
Editorial: sustainability networks

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Abstract: At the level of society, the concept of sustainable development can be divided into three facets, namely protection of the natural environment, maintenance of economic vitality, and preservation of social sustainability. However, at the company level, sustainability refers to the integration of ecological and social aspects into decisions that focus on the core business activities of the firm. The concept of sustainability networks extends the normal intraorganisational corporate social responsibility and corporate environmental management to interorganisational approaches. Sustainability networks are local/regional systems of voluntary and organised cooperation among different stakeholders exhibiting a common vision of sustainable development, and are organisational frameworks at the meso-level, allowing a wide variety of different forms of interorganisational cooperation for sustainable development. The contribution of this editorial article is to show how the concept of sustainability networks relates to the theory of Industrial Ecology (IE) and how the individual articles in this special issue can be reflected upon the concept of sustainability networks.

Keywords: industrial ecology; sustainable development; networks; sustainability networks.

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1 Introduction

This special issue of *Progress in Industrial Ecology – An International Journal* (PIE) is devoted to the concept of sustainability networks, a framework for interorganisational cooperation for sustainable development. The term 'sustainability networks' is a synthesis of two rather vague and unclear expressions. Sustainability is a term often used (and also abused) for many different interpretations, and is often more dialectical than analytical (Daly, 1996). Therefore, in Section 2 of this editorial article, the concept of sustainable development and its dimensions will be outlined. Here, it will be necessary

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to distinguish between sustainability at society and at industry level. The logic of decision-making within single enterprises, and hence, the way of perceiving and integrating the normative aspects of the concept of sustainability at this level, obviously differ from related processes occurring at society level. Consequently, statements related to sustainability which are true at society level might be false or at least in need of critical reinterpretation at industry level.

The term 'network' is also quite vague. At a most abstract level, networks can be defined as the totality of nodes or positions, which represent entities such as individuals, households, companies, associations, or other types of organisations, and links. They symbolise some kind of interaction or interrelation among the positions/entities. Sydow even states that almost any empirical phenomenon can be considered as a network (Sydow, 1992). Networks are nothing more than a methodological construct of the researcher. The researcher has to decide what object of investigation should be understood as network; and determine how the boundaries of this object are to be defined. "The point here is that the entire economy may be viewed as a network of organisations [...]" (Thorelli, 1986,p.38).¹

Nevertheless, there are many voices postulating the importance of networks for sustainable development. Roome (2001) argues that environmental problems and poverty, i.e., problems of unsustainability, are examples of meta-problems. Such problems are constituted by smaller sets of complex problems. The systems context for the problems of unsustainability is, at best, only partially appreciated by an individual organisation. A response to an individual problem may provide immediate short-term relief, but usually affects other connected problems. Therefore, Roome maintains that responses to meta-problems need to be coordinated through the interaction among many organisations. Interorganisational cooperation and networking are critically important for the meta-problems comprising the social and environmental dimensions of sustainability. (Korhonen et al., 2004)

Thus, in Section 3 of this paper, an attempt will be made to define more clearly the term 'sustainability network'. Then, a short overview of the papers in this special issue of *PIE* will be provided and the papers will be reflected upon the concept of sustainability networks. These papers describe different perspectives on sustainability networks, and provide valuable contributions to this increasingly important research field. In the concluding remarks, some major questions concerning sustainability networks, their organisation, and their management indicate areas in need of future research.

2 Sustainable development

In the industrial ecology conceptual framework established by Allenby, the vision of sustainable development occupies the highest level, while at the "second level is industrial ecology, the multidisciplinary study of industrial systems and economic activities, and their linkages with fundamental natural systems" (Allenby, 1999; 2000,p.165). This shows the great importance of the (normative) concept of sustainable development for the field of industrial ecology, and also, the potential contribution of industrial ecology to sustainability. In this section the concept of sustainable development and its implications for companies are briefly discussed, before moving on to the meso-level of networks.

2.1 *The dimensions of the concept of sustainable development*

The central document, on which the concept of sustainable development is based, is the final report of the World Commission on Environment and Development in 1987. It is named after the chairperson of the commission, the then prime minister of Norway Gro Harlem Brundtland (WCED, 1987). The central position of this report can be justified by the argument that this commission was mandated by the General assembly of the UN to create a worldwide programme of change. Based on long-term considerations, strategies to solve environmental problems and to identify possibilities for cooperation between nations at different stages of economic and social development were to be created. Moreover, the Brundtland report provided the basis for convening of the UN Conference on Environment and Development at Rio de Janeiro in 1992. At this conference, Agenda 21, a binding and comprehensive determination of political goals for the international community of nations, was formulated. The central definition of the Brundtland report is as follows:

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (WCED, 1987,p.43)

While this sentence is still very often cited, the remarks that explicate the concern of the Brundtland report, and follow directly upon the above statement, have received far less attention, i.e.,:

“It contains within it two key concepts:

- 1 the concept of ‘needs’, in particular the essential needs of the world’s poor, to which overriding priority should be given
- 2 the idea of limitations imposed by the state of technology and social organisation on the environment’s ability to meet present and future needs.

Thus, the goals of economic and social development must be defined in terms of sustainability in all countries – developed or developing, market-oriented or centrally planned. Interpretations will vary, but they must share certain general features and they must flow from a consensus on the basic concept of sustainable development and on a broad strategic framework for achieving it.” (WCED, 1987,p.43)

Hence, the concept of sustainable development attains considerable additional complexity, since the desire to preserve resources for future generations and to address their needs is directly connected to the desire to meet the essential needs of the world’s poor. It is explicitly and unmistakably stated that not only intergenerational but also intragenerational justice is part of the concept of sustainable development (Busch, 2001; Vornholz, 1998). To date, in many scientific works in the field of sustainable development, only the aspect of intergenerational justice and the resulting demand for environmental protection have been considered. The question of intragenerational justice has been largely overlooked. It is true that this selective focus on saving natural resources offers some advantage in that there quite clear ideas and principles in dealing with the natural environment have been developed, while the goals and principles of social sustainability still remain very vague and inconsistent (Busch, 2001).

In recent years, an understanding of the concept of sustainability has been established that consists of three dimensions: the protection of the natural environment, the maintenance of economic vitality, and observance of specific social considerations.

Consequently, sustainable development is no longer synonymous with environmental protection. The ecological question of resource management is no longer treated in isolation, but has become integrated as an important part of the comprehensive question of societal development. Moreover, it is even stated now that the three dimensions of sustainability, i.e., ecological, economic, and social development, are of equal importance. Thus, there is no justification for prioritising one area over others. However, the 'equal' is very difficult to determine, because the three dimensions of sustainable development are qualitatively different (e.g., costs, profits vs. social bonding, community vs. CO₂ emissions etc.) (Korhonen, 2003a).

In this broader concept of sustainable development, the interrelations and interactions between the three dimensions need to be determined and considered. For example, a maximum of environmental protection that leads to a collapsing economy and social unrest is as unsustainable as promoting high economic growth at the cost of ecocide and social injustice. But the simultaneous consideration of the three dimensions of sustainability makes the concept difficult to apply. In practice, problems are often overlooked by simply focusing on the positive effects in all three dimensions. Common slogans such as 'profit by environmental protection', 'environmental protection through economic growth', or 'social justice through economic growth' are invoked in order to imply that interrelations among the dimensions are always positive. Although it certainly makes sense to direct one's attention to such fields of action where positive effects can be achieved in more than one dimension of sustainability, it cannot be denied that trade-offs among the dimensions also exist. Measures directed at one dimension of sustainability can definitely have a negative impact on the others.

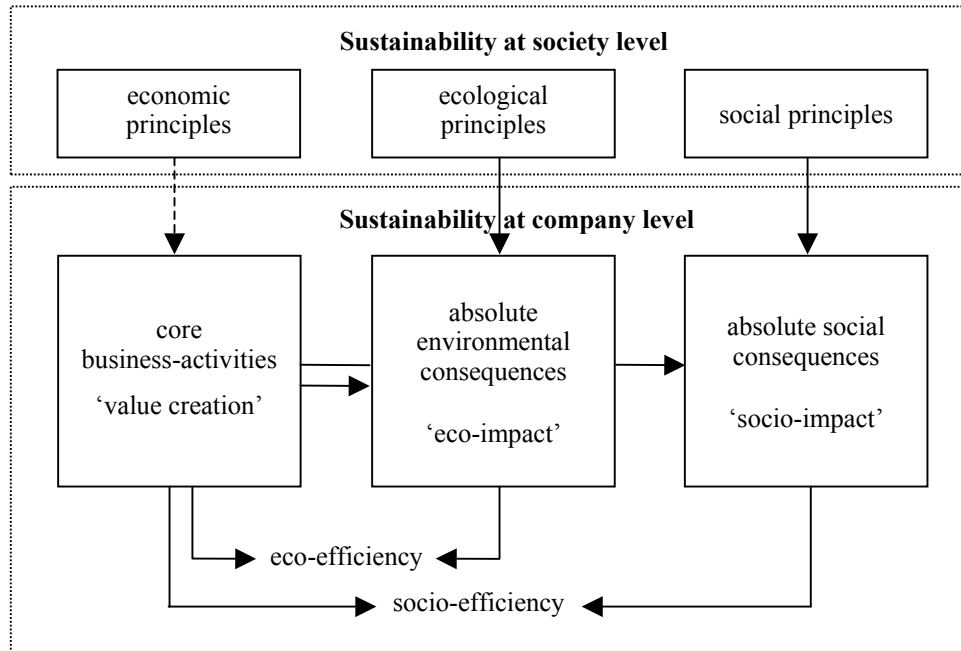
Hence, in practice, the need to establish implicit or explicit weighting for each dimension becomes necessary. It is not satisfactory to once again reduce the concept of sustainability to matters of environmental protection alone. The conscious exclusion of two dimensions of sustainable development is not a proper solution to the problem of dimensional weighting. On the other hand, there are also claims for a more complete taxonomy of sustainability dimensions, e.g., by splitting up the environmental dimension into thermodynamic, environmental, and ecological criteria (Seager and Theis, 2004). However, it is beyond the scope of this paper to venture into this debate and the overall three broad categories will be used.

The search for scientific models and definitions of sustainability entail the danger of diverting attention away from the urgency of taking real measures for achieving sustainable development in society (Graap, 2001; Korhonen, 2003a). Here, it would appear helpful to take the inherent dynamic of sustainable development into account and view it as a "form of ongoing inquiry" (Laws et al., 2002,p.5): "...sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investment, and institutional change are made consistent with future as well as present needs" (UN, 1992,p.9). This definitely does not allow for optimisation, but if the general direction towards sustainability or the direction away from unsustainability is known (Korhonen, 2004b,p.810), at least heuristic improvements, i.e., an approximation, will be possible. For this, awareness that each individual is responsible for the well-being of current and future fellow beings' needs to be created. Both individual and social activities need to be organised in a way that they represent a general rule for guidance both in an intergenerational and geographical sense.

2.2 Sustainability in industry

However, the concept of sustainability as discussed above cannot be directly applied to single companies. In general, firms conduct their core business activities with the overall goal of earning profits and ensuring the long-term existence of the enterprise. These activities can have a negative impact on the natural environment and society, and thus conflict with the principles of sustainability. Therefore, in orienting single enterprises towards sustainability, firm activities should be screened first, in terms of their environmental and social impact. In single enterprises, the topic can be relevant in terms of ethics or strategy. Ethical reasons imply the need for a conscious orientation of the company's activities with respect to basic values and norms, whereas strategic reasons focus on improvements in the company's productivity and efficiency, on matters of legitimacy and acceptance by important groups of stakeholders, on reduction of risks and uncertainties as well as the generation of new market-possibilities and opportunities for innovation (Bieker et al., 2001; Tschandl, 2003). While it is certainly true that at individual company level, the goals for potential sustainability are based on social and environmental sustainability problems of society, these still need to be transformed into individual company goals suited to the specific company's business activities (Strebel, 1997). In other words, the central objective is to reduce the ecological and social 'footprint' of the company, and possible strategies that can be applied to try and achieve this objective include eco-efficiency and socio-efficiency (Dyllick, 2003).

Eco-efficiency is defined as the ratio of the positive economic output of company activity to the respective adverse ecological impact (Schaltegger and Sturm, 1992; Figge and Hahn, 2001). Analogously, socio-efficiency refers to the ratio of positive economic impact to adverse social impact. It is important to realise here that neither for natural nor for social systems do the relative impacts in regard to the companies' economic success count, but only absolute impact. Employing eco- and socio-efficiency as the overall goals of the company is problematic, because reduced costs in production achieved through efficiency can lead to reduced prices of end products. This, in turn, can create increases in demands and consumption. Eventually, the negative environmental and social effects of the overall economic growth can exceed the gains created by eco-efficiency and social efficiency, i.e., the "rebound effect" (Korhonen, 2003a; Cerin, 2004). Further, it can be argued that the efficiency concept does not target the root of the problem, e.g., existing consumption habits and lifestyles, but tends rather to reinforce economic logic (Störmer, 2001). As indicated in Figure 1, sustainability at company level always needs to be focused also on absolute improvements in regard to its ecological and social consequences, i.e., the attainment of lower eco- and socio-impact (Dyllick, 2003). Hence, it is certainly not legitimate to define sustainability in terms of greater eco-efficiency alone. The eco-efficiency approach has potential for improvement in industry, but is not an absolute or perfect tool for sustainable development (Korhonen, 2004b; 2003a).

Figure 1 Interrelations between sustainability at society and at company level

Although the integration of all three dimensions of sustainability is clearly desirable in terms of developing a comprehensive management system, the above figure shows that the theoretical claim for equal importance of the three dimensions does not make sense at all at company level. The idea of a separate economic dimension of sustainability for single firms would not lead to greater insight than that found in traditional business literature, since it is already a core idea here. Sustainability at company level means nothing more and nothing less than the continuous relative and absolute reduction of the negative environmental and social impacts of business activities. There is no need to convince company decision-makers to consider also the economic dimension of sustainability in addition to the ecological and social ones. From a business perspective, the basis of sustainable development is economic success, maybe even growth, i.e., in company decisions the achievement of the core business goals, e.g., maintaining customer relationships, attracting talented employees, or integrating technological improvements for cutting costs, always is of main interest. Consequently, what makes a difference between traditional management practices and sustainable management is the consideration of environmental and social aspects in company decisions. On the contrary, the application of the three-dimensional concept of sustainability at company level implies the danger that ecological and social goals are neglected in cases where economic profit is not achieved (Lübke, 2003).

The measures necessary for this continuous process of improvement can be taken in different fields of activity. For example, special emphasis can be given to the ecological and social effects of activity undertaken by single company divisions or production processes, or by the whole factory or enterprise, or of activities of a product system throughout the life cycle ('from cradle to grave'). Depending on the field of activity, different targets need to be set and different persons or groups of persons are involved.

While some activities like process improvements often can be achieved by the production department in isolation, many activities, for instance, eco-design, require the cooperation of different departments, or even of different companies or industries. Here, the concept of sustainability networks becomes important.

3 Sustainability networks

In the literature, there seems to be broad consensus regarding the importance of company networks in achieving sustainable development. For example, *Sinding* states that firms need to move beyond a narrow intraorganisational approach if they are to contribute significantly to goals of sustainability and they need to proactively adopt an interorganisational approach (Sinding, 2000). Company networks are regarded as an appropriate point of departure in coping with the challenge of sustainable development. From a global perspective, they are considered as an important 'stepping stone' on the way to sustainability (Kirschten, 2003). Others state that cooperation under the aegis of sustainability is essential since it supports overall structural change in the direction of sustainable development of regions or product systems (Liedtke and Rohn, 2003).

The central theme in the field of Industrial Ecology (IE) is systemwide and network-covering description and analysis of the physical flows of matter and energy. Therefore – and because the flows cross process, firm and regional boundaries and borders – the central theme should also be interorganisational cooperation for reducing negative environmental effects of industry. What I mean here is that we should take the network and the systems approach into account not only in the description of the material and energy flows, but also in the consideration of the human dimension of the networks, the actors and the decision-makers in industrial ecosystems (Korhonen et al., 2004). For example, Boons and Baas argue that the concept of industrial ecology:

“essentially calls for an integrated approach towards the environmental effects of industrial processes, rather than aiming at the reduction of the effects of separate industrial processes. An implication of this perspective is that the organisations responsible for the processes that are subject to this integrated approach should somehow coordinate their activities.” (Boons and Baas, 1997,p.79)

In this context, Roome talks about the necessity of building a network as “meta-textual organisation, which seeks to address the meta-problem of sustainable development, through the multiple interactions arising from a highly networked inter- and intraorganisational fabric” (Roome, 2001,p.72). Harris and Pritchard even state that a “regional IE network has the potential to provide an umbrella for any sustainability or resource efficiency initiatives in the area” (Harris and Pritchard, 2004,p.99).

This special issue of *Progress in Industrial Ecology – An International Journal* is also devoted to networks for sustainable development – to the concept of sustainability networks. But before discussing the contributions in this area, the following subsection first provides a few thoughts on the problem of defining sustainability networks.

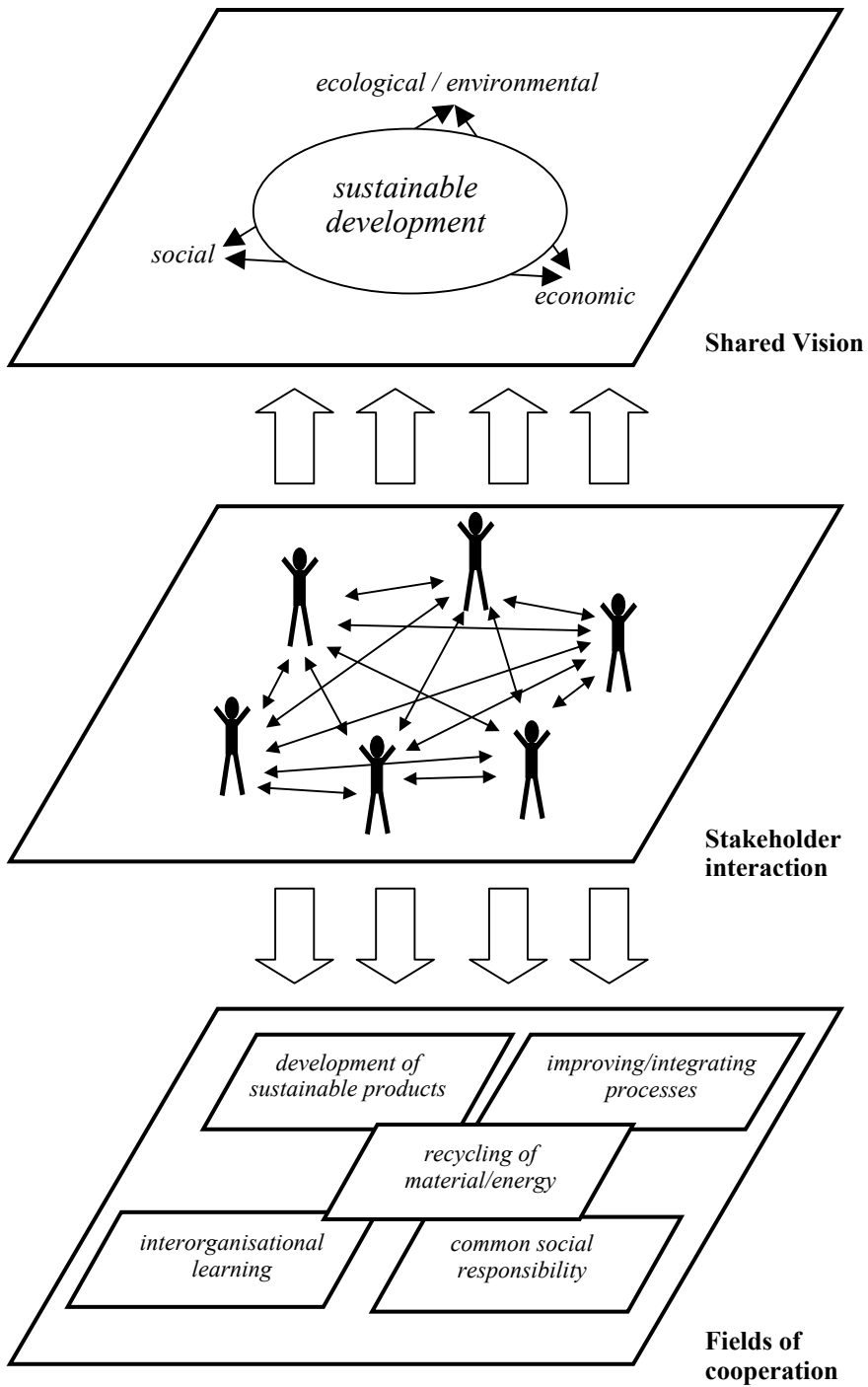
3.1 Definition of sustainability networks

Sustainability networks are defined as *local/regional systems of voluntary but organised cooperation among different stakeholders exhibiting a common vision of sustainable development*. As shown in Figure 2, the concept of sustainability networks can be distinguished in three layers. The most important layer is the stakeholder layer in the middle of the picture. It symbolises that integration of and interaction among stakeholders are the most essential starting points of sustainability networks, both logical, i.e., in terms of an if-then-relation, and temporary, i.e., in terms of a before-after-relation. Only on the basis of this stakeholder interaction can a common vision of sustainable development, symbolised by the upper layer, be established. Further, only if the integrated stakeholders share this vision, cooperation for sustainable development will take place. The lower layer symbolises different fields of possible cooperation between the stakeholders. Here, it is worth to mention that the vision layer is not directly connected with the cooperation layer. Instead, the stakeholder layer is in-between. Again, this means that stakeholder interaction is needed to transform the normative aspects of the shared vision for sustainable development into concrete action, such as interorganisational recycling activities, cooperation on the development of sustainable products, or on improving and integrating processes, common acceptance of social responsibility, or promotion of interorganisational learning and knowledge generation.

In fact, this strong focus on stakeholder interaction and cooperation, on the creation of a common vision by these stakeholders, and on decisions for concrete cooperation made by these stakeholders is the main innovation in comparison with other chartings of industrial ecosystems. For example, in the diagram, the picture describing the vision of an industrial ecosystem by Korhonen (2004b,p.814), '*roundput*' – the utilisation of waste material, renewables and waste energy in cooperation – is at the centre, leading to environmental, economic, and social wins. Furthermore, the systems or network approach in the classic texts of Frosch and Gallopoulos (1989) and Graedel and Allenby (1995) is mainly presented highlighting the physical flows of matter and energy and their cyclical, circular and cascading flows.

In contrast, in Figure 2 interorganisational recycling is only one possible practical field of cooperative activity among others. With the concept of sustainability networks, the main attention is thus drawn away from waste and material flows towards the interaction and cooperation of the network actors who initiate interorganisational recycling or other forms of cooperation on the basis of the vision for sustainable development shared by them. I want to argue that the essence of sustainability networks is the focus on the human actors, the stakeholders and the cooperative culture created and maintained by them. Recycling and cascading of the physical flows of matter and energy are only one possible practical and concrete outcome that such a cooperation culture can eventually yield. The meaning of the definition of sustainability networks and its main constituent elements need to be established in more detail. This is done below.

Figure 2 Three levels in the concept of sustainability networks



Stakeholders, symbolised by the middle layer of Figure 2, are understood as ‘persons or groups of persons who pursue interests in the context of the (sustainable) development of the specific system (region or organisation) or who are affected positively or negatively by the activity under investigation’. This definition differs considerably from the original version of the Stanford Research Institute, according to which stakeholders are defined as ‘those groups without whose support the organisation would cease to exist’. It is much closer to the extended definition of Freeman, whereby “any group or individual who can affect or is affected by the achievement of the organisation’s objectives’ can be called a stakeholder” (Freeman, 1984).

Membership in sustainability networks is voluntary, since compulsory membership would obviously be highly counterproductive. Certainly, in some cases, regulations might be necessary to enforce greater coordination and cooperation between certain actors or institutions. But here, sustainability networks are understood as an organisational framework that enables stakeholders for proactive cooperation towards sustainability and not only for mere legal compliance. But why should private persons or groups, companies or even public or governmental organisations take part in a sustainability network? In general there are two possible motives for membership:

- 1 On the one hand, there can simply be economic reasons, i.e., whenever activities within the sustainability network also lead to profits. In fact, (successful) interorganisational recycling activities between companies within a recycling network are a good example of environmentally and economically advantageous behaviour. Recycling networks such as those in Styria would never have developed if there had not been clear economic advantages for the firms involved, e.g., lower prices for recycled materials than for raw materials or cheaper/safer disposal of by-products.
- 2 On the other hand, it cannot be denied that economic, environmental, and social win-win-win situations for all stakeholders do not always exist. Hence, the objective of sustainable development needs to be a normative one. In terms of Kant’s categorical imperative it becomes obvious that caring for future well-being is an ethical obligation for the whole of society. Sustainability means more than saving costs or reducing company risks. It means to act responsibly towards our fellow men and descendants ensuring that they will be able to satisfy their needs and human aspirations (Ehrenfeld, 2000).

In addition, the need for a relevant sustainability oriented vision, symbolised by the upper layer in Figure 2, is deemed to be an essential criterion in defining sustainability networks. This is, of course, problematic. First, the existence of a suitable network vision presumes the existence of some authority that is empowered to define what forms such a vision might take, e.g., a network agency, a focal hub firm, or a committee consisting of representatives of the network members. Further research is definitely needed on the question of who sets or should set the network’s visions and goals. The more important self-organising elements in sustainability networks are considered to be, the less plausible it is that such an authority exists. Second, it can be questioned whether a vague concept such as sustainability which can have different implications for different types of systems, e.g., at society level and at company level, is adequate at all as the main element of a vision of any kind of organisation or network. Certainly, sustainability is not a fixed end state, nor is it a clearly defined and deterministic path of development. In this respect,

Korhonen talks about a paradigmatic, metaphoric, and normative stage of sustainability, that has to be distinguished from an analytical and descriptive stage (Korhonen, 2003b; 2002).

Because of this vagueness with respect to sustainability, or more precisely this stage of the sustainability paradigm, it can still be used as guiding idea, a kind of complex symbolic system that helps the network actors to define their perceptions of reality and to structure their thoughts and actions (Schneidewind, 2003). It is especially within complex systems that such guiding ideas are considered as important for indirect regulation of the system. Hence, the vagueness of the concept of sustainability can even be evaluated positively (Gärtner, 2003), since “[...] most important concepts are not subject to analytical precise definition – think of democracy, justice, welfare, for example. Important concepts are more dialectical than analytical [...]” (Daly, 1996,p.2). Boons and Roome (2000,p.53) state that:

“the concept of sustainable development [...] appeals to many people precisely because the ‘openness’ of the definition enables people to construct and contribute to the process of defining what sustainable development entails. This is its most important feature, because it enables actors who wish to work on the goal and process of sustainable development to be involved in discussion of what the concept means to the parties involved.”

The alternative to using vision as a defining characteristic in sustainability networks would be to use the real actions taken within the network, which are symbolised in the lower layer in Figure 2. Unfortunately, such an approach to defining sustainability networks creates even bigger problems: It would be necessary to define which kind of action contributes or does not contribute to sustainable development (see Korhonen and Strachan, 2004). Consequently, this would link the definition of sustainability networks to the still ongoing discourse on sustainability oriented assessment criteria and methods and thus make the definition nonoperational. Ehrenfeld even states that sustainability can never be really measured: “It is possible only to know if the world *has been* sustainable by only looking backward. To determine if it *will be* sustainable, one must divine the future by looking at a crystal ball” (Ehrenfeld, 2000,p.232). Hence, despite the drawbacks mentioned above, the existence of a sustainability-oriented vision seems to be an appropriate criterion for defining sustainability networks, or more precisely a sustainability-oriented network.

3.2 Papers in the part I of the special issue

This editorial article starts the Section I of this special issue, ‘*The Concept of Sustainability Networks*’. The contribution by *Strebel* and *Posch* uses the concept of regional recycling networks as a possible starting point for the more comprehensive form of cooperation within sustainability networks. It seems quite obvious that companies which cooperate in interorganisational recycling activities might already have an attitude conducive to starting other forms of collaboration for sustainable development. Although waste exchange relationships within existing recycling networks might be initiated mostly for economic reasons, such cooperation can also contribute to the efforts to achieve such visions as those in the ‘circular economy’ and the ‘roundput model’ as opposed to the linear throughput flow of matter, the dominant model of material flows in society. Thus this cooperation contributes to environmental protection in industry. Moreover, the social dimension of sustainability is also taken into account in

interorganisational collaboration within sustainability networks. In this paper it is stated that it is most crucial to develop a network vision that is shared by all members of the sustainability network. Only from this basis, objectives and concrete collaborative actions towards sustainable development within the network can be derived.

Walther and *Spengler* based their findings on detailed empirical research on product recovery networks. On the basis of a general analysis of the treatment of waste electrical and electronic equipment, they analysed seven German disassembly networks. From this research, they derived valuable recommendations for preservation, redesign, and further development of existing decentralised treatment systems, which support small- and medium-sized enterprises in anticipating change, and also help political decision-makers establish proper conditions for sustaining these network structures.

Besides the recycling networks described in the papers mentioned above, there are also other possible starting points for analysing sustainability networks. In Section II 'Stakeholder Orientation', there are two papers that emphasise the importance of stakeholder demands for defining a sustainability vision and strategy in industry. In his paper, *Boons* takes as starting point the system(s) in which a single firm is embedded, and focuses on the firm as an actor developing a strategy towards sustainability. In terms of a systems perspective, he emphasises the importance of addressing the web of stakeholder relations in creating innovations in more sustainable technologies. Engaging with stakeholders, the corporation can acquire a legitimate position within society. Strategically focused stakeholder dialogue and management, for which *Boons* provides a general framework, become crucial in integrating different stakeholders with different capabilities in order to promote system change towards sustainability. *Boons* states that continuous stakeholder engagement helps companies to define a sustainability strategy and to find a balance between ecological, social, and economic values. This, in fact, is an interesting link to the concept of sustainability networks.

Kovács also applies the stakeholder approach to arrive at what he calls 'demand network for sustainability'. He convincingly brings forward the argument that a supply chain management (and life cycle) view of corporate sustainability, so-called cradle-to-grave thinking, has substantial limitations, and hence needs to be extended to incorporate other stakeholders such as competitors, governmental organisations, etc. Vertical, horizontal, and lateral cooperation have the potential to drive sustainability questions within a demand network in a proactive manner. Hence, *Kovács*' paper also emphasises the most important issue of stakeholder interaction for developing a sustainability vision and strategies. In this way, the paper provides a better understanding of the importance and the interrelations among different actors regarding sustainability, not only at company level but also at network level.

The Section III of this issue of *PIE* focuses on the 'Industrial ecosystems, communities and social networks'. In her paper, *Lindfelt* explores the ethical basis for sustainability networks by asking whether ethical codes are used strategically for network positioning of firms. Referring to *Granovetter*'s concept of social embeddedness she establishes an innovative conceptual framework of ethical embeddedness of firms within business networks. By assessing five organisations in the Finnish forestry/forest industry, she was also able to apply a qualitative and explorative research approach, and arrives at some interesting conclusions, i.e., strong institutional arrangements might undermine trustworthy behaviour within the network. This strengthens the argument that the development of a common network culture and sustainability vision might be able to

substitute the need for detailed contracts or even regulatory pressure for cooperation towards sustainability.

Although it does not start from the point of view of a single company, the approach centred on the concept of Eco-Industrial Networking (EIN) also leads to a network structure, similar to that found in the single company perspective, i.e., a structure supporting collaborative partnerships between businesses, local governments, and the wider community resulting in more efficient and ecological resource use. In their paper, *LeBreton*, *Côté*, and *Casavant* focus on small-scale eco-industrial networking, which is intended to yield the same economic, social, and environmental benefits as in the larger setting, and at the same time bridges the gap between business and the wider community. The authors use a case study to examine the opportunities for applying small-scale EIN, and also present the various possible benefits for network members resulting from the integration of economic, social, and environmental aspects. In fact, the potential role of small business associations and of community-based organisations needs also to be strongly considered in sustainability networks.

4 Concluding remarks

As described above, the concept of sustainability networks can be a flexible organisational framework for different kinds of interorganisational cooperation efforts aimed at achieving sustainable development. Nevertheless, many very important questions about the organisation of sustainability networks remain unanswered: For example, who runs a sustainability network? Does it have a management board? Is there an authority that has the power to take decisions on behalf of all the network participants? In the REMS concept (regional environmental management system) developed by Welford, a conversion plan development team, with representatives from local communities and industries, and from local government, are supposed to set environmental targets and protocols at all levels (Welford, 1996; 2004). In recycling networks, waste management agencies established as public-private-partnerships can be authorised to take certain decisions on behalf of the network companies. See for example the case of Oldenburger Münsterland, briefly described in the paper by Strebel and Posch in this issue of PIE.

Generally, in public-private-partnerships for sustainable development, a high degree of trust is needed to help offset the adverse impact of possible asymmetric power-dependence relations (von Malmborg, 2003). Burström and Korhonen argued in a paper on Municipal Environmental Management (MEM), that a municipality could also serve as an institutional 'anchor tenant', providing the regional IE effort with the necessary institutional support (Burström and Korhonen, 2001,p.36). In contrast, in the case of a strategic network a focal enterprise, a hub-firm might dominate and lead the network (Sydow, 2003,p.301). For example, in the product chain of milk packaging in the Netherlands, chains of supermarkets have considerable power over the dairy producers so that they determine decisions within the network to a large extent (Boons and Baas, 1997, pp.83–84).

No doubt, there could also be networks that evolve with a high degree of self-organisation. Referring to the Industrial Symbiosis in Kalundborg and other similar cases, Desrochers doubts that public planning can outperform the decentralised coordination of the marketplace (Desrochers, 2002,p.39; see also his paper in the

forthcoming Part II of this special issue). In such systems, planning and goal setting cannot take place, at least not in the conventional way (Posch, 2004). Sustainability networks also need to be thought of as evolutionary and self-organising systems (Baldwin et al., 2004). In the face of such considerations, the question arises, as to how and whether an 'organic' management system and task culture (Moxen and Strachan, 1998), characterised by rapid organisational learning and flat, dispersed decision-making, can be applied in sustainability networks.

Further, from a more critical point of view, what are the possible constraining effects and disadvantages of networks for sustainability? Participation in a network also means becoming dependent on others and thus abandoning freedom of choice to a certain degree. Moreover, how can opportunistic behaviour of network members be avoided or dealt with? As stated by Boons, networks always exhibit a dual nature, positive and negative (Boons, 1998).

The different scientific backgrounds of the authors of the contributions to different aspects of sustainability networks in this special issue of *Progress in Industrial Ecology – An International Journal* allow them to focus on certain aspects of sustainability networks from different perspectives and in this way, generate valuable findings and draw interesting conclusions. Nevertheless, we have to remember that research on sustainability networks is still in its infancy. There is a forthcoming second part of this special issue, including seven articles, and hopefully, scientific discourse will continue to support the concept of sustainability networks and thus contribute to progress in industrial ecology.

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Note

- 1 Note from the Editor-in-Chief: The definition of the system boundaries is a critically important research question for industrial ecology as the physical flows of matter and energy cross product, process, organisational, local and regional boundaries and borders. In industrial symbiosis and industrial recycling networks, for example, waste maximisation at the level of an individual firm may be required to achieve waste minimisation at the level of the network of firms. Such potential conflicts are difficult challenges for the strategic decision making of industrial actors (Korhonen, 2004a).