

The influence of the chain and network information and communication structure on sustainable business development

- Using Ajzen's model to explain the effect of the supply chain and network communication on sustainability performance-

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Key words : sustainability, chains and networks, Ajzen, environmental management, embeddedness

ABSTRACT

This article links the public-private information and communication structure (IC-structure) and Ajzen's model of planned behaviour to explain the development of environmental management systems (EMSs). The structure of the IC-system, especially the public-private information exchange, can influence the priorities of managers in favour of environmental management development. From an survey under medium-sized companies in the Dutch agri-food sector we conclude that the setting of priorities by managers on environmental goals is *not* significantly influenced by the *quality of communication* between government and industry. Safeguarding the licence-to-produce makes the norms of non-governmental stakeholder groups of overruling importance for their strategic orientation. Therefore, governmental action to protect the environment should address the perceptions of ngo-stakeholders. For many medium-sized companies, a coercive rather than a co-operative governmental attitude should be adopted. This deviates from the present Dutch public policy, in which non-coercive instruments dominate.

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1. RESEARCH PROBLEM AND SCOPE

The Dutch government was among the first in Europe stressing on self-responsibility of companies to take care of their environmental impacts. Sustainable business development has become highly important to Dutch companies (De Bakker, 2001; Wijen, 2002; De Bruijn and Hofman, 2000; Van Berkel and Van Kampen, 1999). Sustainability is enhanced by means of life-cycle assessment, product-redesign and effective cooperation within the supply-chain (Hagelaar and Van der Vorst, 2001; Green, Morton and New, 1998; Beamon, 1999). A supply-chain is defined as a network of organizations involved in value-creating activities (Christopher, 1998). Sustainable development is not a naturally enrolling state (Kolk and Mauser, 2002), but is provoked by (among others) managerial behavior, that in itself can be linked with the information and communication structure in chains and networks. The problem that we address is the lack of understanding of interdependencies between the information and communication structure (IC-structure) in chains and networks on the one side, and managerial behavior within the individual companies on the other. Such an understanding is important to be able to formulate joint supply chain policies and to direct public policy towards goals that really have an effect on corporate behavior.

In this paper we focus on the Dutch agri-food sector. This sector is especially interesting because of the peculiarities of raw material that is used (high hygienic and quality demands) and the far-reaching governmental interference (for instance because of food safety, quality and liability reasons).

The goal of this paper is to gain insight in the behavioural effects of the supply chain and network IC-structure on sustainability management..

The following research questions will be addressed.

1. What is the effect of the supply chain and network information structure sustainability management? (see also: Clarkson, 1995; Wood, 1991).
3. What policy implications can be formulated, given the answer on question (1)?

We use Ajzen's model of planned behavior (1991) to get insight in the relationship between the managerial attitude towards sustainability issues (perceived benefits and costs of a certain behavior), subjective norms (norms coming from the supply chain and network environment) and perceived behavioral control (the opportunity to behave as intended). From these (clusters of) variables, effects are proposed on the managerial intentions, and finally ultimately on the behavior itself (sustainability performance).

In the following sections we first explore the basic concepts that underly this research. We define the research model and the constructs in Ajzen's model. We will explore the data set we are going to analyse. Next, the empirical results will be presented. We finish with conclusions and policy implications.

2. THEORETICAL FRAMEWORK

In this section, we will deal with the basic concepts: sustainability and transparency, sustainability performance, information and communication structure (IC-structure), as well as basic constructs within Ajzen's model (behavioural intentions, attitudes, subjective norms, and control).

2.1 Sustainability and transparency

In a benchmark paper by S. Hart (1995), the author argues that over the next 40 years either the nature of economic activity has to alter, or the risk is taken that ecological systems worldwide will be damaged irreversibly. In many companies, the focus of market interaction with the natural environment has made place for sustainable business management. Sustainability not only includes *present* purposes in strategic planning and investment, but also the preservation of life-space for future generations. Transparency can *enhance* sustainability, since it promotes grounded decision-making on environmental, social and economic issues.

Stakeholders have a right to be informed (principle no 10, Declaration of Rio de Janeiro) about the company's behavior and prospects, to be able to make sound decisions about their involvement in the firm. Stakeholders more and more take an interest in sustainability features of firms in which they invest.

The firms' managers need information also, to be able to make decisions in concordance with the firm's goals. Information exchange is by definition a two-way street. Information and communication processes (dynamism) can create structures (adaptation to existing norms, habits, opinions for instance), while structures on the other side can mold processes within definite boundaries (see: Giddens' structuration theory in: Giddens, 1996). So, the level of sustainability management can directly be related with the quantity and quality of information processing. Companies that are entangled in a web of IC-structures, forcing them to adopt the norms and practices of the business network, will (depending on the level of sophistication and acceptance of sustainability policy) probably perform better with respect to managing sustainability topics.

In general, sustainability issues refer to social, economic and environmental opportunities and demands the task-environment deploys for a specific firm. In this paper, we limit ourselves to managerial performance with respect to environmental issues, a key part of *sustainability performance*.

2.2 Sustainability performance

For measuring performance, two kind of measures can be used: physical and managerial performance (Rocha and Brezet, 1999). These are linked, since the implementation of an environmental management system (EMS) will reduce the physical influences of companies on the environment. For determining the level managerial environmental performance, we refer to items included in ISO 14001 (like environmental auditing, education of personnel, measurement of pollution on a regular basis etc). In many ways, these items also contribute to social and economic performance.

The ISO-related *internally directed elements* focus at compliance at the business-unit level, whereas for a substantial change in management's intentions an open focus towards

the task environment is needed also. Therefore we use *product oriented environmental management (POEM)* as a complementary set of measures. Rocha and Brezet (1999) address the key elements of POEM-performance: information gathering for chain-oriented environmental management, cooperation with suppliers and buyers, and data-exchange in the supply-chain.

2.3 Ajzen's theory of planned behavior

Ajzen's theory of planned behaviour (Ajzen, 1991) is well supported by empirical evidence, as a predictor for human behaviour. The components of Ajzen's model are reviewed below.

Intentions

'Behavioral intentions' refers to the inclination a person has to perform a certain behavior. In our research this is towards sustainability management. In Ajzen's view, behavioral intentions are determined by a person's attitude, subjective norms and perceived behavioral control.

Attitude

A person's attitude is a result of his personal 'cost-benefit analysis' of the consequences of a certain behavior. The manager's personal opinion on whether 'pollution prevention pays' will direct his behavioral intentions. In our view, the level of informedness (on positive and negative reinforcements) will therefore be of key importance for the explanation of environmentally conscious behavior. We expect that the quantity and quality of public-private information exchange will direct the managerial attitude towards sustainable business management.

Subjective norms

Subjective norms point at the norms and standards from the environment which provide psychological support to the firm's manager. For instance, the opinions of stakeholders as well as of supporting institutions in the business environment (the level of network 'embeddedness', Granovetter, 1985) will generate an inclination to deploy a certain behavior, or not. Companies will have to communicate with key stakeholder groups and inform them about the progress they make with respect to environmental management, to keep their 'license to produce'. According to Kagan, Gunningham and Thornton (2003), this licence consists of three elements: regulatory, social, and economic (see also: Reinhardt, 1999). For environmental performance, the informedness on regulatory requirements seems to be of key importance.

Policies that correspond with existing structures and procedures will be adopted more easily than 'alien' rules and regulations. The existing structures form a 'frozen memory' of past influences of regulatory and other stakeholders. The already developed competences and devices (like tracking & tracing systems, quality management etc.) could leverage the implementation of EMSs. On the one hand, we expect agri-food food companies to be able to introduce sanitation and process-oriented elements of environmental care with relative ease in the organization. On the other hand, the availability of existing structures, routines, interpretation routines, skills and competences

could limit the eyesight on innovativeness (Gersick and Hackman, 1990) and possibly restrict the perceived options to change in a more radical way.

Control

A last category is behavioral control: the ability to actually behave as is intended. The level of informedness about the available environmental technologies is important in this respect, as well as the perception that there are budgets available to invest and/or to innovate (in tangible assets but also in intangibles: procedures, knowledge and social structures for instance). This could be called ‘instrumental control’. Also, the correspondence of environmental demands with company goals is possibly a major factor that shapes the intentions of managers (we call ‘strategic control’).

3. RESEARCH MODEL AND OPERATIONALIZATION

3.1 Research model

Figure 1: Ajzen’s model of planned behaviour and the information system
(based on: Ajzen (1991), De Leeuw (1982) and Van der Vorst (2000))

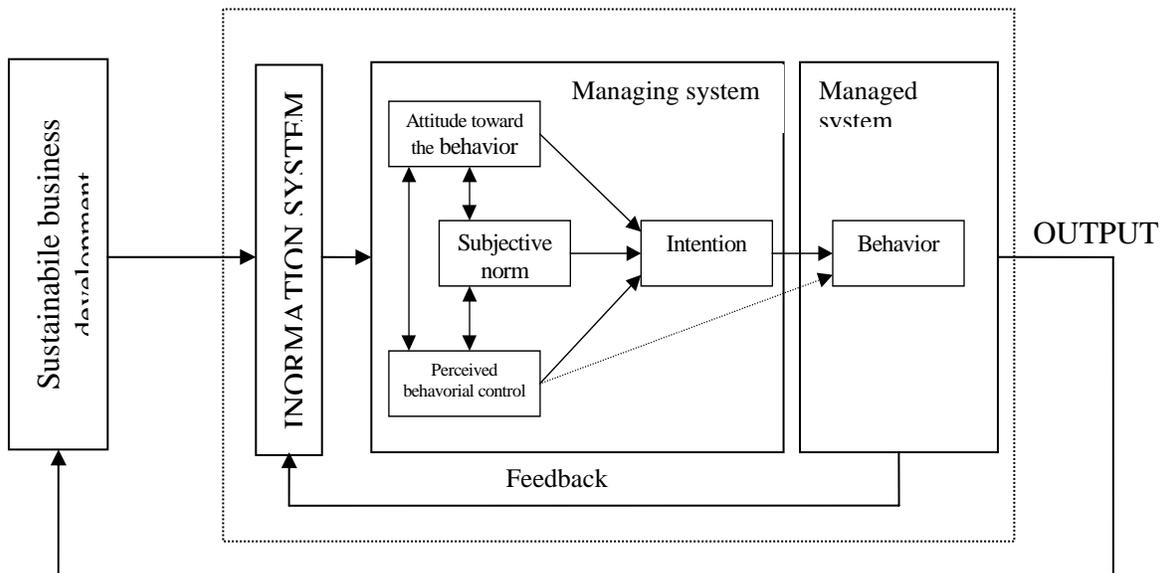


Figure 1 shows the research model we designed for this paper. The IC-structure is supposed to have an influence on the ‘managing system’. The managing system is defined with reference to the basic constructs in Ajzen’s theory. Attitude, norms and control will influence the intentions to perform a certain behavior. The behavior itself is the actual environmental management (internal EM-performance and product oriented management performance (POEM-performance)). The results of the managerial efforts (output) will be captured in information. This information, together with signals from the network-environment, will be input in a next round of managerial efforts.

3.2 Material and methods

The data we use were gathered in 2002 by means of a written survey. In this article, we focus on the Dutch agri-food sector. On a survey-questionnaire, 492 companies responded (of a population size of 2620 of companies with 5 employees or more). For a main part of our analyses we used a subset of 78 companies (out of a population of 305 companies) in the size category 50-250 employees. (which means a response rate of 25.6%). The average size of the companies in the sample is 123.46 (population: 107,79) employees with a S.D. = 54.019 (population: 53.23 employees). With respect to size we can conclude that the companies in the sample are on average about 14% bigger than the companies in the population. The standard deviation is nearly identical. This means that the distribution of companies over size classes is fairly representative for the population. Moreover, the skewness of the sample distribution is only .613, indicating a normal distribution of the companies over size categories.

In this paper we use SPSS 11.5 to analyze the data. We use Spearman rank correlations and non-parametric Kruskal Wallis tests to investigate differences between mean scores of variables. All variables were measured on ordinal 0-5 or 1-5 scales.

3.3. Operationalization

An extensive overview of the questions behind the constructs is given in appendix (1).

Sustainability performance

For measuring sustainability performance we refer to the ISO14001-items as mentioned earlier. The measure for POEM-performance we refer to Rocha and Brezet's criteria for this aspect of performance.

IC-structure

We measure the specifics of the IC-structure by focusing on three issues: clearness (content), dialogue (relational quality) and facilitation (technical characteristics). *Clearness* is measured by the transparency of the information on environmental regulations from public bodies (possibly associated with 'subjective norms'), the perceived possibility to distinguish between major and minor environmental issues (presumed relating to 'behavioral control'), and the clearness of the information with respect to public demands and permits (relating to 'attitude'). *Relational* quality is measured by the reciprocity and equality in the information exchange process: the level of 'open dialogue' with governmental agencies (referring to the 'subjective norms'-issue, the level of informality in communication (referring to 'attitude') and the perceived amount of influence with respect to the environmental policy of lower governmental bodies (referring to 'behavioral control').

Attitude

We measure the manager's *attitude* towards environmental management system development by looking at the variables (1) perceived effectiveness of environmental policy of lower governmental bodies, (2) the correspondence of public goals with company goals and (3) the perceived inter-governmental consistency of public rules.

Subjective norms

As already indicated, managers will look for a confirmation on the adequacy of their behavior in their environment. Subjective norms originate from the *stakeholder environment* and in an ambiguous category that we call '*intermediaries*': instruments and structures that encapsulate the managerial behavior in a circle of acceptance or disapproval.

Behavioral control

- We suppose, that the higher the level of certainty, the better able companies are to make long-term plans on environmental changes. Perceived behavioral control probably depends on the financial limits to act in a certain way (the available budget). Also the perception of having a possible partner in lower governmental bodies can influence the perception of behavioral control.

Behavioral intentions

Behavioral intentions are measured by the level of priority of environmental policy development of the respondents.

4. RESULTS

4.1 Baseline results

Figure 2: Performance and size

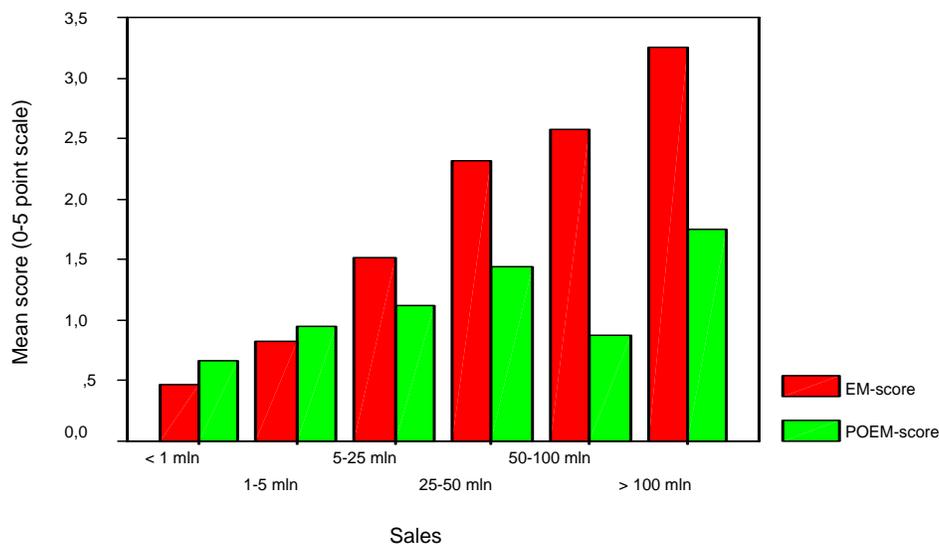
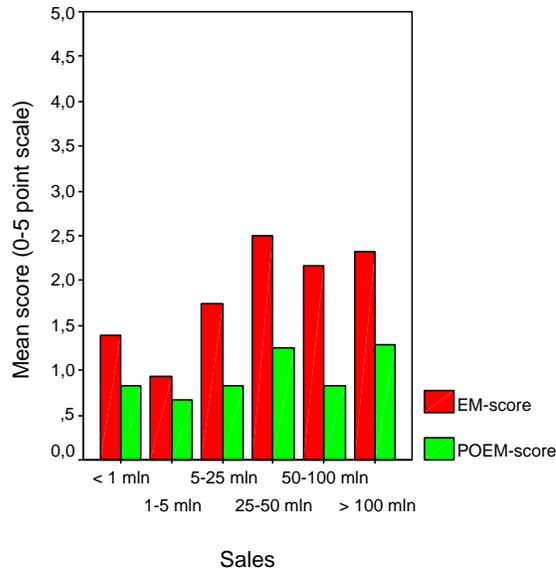
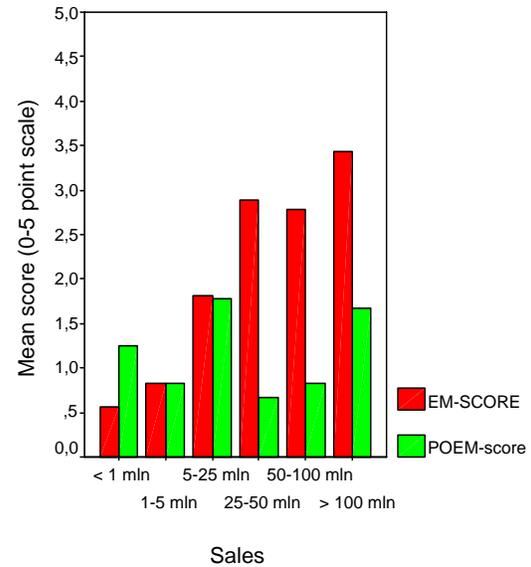


Figure 2 shows the scores on (internal) environmental management (EM) and on product oriented environmental management (POEM). It shows that size has a definite influence on the overall environmental performance of the firm. But also it can be seen that there is a definite drawback in size-category 50-100 mln.

Figure 3a and 3b confront the scores for two different sub-sectors in the sample: ‘slaughterhouses and meat’ and ‘fruit and vegetables’.



3a: Slaughterhouses and meat



3b: Fruit and vegetables

The meat and slaughterhouses subcategory has an average EM-score of 1.64 (N =64, S.D. = 1.15) and a POEM-score of 0.89 (N = 57, S.D. = 1.03), while the fruit and vegetables sector has an average EM-score of 1.12 (N = 27, S.D. = 1.48) and a POEM-score of 1.31 (N = 26, S.D. = 1.16). Interestingly, the fruit and vegetables sector scores better on network-related items, despite the fact that the production process in the meat and slaughterhouses sector has a bigger environmental impact.

We performed a non-parametric Kruskal-Wallis test, to investigate the difference in influence of the different stakeholder groups on the corporate environmental policy (table 1).

Table 1. Stakeholder influences and size (5-point scale except o/ (0-5), SD in parentheses); N = 337, 75 and 24 respectively (Bremmers et al, 2005).

	≤ 50	51-250	>250	KW (p)
Government	3.53 (1.13)	4.04 (.751)	3.69 (.928)	.002
Competitors	1.63(.817)	1.84(.823)	1.79(.509)	.017
Suppliers	1.98 (1.034)	1.96(.738)	2.29 (.955)	.206
Clients	2.41(1.255)	2.62 (1.1)	2.48 (1.22)	.031
Environmental organizations	2.00 (1.13)	2.15(1.036)	2.17(.868)	.140
Inhabitants	2.63(1.247)	3.05(1.129)	3.13 (.947).	.007
Intermediaries o/	1.41 (1.260)	2.25 (1.320)	2.34(1.433)	0.00

Table 1 shows, that especially in the category 50-250 employees the influence of the government is relatively high. The question however remains whether this high influence on corporate environmental policy is translated in priority-setting. As we shall see, this is not the case! It seems that the middle-sized category is ‘accommodative’, rather tah ‘pro-active’.

4.2 Bivariate correlations

In figures 4a, 4b and 4c the significant (p at least <0.05, two-tailed) Spearman rank correlations are shown. Each figure refers to a main construct of the Ajzen-model (attitude, norms and control) and relates it to the IC-specifics, priority-setting of environmental care (operationalization of ‘behavioral intentions’) and the actual behavior with respect to internal EM and POEM.

Figure 4a: ICT, Attitude and Environmental management

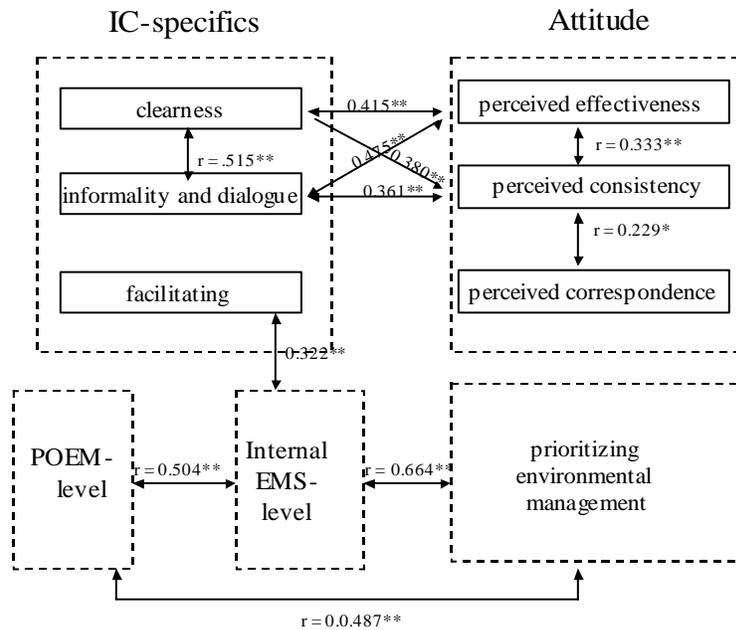


Figure 4a shows, that the clearness of information from governmental agencies on environmental issues and the level of informality and dialogue (the ‘communication’ specifics) are positively associated, and are associated with the perceived consistency and effectiveness of the governmental environmental policy. The IT-component of the IC-system (the ‘facilitating role’ of ICT) does not bring about any attitudinal changes. It relates directly and significantly ($r = .322$, $p < 0.01$ two-tailed) to internal environmental management (which can be understood from the way we operationalized internal EM-performance). The prioritizing-box in figure 4a is not associated with any of the constructs within the attitude-box at all. So perceived effectiveness and consistency of policy is more a ‘satisfier’ than a ‘motivator’ for actual behavior!

Perceived priorities are strongly related with internal EMSs ($r = .664$, $p < 0.01$ two-tailed) and POEMs ($r = 0.487$, $p < 0.01$ two-tailed). Internally oriented EM-systems are strongly associated with POEM-development ($r = 0.504$, $p < 0.01$, two-tailed).

Figure 4b: ICT, subjective norms and environmental management

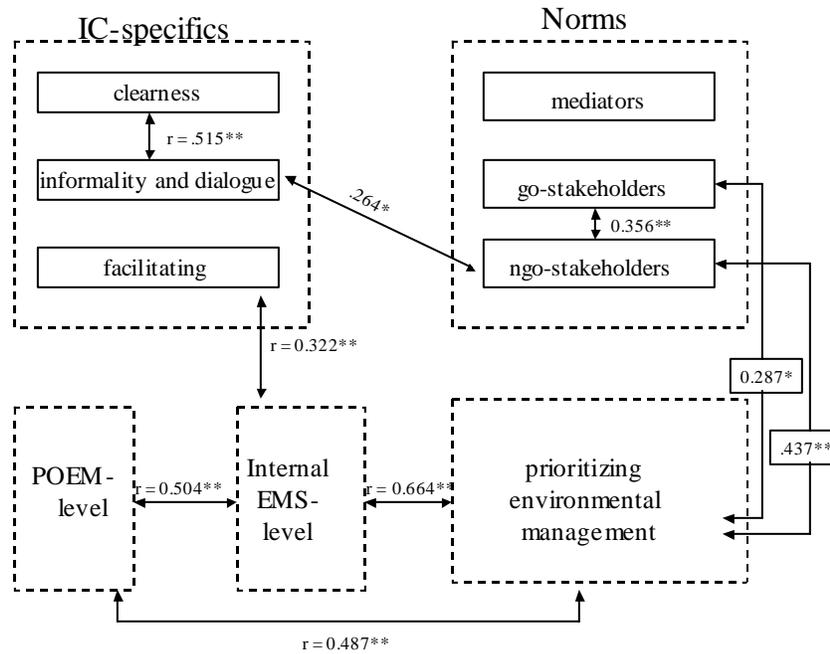


Figure 4b shows, that the characteristics of the IC-system are not significantly associated with the services of mediators, and influence of governmental and non-governmental stakeholders on firm environmental policy. Priority-setting of environmental management is stronger associated with ngo-influences than with go-influences.

Figure 4c: ICT, Control and Environmental Management

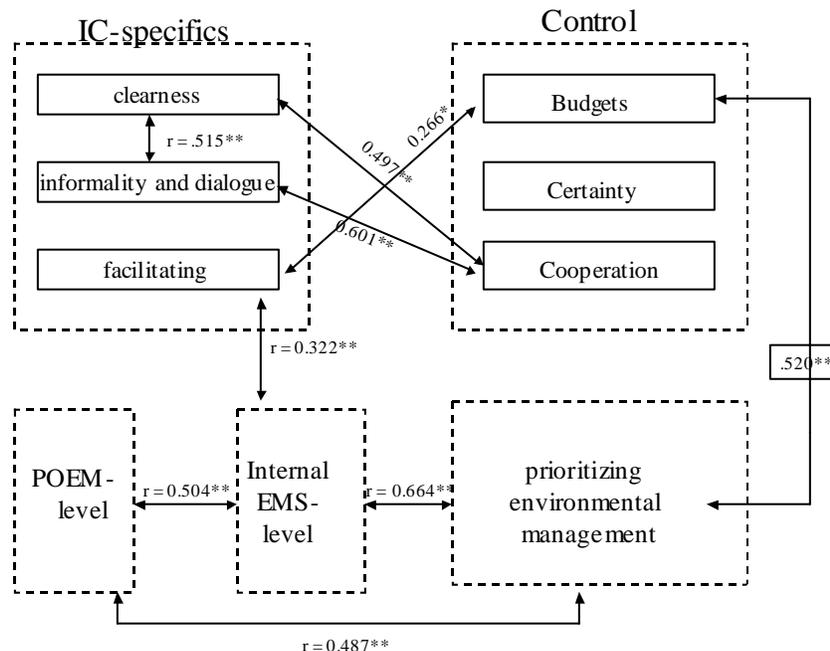


Figure 4c shows, that that there is a positive association between the availability of budgets and the perceived facilitating role of ICT. Informality and dialogue in the public-private relationship as well as clearness of environmental rules are associated with the perceived opportunities to cooperate with governmental bodies. The availability of budgets and prioritizing environmental management are positively and significantly associated.

5. CONCLUSIONS AND POLICY IMPLICATIONS

The first research question was:

What is the effect of the supply chain and network information structure on the managerial behaviour with respect to promoting sustainability (see also: Clarkson, 1995; Wood, 1991).

The communication-specifics of the ICT-system (clearness, informality and dialogue) seem to influence the perceived effectiveness and consistency of public environmental policy. Surprising, the perceived level of correspondence between public and private goals is not affected directly by the communication-variables in the IC-system. In general, there seems to be a dichotomy between companies' goals and priorities on the one side, and the attitude towards the government at the other side. Although one might argue, that reciprocity in the public-private relationship is a condition ('satisfier') for enhancement of environmental goals, it has no link with priorities set at the business level. Or differently stated, a positive attitude towards public goals does not mean that these goals also correspond with the company's objectives; priorities are set on different grounds than interpersonal relationships and understanding alone. What are these grounds?

From figure 4b it follows that, even more than the government, non-governmental stakeholders (like consumers, people living in the neighborhood of firms, environmental organizations etc.) will influence the firm's environmental policy and priorities. This is surprising, since from previous research we undertook for the agri-food sector as a whole (in which small companies dominate) it appears that not only the (central) government, but also intermediaries influence the internal development of environmental management in a fundamental way. We conclude, that for the medium-sized companies the IC-specifics in the public-private interaction are associated with attitudinal variables towards public goals, but a gap exists towards corporate environmental management priority setting. The government is not as influential as it probably would like to be in influencing the firm's environmental agenda! Figure 4c, from which a positive association between communication variables in the IC-system and the perceived possibility of public-private partnership can be derived, confirms this conclusion. Governmental agents increasingly are seen as partners for working on environmental issues, but do not directly influence the priorities the firms set. As already stated, the non-governmental stakeholder-

environment seems to be much more important than the governmental sphere of influence for corporate strategy development.

Whereas from the Ajzen-model it would follow that a higher budget would implicate a better behavioral control and would positively influence behavioral intentions, we could as easily say that the environmental management priority induces the granting of budgets. A similar reverse relationship gives probably ground to the small but significant relationship between the availability of an environmental budget and the facilitating role of the IC-system: sufficient budgets lead to the adoption of IT-hardware to monitor, control and communicate on environmental issues. This means, that these firms do *not* 'internalize' environmental goals for the sole benefit of the environment, but do act environmentally conscious if this leads to higher economic performance (see also: Bremmers et al, 1995).

The second research question was:

What policy implications can be formulated, given the answer on the research question (1)?

Our research shows, that the environmental care level of medium-sized companies is influenced by different parameters than one would suggest on the basis of the existing literature. Communication specifics have no significant influence on the priorities set. So intensive communicative efforts (to convince and stimulate) with respect to medium-sized companies are doomed to fail. Non-governmental stakeholders appear to influence the company's policy and priorities more than the government does. With respect to the non-governmental stakeholders, a further distinction can be made between stakeholders within the business network and 'non-commercial' stakeholders. Companies in the sample especially are influenced with respect to their external priorities by the inhabitants in the neighborhood of the plant. This is evident: companies with this size will be pollutant for the environment; they are especially vulnerable, since as a result of dissatisfaction of the direct environment, they can loose their 'license to produce' at their location. Given the size, moving costs might be exorbitant, so continuity is directly at stake.

In general, the research shows that the IC-structure facilitates information processing, but does not influence priorities. There seems to be a hidden conflict between public and private interests. Enforcement seems therefore a more effective instrument than persuasion for this middle-category. Public policy should not only be differentiated with respect to size, but also with respect to sub-sector (figures 3a and 3b). A set-back in environmental management can be discerned for the middle category, compared with smaller companies (see figures 2, 3a, 3b). Creating synergy between company goals and non-commercial sustainability goals could bridge the gap between public policy and private interest, to the benefit of the environment. If this is not possible, the government should fight, not (only) talk.

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Appendix 1

Measures for IC-structure

Variable description	Survey question	SD (σ)	Mean (μ)	Scale
Facilitating function of ICT for gathering environmental information	E4a,b,c	.905	2.34	1-5
FACILITATING		.905	2.34	1-5
clearness of environmental regulations with respect to the company	D2c	.894	3.06	1-5
clearness of prescriptions in permits	D2g	.983	2.82	1-5
major and minor issues can be discerned on the basis of the information that is provided	D3b	.798	2.95	1-5
CLEARNESS	$\Sigma/3$.709	2.94	1-5
open dialogue with lower governmental bodies	D3a	.976	3.18	1-5
level of informal communication with lower governmental bodies	D3d	.880	3.07	1-5
Perceived level of influence on environmental policy of lower governmental bodies*)	D2m*)	.921	2.37	1-5*)
DIALOGUE	$\Sigma/2$.775	3.13	1-5
*) excluded after principle axis factoring (communality<0.3)				

Ajzen's model- main components (N=78)

Variable description	Survey question	SD	Mean	Scale
perceived effectiveness of environmental policy	D2a	.644	3.08	1-5
perceived correspondence of goals	D2b	.778	2.82	1-5
perceived consistency of communal and provincial rules	D2j	.847	2.77	1-5
ATTITUDE	single items			

Variable description	Survey question	%	Scale
the participation in one or more environmental covenants	C2	82.9	0-1
the availability of a sector-wide organisation that performs activities regarding environmental issues	C1	57.1	0-1
the participation in a chain-wide quality system	C4a	42.9	0-1
the availability of a central company that provides directives with respect to the company's environmental policy (chain leadership)	C3	33.3	0-1
Te availability of a tracking and tracing system beyond the boundaries of the firm	C4b	72.7	0-1
INTERMEDIARIES	$\Sigma/5$	$\mu= 2.25$ $\sigma=1.32$	1-5

Variable description	Survey question	SD	Mean	Scale
Influence on corporate environmental policy of governmental agencies	C6a	.751	4.04	1-5
GOVERNMENT		.751	4.04	1-5
Influence of competitors	C6b	.823	1.84	1-5
Influence of suppliers	C6c	.738	1.96	1-5
Influence of clients	C6d	1.10	2.62	1-5
Influence of environmental organizations	C6e	1.04	2.15	1-5
Influence of surrounding inhabitants	C6f	1.13	3.05	1-5
NON-GOVERNMENT	$\Sigma/5$	1.32	2.25	1-5

Variable description	Survey question	SD	Mean	Scale
the perceived availability of a sufficient environmental budget	B6c	.848	2.58	1-5
the level of certainty about the future environmental rules for the company	D2l	.912	2.51	1-5
Perception of lower governmental bodies as being suitable partners for working on a better environment	D2e	.889	3.16	1-5
CONTROL	single variables	--	--	--