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Auteur

Marcus WAGNER

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Faculté des sciences économiques et de gestion
Pôle européen de gestion et d'économie (PEGE)
61 avenue de la Forêt Noire
F-67085 Strasbourg Cedex

Secrétariat du BETA
Christine Demange
Tél. : (33) 03 90 24 20 69
Fax : (33) 03 90 24 20 70
demange@cournot.u-strasbg.fr
http://cournot.u-strasbg.fr/beta

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ulp UNIVERSITÉ LOUIS PASTEUR STRASBOURG

Effects on competitiveness and innovation activity from the integration of strategic aspects with social and environmental management

Marcus Wagner[a]

[a] Bureau d'Economie Théorique et Appliquée

Université Louis Pasteur

Strasbourg

E-mail: wagner@cournot.u-strasbg.fr

Abstract

This paper analyses the nature and details of the impact which the integration of social and environmental considerations with business strategy has on different dimensions of competitiveness and innovation activity on the firm level. Its objective is to answer the question as to whether a positive link exists between integration and the effects of environmental and social performance on competitiveness and innovation activity. After presenting a theoretical framework based on extant work, the paper introduces the research methods and variables. Subsequently results are presented for four different dimensions of competitiveness, namely market-related, image-related, efficiency-related and risk-related advantage as well as for innovatory activity in terms of product and process innovation. These raise the possibility that the process of integration is more important for bringing about a positive link than a resulting integration type. Based on the results, implications are discussed and we shall draw the conclusions from the findings.

Keywords: stakeholder, environmental management, integration, strategy, quality, social performance, environmental performance, competitiveness, innovation

Introduction

This paper addresses the question regarding the nature of the association between corporate sustainability, competitiveness and innovation. Furthermore, it is of interest to know whether this association can be influenced positively by integrating environmental, social, quality and health and safety aspects with the general strategy of the firm. Corporate sustainability is a newly emerging term in the debate about business and the environment and the social responsibility of firms which refers to firms addressing the social, environmental and economic performance aspects of sustainable development (Sharma and Starik, 2002; Takala and Pallab, 2000; WBCSD, 2000). Even early contributions (e.g. Carroll, 1979) adopted a three-pillar approach to corporate sustainability, and this has become the prevailing paradigm with its associated realisation into the three interacting (aggregate) dimensions of economics, the environment and the social sphere. Whilst there have been empirical studies analysing the performance link of all three pillars of sustainability including the social dimension (e.g. Rennings et al., 2003; Waddock and Graves, 1997), these have not taken into account the different levels of integration of these pillars with the strategy of a firm. Strategy is understood here as a pattern (whether intended or unintended) in a stream of decisions (Mintzberg, 1989; Mintzberg and Quinn, 1991). It is not measured explicitly, but only in relation to its integration with other aspects. The relevance of integration, particularly its social aspects has also been highlighted with regard to enabling firms to achieve the integration of social and environmental dimensions alone (Sharma and Ruud, 2003: 206) and a general need for integration has also been identified by Jansson et al. (2000), Starik and Marcus (2000: 543), Starik and Rands (1995: 914) and Sarkis and Sroufe (2004). The effect of integration on the performance link, i.e. the relationship between social, environmental and economic performance is therefore considered to be innovative and relevant enough to be the focus of this paper.

Integration is understood in this paper in terms of the specific patterns of integration levels of environmental, social, quality and health and safety aspects and the firm's strategy which correspond to specific integration types. This is further specified in the section on the integration of environmental and social management with strategy. Complementary to integration, co-operation (e.g. in terms public-private partnerships or in the context of the various voluntary initiatives aimed at improving social and environmental performance of recent years) is a second aspect upon which rests the implementation of corporate sustainability (King and Lenox, 2000; Harman and Stafford, 1997; Husted, 2003). However since there is no immediate conflict of objectives between co-operation and integration, this second aspect will not be pursued further in this paper.

The following two sections will introduce and evaluate the link between social and environmental management and different dimensions of competitiveness and innovation and the idea of integration with regard to environmental management and corporate social responsibility. Subsequently we shall formulate hypotheses regarding the main research questions. Using a large data set drawn from European firms the paper will then proceed to analyse whether strategies of integrated sustainability management contribute positively to competitiveness and innovation.

Hypothesis development

The link of environmental and social performance and competitiveness

Competitive advantage is a powerful driver for organisations active in sustainable networks and partnerships (Sharma and Ruud, 2003: 211) and therefore a focus on the performance link or the business case of corporate sustainability can yield insights of considerable relevance for managers and policy makers alike. Indeed, extant research on this topic has always stressed the important nature of this focus of research (e.g.

Waddock and Graves, 1997; McGuire et al., 1988). The relationship between environmental management activities and competitiveness captures an important aspect of the performance link. Assuming that environmental management activities determine the level of environmental performance of an organisation and that competitiveness is a major determinant of economic performance (e.g. in terms of profitability ratios) this relationship can be mapped to a performance link between environmental and economic performance for the purpose of deriving hypotheses for this paper. These links will be referred to interchangeably in the remainder of the paper.

Earlier empirical studies on the performance link used both univariate (e.g. Jaggi and Freedman, 1992) as well as standard multivariate (e.g. McGuire et al., 1988; Cormier and Magnan, 1997) analysis. More recent studies applied advanced multivariate techniques (e.g. Hart and Ahuja, 1996; Klassen and McLaughlin, 1996; Russo and Fouts, 1997; Waddock and Graves, 1997; Konar and Cohen, 2001; Ziegler et al., 2002) up to the point of using panel models and simultaneous equations approaches (e.g. King and Lenox, 2001; Al-Tuwaijri et al., 2004). However all of these studies specify a linear relationship between environmental or social performance and economic performance which seems to be a limitation.

The specification of a (positive or negative) linear performance link is based upon a positive net effect of environmental performance improvements on economic performance for lower levels of environmental performance. Extant theorising suggests that such a link is possible, since firms can benefit economically from improving environmental performance by acting proactively to improve processes and products beyond the regulatory requirements, or by creating complementary assets or reputation value, especially when starting off at low levels of environmental performance (Hunt & Auster, 1990; Porter, 1991; Porter and van der Linde, 1995; Aragon-Correa, 1998; Sharma and Vredenburg, 1998; Christmann, 2000). On the other hand, decreasing

marginal benefits and an increasing marginal cost of improving environmental performance as proposed in neo-classical environmental economics suggest a negative linear relationship (e.g. Palmer et al., 1995). In a broader view, purely positive or negative linear relationships represent extremes of a continuum which possibly includes non-linear links. Thus combining the logic of net positive effects for low levels of environmental performance with that of decreasing marginal benefits and increasing marginal cost of improving environmental performance leads to the proposition that an inversely U-shaped curve would represent a more general functional form for the relationship, since it allows for the existence of win-win situations with profitable environmental performance improvement activities whilst being consistent with neo-classical environmental economics.

This idea will be extended in this paper to the case of social performance, since similar arguments as for the relationship between environmental performance and dimensions of competitiveness can be made for the shape of the relationship between social performance and competitiveness (Figure 1). A similar transfer of arguments from environmental to social performance is made by Sharma and Ruud (2003: 209). Although using mainly environmental examples and cases, they stated that the perspectives they present can be easily extended to a broader definition of sustainability that encompasses corporate social responsibility and this transfer is applied here, too. As one special case of an inversely U-shaped link (and analogously to improving environmental performance beyond the legal requirements in the light of potentially tightening regulations) firms may also anticipate strengthening social trends and proactively position themselves in order to be able to realise a positive link (Aragon-Correa and Sharma, 2003: 73). Another special case for the possibility that environmental or social performance improvements only increase cost and reduce profits or competitiveness is also captured by a non-linear relationship. Under the latter

conditions, the optimal level of environmental or social performance for a firm would be that prescribed by environmental or social regulations, i.e. compliance without over-compliance (as indicated in Figure 1, see also Husted (2004) for a related discussion).

The corresponding curves in the graphical representations of the abstract functions of Figure 1 are upward-sloping for social/environmental management levels (and the resulting environmental and social performance levels) below the optimum. This means that the net benefits from increased environmental/social performance are positive for the lower levels of both. The rising gradient of the curve holds up to a certain point somewhat above average levels of social or environmental performance. Beyond this point, the relationship is represented by a downward sloping curve, i.e. increasing environmental/social performance corresponds here to reduced competitiveness because the cost of doing so exceeds the benefit.

Insert Figure 1 about here

Based on these arguments, the following hypothesis can be formulated:

Hypothesis 1: An inversely U-shaped relationship exists between dimensions of competitiveness and both environmental and social performance.

Empirically, assuming an inversely U-shaped link with an optimum point (i.e. a level of social or environmental performance based on related levels of managerial or operational activities at which competitiveness or a specific dimension thereof is maximised) does not preclude the possibility of a (positive or negative) linear relationship as a special case and hence is considered to increase the breadth and flexibility of the empirical analysis without being limiting in any way.

Integration of environmental and social management with strategy

Environmental and social management are often conceived as being separate management systems with only minimal links (e.g. in terms of personnel or organisational structures and processes) to the general management system of a firm (Hamschmidt and Dyllick, 2002). This often entails a doubling of corporate functions. Thus whilst the general management system is responsible for strategic and operative planning (to be subsequently implemented through budgets, resource allocation and monitoring) environmental management for example is responsible solely for planning the environmental activities of the firm and supporting these by means of guidelines and tools. The result is frequently insufficient ecological or social effectiveness and limited economic efficiency (resulting from the additional coordination efforts needed).

Central to the limited efficiency characteristic for the current situation of formalised environmental management systems (EMS) or social management systems (SMS) is the "parallel", but unconnected existence of environmental or social management systems. Furthermore, the general management system of a company acts to reduce the competitiveness of a firm because additional resources are needed for coordination. These resources are frequently indirect or overhead costs or expenditure, and are therefore not always traced adequately in the accounts of a company. This produces negative effects from the lack of integration, on competitiveness being neglected or, even worse, being overlooked due to limited managerial resources. On the other hand, when firms voluntarily enhance their environmental or social performance beyond the minimum level legally required, they are motivated often only by the desire to produce improvements in their corporate image or other, similar competitiveness aspects. Such aspects are difficult to assess in terms of their economic value and therefore an assessment of the impact is often not even attempted. Again, limited managerial attention may lead to important benefits resulting from increased integration being

overlooked. These considerations so far highlight the value and necessity of integration, as also identified in earlier studies (e.g. Ilinitch and Schaltegger, 1995; Burke and Logsdon, 1996).

Next to competitiveness, innovation activities are another important dimension of firm performance. In the literature, for example the effect of regulatory uncertainty on innovation has been highlighted (Marcus, 1981). Also, the development of stakeholder integration and continuous innovation capabilities has been identified (Sharma & Vredenburg, 1998). Most of the arguments made above for competitiveness can also be extended to the aspect of innovation activity in firms, which can also in a wider sense be understood as one very specific aspect of competitiveness.

On the operative side, a limited level of integration of EMS and SMS within the general management system of the firm is often reflected by the use of performance indicators which are part of the management accounting function in firms. Whilst for EMS in recent years numerous initiatives (e.g. WBCSD, 2000) have formulated largely converging performance indicators for a large number of potentially relevant environmental aspects in different industries, these have often had only limited links to the general management system. The situation for SMS is similar, but additionally complicated by the varying definitions of that to which “social” in the context of sustainability management refers. As a result, the definition of performance indicators in the context of SMS and EMS is not greatly linked to the general management system. In addition to issues of identification and attention, this separation at the measurement level adds to the inefficiency in decision-making and in turn is likely to increase the negative effects on the competitiveness of a firm resulting from an insufficient level of integration.

As previously noted, integration is understood in this paper in terms of specific patterns of integration levels of the aspects of environmental, social, quality and health and

safety (H&S) with the firm's general strategy, that result in a specific integration type. This definition includes quality and H&S, because their integration has been proposed by many authors as being a specific stage of integration i.e. integration proceeds form environment, health and safety to total environmental quality management to being integrated with social and strategic issues (GEMI, 1993; Pischon and Liesegang, 1999; Benn and Probert, 2006) The specific processes leading to this could not be observed and therefore the process aspect is not elaborated further in this paper. Instead, the focus rests on the type of integration resulting from the process. Whilst the process of integration can be important e.g. in terms of acquiring specific capabilities, the type of integration (which can be perceived as one element of a firm's environmental or sustainability strategy) mainly determines the fit between strategy and the general business conditions. Even in the case of dynamic capabilities, the process aspect of integration is more relevant for the actual management of these '.. processes by which managers integrate, reconfigure, gain and release resources (Eisenhardt and Martin, 2000: 1107)'. What predominantly determines the sequence of equilibrium states that represent the instantaneous fit between strategy and business conditions at any given point of time is however the type of integration which results from such processes (which is fixed for a finite or infinite period of time).

Whilst a number of conceptual papers have addressed integration (e.g. Hart, 1995; 2000; Aragón-Correa and Sharma, 2003: 74), empirically it is rare that the differences in the effect of environmental or social performance on competitiveness and innovation activity which result from different types of integration are analysed. As a result, only limited evidence on the empirical effect of integration exists from survey data. Furthermore, the relationship between environmental and social performance and competitiveness and innovation, i.e. the question as to whether environmental protection or social engagement benefits a company from an economic point of view can often not

be answered unequivocally but depends on the resources available to a firm and is contingent on the fit between a firm's strategy to utilising these and the general business conditions (Aragon-Correa and Sharma, 2003). However the incentives for an integration of environmental and social aspects with corporate strategy should be strong, as integration would be likely to result in a more positive effect of environmental and social performance on the various dimensions of competitiveness and innovation, i.e. a more positive effect on competitiveness or innovation for more integrated sustainability management characterised linking strategy, social, environmental and health and safety aspects. Therefore it is hypothesized that a positive effect from integration exists for both competitiveness and innovation.

Hypothesis 2: Integration exercises a positive moderating effect on the relationship between environmental and social performance on competitiveness.

Given the point made earlier, that for innovation and competitiveness, the effect of integration is alike, a similar hypothesis can be formulated for innovation.

Hypothesis 3: Integration has a positive effect on the level of innovatory activity.

The next section focuses on the operationalisation and empirical testing of the three hypotheses. After introducing the data set, the measurement of core variables and the method of analysis, the results are presented. Based upon this, conclusions are drawn.

Research method and analysis

Approach and data set

The empirical analysis is based upon data collected during the European Business Environment Barometer (EBEB) survey. This is a bi-annual survey of the state of environmental management in practice carried out in several European countries. The data was gathered using a postal questionnaire. The questionnaire asked firms for a self-

assessment of the main environmental effects and stakeholder demands; of the benefits from environmental management and of the level of integration between environmental, social, quality and H&S aspects with the firm's general strategy. The questionnaire is accessible at ww.agf.org.uk/pubs/pdfs/UK.pdf in an English version (the survey was carried out in each country's official language).

The data is based on the last EBEB survey round in 2001 carried out in nine European countries (Belgium, France, Germany, Hungary, Netherlands, Norway, Sweden, Switzerland, United Kingdom). Prior work provides some descriptive results and some comparison of the effects that several stakeholders have on the companies, the relevance of different management and technology measures as well as influences of strategy choice (Baumast and Dyllick, 2001). The empirical analysis aimed at testing the hypotheses proposed in this paper is based on four steps:

1) a hierarchical cluster analysis of different items surveyed in the EBEB with regard to the integration of environmental, social, quality, H&S and corporate strategy aspects resulting in a categorising variable, the integration type;
2) calculation of two indices of social and environmental performance based on item sets to test for effects on competitiveness;
3) a factor analysis (PCA) on different measures referring to various aspects of competitiveness yielding four dimensions and indices of competitiveness used as dependent variables in the analysis;
4) an ordinary least squares (OLS) multiple regression model aimed at predicting competitiveness based on various industry and sector dummy variables, control variables and the firm's social and economic performance as predictors.
5) an exploratory analysis of the interaction of integration with innovation activity.

In the 2001 EBEB round, 2095 firms in the manufacturing industries were surveyed Europe-wide. In the Appendix, Tables A1 to A3 provides an overview in terms of a

sample breakdown by country and industry, general descriptive statistics and correlations. The sample for the survey was based on random sampling with the firm population equaling the total number of firms in the manufacturing sector of each country. The questionnaires of the survey were addressed to the general or environmental manager of a company and it was asked that the person most knowledgeable should answer it. In some case therefore quality managers completed the questionnaire. Especially in small firms the general manager or managing director herself or himself often completed the questionnaire. In total 2095 firms responded to the survey.

In terms of response behaviour the response rates varied across countries (e.g. Germany 16.7 per cent, Hungary 35.2 per cent, Switzerland 14.9 per cent, Sweden 36.3 per cent, Netherlands 17.4 per cent, Norway 22.2 per cent and United Kingdom (UK) 10.7 per cent) but this is an issue also encountered in the European Community Innovation Survey (Smith, 2005: 168) and may be more of a challenge in Europe compared to e.g. the US. The country managers for the survey stated as reasons for this fewer responses from smaller firms (in the case of Norway, Switzerland, the UK and Germany), a decreasing interest of especially large and medium-sized firms in participating in survey research (in the Netherlands) and (in Hungary) a generally strong interest in environmental issues (Baumast and Dyllick, 2001; Harkai and Pataki, 2001; Batenburg, 2006). The very low response rate in the UK is additionally explained by the fact that no second mailing was sent to those firms who did not respond to the first invitation to participate in the survey. The average response rate of 26.1 per cent in the 2001 survey was, however, similar to the average of the earlier EBEB survey rounds in 1998 (17.6 per cent) and 1996 (33.9 percent).

Concerning response bias beyond country differences, it may be that the replies represent over-proportionally many firms that are very active in terms of environmental

management since such firms could be more interested in the subject. However such bias was not found to be strong. For example in case of the German responses, the characteristics and response behaviour of early respondents was not significantly different from the late replies, based on comparison of means for all variables between the first and last 10 per cent of respondents and similar findings were made for the other countries. Furthermore, broad variability is found in the responses, indicating that the data also includes environmentally inactive firms. One bias evident in the data is that smaller firms are under-represented in the replies for several countries, especially Norway, Switzerland, UK and Germany. The implication of this is that results may not be representative for small firms.

Next to response bias, self-assessment and use of only one survey instrument may be a cause for distortions in the data set, in particular concerning common method bias. Common method bias results from variance in the date being more attributable to a measurement method than to the constructs measured (Podsakoff et al., 2003). The extent of common method bias differs between disciplines and is below average in the fields of marketing and business (Cote and Buckley, 1987). Self-assessment or soliciting data on independent or dependent variables does not per se imply the existence of common method bias since its strength can differ amongst subgroups of respondents (e.g. respondents from different countries) and since method-related variance can deflate or inflate the relationships observed (Cote and Buckley, 1987; Podsakoff et al., 2003). For the EBEB survey data used here a number of procedural and statistical steps were taken to ensure that common method bias is minimised.

Procedurally, different response formats were used, the anonymity of respondents was ensured, question order was counter-balanced and scale items were improved, especially throughout the pre-test phase of the survey. All these steps were aimed at reducing socially desirable responses and item ambiguity. For the sake of keeping the anonymity

of respondents, it was not generally possible to pursue two other procedural remedies, namely obtaining assessments from different respondents and separating measurements. However the instructions provided for the survey (in particular the request to let the most knowledgeable person answer) and the implementation of the survey made it possible that even these two latter remedies could in principle be applied by respondents. In terms of statistical ex post evaluation of the presence of common method bias in the data finally used in the analysis, Harman's single-factor test is applied to establish whether one single factor accounting for most of the variance in the data could be identified from the unrotated solution of a factor analysis. The unrotated factor solution yields 40 factors of which 21 have Eigenvalues larger than unity. The first three factors explain 8 per cent, 5.4 per cent and 4.3 per cent, respectively. All remaining factors with Eigenvalues greater than one explain between 2.5 per cent and 4 per cent of the variance in the data. This is strong evidence against the existence of one general factor accounting for most of the variance in the data. Overall, common method variance does not seems to be a critical issue in the data in terms of both ex ante procedural precautions and ex post statistical evidence.

Cluster analysis of environmental, social, quality, H&S and strategy integration

As a first step of the empirical analysis, a cluster analysis was carried out on four items concerning the integration of environmental, social, quality, H&S and strategy aspects to identify different types of integration of these. The questions underlying these items asked to rate on a five-point Likert scale ranging from "not at all" to "fully integrated" the level of integration of environmental with social, quality, H&S and strategy issues, respectively. The cluster analysis then used squared Euclidian distance and the Ward linkage procedure to identify clusters (Hair et al., 1998). The resulting variable is

subsequently used to define groups of firms in the data (shown in Figure 2) with a similar pattern of integration for the four items surveyed in the questionnaire.

Insert Figure 2 about here

Figure 2 provides the six-cluster solution of the cluster analysis which shows a relatively clear stage-wise approach.

(a) Cluster 1 in Figure 2 is characterised by low levels of integration of environmental, social, quality, H&S and corporate strategy aspects;

(b) Cluster 2 has intermediate levels of integration and consists of four sub-groups;

(c) Cluster 3 has (very) high levels of integration on all items, but even here integration of social and environmental aspects is still lower than for the other items. Consistent with conceptual integration models (e.g. Benn and Probert, 2006) cluster 2 reported under (b) can be disaggregated meaningfully into four different groups of firms (corresponding to a six-cluster solution).

The first of these (Cluster 2a) is characterised by high average values for the level of environment, health and safety (EHS) integration and for integration of environmental issues with quality assurance and improvements. Integration of environmental and social aspects and of environment with general strategy is low. This group of firms could be termed management system-oriented. Cluster 2b has intermediate levels of EHS integration, high levels of integration of quality and strategy aspects with environmental themes but low integration of environmental and social aspects (however still higher than for Clusters 1 and 2a). These firms can be considered as being business oriented.

Cluster 2c is characterised by a high average value for EHS integration and intermediate levels of integration for all other items (i.e. the second highest level of integration

between environmental and social aspects). This group of firms shows a somewhat balanced orientation. Finally, Cluster 2d is characterised by the highest level of EHS integration across all clusters in the six-cluster solution, but also has the lowest levels of integration for all other items. Thus it represents firms exclusively with EHS integration. Table A5 of the appendix summarises the mean values across clusters and items. The six sets of firms resulting from the cluster analysis are the basis for the regression analysis. Prior to reporting its results, the empirical analysis steps 2) and 3) referring to index construction and factor analysis are briefly described.

Indices for environmental and social performance, and competitiveness

Environmental performance is measured in terms of an index assessing the reduction of the environmental impacts of the firms in a number of categories (such as energy or water use or use of toxic inputs), each measured by a separate item variable. For each of the items, the survey asked about the degree to which environmental management activities reduced the company's environmental impact for this variable. Respondents were asked to provide answers on a five-point Likert scale ranging from 'no reduction', 'little reduction', via 'average reduction' to 'strong reduction' and 'very strong reduction' with the highest score corresponding to the largest reduction.

Social performance is measured in this research based on the extent of stakeholder pressure. Waddock and Graves (1997: 303) argue that '… a company's interactions with a range of stakeholders arguably comprise its overall corporate social performance …'. Wood (1991) concurs (under the assumption that decision making in firms relates to performance) when stating that social issues and stakeholder concerns affect the decision making of firms. Burke and Logsdon (1996) see the total pressure exerted by different stakeholder groups (as perceived by firms) positively correlated with the level of activities and (assuming that activity levels influence

performance) also the social performance of firms. All else being equal therefore, the more pressure stakeholder groups exert, the higher is the overall stakeholder pressure and hence the better social performance should be. One could argue that social performance is by definition the degree to which stakeholder demands (i.e. pressure) are fulfilled by a company and hence that the latter are a more reliable and valid measure than evaluator or observer judgements or judgements based on voluntary disclosures by firms. Margolis and Walsh (2001) consider the latter two as problematic because of availability bias and because executives have incentives to under-report on their social activities. Therefore, for constructing an index of social performance 13 stakeholder groups were evaluated. These were the owning company, employees, trade unions, distributors, corporate buyers, consumers, consumer associations, insurance companies, national legislators, European legislators, the press/media, scientific institutes and local communities. A high rating on stakeholder pressure for any of these groups (measured on a five-point Likert scale ranging from 'none' via 'average' to 'very strong') correlates according to the above ceteris paribus with higher social performance. This is because high pressure implies that firms have to care more about the legitimacy of their operations and their social 'license to operate' and are thus forced to define proactive sustainability strategies if they want to avoid giving the impression of not caring about social issues according to Hart and Sharma (2002, quoted in Sharma and Ruud, 2003).

Competitiveness is defined in this paper in a narrow sense as that part of the overall economic performance of a firm, which can actually be influenced by sustainability management activities and different dimensions are used as dependent variables in the regression analysis. The reason for this was the assumption that economic performance in general is determined by many factors, of which sustainability management is only a minor one and that the chosen definition would enable a better focus Lankoski (2000)

pursues a similar approach with her concept of environmental profit). The most suitable approach for measuring competitiveness defined in this way seemed to be the use of self-assessment by firms, based on a number of items, an approach also used by Sharma (2001). Sustainability-related competitiveness was thus measured by means of a set of items asking about the effect of management activities on different aspects such as e.g. the effects on market share or the cost of insurance to the company for business risks.

A PCA was carried out on the (sustainability-related) competitiveness items used in the survey. This allowed identifying three different factors (dimensions) of (sustainability-related) competitiveness. The first factor refers to product image, sales, market share and new market opportunities. Therefore it was labelled ‘market-related competitiveness’ since it predominantly relates to the market- and product-related benefits of a company’s activities. The relevant items for the second factor are corporate image, owner/shareholder satisfaction, management satisfaction, worker satisfaction and recruitment and staff retention. This factor was termed ‘image-related competitiveness’ since it mainly refers to internally oriented satisfaction and company image benefits from a company’s activities. For the third factor identified, the items short-term and long-term profits, cost savings and productivity are particularly relevant. These predominantly refer to the profitability of a company and this factor was therefore named ‘efficiency-based competitiveness’. The two remaining items, namely ‘improved insurance conditions’ and ‘better access to bank loans’ could not be assigned to one of the above factors, but looking at them, it becomes clear that they potentially represent a fourth factor, since both are linked to the financial effects on a company from its chosen level of sustainability management activities. These two items were therefore interpreted as a fourth factor labelled ‘risk-related competitiveness’. For further analysis indices were calculated based on the factors identified, which represent four dimensions of sustainability-related competitiveness.

Regression model, estimations and analysis of innovation effects

For each cluster the influence of environmental and social performance on each of the four dimensions of (sustainability-related) competitiveness was assessed separately. Whilst another approach to the analysis would be to use interaction terms, separate estimation is considered more appropriate here for three reasons. Firstly, Hypotheses 1 and 2 above refer essentially to four explanatory variables (environmental and social performance and their squares) which would have rendered interpretation difficult had interaction terms been included in the model. Secondly, using interaction terms to test the hypotheses would make the implicit assumption, that the estimates for all other explanatory variables in the model are identical across clusters. However this is not necessarily the case and to allow for differing coefficients on the same variable across clusters, a regression model is estimated for each cluster separately. Thirdly, the use of interaction terms may increase standard errors, rendering the estimation less efficient.

Since 36 independent variables are used in the regression analysis, data is pooled across countries. Given that the analysis uses cross-sectional data OLS is an efficient estimation method and the multiple linear regression equation estimated separately for each dimension of competitiveness is defined as follows:

> competitiveness dimension i = linear additive function of (firm size, square of firm size, sector dummies, country dummies, market growth rate, firm_age, legal form, overall profit, dummies for level of EMS implementation, existence of a quality management system, environmental/social performance index, square of environmental/social performance index)

The inclusion of squared terms for social and environmental performance indices accounts for the possible non-linear relationship of these with competitiveness as proposed in Hypothesis 1. The squared terms model decreasing marginal benefits of

improving performance and a negative relationship (if estimated coefficients are negative). They essentially enable testing for a non-linear link against a linear one without precluding the latter. In the EBEB survey, innovation was only measured in terms of a binary variable asking firms if they develop environmentally sound products or utilise integrated environmental technologies. Therefore, a multivariate analysis seemed inappropriate. Instead, an exploratory analysis of direct associations between integration and these different innovation dimensions was carried out. Table A4 in the Appendix summarises all variables used in the regression model. The following Tables 2 to 4 summarise the results of the analysis for each of the four competitiveness dimensions separately, whilst Tables 5 and 6 provide results on innovation activity.

Insert Table 1 about here

Insert Table 2 about here

Insert Table 3 about here

Insert Table 4 about here

Insert Table 5 about here

Insert Table 6 about here

Results

As concerns Hypothesis 1, the results indicate that in about only half of the cases was it possible to observe a significant link between environmental and social performance

with competitiveness. This was on all but one occasion non-linear, yet not always an inversely U-shaped curve, as depicted in Figure 1. For the large majority of clusters and competitiveness dimensions, the link with both environmental and social performance was insignificant. Hypothesis 1 can therefore only be partly accepted.

The indices of environmental and social performance were only significant for cluster 2b (with environmental performance having a negative effect, and its square a positive effect) and for cluster 3 (with social performance being negative and its square positive) for market-related competitiveness. In addition, for image-related competitiveness, social performance had a significantly positive effect and its square a significantly negative effect for clusters 1 and 2d as had for cluster 2d environmental performance (negative) and its square (positive).

For efficiency-related competitiveness as a dependent variable, social performance had a significant negative and its square a significant positive influence but only for cluster 3. Finally, for financial risk-related competitiveness, the square of social performance had a significant negative effect on cluster 1 as did the linear term of social performance on cluster 3. This was the only case were only the linear or the squared term was significant.

As concerns Hypothesis 2, no strong positive moderating effect of the level of integration on the relationship exists. Only in the case of image-based competitiveness, was it possible to observe that integration had an effect upon social performance. This was shown in the cases of cluster 1 and 2d. As both clusters are characterised (except for a high EHS integration level in cluster 2d) by low levels of integration, this largely refutes our second hypothesis. This conclusion is supported by the fact that although cluster 3 with the highest integration levels had the highest number of significant effects of environmental and social performance across all four dimensions of competitiveness, these were negative for two competitiveness dimensions and U-shaped only for one.

Concerning Hypothesis 3 on the effects of integration on innovation, the exploratory analysis finds that also for innovation, the highest level of integration (i.e. cluster 3) is associated with the highest percentage of firms carrying out innovation activities. In terms of the four individual integration items it is found that innovation activity is especially associated with integration of environmental management with corporate strategy and quality management.

Conclusions, Discussion and Limitations

Conclusions

Referring to extant research on environmental management and social issues, observation of the results reported here shows that whilst an inversely U-shaped relationship seems theoretically very plausible, it is not predominant in empirical data. Continuing to assume a linear relationship may be a limitation, since on several occasions significant non-linear relationships were found. In this research, where the effect of environmental and social performance on competitiveness was found significant, mainly U-shaped relationships were observed, something also proposed by Barnett and Salomon (2003) for investment funds. The implication is that as in the screening of investment funds for socially responsible investment, mechanisms similar in nature rather than firm-level specific mechanisms are at work. This could represent a fruitful subject for future research.

As concerns the association of integration to innovation, it is also found that Hypothesis 3 cannot be fully confirmed in that firms with lower levels of integration have proportionally higher innovation activity. A focus for future research that can be derived from this could be the question of what aspect of integration mainly brings about higher levels of innovation in a firm. The results indicate that for example integration of

environmental with quality management seems to do so and this should be confirmed in further studies.

The question of whether process or outcome is most critical for integration at the firm level has also profound implications for management, as firms may put considerable effort in implementing those tools in their organisation that they consider to be most suitable for bringing about integration with a positive effect on competitiveness.

Last not least, managers can learn important lessons from the insight that different context factors such as country location or EMS have a stronger simultaneous influence on different dimensions competitiveness than has strategic orientation. This finding supports a view of sustainability management rooted in contingency theory in which a fit of context and strategy becomes critical. For example, image-related competitiveness effects are strongly linked to the site level and to stakeholder concerns internally from employees and externally from local residents and this across all strategic orientations. Furthermore, regulation is more similar within one country (e.g. as concerns the stringency of regulation) than across countries and thus my influence different dimensions of competitiveness in a similar fashion. Managers therefore need to identify which context factors are most relevant in the specific situation of their company and focus on these which may make some patterns of integration more suitable than others to adopt.

As concerns the limitations of the study variation in response rate by countries, it may be necessary to acknowledge a certain level of self-selection of respondents and self-assessment. Reasons for the variations in response rate have been discussed and other than low responses of small firms, it was not possible to find any systematic non-response of specific groups of firms. Self-assessment is mainly a concern in terms of common method bias, but testing for this indicated that this is not an issue. Given the common limitations of survey data based on self-assessment it would be desirable to

carry out confirmatory analyses with e.g. United States Toxic Release Inventory or other pollutant release and transfer register data. The age of the data may be an issue because at the time of the survey likely no dedicated social issue managers existed in many firms. However the request that the most knowledgeable person provides answers meant that questions related to social issues could be answered by the competent staff or, especially in the case of smaller firms, by owners or managing directors themselves. Overall therefore, none of these limitations were found to be so severe that it would prevent meaningful analysis.

In addition to these limitations the Eurocentric nature is a feature of the research, which, in light of the institutional differences in other regions, could limit the transferability of the findings. On the other hand, a European focus is complementary in that most extant research on the performance link has been carried out on US data. Thus despite its limitations this study has hopefully clarified the relevance of integration for corporate sustainability research and will provide a spur for further work.

Appendix

The development of the questionnaire was a joint effort of researchers from nine European universities and business schools and started with a joint workshop in late 2002. Prior to this the large majority of the questions of the questionnaire had already been used in two earlier EBEB surveys in 1996 and 1998. Nevertheless, the final version of the questionnaire used in the 2001 survey was translated anew from English into the respective national languages as necessary and then pre-tested as a whole in each country. For example, the translation of the German version of the questionnaire was tested with four firms to ensure that the questionnaire could be understood easily by firms, that the time for completion was acceptable and that there were no problems with

any individual questions. The pretests which were carried out separately in all countries were then aggregated by a coordinator and minor changes were made following this.

Table A1 provides an overview of the breakdown of respondents from different countries in industry sectors. The responses are largely representative for the sector distribution of manufacturing industries in the EU. Table A2 provides descriptive statistics for all variables used. It shows that except for the case of firm size (due to overrepresentation of larger firms) none of the variables is skewed to a high degree.

Table A3 shows correlations for all variables and Table A4 a summary of the definition of all variables used in the empirical analysis. Table A5 gives the mean values across clusters for the items used in the cluster analysis. Table A6 shows that all individual items making up the environmental performance index used are correlated with this overall performance measure, giving confidence in the validity of the measure. In addition to this, Cronbach's Alpha for the index is 0.9, confirming its reliability. Table A7 shows the same information for the social performance index for which Cronbach's Alpha is 0.8. Finally whilst the validity of the indices for sustainability-related competitiveness was addressed when these were introduced in the paper, their reliability is confirmed by their Cronbach Alpha's, which were 0.8 (market- and image-related indices, respectively), 0.7 (efficiency-related index) and 0.6 (risk-related index).

Insert Table A1 about here

Insert Table A2 about here

Insert Table A3 about here

Insert Table A4 about here

Insert Table A5 about here

Insert Table A6 about here

Insert Table A7 about here

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Figures and tables

Figure 1

Relationship between environmental/social performance and competitiveness (based on Lankoski, 2000; Wagner, 2000; Schaltegger & Synnestvedt, 2002)

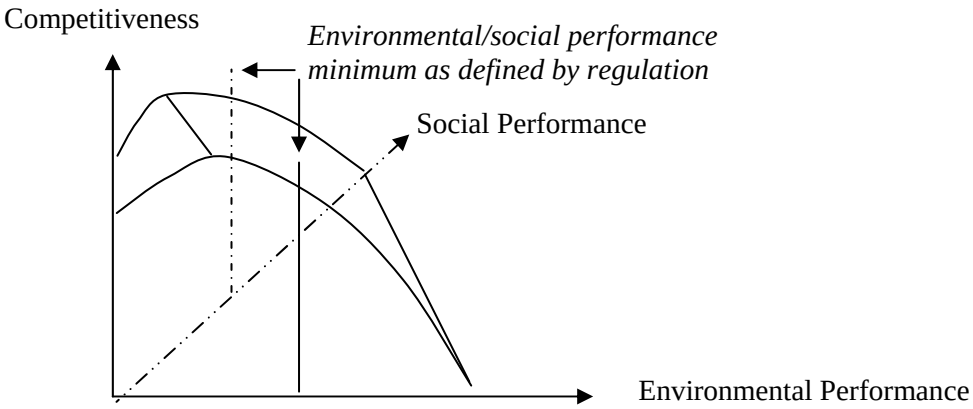

Figure 2

Error bar graph for the three-cluster solution for integration variables

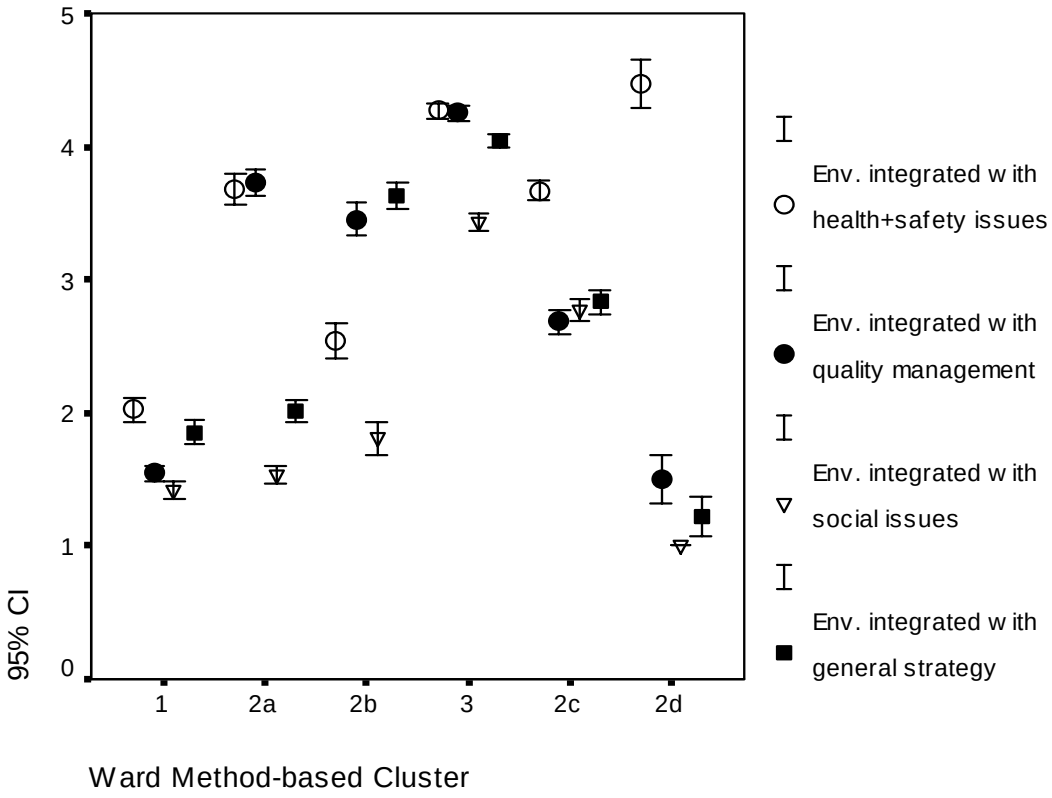

Table 1

Market-based competitiveness results[a]

Cluster number	**1**	**2a**	**2b**	**2c**	**3**
Equation variable	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**
Constant (unstandardised)	2.96**	3.16**	2.82**	4.69**	4.12**
Germany	-0.02	-0.09	0.28†	-0.06	0.15*
Sweden	0.10	0.14†	0.33*	0.19*	0.33**
Switzerland	0.045	0.10†	0.23†	-0.06	0.11†
United Kingdom	-0.02	0.16*	0.38**	0.14	0.19**
Hungary	0.59**	0.57**	0.43**	0.32**	0.08†
France	0.04	0.05	0.03	-0.03	0.002
Belgium	0.08	0.07	0.15	-0.02	0.18**
Norway	0.08	-0.03	0.20†	0.16	0.29**
Market change in last 3 years	-0.01	0.11*	0.18†	0.12	0.16**
Firm considers EMS	0.04	0.04	0.07	-0.04	0.04
EMS set-up in process	0.06	0.11†	0.28*	0.004	0.04
Has implemented an EMS	0.10	0.21**	0.41**	0.11	0.20**
Quality standard implemented	0.06	0.04	-0.09	-0.06	-0.04
Company solely owned	0.05	-0.004	0.11	-0.01	-0.03
Overall business performance	0.19**	0.09†	0.01	0.12	0.03
Number of FTE employees	-0.02	0.04	-0.06	0.01	-0.003
Firm age	-0.05	-0.06	0.14	0.03	-0.02
Social performance index	0.26	-0.49	1.14	-0.04	-0.75**
Squared social performance index	-0.38	0.39	-1.38	-0.05	0.52†
Environmental impact index	-0.34	0.10	-1.56*	-0.33	-0.23
Squared environmental index	0.33	0.10	1.49*	0.41	0.25

Number of observations	235	253	125	200	475
Adjusted R-squared	0.38	0.47	0.29	0.13	0.21
F statistic	5.26**	7.56**	2.44**	0.19**	4.61**

Note: 13 industry dummy variables were supressed for better readability.

† $p < .10$; * $p < .05$; ** $p < .01$

[a] For cluster 2d, no model could be estimated due to the low number of observations in this cluster combining unfavourably with missing values in the regression variables.

Table 2

Image-based competitiveness results

Cluster number	**1**	**2a**	**2b**	**2c**	**2d**	**3**
Equation variable	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**
Constant (unstandardised)	2.02**	2.95**	2.31	2.80**	0.57	3.91**
Germany	0.11	-0.05	0.05	-0.04	-0.51*	0.12†
Sweden	0.02	0.13	-0.01	0.05	-	0.09
Switzerland	0.07	0.07	0.09	0.07	0.29*	0.13*
United Kingdom	0.03	-0.06	0.11	-0.06	0.06	0.08
Hungary	0.41**	0.39**	0.37**	0.28**	0.89*	0.08†
France	0.14*	0.14*	0.05	0.07	0.08	0.14**
Belgium	0.18*	0.06	0.13	0.16*	0.09	0.17**
Norway	0.12*	0.28**	0.19	0.21**	-0.06	0.16**
Market change in last 3 years	-0.08	0.01	0.02	0.11	-0.22†	0.07
Firm considers EMS	0.08	0.05	0.16	0.06	0.03	-0.01
EMS set-up in process	0.16**	0.25**	0.42**	0.06	-0.50	0.14*
Has implemented an EMS	0.32**	0.29**	0.43**	0.35**	-0.27	0.27**
Quality standard implemented	0.05	0.07	0.01	-0.09	-0.23†	-0.06
Company solely owned	-0.003	-0.11†	0.11	-0.06	0.03	-0.02
Overall business performance	0.09	0.04	0.25**	0.05	0.05	0.09†
Number of FTE employees	-0.03	0.04	0.06	-0.03	0.38*	0.04
Firm age	0.06	-0.02	0.06	-0.03	0.41†	0.04
Social performance index	0.97*	0.41	0.07	0.72	4.37*	-0.45
Squared social perf. index	-1.20**	-0.57	-0.32	-0.81	-4.25*	0.26
Environmental impact index	<0.001	0.03	0.62	-0.31	-2.22*	-0.06
Squared environmental index	0.03	0.04	-0.58	0.42	2.14*	0.16

Number of observations df+1	248	262	126	205	37	478
Adjusted R-squared	0.35	0.25	0.30	0.26	0.98	0.17
F statistic	4.84**	3.59**	2.50**	3.11**	47.96**	3.83**

Note: 13 industry dummy variables were supressed for better readability.

† p < .10; * p < .05; ** p < .01

Table 3

Efficiency-based competitiveness results[a]

Cluster number	**1**	**2a**	**2b**	**2c**	**2d**	**3**
Equation variable	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**
Constant (unstandardised)	3.82**	2.45**	5.04**	3.49*	8.40	3.97**
Germany	<0.001	-0.21*	-0.11	0.004	-0.51	0.05
Sweden	0.05	-0.12	0.10	0.03	-	0.10
Switzerland	0.001	-0.04	0.01	-0.01	-0.16	0.09
United Kingdom	-0.01	-0.08	-0.15	0.003	-0.62	0.04
Hungary	0.20*	0.01	0.22†	0.24**	-1.82	0.05
France	0.01	-0.10	-0.08	0.19*	-1.38	0.02
Belgium	-0.04	-0.13	0.01	0.09	0.05	0.09
Norway	0.07	-0.02	0.003	0.25**	-0.48	0.21**
Market change in last 3 years	0.04	0.05	0.08	0.03	-0.88	0.08†
Firm considers EMS	-0.04	0.01	0.10	-0.03	-1.09	-0.01
EMS set-up in process	0.06	0.14†	0.16	0.10	-2.40	0.05
Has implemented an EMS	-0.01	0.16†	0.08	0.08	0.06	0.12†
Quality standard implemented	-0.01	0.001	0.17†	0.04	2.29	0.01
Company solely owned	-0.22**	-0.01	-0.04	-0.11	-0.34	-0.05
Overall business performance	-0.05	0.13†	0.02	0.12†	1.22	0.06
Number of FTE employees	0.02	0.01	0.03	0.17*	-0.637	0.10*
Firm age	-0.05	0.004	-0.04	-0.11	-0.77	0.02
Social performance index	-0.33	-0.45	-0.98	-0.05	12.84	-0.83**
Squared social perf. index	0.28	0.34	0.99	-0.06	-14.25	0.75*
Environmental impact index	-0.03	0.74	-0.39	-0.02	-15.39	-0.16
Squared environmental index	0.003	-0.55	0.31	0.17	14.47	0.21

Number of observations df+1	246	260	126	205	35	476
Adjusted R-squared	0.07	0.05	0.16	0.18	0.88[a]	0.07
F statistic	1.54*	1.433[†]	1.69*	2.39**	0.23	2.01**

Note: industry dummy variables were supressed for better readability.

[†] p < .10; * p < .05; ** p < .01

[a] Unadjusted R-squared

Table 4

Financial risk-based competitiveness results[a]

Cluster number	**1**	**2a**	**2b**	**2c**	**3**
Equation variable	**Beta**	**Beta**	**Beta**	**Beta**	**Beta**
Constant (unstandardised)	2.08**	3.15**	3.38**	1.80**	4.20**
Germany	0.10	-0.03	0.19	0.05	0.19**
Sweden	0.04	-.011	0.01	-0.10	0.03
Switzerland	0.06	-0.002	0.14	0.03	0.14*
United Kingdom	-0.05	-0.01	0.06	0.08	0.13*
Hungary	0.54**	0.24**	0.36**	0.08	0.18**
France	0.16**	0.08	0.01	0.12	0.09†
Belgium	0.16*	-0.10	0.20	0.18†	0.15*
Norway	0.03	0.02	0.09	0.09	0.04
Market change in last 3 years	0.03	0.07	0.28*	0.02	0.004
Firm considers EMS	0.01	-0.003	0.05	0.09	-0.08
EMS set-up in process	0.01	-0.07	0.19	0.12	0.04
Has implemented an EMS	0.08	0.04	0.30†	0.21*	0.09
Quality standard implemented	0.01	0.03	0.08	-0.01	-0.05
Company solely owned	-0.05	-0.13†	-0.07	0.05	-0.04
Overall business performance	0.07	0.02	-0.03	0.02	0.05
Number of FTE employees	-0.04	0.10	0.04	0.23**	0.01
Firm age	0.10	-0.11†	0.13	0.03	-0.02
Social performance index	0.82	-0.11	-0.55	0.77	-0.65*
Squared social performance index	-0.94†	-0.08	0.50	-0.82	0.44
Environmental impact index	-0.08	0.36	-0.37	0.51	-0.26
Squared environmental index	0.004	-0.23	0.40	-0.46	0.22

Number of observations df+1	227	247	120	197	472
Adjusted R-squared	0.28	0.19	0.22	0.07	0.10
F statistic	3.61**	2.69**	1.99**	1.45†	2.53**

Note: 13 industry dummy variables were supressed for better readability.

† p < .10; * p < .05; ** p < .01

[a] For cluster 2d, no model could be estimated due to the low number of observations in this cluster combining unfavourably with missing values in the regression variables.

Table 5

Crosstabulation of integration type and innovation activity

Integration type	1	2a	2b	2c	2d	3
Innovation activity						
Keine Innovation	45%	29%	20%	31%	41%	17%
Nur Prozessinnovation	31%	39%	36%	38%	46%	41%
Nur Produktinnovation	13%	15%	15%	16%	3%	14%
Produkt- und Prozessinnovation	11%	17%	29%	15%	11%	28%

Table 6

Significant positive association of specific integration dimensions on innovation activity

Integration type	Corporate strategy and environmental management	Environ-ment, Health and Safety	Quality and environ-mental ma-nagement	Social issues and environ-mental management
Innovation activity				
Process innovation	positive	positive	positive	positive
Product innovation	positive	none	none	little positive

Table A1

Overview of sector and country distribution of respondents*

Country	**NL**	**D**	**S**	**CH**	**UK**	**HUN**	**FRA**	**BEL**	**NOR**	**Total**
Industry										
Food products, tobacco	55	39	20	13	6	27	2	37	28	227
Textile products	6	15	6	5	7	33	11	17	8	108
Leather products			1		1	11	1	1		15
Wood products	10	1	29	3	6	7	3	15	10	84
Pulp & paper products	14	11	12	3	3	11	4	9	9	76
Publishing & printing	18	23	18	3	14		4	7	12	99
Energy; cokes, oil fuel	3	2		1	3	9	3	1		22
Chemical products, fibers	16	24	17	13	18	10	23	32	10	163
Rubber and plastic	28	16	19	11	5	11	10	17	7	124
Non-ferrous mineral products	12	17	1	3	4	16	3	15	8	79
Metal products	94	44	78	18	23	16	30	48	35	386
Machines & equipment	30	35	30	12	12	20	22	15	7	183
Electrical & optical equipment	12	34	15	17	13	8	10	8	9	126
Transport products	6	17	6	1	9	10	12	6	2	69
Other	56	56	34	9	54	3	4	54	8	278
Total	360	334	286	112	178	192	142	282	153	2039

* Some firms did not answer which industry sector they belong to and are therefore not reported in Table A1.

Table A2

Descriptive statistics for all variables of the regression analysis

Variable	N	Minimum	Maximum	Mean	Std. dev.
Environmental performance index	1817	1.00	5.00	3.33	0.72
Square of environmental performance index	1817	1.00	25.00	11.58	4.72
Social performance index	2032	1.00	5.00	3.67	0.75
Square of social performance index	2032	1.00	25.00	14.03	5.23
Overall business performance	1860	1.00	5.00	3.85	1.00
Company in sole proprietorship	2047	0.00	1.00	0.40	0.49
Firm has not implemented EMS	2066	.00	1.00	0.36	0.48
Firm considers EMS implementation	2066	0.00	1.00	0.12	0.33
Firm is in progress of EMS implementation	2066	0.00	1.00	0.18	0.38
Firm has implemented an EMS	2066	0.00	1.00	0.33	0.47
Decadic logarithm of firm age	1973	0.30	2.83	1.61	0.39
Netherlands	2095	0.00	1.00	0.17	0.38
Germany	2095	0.00	1.00	0.16	0.37
Sweden	2095	0.00	1.00	0.14	0.35
Switzerland	2095	0.00	1.00	0.06	0.23
United Kingdom	2095	0.00	1.00	0.10	0.30
Hungary	2095	0.00	1.00	0.09	0.29
France	2095	0.00	1.00	0.07	0.26
Belgium	2095	0.00	1.00	0.14	0.34
Norway	2095	0.00	1.00	0.07	0.26
Firm size	2064	0.00	316.00	1.34	10.54
Textile products	2039	0.00	1.00	0.05	0.22
Leather products	2039	0.00	1.00	0.01	0.09

Wood products	2039	0.00	1.00	0.04	0.20
Pulp and paper products	2039	0.00	1.00	0.04	0.19
Publishing and printing	2039	0.00	1.00	0.05	0.21
Energy, cokes and oil fuel	2039	0.00	1.00	0.01	0.10
Chemical products and fibres	2039	0.00	1.00	.08	0.27
Rubber and plastics	2039	0.00	1.00	0.06	0.24
Non-ferrous mineral products	2039	0.00	1.00	0.04	0.19
Metal products	2039	0.00	1.00	0.19	0.39
Machines equipment	2039	0.00	1.00	0.09	0.29
Electrical and optical equipment	2039	0.00	1.00	0.06	0.24
Transport products	2039	0.00	1.00	0.03	0.18
Other manufacturing	2039	0.00	1.00	0.14	0.34
Food, tobacco	2039	0.00	1.00	0.11	0.31
Market-related competitiveness	1902	1.00	5.00	3.31	0.43
Image-related competitiveness	1948	1.00	5.00	3.65	0.48
Efficiency-related competitiveness	1932	1.00	5.00	3.18	0.52
Risk-related competitiveness	1843	1.00	5.00	3.20	0.41
Market change last 3 years	1992	1.00	5.00	3.35	0.96
Existence of a quality standard	1998	.00	1.00	0.73	0.44

Table A3

Correlation of independent variables (with number of observations)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Social performance index	1												
(1)	2032												
Firm considers EMS	0.01	1											
implementation (2)	2020	2066											
Firm is progress of EMS	-0.03	-0.17**	1										
implementation (3)	2020	2066	2066										
Firm has EMS (4)	-0.23**	-0.26**	-0.33**	1									
	2020	2066	2066	2066									
Decadic logarithm of	-0.06**	-0.02	-0.001	0.17**	1								
firm age (5)	1919	1952	1952	1952	1973								
Square of environmental	-0.13**	-0.001	-0.10**	0.08**	-0.04	1							
performance index (6)	1784	1797	1797	1797	1717	1817							

Environmental	-0.12**	0.001	-0.10**	0.07**	-0.04	0.97**	1						
performance index (7)	1784	1797	1797	1797	1717	1817	1817						
Market change last 3	0.01	0.00275	0.08**	0.04†	-0.08**	-0.11**	-0.10**	1					
years (8)	1940		1975	1975	1901	1736	1736	1992					
Number of employees	-0.10**	-0.04	-0.04	0.13**	0.08**	0.05*	0.05*	0.01	1				
(9)	2010	2042	2042	2042	1965	1795	1795	1977	2064				
Quality standard exists	-0.15**	-0.01	0.06**	0.27**	0.06*	0.03	0.04	0.08*	0.04†	1			
(10)	1961	1991	1991	1991	1888	1748	1748	1908	1975	1998			
Sole proprietorship (11)	0.11**	-0.02	-0.09**	-0.20**	-0.06**	0.06*	0.06*	-0.05*	0.02	-0.21**	1		
	1994	2026	2026	2026	1947	1780	1780	1963	2036	1959	2047		
Overall business per-	-0.04†	-0.05*	-.004	0.10**	0.04	-0.03	-0.03	0.27**	0.06*	0.08**	-0.05**	1	
formance (12)	1813	1847	1847	1847	1788	1627	1627	1842	1848	1782	1834	1860	
Square of social	0.99**	0.003	-0.03	-0.24**	-0.08**	-0.13**	-0.12**	0.02	-0.10**	-0.17**	0.13**	-0.04†	1
performance index (13)	2032	2020	2020	2020	1919	1784	1784	1940	2010	1961	1994	1813	2032

† p < .10, * p < .05, ** p < .01

Table A4

Summary of variable definitions for variables used in the empirical analysis

Concept	**Variable**	**Description**	**Type**
Economic performance & Innovation activity	Competitiveness indices 1-4	Indices calculated based on factor analysis of items measuring (sustainability-related) competitiveness in the survey	conti-nuous (cont.)
	Innovation in - Products	Binary variable of value 1 if firm developed environmentally sound products, 0 otherwise	dummy
	- Processes	1 if integrated environmental technologies	dummy
Social performance	Social performance index	Averaged index score (based on assessment of pressures from a set of different stakeholders most relevant to social performance)	cont.
Environmental performance	Environmental impact reduction index	Averaged index score (based on set of variables measuring impacts for different dimensions of environmental performance)	cont.
EMS implementation status	"No"	Firm has not implemented EMS (reference)	dummy
	"Considering"	Firm considers EMS implementation	dummy
	"In process"	Firm is in progress of implementing an EMS	dummy
	"Implemented"	Firm has implemented an EMS	dummy
QMS	Quality system	Dummy taking value 1 if no QMS is acquired	dummy
Country	Belgium	Firm located in Belgium	dummy
	France	Firm located in France	dummy
	Hungary	Firm located in Hungary	dummy
	Netherlands	Firm located in the Netherlands (reference)	dummy
	Norway	Firm located in Norway	dummy

	Sweden	Firm located in Sweden	dummy
	Switzerland	Firm located in Switzerland	dummy
	United Kingdom	Firm located in the United Kingdom	dummy
	Germany	Firm located in Germany	dummy
Sector control variables	Food / tobacco	Firm in food and tobacco sector	dummy
	Textiles	Firm in textile products sector	dummy
	Pulp and paper	Firm in pulp and paper products sector	dummy
	Printing	Firm in printing and publishing sector	dummy
	Energy, oil etc.	Firm in energy, oil and nuclear fuels sector	dummy
	Chemicals	Firm in chemicals and fibres sector	dummy
	Rubber & plastic	Firm in rubber and plastic products sector	dummy
	Non-ferrous	Firm in non-ferrous mineral products sector	dummy
	Machinery	Firm in machines and equipment sector	dummy
	Electrical optical	Firm in electrical and optical products sector	dummy
	Transport products	Firm in transport products sector	dummy
	Metals products	Firm in metals products sector (reference)	dummy
	Other manufac-turing products	Firm in sector producing other manufacturing products	dummy
Other control variables	Firm age	Logarithm of firm age in years	cont.
	Market development	Measured on a 5-point scale to assess if firm has decreasing or increasing sales	ordinal
	Firm legal status	Dummy taking value 1 if firm is solely owned	dummy
	Firm overall profitability	Measured in the survey on a 5-point scale to assess if firm is profit-making or loss-making	ordinal
	Firm size	Number of employees (in thousands)	cont.

Table A5

Mean values across clusters and items *

Cluster	Health/Safety	Quality	Social	Strategy
1	2.03	1.54	1.42	1.85
2a	3.68	3.73	1.54	2.01
2b	2.54	3.45	1.81	3.63
2c	3.67	2.68	2.77	2.83
2d	**4.47**	1.50	1.00	1.22
3	4.27	**4.26**	**3.44**	**4.04**

* Highest row (cluster) means are underlined, highest column (item) mean are in bold

Table A6

Correlation of environmental performance index with individual items[a]

Individual item	N	Pearson	Kendall Tau-b	Spearman-Rho
Reduction in water use	1562	0.678**	0.546**	0.669**
Reduction in energy use	1722	0.666**	0.524**	0.646**
Reduction non-renewable resource use	1375	0.645**	0.507**	0.620**
Reduction in use of toxic inputs	1263	0.708**	0.572**	0.696**
Reduction of solid waste	1675	0.667**	0.533**	0.658**
Reduction of soil contamination	996	0.690**	0.554**	0.673**
Reduction of waste water emissions	1461	0.711**	0.580**	0.703**
Reduction of air emissions	1493	0.686**	0.544**	0.666**
Reduction of noise emissions	1485	0.680**	0.522**	0.636**
Reduction of smell / odour	1110	0.612**	0.461**	0.561**

emissions				
Reduction of landscape damage	869	0.495**	0.373**	0.457**
Reduction in risk of severe accidents	1399	0.663**	0.523**	0.635**

[a] individual items measured on 5-point scale

* p < .05 ** p < .01

Table A7

Correlation of social performance index with individual items[a]

Individual item	**N**	**Pearson**	**Kendall Tau-b**	**Spearman-Rho**
Owning company	1534	0.556**	0.432**	0.562**
Employees	1966	0.561**	0.436**	0.554**
Trade unions	1750	0.533**	0.414**	0.519**
Distributors	1518	0.610**	0.487**	0.604**
Corporate buyers	1832	0.599**	0.465**	0.600**
Consumers	1475	0.654**	0.507**	0.640**
Consumer associations	1421	0.675**	0.532**	0.657**
Insurance companies	1801	0.631**	0.491**	0.617**
National legislators	1932	0.587**	0.456**	0.581**
European legislators	1876	0.650**	0.514**	0.655**
Press/media	1828	0.686**	0.549**	0.680**
Local communities.	1813	0.633**	0.493**	0.620**
Scientific institutes	1784	0.678**	0.542**	0.666**

[a] individual items measured on 5-point scale

* p < .05 ** p < .01

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