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POLICIES FOR SYSTEM CHANGE: THE TRANSITION TO THE BIOECONOMY

Lisa Scordato[1*], Markus M. Bugge[1], Teis Hansen [1,2], Anne Tanner[4,5], Olav Wicken[3]

[1] Nordic Institute for Studies in Innovation, Research and Education (NIFU), Box 2815 Tøyen, No-0608 Oslo, Norway,
[2] Department of Human Geography, Lund University, Sölvegatan 10, SE- 223 62 Lund, Sweden
[4] Department of Management Engineering, Technical University of Denmark (DTU), Diplomvej, 2800 Kgs. Lyngby, Denmark
[3] Centre for Technology, Innovation and Culture (TIK), University of Oslo, Box 1108 Blindern, NO-0317 Oslo, Norway
[5] Centre for Innovation, Research and Competences in the Learning Economy (CIRCLE), Lund University, Sölvegatan 16, SE-221 00 Lund, Sweden
* Email: lisa.scordato@nifu.no

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ABSTRACT

Keywords: Sustainability transitions, innovation system failures, policy mixes, bioeconomy, Nordic countries.

1. Relevance

Over the past 10-15 years the bioeconomy has increased in importance and has been promoted as a possible contribution to address important societal challenges such as climate change, food security, and global health issues. It is argued that the development towards a circular bioeconomy can be characterised as a system change as it requires fundamental changes in both production and consumption systems (Coenen, Hansen, and Rekers 2015; Bugge, Hansen, and Klitkou 2016; Scordato, Bugge, and Fevolden 2017). However, even if governments in many countries have started to introduce policies addressing grand societal challenges, it remains unclear how policies can be implemented to achieve determined goals, and also how such policies can be understood in relation to existing policies (Kuhlmann and Rip 2014; OECD 2015; Schot and Steinmueller 2016). Still, we know very little about the extent to which policies are in fact giving sufficient importance to transformative failures (vis-à-vis market and structural failures). Also, to the extent that transformative failures are given attention in bioeconomy policies, we don't know whether this is consistent in the policy mix or only in terms of formulating visions.

In this paper we therefore wish to investigate the occurrences and characteristics of policies for system change by i) exploring the rationales for policy intervention aimed at a transition to the bioeconomy; and ii) whether and how policy mixes for transition are combined and implemented differently in various national contexts.

2. Aims and research questions

The aim of the paper is to study how policies for system change towards a circular bioeconomy are formulated, and how they co-exist along other types of policy rationales. To our knowledge no studies

have explicitly explored "real-world" bioeconomy policies from a socio-technical transition perspective. We hence believe that this study could contribute to filling this identified knowledge gap. The research questions guiding the study can be formulated as follows:

1) How is policy legitimized to address the transition to a circular bioeconomy (market failures, structural system failures or transformational system failures)?
2) How can the different policy strategies identified be interpreted as an expression of a policy mix across the three different policy rationales?
3) What are the policy strategies, instruments and policy processes characterizing the policy mixes across the Nordic countries?

3. Theoretical framework

Over the past years, scholars within the field of innovation studies have increasingly been interested in understanding the complex features of policies addressing contemporary problems, such as climate change, loss of biodiversity, resource depletion, health and urbanisation. The solutions to these problems, commonly defined as grand societal problems due to their unpredictable, open- ended and complex nature, are seen as requiring broad systemic changes and novel approaches by innovation policies (Kuhlmann and Rip 2014; Schot and Steinmueller 2016). Concepts such as *Innovation policy 3.0* and *Deep Transitions* have recently been introduced into the scholarly debate to indicate that it is time for innovation policy "to focus much more on the achievement of wide systems transformations, since optimization of existing systems will not be a sufficient answer" (Schot and Steinmueller 2016p. 17; Schot and Kanger 2016).

The importance of long-term strategic orientation in sustainability transitions is acknowledged as having a fundamental role in giving a direction to system changes. A key assumption is that policies play a key role for the redirection and acceleration of technological change, a central requirement for such transitions (Weber and Rohracher 2012; Rogge and Reichardt 2016). Innovation policies for system change, thus differs quite substantially from traditional innovation policy which is directed towards improving generic capacities of industries, regions, etc. with the main objective to create economic growth and employment. Policies aimed at system change can be understood as "a horizontal policy approach that mobilises technology, market mechanisms, regulations and social innovations to solve complex societal problems in a set of interacting or interdependent components that form a whole socio-technical system" (OECD 2015 p.7). Weber and Rohracher (2012) have identified four possible types of policy failures in transformative change; (a) directionality failure, (b) demand articulation failure, (c) policy coordination failure and (d) reflexivity failure. These add to previously identified structural innovation system failures, such as capabilities failures, infrastructural failures, network failures and institutional failures (Woolthuis, Lankhuizen, and Gilsing 2005) that are commonly used to legitimize and shape research and innovation policy. The different types of failures are summarized and illustrated in Table 1.

Table 1: Different kinds of failures and policy rationales in different analytical approaches: neo-classical, innovation systems and system innovation. Source: adapted from Weber and Rohracher, 2012: 1045 in OECD 2015.

Market failures (neo-classical)	**Structural system failure (innovation systems)**	**Transformational system failures (system innovation)**
1) Too little investment in R&D, because of the public good character of knowledge (and leakage) and uncertainty about outcomes (which hinders cost benefits calculations)	1) Infrastructural failure: limited investment in physical infrastructure because of risks (large-scale investments and long-time horizons) and low return on investments.	1) Directionality failure: Transformation process will be hindered by: a) lack of shared vision regarding goal and direction, b) inability of collective coordination of distributed agents involved in shaping system change.
2) Negative externalities: private actors do not take negative consequences into account if they can externalize costs.	2) Institutional failures: Problems in formal institutions (laws, property rights, regulations) creates uncertainty that hinders investment and innovation. Informal institutions (norms, values, attitudes, trust, risk-taking) may also hinder innovation.	2) Demand articulation failure: The exploration of new user patterns and opening up of new markets will be hindered by: a) insufficient spaces and opportunities to learn about user needs, b) absence of orienting signals from public demand (*e.g.* public procurement), c) lack of demand-articulation capabilities
3) Over-exploitation of commons, leading to over-use of public resources in the absence of regulations.	3) Interaction or network failure. Very strong cooperation may lead to lock-in and inward-looking behaviour. Too limited interaction hinders knowledge exchange and interactive learning.	3) Policy coordination failure: Transformation will be hindered by: a) lack of multi-level policy coordination (regional, national, European), b) lack of horizontal coordination between innovation policies and sectoral policies (transport, energy, agriculture), c) lack of vertical coordination (between Ministries and implementation agencies)
	4) Capabilities failure: Lack of appropriate competencies prevents access to new knowledge and inability to adapt and compete.	4) Reflexivity failure: Transformation will be hindered by a lack of monitoring, learning, open debate, adjustment, and reflection about direction and speed.

Another related approach to study the policy complexities characterising societal challenges focuses on policy mixes. The concept of policy mixes, has been used narrowly by Borrás and Edquist (2013) to define "a set of different and complementary policy instruments to address the problems identified in a national or regional innovation system" (Borrás and Edquist 2013 p.1514). More broadly the concept also encompasses policy goals and rationales, processes of policy making and implementation (Rogge and Reichardt 2013; Flanagan, Uyarra, and Laranja 2011). In the context of sustainability transitions it is argued that policy mixes need to address a *strategic component*, associated *policy processes* and the *characteristics* of policy mixes (Rogge and Reichardt, 2016). Moreover, these three "building blocks" may be analysed in terms of their elements: 1) *Policy strategy* (including policy objectives and principal plans) 2) *Instruments* (including their types and purpose) and 3) *policy processes* (including policy learning and policy implementation aspects) (Rogge and Reichardt 2016). In the real world, each of the three "building blocks" will be motivated by certain policy rationales. Therefore, we may assume that changing policy rationales in the long run have effects on and require adjustments in policy mixes.

4. Methodology and analysis

Empirically we focus our attention upon government policies encouraging bioeconomy development in four Nordic countries (Norway, Denmark, Sweden and Finland). Like many other countries in the world these countries have over the past decade developed policy strategies which encourages the development of a bio-economy. In this sense, they share a strong interest in the bioeconomy with governments at different levels worldwide (German Bioeconomy Council 2015).

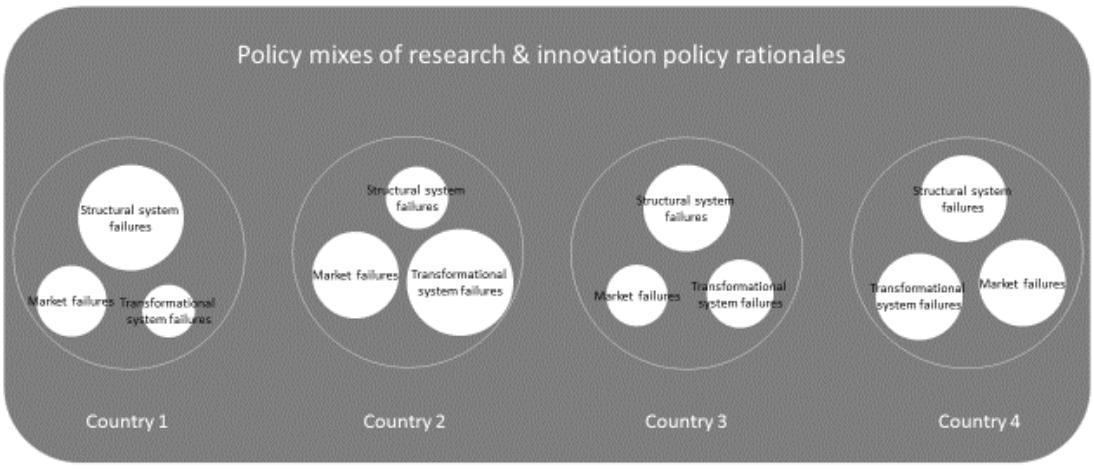
The data collection includes i) document analysis, which involves an analysis of key documents in relation to the building blocks of the extended policy mix framework described above and; ii) semi-structured interviews with policy makers and other relevant stakeholders across the selected countries.

The document analysis covers official governmental documents or documents that are treated in the country itself as primary documents. Several sources have been used to identify the documents, such as from the Bioeconomy Observatory of the Joint Research Centre (JRC) and the overview of national bioeconomy strategies from the German Bioeconomy Council. The document analysis is used to prepare the background for semi-structured interviews.

5. Expected outcomes

Reflecting the research questions posed the paper aims to investigate how policies addressing the bioeconomy is justified and legitimized in terms of the three policy rationales introduced. In comparing the balance between the three policy rationales across the Nordic countries the paper suggests that the use of different logics can be interpreted as a dimension of depth in the notion of policy mixes. Figure 1 below illustrates how the analysis is expected to provide insights on these parameters.

Figure 1: Illustration of the expected outcomes from the analysis.



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