



Exposing the attractors of evolving complex adaptive systems by utilising futures images: Milestones of the food sustainability journey



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ABSTRACT

This study aims at exposing the potential of futures images in anticipating and informing transitions of complex adaptive systems toward sustainability. Our case concerns the food system. The inherent properties of complex adaptive systems make the exact trajectories of these systems unforeseeable. However, since the systems unfold into a common direction, we can say something about the qualities of the milestones toward which these systems navigate. Attractors configure the evolution of complex adaptive systems. Since attractors are the most stable and robust elements in these systems, they are more feasible targets for foresight than the several variants that they configure and effectuate. We have depicted attractors of sustainable local food systems by futures images: through working with an appropriate level of abstraction, by leaning on a multi-perspective approach and by breaking the linear relationship between the present and the future. In this context they were sustainability-oriented trading and delivery systems, food cultures, product development projects, food brands and transparent food systems. We also located hot spots of structural change and agency within the food system. These insights may inform transition management efforts, but they must be updated frequently, since sustainable development is a journey.

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1. Introduction

We live at the edge of two paradigms, two worlds with different logics and guiding stars. The socio-economic paradigm of the 20th century was characterised by orientations based on production, processing, division of labour, disintegration and material welfare. We suspect that the socio-economic paradigm of 21st century will navigate toward sustainable development, systems view, integration and immaterial welfare. Embodiment of the new paradigm gives rise to many system level changes, which have been anticipated by the scientific enterprise: studies on sustainability journeys and transitions are booming (Fuenfschilling and Truffer, 2014; Garud and Gehman, 2012; Geels and Schot, 2007; Genus and Coles, 2008; Hjorth and Bagheri, 2006; Holtz et al., 2008; Jørgensen, 2012; Kemp and Martens, 2007; Markand et al., 2012; Safarzynska et al., 2012; Vasileiadou and Safarzynska, 2010). The feeling of change has made us all hungry for knowing about these futures. In this orientation, empirical contributions for the alternative milestones and destinations are important.

The dominant designs of food, energy, transport and housing systems have several features that do not fit to the new paradigm (Geels et al., 2015, 2; Hinrichs, 2014, 152; Markand et al., 2012, 955; Ros et al., 2006, 193; Voß et al., 2009, 283). Consequently, they will face fundamental

changes or transformations. We will take a closer look at the food systems. The problematic features of the 20th century food systems – partly depending on the point of observation – relate to the dominance by retailers and other intermediaries (Flynn and Bailey, 2014; Konefal et al., 2005), extensive processing, packing and cross-transportation fuelled by non-renewable energy (Hendrickson and Heffernan, 2002; McMichael, 2009; Wilson, 2015) together with long and non-transparent supply chains permitting unethical conduct and health risks (Blay-Palmer, 2008; Kjærnes and Torjusen, 2012). These features have come along with industrialisation, capitalisation, specialisation, concentration, spatial separation and globalisation of the food systems (Blay-Palmer, 2008; Jarosz, 2008; Oosterveer and Sonnenfeld, 2012; Palpacuer and Tozanli, 2008; van der Ploeg, 2010).

Many scholars anticipate that the 21st century food systems will facilitate sustainable development by “reconnecting” food, people and places as well as by integrating economic, environmental, social and cultural aspects of food (Fonte, 2008; Grauerholz and Owens, 2015; Kirwan, 2004; Lyson, 2004; Marsden, 2013). In this vein, manifestations of the new paradigm would be more locally governed sustainable food systems (Feenstra, 1997; Flynn and Bailey, 2014; Hinrichs, 2014), which may provide resilience and safety in a turbulent world with social, environmental and market-led crisis (Tendall et al., 2015). Consequently, the “food from somewhere” challenges the “food from nowhere” (Campbell, 2009) upon the paradigm shift and subsequent sustainability journey. At the 21st century, the new food systems may replace the

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dominant regime, they may remain small and “alternative” or they may co-exist with the old regime in a tandem setting where starkly different global and local food systems emancipate. However, “even with public enthusiasm now for local and regional food, the twentieth century move to long distance food distribution has path-dependent elements that suggest caution about expecting a quick, uncomplicated or thorough transition” (Hinrichs, 2014, 149).

A major problem in foreseeing aspects of the paradigm shift or transition originates from the fact that alternative transition paths are difficult – if not impossible – to foresee. This is an inherent feature of complex adaptive systems (CAS). Complex adaptive systems have agency, which energises and directs their emergence and evolution and distinguishes them from “just” complex systems (Choi et al., 2001, 353). Food systems as many other social systems in developed market economies are CAS (Nesheim et al., 2015, 233): they unfold and self-organise without central command on the basis of non-linear and mostly local interactions among their heterogeneous elements (Byrne and Callaghan, 2014; Holland, 1995). For example, *Produit en Bretagne* as one of the oldest regional food brands in Europe is a “self-organised complex system in which the stakeholders and their interactions – either intuitively or via joint strategic actions – result in resilience accompanied by periodically renewed emerging properties showing the diverse quality characteristics of their products” (Perrot et al., 2016, 97). In the myriad of complex adaptive food systems, many novel constellations (innovations; practices, technologies, businesses) typically emerge as a response to the changed environment, making their detailed futures unforeseen.

However, the constellations in complex adaptive systems tend to accumulate around specific junctures or nodes called attractors (Gerrits, 2012, 157; Room, 2011, 130). While attractors are the most stable and robust elements of complex adaptive systems, they are more feasible targets of foresight than the several variants of detailed socio-economic systems that the attractors configure and effectuate. If we could foresee these attractors, then management of the transition with targeted research, development, business and policy actions becomes more productive. A way to anticipate these attractors within the food systems could rest on three premises. First, the dynamics of diverse food systems are unfolding along with social action (Chase and Grubinger, 2014, 1; Koc, 2010, 43). Second, transition-oriented social action is fundamentally teleological in nature (Smith et al., 2010, 444). Third, teleological social action is guided by objectives, ideals, visions and images (Bell, 1998). Consequently, futures images may frame and guide the sustainability journey (Beers et al., 2010, 725; Kemp and Martens, 2007, 9). According to Vasileiadou and Safarzynska (2010, 1178), images of the future are “expected to act as attractors for managing transitions, i.e. by creating expectations which attract support, actors, ideas and funding”. By exercising disciplined imagination (Weick, 1989) to produce futures images, it could be possible to “jump” to the sketches of new realities across the diversity of unforeseen paths and bifurcation points. In this orientation, the “discipline” should come from the normative guideline of sustainability, and the “imagination” could come from the visionary and creative contribution of futures research methods. Identification of the becoming attractors in this way may unravel the mystery of the milestones of the sustainability journey of the local food systems.

Following this line of logic, this study aims at exposing the potential of futures images in anticipating and informing transitions of complex adaptive systems toward sustainability. This is illustrated by studying emerging sustainable local food systems in Finland. Transition of food systems toward sustainability will be discussed first in Section 2. The characteristics of complex adaptive systems and attractors are discussed in Section 3, whereas the potential of the futures images in the anticipation of attractors will close the theoretical-conceptual discussion in Section 4. Methods and materials of the analysis are presented in Section 5 and the results are reported in Section 6. Finally in Section 7, the findings are evaluated in terms of feasibility and benefit for the scientific enterprise and in practice for stakeholders struggling to anticipate and manage sustainability journeys.

2. The sustainability journey of food systems

Sustainable development is a widely used but fuzzy concept. In the broadest sense, it refers to intergenerational equality in meeting human needs and desires (Brundtland, 1987). In contextual and disciplined specifications, it often boils down to economic, environmental, social and cultural dimensions (Borch, 2007; Magee et al., 2013; Nielsen et al., 2010; Pezzey and Toman, 2002). These dimensions host the ideal that human needs should be met within the bounds of economic profitability, biological carrying capacity, social justice and cultural continuity. Sustainable development does not degrade the stocks of economic, environmental, social and cultural capital in their diverse contexts and scales. This makes it possible for the future generations to fulfil their needs by the services of these stocks. Over time, the goals of sustainable development have diversified to include good governance as an additional dimension (e.g. FAO, 2013) and recently the United Nations (2015) has defined as many as 17 sustainable development goals for 2030. Sustainable development is multidimensional.

Each social system, context and generation has its own sustainability concerns. As such, “sustainable development is an issue of complex systems” (Hjorth and Bagheri, 2006, 90) and could be conceived as an unending multidimensional, deliberate and reflexive process toward the socially constructed and temporally relevant ideal of sustainability in each context (Darnhofer, 2015; Forsell and Lankoski, 2015; Kemp and Martens, 2007; Koc, 2010; Oosterveer, 2014). Indeed, the change of the food systems toward sustainability is a journey, which “navigates” (Sage, 2014, 255) toward this ideal along thousands of milestones exhibiting different scales, scopes and temporalities. In studying these journeys and their milestones, we “have to work with complex and multi-layered notions of food systems and sustainability” (Flynn and Bailey, 2014, 117). Consequently, the transition of food systems toward sustainability may also proceed on four parallel tracks: economic, environmental, social and cultural serving the profit, the people and the planet (Ros et al., 2006, 193).

Various forms of “alternative” *food systems* – which also may take the form of networks (Watts et al., 2005) or hubs (Blay-Palmer et al., 2013) or movements (Grauerholz and Owens, 2015; Sage, 2014; Starr, 2010) – are our units of analysis and vehicles for sustainability journeys. Most of these alternative food systems have a local orientation: they reconnect producers and consumers through direct interaction (Forsell and Lankoski, 2015; Kirwan, 2004; Kneafsey et al., 2013). They also have a multidimensional sustainability orientation as they have “a commitment to the social, economic and environmental dimensions of sustainable food production, distribution and consumption” (Jarosz, 2008, 232) and “share values of economic and social solidarity, environmental conservation and opposition to the logic of the dominant food-system” (Darrot et al., 2015, 143). Many of them also have communal features (Feagan, 2007). So, it seems that the emerging food systems share some common elements or “attractors” around which the diversity organises. These local sustainability-oriented food systems include farmers' markets, food hubs, various short supply chains, community supported or shared agriculture, consumers' purchasing groups or organisations, community gardening, certification and labelling programmes, food box schemes, internet sales and much more, partly blurred by conceptual vagueness (Blay-Palmer et al., 2013; Cleveland et al., 2014; Feagan, 2007; Grauerholz and Owens, 2015; Le Velly and Dufeu, 2016; Parker, 2005; Watts et al., 2005).

It is important not to overstate the superior sustainability of these heterogeneous systems (Born and Purcell, 2006; Tregear, 2011), but their emergence along with either deliberate action toward sustainability (Blay-Palmer et al., 2013; Cleveland et al., 2014) or as a counteraction toward unsustainable features of the dominant regime (Allen et al., 2003; Hendrickson and Heffernan, 2002) point in this direction. Many of the contemporary alternative food systems, which co-exist under different brands, simultaneously promote several dimensions of sustainability (Table 1). Through the local food systems, sustainability operates at the

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