

CECAN Webinar:

BOOK LAUNCH: Systems Mapping: how to build and use causal models of systems by Pete Barbrook-Johnson and Alexandra Penn

Tuesday 27th September 2022, 13:00 – 14:00 BST

Welcome to our **CECAN Webinar**.

All participants are muted. Only the Hosts and Panelists can speak. The webinar will start at **13:00 BST**.

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

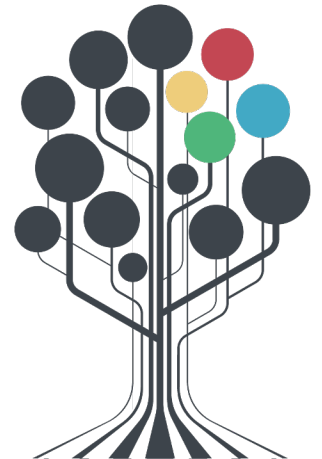
Today's webinar will be recorded and made available on the CECAN website.

E Mail: cecan@surrey.ac.uk

Web: www.cecan.ac.uk

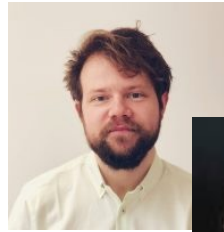
www.facebook.com/CECANEXUS

Twitter: [@cecanexus](https://twitter.com/cecanexus)



Session Outline, Speakers, Panel, Q&A

- Introduction
- The Book!
Overview by the authors
- Panel: System Mapping
Experiences Future
- Q&A
- Close



Speakers

Pete Barbrook-Johnson
and Alex Penn



Panel



Dan McGonigle

Head of Systems, Innovation and Futures, Chief
Scientific Advisor's Office, **Defra**



Prof Petra Meier

Professor of Public Health, **University of Glasgow**.
Director, SIPHER Consortium

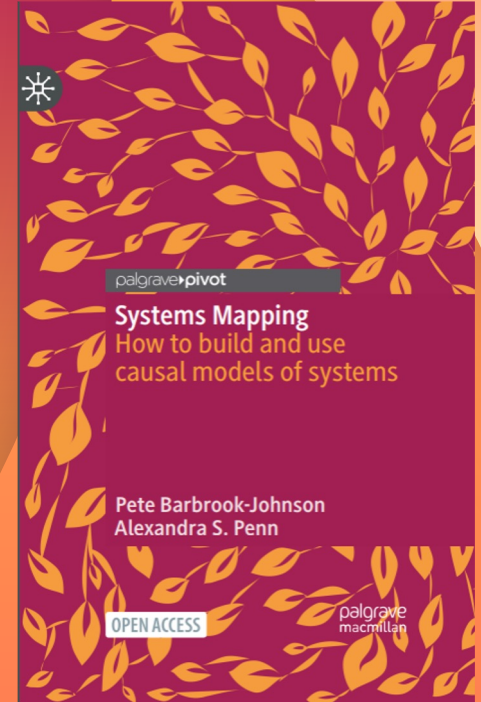


Prof Birgit Kopainsky

Professor in System Dynamics
University of Bergen

Systems mapping: How to build and use causal models of systems

By Pete Barbrook-Johnson @bapeterj
& Alexandra S. Penn @DrAlexPenn





The book is out now
and free...

<https://link.springer.com/book/10.1007/978-3-031-01919-7>



What is in this book?

Introduction

7 methods chapters

Cross-cutting chapters

Conclusion

- Rich Pictures
- Theory of Change diagrams
- Causal loop diagrams
- Participatory Systems Mapping
- Fuzzy Cognitive Mapping
- Bayesian Belief Networks
- System Dynamics

○ Each one has...

- What are they?
- How do you do it?
- Common issues and 'tricks of the trade'
- What are they good and bad at?
- A brief history
- Getting started



What is in this book?

Introduction

7 methods chapters

Cross-cutting chapters

Conclusion

- What data and evidence can you use to build system maps?
- Running workshops
- Comparing, choosing, and combining methods

Why did we write the book?

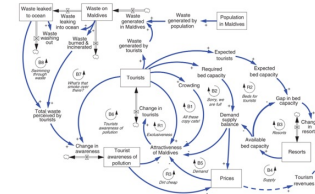
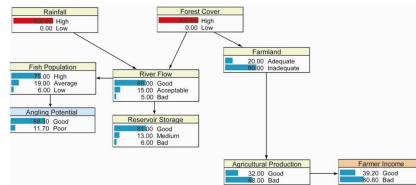
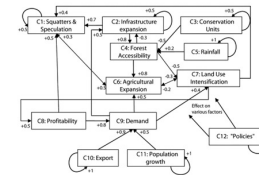
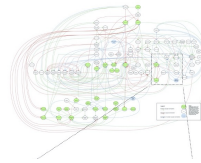
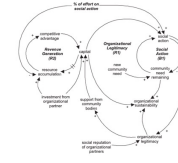
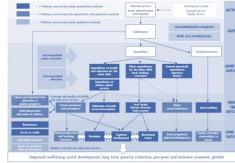
- Timely
 - Surge in interest
 - Entry point for societal challenges
- Confusion around systems mapping
 - is it one thing?
 - underestimate differences
 - Few guides that bring together different approaches in a way that reflects use and current interest

Who is it for?

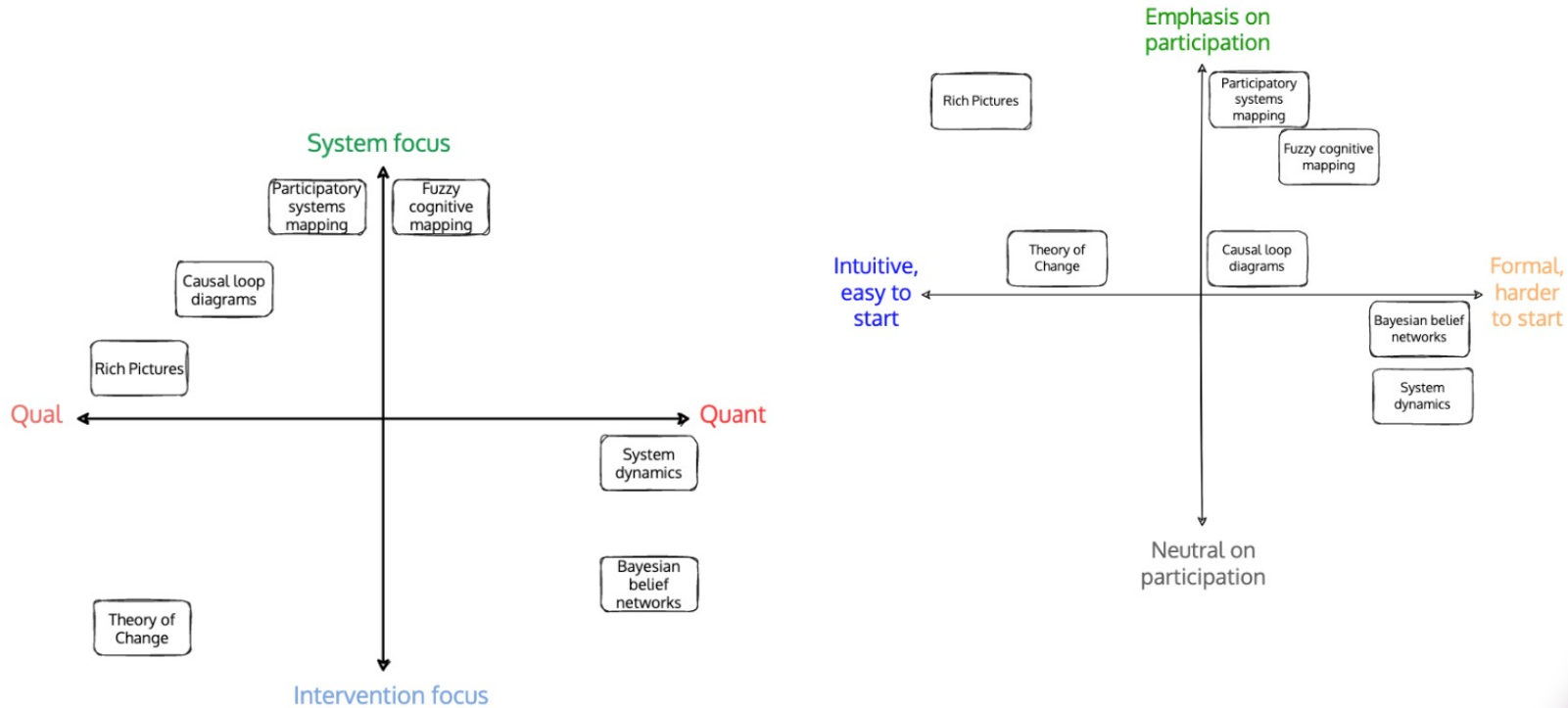
- Our former selves!
- People who want to get a sense of what systems mapping is
- People thinking about using systems mapping
- People who want to use a specific method
- People who know one method well but want to expand

What is systems mapping?

- Many definitions and types
 - Describe a system
 - Modelling
- Easy to agree
 - Focus on cause and influence
 - Network of nodes and edges
- In this book



How do these methods relate to each other?





How can systems mapping be useful?

- Help us think
- Help us orient ourselves
- Help us synthesise and connect information
- Help us communicate
- Help us extrapolate from assumptions to implications
- Surprise us!



Rapid methods rundown



Rich Pictures

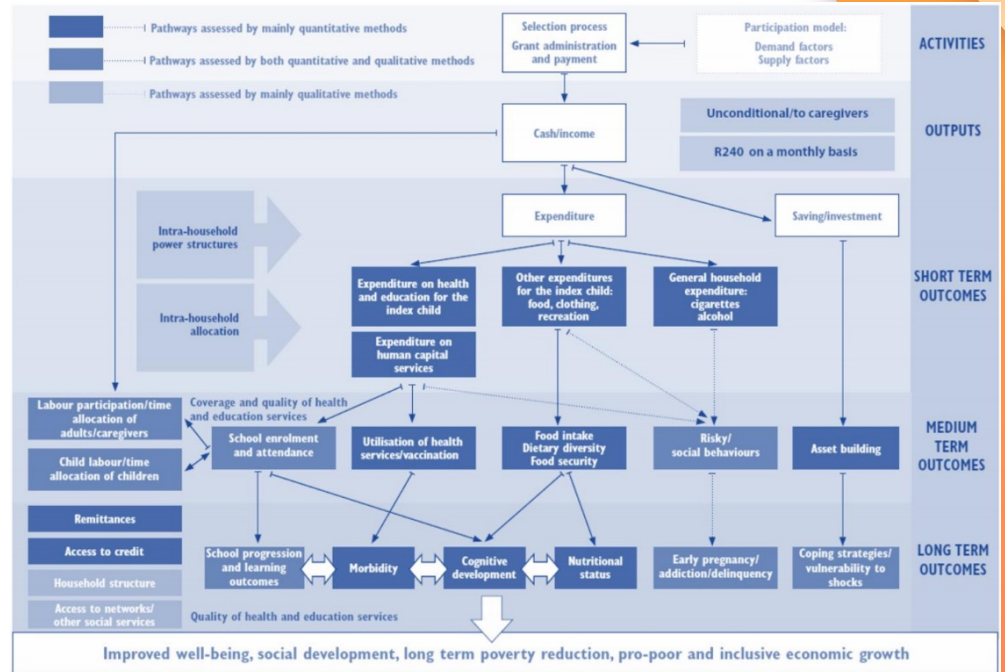
Method	RP
Level of focus	Situations within a system
Type of map	Drawings, narrative
Mode of construction	Free-form
Emphasis on participation	High
Mode of analysis	Thematic
Ease of use	Easy
Key contributions	Inclusive and flexible
Key constraints	Not a model Difficult to share findings No quantitative output
When most appropriate	When participation and rich expression are wanted



Bell, S., & Morse, S. (2013a). How people use rich pictures to help them think and act. *Systemic Practice and Action Research*, 26, 331–348. <https://doi.org/10.1007/s11213-012-9236-x>

Theory of Change

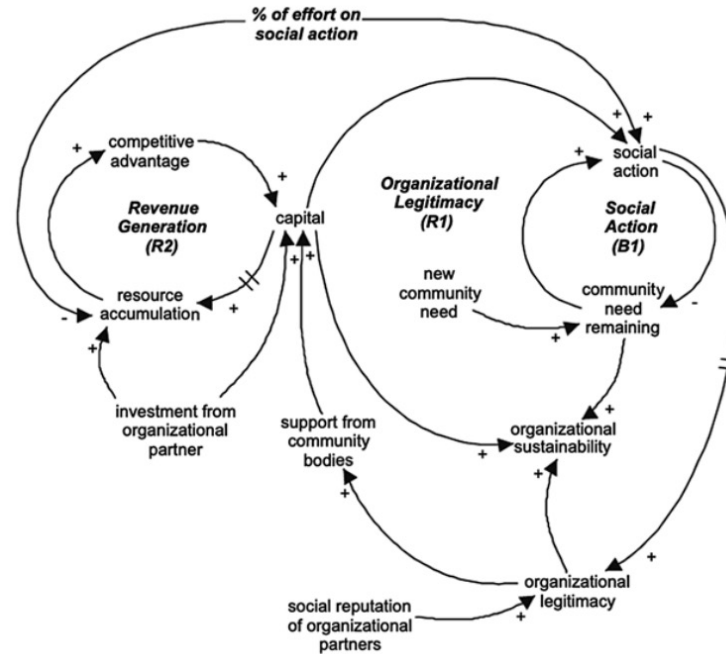
Method	ToC
Level of focus	Intervention
Type of map	Flexible, diagrammatic, cause and effect logic
Mode of construction	Start with outcomes and intervention, and connect
Emphasis on participation	Neutral
Mode of analysis	No formal analysis
Ease of use	Easy
Key contributions	Discipline intervention logic, plan intervention design and evaluation
Key constraints	No analysis May exclude important wider context
When most appropriate	When focussed on one intervention, when flexible 'framing tool' wanted



DSD, SASSA and UNICEF. (2012). The South African child support grant impact assessment: Evidence from a survey of children, adolescents and their households. UNICEF South Africa.

Causal Loop Diagrams

Method	CLD
Level of focus	System engine and feedbacks
Type of map	Qualitative, cyclic, causal relations
Mode of construction	Start with system engine and feedback loops, build out Often use systems archetypes
Emphasis on participation	Neutral
Mode of analysis	Qualitative dynamics
Ease of use	Easy – medium
Key contributions	Focus on feedback loops and 'system engine'. Gives qualitative sense of dynamics
Key constraints	Can produce v stylised system No quantitative output
When most appropriate	When feedbacks or dynamical behaviour important, and quantification not required



Moizer, J., & Tracey, P. (2010). Strategy making in social enterprise: The role of resource allocation and its effects on organizational sustainability. *Systems Research and Behavioral Science*, 27, 252–266. <https://doi.org/10.1002/sres.1006>

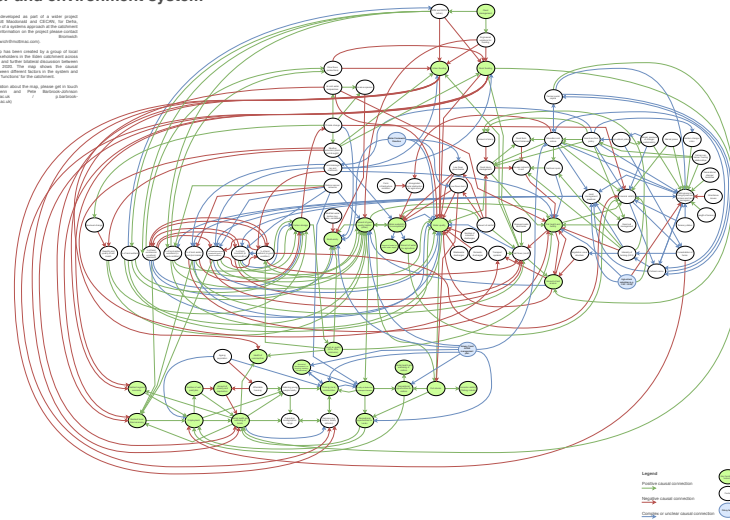


Participatory Systems Mapping

Method	PSM
Level of focus	System
Type of map	Qualitative, cyclic, causal relations
Mode of construction	Start with focal factors and build out, info on factors and links
Emphasis on participation	High
Mode of analysis	Bespoke analysis using submaps, network analysis, causal flow, and stakeholder info
Ease of use	Medium
Key contributions	Using submaps, network analysis, causal flow, and stakeholder information to make sense of large maps
Key constraints	Difficult to share findings No quantitative output
When most appropriate	When participation emphasised, when flexibility of construction and analysis wanted, when large, inclusive maps desired.

Participatory System Map of the Eden catchment water and environment system

The map was developed as part of a wider project...
This participatory map was created by a group of local...
The map shows the relationships between...
The map is a complex network of...
The map is a complex network of...
The map is a complex network of...

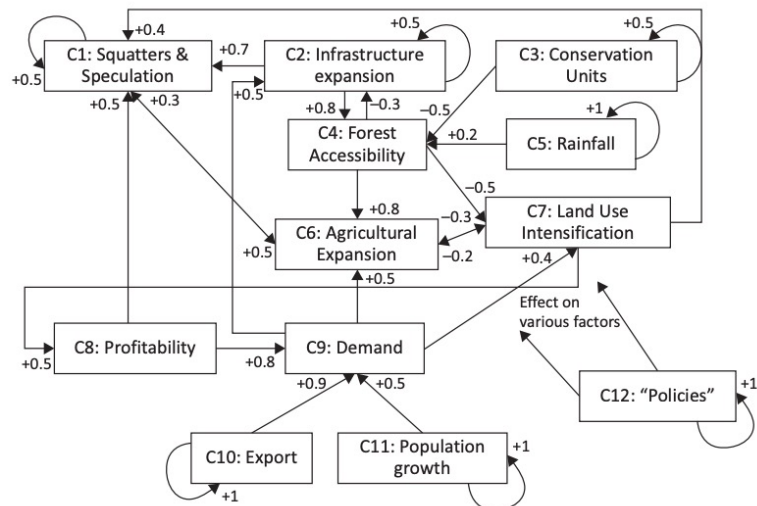


cecac Centre for the Evaluation of Complexity Across the Nexus
M M
NOTT MACDONALD

Bromwich, B., Penn, A. S., Barbrook-Johnson, P., & Knightbridge, J. (2020). Systems analysis for water resources: Final report. Defra report. <http://randd.defra.gov.uk/> (search for WT1512)

Fuzzy Cognitive Mapping

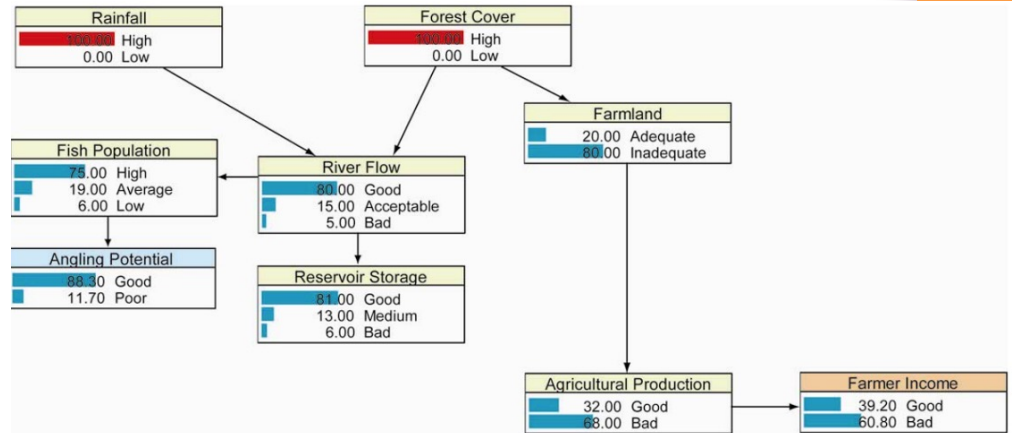
Method	FCM
Level of focus	System
Type of map	Semi-quantitative, cyclic, causal relations
Mode of construction	Start with focal factors and build out, quantify connections
Emphasis on participation	High
Mode of analysis	Compute impact of factors, rank, 'run' to equilibrium. Comparing network structures.
Ease of use	Medium
Key contributions	"Quick and dirty dynamics" or relative causal importance of factors. Examination of stakeholder mental models
Key constraints	Analysis results highly sensitive to assumptions
When most appropriate	When quick comparative semi-quantification wanted. When implications of assumptions, consolidation of inputs to relative size of impacts desired. When participation emphasised.



Kok, K. (2009). The potential of Fuzzy Cognitive Maps for semi-quantitative scenario development, with an example from Brazil. *Global Environmental Change*, 19(1), 122–133. <https://doi.org/10.1016/j.gloenvcha.2008.08.003>

Bayesian Belief Networks

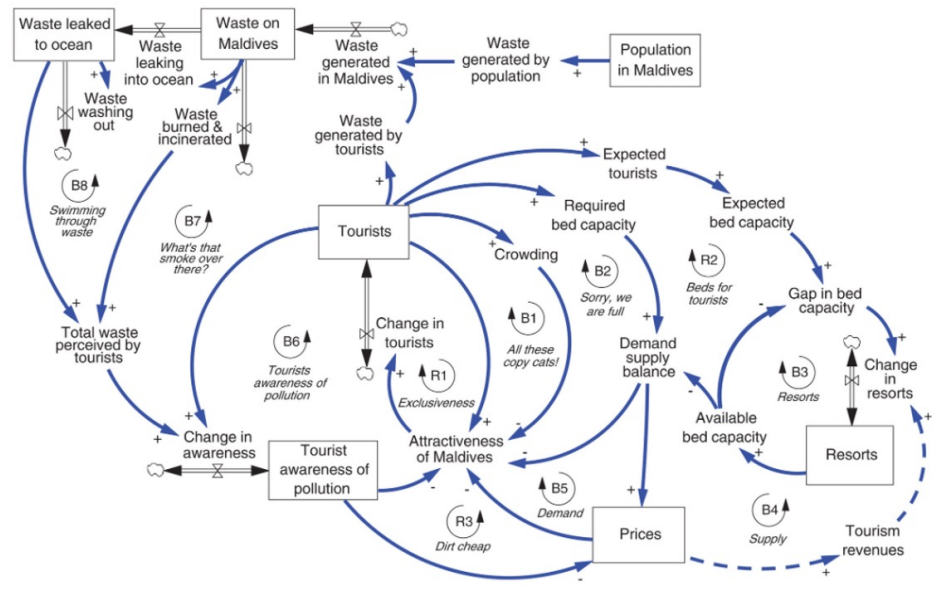
Method	BBN
Level of focus	Intervention to outcomes within a system
Type of map	Quantitative, acyclic, causal relations
Mode of construction	Start with outcome and build back, or start with intervention and build down, define conditional probabilities
Emphasis on participation	Neutral
Mode of analysis	Estimate effects of interventions, or contribution of factors to outcomes
Ease of use	Hard
Key contributions	Estimate impacts and contributions quantitatively. Quantification with low risk of producing meaningless analysis.
Key constraints	Strong constraints on structure of map
When most appropriate	When low-risk quantification wanted, when quantitative analysis of contributions to outcomes wanted



Bromley, J. (2005). Guidelines for the use of Bayesian networks as a participatory tool for Water Resource Management. MERIT. <http://nora.nerc.ac.uk/id/eprint/3300/>

System Dynamics

Method	SD
Level of focus	Dynamical problem
Type of map	Quantitative, cyclic, stock and flow, causal relations
Mode of construction	Start with system engine, and feedback loops, build out and quantify
Emphasis on participation	Neutral
Mode of analysis	Simulate dynamics through time
Ease of use	Hard
Key contributions	Simulate aggregate dynamics. Explore feedback loops quantitatively.
Key constraints	Time consuming. Empirical validation often required. Sensitive to assumptions.
When most appropriate	When full rigorous simulation wanted, when feedbacks/dynamical behaviour considered important



Kapmeier, F., & Gonçalves, P. (2018). Wasted paradise? Policies for Small Island States to manage tourism-driven growth while controlling waste generation: The case of the Maldives. *System Dynamics Review*, 34(1–2), 172–221. <https://doi.org/10.1002/sdr.1607>



Cross-cutting chapters

Types of data and evidence

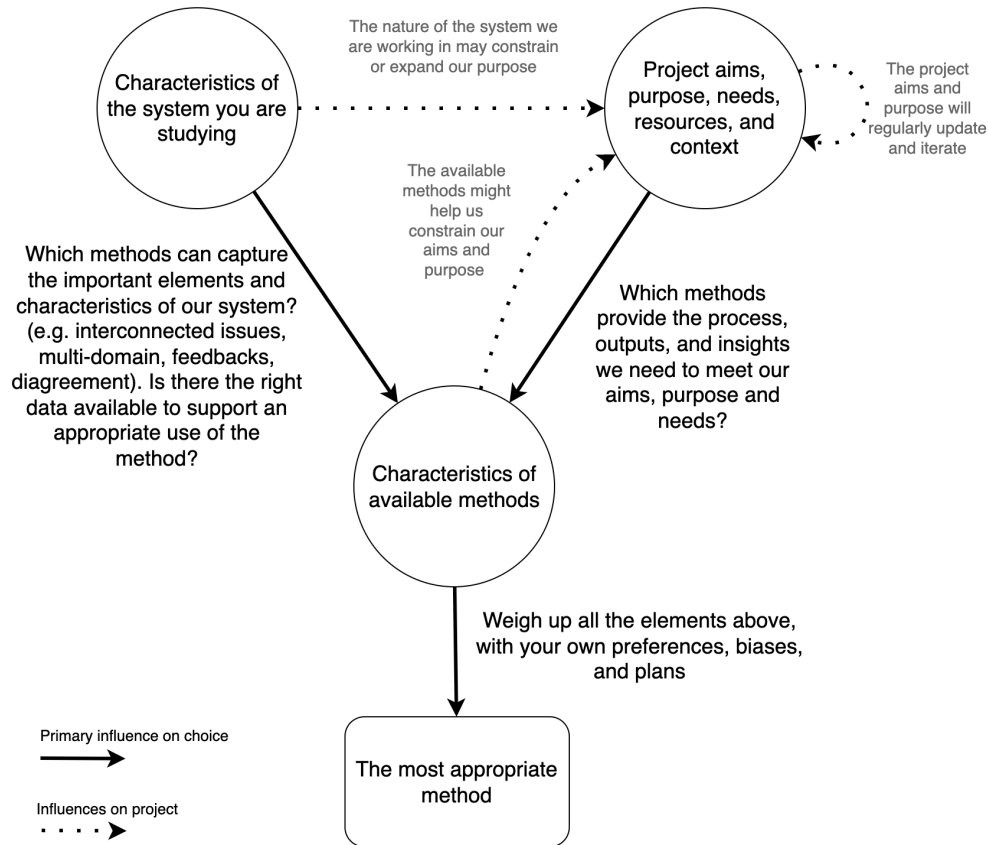
- Defending need for participation
- Qualitative
 - qual data -> systems map
 - good software support
- Existing evidence
 - systems mapping as rapid evidence review / systematic review
- Quantitative
 - maps as visualisations of statistical analysis
 - network estimation
- In reality, we should combine to meet our goals



Running workshops

- Planning
 - purpose, who, when, timeplan
- Venue, materials, tech
 - where, tables and chairs, walls, paper and pens, IT, existing maps
- Facilitation
 - plan, prompts, know the method, practice, group dynamics, giving away power, breaks, working in pairs
- Recording
- Post-workshop
- Common issues
 - power dynamics, disagreement, confusion, disengagement, burnout
- Doing it online
 - easier attendance, interaction far worse, shorter but more sessions, software nuances vital, physical and online create wholly different experiences, burnout

Compare and choosing methods





Concluding thoughts

Conclusion

● Lessons

- Some systems mapping methods are simple
- But the systems mapping method space is confusing and ill-defined
- Differences are underestimated

● Final messages

- Choose methods with purpose
- Do we want value from process, outputs, or both
- Do we want participation or conceptual rigour
- Maps as living documents
- Learn as many methods as possible
- Advocate for wider philosophy of steering complex systems

Thanks!

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- peter.barbrook-johnson@ouce.ox.ac.uk & a.penn@surrey.ac.uk