FCRN Food Climate Research Network

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FCRN foodsource

A free and evolving resource to empower informed discussion on sustainable food systems

Building Block

What are food systems?

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Food Climate Research Network

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Contents

Why should you read this building block?

Many social, economic, moral, and environmental concerns are interconnected and interact with each other through food, and do so in complex ways. In order to understand this, we need to apply a 'systems thinking' approach to food.

This building block explains what is meant by the term 'food system' and provides a brief introduction to the food systems approach.

Definitions

A system. A set of independent parts that interact with each other as part of a mechanism or an interacting network of things. Taken together, these make up an identifiable whole that exists within certain spatial boundaries, and which can recognisably come into existence, change, and be dismantled. Examples include machines or the human body.

A complex system. A type of system whose parts are highly interdependent, and so are continuously changing and influencing one other, creating an infinite circularity of cause and effect. Overall, this leads to a distinct whole that is more than the sum of its parts, characterised by particular types of outcomes and behaviour, and whose functioning often hard to model or predict. Examples include cities, ecosystems, and the climate.

The food system. A general term, referring to the global web of interconnections and the continuous process of interactions – spanning time and geographic space – between food, natural resources, people, organisations, government, organisms, the climate, and more. In other words, everything food influences and is influenced by. The food system is an example of a complex system.

A food system (or food systems). A specific term which denotes a particular set of interconnections and interactions between things, within the wider food system, that has been defined and focussed upon for some particular purpose. Examples might be urban or organic food systems. They can be thought of as parts or sub-systems of 'the food system'.

A food systems approach. The application of a 'systems thinking' approach to the subject of food. This includes different ways of breaking down and representing 'the food system' and specific food systems. And also includes a variety of thinking tools and research methods, through which all systems can be investigated and understood.

1. Introduction

Many social, economic, moral, and environmental concerns are interconnected and interact with each other through food, and the roles it plays in human lives and humanity's collective activity.

Fully understanding the causes and solutions to these concerns is not possible when thinking about them in isolation from one another, and from the whole of which they are a part. The conceptual tools that enable us to overcome this siloed thinking are collectively known as 'systems thinking'.[1-3]

The goal of this approach, and also its main benefit, lies in trying to understand causation:

- How do things fit together?
- What influences what?

- And how do complex (and often unexpected) things happen as they do?

This provides a way to understand how things can change, and what the outcomes of a particular change might be.

2. The food system is complex

The global food system includes all thing that affect and are affected by food. Mapping out these interconnections reveals the enormous breadth and complexity of what is included in this concept in its broadest sense (Figure 1).

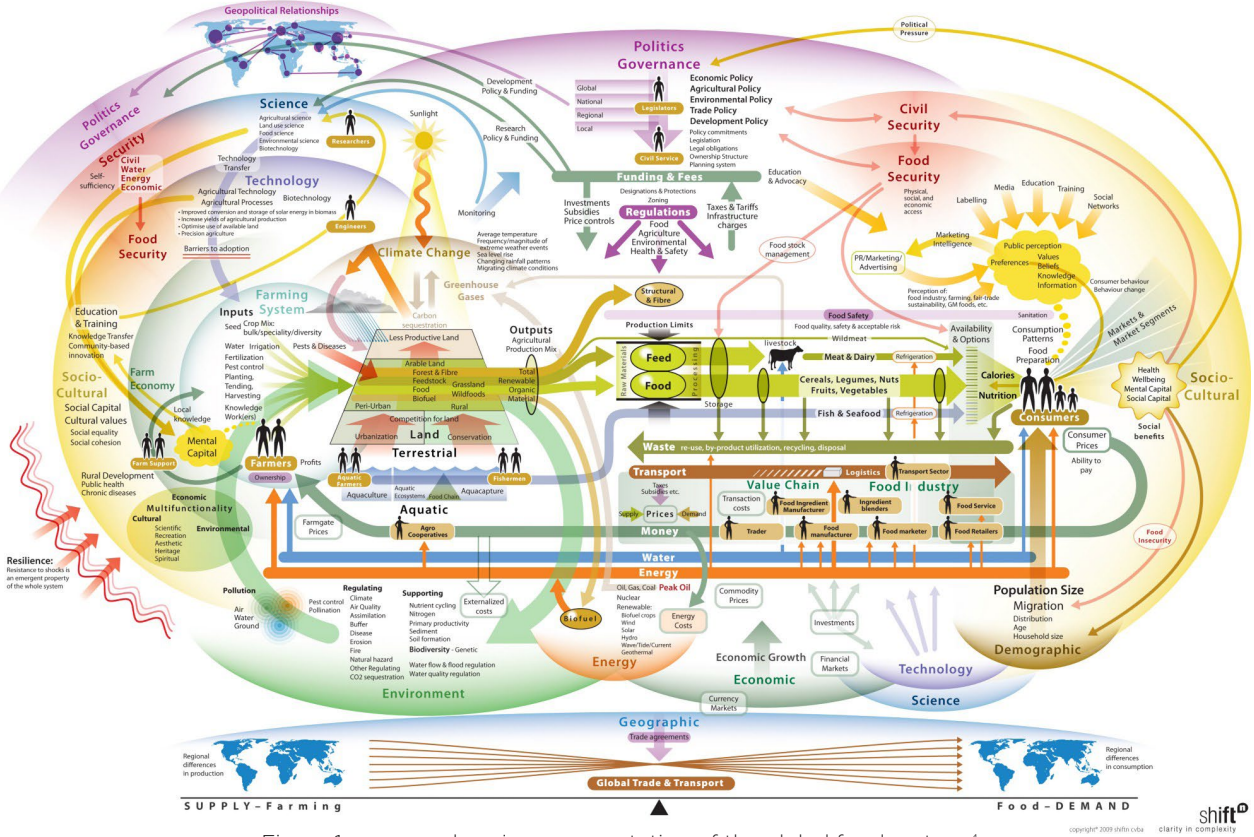

Figure 1: a comprehensive representation of the global food system.[4]

To help think about this complexity, various simplifications are used when representing food systems. Nevertheless, a food systems approach is one that pays attention to how whatever is being focussed upon, affects, and is affected by, the whole of which it is a part.

3. The food system: actors and activities

All food undergoes a journey from its point of production, through to its ultimate consumption or disposal (often called a product 'life cycle').

Reflecting this, a common and useful way of representing food systems is as a linear set of stages along this journey where particular types of 'activities' take place, undertaken by particular types of people or organisations (known as 'actors') (Figure 2).

At each stage, particular actors (e.g. farmers) perform processes (e.g. harvesting); inputs are used (e.g. energy or water); outputs are produced, some desirable (e.g. food) and others undesirable (e.g. pollution); and as a consequence, various issues are affected, such as climate change, or ***food security***, or ***livelihoods***.

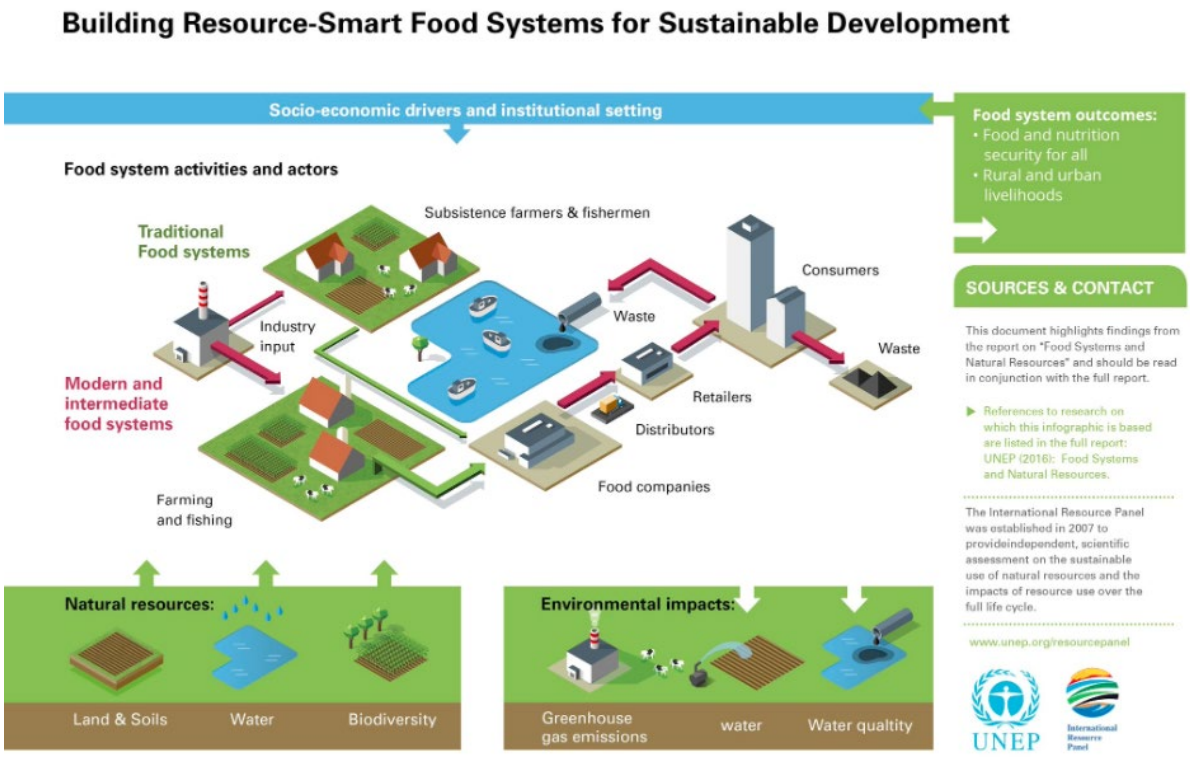

Figure 2: a representation of the food system showing the relation between activities at different stages, actors involved, inputs and outputs, and outcomes.[5]

4. Characteristics of food systems

Feedback loops

An important drawback of Figure 2, is that it represents the food system as being linear. One thing leads to the next, and so on, in an unbroken chain of cause and effect, eventually leading to an outcome.

However, core to a systems thinking approach is a recognition that causation can often be circular in nature (Figure 3). For example:

1. food system activities lead to the release of greenhouse gas emissions; which
2. drives climate change; that then in turn
3. affects greenhouse gas emissions from the food system;
4. and so back to step 1.

These circular interactions between different parts of systems are known as feedback loops, of which there can be many in any system. Feedback loops can act to reinforce a change in the system (e.g. climate change), or alternatively may resist it, maintaining stability.

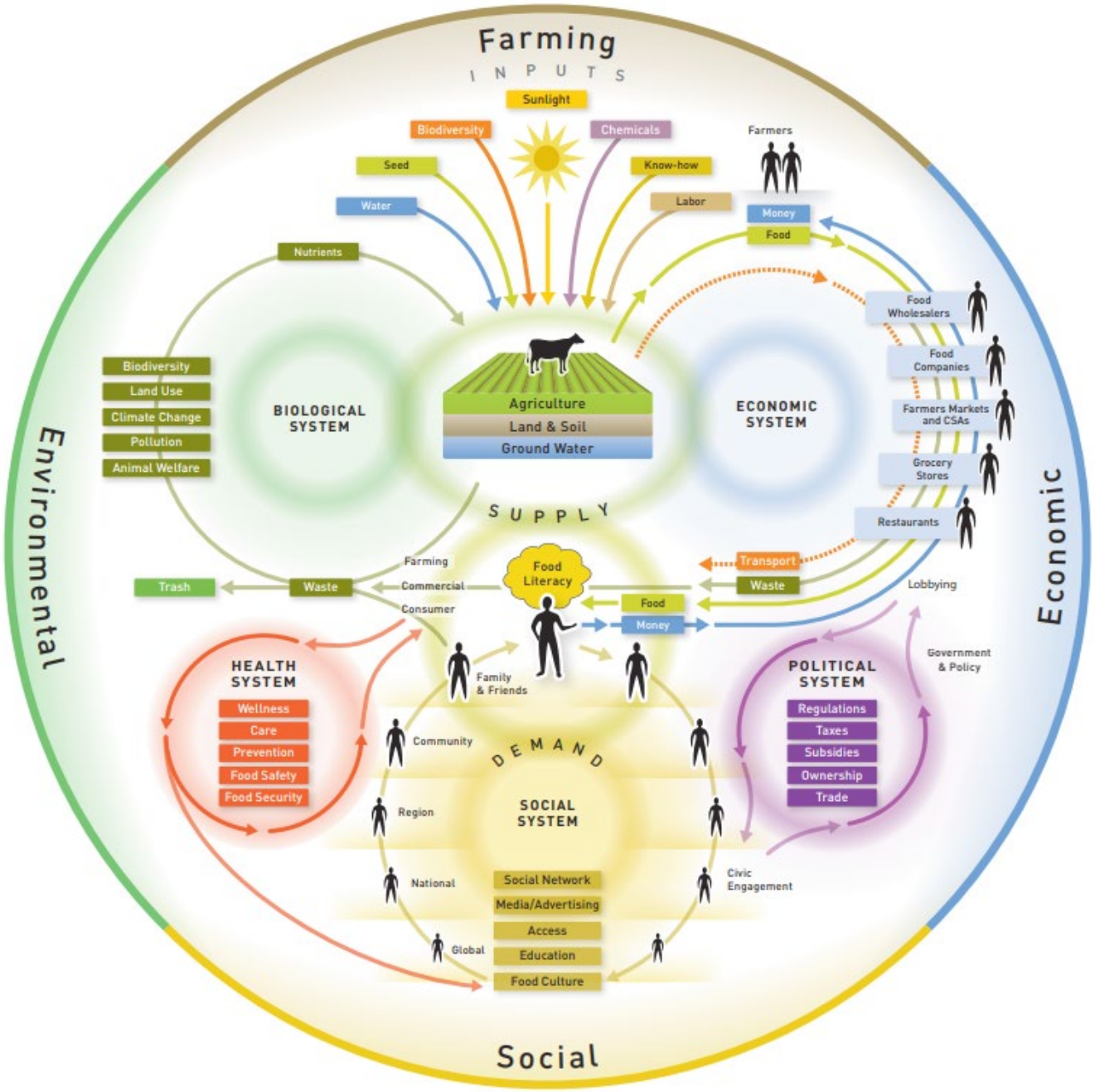

Figure 3: a representation of the food system showing its composition of intereacting sub-systems that create feedback loops.[1]

When systems and their feedback loops are poorly understood, this can sometimes lead to unanticipated extreme changes, that can be difficult or even impossible to reverse. Examples in food systems include fish stock collapses and ***desertification*** of farmland.[6]

Feedback can be the result of the interaction of physical processes (as in the climate example), or may result from the flow of information (e.g. changes in prices, regulation, or social norms) which can affect that way that individuals or organisations in food systems make decisions and behave.

Trade-offs and synergies

Many different issues of concern are interconnected via food systems, and so changes to food systems will inevitably affect multiple issues at once (and so any objectives that are related to these).

One potential outcome is a trade-off between objectives. For example, ***agricultural intensification*** may bring benefits for one issue (e.g. ***land use***), and at the same time, it may make others worse (e.g. environmental pollution).

Another potential outcome is a synergy between objectives. For example, a decrease in food loss and waste, can bring with it multiple benefits, such as reduced resource use, and an increase the amount of food available for consumption.

Both trade-offs and synergies are characteristics of systems in general. Identifying and understanding these is an important part of applying a food systems approach.

Drivers of change

Drivers of change are trends in specific bits of a system, or parts of the external environment which affect a system, that over-time, are able to affect the functioning and the outcomes related to the whole system.

Taking the human body as an example, exposure to an increasingly cold environment can eventually drive changes in the body, which it cannot internally resist, leading to hypothermia. Alternatively, a change in a cell to form a cancer, may lead to failure of an organ, and ultimately the entire bodily system.

Drivers of change needn't lead to failure of the whole system, as above, but because they are capable of causing substantial changes to systems over-time, identifying and understanding the effects of these drivers of change is another important part of applying a food systems approach.

Examples in the context of food systems include climate change; resource scarcity; population growth and demographic change; technological innovation; social attitudes towards consumption; and more as shown in Figure 4.

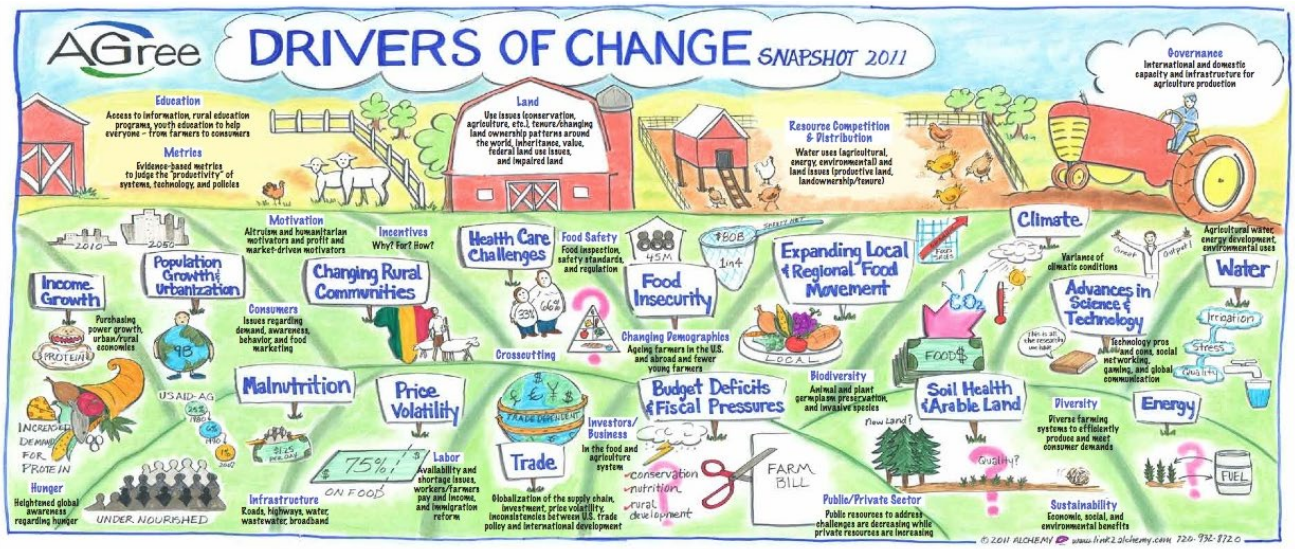

Figure 4: a range of factors which can drive change in food systems.[7]

Scale effects

A consideration of the effects of scale is another important feature of food systems thinking.

Systems such as the planetary system contain within them many sub-systems, such as ecosystems, which also contain subsystems such as animals, which are composed of cells, and so on. Interactions across these different scales, can lead to:

- Local changes having globalised effects and vice versa; and changes in one geographic location causing changes in distant locations.
- Changes taking place at one place or point in time, leading to impacts on the wider system across a range of timescales, and potentially being delayed by decades or more

5. Food systems in practice

What is common to all applications of a food systems approach is the explanatory perspective that systems thinking brings, and an appreciation of how the different parts of a system, interrelate to each other, and to the bigger picture.

But because the nature of food systems is that they are highly complex (Figure 1), a process of simplification is always necessary. This innevitably involves choice and selection, that makes each application of a food systems approach different in terms of:

- What needs to be explained / understood
- What parts, inteconnections, and interactions are considered important
- How the system is conceptualised and represented; and
- What disciplines, theories, and methods it brings to the task.

Because of this, building a big picture understanding of food systems, necessarily involves integration of understanding gained from looking at many different parts of the system, produced from a particular perspective and for a particular purpose. To do this requires dialogue and collaboration across disciplines and sectors.

Recommended resources

To learn more about food systems, we recommend the following resources:

- Online course: Food and Our Future: Sustainable Food Systems in Southeast Asia
- Online course: Sustainable Food Security: The value of systems thinking
- Video: A food systems approach
- Video: Understanding complex systems in a food context
- Book (open access): Food Security and Global Environmental Change
- Review artice (paywall): Conceptualizing Food Systems for Global Environmental Change Research

Glossary

Agricultural intensification
Agricultural intensification is the process of increasing the inputs of agricultural resources (e.g. seeds, labour, fertilisers, pesticides, technologies, knowledge) to increase the level of yield per unit of farmland or pasture. Agricultural intensification is not always clearly or consistently defined and is often confused with the term intensive agriculture. Unlike intensive agriculture, which could be seen as a specific system of agronomy, agricultural intensification is a general process that can apply, in principle, to any type of agricultural production. Examples of agricultural intensification may range from using new pesticides in intensive agriculture to intensifying the use of indigenous and context-specific knowledge in local farming practices. Although agricultural intensification can take many forms, it always involves the intensification of some types of agricultural input with a view to increase levels of yields.

Desertification
Desertification refers to a process by which fertile land becomes desert; this can be due to deforestation, drought or inappropriate agriculture methods.

Food security
Food security is an idealised state or goal where all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Land use
Land use is the purpose for which an area of land is used by humans: e.g. cropland, urban settlements, managed forests. Wild land, by contrast, is that not used by humans.

Livelihoods
A livelihood is a person's, household's, or group of people's means of making a living. It encompasses people's capabilities, assets, income, and activities that are required for securing the necessities of life, such as food, water, medicine, shelter and clothing.

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