



# Paradox of mainstreaming agroecology for regional and rural food security in developing countries



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## ABSTRACT

Paradox of mainstreaming agroecology refers to an apparent contradiction between upscaling niche innovations to produce more food in sustainable ways, and the concerns for a loss of core values and principles of agroecology in the mainstreaming process. This paper examines this paradox of mainstreaming and sidestreaming (continuity of niche practises) using longitudinal case studies of agroecological innovations in soil and water conservation, crop improvement, crop intensification, and market differentiation in the regional and rural contexts of developing countries. Findings suggest that there are latent and salient paradoxes of mainstreaming niche innovations, respectively explaining cooperative and competitive interactions with the incumbent regime of industrial food and agriculture. While the former paradox involves continuity of niche practises as well as regime conditions through incremental adaptations, the latter comprises regime shifts through transformational adaptations. However, as these two paradoxes are in flux a latent paradox can become salient when competitive elements of seemingly cooperative niche-regime interactions unravel.

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## 1. Introduction

Effective approaches to feeding the future are debatable. Some argue for expanding the frontier of the industrial food and agriculture in marginal lands using modern technological solutions, such as large-scale irrigation systems, high yielding crop varieties and modern agrochemicals. Others critique that the continuity of this incumbent regime that was particularly influential during the Green Revolution (1960s and 70s) indeed, does not necessarily work for all types of people, problems, spaces and places in the twenty-first century (Conway, 2012). They posit that despite being highly effective in promoting modern technologies, the incumbent regime marginalises the rural poor in two major ways (Gliessman, 1998; Conway, 2012; Lacey, 2005): first, modern technologies are less accessible and adaptable to marginal areas cultivated by the poor; and second, industrial food production externalises long-term environmental costs, such as biodiversity loss, soil degradation, nitrate leaching, greenhouse gas emission, chemical toxicity and disruption of geochemical cycles, to those whose livelihoods depend on the customary use of renewable natural resources. In response to social, health and environmental impacts of the incumbent technological regime, alternative thinkers and doers advocate for agroecological niche innovations, such as organic agriculture, fair trade, minimum tillage, permaculture, agroforestry, home gardens, community gardens and community forestry. However, there is an apparent contradiction between the need to up-scale agroecological innovations to produce more food in sustainable

ways, and the growing concerns for a loss of core values and principles of agroecological niches in the mainstreaming process. Moreover, mainstreaming is paradoxical in procedural as well as substantive terms, respectively in managing institutional processes of change and continuity, and enhancing regional and rural food security. Thus, as discussed in the organisational studies literature, mainstreaming agroecological niche innovations may seem logical in isolation but they can be paradoxical when assessing social, economic and environmental impacts from systems perspectives (Lewis, 2000; Smith and Lewis, 2011).

Reconising the apparent paradox of mainstreaming niche innovations, some scholars argue that niche formation and regime transformations should involve reflexive interactive design and development of technological prototypes, reflexive interactive assessment of risks and benefits of technologies, and promotion of evidence-based policy and practises (Bos and Grin, 2012; Joss and Bellucci, 2002). Many argue that mainstreaming is essentially paradoxical in terms of procedural (e.g., institutional processes of organising, belonging, learning), and substantive aspects (e.g., increasing productivity, social equity and environmental justice) (Lüscher and Lewis, 2008; Smith and Lewis, 2011). First, procedural paradoxes of organising and belonging arise from institutional processes of identity formation and collaboration beyond niche spaces. Similarly, the paradox of learning involves social learning and innovation for fundamental transformations in technologies, economies, livelihoods and lifestyles (so-called sustainability transitions) (Elzen and Wiczorek, 2005). Second, the substantive paradox of performing involves competing strategies, visions and goals, such as controversy over the most effective food security strategy

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(e.g., industrial monoculture or ecological agriculture). Thus, this paper aims to examine substantive and procedural paradoxes of mainstreaming and their importance in setting a conceptual framework for discussion on agri-food innovations and sustainability transitions. As suggested by Hall and Clark (2010) in their examination of complex adaptive systems of food and agricultural innovations, the analysis in this paper situates the mainstreaming paradox of agricultural change and continuity within the broader framework of agricultural innovation systems in articulation of the following research questions: How do mainstreaming paradox relate to agricultural adaptations in the regional and rural contexts of developing countries? What are the institutional determinants of mainstreaming agroecological innovations for regional and rural food security?

Section 2 of this paper reviews literature on sustainability science with a focus on three attributes of complex adaptive systems: adaptation, transition, and adaptive transition. Section 3 presents four longitudinal case studies of agroecological innovations. Section 4 will then discuss the case study findings using multi-level analytical perspective on cooperative and competitive niche-regime interactions, which respectively involves a latent paradox of incremental adaptations, and a salient paradox of transformational adaptations. Then conclusions are drawn to inform the mainstreaming paradox.

## 2. Review of relevant theoretical literature on complex adaptive systems

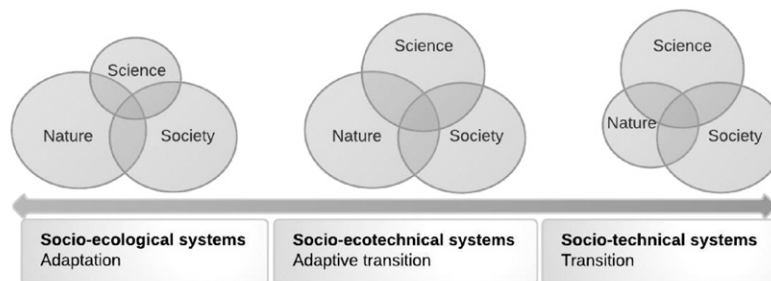
The literature on adaptation and transition evolved in isolation until recently. At the two extremes of a continuum, socio-ecological systems approach explores adaptive capacity of local and indigenous communities while socio-technical systems approach informs transitions to low-carbon systems (Fig. 1). In between them, adaptive transition involves innovations at the interface of science, nature and society to chart more balanced sustainability transition pathways. As it applies to agri-food innovation, adaptive transition integrates socio-ecological principles of agricultural adaptation with socio-technical principles of transitions to low-carbon systems of production in regional and rural contexts. The remainder of this Section reviews literature on adaptation, transition and adaptive transition as three attributes of complex adaptive systems.

### 2.1. Adaptation

Adaptation literature stresses the importance of developing adaptive capacity of those whose livelihoods depend on renewable natural

resources. Adaptive capacity, an antithesis to vulnerability, is a source of socio-ecological resilience against transient shocks and enduring stresses. Vulnerability is determined by exposure to shocks and stresses, sensitivity of exposures, and capacity to adapt to the effects (Engle, 2011). From the mainstreaming perspective, a multi-level construct which is central to socio-ecological systems is 'panarchy' (named after the Greek God of nature, Pan, to refer to sacred rules), which entails conceptualisation of the hierarchy of ecosystem structures, functions and services (Gunderson and Holling, 2002; Gallopin, 2006). Scales of ecological systems range from a single cellular organism to the biosphere over periods from seconds to geologic epochs, and of social systems from an individual to a socio-political region over periods from years to centuries. Building on the principles of ecological succession, Holling (1986, 2001) develops a perpetuating adaptive cycle that involves exploitation, conservation, release and reorganisation as four interlinked stages. The panarchical connections involve 'revolt' and 'remember', respectively illustrated by how a small fire develops into a wildfire, and whether a burnt down forest enters a secondary succession releasing the potential resources accumulated and stored in it.

Adaptation capacity development should differentiate specific capacity from generic capacity (Lemos et al., 2013). The former involves small and fast adaptive cycles to deal with risks, such as drought, floods and forest fire, while the latter includes large and slow adaptive cycles to address structural deficits, such as soil fertility decline, deforestation and biodiversity loss, and lack of income, education, health and political power. Thus, adaptation can be incremental as well as transformational; when small incremental changes are not enough to deal with structural deficits, generic adaptive capacity should be developed to promote transformational adaptations (Kates et al., 2012). Scholars suggest that developing generic adaptive capacity to deal with structural *status quo* requires polycentric governance involving multiple power centres as opposed to either state-led, 'command and control' regulation or market-based, *laissez-faire* governance (Adhikari and Tarkowski, 2013; Andersson and Ostrom, 2008; Ostrom, 1990). As well, adaptive co-management is insufficient to inform mainstreaming paradox as it depends on voluntary engagement of vulnerable communities in local planning and adaptation processes (see Olsson et al., 2004; Schultz et al., 2011; Schwarz et al., 2011). Some scholars suggest that mid-range governance is effective to integrate state-led, command and control regulation, and a voluntary response from local and indigenous resource users (Clark and Semmahasak, 2013). Referring back to the adaptive cycle, a paradox is between stability and change of socio-ecological systems (Holling, 2001): first, growth and conservation to enhance stability and continuity of local and indigenous resource use



Note: Size of the overlapping circles in the Venn diagram illustrates that socio-ecological systems assumes science and technology as given (Smith & Stirling, 2010) whilst socio-ecological systems focuses on long-term transitions without addressing the sense of space and place (Truffer & Coenen, 2012). An integration of the two complex adaptive systems can address these limitations.

**Fig. 1.** Complex adaptive systems at the interface of science, society and nature Note: Size of the overlapping circles in the Venn diagram illustrates that socio-ecological systems assumes science and technology as given (Smith and Stirling, 2010) whilst socio-ecological systems focuses on long-term transitions without addressing the sense of space and place (Truffer and Coenen, 2012). An integration of the two complex adaptive systems can address these limitations.

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