
Editorial

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1 Introduction

Paradoxically in a time of globalisation and advanced telecommunications, regional disparities in economic prosperity remain an uncomfortable reality for national governments (Cumbers and McKinnon, 2004). Historic patterns of uneven industrial development are now overlain by the effects of a generation or more of de-industrialisation as the traditional Fordist ‘heavy industries’ of Western Europe and North America have declined or re-located to newly industrialising countries. Other smaller scale transformations in the geography of production have also signalled the advent of a post-Fordist era (Amin, 1994). It is suggested that the initial Keynesian response of state-directed wealth redistribution between regions has given way to a ‘new regionalism’ paradigm of regional development based on regional strengths. As a result, regions and cities have attempted to develop policies to enhance their competitiveness, as they enter into a global competition for inward investment (Harvey, 1989; Porter, 1990). Ironically, perhaps, just as Fordist mass production was entering into decline in the west, concern for its effects on the environment began to take root. Thus present day regional policies are not only competing for investment to protect and create employment, but at the same time attempting to address the social and environmental legacy of the past. Policymakers also have a remit to safeguard the environment for future generations and achieve at least an appearance of spatial equity in the share of risk amongst the present one (Gibbs, 2002). In short, we are now in an era for which the language of sustainable development has become commonplace.

It is against this backdrop that Industrial Ecology (IE) grew with remarkable rapidity from a ‘strategy for manufacturing’ (Frosch and Gallopoulos, 1989) to also being a place-based development tool, with the recognition of four demonstration eco-industrial parks by the US federal government in 1994 (Cohen-Rosenthal, 2003). The purported benefits to communities of the latter form of eco-industrial development (defined by Schlarb (2001, p.3) as “industrial ecology in practice”) were new jobs attracted and/or secured by the cost savings to companies associated with energy and resource efficiency and shared access to services such as environmental management (Côté and Cohen-Rosenthal, 1998; Martin *et al.*, 1998). Communities would also benefit from an increased tax base, environmental performance beyond regulatory compliance and lower economic and environmental costs for waste disposal (Dunn and Steinemann, 1998). At the optimistic end of the spectrum, this has attracted comments from practitioners such as “The enhanced economic performance of participating companies will make eco-industrial parks a powerful economic development tool for communities” (Lowe, 2001, p.2).

However, eco-industrial development has proved as difficult to implement as other sustainable development initiatives, rendering its theoretical regional development spin-offs highly elusive (*e.g.*, Chertow, 1999; Gibbs and Deutz, 2005) and fuelling a number of debates within what Andrews (1999, p.367) referred to as the “jurisdiction-based approach to industrial ecology”. For example, is IE best implemented at a local or a regional scale (*e.g.*, Korhonen, 2002; Sterr and Ott, 2004); can policy initiatives be used to generate by-product exchange, or is this best left to market forces (*e.g.*, Desrochers, 2002; Chertow, 2007); and how can institutional and organisational barriers to inter-firm cooperation be overcome (*e.g.*, Boons and Baas, 1997; Wolf *et al.*, 2005)? The papers in this collection address the interconnections between IE and regional development from a variety of perspectives. As we describe in the following section, they help to carry forward existing debates as well as addressing hitherto relatively neglected areas of research such as the social implications of IE. Finally, we review some of the key themes that emerge from this collection and their implications of the progress of industrial ecology as a discipline.

2 Contribution of the papers

The papers in this collection are organised around two themes: the first concerns the complexities of the global economy as manifested locally and the need to align spatial scales of production and consumption. The second theme concerns the policy and institutional context of IE implementation.

2.1 *Scalar alignment*

A recurrent, but under theorised, theme in the IE literature is scale. Randles begins to remedy this shortcoming by drawing upon human geographers’ concepts of scale as a theoretical basis. She argues that the IE literature with its focus on relatively technical issues such as ecosystem boundaries suffers something of a blind spot when it comes to appreciating the ontology of ‘multi-scalar’ landscapes. Following debates within geography Randles views scale as *always* comprising multiple, superimposed *social*

constructions. Also addressing the business ethics literature, she investigates the geographic scales relevant to the formation of environmental business ethics. The article suggests that incorporating these perspectives potentially sheds light on some real, practical issues that arise when a range of stakeholders attempt to translate 'ideal' models of industrial ecology into working projects on the ground. For example, such an expanded perspective may help to explain why, despite the best intentions of the actors involved, attempts to policy-push collaborative, synergetic arrangements between geographically proximate business units with the aim of improving resource efficiency across an industrial complex (known generically as industrial symbiosis) remain in practice elusive, patchy and difficult to sustain. However, the author's case study suggests that where there is a scalar alignment between a business and local stakeholders, the successful implementation of voluntary local collaborative resource efficiency/resource savings projects is more likely.

The Ristola and Mirata and Wells and Bristow papers both argue for a fundamental restructuring of industrial production to fit with local scales of consumption and resource availability. Ristola and Mirata advocate a transition to a distributed economy (Johansson *et al.*, 2005) characterised by a localised production system, with small scale flexible units of production. They argue that this form of industrial organisation would assist in the realisation of the potential environmental and economic benefits of IS that have proven difficult to achieve within the context of the conventional economy. Whilst acknowledging other barriers to IS, they argue that the scale of production has been a fundamental issue, limiting benefits to 'incremental eco-efficiency' (p.201). A smaller, more locally focused scale of production, they argue, could more easily take into account local consumption and the local resource base. Importantly, they distinguish this approach from eco-industrial parks. Whereas the latter may be small units of production, they are embedded in the conventional industrial system that is organised at multiple scales. Ristola and Mirata illustrate their arguments with a hypothetical example based on an urban paper mill. Both the economic and environmental viability of the mill is enhanced by its integration with other locally based activities such as power production and waste management.

By contrast, Wells and Bristow are concerned with local and regional competitiveness as barriers to IE. Their concept of eco-localism (see also Bristow and Wells, 2005) resembles the distributed economies approach of Ristola and Mirata (this volume) and Johansson *et al.* (2005), but is distinguished by the concern to integrate the formal and informal sectors of local economies to their mutual benefit. Notwithstanding their sustainability remit, regional development agencies in the UK strive to compete for investment in large scale innovative manufacturing industries, with little regard to local consumption patterns or resource availability. IE, the authors argue, has been overly pre-occupied with by-product exchange as a goal in itself. Thus both groups have failed to comprehend the extent of restructuring of industrial society that is necessary to achieve sustainable local or regional development. Wells and Bristow address the 'alternative economies' literature on the potential significance of social enterprises for regional development. This is illustrated by the example of a Welsh waste exchange run by a charitable trust and a socially owned enterprise, all the profits from which go to the charity. Together, the two organisations help to provide renovated furniture to those who could not afford new, promote awareness of the benefits of recycling and refurbishment and involve potentially marginalised groups such as the unemployed and those with special needs. Wells and Bristow argue that the IE metaphor has been interpreted too

narrowly: “It is as if the focus has been on the large mammals and the primary food chains from grasses upward, at the expense of the smaller insects, bacteria, viruses and fungi that while unseen provide essential contributions to the functioning of the whole system” (p.Y). They prefer an approach more in tune to the needs and resource capacity of localities, significantly incorporating the ‘alternative’ economy beyond the traditional public and private sectors.

As with the previous two papers, Illsley *et al.*'s paper is concerned with matching local scales of production and consumption. Through a focus on environmental justice, Illsley *et al.*, draw attention to the neglect of the social pillar of sustainable development within the IE literature. Encompassing debates over the distribution of environmental risk, quality of life and decision-making processes, the concept of environmental justice is fundamental to sustainable development (*e.g.*, Agyeman and Evans, 2004), but has hitherto received scant attention in IE. Illsley *et al.* show how the application of IE principles could contribute to the alleviation of fuel poverty through their case study of rural Scotland. In Scotland fuel poverty is defined as the need to spend 10% or more of household income on heating (Scottish Executive, 2002). On-site pelletisation of wood by-products from sawmills creates a renewable, clean energy resource from a by-product material. One social benefit of this could be the creation of additional jobs in the timber industry, while the local use of wood pellets as domestic fuel could help to address the fuel poverty in parts of rural Scotland. Notwithstanding the prominence of wood pellets as domestic fuel elsewhere, the authors' uncover market and image barriers to the development of a wood pellet industry in Scotland. They suggest how socially-aware IE policy approaches to the timber industry could help the Scottish Executive succeed in its efforts to tackle fuel poverty and promote sustainable development of the local resource base.

2.2 Policy and institutional context

Irrespective of the theoretical arguments for and against policy initiatives as a means of implementing IE, there have been numerous attempts to harness IE as a tool for regional development (*e.g.*, Deutz and Gibbs, 2004). All of these papers touch on policy to some extent, but policy is considered most directly by Lyons, who addresses the critical issue of how to engage businesses in the formation of policy initiatives. Using a questionnaire survey, Lyons investigated firms' perception of policies ranging from ‘soft’ (*e.g.*, public education) to ‘strong’ (*e.g.*, mandatory regulations). Significantly, his study utilises an industrial sector with an economic interest in industrial ecology practices, *i.e.*, the recycling and remanufacturing sector in Texas. The policy for which there was almost universal support amongst businesses surveyed was public education. The latter was seen as likely to increase awareness of, and demand for, recycled goods, without government ‘interference’ in the operation of businesses in the sector. A more nuanced analysis points to the existence of two types of firm attitude towards government policy: ‘Self-actualising’ firms and ‘Pragmatic’ firms. The former group supported all policy options more strongly than the latter group but there is little indication that specific preferences exist within the ‘self-actualising’ group. At present, ‘Pragmatic’ firms (which tended to be longer established), eschewed government intervention in favour of market forces. The range of attitudes to policies amongst firms within what may appear to be specialist sector is significant. Even within the recycling and remanufacturing sectors,

firms have different interests, in addition to different fundamental views on the utility of government policy. Policy implementation of IE principles within an industrial sector, and even more so across sectors, will need to pursue a variety of approaches, along with the recognition that firms may have fundamentally different philosophical attitudes regarding the efficacy of government policy.

The question of business recruitment to environmental practices is at the core of the paper by Citterio *et al.* The authors consider the potential for the improvement of industry environmental performance in a specific territory and to this end describe and demonstrate a technique to assist local or regional authorities quantitatively identify the locality within their jurisdiction with the greatest need for intervention. Their rationale is that the adoption of voluntary business practices such as environmental management systems is enhanced by policy driven incentives (*e.g.*, Prakash and Kollman, 2004). However, with limited resources, local authorities need to make the best use of available data to determine where within their jurisdiction to prioritise their efforts at engaging business cooperation. This study is based on a policy-driven exercise and was carried out within the constraints presented by the commissioning authorities in charge (the Region of Lombardy and the Union of Chambers of Commerce in Lombardy in Italy). The first step in the procedure is to identify the scope of the study (*i.e.*, the aspects of the environment to be considered). The second step is data collection, followed in step three by the analysis of the validity and availability of the data at the relevant scales. The fourth step is highly critical as it involves the selection and compilation of indices by which the localities are to be compared. Mapping the summary index for each spatial unit (*e.g.*, in this case municipalities) allows for the identification of the most environmentally pressured area(s), as defined by the scope of the study. The final step is the selection of the area to be targeted for intervention. Critically, the success of the intervention depends on the cooperation of a variety of stakeholders, including businesses and local government.

In their paper D'Amico *et al.* also address a policy-driven initiative for environmental improvement within an existing industrial neighbourhood. Social and economic considerations were critical to this initiative in which the ENEA (Italian Agency for Energy, Innovation and Environment) and the City of Venice were the lead partners. The target for the intervention was the Italian Industrial District (IID) of Murano, an historic centre of glass manufacturing. Gertler (1995) recognised that the close-knit social and economic ties characteristic of an IID were influential in the establishment of the Kalundborg industrial symbiosis network. However, the D'Amico *et al.* study is novel in its application of IE to an actual IID. The pre-existing social connections between businesses and other stakeholders in the environmental intervention made possible the application and (ongoing) implementation of a tool for the identification of the best available technology for a specific location (BATTER: Best Available Techniques for a TERRitory). The object was to find practical solutions to the difficulties of meeting new atmospheric and liquid emissions targets without having to relocate a historic industry cluster away from the centre of Venice. The solutions indicated by the application of BATTER involved interfirm cooperation: shared wastewater facilities and a shared pipe for the purchase of by-product gas from a nearby company that previously dealt with the gas as waste. This paper both presents a tool for the identification of a place-based BAT, and indicates the benefits of existing social networks between stakeholders for the successful implementation of IE principles.

The final paper in this collection concerns a major issue of relevance to industrial ecology and regional development – the role of institutions as mediators of exchanges. A region is itself an institutional domain with a complex governance structure – a multitude of organisations and types of organisations that need to cooperate for an IE implementation to be successful, whether the initiative comes from the public or private sector. Miller and Ford use institutional theory to highlight the economic exchanges that necessarily accompany the physical flows inherent to industrial symbiosis. They argue that the role of institutions, (*i.e.*, the rules and practices governing the interactions of individuals, firms and organisations within society), have not been adequately addressed by industrial ecologists. The authors draw on the extensive and diverse literature on institutions within economics and sociology to demonstrate the necessity of contextualising exchanges within an institutional framework. Several real-world examples underline that IE-centred development, if it is to progress, must incorporate analyses of both flows and exchanges and therefore pay heed to the characteristics of institutions.

3 Conclusion

The papers in this collection represent a wide variety of approaches to the conjuncture of IE and regional development. In doing so they help to take forward the development of the social science side of IE that has been important to this journal from its inception (Korhonen, 2004). We have identified two themes running through the papers in this collection: scale and the policy and institutional context of IE implementation.

The papers on scale are testament to the complexity of the global economy and the varied ways in which it is manifested locally. Randles significantly advances the theorisation of scale in IE by drawing on the geography literature on multi-scalar landscapes. Both the papers by Ristola and Mirata and Wells and Bristow argue that IE cannot be implemented on a local to regional scale unless production is restructured with due regard to local scales of consumption and resource availability. Ristola and Mirata illustrate the potential advances in industrial symbiosis that could be made under the distributed economy model that they have contributed to. Wells and Bristow and Illsley *et al.*, emphasise the social aspects of IE drawing respectively on the alternative economies and environmental justice literatures. These papers stress the importance for IE of not just a social science approach to studying industry and the environment, but of extending its world view to incorporate social concerns.

The complexity of firm organisation and interaction in different places and how this relates to the potential for IE policy implementation and regional development is highlighted in the second set of papers. Lyons demonstrates that attempts at IE regional development policy needs to be cognisant of differences in the perception of policy needs among similar firms whilst Citterio *et al.*, develop a systematic, but flexible methodology, that can be used to identify which regions need what type of IE interventions. Similarly, D'Amico *et al.*, and Miller and Ford highlight the need to account for differences in the governance structures within which firms interact. Drawing from the extensively documented cultural interactions of firms in IIDs (see for example, Becattini, 1990), D'Amico *et al.*, point to the importance of working within the particular social milieu (*i.e.*, cultural norms and practices) of industrial clusters to achieve

successful IE practices. Miller and Ford also highlight the necessity of being aware of the rules, norms and governance structures (including unequal power relations and vested interests) that lie behind the exchanges that accompany the physical flows central to IE policy.

Whilst IE forges its own identity within the field of social science enquiry, a vital stepping point is to acknowledge and incorporate the contribution of other disciplines (e.g., Vermeulen, 2006). These papers, through their varying perspectives on regional development, point to the complexities involved, but also insights that can be gained from attempting to do that.

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References

- Agyeman, J. and Evans, B. (2004) "Just sustainability": the emerging discourse of environmental justice in Britain?, *The Geographical Journal*, Vol. 170, No. 2, pp.155–164.
- Amin, A. (1994) 'Post-Fordism: models, fantasies and phantoms of transition', in A. Amin (Ed.) *Post-Fordism: A Reader*, Oxford: Blackwell, pp.1–33.
- Andrews, C.J. (1999) 'Putting industrial ecology into place; evolving roles for planners', *Journal of the American Planning Association*, Vol. 65, pp.364–375.
- Becattini, G. (1990) 'The Marshallian industrial district as socio-economic notion', in F. Pyke, G. Becattini and W. Sengenberger (Eds.) *Industrial districts and inter-firm co-operation in Italy*, Geneva: International Institute for Labour Studies, pp.37–51.
- Boons, F.A.A. and Baas, L.W. (1997) 'Types of industrial ecology: the problems of co-ordination', *Journal of Cleaner Production*, Vol. 5, Nos. 1–2, pp.79–86.
- Bristow, G. and Wells, P. (2005) 'Innovative discourse for sustainable local development: a critical analysis of eco-industrialism', *International Journal of Innovation and Sustainable Development*, Vol. 1, Nos. 1–2, pp.168–179.
- Chertow, M.R. (1999) 'The eco-industrial park model reconsidered', *Journal of Industrial Ecology*, Vol. 2, No. 3, pp.8–10.
- Chertow, M.R. (2007) "Uncovering" industrial symbiosis', *Journal of Industrial Ecology*, Vol. 11, pp.11–30.
- Cohen-Rosenthal, E. (2003) 'What is eco-industrial development?', in E. Cohen-Rosenthal and J. Musnikow (Eds.) *Eco-industrial Strategies: Unleashing the Synergy Between Economic Development and the Environment*, Sheffield: Greenleaf Publishing, pp.14–29.
- Côté, R.P. and Cohen-Rosenthal, E. (1998) 'Designing eco-industrial parks: as synthesis of some experiences', *Journal of Cleaner Production*, Vol. 6, pp.181–188.

- Cumbers, A. and MacKinnon, D. (2004) 'Introduction: clusters in urban and regional development', *Urban Studies*, Vol. 41, pp.959–969.
- Desrochers, P. (2002) 'Cities and industrial symbiosis: some historical perspectives and policy implications', *Journal of Industrial Ecology*, Vol. 5, pp.29–44.
- Deutz, P. and Gibbs, D. (2004) 'Eco-industrial parks and economic development: industrial ecology or place promotion', *Business Strategy and the Environment*, Vol. 13, pp.347–362.
- Dunn, B.C. and Steinemann, A. (1998) 'Industrial ecology for sustainable communities', *Journal of Environmental Planning and Management*, Vol. 41, No. 6, pp.661–672.
- Frosch, R.A. and Gallopoulos, N.E. (1989) 'Strategies for manufacturing', *Scientific American*, Vol. 261, pp.94–102.
- Gertler, N. (1995) 'Industrial ecosystems: developing sustainable industrial structures', MSc thesis, MIT, <http://www.smartcommunities.ncat.org/business/gertler2.shtml> (accessed 5 March 2007).
- Gibbs, D. (2002) *Local Economic Development and the Environment*, Routledge: London.
- Gibbs, D. and Deutz, P. (2005) 'Implementing industrial ecology? Planning for eco-industrial parks in the USA', *Geoforum*, Vol. 36, pp.452–464.
- Harvey, D. (1989) 'From managerialism to entrepreneurialism: the transformation of governance in late capitalism', *Geografiska Annaler*, Vol. 71B, pp.3–17.
- Johansson, A., Kisch, P. and Mirata, M. (2005) 'Distributed economies – a new engine for innovation', *Journal of Cleaner Production*, Vol. 13, pp.971–979.
- Korhonen, J. (2002) 'Two paths to industrial ecology: applying the product-based and geographical approaches', *Journal of Environmental Planning and Management*, Vol. 45, pp.39–57.
- Korhonen, J. (2004) 'Theory of industrial ecology', *Progress in Industrial Ecology*, Vol. 1, Nos. 1–3, pp.61–88.
- Lowe, E. (2001) 'Eco-industrial handbook for Asian developing countries', A Report to Asian Development Bank, Environment Department, Indigo Development, Oakland, CA, <http://indigodev.com/Handbook.html> (accessed 16 May 2007).
- Martin, S.A., Cushman, R.A., Wetz, K.A., Sharma A. and Lindrooth, R.C. (1998) 'Applying industrial ecology to industrial parks: an economic and environmental analysis', *Economic Development Quarterly*, Vol. 12, pp.218–237.
- Porter, M. (1990) *The Competitive Advantage of Nations*, London: Macmillan.
- Prakash, A. and Kollman, K. (2004) 'Policy modes, firms and the natural environment', *Business Strategy and the Environment*, Vol. 13, No. 2, pp.107–128.
- Schlarb, M. (2001) *Eco-industrial Development: A Strategy for Building Sustainable Communities*, Washington DC: US Economic Development Administration.
- Scottish Executive (2002) *Scottish Fuel Poverty Statement*, Edinburgh: Scottish Executive.
- Sterr, T. and Ott, T. (2004) 'The industrial region as a promising unit for eco-industrial development – reflections, practical experience and establishment of innovative instruments to support industrial ecology', *Journal of Cleaner Production* Vol. 12, pp.947–965.
- Vermeulen, W.J. (2006) 'The social dimension of industrial ecology: on the implications of the inherent nature of social phenomena', *Progress in Industrial Ecology*, Vol. 3, No. 6, pp.574–598.
- Wolf, A., Eklund, E. and Soderstrom, M. (2005) 'Towards co-operation in industrial symbiosis: considering the importance of the human dimension', *Progress in Industrial Ecology*, Vol. 2, No. 2, pp.185–199.