

Implications for the inter-organizational design of environmental care when changing environmental control points

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Abstract

In this paper we try to bridge the gap between two lines of thought within the environmental care literature. We differentiate between two major clusters in this literature; (1) environmental management and (2) strategic approach to environmental care. Although both approaches focus on the same object i.e. management of environmental care, the two bodies of knowledge apply different starting points. The first one focuses on the physical material flow and effects, the second approach starts with the weighing between the opportunities in the environment and the internal organizational possibilities. Our assumption is that the two approaches are complementary. In constructing the bridge we conclude that the approaches are indeed complementary. In combining the two approaches, the starting points can be intertwined. This combination of approaches opens the possibility to relate the physical environment, by means of control points, to the strategic weightings. In this sense, the control points, and in line with that the physical environment together with strategic considerations, form for managers the conditions for their design of inter-organizational environmental care. By altering physical control points and or strategic focus, the inter-organizational design of environmental care will change as well. The integrative framework ends with a table in which ideal typically control points, strategic focus and the inter-organizational design are combined.

Keywords: Environmental management, Environmental Care Strategies, Chain Management

1. Introduction

Environmental Management is a multi-faceted phenomenon especially when approached from a chain or inter-organizational perspective. In addition to a stand-alone-company, the chain incorporates strategic and operational relationships with suppliers and buyers in its management of the material flow stretching from raw materials to the consumer (Mentzer et al., 2001, 3). This supply chain is embedded in a network of organizations which have an influence on the functioning of that supply chain. In recent years an increasing attention can be witnessed for the continuous improvement of the environmental performance. The design of environmental management becomes then an even more immediate challenge (see Schaltegger and Synnestvedt, 2002; Hagelaar et al, 2004). This is well in line with the

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more general call for a normative management-model for supply chain management (see Lambert and Cooper, 2000).

To be able to manage the continuous improvement of the environmental performance three aspects of the supply chain are of importance: (1) The supply chain as an actor network which is more or less intensively interrelated; (2) The supply chain as a material flow with processing stages causing certain environmental burden; (3) Management of continuous improvement of the supply chain needs a certain time span to evolve into the expected performance (see Mentzer et al., 2001; Seuring, 2004, 308). This differentiation underlines the importance of the linkage between supply chain management concepts and environmental performance (see Young et al. 2001; Ammenberg et al 2002; Hagelaar et al 2004; Zhu et al. 2005). Successful environmental management implies that the intervention accounts for the possibilities and constraints of the actor network, the material flow including processing stages, and of time. Moreover, the intervention implies a match between environmental oriented measures in the actor network, and in the material flow, all this within the scheduled time frame (see Hagelaar et al, 2004).

In literature we can see more or less two approaches to the management of environmental care within chains and inter-organizational networks, that is: (1) an environmental managerial approach (see overview article Seuring 2004) and a strategic approach (see De Bakker, Nijhof 2002; Goldbach et al. 2004; Hagelaar et al 2004). The two approaches are, in our opinion, in essence different because of their starting points but are complementary in their contribution to the managerial design of environmental care. The environmental managerial approach is rooted in visualizing and handling of environmental effects and material flows. The strategic approach focuses on the weighing of goals and (organizational) measures to be able to willfully 'produce' certain environmental effects. Both approaches have in common that they are chain or inter-organizationally based.

2. Purpose

To manage environmental care within a chain the material flow seen from an environmental perspective has to be attuned to its organizational counterpart (Hagelaar et al, 2004, 28). The two already mentioned approaches both support managerial activities but need to be combined because of their complementary character and common bases.

Within the approach of environmental management four inter-organizational concepts are developed (Seuring, 2004). Each concept entails control points which can be used to reduce environmental burden caused by industrial production. The concepts are Industrial Ecology (IE), Integrated Chain Management (ICM), Life-cycle Management (LCM) and Environmental Supply Chain Management (ESCM) (Seuring, 2004, 314).

The strategic approach offers a range of environmentally oriented strategies which can be chosen by a manager on the bases of an external and internal analysis. Such, so called Environmental Care Strategies (ECS) e.g. Compliance, Process and Market oriented strategies, are ideal typically elaborated on in their organizational consequences (see Hagelaar, 2004).

The purpose of this paper is to generate a theoretical framework which integrates the approaches mentioned to handle environmental care. Such a framework enables a better understanding of the necessary integration between knowledge on the environmental effects and material flows and on organisational conditions for environmental management.

In section 3 the basic line of thought is developed. Afterwards the different constituting elements of the framework are presented: concepts of environmental management including the control points (4), environmental care strategy (5), and inter-organizational perspective

(6). The integrated framework will be outlined in section 7. Section 8 will discuss managerial and theoretical implications.

3. The basic line of thought

The theoretical base comprises three parts. First, we will explore the four concepts of environmental management. From these environmental concepts potential control points will be derived. ‘Potential’ because a manager in his specific situation has to make a choice of a potential control point, which is made in combination with strategic goals. The potential control points shed light on the environmental effects and material flows. The strategic approach sheds light on the strategic focus which is relevant for managing environmental care within a supply chain. To make successfully use of control points offered by one of the environmental concepts, a manager “needs” an organization which can make use of the proposed control points. Thus, the assumption is that the potential control points can be integrated with an environmental care strategy enabling the manager to form an inter-organizational design for a supply chain. This integration constitutes the third step; presenting the match between the control points and ECS’s. This reasoning is presented in the figure below.

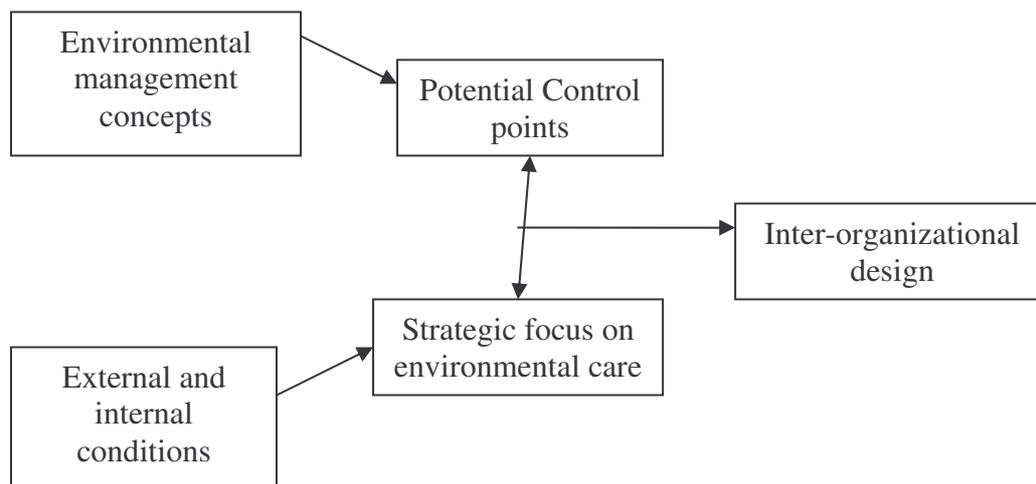


Figure 1 Theoretical framework

4. Concepts of inter-organisational environmental management

4.1 The concepts

As a starting point, industrial ecology is chosen. In their seminal paper, Frosch and Gallopoulos 1989, p. 95 describe the term: “The traditional model of industrial activity – in which individual manufacturing processes take in raw materials and generate products to be sold, plus waste to be disposed of – should be transformed into a more integrated model: an industrial ecosystem. The industrial ecosystem would function as an analogue of biological ecosystems.” The basic idea is to reuse and recycle (by-)products and waste in different industrial activities and thereby minimise both resource extraction from and waste disposal to nature. The nature-like analogy is one of the most distinguished aspects of industrial ecology.

Such thought has also evoked the establishment of life-cycle analysis and more recently life-cycle management, which forms the second concept. Here, the definition of Hunkeler et al., (2003, 19) is taken up. “Life cycle management (LCM) is an integrated

framework of concepts and techniques to address environmental, economic, technological and social aspects of products, services and organizations. LCM, as any other management pattern, is applied on a voluntary basis and can be adapted to the specific needs and characteristics of individual organisations.” This is amended by Linnanen et al., (1995, 21), which more points at the managerial aspects: “Life cycle management consists of three views: (1) the management view – integrating environmental issues into the decision making of the company; (2) the engineering view – optimising the environmental impact caused by the product during its life cycle; and (3) the leadership view – creating a new organisational culture.” Much more than in any other concept, the focus is on the importance of product design and the influence this has on the environmental performance of a product.

Greatly influenced by life-cycle thinking is the establishment of integrated chain management. In particular, this developed in The Netherlands as “Integraal Ketenbeheer” (Wolters et al., 1997) and Germany as “Stoffstrommanagement” (Seuring, Müller, 2006). “Integrated Chain Management (Stoffstrommanagement) is the management of material flows by stakeholders [to be] the goal-orientated, responsible, integrated, and efficient manipulation of material flows. Set targets derive from the ecological and economic realm, under consideration of social aspects. Goals are set on the level of the single firm, within the supply chain of actors, or on the public policy level.” (Enquete Kommission, 1994, 549). As this definition outlines, the most differentiating issue is the emphasis of the political agenda setting, i.e. the importance of the political or societal level for the management of product chains.

The most operational is the approach of environmental supply chain management. “Environmental supply chain management (ESCM) for an individual firm is the set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm’s goods and services.” (Zsidisin, Siferd, 2001, 69).

The following figure represents the foothold and interrelation of the different environmental concepts and supply chain management

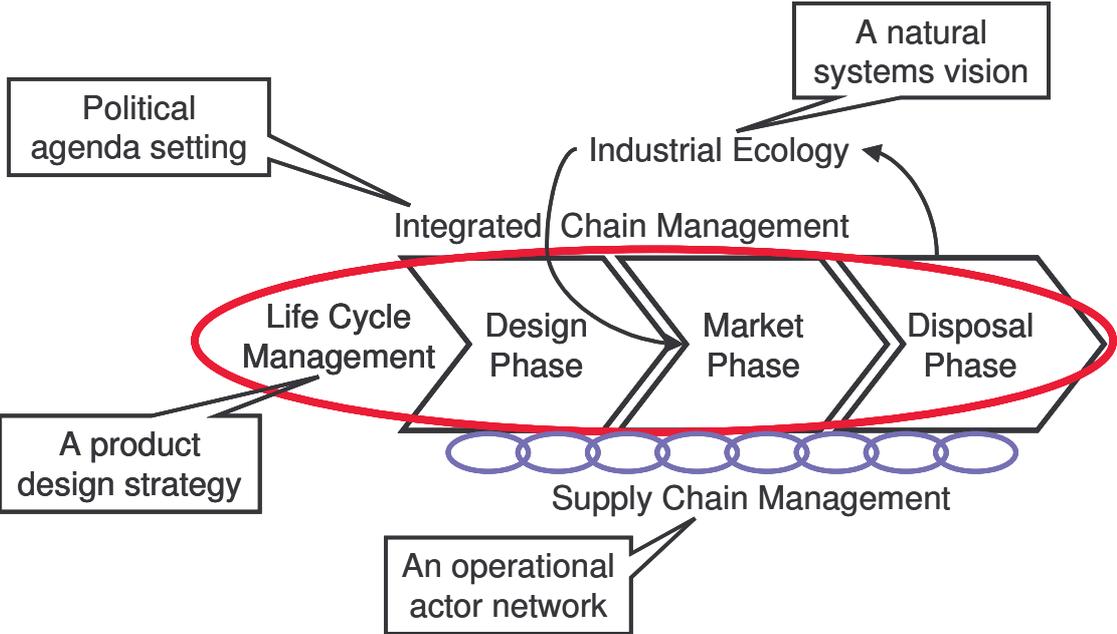


Figure 2 Environmental concepts and supply chain management (Seuring, 2004, 315)

4.2 Control points in the environmental concepts

From a managerial perspective one could ask the question which control points are offered by these concepts to a manager. On the basis of this brief overview we would like to draw the conclusion that the four concepts are based on two dimensions. One dimension is about the *demanded* environmental effects of industrial production incorporated by ICM. The second dimension is about the *produced* environmental effects and present material flows, incorporated in IE, ESCM and LCM. Each dimension constitutes a spectrum of choices for managers to approach environmental care. The dimensions are:

1. Physical material flow

Within the physical material flow one can distinguish different points of departure for managers to take measures on;

IE	effects of the production in the different stages of the supply chain
LCM	the product design incorporating the different stages of the supply chain
ESCM	the operational activities performed to fulfil customer demands and the environmental impact created thereby

2. Demands to environmental performance

With reference to ICM as described above, we can distinguish three major types of stakeholders which pose their demands to the supply chain; external influence by 'market' and 'government' and internal influence by involved 'companies'. For each stakeholder a typical set of demands can be described:

- Market: consumers put demands on the quality of products: demands on the environmental burden of the product itself (including usage and waste)
- Government: one of the public functions of government is to reduce unwanted, external effects of production: setting of minimal standards for emissions, end-of-pipe effects
- Companies: general driver for companies is efficiency i.e. efficiency of usage of inputs

Each dimension has its own specific approach towards prevention of environmental burden, but in their interrelation the possibility of defining managerial control points comes up. After all, the choice of which demands to fulfil has to be linked to the possibilities which are offered by the physical material flow, in order to be able to define your starting point to meet the demands. This interrelatedness is shown in the figure below. It is obvious that further interrelations might be argued on, but for reasons of clarity, we like to concentrate on the issues mentioned in Figure 3 below.

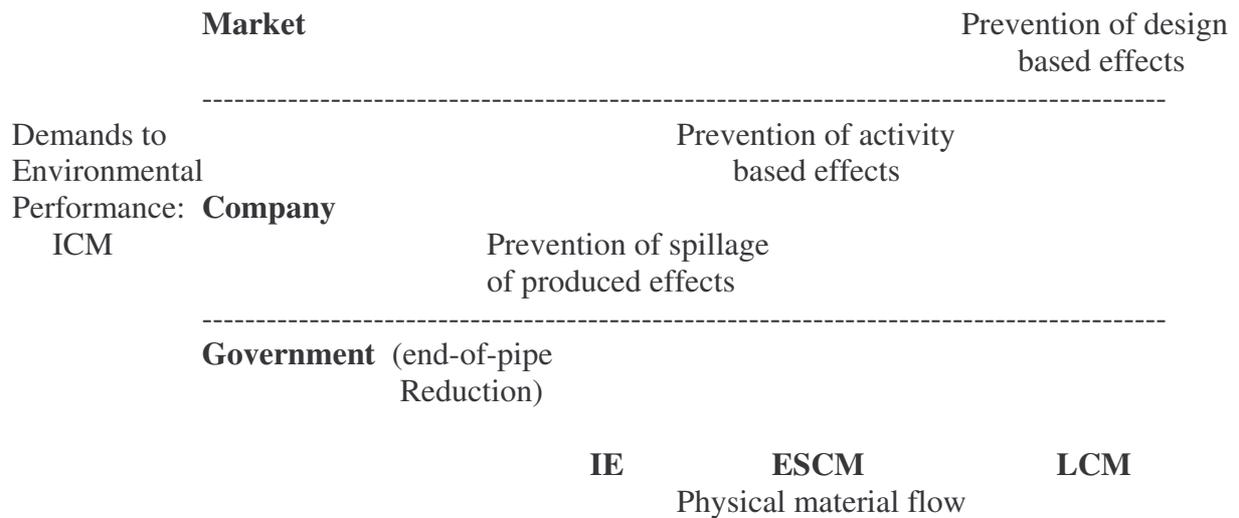


Figure 3 Compatibility of environmental concepts

It becomes clear from Figure 3 above that the environmental concepts IE, ESCM and LCM relate to ICM on the bases of the on company and market level described demands. The way in which governmental demands are defined (reduction of external effects by setting minimal standards for emission by means of end-of-pipe effects) show no link with IE, ESCM and LCM. The compatibility between demands and physical material flow indicates the ambition level of managers who are confronted with certain demands and discern from the physical material flow possibilities (effects and material flows) to manage.

Table 1 Environmental concepts and ambition level

Environmental Concepts	Manager's ambition level
IE – ICM company	<i>valorisation of produced effects</i> Managers will regard the, at the first instance unmeant for, produced environmental effects, as valuable by-products of their production process
ESCM – ICM company	<i>valorisation of activity based reduction of inputs</i> By combining knowledge on the supply chain processing stages and on the desired quality of the processing stages, managers can start to think about a feasible reduction of inputs
LCM – ICM Market	<i>valorisation of environmental design</i> By combining knowledge of the market and the environmental design, managers can aim for a certain market share.

This implicates that changing the environmental concept, thus changing the inherent control point for that particular concept, the ambition level of the manager changes as well.

5 Environmental care strategy and control points

5.1 Environmental care strategy

A literature research resulted in the following ideal typology of environmental care strategies applicable to individual companies and supply chains (e.g. Vermaak, 1995,

Spliethoff et al., 1991, Van Koppen and Hagelaar, 1998), which can also be traced back to earlier contributions on environmental management strategies (e.g. Hunt, Auster, 1990; Roome, 1992):

- *Compliance-oriented* strategy: aimed at reduction of environmental effects, which endanger minimal compliance with rules and regulation, before the effects are released to the surroundings. End-of-pipe techniques are instrumental to this strategy;
- *Process-oriented* strategy: a more pro-active approach based on the internal driver of pollution prevention pays (a better return) under the condition of compliance with rules and regulation. The focus is on reduction of the use of raw materials and prevention of waste within the separate steps in the production process. Examples of process-oriented techniques are new technologies to save water or other raw materials or a process redesign to accomplish less waste during the production process.
- *Market-oriented* strategy: again a more pro-active approach which focuses on the environmental demands to the product as a whole, by consumers. This strategy aims at the combination of the reduction of the environmental burden caused by the design of the product and the achievement of competitive advantage. In this stage of environmental care the R&D department incorporates the environmental aspects in the design process.

These environmental care strategies are linked in an ideal-typical way to characteristics of an organization (company or chain). In the next table this is elaborated on.

Table 2 *Environmental care strategies and organizations (Van Koppen en Hagelaar, 1998)*

Characteristic	compliance	process	Market
Internal			
- Knowledge	Knowledge about some, prescriptive aspects	Knowledge about production process-aspects	Knowledge about the productchain
- Information	Little horizontal and vertical information sharing	Information sharing on tactical and operational level	Information sharing on strategic level
- Technology	End-of-pipe technology	Process integrated technology	Product design technology
- Structure	Few and isolated tasks	Explicit tasks on the tactical and operational level	Integrated tasks on different levels incl. staff level
- Budget	Budget is small	Budget for investments with a long term pay0back period	Budget for strategic investments
Surroundings			
- Risks	Risks related to rules and regulations are deduced	Risks are limited and/or changeable	Risks become challenges
- Opportunities	No opportunities	Opportunities through cost savings	Market-opportunities
Ambition level	Compliance	Process control	Marketing

In section 4.2 the conclusion was drawn that there is no link between IE, ESCM and LCM because of the way in which governmental demands are defined in this paper. The Compliance oriented ECS is thus not relevant in relation to the environmental concepts and therefore will not be involved in further deliberations.

5.2 Relation environmental care strategy and control points

The choice for a certain control point and the choice for an ECS are intertwined. If a chain ‘possesses’ the organizational conditions linked to a Market-ECS, members of the chain should also see within their physical material flow the possibilities to prevent environmental burden by means of the product design. After all, the managers’ ambition level was defined as valorisation of the environmental design. This is in agreement with the Market-ECS in the sense of satisfying the needs of consumers (consumers pose demands to the quality of the overall product). The Process-oriented ECS is driven by efficiency; managers try to combine financial and environmental benefits. One possibility is to use already produced environmental effects such as heath or wastewater for other purposes and by preventing spillage of energy or water, save money as well. In this case, managers should be able to use the produced effects. The other possibility for a Process oriented ECS is by analysing the supply chain activities and find some control points which enable prevention of the amount of inputs which are used. For instance use technology to save on water- or energy-usage or by rescheduling transport routings to save fuel and prevent air pollution. The organizational conditions should be in place to profit from such opportunities. Following this line of thought we come up with the following linkage between control points and ECS’s.

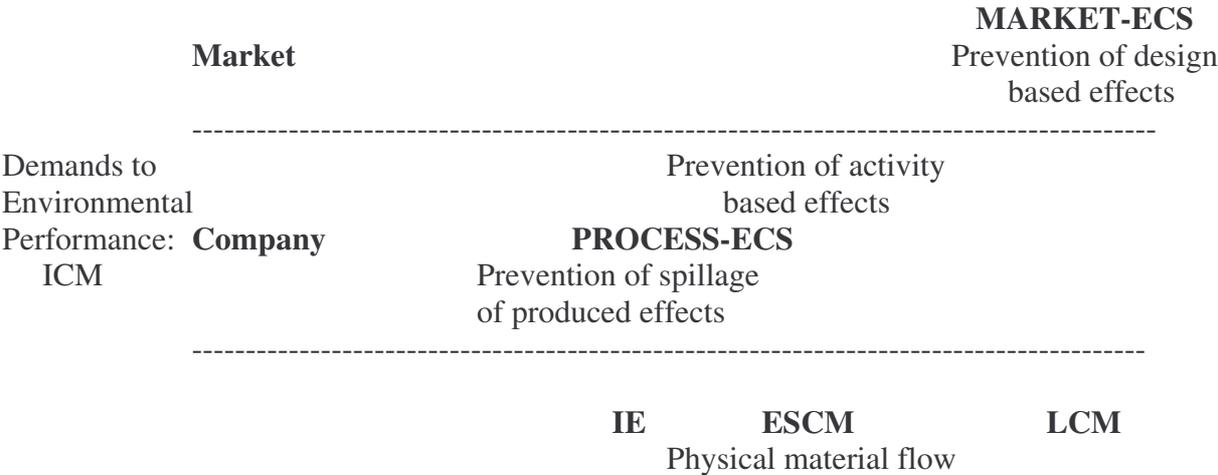


Figure 4 Relation between environmental concepts and ECS

The above figure clarifies that IE and ESCM match with a Process oriented ECS, and LCM matches with a Product oriented ECS. This linkage results in three combinations:

- Process-produced effects IE
- Process-prevention effects ESCM
- Market LCM

6. Inter-organizational perspective

The four environmental concepts and the concept of ECS have in common the inter-organizational bases. This is, besides control points and ECS, the third pillar to understanding

the design of inter-organizational environmental care. The inter-organizational perspective, i.e. the organization of the supply chain, points at the organisational conditions which should be in place to reach a certain environmental performance.

Over the years, several definitions have been developed to describe chain co-operation. At this stage there seems to be no single universally accepted definition which generally covers the field of interest (Migchels, 2001; Beers et.al., 1998; Cooper et al., 1997). The definitions may differ in many respects as they are designed to limit a particular field of research or to fit a specific situation. However, commonalities can still be found. Key aspects that are included in many of the definitions of chain co-operation are (Migchels, 2001): a network of several organizations; processes and transactions; achieve better results; control and co-ordination; vertically organized; consumer oriented; flexible, non-integrated organization.

Lambert and Cooper (2000) provide us with a framework of Supply Chain Management which is in line with our goals. They describe a supply chain as a network of multiple businesses and relationships which offers the opportunity to relate and integrate intra- and inter-company management. Supply chain management is in their view the management of multiple relationships across the supply chain (Lambert and Cooper, 2000, 65). On the bases of a literature review they discern three interrelated elements: the supply chain network structure, the supply chain business processes and the supply chain management components (Lambert and Cooper, 2000, 69).

A brief description of the three elements (Lambert and Cooper, 2000, 69-78):

The following figure results:

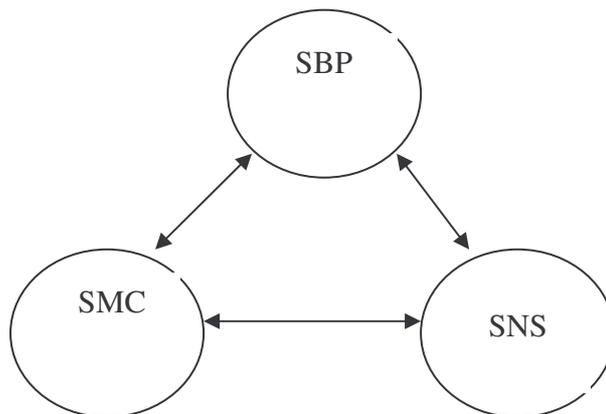


Figure 5 Supply chain management framework (Lambert and Cooper, 2000, 70)

Supply chain Network Structure (SNS):

Key question: who are the key supply chain members with whom to link processes?

The members of the supply chain include all companies with whom the focal company interacts directly or indirectly through its suppliers or customers. They discern between the horizontal structure, so the number of tiers of the supply chain, and the vertical structure, the number of suppliers and customers within one tier (Lambert and Cooper, 2000, 71).

Besides the differentiation in horizontal and vertical structures, we will elaborate on supply chain structure by means of the concept co-operation structure. The following four structures are discerned (see Hagelaar and van der Vorst, 2004):

The *round table structure* is the most basic one. There are few consult structures between partners influencing the decision making processes focused on only one business function (e.g. transportation). All the other business functions and management functions are dealt with by each individual partner separately.

The *multi-focus simple structure* suggests that few consult structures between partners participate jointly in the decision making processes on several functions. Within each firm, the decision making is attuned to the joint decision making.

The *decomposed structure* is characterized by just a limited number of functions to be included in the partnership. However, the nature of those functions requires a highly differentiated consult structure of co-ordination and fine tuning among the partners, horizontally and vertically. This situation occurs for example in highly technologically advanced alliances.

The last structure, the *multi-focus network structure*, fits situations in which the partnership deals with many functions and the decision making process is highly differentiated both vertically and horizontally. Mechanisms that are installed in these structures comprise: joint teams for individual functions, shared facilities, inter-functional and cross-functional interfaces, steering mechanisms for overall managing of the alliance or supply chain, and centralized and decentralized decision making based on decomposition of problems.

Supply chain Business Processes (SBP):

Key question: what processes should be linked with each of these key supply chain members? Within a supply chain key supply chain processes are to be integrated both upstream as downstream. Key supply chain processes are amongst others; relationship management, demand management, manufacturing flow management. Integrating and managing all business process links throughout the entire chain is likely not appropriate. Lambert and Cooper point out that drivers for integration vary from link to link and over time. In line with this reasoning they typify business process links as being managed and not-being managed (Lambert and Cooper, 2000, 72-76).

Supply chain Management Components (SMC):

Key question: What level of integration and management should be applied for each process link? Lambert and Cooper identify nine management components: planning and control, work structure, organizational structure, product flow facility structure, information flow structure, management methods, power and leadership structure, risks and rewards and culture and attitude. Adding more management components to business links can increase the level of integration in the business process link (Lambert and Cooper, 2000, 77-78). We would like to capture the management of the supply chain by means of the concept of administrative structure. Administrative structures comprise two dimensions; centralisation-decentralisation and formalisation and flexibility. Crossing these two dimensions four administrative structures become apparent (see figure 6).

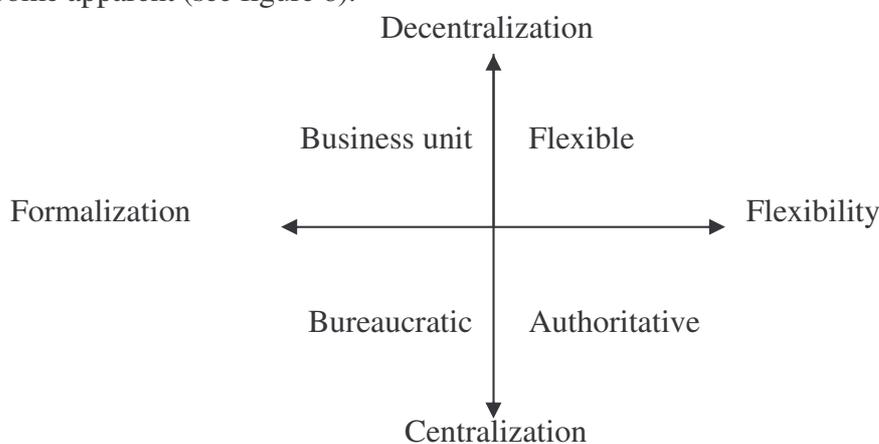


Figure 6 Administrative structures (Luning, Marcelis and Jongen, 2002)

7. Analytical framework

Up to this point three pillars are described to base the design of inter-organizational environmental care on: environmental concepts demarcated to control points, ECS and inter-organizational components. In the following framework the control points, ECS and inter-organizational components will be linked in a ideal typical description of designs of environmental care

The following table contains the ideal typical designs.

Table 3: Ideal typical designs of inter-organizational environmental care

ECS ► Components ▼	Process: IE	Process: ESCM	Market
<i>Ambition level</i>	Valorisation of produces effects	Valorisation of prevention	Valorisation of environmental design
<i>Performance</i>	Effect based process improvements	Input based process improvements	product design improvements
<i>Supply Chain network structure:</i>			
Vertical – horizontal	Vertical: customers apart from the primary chain	Horizontal	Horizontal
Co-operation Structures	Round table or decomposed structure	Multi-focus or decomposed	Flexible
<i>Supply Business Processes</i>			
Amount of shared processes	Low Information exchange	Medium Depends on the selected activities	High Design and marketing
<i>Supply Chain Management Components</i>			
Level of integration	Low	Medium Depends on the selected activities	High Design and marketing
Administrative Structure	Authoritative	Bureaucratic or business unit	Flexible

8. Discussion

In this paper we bridge the gap between two lines of thought within the environmental care literature. We saw two major clusters (1) environmental management and (2) strategic approach to environmental care. Although both approaches focus on the same object i.e. management of environmental care, the two bodies of knowledge apply different starting points. The first one focuses on the physical material flow and effects, the second approach starts with the weighing between the opportunities in the environment and the internal organizational possibilities. The supposition was that the two approaches were complementary. In constructing the bridge we saw that the approaches are indeed complementary. In combining the two approaches, the starting points can be intertwined. This combination opens the possibility to connect the physical environment, by means of control

points, to the strategic and organizational conditions. In this sense, the control points, and in line with that the physical environment and ECS become the conditions a manager has to include in his design of inter-organizational environmental care strategy. The above table 3 is ultimately the result of the integration of the two lines of thought in the literature on environmental care. This general conclusion is followed by some more specific conclusions.

The Process oriented ECS is differentiated into two strategies; one ECS builds on using produced effects, the other builds on the analyses of activities.

Making choices between the different combinations of ECS and control points, after weighing the different possibilities, is of importance. By making a decision to implement a certain inter-organizational design one can restrain the number of alternatives in the future. For instance if actors within a supply chain made a choice for a process oriented ECS build on IE control points, the design of the supply chain organization will be matched to these choices. One can not restructure this organization overnight into a Market oriented ECS built on product design control points. In the Process-IE oriented organization there is a horizontal structure, probably formalized in a contract with other organization to deliver them certain by-products (such as heath) on which the buyers rely. If the by-products are not produced anymore because the new supply chain organization is based on Market-LCM, the relationship with buyers of the by-product has to stop.

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