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Where One Health Meets Food Systems Teaching and Learning: Expanding Skillsets for Food System Transformation

The Interdisciplinary Food Systems Teaching and Learning (IFSTAL) programme in the MSc One Health programme at the Royal Veterinary College and the London School of Hygiene and Tropical Medicine, London, UK. In this case we reflect on the contribution One Health can make to balanced food systems and discuss relevant skill acquisition and development at postgraduate level using the example of interdisciplinary food systems teaching and learning offered to MSc One Health students.

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Abstract

Food systems are often described as the single biggest contributor to complex global health challenges for people, animals, plants, and the environment through pollution, ecosystem degradation, greenhouse gas emissions, land and water use, chemical use, unhealthy and unsafe diets, animal welfare concerns, infectious disease risks, and biodiversity loss. The collaborative, multisectoral, transdisciplinary and systems-focused nature of One Health allows it to make important contributions to these problems by, for example, mitigating disease across animal and human populations or reducing antimicrobial resistance. In this case study, we explore how the combination of food systems literacy and One Health skills can give postgraduate students a valuable foundation to engage in further opportunities for One Health in food systems and thereby contribute to positive change. Areas for potential expansion of One Health in food systems are presented. The example of the Interdisciplinary Food Systems Teaching and Learning (IFSTAL) programme and the MSc course One Health: ecosystems, humans and animals are used to discuss the value of the combination of One Health and food systems skills.

What is the Incremental Value that Makes This a One Health Case?

One Health has important contributions to make to sustainable and healthy food systems but is not (yet) realising its full potential because of its historical roots in human and animal medicine and the associated

epistemic practices[1] making it lean towards positivist paradigms (with a view that facts exist that can reliably and objectively be documented and explained through scientific inquiry and method). This case illustrates how One Health skills can be expanded by food systems literacy in a community of food systems learners. The case focuses on system thinking, reflexivity and collaboration, as these are deemed essential to recognise and understand food system challenges and work constructively in collaborative teams towards sustainable food system transformation. Food is also an excellent example as it sits at a nexus between people, animals, plants and the environment. To achieve long-term food security (a major outcome from food systems) while minimising negative impacts such as environmental degradation and poor animal welfare, there is a need for holistic and transdisciplinary approaches that allow us to deal with complexity and identify effective pathways of change.

Learning Outcomes

Working through this case will help to achieve the following learning outcomes:

1. Explain why the partial knowledge, agency and cognition of individuals are insufficient to solve the heterogeneous and complex nature of food system problems.
2. Recognise the need to work together beyond specialities, knowledge domains, disciplines and experiences across countries, institutions and networks to solve these problems.
3. Summarise how such collaboration and exchange allow gaining a fuller picture of food systems problems and their magnitude at different levels (from local to global) and understanding of food systems dynamics and linkages that can enable solutions.
4. Discuss why One Health learners or practitioners may be well placed for further skill expansion in food systems literacy and application of system thinking to food system problems.
5. Identify limitations to the achievement of metacognitive knowledge in single institution programmes including associated influences of positionality and "home" institutional culture.

Background and Context

Food System Problems and One Health

Current food systems[2] fail to provide adequate, safe, nutritious and sustainable diets to all (Global Panel, 2020). Despite food production levels doubling in the past half century, malnutrition – in all its forms – remains a challenge (Gómez *et al*., 2013). An estimated 26% of the global population experience hunger or lack regular access to sufficient nutrient-rich food, yet around one-third of food produced is wasted (Gustavsson, 2011; Global Panel, 2020). A similar and growing proportion of the human population are classified as obese (Swinburn *et al*., 2019). The agricultural systems of food production have been estimated to generate around a quarter of greenhouse gas emissions, use approximately 70% of freshwater resources and contribute to biodiversity loss through chemical use and land-use change (Masson-Delmotte *et al*., 2019; Benton *et al*., 2021). The growing global demand for animal source food is driving the growth of increasingly intensive livestock production systems (Iannotti *et al*., 2021). This transition to more intensive systems raises various welfare concerns including the impact of stocking density and may increase the risk of disease transmission, including spill-over of emerging zoonotic diseases, particularly in settings with low biosecurity capacity (Iannotti *et al*., 2021). Similarly, these situations lend themselves to greater reliance on antimicrobial use for disease prevention and animal productivity, adding to the global risk of antimicrobial resistance and antibiotic residues in food (FAO, 2018). Despite significant advancements and investment

[1] "the socially organised and interactionally accomplished ways that members of a group propose, communicate, justify, assess, and legitimise knowledge claims" (Kelly and Licona, 2018)

[2] Food system definition from the Centre of Food Policy, City University of London (Parsons *et al*., 2019): *"The food system is the interconnected system of everything and everybody that influences, and is influenced by, the activities involved in bringing food from farm to fork and beyond. It includes the chain of activities from producer to consumer; the factors that influence the chain of activities and are influenced by it; these are drivers and outcomes of the food chain, which have economic, political, environmental, health and social dimensions; the many entities, institutions and people directly and indirectly involved; the connections between all these elements, meaning that action in one part of the system has repercussions across the system."*

in food safety research and surveillance, foodborne disease remains an on-going threat to health even in developed economies (Boqvist *et al*., 2018). The food system presents several opportunities for One Health to leverage healthier and more sustainable outcomes.

One Health with its integrated and holistic work in human, animal, plant, and environment domains and its agenda to promote health for all in a balanced and fair way, operates in many parts of food systems and is an essential component of a sustainable food future. One Health contributes to the functioning of food systems and health through infectious disease prevention, surveillance and control (World Bank Group and EcoHealth Alliance, 2018; Ernest Rugarabamu, 2022); mitigation of chemical hazards such as antimicrobial resistance (McEwen and Collignon, 2018); food safety along food value chains in both formal and informal settings (Grace, 2015; Boqvist *et al*., 2018; Garcia *et al*., 2020); animal welfare in food production systems (Wettlaufer *et al*., 2015); or regenerative agriculture (Newton *et al*., 2020). However, there is scope to do even more by focusing on wider food system questions and structural issues.

Food systems can be viewed as complex adaptive systems (CAS) (Meter, 2019). The latter are described as having many interconnected parts, with non-linear and decentralised interactions across temporal and geographic scales leading collectively to self-organisation that manifests in emergent and often unpredictable patterns and shifts (Holland, 1992; Meter, 2019). Key CAS aspects in food systems include multiple autonomous actors with different properties, motivations and adaptive behaviours (e.g. individuals, communities, institutions); interdependent links and feedback that span scale, sectors and space (e.g. economic, biological and physical levels); heterogeneity in and across actors that shape system outcomes (e.g. producer vs. government interests); spatial organisation in local-global networks, chains and webs (e.g. global trade network); and non-linear behaviour and resilience (e.g. "tipping points") (Nesheim *et al*., 2015). Recent crises have highlighted our food systems as complex and adaptive, given their interconnected nature and the rapid, wide-reaching and often unexpected emergent consequences that they can trigger across space and time through levers and feedback loops within the system. The impacts of COVID19 globally on chicken meat food systems (Chapot *et al*., 2021), and the war in Ukraine (WFP, 2022), clearly illustrate these effects. Food systems are also driven by many heterogeneous elements and sub-systems with multiple interactions across social, economic, environmental, animal, plant, political and cultural dimensions in ways that cannot be easily understood, captured nor influenced. The CAS nature of food systems makes them prone to wicked problems (Hamm, 2009). For example, maintaining food and nutrition security is a primary goal of food systems, yet it presents a wicked problem within the context of ensuring environmental sustainability (Lang and Barling, 2012; Grochowska, 2014). Equally, while focusing on food security, food systems are failing to resolve the triple burden of malnutrition (under-, over-nutrition and micronutrient deficiencies) that can coexist within a community (Pinstrup-Andersen, 2007).

When being confronted with the vastness of different knowledge, disciplines, facts, constituent parts, relationships, competing perspectives and priorities in systems, individuals can feel overwhelmed. Thus, we need people who have the skills to work in complex (food) systems and who can provide guidance to others, deal with uncertainty and find a way to identify actionable solutions (Savona *et al*., 2021), while helping to manage multi-disciplinary or interdisciplinary teams.

How One Health is Evolving

One Health has developed historically from an approach that covered medical aspects of animals and people in One Medicine to expand to wider considerations of the health of animals and people with the gradual inclusion of aspects of the environment (Schwabe, 1984; Zinsstag *et al*., 2011). Ecohealth, by contrast, has developed as an ecosystem approach to health, emphasising that the health of ecosystems underpins the health of plants, animals and humans (Rapport *et al*., 1999; Zinsstag *et al*., 2011). In the past decade, an increasing convergence has been observed between Ecohealth and One Health with both approaches promoting a holistic conceptualisation and sustainable solving of health problems in people, animals, plants and the environment. Both are anchored in systems-focused, participatory and collaborative approaches, but there are differences in epistemology and ontology (Harrison *et al*., 2019; Zinsstag, 2012). While Ecohealth leans more towards constructivist theories, One Health is still influenced heavily by human and animal medical disciplines, which are traditionally underpinned by positivist or post-positivist paradigms (Harrison *et al*., 2019; Brown and Dueñas, 2020). Figure 1 shows an overview of the ontological and epistemological underpinnings of constructivism, positivism, post-positivism, and critical theory.

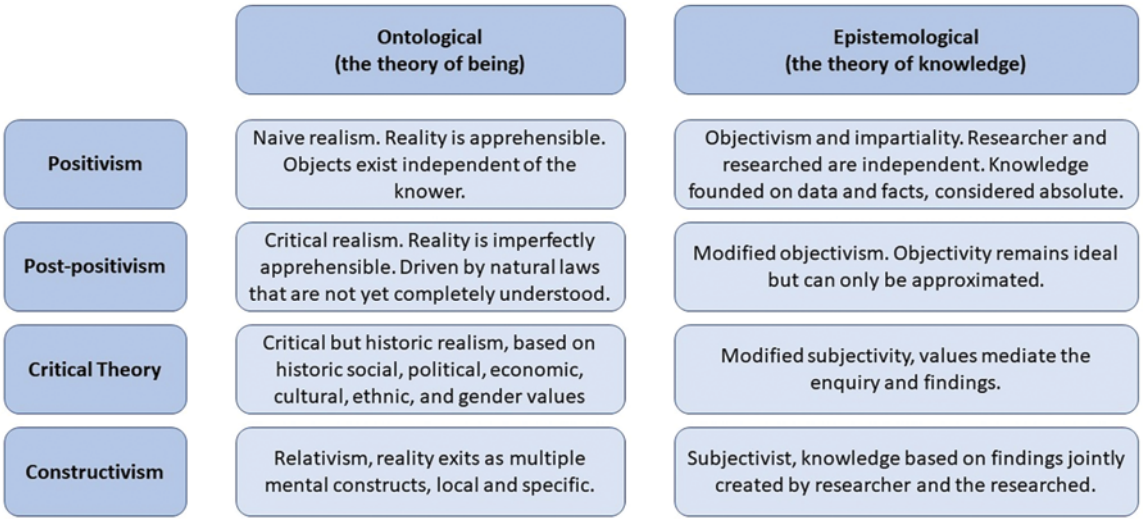

Figure 1. Overview of positivism, post-positivism, critical theory and constructivism with their ontological and epistemological characteristics. Adapted from (Guba and Lincoln, 2005; Scotland, 2012; Gardner, 2013).

In December 2021, the One Health High Level Expert Panel (OHHLEP) that advises the Quadripartite[3] in One Health matters published a new definition of One Health[4] emphasising the importance of sustainably balancing and optimising the health of different populations (humans, animals, ecosystems) through an integrated, multisectoral and transdisciplinary approach. Their inclusion of the need for "clean water, energy and air, safe and nutritious food, taking action on climate change and contributing to sustainable development" takes One Health firmly out of its current sphere dominated by (infectious) disease and other hazards (including food safety issues and AMR) and paves the way towards a broader One Health. The OHHLEP proposes that the key principles accompanying the vision are collaboration, communication, coordination and capacity building underpinned by equity, parity, balance, stewardship and transdisciplinarity (Adisasmito *et al*., 2022). These principles can be applied to a vast array of problems and contexts – including food systems.

Systems Thinking in One Health and Food Systems

In the One Health community, two main streams of thought can currently be observed (Figure 2): Those that are focusing pre-dominantly on the threats and hazards that are occurring at the interfaces between humans, animals, plants and the environment (e.g. infectious disease emergence and spread, antimicrobial resistance) and those that are focusing more on how to generate socio-ecological systems that sustain living beings and allow health to thrive for people, animals, plants and the environment. Although these streams have different conceptualisations and competencies, systems thinking is now becoming more evident in One Health research (Yasobant *et al*., 2020) and appears to be relevant for both streams.

Systems thinking is advocated as an approach to develop a better understanding of complex and wicked problems (Arnold and Wade, 2015). It is more than thinking about a system, and it is perhaps best conceptualised as a system by which to think about systems (Arnold and Wade, 2015). It explores the nature of complexity that makes phenomena difficult to understand without adequate insights regarding the functioning of a large variety of elements that are interconnected, dependable and not following simple rules. It aims to recognise the system behind the problem of interest, to identify the system's boundaries and structure, its elements and their connectivity, and to develop theories on the system's behaviour over time in response to change (Arnold and Wade, 2015; Duboz *et al*., 2018). A fundamental aspect of systems

[3] The Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), the World Organization for Animal Health (WOAH).

[4] *"One Health is an integrated, unifying approach that aims to sustainably balance and optimise the health of people, animals and ecosystems. It recognises the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent. The approach mobilises multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development"* (Adisasmito *et al.*, 2022).

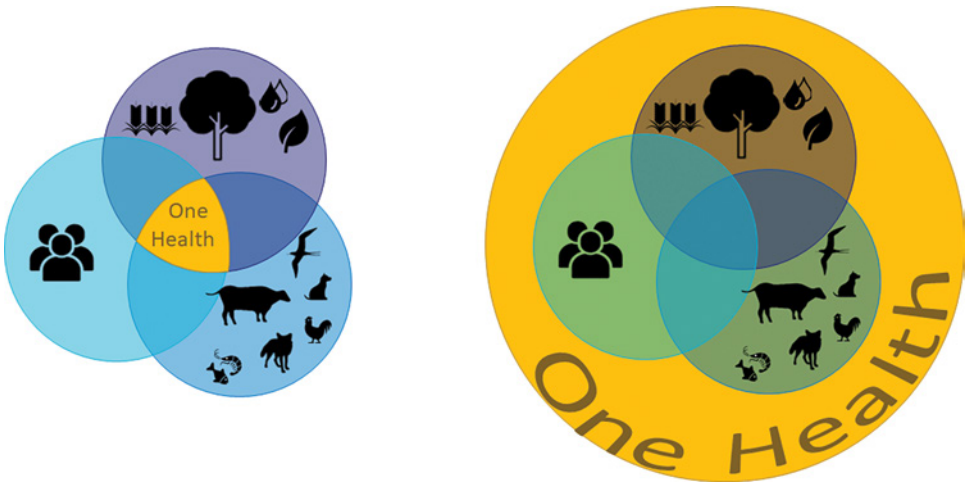

Figure 2. Main streams of thought in One Health: On the left interface and threat focused; on the right systems and balanced health focused. Source: Laing *et al*. (2023).

thinking is the inclusion of the perspectives of a broad selection of stakeholders in the process of defining the problem and setting the system's boundaries and structure (Duboz *et al*., 2018). This is key to ensuring the identification of potential interventions and solutions and increase their likelihood of agreement and implementation (Stroh, 2015). Systems thinking is particularly useful for CAS as seen in food systems and health systems where contexts are often changing, actors and sub-systems may adapt, and interventions yield unexpected results. It can serve as an umbrella term for a range of ways to comprehend and intervene in CAS and is recognised as a core competence in both One Health (Frankson *et al*., 2016; Rüegg *et al*., 2018; Rocheleau *et al*., 2022; Laing *et al*., 2023) and food systems literacy (Pope *et al*., 2021). It can support the convergence of Ecohealth and One Health (Harrison *et al*., 2019) through its focus on understanding complex, real-world challenges, seeing the whole and interrelationships, combinations of qualitative and quantitative aspects, participatory methods and realism mindsets (Duboz *et al*., 2018).

Where One Health Can Do More for Positive Food System Transformation

One Health solutions in food systems depend on an integrated approach spanning political, cultural, behavioural, ecological, economic, epidemiological and community considerations that support holism and multi-dimensionality. Food systems are inherently complex, link in the health of people, animals, plants and the environment and are influenced by anthropogenic factors, which in turn are shaped by economic, political and socio-cultural drivers (Rocheleau *et al*., 2022). Thus, One Health solutions must make connections between health systems, production, natural resources, biomass, trade, economies, social structures, migration and behaviour, among others (Ericksen, 2008; Béné *et al*., 2019; Parsons *et al*., 2019). Defining a control programme for, say, livestock diseases that decreases the mortality of livestock without looking at the negative impact increased livestock numbers can have for the environment is likely to generate partial conclusions only and risk generating unintended consequences in other parts of the system and/or in the long term. Similarly, designing a food system with the sole purpose of economic growth and supplying calories is bound to miss important connections for the health of humans, animals, plants and the environment – or the planet as a whole.

Multiple authors have defined food system outcomes, which can be categorised according to pre-dominant discourses such as resilience, transformation, sustainability or sustainable food and nutrition security (Stefanovic *et al*., 2020). Using the latter discourse in Figure 3, a range of desired food system outcomes are listed and the contribution of One Health to the achievement of these outcomes illustrated. One Health already makes valuable contributions to multiple food system outcomes, for example through working on infectious diseases at the human–animal–plant–environment interfaces, using integrative approaches to combat the antimicrobial resistance problem, or promoting equal rights to health across sectors.

Despite these important contributions, there is potential for further change across levels and time scales, relations between parts and wholes when finding ways to transcend disciplinary and epistemic boundaries. One Health practitioners could use their skills and systems thinking to look beyond traditional One Health topics at how to

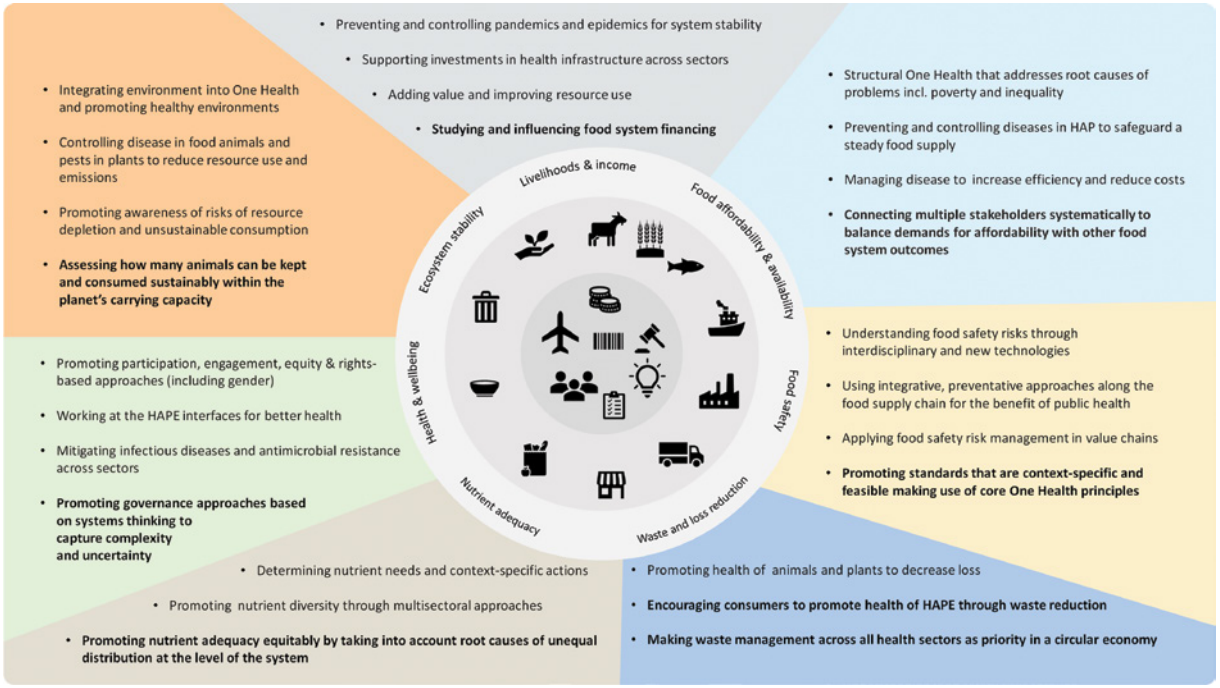

Figure 3. Enhancing the use of One Health in food systems. The circles in the centre illustrate the different components of food systems and desired food systems outcomes. For each outcome, important existing One Health contributions are listed. Indicated in bold are areas where there is room for expansion. Additional integrative activities spanning the whole system are described in the text. HAPE = Humans, animals, plants, environment.

- Contribute to nutrition-sensitive changes in food systems that promote structural changes for a reduction in over- and under-nutrition, better animal welfare and staying within planetary boundaries,
- Consider a broader range of agendas including how to promote healthy social-ecological systems that can sustain people, animals, plants and ecosystems and thereby enable food security in the long term,
- Identify and measure trade-offs between competing priorities in food systems,
- Understand value systems in our societies and how they shape food system outcomes including the health of people, animals, plants and the environment,
- Find ways that feed into circular economies and put sustainability at the centre of food systems,
- Lead difficult debates around food system problems and help to unite people around common ground for benefits of all,
- Recognise ethical dilemmas and differences in values, which can lead to moral hazard and handle these effectively,
- Promote decision making that considers simultaneously and equitably the multiple food system outcomes relevant to people, animals, plants and the environment with a focus on trade-offs and co-positive solutions,
- Promote integrative standards to balance the rights of humans, animals, plants and the environment,
- Generate and use knowledge in a transdisciplinary manner to increase understanding and provide evidence for effective practices,
- Establish evaluation frameworks that conceptualise One Health in food systems as an integrative health concept.

For example, disease control in animals can generate benefits for humans through a reduction in human disease risk and for the environment as production becomes more efficient (expressed for example as reduced emissions per kg of produce). Moving towards a more socio-ecological narrative, the scope may be expanded to consider wider questions such as the carrying capacity of a country in terms of livestock production under principles of sustainability and (animal) welfare.

In the next section, a transdisciplinary process of postgraduate skill acquisition, in particular system thinking, is described. These skills are envisaged to make an important contribution to positive food systems change in the future.

Transdisciplinary Process

The MSc course "One Health: ecosystems, humans and animals"[5] (in short MSc One Health) of the University of London's Royal Veterinary College (RVC) and London School of Hygiene and Tropical Medicine (LSHTM) offers a foundation of the principles of diseases in the context of socio-ecological systems, global health and food safety as well as knowledge and skills in relation to One Health methodologies and transdisciplinary interactions and in using a systems approach. The course focuses predominantly on considerations of (biological and chemical) disease agents as well as epidemiology including surveillance, disease emergence (mechanisms, drivers and impact) and disease control. It is complemented by One Health economics, systems thinking, situation analysis, medical anthropology and research skills (including statistical analysis, scientific method and project management). Students are taught by a broad range of staff with expertise in human health (LSHTM) and animal health (RVC) as well as guest lecturers who bring in different disciplines and policy perspectives (e.g. ecological economics, governance analysis, international organisation project management). Students are from diverse disciplinary backgrounds. Teaching methods encompass group discussions, small group work and problem-based learning to promote communication skills and multi-disciplinary teamwork. Students on the MSc One Health course are therefore exceptionally well placed to broaden their skillset further to be able to tackle health-related challenges in food systems in a holistic and sustainable manner. Complementing the learners' One Health skills with food systems literacy allows for the expansion of their skills and knowledge, thereby increasing employability and offering an opportunity for further advancement of One Health in food systems and a positive food system transformation. Acquiring food systems literacy is offered through the Interdisciplinary Food Systems Teaching and Learning (IFSTAL) programme.

IFSTAL is a cross-university[6], optional, interdisciplinary teaching and learning programme that provides community learning, resources and an enabling environment designed to promote food systems literacy (Reed *et al*., 2017; Ingram *et al*., 2020; Pope *et al*., 2021); in autumn 2022 it started the 8th year of delivery. The food systems literacy includes four key knowledge dimensions (factual, conceptual, procedural and metacognitive) that integrate foundational and food systems knowledge, as well as system thinking, metacognition and reflexivity (Pope *et al*., 2021). IFSTAL uses a blended and flipped classroom model where online units are followed by full-day interactive workshops, and complemented by webinars, public lectures, workplace interactions and engagement, a summer school, community of practice, alumni network and career support. The literacy is worked toward using a scaffolding method, which lays a foundation of shared factual and conceptual knowledge first and then moves on to procedural and metacognitive knowledge. For the latter two, activities are built-in such as journaling or group reflection that promotes metacognitive learning. Learners are encouraged to develop skills in listening and collaboration through a range of group-based learning activities in groups that mix degrees, backgrounds and disciplines. Engagement of food system workplace representatives in workshops, roundtables, group tasks and placements allows exploration of real-world problems and the skillset needed across the food system. In a process of community learning, everyone in IFSTAL can share their experience and knowledge and thereby contribute to a co-creation and co-design. The cross-university structure with representatives from different disciplines and institutions that come with their own cultures, behaviours and epistemic paradigms generates an environment where learners' own awareness can increase and reflexivity be stimulated through exposure to different of worldviews, positions and thinking. This effect is further enhanced through the active engagement of workplace representatives from diverse businesses and organisations across the food system.

Systems Thinking Skills

Systems thinking as a core One Health competency requires skills in capturing relevant components and how they interrelate and interact and understand multiple perspectives, influences, interconnections and boundaries that shape patterns and create shifts in constantly evolving systems (Laing *et al*., 2023). The One Health competent practitioner investigates reality as a system and links components, observed

[5] Course websites: https://www.rvc.ac.uk/study/postgraduate/one-health and https://www.lshtm.ac.uk/study/courses/masters-degrees/one-health

[6] Participating higher education institutions are Oxford University (lead institution), Royal Veterinary College, London School of Hygiene and Tropical Medicine, School of African and Oriental Studies, and University of Warwick. Previously, the University of Reading and City, University of London, were also part of the programme.

patterns, underlying structures, mechanisms and mental models. To do so effectively, multiple tools and methods are available and covered in the MSc and IFSTAL courses, including tools that allow the following:

i. Visualising the system, such as social network analysis or causal loop diagrams in the MSc course or rich pictures in IFSTAL,
ii. Systematically exploring the system, such as the problem structuring methods (including framing and boundary development) in the MSc or the iceberg model; Beneficiaries, Actors, Transformation, Worldview, Owner, Victim, Environment (BATWOVE); or Distinctions, Systems, Relationships, and Perspectives (DSRP) in IFSTAL,
iii. Collaboration, such as identifying participants in stakeholder analysis in the MSc combined group work in mixed groups, networking, formal and informal conversations with diverse stakeholders, and active listening and participation (both courses),
iv. Co-design and evaluation, such as scenario analysis, Theory of Change and other participatory approaches (both courses) and multi-stakeholder approaches (IFSTAL),
v. Meta-cognition through reflective activities and journaling that promote awareness of one's own self, worldview and thinking. Comparing and contrasting it in a safe environment with those of others in the amalgamation process of constructing knowledge. This also allows students to identify how to create an environment conducive to honest sharing and dealing with conflict.

IFSTAL uses a wide range of instruments to move toward more holistic thinking, deal with the complexity and uncertainty resulting from CAS and partial knowledge, appreciate the importance of understanding system boundaries and interconnections, understand how micro-level and macro-level aspects of a system can operate independently but also interact significantly, be aware of individual bias and agendas and the need for diverse perspectives to ensure balance and equity, be open to different ways of thinking and approaching problems, value many sources of knowledge including local and indigenous knowledge and to be willing to co-generate knowledge and maintain curiosity. A detailed description of these instruments including an assessment of their usefulness in relation to the food systems literacy elaborated in IFSTAL is given in Pope *et al*. (2021). Examples include discussions and exercises on how to approach complex and wicked problems, thinking about system boundaries, using diagrams to help identify leverage points, active listening to diverse perspectives, awareness exercises, field trips to interact with a wide diversity of food system stakeholders, activities to work through how different stakeholders might be affected by one or a few changes in a system, considering the resilience of specific real-world food systems (case studies) to shocks and how these could be mitigated against *via* collaboration with colleagues. The engagement and collaboration with colleagues from different disciplinary and institutional backgrounds and the multiple food system stakeholder interactions provide an important opportunity to facilitate learning that incorporates different perspectives and fosters knowledge sharing and collective learning.

Project Impact

IFSTAL has had over 2000 students sign up during its first seven years, with over 350 of these alumni working in the food sector in many areas of great influence. Over the first seven years of delivery, the programme conducted over 40 events, both IFSTAL participant only and public, and has established a great connection with the workplace with associates reaching beyond the 100s in the network. This connection to "real-world" problems and seeing first hand that companies want system thinkers with interdisciplinary skills, can stimulate their development pathway towards well-informed, knowledgeable and critical thinking employees capable of bringing transformative change.

The MSc One Health course stimulates holism and recognition of connections in systems. With additional system thinking and food systems literacy skills, students are gaining tools to make further progress towards dialogic and self-reflective analysis. We have observed a change in awareness of the positivist thinking of the medical school environment, and an increasing recognition of the opportunities in relation to food systems and One Health. We have found that a better understanding of One Health is correlated with a better understanding of food systems, thus emphasising that One Health thinking can be applied to food systems. A formal, quantitative evaluation of the impact of IFSTAL on skill development is on-going. Over the years, student survey feedback and stories (in focus group discussions) were regularly collected to assess students' perception of the programme and to make adjustments where needed. In the box below is a reflection by an MSc One Health and IFSTAL graduate on the skills acquisition and usefulness.

The perspective of a student learner (Eleanor Raj, MSc One Health and IFSTAL graduate)

The wide variety of modules on the MSc One Health course allowed me to take a step back and consider the way in which complex and "wicked problems" are approached, and in particular to think about the socio-ecological context. Essential One Health skills such as systems thinking and a holistic, inclusive and whole of society approach were encouraged through lectures, discussions and reading on topics such as infectious diseases, epidemiology, risk management, animal health economics, medical anthropology and globalisation and health. The systems thinking aspect was complemented especially well by the IFSTAL course, which focused on food systems and used case studies during workshops and e-learning modules to demonstrate the trade-offs and unintended consequences that specific changes could have for the wider food system, for example resilience to climatic shocks. The diverse institutions and disciplines involved with the IFSTAL course also provided a great opportunity to hear and learn from students studying social science courses and from non-clinical backgrounds, who often had different perspectives on complex challenges. This led me to volunteer to help try to develop a mentorship design for future IFSTAL students, so that the strengths of different disciplines and backgrounds can be better appreciated, and students can learn from and support each other in a more structured way if they wish. Finally, an important One Health skill that both courses encouraged was an awareness of one's own position within the broader health context, for example being a researcher from a European institution with the opportunities and privileges that brings or being a civil society organisation advocating for Indigenous Peoples rights and the potential challenges that brings. For me, this is one of the strengths of OHHLEP's One Health definition; the fact that inclusion and respect are so clearly embedded is crucial for just, sensitive and transparent dialogues between the broad range of stakeholders involved in One Health.

Project Outlook

The IFSTAL team will continue to deliver IFSTAL and thereby generate opportunities for students in the participating institutions to acquire food systems literacy and become change makers for food systems. In the learning environment of the authors' institution (the Royal Veterinary College), we will make an active effort to engage MSc One Health students given their potential as future One Health champions in food systems when food systems literacy and One Health skills come together. Further, IFSTAL members will support the running of communities of practice that will help to strengthen the voice of One Health professionals and practitioners in food systems. We encourage One Health practitioners to explore further opportunities for One Health in food systems and to engage in food systems literacy (including systems thinking) to be able to make meaningful contributions in these complex adaptive systems.

Conclusion

The complex food system problems we are facing cannot be solved with a business-as-usual approach and need transformational knowledge. One Health practitioners and graduates have critical skillsets to contribute and they benefit from a tradition of collaboration, cooperation and participation. Thus, they are particularly suited to add further skills in the form of food systems literacy and apply their skills to food system challenges where they can contribute to a process of iterative and collective knowledge and solution generation with the aim of promoting food system sustainability and balance. Importantly, the traditionally large proportion of animal health practitioners in One Health can help to make sure that animals are represented and their rights and welfare protected, as they may otherwise may be overlooked in discourses dominated by anthropocentric and planetary health concerns.

Acknowledgments

We thank the IFSTAL, MSc One Health and Network for Ecohealth and One Health (NEOH) colleagues for the enriching, collaborative journey and the many discussions and interactions we are having that allow us to learn from each other and contribute to the advancement of One Health (in food systems).

Group Discussion Questions

1. Consider antimicrobial resistance (AMR) in relation to the two One Health streams show in Figure 1: In stream 1, we often talk about how we can understand the AMR epidemiology or ecology, how we

can reduce use, what that means for resistance – commonly taking into account humans, animals and increasingly the environment. In stream 2, we could ask questions about animal populations; for example, what if we changed diets and reduced livestock populations? Think about the differences in conceptualisation as well as the practical implications. What would it mean for the health of the animals and antimicrobial use? Over what time frame?
2. Who would be key food system stakeholders to engage in a co-design process that embraces One Health?
3. One of the issues when using systems thinking is the change in temporal considerations with commonly longer-term, more distant effects. How can this be handled when dealing with shorter-term political cycles?
4. How could the voices of One Health practitioners in food systems be upscaled/enhanced to make a positive impact?

Further Reading

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