



Towards a broader perspective on the forms of eco-industrial networks



Samuli Patala ^{a,*,1}, Sari Hämäläinen ^b, Anne Jalkala ^a, Hanna-Leena Pesonen ^b

^a School of Industrial Engineering and Management, Lappeenranta University of Technology, P.O. Box 20, Lappeenranta FI-53851, Finland

^b Jyväskylä School of Business and Economics, University of Jyväskylä, P.O. Box 35, FI-40014, Finland

ARTICLE INFO

Article history:

Received 23 May 2013

Received in revised form

6 March 2014

Accepted 18 June 2014

Available online 26 June 2014

Keywords:

Industrial networks

Industrial symbiosis

Environmental sustainability

Systematic literature review

ABSTRACT

This paper explores various forms of eco-industrial networks in advancing environmental sustainability. Prior research on environmental sustainability primarily identifies industrial actors as autonomous entities or considers the role of networks in advancing environmental sustainability from a rather narrow perspective. However, the networks of ties in which industrial firms are embedded profoundly impacts not only their own performance, but also the natural environment in which they operate. Based on a systematic literature review, we identify four forms of eco-industrial networks that have the potential to advance environmental sustainability: 1) symbiosis networks, 2) sustainable supply networks, 3) environmental issue networks and 4) environmental solution networks.

The paper presents important insights on the operational logic for each of these network forms and the dimensions of their network architecture. The main implications of this comparison are that policy-makers and practitioners need to become aware of the various mechanisms through which inter-organisational networks can reduce environmental load. Furthermore, there is a need to build broad coalitions of organisations that are mobilised to address environmental issues. We suggest that network architecture which maximises its members' capability to self-organise while also including a coordinating organisation can be highly suitable for eco-industrial networks. We also suggest some fruitful avenues for future research on eco-industrial networks. In integrating research on eco-industrial networks with existing research on inter-organisational alliances and networks, the paper provides more understanding on the multifaceted role played by various forms of eco-industrial networks in advancing sustainability.

© 2014 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

1. Introduction

Firms and industries do not accomplish the goals of environmental sustainability in isolation. Organisations are embedded in networks of social, professional and exchange relationships with other organisational actors (Ahuja et al., 2012; Gulati et al., 2000). In addition, problems relating to environmental sustainability are embedded in a complex web of actors comprising businesses, consumers, NGOs and governmental agencies which are involved in collaboration and contestation concerning the problems and their solutions (Wittneben et al., 2012). However, in the extant literature on organisations and the environment, the unit of

analysis primarily lies at the level of individual actors instead of a network of actors. As the locus of change primarily lies in the network of interactions between organisations and individuals, we need a better understanding on the linkages between environmental issues and organisational networks. This paper advances the shift of focus in the unit of analysis by examining *eco-industrial networks*, defined here as industrial networks that advance environmental sustainability through inter-organisational collaboration.

However, research on eco-industrial networks is surprisingly limited and has focused primarily on industrial symbiosis (IS), which refers to inter-firm activities that focus on the re-utilisation of waste and by-products and the exchange of resources (e.g. Chertow, 2000; Doménech and Davies, 2011). While the IS literature focuses on the potential of energy and material linkages between firms, it provides a limited perspective on the forms of eco-industrial networks in advancing sustainability. Thus, we suggest that a broader understanding is needed on the mechanisms

* Corresponding author.

E-mail addresses: samuli.patala@lut.fi (S. Patala), sari.m.hamalainen@jyu.fi (S. Hämäläinen), anne.jalkala@lut.fi (A. Jalkala), hanna-leena.pesonen@jyu.fi (H.-L. Pesonen).

¹ Tel.: +358 40 6853840.

through which industrial networking can advance environmental sustainability. Analysis of the operational logic and network architecture of eco-industrial network forms could shed light on the processes advancing environmental sustainability. Operational logics of networks describe the focus of environmental action and the mechanisms through which a network aims to achieve environmental benefits. Network architecture represents the form of networks in response to their function (Fjeldstad et al., 2012). A better understanding on the underlying structural elements of these networks is needed to gain a deeper understanding on how these networks operate. Our main objective in this research is to make salient the potential mechanisms that have been addressed in the extant literature and establish a starting point for further empirical work. Specifically, we address two research questions: What forms of eco-industrial networks with the potential to advance environmental sustainability can be identified in the literature? What are the principal operational logic and architecture of these network forms? We answer these questions through a systematic literature review by analysing four different literature streams.

The paper begins with a general discussion on networks and sustainability, followed by an introduction to four forms of eco-industrial networks that have been identified through a systematic literature review. Subsequently, the identified forms of eco-industrial networks are compared and their similarities and differences evaluated through dimensions adopted from the literature on inter-organisational alliances and networks. The paper ends with conclusions and implications for practice and research.

2. Networks and sustainability

There is an extensive body of knowledge on how networks can contribute to the creation of various types of outcome. Networks enable organisations to access resources that might otherwise be difficult to develop or acquire (Ahuja et al., 2012; Gulati et al., 2000). They transfer information that gives rise to attitude similarity, imitation and generation of innovations (Ahuja, 2000; Brass et al., 2004). Thus, networks are powerful carriers of new norms, values and practices. In addition, they serve as governance mechanisms that can constrain opportunism and enhance trust (Ring and Van De Ven, 1992). Conversely, networks also have inertial properties that can constrain change (Kim et al., 2006).

Networks are potentially powerful tools with which to influence the context and shape the practices of involved actors. However, we have limited understanding on the transformative power of networks in addressing the problem of environmental sustainability. Prior network research primarily focuses on the outcomes of networks for individual firms and industries, rather than on the functioning of the natural environment. From the perspective of an individual firm, network-based collaboration has been shown to reduce risk, speed products to market and decrease the cost of process improvement and product development (for a review, see Fjeldstad et al., 2012).

Environmental sustainability, however, is profoundly affected by complex networks of actors that comprise industries, NGOs and governmental agencies. These networks are involved in collaboration and contestation over the urgency of environmental problems and the role of government and markets in addressing these problems (Wittneben et al., 2012). In addition, specific forms of collaborative networking can contribute to reducing the environmental load of industrial operations. For example, Ostrom (2009) regards environmental degradation as a problem of collective action and proposes a polycentric approach that relies on small-scale regional institutions and governance mechanisms which take advantage of local incentives for cooperation.

Collaborative inter-organisational networks are often characterised by novel ways of organising that suit the collective purpose of the network (Fjeldstad et al., 2012). It is thus vital to understand these networks' architecture, which can be defined as the synthesis of their form in response to their function. These collaborative arrangements can be conceptualised through an actor-oriented network architecture, which is focused on enabling the set of involved organisations to dynamically form collaborative relationships. Actor-oriented network architecture comprises three major elements: actors, commons and also protocols, processes and infrastructures (Fjeldstad et al., 2012). Furthermore, a study by Gulati et al. (2012) identified two other elements through which a network's architecture can be characterised. The first element is the permeability of boundaries; in other words, the extent to which a network's boundaries are open or closed. Also, the internal stratification of decision making affects a network's design (Gulati et al., 2012).

Research on business and sustainability appears to draw surprisingly little from the substantial literature on inter-organisational alliances and networks. We propose that research on eco-industrial networks will benefit from better integration with traditional network research. In addition, more understanding on the potential and characteristics of network cooperation in addressing environmental problems is needed.

3. Methodology

As the existing research on industrial networks and sustainability is divided into mostly unrelated research streams, we adopted a multidisciplinary systematic literature review to address our research questions. A systematic literature review can provide a more comprehensive analysis of the literature in comparison to traditional, more subjective literature reviews (Denyer and Tranfield, 2006). It includes a clear statement on the purpose of the review, a comprehensive search protocol to obtain the relevant literature and explicit criteria for qualifying the relevant literature. Its strength lies in reproducibility due to careful documentation of the search protocol, thus enabling other researchers to generate similar findings by following the same protocol (Denyer and Tranfield, 2006).

First, the search was conducted by two researchers on two different academic databases to cover a diverse range of publications. The two chosen databases were Scopus and Web of Science. The date range chosen for analysis was 1990–2012, and the selected keywords were as follows:

("Industrial" OR "Business" AND "Network" AND "Sustainability" OR "Environmental") OR "eco-industrial network" OR "industrial symbiosis" OR "eco-industrial park" OR "eco-cluster" OR("industrial ecology" AND "network")

Both databases were searched individually with the chosen keywords. The search covered the title, keywords and abstracts of the articles and found a total of 808 articles. Based on a review of their abstracts, 160 articles were qualified and their full texts scanned. This resulted in 36 articles being chosen for further analysis. An additional three articles were identified through a snowball method of scanning the references of the 36 selected articles, bringing the total number of articles to 39. After this process, a need for more recent articles on some eco-industrial network forms became apparent. For this reason, selected journals from industrial ecology, supply chain management and marketing, which are named in the next chapter, were scanned for the years 2012 and 2013. Along this process, two more articles matching the employed criteria were found. Thus, in total, 41

Download English Version:

<https://daneshyari.com/en/article/8105790>

Download Persian Version:

<https://daneshyari.com/article/8105790>

[Daneshyari.com](https://daneshyari.com)