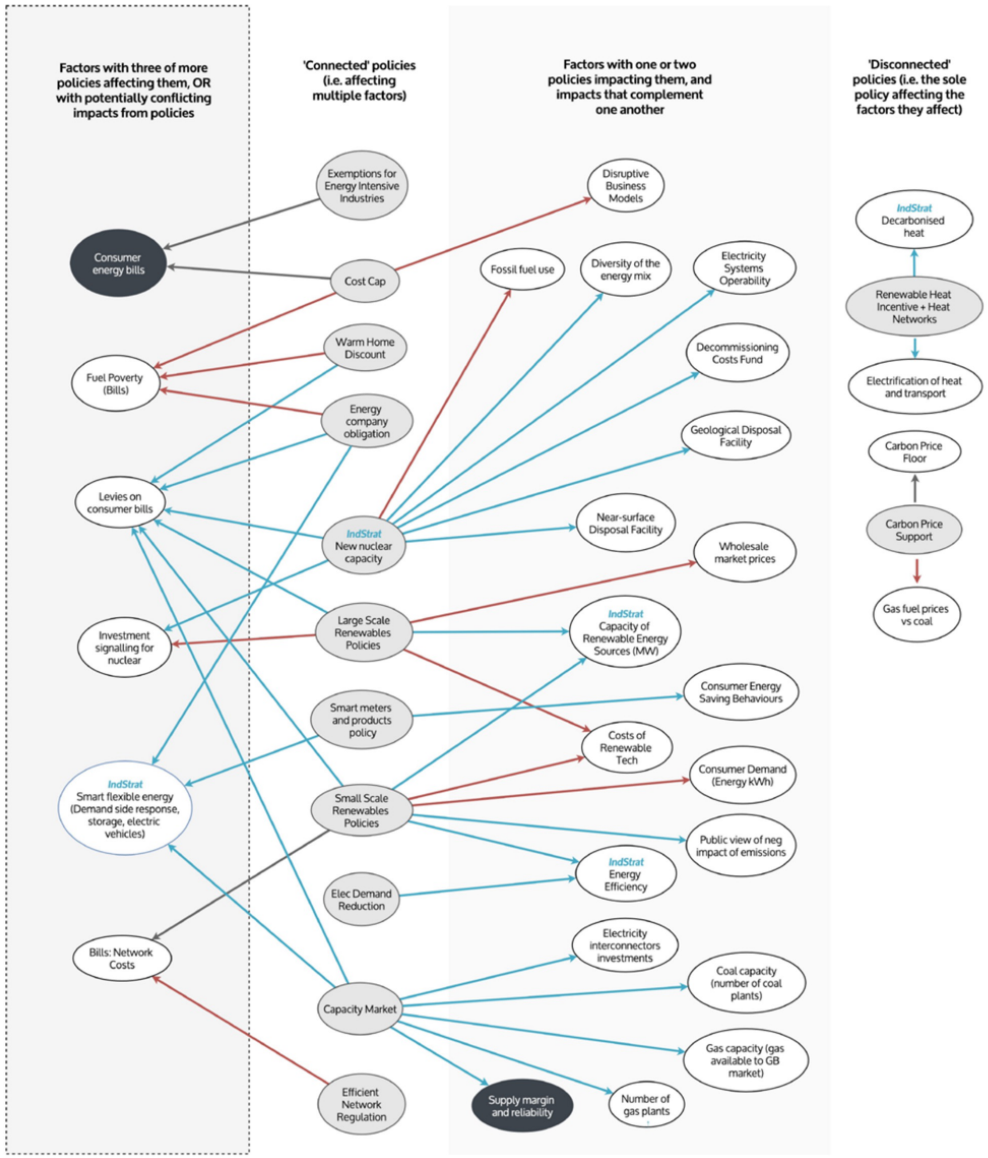
Way to start	Starting point options	How to build	Interpretation
Stakeholder-suggested factors	Intervention or controllable factors	Downstream nodes and edges	What is the intervention or controllable factor affecting? Unexpected indirect effects?
		For multiple nodes create a union or intersection of multiple downstream submaps	How are multiple interventions complementing or clashing with each other?
		Paths between intervention nodes and outcome nodes, including ego networks of nodes on paths	What does the intervention rely on to achieve its goals? What wider context might affect it?
	Important or outcome factors	Upstream nodes and edges	What is influencing the thing we care about? Constraints? Control? Buffered or buffeted?
		For multiple nodes create a union or intersection of ego networks. Or, pull out paths between outcomes.	What trade-offs or synergies might there be between achieving the things we care about?
		Ego networks	What is influencing the thing we care about, what does it influence and how do those things interact?
		Union or intersection of upstream nodes and edges	What factors influence multiple outcomes? Identify potential levers in the system, co-benefits, synergies, or risks.
	Vulnerable to change factors	Up and/or downstream nodes and edges	What might mitigate change in this factor? What impact might change have?
		Union/intersection multiple downstream sub maps	Are there compound risks, how might interventions interact with external change?
System-suggested factors	Influential (i.e. many outgoing connections)	Downstream nodes and edges	What is this influential thing affecting? Vulnerability or lever?
	Central to the map (i.e. well-connected, or bridging)	Downstream and/or upstream nodes and edges	What is influencing this central factor? What influence does it have? Bottleneck, bridge, transmitter?
		Ego networks	What does this factor bridge or connect?
	Influenced (i.e. many incoming connections)	Upstream nodes and edges	What is influencing this highly influenced factor? Buffered or buffeted?
	Unusual network property	Any of the above	Does this factor play an important but counter-intuitive role in the system?

Analysis





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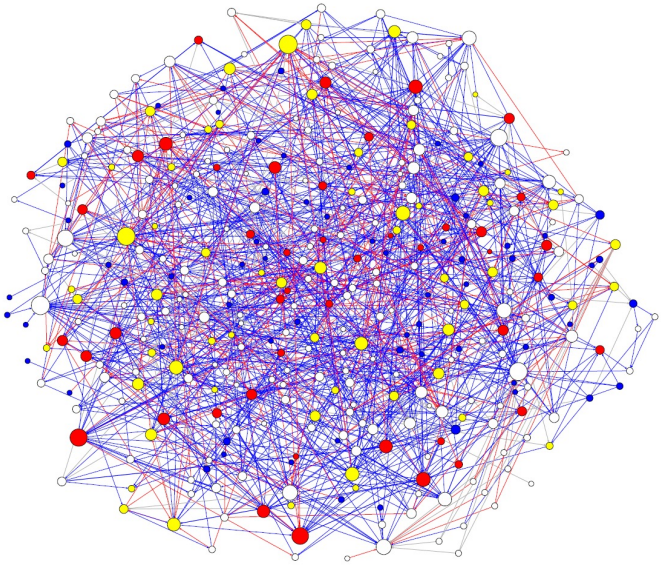
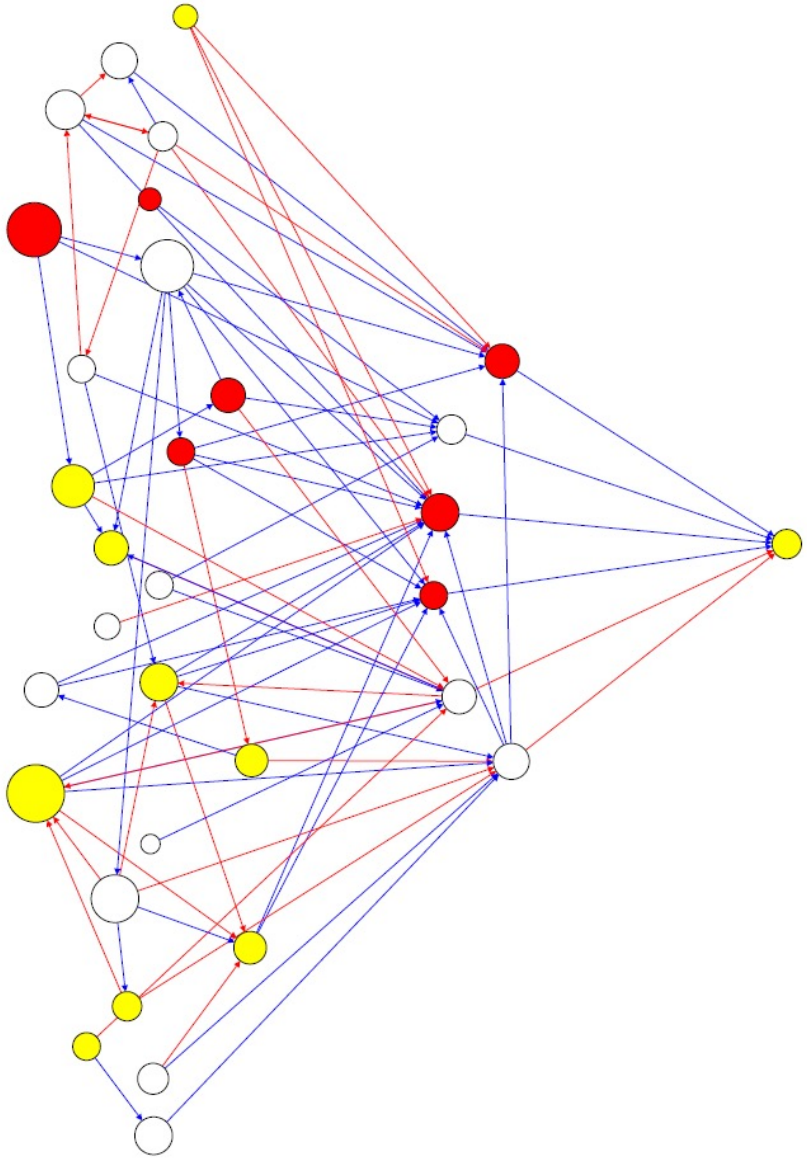
Analysis





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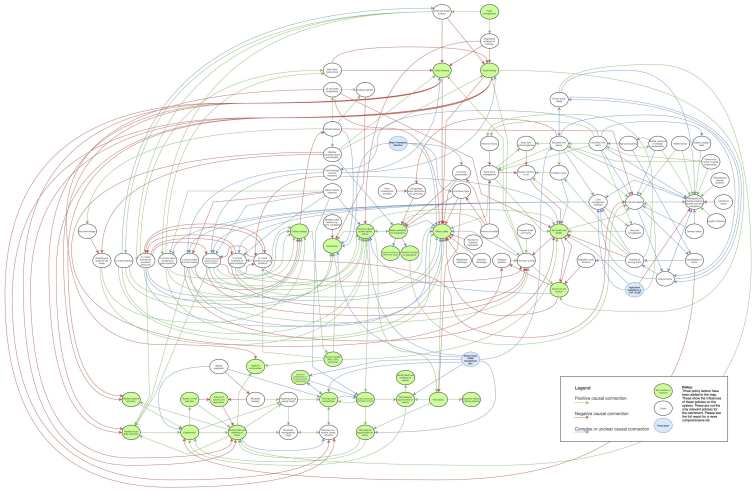
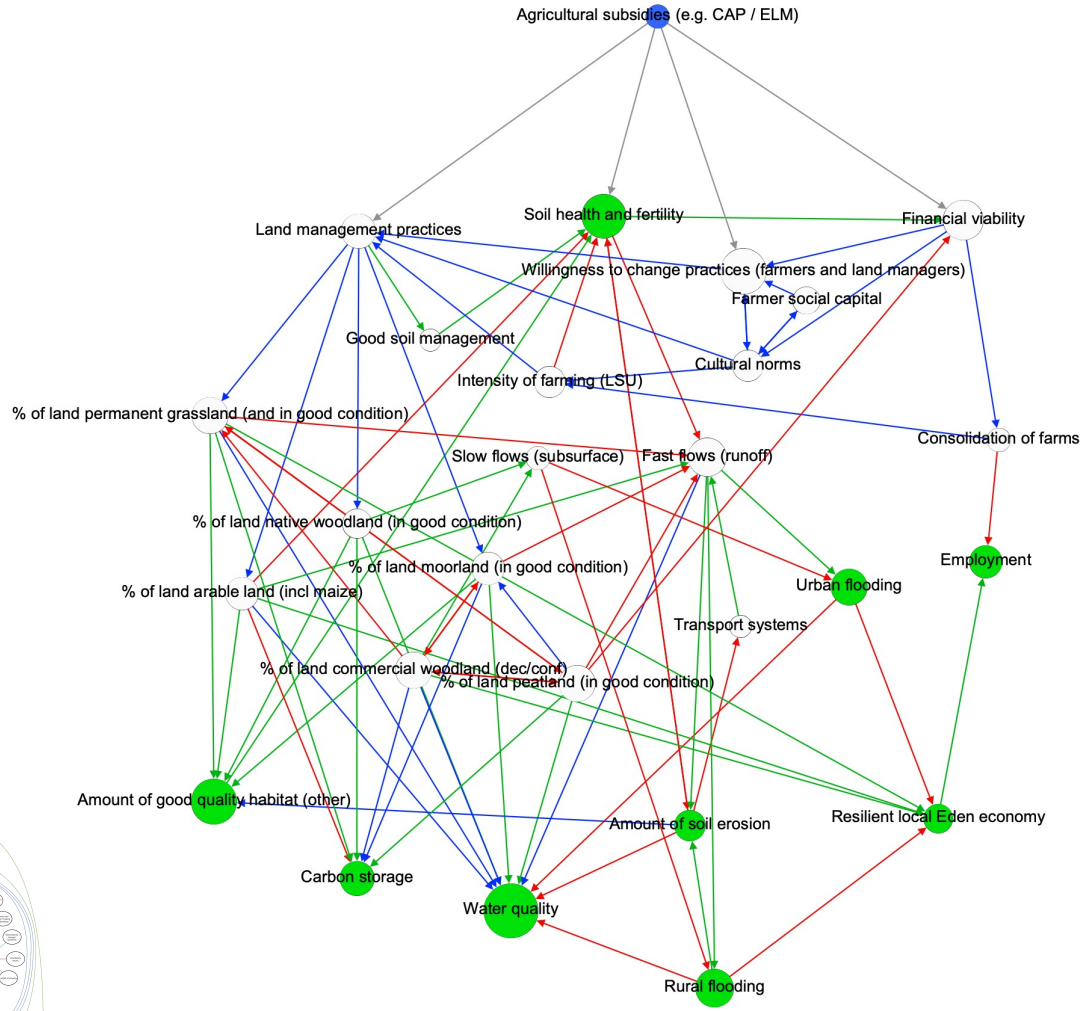
Analysis




Agricultural subsidies (e.g. CAP / ELM)
Soil health and fertility
Financial viability
Land management practices
Willingness to change practices (farmers and land managers)
Farmer social capital
Good soil management
Cultural norms
Intensity of farming (LSU)
% of land permanent grassland (and in good condition)
Consolidation of farms
Slow flows (subsurface)
Fast flows (runoff)
% of land native woodland (in good condition)
Employment
% of land moorland (in good condition)
% of land arable land (incl maize)
Urban flooding
Transport systems
% of land commercial woodland (dec/conf)
% of land peatland (in good condition)
Amount of good quality habitat (other)
Amount of soil erosion
Resilient local Eden economy
Carbon storage
Water quality
Rural flooding

Energy trilemma case study

- Prices <-> Carbon <-> Security of supply
- Crowded policy landscape
- PSM
  - inform evaluation planning, prioritisation, and proportionality
  - map to inform other ToC and logic models
  - general-purpose resource - ‘up on the wall’
- One full internal workshop, followed by multiple smaller meetings refining the map

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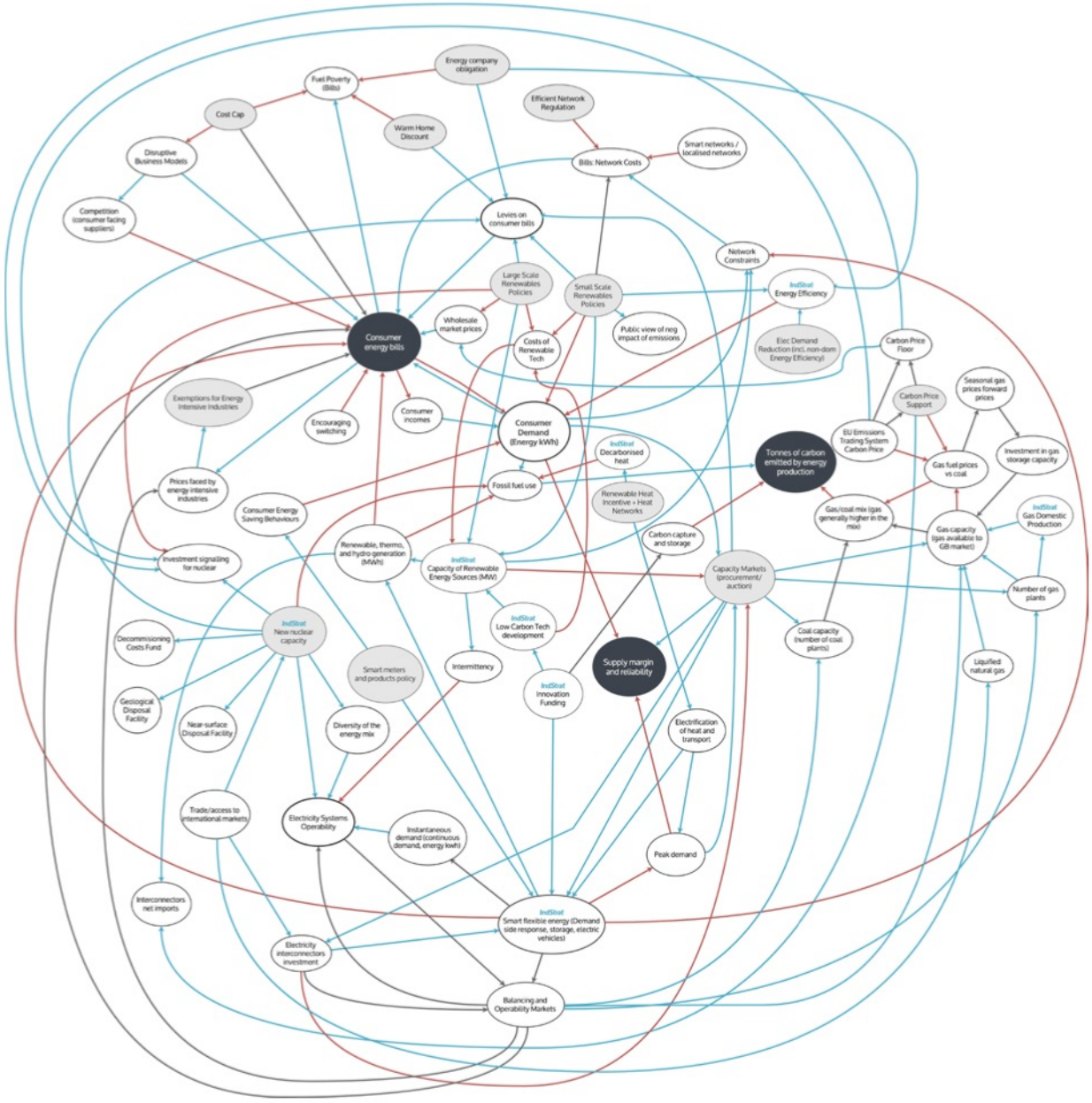
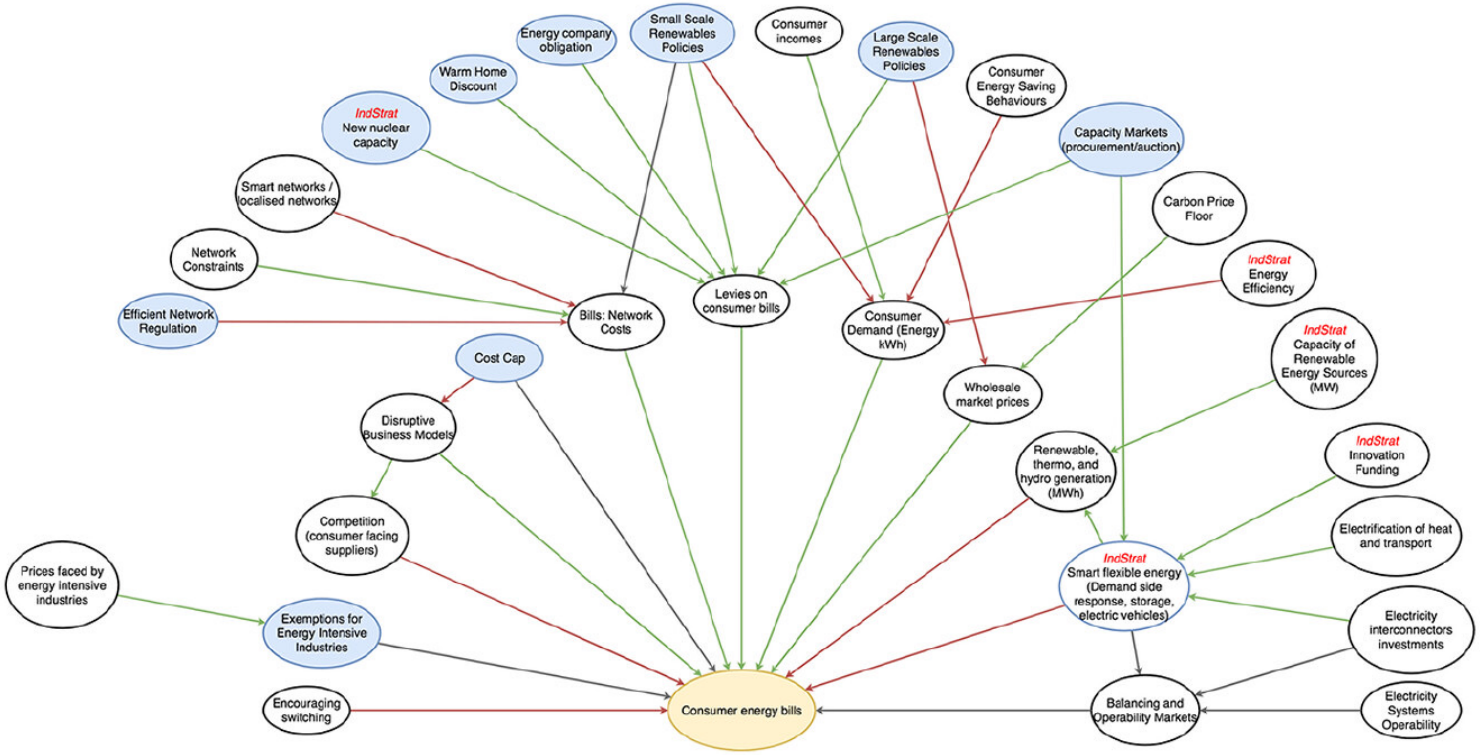
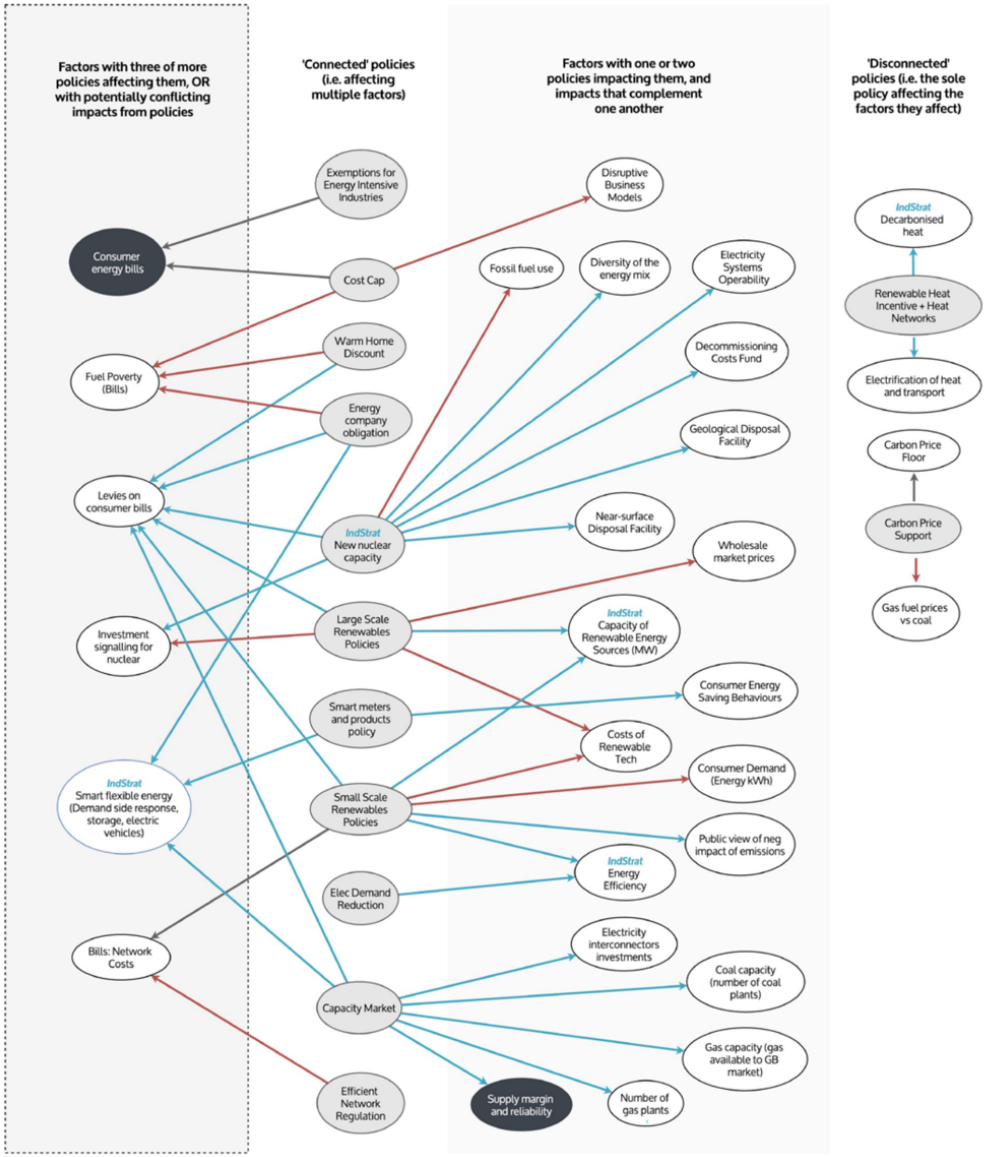


Legend

- Key outcome for BEIS
- BEIS policy
- IndStrat Of interest owing to the Industrial Strategy
- Positive causal relationship: increase in A leads to increase in B, or decrease in A leads to decrease in B
- Unclear or complex causal relationship (e.g. not sure, depends on other things, tipping points)
- Negative causal relationship: increase in A leads to decrease in B, decrease in A leads to increase in B


Energy company obligation
Small Scale Renewables Policies
Consumer incomes
Large Scale Renewables Policies
Warm Home Discount
Consumer Energy Saving Behaviours
IndStrat New nuclear capacity
Capacity Markets (procurement/auction)
Smart networks / localised networks
Carbon Price Floor
Network Constraints
IndStrat Energy Efficiency
Levies on consumer bills
Efficient Network Regulation
Bills: Network Costs
Consumer Demand (Energy kWh)
IndStrat Capacity of Renewable Energy Sources (MW)
Cost Cap
Wholesale market prices
Disruptive Business Models
Renewable, thermo, and hydro generation (MWh)
IndStrat Innovation Funding
Competition (consumer facing suppliers)
Electrification of heat and transport
Prices faced by energy intensive industries
IndStrat Smart flexible energy (Demand side response, storage, electric vehicles)
Exemptions for Energy Intensive Industries
Electricity interconnectors investments
Encouraging switching
Consumer energy bills
Balancing and Operability Markets
Electricity Systems Operability
LEGEND
Key outcome for BEIS
BEIS policy
IndStrat = Of interest owing to the Industrial Strategy
Positive causal relationship: increase in A leads to increase in B, or decrease in A leads to decrease in B
Unclear or complex causal relationship (e.g. not sure, depends on other things, tipping points)
Negative causal relationship: increase in A leads to decrease in B, decrease in A leads to increase in B


Factors with three of more policies affecting them, OR with potentially conflicting impacts from policies
'Connected' policies (i.e. affecting multiple factors)
Factors with one or two policies impacting them, and impacts that complement one another
'Disconnected' policies (i.e. the sole policy affecting the factors they affect)
Consumer energy bills
Fuel Poverty (Bills)
Levies on consumer bills
Investment signalling for nuclear
IndStrat Smart flexible energy (Demand side response, storage, electric vehicles)
Bills: Network Costs
Exemptions for Energy Intensive Industries
Cost Cap
Warm Home Discount
Energy company obligation
IndStrat New nuclear capacity
Large Scale Renewables Policies
Smart meters and products policy
Small Scale Renewables Policies
Elec Demand Reduction
Capacity Market
Efficient Network Regulation
Fossil fuel use
Disruptive Business Models
Diversity of the energy mix
Electricity Systems Operability
Decommissioning Costs Fund
Geological Disposal Facility
Near-surface Disposal Facility
Wholesale market prices
IndStrat Capacity of Renewable Energy Sources (MW)
Consumer Energy Saving Behaviours
Costs of Renewable Tech
Consumer Demand (Energy kWh)
Public view of neg impact of emissions
IndStrat Energy Efficiency
Electricity interconnectors investments
Coal capacity (number of coal plants)
Gas capacity (gas available to GB market)
Number of gas plants
Supply margin and reliability
IndStrat Decarbonised heat
Renewable Heat Incentive + Heat Networks
Electrification of heat and transport
Carbon Price Floor
Carbon Price Support
Gas fuel prices vs coal

Renewable Heat Incentive case study

- Ongoing evaluation led by CAG consultants
- RHI support for biogas and biomethane plants
  - Big budget burner
  - complex systems in their own right
- External workshop with multiple meetings after refining map and using it
- Map converted to l-R ToC-style

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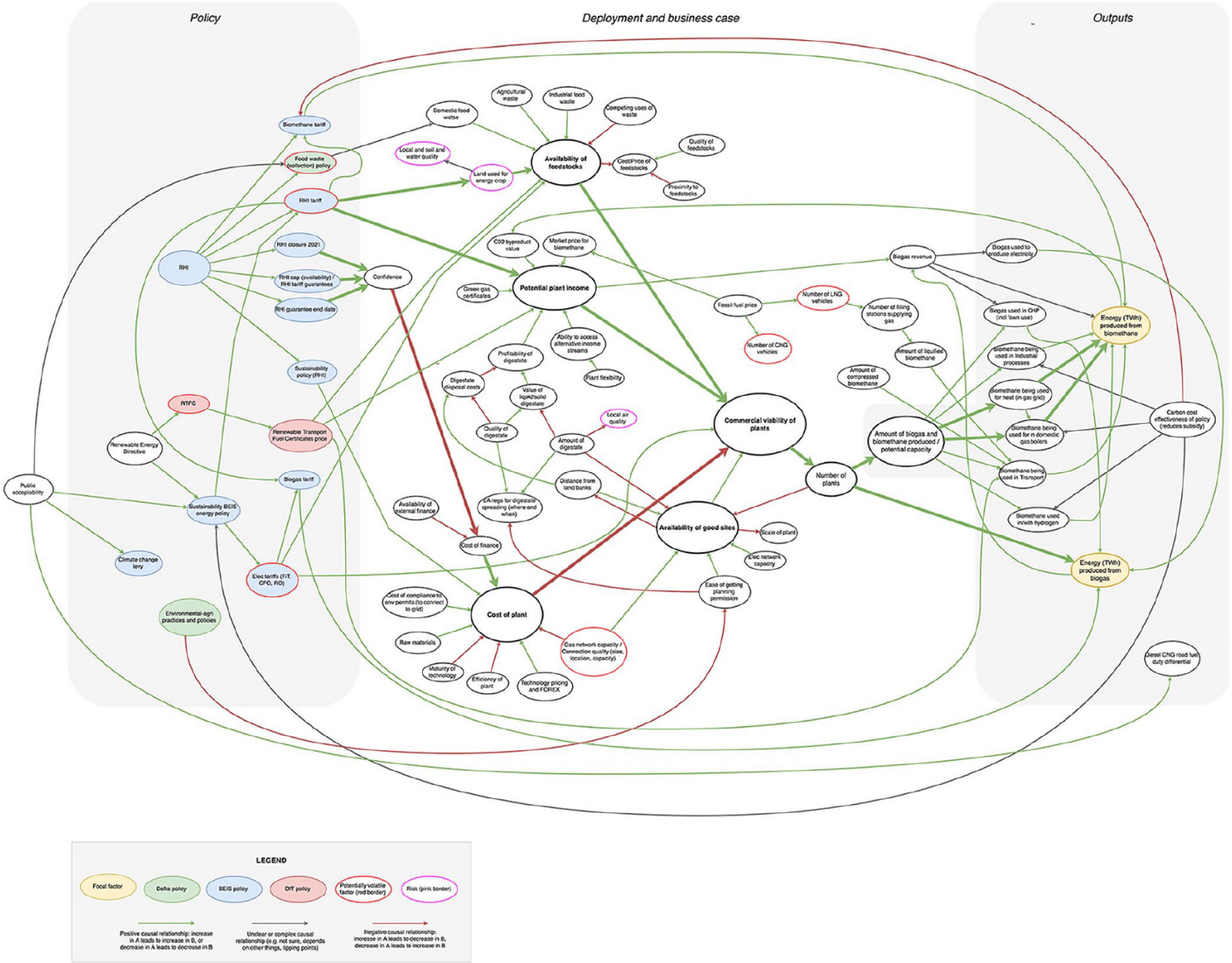
Policy
Deployment and business case
Outputs
Biomethane tariff
Food waste (collection) policy
RHI tariff
RHI
RHI closure 2021
RHI cap (availability) / RHI tariff guarantees
RHI guarantee end date
Sustainability policy (RHI)
RTFC
Renewable Energy Directive
Renewable Transport Fuel Certificates price
Biogas tariff
Public acceptability
Sustainability BEIS energy policy
Climate change levy
Elec tariffs (FiT, CFC, RO)
Environmental agri practices and policies
Confidence
Domestic food waste
Agricultural waste
Industrial food waste
Competing uses of waste
Local and soil and water quality
Land used for energy crop
Availability of feedstocks
Cost/Price of feedstocks
Quality of feedstocks
Proximity to feedstocks
CO2 byproduct value
Market price for biomethane
Green gas certificates
Potential plant income
Profitability of digestate
Ability to access alternative income streams
Digestate disposal costs
Plant flexibility
Value of liquid/solid digestate
Quality of digestate
Local air quality
Amount of digestate
EA regs for digestate spreading (where and when)
Distance from land banks
Availability of external finance
Cost of finance
Commercial viability of plants
Availability of good sites
Scale of plant
Elec network capacity
Ease of getting planning permission
Cost of compliance to env permits (to connect to grid)
Raw materials
Maturity of technology
Efficiency of plant
Technology pricing and FOREX
Gas network capacity / Connection quality (size, location, capacity)
Cost of plant
Fossil fuel price
Number of LNG vehicles
Number of CNG vehicles
Number of filling stations supplying gas
Amount of liquified biomethane
Amount of compressed biomethane
Number of plants
Amount of biogas and biomethane produced / potential capacity
Biogas revenue
Biogas used to produce electricity
Biogas used in CHP (incl 'own use')
Biomethane being used in industrial processes
Biomethane being used for heat (in gas grid)
Biomethane being used for in domestic gas boilers
Biomethane being used in Transport
Biomethane used in/with hydrogen
Energy (TWh) produced from biomethane
Energy (TWh) produced from biogas
Carbon cost effectiveness of policy (reduces subsidy)
Diesel CNG road fuel duty differential
LEGEND
Focal factor
Defra policy
BEIS policy
DfT policy
Potentially volatile factor (red border)
Risk (pink border)
Positive causal relationship: increase in A leads to increase in B, or decrease in A leads to decrease in B
Unclear or complex causal relationship (e.g. not sure, depends on other things, tipping points)
Negative causal relationship: increase in A leads to decrease in B, decrease in A leads to increase in B

RHI - reflections from evaluation team

- Mapping session was a relatively quick way to orient themselves to the policy area
- Used the map to refine their intervention theory
  - Sense check existing C-M-Os
  - Look for new C-M-Os
  - Consider which areas they had covered or not
  - Inspiration for qualitative description of C-M-Os.
- Informed scope
  - System boundary = evaluation boundary?
  - Question confirmation bias on impacts regularly articulated
- Informed topic guides for interviews
- Informed stakeholder mapping and sampling
- Informed concepts to use in qualitative data analysis

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Reflections on both case studies

- Very different modes of how to use PSM
  - Tendency towards beginning?
  - New uses may emerge as you go
- Generate new narratives
- Identify new questions
- A vehicle for more joined up policy cycle?
- Connect more to ToC – Wilkinson et al. 2021
- Maps hard to communicate
  - need to generate ownership and capacity

What next for PSM?

- Currently
  - Developing use in policy appraisal, design & delivery
  - Unifying ToCs across large programmes
  - Combining with scenario analysis + risks of discontinuous change, vicious cycles
  - System Resilience
- PSM for Actionability Complexity & full methods guidance forthcoming
- Subjective network analysis & submap extraction automated
- How to bring in data and more traditional forms of evidence?
- Submaps as Bayesian networks

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And now, a shameless plug

Systems mapping book

- Palgrave Pivot, Open access (free PDF), late 2021?
- "Systems Mapping: what it is and how to do it"
- Premise
  - We need richer, more nuanced, yet actionable and participatory understandings of the world
  - Complexity science and systems thinking offer us hope, but sometimes fail
    - Technical 'black box' modelling,
    - Metaphors and language which don't directly lead to action,
    - Exclude people
    - Overwhelming and paralysing complexity
  - Systems mapping can help, but
    - Confusion about terms and differences
    - Underappreciated value
  - Let's get past territorialism and understand the variety and value here
  - Let's develop practical guidance on how to choose and use these methods

Systems mapping book

- Methods – 'causal' and 'systems'
  - Fuzzy Cognitive Mapping
  - Participatory Systems Mapping
  - Bayesian Belief Networks
  - Causal Loop Diagrams
  - System Dynamics
  - Theory of Change
  - Rich Pictures
- Meta chapters
  - Running workshops
  - What knowledge and evidence can you use?
  - Choosing and combining methods
- Podcasts

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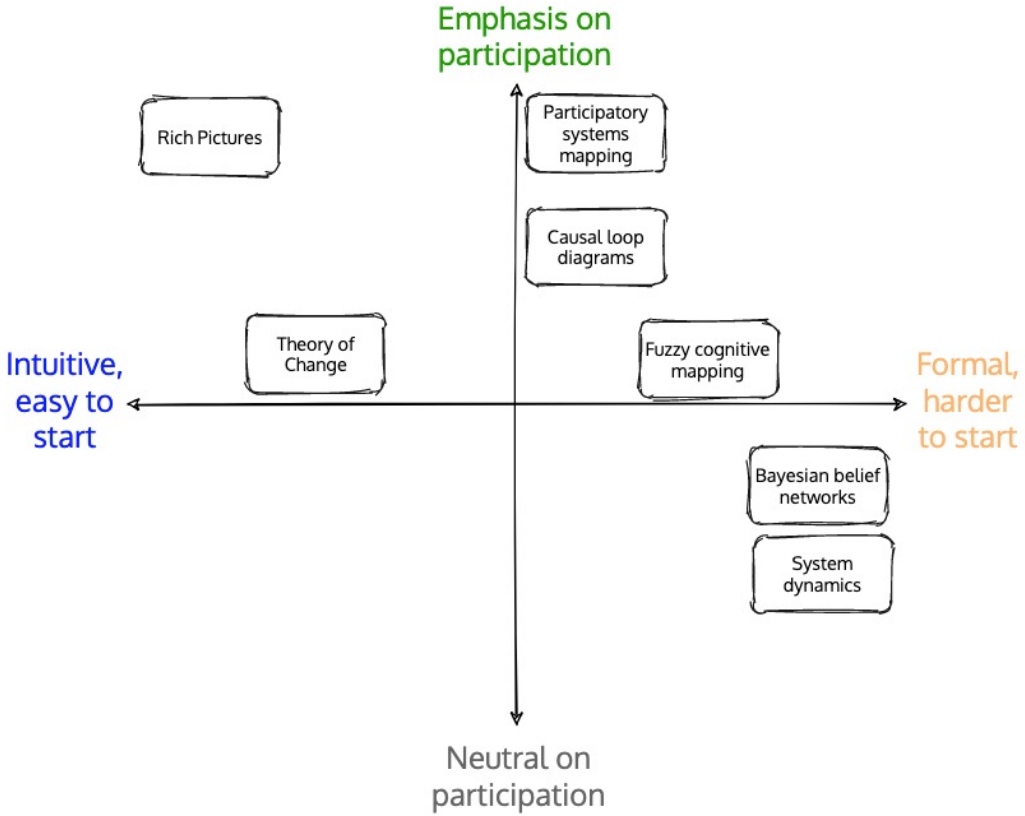
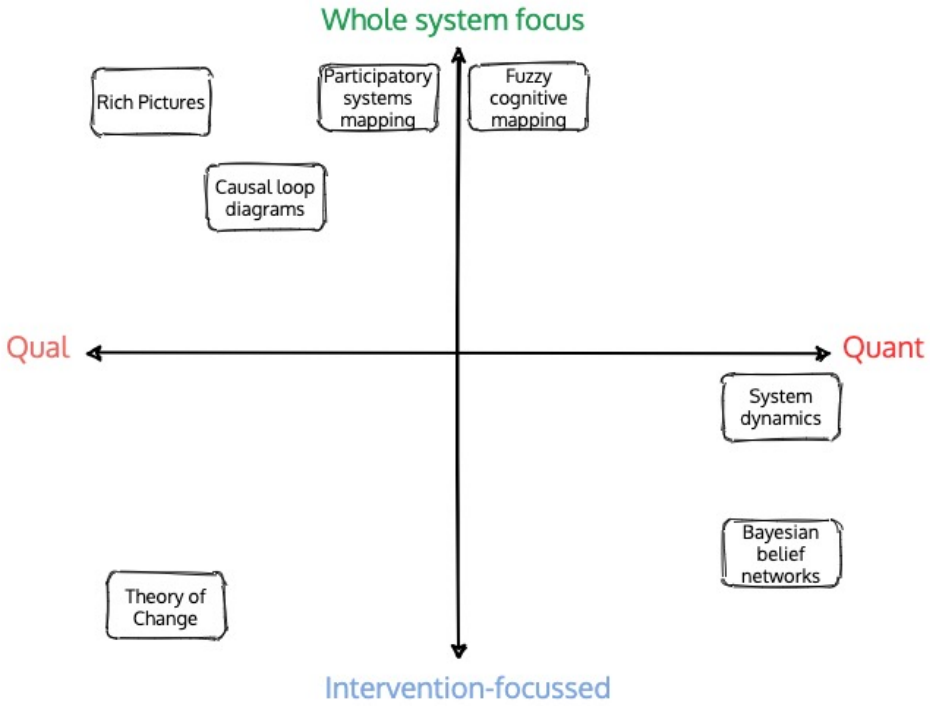
A landscape of methods





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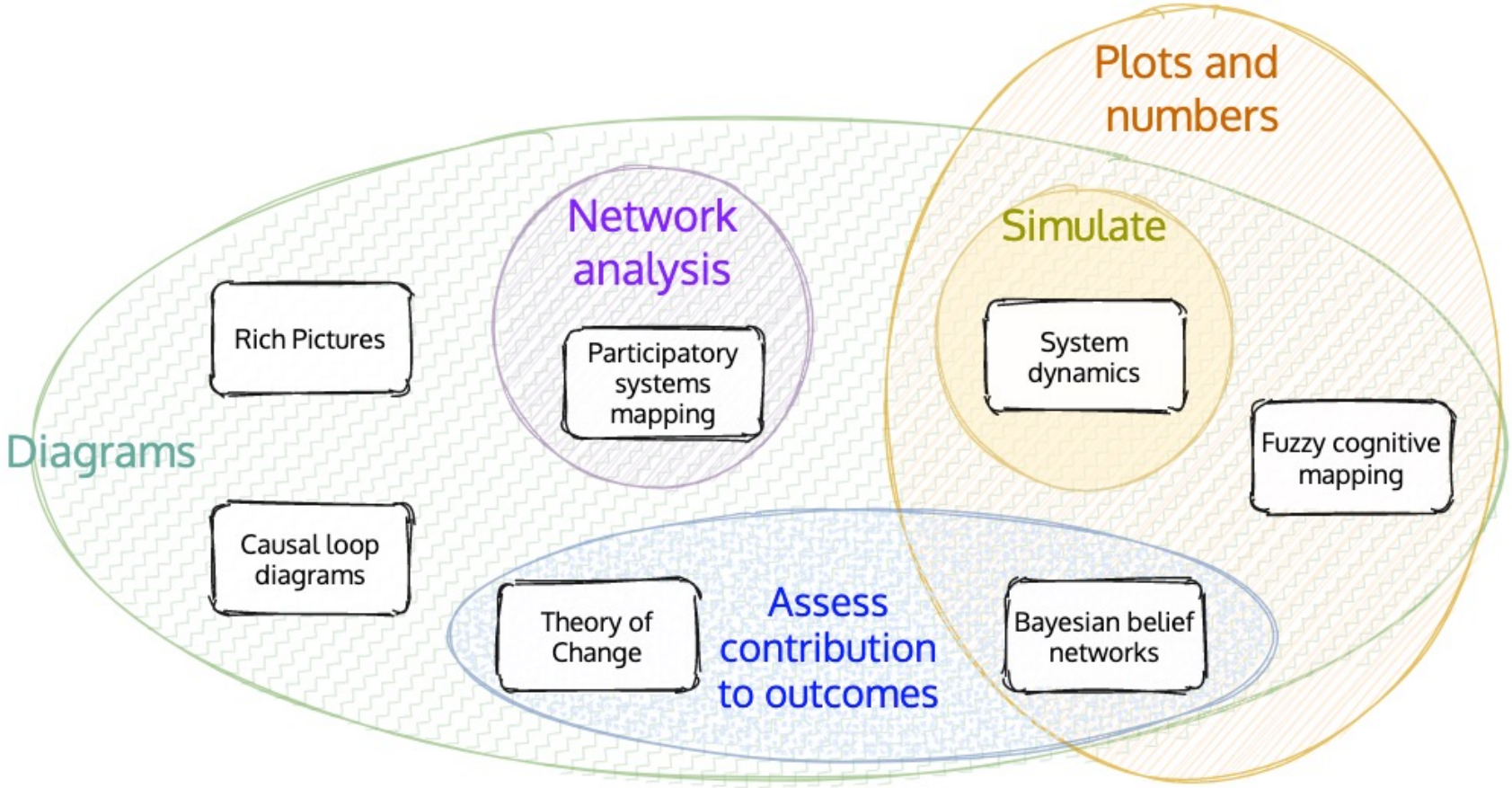
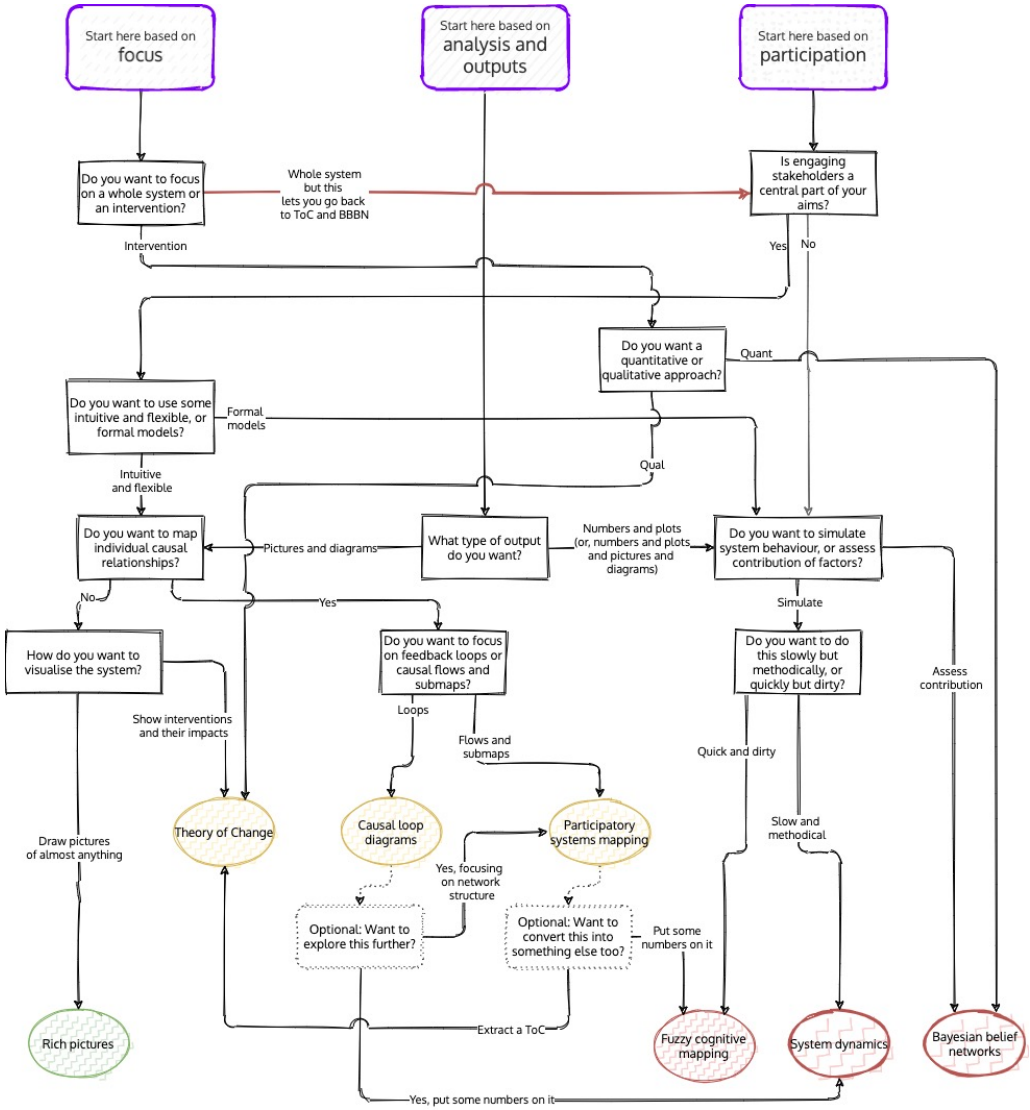
Analysis and outputs landscape



Choosing and combining methods



THANK YOU

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