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Title of the article: Designing for sustainability transitions of aquaculture in Finland

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ABSTRACT:

To facilitate transitions in socio-technical systems, it is necessary to adopt a strategic and systemic perspective. The dynamics of socio-technical systems are associated with uncertainty and may yield to critical problems as the systems change and may lead to adverse results without deliberate intervention. This case study research develops a new theoretical framework to support strategic design interventions that aim to anticipate and address problems in systemic transitions by integrating two areas of knowledge – strategic design and transitions theories. The theoretical framework is applied to a case study of facilitating salmon trout aquaculture in Finland that has been reaching stalemate. The resulting design demonstrates a new kind of strategic design intervention that is neither attached only to the present-day concerns to solve only present problems nor abstracted merely to the strategic level to project only long-term visions. Rather, the Strategic Ekofish Certification concept presents new strategic design with operational importance to mitigate foreseeable problems aligning with near-future goals.

1. Introduction

Design can contribute to realizing sustainable futures, which has been advocated by Fuller, Papanek, Manzini and others, starting from the late 1960s (Fuller, 1969; Papanek, 1971; Manzini, 1992). Since then, there have been ongoing efforts to advance design knowledge for sustainability. However, design knowledge alone is insufficient to tackle the increasing complexity and persistence of environmental problems. This insufficiency of design knowledge was reflected on in a recent article exploring the evolution of design for sustainability by Ceschin and Gaziulusoy (2016). Their study indicated that the trend of design for sustainability has expanded towards large-scale system-level changes. According to the authors, the evolution was reasoned on the understanding of sustainability as a socio-technical challenge, which brought the field of design for sustainability to the level of socio-technical system innovation. On this level, studies of design for sustainability developed design from a strategic and systemic perspective. For instance, Manzini and his associates (Manzini, 1999; Manzini and Vezzoli, 2003; Meroni, 2008; Ceschin, 2014) explored the social role of design on a strategic level in order to reconfigure a production and consumption system. Ceschin (Ceschin, 2012, 2014) and Joore (2010) integrated transitions theories with a product-service system (PSS) to facilitate socio-technical system-level changes. In an even broader transdisciplinary manner, Gaziulusoy explored design for sustainability by integrating design with transitions theories and other fields of sustainability science and future studies in order to orient transitions in organisations and urban cities (Gaziulusoy, 2010; Gaziulusoy and Brezet, 2015). Moreover, Irwin and her affiliates developed a design curriculum to support design with theories developing design for change within complex systems, namely transition design (Irwin et al., 2015). These studies enhanced design with a strategic perspective when addressing socio-technical challenges. Against a backdrop of the emergent level of design for sustainability regarding socio-technical system innovation, this study builds on current research exploring what design could contribute in terms of sustainability in the new context of socio-technical systems. Having set its starting point, this study has further developed design for sustainability by integrating strategic design with transitions knowledge. The integrated knowledge was applied to a case study of facilitating salmon trout aquaculture transitions in Finland.

This case study of Finnish sustainable aquaculture transitions was part of the Finnish National Aquaculture Programme targeting doubling fish production by 2020 as part of the long-term EU vision

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of the Blue Growth strategy promoting growth in both marine and inland aquaculture (Eurostate, 2015; EU, 2016). This article deals with marine aquaculture in the Baltic Sea. This aquaculture transitions case was situated in socio-ecological-technical systems that co-evolved with societal, environmental and technological development. The current aquaculture systems are dominated by the import of Norwegian farmed salmon, which occupied 85% of the Finnish market in 2015 (Sandell, 2016). In addition, other activities – such as the farmed salmon production and salmon consumption behaviour entrenched in the current aquaculture systems – have furthermore intensified the persistence of the problems. In the meantime, one of the paths leading to Finnish aquaculture transitioning to sustainable systems was the adoption of a new concept of recirculating nutrients in the Baltic Sea, which was made available by the prompt launch of Baltic herring fishmeal production in Finland. This provided legitimacy for Finland growing sustainable aquaculture. However, this measure alone would not be enough to break through the current regime of the import of Norwegian farmed salmon in Finland. Other initiatives underway were, for instance, streamlining the fish farming licensing process in order to ease industrial growth (Mäkinen et al., 2010: 45) and the identification of desirable water areas for siting fish farms in the outer Baltic Sea in order to increase production efficiency. In addition, Finland's recent quota increase of the Baltic herring catch allowed by the EU ensured economic viability by farming the relatively high-value salmon trout with low-value native resources. These measures created an opportune time for the transitions. However, Finnish aquaculture transitions have still been slow.

To date, the contemporary transitions situation that culminates a long process of historical events, societal circumstances and industrial development has developed the Finnish aquaculture systems into a highly complex network. The most critical factors were unforeseen changing elements that could potentially form at a particular time and space in the near future due to co-evolving socio-technical development, in other words, potential critical problems (Hughes, 1983, 1986). The transitions situations would be even worse for those unforeseen changing elements underlying the ongoing strategic pathways. Some summer dwellers, water recreationists and environmentalists are likely to disapprove of the siting of fish farms in the sea. Fish farmers were likely to be intimidated by the stringent legislation of fish farm licencing as well as worried about the effect of using new fish feed on both the appetite of the farmed fish and the taste of the fish. Additionally, fish consumers were apparently sceptical about consuming fish from the Baltic Sea, presuming that the water quality was bad. In this case, it was also easily presumed that any increase in salmon trout production in the Baltic Sea would logically result in accelerating eutrophication in the sea and that fish farmers would be sceptical about recirculating nutrients. These factors mean that it is impossible for the Finnish sustainable aquaculture to achieve production growth by 2020. Without deliberate orientation, failing to fulfil the production target will lead to further adverse results, such as the increasing domination of the existing import of Norwegian farmed salmon, which makes shifting to new systems difficult. In this understanding, solving critical problems in socio-technical systems is seen to be particularly challenging. Breaking stalemate, strategic plans sensitive to envisaging unforeseen contingencies were unarguably required and equally important, strategic solutions with operational goals to mitigate near-future problems were necessary.

The multiplex ties and unforeseen contingencies in transitions urge problem solving from a systemic and strategic perspective. This research aims to explore how design contributes to sustainability in addressing socio-technical challenges, with a focus on anticipating and solving critical problems. Regarding this overall research aim, two specific research objectives were developed: objective 1) to identify opportunities for strategic design engagement in sustainability transitions and objective 2) to develop a strategic design intervention addressing the problems identified in transitions. In setting the research objectives, an integrated framework of strategic design for sustainability transitions was developed. The framework was evaluated through the case study methodology. This paper is organized as follows: the next section (Section 2) integrates strategic design with transitions knowledge, developing the integrated framework of strategic design for sustainability transitions. In Section 3, this framework is applied to the case study of the Finnish aquaculture transitions for empirical assessment, describing the methods and case study findings. Section 4 discusses the results that are supported by the integrated knowledge. This study ends with Section 5, the conclusion.

2. The integrated framework of strategic design for sustainability

Designing in the context of systemic transitions requires adopting a systemic and strategic perspective. Additionally, in the long process of transitioning towards sustainable futures, design is urged to deepen strategic knowledge to fulfil short- and mid-term goals that align with longer-term visions. This section drew understanding from transitions theories and strategic design, and presented an integrated framework for the strategic design of sustainability transitions. This integrated framework was used during empirical assessment.

2.1. Transitions theories

Transitions theories target sustainability as the normative goal for systemic transitions (selected sustainability transitions research includes studies by Elzen et al., 2004; Smith, 2006; Geels, 2014; Darnhofer, 2015; and many others). They also recognise technology as having a key role in sustainability transitions, without disregarding the importance of addressing environmental issues in conjunction with societal challenges. This section outlines six characteristics of sustainability transitions from transitions literature on socio-technical systems.

The six characteristics of sustainability transitions are:

1. Niche-regime dynamics
2. Interconnectedness and interdependencies
3. Unforeseen contingencies
4. Niches' resistance to change
5. Multiple value conflicts
6. Multiple time frames

2.1.1. Niche-regime dynamics

Transitions theories conceptualize two core players: socio-technical regimes and niche innovations. On one level, socio-technical regimes are the current, incumbent systems that are self-reinforced by the predictable trajectories of path dependencies (Nelson and Winter 1977) and lock-in mechanisms (David, 1985; Unruh, 2000). This results in the persistence of regimes that keep out niche innovations. On another level, niche innovations require protected spaces in order to develop and become competitive within the regimes (Vergragt and Brown, 2004). More recent transitions research (Smith, 2007; Smith and Raven, 2012) also examines the niche-regime dynamics residing at the niche regimes' interlevels, where incumbent systems and niche innovations interface. This enhances niches' path-breaking transitions through concepts of diffusion (Vergragt and Brown, 2004) and