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# Taking Complexity in Food Systems Seriously: An Interdisciplinary Analysis

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**Summary.** — Motivated by donor interest in innovative thinking on food security, we conducted an interdisciplinary, triangulation analysis of four divergent conceptual frameworks, each relevant to diagnosing food insecurity in developing countries. We found notable tensions as well as synergistic interactions between agroecology, agricultural innovation systems, social–ecological systems, and political ecology. Cross-framework interactions enhance our understanding of how sectoral and macro-economic development strategies impact on livelihoods, availability, and access. Re-invigorated, more profound dialog between divergent conceptual frameworks enables diagnosis of complex food insecurity problems, and context-specific interventions and innovations. Informed use of divergent approaches constitutes a new ambition for research and practice.


*Key words* — food security, innovation, interdisciplinary analysis, dialog, sustainable intensification, Africa

## 1. INTRODUCTION

Both "food security" and "innovation" are invoked frequently in policy discourse around agricultural development, with innovation seen as vital to achieving better food security outcomes (De Schutter, 2010; Scoones, Thompson, & Chambers, 2008). Donor and practitioner enthusiasm for agriculture "innovation" notwithstanding (Frost, 2013; Hounkonnou *et al.*, 2012; World Bank, 2012), the intricate and contested nature of food systems means that efforts to innovate cannot escape complexity.

For example, a given food system offers multiple potentially competing and complementary points for intervention. To reduce food insecurity, policy makers could potentially invest in women's agriculture (Quisumbing & Pandolfelli, 2010); subsidize inorganic fertilizer (Twomlow *et al.*, 2011); reform agricultural input markets (Makonese & Sukalac, 2011); improve water productivity in rainfed agriculture (Rockström *et al.*, 2010); improve resource efficiency, participation, and accountability in water and energy systems (Hoff, 2011; Molle, Foran, & Käkönen, 2009); strengthen common property regimes that provide high quality wild foods (Friend, Arthur, & Keskinen, 2009); help smallholders gain a better position in global food supply chains dominated by agro-food corporations; reduce food losses (FAO, 2012b); liberalize trade (Anderson, 2010); and invest in nutrition and health (Bhutta *et al.*, 2008; Micronutrient Initiative., 2013). Going beyond a specific food system, policy could encourage deficit-producing farmers to exit agriculture (World Bank, 2007); invest in rural nonfarm economies (Akram-Lodhi, 2013); invest in transport; support labor to organize for better

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employment conditions (FAO, 2012a) and providing social security nets (FAO, 2012b).

We invoke these examples to underscore how complex food, agriculture, and development agendas have become (Hall, 2007; Lang, Barling, & Caraher, 2009; McIntyre, 2009). As a contribution to thinking more critically about the prospects for innovation, we re-visit the fundamental question of what changes need to occur to reduce food insecurity, and address that question in the form of a conceptual triangulation.

Food security is a contested, evolving, multi-dimensional construct, including both well-established dimensions such as availability, physical access, economic access (affordability), consumption, and utilization. It also includes dimensions such as agro-ecosystem sustainability and resilience that have received more recent acceptance on policy agendas (FAO, 2012b). When authors offer divergent theoretical framings on what constitutes a "food system," they underscore contestation and complexity (cf. Akram-Lodhi, 2013; Godfray *et al.*, 2010; Ingram, Ericksen, & Liverman, 2010).

The dominant framing of food insecurity focuses on the "double challenge" of (1) increasing access to adequate food for more than a billion people who suffer from hunger and malnutrition and (2) increasing availability by 70–100%, mainly through increases in yield and cropping intensity, to feed an estimated population of nine billion by 2050 (FAO, 2009a, p. 3). However, complexity over the future of rural livelihoods in the context of multi-level, and increasingly globalized food systems has different implications for what food gets produced, by whom, and what poor people must do to access it (Akram-Lodhi, 2013; Patel, 2007; Weis, 2007). The fact that food systems can be approached through diverse and often divergent conceptual perspectives suggests it would be useful to undertake a pluralist, interdisciplinary inquiry on the meanings of, and possibilities for improved food security.

## 2. METHODS

To implement a pluralist interdisciplinary analysis of food security, we found triangulation methods helpful. Triangulation refers to the use of more than one observation, data set, technique or—in our case—conceptual framework, to provide fresh insight into an issue (Denzin, 1970; Moris & Copestake, 1993). Triangulation is used in participatory rural appraisal, sociology, policy analysis, and development studies (Olsen, 2006; Roe, 1998). For example, Roe (1998) used four divergent theories to answer questions such as: what is sustainable development; why is it a problem; ideally what should be done, and practically, what can be done? [1] Conceptual triangulation does not replace insights offered by a given theory. Rather than converge on a unified set of truths, conceptual triangulation aims to converge on new problem definitions, or points of departure from conventional definitions (Roe, 1998). Olsen (2006, p. 1134) describes this kind of methodology as meta-theoretical: it attempts to "view several theories' character, and their strengths and weaknesses, from a vantage point that takes into account both empirical evidence and the nature of the different available theories."

Following Roe (1998), we selected a divergent set of conceptual frameworks, each of which takes complexity in food systems seriously (Table 1). Each de-familiarizes food security in fresh ways (i.e., is not subsumed by the dominant framing), and differs fundamentally with respect to problem framing. However, departing from Roe (1998), our aim is not to derive more general precepts about food security. Rather, we triangulated in order to identify important tensions and synergies between literatures, with a desire to motivate development interventions characterized by what we refer to as "informed synergies:" interdisciplinary interactions that have the potential to enhance our ability to understand and intervene in food security dynamics.

Literature was sourced in an iterative manner. During the first round, some twenty members of a multi-disciplinary community of practice, the Food System Innovation for Food Security (FSIFS) project [2] were asked to nominate published literature they considered noteworthy and relevant. During a second round, the authors conducted online literature review using a variety of academic search engines. Four theoretical frameworks were selected by the authors as representative—not exhaustive—of the conceptual and applied interests of the FSIFS community of practice. We explored synergies between the four frameworks using a comparative matrix (Table 2) which guided additional rounds of literature search.

To keep the triangulation tractable, we chose not to review literatures on nutrition, health, and human rights law, which curtailed our understanding of consumption and utilization. We justify these choices on the grounds that the triangulation was an exploratory attempt to generate a cross-disciplinary conversation, focusing on the complex connections between availability and access in food systems.

The four frameworks (agroecology, agricultural innovation systems, social-ecological systems, and political ecology) are nonetheless broad and sufficiently divergent for a triangulation. The core focus of *agroecology* has been on improving the long-term sustainability of farm level practices through a critical understanding of biological interactions (Pretty, 2005), but the framework has also motivated thinking about agroecosystems at higher levels, and around "sustainable intensification" (Pretty, Toulmin, & Williams, 2011; Tomich *et al.*, 2011). *Agricultural innovation systems* (AIS) frameworks stem from literature on enhancing agriculture research and extension systems, with roots in earlier farming systems research [3] and participatory development literatures [4] (Hall, 2007; Mbabu & Hall, 2012). Actor- and market-oriented versions of this framework have influenced recent rural development programing (Pant & Hambly-Odame, 2009; World Bank, 2012), popularizing the use of multi-stakeholder "innovation platforms." The *social–ecological systems* (SES) framework has roots in literature on ecosystem management and ecology, including theories of resilience and vulnerability. This framework has influenced thinking about adapting to global environmental change in natural resource management and

Table 1. *Frameworks used in this triangulation*

| Framework | Characteristic focus/foci |
|---|---|
| Agroecology | Sustainable agricultural practices |
| Agricultural innovation systems (AIS) | Multi-stakeholder processes for problem solving and capacity development |
| Social-ecological systems (SES) | Cross-level, cross-domain impacts of particular actions |
| Political ecology | Historical determinants of vulnerability, insecurity, or poverty in specific places<br>Winners and losers from particular actions |