Building Systems Science Thinking into One Health:

Brainstorming Workshop One

29 June 2023

Workshop Outcomes

Background and Objectives

Our world now faces interlinked health, climate, ecological, social, and economic crises. We are approaching tipping points, after which life as we have known it can no longer exist. The One Health approach has been used successfully to strengthen necessary communication and collaboration between the animal health and human health sectors in addressing zoonotic diseases and other health challenges at the human-animal interface. However, as currently applied, One Health is insufficient to effectively understand and sustainably address challenges at a larger, more complex socio-ecological systems level without causing negative impacts to other aspects of the system, such as disrupting communities or decreasing the resilience and sustainability of ecosystems. Methodologies and approaches such as Complexity Science and Systems Thinking, which allow consideration of climate, socio-cultural, ecological, psychological, economic, and political aspects, as well as justice, equity, and sustainability of impacts, are already being applied within the biological and environmental sciences to address such complex challenges to impact activities and policy.

To explore systems thinking in the context of One Health and to begin to build systems approaches and methodologies into One Health activities, a brainstorming workshop was co-convened by a core group of researchers already engaged in these discussions from the University of Surrey and the Royal Veterinary College.

The following Aspirational Objectives were presented in the meeting opening, to set the scope of the discussion in the larger scope of work:

- To identify and explore some main challenges and gaps in the application of system thinking methodologies in One Health, and the existing scope and benefit of improving the use of systems approaches
- To co-create a common understanding of goals and way forward
- To identify other activities to strengthen and expand systems thinking in One Health
- To co-develop a concept/s for development into a research proposal/s
- To discuss next steps for seeking funding and other support

Getting on the same page: Perspectives on One Health and systems thinking

In 2022 the One Health High Level Expert Panel published an updated definition of One Health and a new visual based on five underlying principles (Equity, Sociopolitical and multicultural parity, Socioecological equilibrium, Stewardship, and Transdisciplinary). However, differing perspectives on One Health's scope and approach remain from both within and outside the One Health community. Other integrated approaches to health include Planetary Health and EcoHealth, all of which aim to improve health outcomes through collaboration. Although these integrated approaches aspire to address complex systems through collaboration, and despite groups such as the Network for

EcoHealth and One Health (NEOH) consistently advocating for systems approaches in One Health, Complexity Science and systems approaches are not routinely applied in One Health contexts.

Complex systems are different from simple systems and complicated systems in that the long causal chains of relationships, non-linear interactions between components, and feedback loops within complex systems give rise to characteristics such as adaptation, tipping points, and emergence, leading to unpredictability and uncertainty. Relationships within complex systems can be challenging to explain, for example to policy makers. "Systems thinking" can be considered an umbrella term that captures the large number and broad scope of qualitative and quantitative methodologies for exploring and describing relationships within complex systems. These diverse methods can be used in combination and as appropriate to context and challenges as part of a holistic, pluralistic, inclusive, reflexive, exploratory approach. Working with complex systems in this practical, applied way to make effective, sustainable change that matters has been referred to as "actionable complexity."

Global policy bodies such as the G7, G20, and Global Risk Forum have now committed to using a One Health approach to address converging global crises, therefore it is critical that One Health evolves sufficiently to meet this challenge. This meeting aimed to explore current One Health activities, methodologies, and options for such an evolution through transdisciplinary operational research and policy discourse. Opportunities available for funding and support were presented and explored throughout the meeting.

Real world examples and emerging themes

Prior to the meeting, invited participants were asked to consider their engagement with systems approaches and to briefly present their experiences and perspectives for further discussion based on the following frame:

- What was the technical challenge or research question?
- What specific aspect of the challenge/question prompted you to choose a systems approach?
- What methods were used/considered?
- What worked well? What problems were encountered?

Through these brief presentations and further in-depth discussion, a glimpse of the rich and nuanced research and policy activities ongoing across the One Health and systems science landscape emerged. A range of methodologies were being used, from standard epidemiological modelling approaches, causal loop diagrams, network models, dynamic modelling, participatory systems mapping, and mixed methodologies to applied game theory for teaching collaboration and systems science advocacy.

All participants mentioned their attempts to capture complexity, contextual information, and trade-offs (e.g. sociocultural aspects including poverty, behavioural aspects, environmental and conservation aspects, equity) in some way, though were mostly dissatisfied with the capacity of the available tools and methods to collect, integrate, and understand different knowledges. Balancing the richness of a qualitative model, with a pared-down quantifiable model was also challenging. The discussion highlighted that a wide scope of expertise and disciplinary perspectives was fundamental to understanding, adapting, and authentically applying complexity theory and systems methods that are currently being used in engineering and the social sciences to One Health-relevant systems. There was general agreement that thinking about complexity and being able to demonstrate it to others was already useful in changing individual's perceptions (or mental models), even if no tool was directly available. The overwhelming nature of complexity was mentioned as a constraint to operationalization of complex systems approaches. However, using participatory approaches to develop a visualisation

of the system, and using the visualisation of interconnected variables in modules or subsystems to explain the system, e.g. to policy makers, was deemed useful.

Thoughts, observations, and questions clustered around three emerging themes: equity, integration of approaches, and teaching and networking. The below summaries can only begin to demonstrate the richness of the conversations; more nuanced discussions and action on each theme – and others – will continue.

Equity

It was agreed that equity considerations are fundamental to the One Health discourse and that equity should be viewed as an underpinning value in One Health activities. Despite nominal inclusion of animals, humans, and the environment, One Health activities have tended to be anthropocentric. An enormous challenge is how to best include the non-human voices and perspectives into the discourse.

One Health endeavours to bring stakeholders to the table, however, methods for equitably including all relevant and diverse groups, including women and underserved communities, in One Health activities are not readily available. Even if relevant stakeholders are included, more work is needed to ensure that all voices are heard and that individuals are empowered to ask the questions they want answered. This will result in greater ownership of solutions. Power dynamics also impact the differential inclusion and valuing of the medical, veterinary, and environment sectors, the "hard" vs "soft" sciences, groups with different worldviews or epistemologies, and technical 'experts,' government bodies, and funding agencies, by limiting inclusion or otherwise diminishing voices seen to be less powerful or valuable at the individual as well as institutional levels. Issues of language and terminology can affect actual and conceptual access to information and contribution to activities, and having a shared language is important to be able to look at problems and understand each other's agendas and motivations. Similarly, knowledge generated through alternative knowledge systems (such as Traditional Indigenous Knowledge) may not be valued.

Practical ways to encourage reflexivity among One Health researchers and openness about methodologies, weightings and trade-offs are required, as are methods to combat structural and subconscious paradigms and biases in development and research, such as colonialism and anthropocentrism. These may impact the way systems are identified, bounded, mapped, and analysed.

First practical steps in this theme could include a definition of equity with consideration of animals, plants, and ecosystems and a position paper on equity values, building on work done in other fields and establishing equity principles or expectations for One Health systems research. Contribution of this theme to the systems thinking body of work would include making sure that equity and reflexivity are built into research and educational processes.

Integration of approaches

A proposed way forward is to use a systems approach to map the contributions from different methods that can be used to tackle a complex One Health problem. Diverse approaches, models and methods are currently being used to explore complex systems in One Health contexts. However, these methodologies evolved in unrelated disciplines and often lack interoperability. They may be seen as opposing or even mutually exclusive, for example "qualitative vs quantitative" research or "social sciences vs natural sciences." While One Health researchers from the natural sciences are increasingly vocal about the "need to work with social scientists", few know how to make it happen in an impactful way, beyond tokenistic attempts at collaboration. Similarly, despite intending and aspiring to consider

diverse factors across the system, One Health activities are currently not yet utilising complexity science and systems approaches in the field.

Further, methodologies for combining or integrating tools, models, and approaches and for bringing together different types of empirical knowledge in One Health are not available. For example, when using social science methods within epidemiological programmes, qualitative information, typically generated through ethnographic and participatory approaches, is often quantified for analysis alongside quantitative data, reducing its nuance and value. There is currently no guidance on when to choose different methods to look at different aspects of the system or achieve different objectives, especially considering that the method(s) chosen will impact the outcomes.

The development and testing of methods implies a discussion of what constitutes valid and valuable evidence and who decides, how to collect appropriate contextual information, and how to address gaps in data quality and quantity. Flexibility in defining boundaries of the system is required, but may be challenging when scoping models and planning data collection. Presenting and discussing outputs with policy makers becomes more challenging with an increasing number and combinations of methodologies and the resulting complex and nuanced "answers."

First practical steps in this theme could include investigating and validating these options, requiring both theoretical and operational development. This would include empirical assessment of the benefits of systems approaches in the field, as well as inclusively identifying what methods are useful to answer what questions, acknowledging their respective contributions and scopes with the aim of identifying where and how they can interface with each other.

A useful tool to develop first would be a generic schema for systems thinking in One Health to provide a flexible, yet systematic, operational framework for approaching a system in a standard stepwise and cyclical/iterative manner with feedback loops and alternative pathways. Such a schema would indicate the methodological steps (e.g. participatory activities, data collection, mapping, integration of knowledges, modelling), inclusivity and equity considerations (e.g. participatory community engagement, co-creation, worldview inclusivity) and the types of actors involved (e.g. stakeholders in the system, scientists involved in the analysis, decision makers), and would frame the objectives for each step (e.g. gathering data, brainstorming local options, sense checking, testing). The schema would aim to enable innovation and experimentation within a quality control framework (with proper planning and validation) and could also be tested through field applications.

Teaching and networking

Critical in systems thinking is moving away from maintaining siloes and hierarchies and towards building networks.

Teaching systems thinking is becoming critical in both academic and in-service One Health contexts. It is also important that the public and others – such as policy makers - understand complex systems concepts and can participate actively in systems approaches. Systems thinking is intuitive for people in some contexts, especially in our daily lives, making conveying the concept of systems easier. Farmers, for example, already understand and recognize the impact of the system, though they may not recognize it as systems thinking. In contrast, we are trained as scientists to think linearly, and so may unconsciously seek (and feel more comfortable with) single cause and effect relationships.

There is already experience in teaching systems thinking in the engineering and conservation fields, so it is possible to build on the system thinking scholarship and pedagogy that is already available. The

critical components and range of skills people need to learn relative to One Health, and how to include systems thinking into the curricula of different programmes, will need to be explored.

Next steps in this theme would be to understand what form of systems thinking teaching already occurs in different One Health courses, as well as in other established fields of study. This information would allow expansion of existing systems thinking teaching and training efforts such as NEOH and the One Health European Joint Project to include successful and innovative teaching methods across different levels. This could be supported by the existing Systems thinking networks.

Other observations and challenges

A large-scale shift to systems thinking would encounter institutional constraints, eventually compelling a larger paradigm shift. Perspectives, infrastructures, and ways of working in international development, external funding systems, scientific fields of study, academia, and education would be impacted. This shift would also necessarily require new, creative approaches to adaptively managing and conveying unpredictability and uncertainty for policymakers and other stakeholders as well as funders.

Moving forward

Overall, there was motivation to explore new operational approaches to address the diverse concerns emerging as the complexity of systems is recognized. Two lines of activity were recognized for each of the themes, namely:

- Theoretical development of systems thinking in One Health contexts
- Empirical work – testing and implementing the principles

This workshop contributed to the growing Community of Practice for One Health Systems Approaches. Efforts to expand this community are underway, with regular communications planned.

Core Team

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Support

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	Workshop Agenda Thursday, 29 June 2023 Location: Royal Veterinary College Campus, Camden, UK	
9.00 - 9.45	1. Opening, welcome, and aspirational objectives for the meeting (B. Haesler, L. Mumford) 2. Introductions 3. Overview of the meeting flow (A. Penn)	Chair: B. Haesler
9.45- 10.45	4. What do we mean by OH and integrated approaches to health (B. Haesler) 5. What do we mean by systems thinking (A. Penn) 6. Why is systems thinking needed in One Health now (L. Mumford) 7. Funding / support calls on the horizon	Chair: P. Alarcon
10.45 - 11.00	Tea	
11.00 - 12.15	8. Examples of application of systems thinking and other approaches from participants and core team members	Chair: A. Cook
12.15 - 13.00	9. Brainstorming: identification of commonalities and synergies based on examples presented	Chair/Facilitator: A. Penn
13.00 - 14.00	Lunch	
14.00 - 15.45	10. Elaborating themes and challenges - break out groups to expand on themes that emerge from the brainstorming 11. Feedback & discussion in plenary	Chair/Facilitator: A. Penn
15.45 - 16.00	Tea	
16.00 - 16.50	12. Aspirations and next steps for each group	Chair: L. Mumford
16.50 - 17.00	13. Closing	Chair: L. Mumford / B. Haesler