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A future workforce of food-system analysts

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Food systems have evolved dramatically over recent decades to feed billions of people. However, the ‘triple burden’ of malnutrition (hunger,

insufficient nutrients, and overweight and obesity) is increasing and is recognised as the ‘new normal’[1, 2, 3]. The food sector is responsible for about 30% of all anthropogenic greenhouse gas emissions[4], decreased biodiversity[5], water pollution and soil degradation[6]. Current technologies are degrading the natural resource base that underpins our food security at an alarming rate[7], and environmental change will hit the most marginalised soonest and hardest. At the same time, we are wasting about a third of all food produced[8]. Food systems are, however, a major source of livelihoods and a driver for innumerable businesses and enterprises[9]. In the United Kingdom, for instance, food is the biggest manufacturing sector, contributing £28.2 billion to the economy annually and employing 400,000 people[10]. Worldwide, however, employment in food production, manufacturing and service is some of the lowest paid. Inequality underpins many aspects of the food system, and is often an outcome driven by the system itself[11].

These problems are all interconnected, and hence tend to have no clear solution or line of responsibility. Solutions and improvements in the functioning of food systems are often expected to derive from technological — and especially agricultural — innovations. Yet, we cannot look to these alone to address all the challenges. New approaches based on ‘food-systems thinking’ are required, drawing on innovative types of learning, analysis and institutional arrangements, coupled with greater collaboration between economists, agriculturalists, policy makers, ecologists, engineers, food and crop scientists, and business, among many others[12].

The systems-thinking approach

Food systems are socio-ecological, complex and adaptive[13], encompassing interactions by multiple actors and institutions with numerous positive and negative feedback loops that are difficult to capture. Food systems are often characterised by lack of knowledge and

data, and have high levels of complexity that are not sufficiently accommodated for in current financial, economic, political, legal and social structures and processes. ‘Systems-thinking’ provides a framework and range of methodologies for steering policy and practice away from conventional foci on linear and distinct food system elements, and toward modes of working that account for complex and dynamic linkages and emergent properties. It is founded on building collaborative relations, drawing on a variety of skills and experience, and applying multi-criteria analysis rather than more conventional single-cause analyses. As such, we believe a systems-thinking approach holds the potential for guiding the development of more effective interventions for food security, health, environment and enterprise over the medium- to long-term; there is an urgent need for people and institutions skilled in its use and application. We, therefore, recognise the need to connect food-systems perspectives, people and systems-thinking to create a new generation of food-systems thinkers. This will not only lead to new approaches for analysis, but also different ways of working. The Interdisciplinary Food Systems Teaching and Learning (IFSTAL) programme was developed to build this capability within the food sector[14].

Training food-systems analysts

IFSTAL was launched in October 2015, led by the University of Oxford and in partnership with City University, University of Reading, University of Warwick and the Leverhulme Centre for Integrative Research on Agriculture and Health (comprising the London School of Hygiene and Tropical Medicine, Royal Veterinary College and School of Oriental and African Studies). IFSTAL received core funding from the Higher Education Funding Council for England, and in-kind support from the partner institutions. This allowed IFSTAL educational coordinators at the partner institutions to be recruited to work across departments as diverse as economics, health sciences, business and law schools, and agricultural sciences, to help students engage in the programme. It also covered the costs of delivering all IFSTAL activities.

Based on the conceptual model developed by the Global Environmental Change and Food Systems project[15], IFSTAL offers any postgraduate student, enrolled in the partner institutions, a training programme on food systems and contextualisation of their chosen discipline within the broader concept. IFSTAL thereby enables students to perceive the connections between disciplines and provides them with the knowledge, skills and capability to address food-systems challenges after completing their studies.

IFSTAL is voluntary and not assessed. Its delivery is based on a flipped-classroom approach[16] with interactive face-to-face learning supported by an online virtual learning environment. There are four core units delivered over the academic year: food-systems concepts, systems thinking, food-systems methods and intervention for food-systems change. After studying each unit's material online, students from across the partnership meet for an away-day workshop to discuss the content and engage with peers, faculty and representatives from public, private and third-sector workplaces. The training also includes a series of workplace interactions, webinars and public-facing events, including live-streamed lectures and symposia. The year culminates in a highly-interactive summer school where interdisciplinary groups of students from across the partnership work on real-world problems. An alumni network supports the active creation of a dynamic knowledge-exchange and learning network where members can continue to interact with each other. IFSTAL is building a self-sustaining network of 'food-system analysts'.

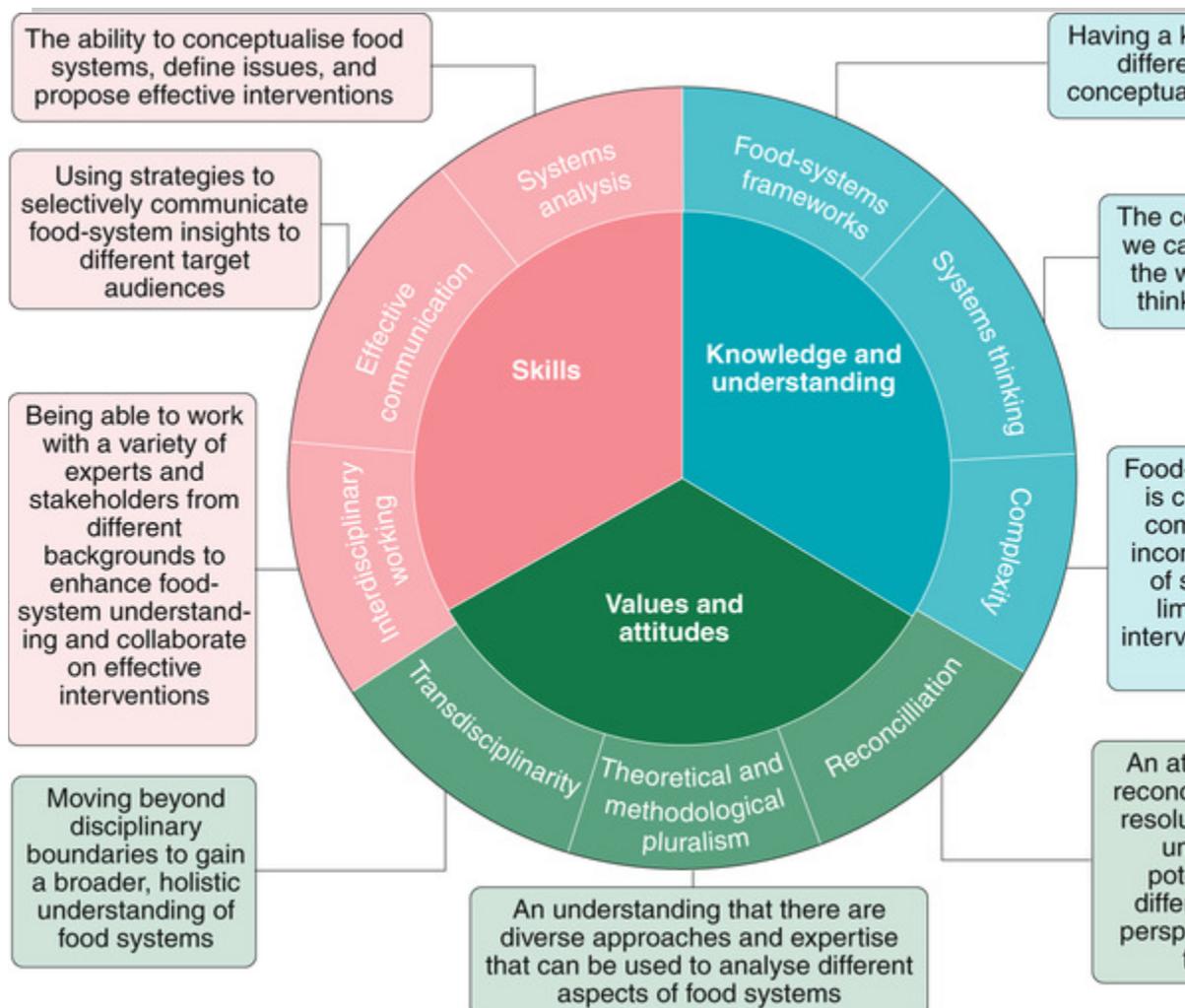
Interdisciplinarity is the capacity to integrate knowledge of two or more disciplines, and is known to facilitate cognitive advancement in ways that would have been impossible or unlikely through single disciplinary means[17]. IFSTAL's multi-institutional, interdisciplinary and problem-based learning approach has brought valuable interdisciplinary learning to students. It thus addresses the urgent challenge in educational settings of how to provide students with the tools to analyse multiple issues, find and develop innovative interventions, and work across disciplinary boundaries[18]. Moreover, addressing systemic problems across the food sector not only needs people skilled in systems thinking, but also equipped with soft skills to allow them to be capable within an

often-challenging and increasingly demanding working environment [19]. Soft skills (such as effective communication, recognising different personality types and team working) therefore form a core component of IFSTAL's away-days and summer schools, and are included in IFSTAL's learning objectives (Fig. 1).

Fig. 1 The green 'wedge' needs to be re-drawn (moved) to better align with the 3 sections of the solid wheel it relates to.

Learning objectives.

The aspirations of the IFSTAL programme map onto desired outcomes such as knowledge and understanding, skills, and values and attitudes (solid wheel). Figure adapted from ref. [20], Vitae



Since launching, IFSTAL has enabled over 1,500 students, from 45 different university departments, to gain a better understanding of food-

systems and how to address some of the complexities therein. The interdisciplinary focus is strongly encouraged; students in a recent cohort came from over 100 different masters and PhD programmes. IFSTAL has also facilitated cross-sector ways of working and has collaborated with over 100 public, private, non-governmental and civil society organisations in the food sector to shape and drive IFSTAL's content and approaches, and many workplace professionals have interacted with students throughout the year. We know that at least 350 students who engaged in IFSTAL during its first three years have moved into food-systems-related employment within a wide range of organisations. They are forming a powerful alumni network encouraged to support each other in their careers, bringing about change in the food system. A recent development is a reach into Europe via the European Institute of Innovation and Technology, with the universities of Hohenheim and Turin. Further afield, two, intensive 1-week courses have been delivered in Ghana and another in Indonesia, and others are planned for East Africa and the Pacific. While activities in the United Kingdom are restricted to students, these 1-week courses include both students and early-career professionals, and feedback from this combination has been very positive. There is also interest in establishing IFSTAL analogues in Australia and Canada.

For several years there has been a clear recognition that food systems need to be understood and managed from different and multiple perspectives, and there is a growing need for people skilled in food-systems thinking across the sector. IFSTAL has been, to our knowledge, a pioneering experiment in what is widely agreed to be needed. IFSTAL's interactive, interdisciplinary programme is providing an environment that facilitates the necessary learning and cross-sector working, all delivered on top of existing regulated and approved masters-level and above, teaching and learning. Learning through practical, interactive and problem-based methods results in an ability to plan and implement better options for addressing food system problems and seizing opportunities.

We believe that IFSTAL is changing how we think, work and act in the food system.

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