

Towards innovative environmental management in the Agro-food Industry

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Abstract: This article focuses on the problem: what external (stakeholder) and internal (structural/organizational) factors drive companies in the food- and agribusiness towards innovative environmental management? Innovative companies are those considered to have adopted a supply-chain perspective, instead of a focus on the single business unit. We propose that innovativeness is associated with stakeholder wishes (the government, the public environmental policy being a major influential factor), in combination with structural characteristics of the firm (like R&D-efforts, culture and managerial competences).

We surveyed 492 companies in 2002, to get insight into the causes of innovativeness in the Dutch agri-food sector, and supplemented this data by means of a similar questionnaire in 2005. Structural equation modeling and correlation analysis were applied.

The research provided evidence that companies are restricted by, and therefore not comfortable with, public environmental policies, which seem to obstruct innovativeness rather than stimulate it. Firms that (1) have enough internal (physical, financial, social) resources to innovate, and (2) are more embedded in a web of (commercial) stakeholder wishes, prove to be more innovative. Suggestions are made to shift the corporate and public policies towards a supply chain-oriented approach by granting benefits for vertical cooperation in supply-chains.

Key words: environmental management, innovation, governmental policy, stakeholder influences

1. Introduction

In a report of the British Department of Trade and Industry, it is clearly stated that “innovation is essential for meeting the environmental challenges of the future” (*DTI Innovation report*, 2003). The implementation of an environmental management system (EMS) is essential to reduce environmental pressure. An EMS provides a managerial framework, directed at integrating environmental measures in the organization and to continuously improve the environmental performance (*Netherwood*, 2004). Companies are challenged to make the EMS profitable and competitive (compare: *Hart*, 1995; *Porter and Van der Linde*, 1995), at two managerial levels:

- the external level. Companies are challenged to improve their product characteristics in cooperation with their supply chain partners in such a way, that both environmental and customer demands are taken into account.
- the internal level. Companies are challenged to adapt the different processing stages to environmentally-friendly conditions through measures that influence production efficiency and effectiveness;

These different levels are related to each other. The satisfying of external stakeholder wishes can only be achieved by internal restructuring and a shift in managerial focus. The different perspectives get differing attention in recent literature. As to Cooper (2003) external challenges can be met by means of new technologies, new applications and/or entering new markets. Janszen on the other hand

(2000; p.61) focuses on organizational restructuring to enhance competitiveness. The problem that has to be addressed is a lack of insight into the factors that promote innovativeness in the Dutch agro-food sector.

The research objective of this study is to gain an understanding of the organizational and relational determinants for innovativeness in the Dutch agro-food industry. Innovativeness is linked to environmental performance, since pro-active firms that adopt environmental policies beyond the bottom-line will have to change and improve their relational and organizational capabilities.

The agro-food industry is of interest, because it is responsible for a great deal of impact on the natural environment in the Netherlands, because of i.e. high levels of noise, smell (*Dutilh and Blijswijk*, 2004). However, the industry is also widely known for its consumer-driven innovations in products (e.g. packaging material, taste, and color), as well as its strong focus on achieving cost-savings in logistics and the production process (*Batterink, Omta et al*, 2005). This industry is therefore very suitable for getting an insight into the conditions that influence the adoption of environmental measures.

This paper is structured in two layers.

- (1) The external managerial level is addressed by means of a structural equation model. We highlight the influence of stakeholders (especially the government) as a determining factor for promoting or hindering pro-activeness. Does the dominant stakeholder (government) promote or obstruct environmental innovativeness, and why?

- (2) The internal managerial level is addressed by means of an analysis of organizational determinants for EM-performance.

In the conclusions & discussion part of this paper (par. 5), we interrogate policy consequences for both private companies and public bodies, to stimulate a more sustainable and environmentally friendly (future) production.

2. Context and concepts

2.1 The two sides of environmental policy

Stimulating the adoption of environmental management in organizations has been fostered by governmental as well as other stakeholder groups for decades. The main stakeholders for sustainability improvement are local governments, as well as international organizations. Long time political discussions have shifted back and forth between top-down regulation and stressing companies' own corporate responsibility. For some firms, elements of an environmental management system will have to be implemented; otherwise, the permit (license to produce) will be withdrawn. The adoption of environmental management elements is stimulated also by means of subsidies, regulatory relief and voluntary agreements (see: Vermeulen, 2002; Jordan and Lenshow, 2000; Glasbergen and Driessen, 2002). However, as in other countries, the government is the most significant stakeholder in environmental issues, especially for small and medium-sized companies (Clarkson, 1995; Madsen and Ulhøi, 2001).

A factor that could obstruct innovativeness and pro-activeness is the difference in focus between public and business policies. Dutch environmental policy and its regulatory system are directed mainly at the single business unit: permits are unit-bound, environmental reports have to be made for every single business unit, prescriptions are mainly sanitation and process-oriented. What happens outside the business unit is covered by less restrictive policy instruments, such as voluntary agreements (for instance the Dutch packaging covenant), and the provision of documentation and information, mainly to legislative bodies.

Companies that are compliance-oriented will not easily act pro-actively and innovate to a beyond-compliance level. As the public policy is mainly internally oriented (taking sanitation and process-control as a goal), they will not easily adopt goals that, from their viewpoint, only cost money. They will minimize their efforts to keep their 'license to produce' and eventually collect 'low-hanging-fruit'. Companies that perceive environmental care as a source of profits ('pollution prevention pays' because of lower operating costs, redesign of products and processes, recycling, better image, higher company value) will possibly proceed beyond the formal rules and regulations, aiming at 'high-hanging-fruit'.

Figure 1 proposes a relationship between the level of public-private policy correspondence and the willingness to perform beyond the myopic, isolated firm.

Willingness to perform	High	Type I firms	Type II firms
	Low	Type III firms	Type IV firms
		Level of public-private correspondence	

Figure 1: Performance and correspondence

Provided that our proposition is right, namely that governmental policy is oriented at the lower levels of environmental performance, type I and/or type III firms will dominate the agro-food sector. Type I-firms' strategies can be characterized as 'beyond-compliance'. They are willing to adopt higher goals than publicly required and set targets that go beyond internal control. This means that public and private goals do not match, either because intentions are different (high environmental performance because of the contribution to profit (instead of environmental) goals and/or because the focus is different (Rugman and Verbeke, 1998; Clemens and Douglas, 2005). On the other hand, the low-low type-III firms do not embrace environmental goals. They will comply with a minimal level, if they are forced to do so. Compliance will have to be enforced by means of penalties, monitoring and control.

2.2 Environmental management and performance

The primary objective of an EMS is to reduce the environmental impact. This is a managerial framework that facilitates the reduction of pollution by the firm (Netherwood, 2004). The elements are: compliance (for realized by means of environmental audits, process-oriented measures, environmental reporting), coordination (design of and environmental action program), control (inclusion of an environmental database for instance and communication (internal and external reporting) (Bremmers, 1995). For some firms, the system is formalized, following the ISO-14001 guidelines, EMAS and/or BS 7750 (Starkey, 2004).

Agro-food companies have an advantage in the implementation of EMSs, because quality and food safety systems already have on a wide scale. Formalized EMSs have similar characteristics as quality management systems (QMSs) and systems to improve working conditions. We therefore expect, that companies that already implemented QMSs systems will perform better than companies that have to organize the system "stand-alone" (Karapetrovic and Willborn, 1998; Wilkinson and Dale, 1999).

In this study, we view environmental performance as "managerial" performance and not "physical" performance in the sense of actual reduction of impact on the environment. The link between the two is obvious: managerial effort is necessary to achieve reduction targets. We make a distinction, within (managerial) environmental performance, in four different levels:

1. sanitation: the implementation of measures that are meant to clean-up and reduce immediate environmental impact;
2. process-oriented: measures focusing at controlling the processes in the organization;
3. product oriented: measures in the organization with a long-term perspective;
4. supply-chain oriented: measures that foster cooperation with external partners in the food supply chain.

As indicated, our predisposition is that the public environmental policy is primarily directed at the first two levels of environmental management. Will this orientation obstruct companies from being more pro-active and innovative?

2.3 Innovation and performance

Utterbach and Abernathy (1975) distinguish between two types of innovation: product and process. Process innovation aims at reducing the costs of the production in order to increase the efficiency, whereas product innovation focuses at redesigning the product-market combination.. Innovation in the agro-food sector must find a balance between R&D needs, production process and marketing efforts. An optimal innovation effort could be seen as the best trade-off between the dimensions.

At the lower levels of environmental performance, innovations take place to reduce and/or improve internal processes to reduce emissions instantly. The measures are in general: short-term, internally directed and with a focus on immediate returns. In contrast, product- and supply-chain oriented performance requires a different attitude towards the stakeholder environment, a long-term strategy and an awareness of “indirect” gains (connected with a better image and positive consumer-attitude).

The focus on process- versus product-oriented innovation (and therefore environmental performance as we conceive it) will not be stable over time. It is well-known that companies develop through stages in the course of their lives (Keuning, 2006). This implies that there are differences in innovative power over time, depending on size and structure. We will assess the effect of size in our further analyses by using size as a control variable.

Another question related to innovation is: how does environmental innovation occur, will it be a bottom-up activity, starting with sanitation and (hopefully) ending with chain-oriented environmental care? Or will it occur top-down, with setting long-term and strategic management goals by top-management, the influence of which then pervades through the organization, ultimately reaching the

work-floor. Some authors will adhere to the top-down approach: support from the top-management is regarded as a prerequisite for organizational change, whether it will be more strategic or operational of a kind (Lee and Ball, 2003; Govindarajulu and Daily, 2004). Others stress the developmental aspects of organizational change (with links towards systems theory, that itself has its origins in biology), and see organizations change in stages from process- towards product orientation, from sanitation to external orientedness (e.g. King, 2000; Blomquist and Sandström, 2004). Although one could argue that both are necessary and synergetic, we want to assess the dominant causal effect. The above elaborations lead to the “layer 1”-research model as it is described in par. 3.

3. Research outline layer (1)

3.1 Research model

To get insight into the external determinants for sustainable environmental management, we elaborated the following research model.

The middle part of figure 2 represents the structural model, which is composed of 6 latent variables and their interconnections. The left side are the observed variables that are linked to the independent variables in the structural model: IMPACT (the perceived impact of environmental influences), NONCOM (the influence of non-commercial stakeholders on the corporate environmental policy), COM (the influence of commercial stakeholders on the corporate environmental policy) and the perceived need for ‘changing the rules’ for environmental management, which we depict as the perceived need for relational change with respect to public environmental policy, i.e. the desirability of the following innovations, included in the construct INNOVAT:

- introduce a chain-wide environmental permit, instead of a permit per business unit (‘chainpermit’);
- introduce a chain-wide environmental report, instead of an environmental report per business unit (‘collper’);

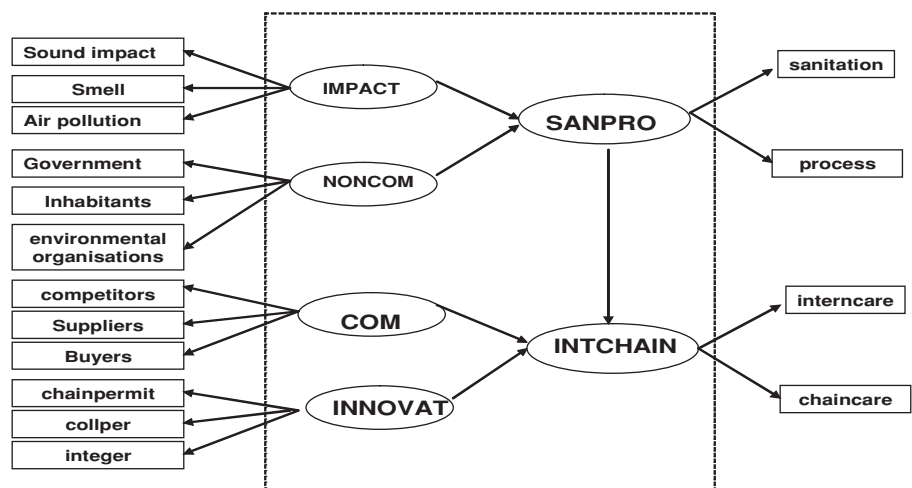


Figure 2: Research model layer 1

- integrate environmental management information with other information addressed to governmental agencies ('integer').

We expect a significant causal but negative relationship for companies that feel limited in their efforts to obtain higher stages of environmental care; this means that the path-coefficient between INNOVAT and INTCHAIN is negative. If, however, such an obstruction would not be perceived (companies actions are not restricted by the present environmental policy), we would expect this relationship not to be significant. A positive relationship however would mean that the theoretical propositions of the model, which is of extreme importance in confirmatory factor analysis and model building, would not have been adequate. The presented model presupposes a positive influence from sanitation and process-oriented environmental care, and product-oriented combined with chain oriented environmental care. Such a positive causal relationship suggests that the former stages facilitate reaching the higher stages. This implicates that changes on the work-floor are necessary (but will probably not be sufficient) to bring about innovative EM.

3.2 Material and methods layer (I)

Material: This study population consists of 2620 companies with five or more employees in the Dutch agro-food sector. All the companies were addressed in 2002 using a written questionnaire. The questions asked were pre-tested by a team of experts and by means of interviews with 10 firms from the sample. Of the initial response of 592 (response rate 43%), 492 questionnaires were used in the structural equation modeling process to test the designed model (100 questionnaires were discarded immediately, among others because of incompleteness).

Methods: We applied structural equation modeling, combining confirmatory factor analysis with path analysis. We used a covariance matrix as input in the data-analysis process, and (in further stages of analysis with a lower N, see par. 3.3.2) the EM-algorithm for imputation to reduce the number of missing values, per category of observed variables, that constitute latent variables. We used Chi-square, in relation with degrees of freedom, p-value, RMSEA, NFI, GFI, and NFI-measures for assessing model fit. We standardized the regression solutions and assessed the appropriateness of dependencies using t-values.

Measures

We measured environmental performance as a multi-dimensional concept, consisting of sanitation, process-, product- and chain-oriented environmental care (see par. 2.2). These dependent variables are formative of a kind; we related the answers on the single questions to the constructs by applying non-weighted averages of 4 x 5 answer categories. An example of a question to measure sanitation is: "An environmental audit has been carried out". Process-care has

been measured by means of questions such as "Regular measurements of environmental impact take place". One of the questions to measure product-oriented EM was "Information gathering for product redesign", whereas the chain-oriented EM was employed by means of questions such as "Cooperation with suppliers/buyers" (0/1-scales).

3.3 Results layer (I)

Baseline results

2-statistics show that the study-sample (N=492) is representative for the total population of companies (N = 2620). With respect to size, however, the bigger companies are slightly overrepresented. *Figure 3* shows the score on the different care levels, with size as an independent variable.

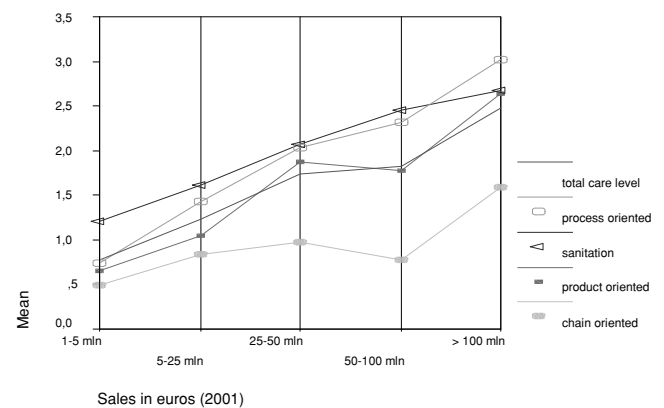


Figure 3: Care level and size (Bremmers et al, 2003)

It appears that care levels are influenced by the size of companies in a positive way. Remarkably, a relative decline in performance for the middle-sized category can be observed. This could be an indication that in different stages of corporate development, different factors will influence the performance level. Especially the score on the innovative chain-oriented environmental care level appears to be relatively low for this category. In contrast, it is cared for by the bigger companies.

Structural equation model (SEM-) results

The SEM-results (standardized solutions) show mixed indications for the model fit (figure 4). χ^2 -value relative to degrees of freedom indicates improvement possibilities, RMSEA (0.066), NFI (0.93), GFI (0.93) and AGFI (0.90) indicate a reasonable/good model fit. T-values are satisfactory within the model ($t > |2|$).

We applied the same model to the companies with 50 or more employees. The results are similar, but are not presented here since the number of cases is relatively low (N = 107) for a similar application of SEM. Another check included reducing the number of 288 cases, by eliminating those variables with on average many variables missing, and

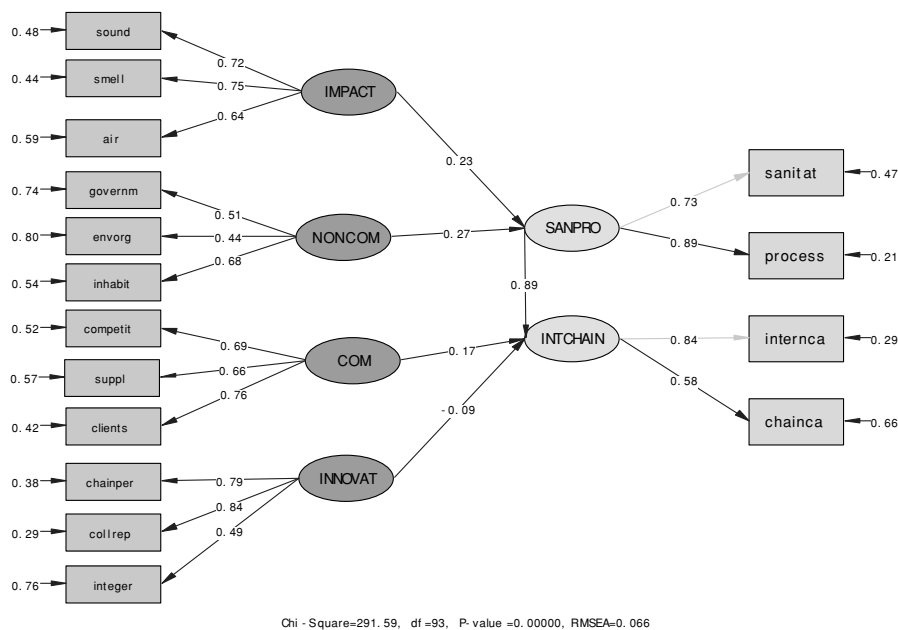


Figure 4: SEM-results (N= 492)

for sales levels < € 5 mln in 200. The results indicated a better fit ($\chi^2 = 170.51$, $df = 79$, $RMSEA = 0.064$). All model results showed a significant and negative relationship between INNOVAT and INTCHAIN.

It is interestingly to see that there is indeed a negative relationship between the innovative environmental management (INTCHAIN) and the willingness to change governmental policy. In other words, the companies that wish a pro-active change of governmental policy (positive scores on 'chainper', 'collrep', and 'integer'), score low with respect to the higher levels of environmental care, represented by the latent variable INTCHAIN.

Possible explanations are:

- firms are willing to perform better, but are hindered by governmental policies in doing so (type III-firms);
- firms are not willing to perform, experience low correspondence of business policy and public (environmental) policy (type I firms);
- the variables 'internca' and 'chainca' are influenced by other, intervening factors, not included in the model (like size, administrative loads).

4. FURTHER ANALYSIS (LAYER II): INTERNAL FACTORS

The research outline in layer II is presented in a condensed form, to limit the size of this paper.

4.1 Theoretical background

To get insight into the internal factors governing innovativeness, we applied the McKinsey 7S-model (Peters

and Waterman, 1982). On the basis of data, gathered in 2005, we constructed an alternative research model. The research model includes four S's of the 7S-model: environmental strategy, environmental structure, systems & procedures and one soft S (style/culture). These variables were supplemented by generic structural organizational characteristics: corporate culture, innovative product strategy, financial resources and company size. 'Environmental strategy' ('Envstrat') refers to the level of integration of environmental management with other management activities (for instance: quality management), from which synergy-benefits are expected. 'Environmental structure' refers to the impact of the environmental manager on business policy (Schaltegger and Synnstedt, 2001). "Systems and procedures" ('Sysproc') refers to the

willingness to change existing procedures to incorporate environmental management targets. The necessity to change existing systems and procedures can meet organizational resistance (Hannan and Freeman, 1984), in 'unfreezing' for organizational change, the R&D-department should play a leading role (Roome, 1994; Blomquist and Sandström, 2004). The cultural element ('Corpcult') in the model stresses the fact that environmental management can benefit from a culture of corporate social responsibility ('CSRcult'), because it contributes in terms of environmental responsiveness and transparency (Robert et al. 2002; MacDonald, 2005). Other structural elements are pressure on margins ('Presspro') and size. It is expected that bigger companies do not experience strict limitations on spending resources for environmental management. Last, "innovative product strategy" is a main key to competitive advantage (Porter, 1980). The innovative product strategy ('Corpstrat') encompasses dimensions as:

- an orientation on technical innovation (development of new products)
- and, especially important for the agro-food sector: the possibility to innovate (Berchicci and Bodewes, 2005; Van Nes and Cramer, 2005).

4.2 Data, methods and measures

The data that we collected in second instance focus especially on the internal organizational characteristics of pro-active firms. The analysis, presented in this paper, is based on 75 completed questionnaire forms (all included firms have at least fifty employees). This sample is representative for the total population ($N = 417$) in the agro-food sector of companies of this size-category ($\chi^2 > 0.05$).

Environmental performance was measured in a similar way as in 2002. However, two generic performance measures

were discerned: internally oriented (EMInternal) versus externally oriented (i.e., innovative) managerial performance (EMexternal). Explorative measures of analysis were applied, including Spearman rank correlations and Cronbach alphas. The α 's appeared to be satisfactory given the explorative character of the research (≥ 0.69).

4.3 Results

The main results are included in the correlation matrix in *table 1*.

As in the 2002-data:

- size is a major determinant for internal environmental care. However, for externally oriented (innovative) environmental management systems, correlations are lower, positive, but not significant.
- internally and externally oriented environmental management are significantly correlated ($r = 0.52$, $P < 0.01$).
- Additionally the data provide the following information:
- corporate culture and CSR-culture are distinctively correlated. Whereas corporate strategy is related to both types of EMS, the CSR-culture is significantly correlated with externally oriented EMs only.
- there is a positive association between an innovative corporate strategy and externally oriented EMS-implementation ($r = 0.27$, $P < 0.05$).

5. Conclusions and policy implications

With respect to the governmental policy the results stated in figure 4 confirm the negative association of the governmental policy with externally oriented EM. The distinct and positive association between sanitation/process-orientedness and product/chain-orientedness suggests (which can not be reversed in the model without losing explanatory value), that sanitation and process-oriented care implementation constitute a necessary first step to be taken.

This indicates, that EM starts bottom-up (but needs top-management support to become a strategic issue).

On the basis of a relatively well-developed internally oriented EM-system, the agro-food sector could take a decisive second step. The synergy between quality, social and environmental control systems can provide a sound foundation for a more pro-active strategy. An external reward, especially for the big companies, is the positive effect this brings along won image, brand-quality, and thus to sales. The bigger and more open companies are, the more they will have to come up to external stakeholder wishes, the higher this reward will be: not only for financial performance, but also for corporate social responsibility, which is of viable importance for survival of the agro-food industry in The Netherlands.

Remarkably, a draw-back in performance can be discerned for the middle-sized companies (see figure 3). This result is not an anomaly within the (almost linear) relationship between size and performance. In contrary, middle-sized companies are possibly more internally directed, for instance because of business-unit development and therefore a revival of a profit on the path of corporate development. A differentiation in public environmental policy is therefore necessary.

Structural organizational specifics (see par. 4) indeed appear to have a definite impact on EM-implementation levels. Especially the R&D-program of firms is managerial of a kind, although limited by product-specifics. Pro-active firms seem not only leading to be leading in R&D-activities, but also in adjusting organizational structures in the direction of sustainability. One could argue that bigger firms are more innovative and therefore are more sustainability-minded. This relationship is not confirmed (see table 1). Size is only a determinant for internal measures, whereas market-orientedness, the willingness and possibilities to innovate, appear to go hand in hand with externally-oriented EM. So a commercial attitude and innovative management seem to point in the same direction.

This article has taken as a starting point that innovativeness is necessary to reach beyond-compliance environmental goals. To further stimulate pro-activeness, initiatives should come from three sides:

Table 1: Spearman rank correlations layer II (Haverkamp et al, 2005)

	EMInternal	EMexternal	CorpCult	CorpStrat	PressPro	Size	EnvStrat	EnvStruct	SysProc
EMexternal	0.52**								
CorpCult	0.13	0.15							
CorpStrat	0.08	0.27*	0.41**						
PressPro	-0.13	-0.17	0.09	0.05					
Size	0.29*	0.19	0.04	0.14	-0.07				
EnvStrat	0.37**	0.28*	0.20	0.11	-0.12	0.05			
EnvStruct	0.49**	0.40**	0.40**	0.15	0.04	0.22	0.27*		
SysProc	0.33**	0.30**	0.46**	0.32**	-0.06	0.12	0.37**	0.41**	
CSRCult	0.18	0.29*	0.48**	0.39**	0.05	0.02	0.22	0.25*	0.41**

** $P < 0.01$, * $P < 0.05$

- environmental organizations, which appear to have a low influence on EM (*figure 4* gives an indication with the low loading for environmental organizations' influence) should refocus their policy from macro- to micro-levels.
- governmental agencies should refocus their policy, from the firm to the supply-chain level (which is actually done already in some – like the energy-covenants).
- Managers at the top-level of organizations should be made aware, that higher levels of environmental performance are beneficial in the long run. Via the mediating role of stakeholders, sustainability can enhance continuity and profitability.

There are a multitude of instruments that can be used to bring about a chain-oriented approach. Three of them are already mentioned in this paper: a permit for the supply-chain, integration of reporting (a framework is provided by the GRI-guidelines), and an environmental report for the supply-chain. These instruments will only work for the bigger companies. For SMEs, it is especially important to influence scale (as can be done by forming 'environmental cooperatives') and mediation by branch-organizations and chain-leaders (dominant companies within the supply-chain), as is the case in food quality and safety management (Eurep-Gap, available at www.eurep.org). The proposed reorientation is in line with recent research, which shows that the leaders in environmental innovation tend to outperform in the stock market. This underlines the importance of environmental innovation and of a constant measurement of innovative power, to the benefit of all stakeholders (Esty and *Cornelius*, 2002).

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