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Charting corporate greening: Environmental Management Trends in Sweden

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Going Green: Environmental Management Trends in Sweden

Abstract

Three surveys of the Swedish construction industry were carried out in 2002, 2006 and 2010. With the aim to provide insights regarding long-term environmental work in the construction industry, trends and significant changes in corporate environmental management and performance are identified and discussed. The results show that environmental work in Sweden has become institutionalized as a strategic part of the companies' business, environmental management activities are integrated within the companies' work practices, and the companies show a greater maturity as well as raised ambitions in their environmental actions. Although, the companies perceive less legislative force, the pressure from, and need for cooperation with, a larger variety of stakeholders and across disciplines has increased. Environmental management systems are adopted on a wide front, meaning that the work relies on self-surveillance and voluntary actions. A consolidation of environmental management within the companies, but also an emerging business niche of environmental expert consultancy, is observed. Despite extensive environmental efforts in the Swedish construction industry the effects on competitiveness and financial performance seem unclear implying that there are other justifications for change than financial and legal justifications.

Keywords: corporate environmental management, environmental performance, attitudes, trends, change, questionnaire survey, Sweden

1. Introduction

In recognizing that main barriers for sustainable building lie within policy, process and social aspects rather than in technology (Häkkinen & Belloni, 2011; Oreszczyn & Lowe, 2010), researchers have pointed to a need to pay increased attention to actions and attitudes towards greening of industry among built environment professionals (Phua, 2013; Summerfield & Lowe, 2012; Whyte & Sexton, 2011; Feige, et al., 2011; Hoffman & Henn, 2008). During recent years, several surveys covering the built environment professionals' perceptions of the management of green construction have been carried out in for example Sweden (Isaksson, et al., 2009), Finland (Häkkinen & Belloni, 2011), Singapore (Hwang & Tan, 2010), China (Zhang, et al., 2011), Hungary (Màlovics, et al., 2011), and US and Korea (Son, et al., 2009). The surveys have in common that they have identified major institutional and organisational barriers that hinder the industry's progress towards sustainability. Hwang and Tan (2010, p. 347) describe it as a 'vicious cycle' of high costs, lack of client demands, lack of R&D, and lack of collaborative efforts and communication between various stakeholders. The latter has, in terms of stakeholder participation and collaborative learning, also been emphasised in the work by Kaatz, et al. (2006, 2005). Moreover, despite increased research and industry efforts and more stringent regulative environmental measures, policies, standards and codes, researchers claim that work practices in the construction industry have only marginally been affected (eg. Pan & Garmston, 2012; Häkkinen & Belloni, 2011; Ryghaug & Sørensen, 2009; Sayce, et al., 2007). It has even been questioned if built environment professionals due to conflicting institutional and epistemological logics currently frame and address

the sustainability issue at all (Hill, et al., 2013).

In sum, research depicts a rather negative view regarding the construction industry's ability to manage sustainable development. Based on the literature review one can ask: is the construction industry really not progressing within this field?

Although there are several studies that address the change of environmental management in construction (for overviews see Summerfield & Lowe, 2012; Cole, 2011; Marsh, et al., 2010; Kibert, 2007), few surveys seem to have collected empirical data over a long period of time. Thus, empirical evidence supporting the assumption of the construction industry's lack of environmental action seems to be missing. Given that many of the initiatives taken by various stakeholders within the industry depart from this assumption it is therefore important to scrutinize it by tracking the greening of the construction industry over time.

In order to track environmental development in the Swedish construction industry, this paper utilizes three environmental barometer surveys, carried out in 2002 (Baumann, et al., 2003), 2006 (Gluch, et al., 2007) and 2010 (Gluch, et al., 2011). Each survey covers the prior four years, meaning that a total period of twelve years is taken into account, from 1998 to 2010. Based on environmental managers' perceptions of their companies' activities and actions the aim of this paper is to identify and discuss trends in corporate environmental management in the Swedish construction industry. The term *construction industry* is here used in a broad sense, including architect firms, building engineering and design consultancies, construction companies, and property and real estate companies.

2. Method

2.1 Data collection

Three surveys were carried out in 2002, 2006 and 2010 as total surveys comprising the entire population of companies within building engineering and design, construction, and property and real estate with at least 50 employees, and architect companies with at least 20 employees (table 1). The companies were selected from Statistics Sweden's business register according to the Swedish Industrial Classification industry codes (SNI, corresponding to the European industrial activity classification–NACE).[1]

[Insert table here] 1

There are differences in the population size, with about 15% less companies in the 2010 survey, table 1. One explanation is a change in the data collection method, from a paper to an electronic questionnaire in 2010. In the electronic questionnaire, the respondents were able to drop-out and some e-mails bounced which led to a smaller final population.

2.2 Preparation of questionnaires

A first *Environmental Barometer survey* was carried out for the Swedish manufacturing industry in 1993 (Terrvik, 1994). The barometer rapidly grew into a Nordic, then a European survey, called the International Business Environmental Barometer (IBEB) survey (for an overview, see Baumann, et al., 2002). The general structure of the surveys covers the industry's environmental challenge, its response to this challenge, and results from measures taken.

The first barometer for the Swedish construction industry in 2002 was a

modified version of this general *Environmental Barometer survey* (Nilsson & Hellström, 2001; Terrvik, 1994). In the 2006 survey, minor adjustments were made based on the experiences from 2002 survey. Changes mostly concerned wording, for example, "client/customer" instead of "consumer." In 2010, some minor adjustments were made based on experiences from the two previous surveys but also because the questionnaire was distributed electronically instead of on paper. The main difference was that there was no longer a need to ask the respondents for general company information since those data were already available in the register from Statistics Sweden. The aim and scope of all the surveys has been consistent over time. Keeping the questionnaire as similar as possible has been a deliberate move in order to be able to make comparisons over time.

The questions measured the opinion of the respondents by using a Likert scale with a four- to seven-point range[2], a binary scale only allowing yes or no answers and questions concerning demographic and more general and descriptive information.

The questionnaires were pretested on practitioners; an instructive cover letter together with detailed contact information and multiple reminders were sent out; and the reasons why some respondents failed to respond were investigated and analysed in order to decrease possible systematic bias. In a survey that aims to assess peoples' attitudes and values there is always a risk that the respondent gives answers that reflects how it ought to be rather than how it is in order to appear good. Possible bias from this should therefore be considered when interpreting the results.

2.3   Data analysis

Data have been compiled and analysed with the aim of identifying significant changes over time. In the surveys of 2002 and 2006, the data were entered manually, stored in and analysed by using the statistical data program SPSS®. In the 2010 survey, the data were entered by the respondents directly into the database of the online software SurveyMonkey™. From there, the data were exported and analysed in SPSS®.

To enable analysis over time, data from all three surveys have been merged into one data set with the 2006 survey as reference. The 2006 survey has the most questions and functions well as a link to both the 2002 and 2010 surveys. For Likert scale variables, mean values have been calculated and one-way analysis of variance (ANOVA) was performed, followed by post hoc tests to test for differences between the surveys. For dichotomous variables (binary scale), cross-tabulation has been chosen for detailed analysis.

3.   Results

In the following section, results related to the main themes of the survey are presented: these themes are *stakeholder influence*, *corporate response to meet environmental challenges*, *business effects from taken measures*, and *perceived obstacles*.

3.1   Stakeholder influence

Together with managers, clients are seen as the most influential stakeholders on

companies' environmental work in all three surveys. Also, the end customer and the employees are considered important stakeholders. Overall, in 2010, a larger variety of stakeholders are perceived as having influence on the companies' environmental work than in the previous surveys. For about half of the stakeholders, the degree of influence has significantly changed, mostly during the period 2006 to 2010. Most of the changes are a significant increase in perceived influence, but for some stakeholders, there is a significant decrease, for example influence from environmental authorities and owners/shareholders (see table 2).

[Insert table here] 2

Seen from an environmental research and knowledge perspective, in the 2002 and 2006 surveys it was noticed that research institutions, environmental organizations, mass media and politicians were perceived as having a very low influence on the companies' environmental work. In 2010, this seems to have changed. With politicians excepted, these stakeholders are now perceived to have a significantly increasing influence. Other stakeholders with a significant change of influence are local citizens/groups, which were perceived to have very little influence on the companies' environmental work in the 2002 and 2006 surveys but are now considered more influential.

There is also a significantly increasing trend whereby financial actors, especially banks and controlling entities such as accountants, are perceived as more influential than previously.

3.1.1 Identified trends

Related to stakeholder pressure on corporate environmental change, the following

trends can be identified:

- Increased influence from a broader range of stakeholders

- Knowledge intensive and communicative actors increases in importance

- Companies perceive less institutional pressure from authorities

- Increased influence by financial stakeholders.

3.2 The companies' response to the environmental challenge

3.2.1 Technical measures

Waste separation has been the most common measure to reduce the environmental impact of the Swedish construction industry during the last twelve years (see table 3). However, compared to 2002 and 2006, all respondents in the 2010 survey reported a higher level of activity concerning all kinds of technical measures. All technical measures show a significant increase, except measures for the *substitution of hazardous substances,* which has neither increased nor decreased.

[Insert table here] 3

In both 2002 and 2006, many of the companies reported 'energy' as the major problem for the sector to handle. Despite this, less than half of the companies were acting to reduce their energy use in production (35% in 2002 and 45% in 2006) and the energy use from products/services (42% in 2002), table 3. A significant change appears in 2010, as 75% state that they have reduced energy use from products/services and 85% in production. Also, in 2010 there is a change from mostly handling already-generated waste to include measures to minimize

and prevent waste. Environmental projects are becoming more popular within the companies, as are space management and the implementation of cleaner technology. Thus, environmental work has become more than waste separation.

3.2.2 Managerial measures

The results show that many of the companies within the construction industry work in accordance with an environmental management system (EMS). There was a considerable increase in the percentage of companies that adopted EMS as a way of working between 2002, when 46% had an EMS, and 2006 when 70% had one. In 2010 about 73% of the companies had an EMS.

In all three surveys, companies' most frequent activity was to set up an environmental policy. The results show a significant increase over time for about half of the environmental management activities (table 4). Notable is that measures taken are foremost related to and part of the consolidation and completion of EMS routines. Companies have, for example, implemented routines to ensure observance of environmental laws (significant increase from 74% in 2002 to 88% in 2010), they have set up measurable environmental goals (significant increase from 69% in 2002 to 84% in 2010), as well as established an order of accountability (significant increase from 69% in 2002 to 83% in 2006 and stabilized 2010).

[Insert table here] 4

A majority of the companies claim to have set measurable environmental goals, but fewer have measured the actual environmental performance. The situation has, however, improved over time, from 25% in 2002 to 35% in 2006

and 52% in 2010, a significant trend over the whole period.

Also, environmental audits are done on a more regular basis (the results show a significant increase from 49% in 2002 to 70% in 2010). Integrating HSE data in annual reports shows a similar trend with a significant 25% increase for the whole surveyed period. Benchmarking is another measure where the results show a significant increase between 2006 and 2010. In general, the results point in one direction, an increasing number of companies has carried out managerial measures, especially governing measures, and they have also increased their total number of activities. The only decreasing trend, but not significantly, concerns initial environmental reviews.

In addition to activities related to the EMS, the companies predominantly carry out activities that aim at transferring environmental information and accountability between actors involved in the construction process. Table 5 illustrates that collaboration projects, the use of LCA, and labelling have become more frequent over time. For measures of an informative nature, checklists, guidelines and declarations, the results show that a significant increase between 2006 and 2010. Contrary, the results show a significant decrease for the use of building declarations and supplier demands.

[Insert table here] 5

3.2.3 Environmental manager: responsibilities and power

Over the whole period, a majority of the companies have reported that they have some kind of personnel that specifically handles environmental issues within the company. With a significant increase between 2002 and 2006 the number of environmental personnel per company has in 2010 stabilized to 2006 figures.[3]

Results from the 2010 survey show that half of the environmental managers (50%) were members of the corporate management board, which was a significant increase from 2006 and 2002, when the corresponding figures were 34% and 43%, respectively.[4]

The respondents were asked to what extent they agree to a number of statements concerning their perceived level of influence and their role as an environmental manager[5]. The agreement is quite high for most statements[6]. For instance they perceive themselves as having enough *knowledge to influence practice* as well as having *knowledge to influence strategic decisions.* However, the only significant increase over time concerns the respondents' perceived *authority to influence strategic decisions*.

3.2.4 Identified trends

Related to the companies' response to the environmental challenge, the following trends can be identified:

- The variety of technical environmental measures is increasing

- Carrying out technical environmental measures is becoming mainstream

- The corporate environmental work relies on self-governance through EMSs, audits and various assessment methods

- Activities with the aim of transferring environmental information and accountability are increasing

- Environmental expertise is built up in the companies

- Environmental managers are getting a more authoritative role.

3.3   Business effects and perceived obstacles

3.3.1 Effects on business

A stable trend shown in all three surveys is that companies in the construction industry consider that environmental activities mostly bring intangible benefits to the business. It is believed to bring benefits for principal stakeholders, such as staff, management and owners/shareholders. There is a significant trend indicating that environmental activities are mainly perceived to have a positive effect on 'soft' values, such as company image, personnel satisfaction, management satisfaction, product image and recruitment. None of the more 'hard' values, such as short-term profit, productivity, or market share show a significantly positive trend over time (see table 6). In addition, competitive advantage due to increased environmental work is unchanged over time.

[Insert table here] 6

3.3.2 Perceived obstacles

The results show a significantly increasing trend that respondents perceive external obstacles, i.e. obstacles out of the company's immediate control, as hindering (table 7). Out of 12 potential obstacles, there are only four that do not follow this increasing trend: lack of relevant information, lack of clear regulations, no regulations, and lack of willingness to cooperate within the sector as a whole. Thus, the respondents do not feel a need for more information or more regulative initiatives, and they at least feel that there is an intention to cooperate

within the industry. Still, lack of cooperation is put forward as an obstacle, especially regarding cooperation with suppliers. In addition, the respondents perceive a number of market-related issues as hindering, such as lack of market incentives in terms of demands and competitive advantages, which correlate to the perception that environmental work has not contributed to business opportunities (see previous section and table 6). They also feel that lack of fostering regulatory incentives and lack of available technical solutions are factors that hinder environmental work (table 7).

[Insert table here] 7

A general trend is that the perception of internal obstacles, i.e. obstacles within the company, and thus, potentially easier ones for the company to control, have not changed significantly over time. The only obstacle that shows a significant change is the perception that environmental work is too costly (table 7).

Overall, the results show a trend that the environmental managers experience obstacles as more pronounced in 2010 than previously. It also seems to be difficult to join forces with suppliers and/or customers (e.g. end users). There is also a trend that new challenges for the industry, for example, a rising need for the renovation of buildings, have implied that the companies have come across 'new' obstacles, such as cultural heritage demands. However, one should also bear in mind that the mean value over time is around 2, 'somewhat hindering,' meaning that many of the obstacles, although showing an increasing trend, are perceived to be of minor character.

3.3.3 Identified trends

Related to business performance, obstacles and attitudes toward environmental issues, the following trends can be identified:

- Business effects are of a soft and intangible character

- Except for informative and regulative initiatives, the number and perceived extent of external obstacles is increasing

- Lack of cooperation with suppliers and customers is an increasing obstacle

- The demand and market for green buildings is perceived as indifferent over time

- The perception of internal obstacles is unchanged over time

- The perception that environmental work is costly is enforced.

4. Discussion

Results of the 2002 survey showed that environmental actions taken were few. In the 2006 survey there was an increased awareness, but a gap between perceived environmental problems and actions taken. The results of the 2010 survey show a different picture: with a greater variety and intensity of activities and a greater awareness of problems and challenges related to sustainable building.

4.1 Strategic corporate responsibility or impression management?

Over the years there has been a significant change in the environmental managers' responsibilities and positions. Environmental managers are now part of the companies' top management. A higher number of responding environmental

managers perceive having increased influence on their companies' strategic decisions. Thus, it seems that the discrepancy between knowledge to influence and actual authority to do so has diminished. Hopefully this increased focus, together with a more strategic position in the company, will ease the work of environmental professionals in construction projects, a professional group that has so far been seen struggling to find a role and identity (Gluch, 2009; Gluch & Räisänen, 2012).

Despite an increased strategic focus on sustainable development, there is still no evidence showing a link between increased environmental work and financial performance (e.g. Gluch et al., 2009; Lee & Rhee, 2007). As in the earlier surveys, there is a lack of market pull for green innovation, and the influence from increased environmental work on the companies' competitive advantage remains low over the whole study period (Häkkinen & Belloni, 2011; Gluch et al., 2010; Bossink, 2004). Similar to what other researchers have observed (Häkkinen & Belloni, 2011), this study also showed that environmental work is perceived as too costly. From the results of the 2006 survey, a green innovation inertia within the industry was observed, and it was concluded that environmental work at that time was excluded from the companies' strategic business agenda (Gluch, et al., 2010). Four years later, this seems to have changed; instead, one now sees that companies chose to work proactively despite lack of financial incentives, that they have increased their environmental work, and that many measures have become mainstream practice, meaning that increased environmental efforts are driven by other incentives (Hahn & Scheermesser, 2006). This indicates that the so-called 'vicious cycle' (Hwang &

Tan, 2010), of high costs, lack of client demand, lack of R&D, lack of collaborative efforts, and lack of communication between various stakeholders seems to be loosening up for the Swedish construction industry.

The business effects put forward by the respondents are said to be soft, and intangible. Thus, the environmental work seems to be driven by vague prospects of a sustainable future. Here one can sense a possible danger related to motivation. If considered too soft, the whole issue may risk ending up in impression management and green-washing (Bansal & Clelland, 2004), lacking in substance and a value of its own. Furthermore, over the last decade, the Swedish construction industry as a whole has worked in times of prosperity. In another financial climate, it might be even more important to find ways to concretize and motivate environmental work (Oreszczyn & Lowe, 2010). The relative lack of observations explaining business performance demands further analysis to better understand the business justifications for environmental efforts that are now quite extensive in the Swedish construction sector.

4.2   Does increased self-regulation give root to win-lose situations?

An interesting result from the study is that companies today perceive less pressure to cope with legislative measures than previously, something that four years earlier was seen as the most likely solution to handle the industry's environmental problems (Gluch, et al., 2010). This suggests that the environmental maturity, as well as the ambition level within the Swedish construction industry, has risen, which follows the same course as other industrial sectors in Sweden (Arnfalk, et al., 2008a; Arnfalk, et al., 2008b). Less focus on

legislation as a driver for sustainable change means that legislators should be more selective regarding which areas to regulate or not. In failing to correctly assess the current state, legislation and incentives can possibly even be harmful if employed in areas where business is already improving in terms of environmental work. What can occur is that the internal drive of business entities in promoting environmental work might be replaced by more strategic thinking, which actually might lead to less compliance with environmental laws and regulations than would have been the case if no regulations or dis-incentives were in place (Messick, 1999; Tenbrunsel & Messick, 1999).

Similar to other industrial sectors in Sweden (Arnfalk et al., 2008a; Arnfalk et al., 2008b), this study shows that the Swedish construction industry relies to a great extent on self-monitoring through a variety of voluntary environmental management systems and assessment methods. However, the perceived influence of increased environmental work on the companies' competitive advantage has remained on a similar level over the whole study period. Thus, better environmental performance, more focus within a larger variety of areas, and a more strategic position for environmental management have not provided the companies with the knowledge and services to give them a strengthened competitive position on the market. Here, one can speculate whether the uniform one-direction movement along the EMS trail has diminished these possible opportunities by making the companies' actions too alike, resulting in a win-lose situation. Herein, it is especially paradoxical that the construction industry has so uniformly chosen EMS measures, since these involve a high degree of top-down control, administration and structure, which automatically leads to an increased

need for bureaucracy, something that contradicts the decentralized and autonomous decision making culture within the industry (Gluch, 2005; Dubois & Gadde, 2002). In addition, and maybe as a consequence of these conflicting logics, research shows that although nearly all companies have adopted EMS systems, these are rarely used by the built environment professionals in environment-related decisions (Isaksson, et al., 2009). Isaksson et al. (2009) conclude that this is worrying since it indicates that most environmental decisions are made 'outside the controlled information systems of the company, without knowledge of what is the optimal decision from a sustainability perspective, and by actors that were not originally expected to make these decisions' (p. 202).

4.3   Increased stakeholder pressure and cooperation

Besides perceiving less regulative pressure, the respondents still feel that external obstacles are increasing, while internal ones remain on the same level. This may be a consequence of them taking more responsibility for environmental impact caused by their business, directly as well as indirectly. It also emphasizes that companies cannot carry out environmental work in an isolated bubble; the companies are dependent on societal changes and must cooperate and interrelate with other actors/stakeholders (Bansal & Clelland, 2004).

Related to the interrelations between stakeholders, the results of this study show that companies perceive growing pressure and higher expectations from a larger number of stakeholders than previously, when the pressure could mostly be traceable to the traditional client-contractor relationship. Research has shown that collaborative and interdisciplinary actions within the field of sustainable

development are crucial for the development and implementation of proactive, holistic and innovative green solutions (Quist, et al., 2011; Bossink, 2007; Vergragt & Brown, 2007; Brown, et al., 2003). The same logic applies to the field of sustainable building (Hartenberger, et al., 2013; Glad, 2012; Cole, 2011; Heiskanen & Lovio, 2010; Brown & Vergragt, 2008). The perceived increased pressure and need for cooperation with different stakeholders may be a symptom that such development takes place in the Swedish construction industry. Moreover, to address increased and more diverse pressure, one might also see new types of organizations, organizations that have the ability to cooperate with various stakeholders, across disciplines as well as across organizations, and that can meet the specific needs of both local actors and general societal stakeholders. This intersection and focus on stakeholder engagement and how change occurs across complex multi-stakeholder organizational environments is an interesting and also under-researched area (Cole, 2011; Whyte & Sexton, 2011) deserving more attention in future research.

4.4   New actors and new competences

There is also a tendency toward increased specialization among the companies as well as a need for expertise knowledge, meaning that knowledge-intensive actors become more important. The broad entrance of EMS has given rise to new roles and new companies that specialize in environmental auditing, and it may very well be here that a new market of specialist consultancies and future business opportunities can be discerned. As a result, over the next coming years, a fast-growing market for expert consultancies is to be expected. One can also expect

new corporate units that not only support internal corporate development but also provide the companies with new business opportunities. In addition, following the line of action steered by EMS and other assessment systems relies on a high level of professionalism within the industry as it sets demands on self-monitoring (Hartenberger, et al., 2013).

The perception of environmental work as mainstream practice, higher demands on professionalism, self-monitoring as steering mechanisms, and a proactive approach toward the environmental challenge, necessitate a high minimum level of environmental competence within the industry. To achieve and maintain this high level of awareness may also mean new challenges and/or opportunities for educational institutions, e.g. universities. Besides providing environmental training to the great majority of built environment professionals, the need to train actors with other competencies than those of traditional construction project managers can also be anticipated. To meet the challenge of sustainable development in the built environment, there is a need to train professionals that can mediate between research, education and practice; that can seek to extend competence and excellence beyond a single discipline; and that have the intrapersonal skills to be self-motivated and self-monitoring and to motivate others (Hartenberger, et al., 2013; Gluch, et al., 2012; Ryghaug & Sørensen, 2009; Gluch, 2009).

It is also apparent that more active environmental work has led to the identification and awareness of an increasing number of obstacles. To handle these newly identified challenges may, in turn, stimulate the development of new approaches and perspectives on environmental work. However, even if making

green business seems to be desirable, it also seems to be somewhat strange for the actors in the construction industry. Notwithstanding, it is difficult to establish a market if the actors are not offering anything on it.

5. Conclusion

It can be concluded that the environmental work is on its way to becoming institutionalized as a strategic part of the companies. Environmental management activities, especially related to EMS, have increased and are today a common and integrated part of many companies' environmental work. Many observations point to a process of capacity building to deliver green buildings. Over the years, a consolidation of environmental management can be observed. Environmental managers are part of the management team in the companies' organization or members of the management board. This in turn means that they have increased opportunities to impact companies' strategic directions. In addition, as environmental activities of a technical nature in the companies are getting more intensified and are of greater variety, and as cooperation with different stakeholders is getting more intensified, one can hope that this will nurture new thinking and more green innovations as it can be anticipated that social learning processes will take place between parties (Gluch, et al., 2013; Heiskanen & Lovio, 2010; Mathur, et al., 2008; Brown, et al., 2003). However, although environmental efforts now are quite extensive in the Swedish construction sector the relationship between these efforts and business performance in terms of for example increased profit, competitiveness, and productivity, i.e. clear business justifications, seem to be missing. Thus, the relative lack of observations

explaining perceived business performance demands further analysis.

This paper has also discussed the need for a new research approach, e.g. research focusing on new types of organizations and professions as well as on various stakeholders' motives and drivers. Here, the need for educational institutions to take an active role in the development is emphasised.

Currently, the whole construction sector in Europe faces similar environmental challenges and the results from this study should be of interest for a broad audience within sustainable development as well as in strategy management. Sweden has been among the more proactive countries in the world when it comes to environmental regulation and green corporate change where there are lessons to be learned. By identifying trends over time and describing environmental management activities in the Swedish construction industry this paper provides knowledge regarding long-term change processes and consequences thereof to a broad spectrum of practitioners within the construction industry.

In future research it is of interest to carry out a comparative analysis between various actors or discipline groups since it is likely that these have different perspectives on sustainable building. For future research it is also of interest to further explore the relationship between measures and actions taken by the companies regarding environmental and business performance, i.e. to scrutinize if all these environmental actions has given any perceived results. In addition, a comparative study of environmental management activities in different countries would be of interest setting these results into a global perspective.

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Table 1 Data collection, population and response rate

Year of survey		2002				2006				2010[1]			
Population	**Total**	534				542				461			
(companies)	*Actor groups[2]*	*A*	*B*	*C*	*P*	*A*	*B*	*C*	*P*	*A*	*B*	*C*	*P*
		7	*103*	*279*	*145*	*36*	*55*	*300*	*151*	*46*	*37*	*262*	*116*
Responses (no.	**Total**	217				246				195			
of answers)	*Actor groups*	*4*	*38*	*107*	*68*	*20*	*25*	*123*	*78*	*17*	*18*	*96*	*64*
Response rate	**Total**	41				45[3]				42[3]			
(%)	*Actor groups*	*57*	*37*	*38*	*47*	*56*	*46*	*41*	*52*	*37*	*49*	*37*	*55*
Distribution of questionnaire		Mail				Mail				e-mail			
Questionnaire form		Paper				Paper				Online form			
Reminders		1[4] (mail)				3 (mail)				4 (e-mail)			
Number of questions		32				31				23[5]			

[1] *Time of survey, December 2010 - March 2011. The survey is called 2010 survey as data collection started in 2010.*
[2] *A=Architecture, B=Building Engineering and Design, C=Construction, P=Property and Real Estate*
[3] *The surveys cover companies within architecture with at least 20 employees; the other actor groups cover companies with at least 50 employees.*
[4] *Two reminders to the architect group*
[5] *Questions related to company information were not needed since these were already available*

Table 2 Mean values of companies' rating of stakeholder influence on environmental activities in the company. The 5-point scale ranged from 1='not at all' over 3='quite some' to 5='very much'. Variables marked with * indicate a significant difference at p<.05. *NOTE: By means of post hoc t-tests. The p value indicates that the likelihood that these differences have occurred by chance is less than 5 per cent.*

Stakeholder	2002	2006	2010
Managers	3,44	3,45	3,45
Customer/client	3,50	3,52	3,40
Final customer	3,20	3,11	3,23
Employees	3,18	3,08	3,15
Banks*	1,35	1,30	2,84
Environmental organizations*	1,92	1,97	2,83
The mother company	3,03	2,89	2,70
Trade associations	2,53	2,57	2,58
European regulators*	1,80	2,24	2,57
Competitors	2,52	2,41	2,43
Accountants*	1,63	1,85	2,39
Mass media*	1,96	1,86	2,37
National authorities/regulators	2,57	2,68	2,37
Environmental authorities*	2,71	2,72	2,33
Suppliers	2,29	2,31	2,30
Consumer/tenants	2,42	2,36	2,13
Research institutions*	1,72	1,64	2,12
Local citizens/groups*	1,58	1,54	2,07
Owners/Shareholders*	2,76	2,78	1,93
Politicians	-	1,81	1,64
Unions	1,75	1,58	1,63
Financial analytics*	-	1,26	1,42
Insurance companies*	1,35	1,54	1,42

Table 3 Frequencies in percent of companies' environmental activities of a technical nature. Variables marked with * indicate a significant difference at *p*<.05 between year 2006 and 2010. *NOTE: The frequencies were subjected to Chi^2-tests in order to for significant differences as function year.*

Environmental Activity	2002	2006	2010
Waste separation*	87	90	95
Material recycling within the company*	62	62	86
Reduced energy use of transports*	49	52	85
Reduced energy use in production*	35	45	85
Actions to reduce solid waste*	54	67	84
Reduced travelling*	-	34	83
Environmental projects re. products/services*	55	57	82
Substitution of hazardous inputs	63	75	81
Substitution of non-renewable materials*	37	-	76
Reduced energy use of products/services*	42	-	75
Implementation of cleaner technology*	34	41	67
Reduced material use of products/services*	32	32	67
Space management*	35	38	66
Actions to reduce emission to air*	43	40	64
Actions to reduce noise*	44	35	59
Reduced water use in production*	19	21	51
Selective demolition*	46	41	49
Green open spaces to foster biological variety*	-	18	41
Actions to reduce emission to surface water*	15	14	31
Re-use of waste from other companies*	12	9	29

Table 4 Frequencies in percent of companies' environmental management activities related to an EMS. Activities marked with * are significant at *p<*.05. *NOTE: The frequencies were subjected to Chi^2-tests in order to for significant differences as function year.*

Environmental management activity	2002	2006	2010
Routines to secure the observance of env. laws*	74	81	88
Measurable environmental goals*	69	76	84
Established an order of accountability*	69	83	83
Environmental audits*	49	64	70
HSE data annual report*	36	50	61
Environmental indicators to measure env. performance*	25	35	52
Benchmarking*	25	26	39
Written environmental policy	91	93	94
Environmental goals as a part of continuous improvements	71	80	82
Plan of action to achieve environmental goals	-	71	80
Env. considerations integrated in strategic decisions	-	72	77
Environmental training program	67	65	67
Initial environmental review	75	71	67
Separate HSE report	21	23	26

Table 5 Frequencies in percent of companies' environmental management activities related to purchasing and market. Activities marked with * are significant at *p*<.05.
NOTE: The frequencies were subjected to Chi^2-tests in order to for significant differences as function year.

Environmental management activity	2002	2006	2010
Implementation of checklists & guidelines*	51	63	85
Collaboration projects*	33	24	53
Energy declarations*	-	35	51
Use of LCA*	15	14	32
Eco-labelling*	14	14	23
Green marketing*	11	8	20
Environmental demands on suppliers*	79	87	76
Building product declarations*	-	50	24
Environmental evaluation of suppliers	76	81	73
Environmental information to customers	46	50	47
Environmental declarations	-	44	36

Table 6 Mean values of effects of environmental activities on business. The scale ranges from 1='very negative' over 3='no effect' to 5='very positive'. The variables marked with * indicate a significant difference. *NOT: The differences was tested by means of t-test and significant at p<.05*.

Effects on business	2002	2006	2010
Company image*	3,86	3,88	4,03
Management satisfaction*	3,75	3,67	3,87
Personnel satisfaction*	3,64	3,69	3,81
Owners/shareholders satisfaction	3,60	3,57	3,71
Long-term profit	3,61	3,54	3,68
Product image*	3,50	3,52	3,68
Competitive advantages	3,64	3,59	3,65
Sales	3,44	3,42	3,51
Recruitment*	3,35	3,33	3,50
Market advantages	3,41	3,38	3,47
Cost savings	3,28	3,35	3,45
Market shares	3,35	3,27	3,37
Productivity	3,25	3,11	3,20
Improved terms of insurance	3,10	3,12	3,13
Short-term profit	3,02	3,04	3,13
Improved terms of bank loans	3,07	3,06	3,09

Table 7 Mean values of perceived obstacles that have influenced environmental activities in the companies. The scale ranges from 1 =''not at all" over 3 = "some" to 5 = "much". The variables marked with * indicate a significant difference. *NOTE: The differences was tested by means of t-test and significant at p<.05.*

Obstacles	2002	2006	2010
External obstacles			
Lack of willingness to cooperate from suppliers*	1,94	2,10	2,77
No competitive advantages*	2,29	2,58	2,76
No demand for green products/services*	2,33	2,56	2,74
No regulatory incentives*	2,03	2,04	2,46
No technical solutions available*	1,99	2,03	2,41
Lack of willingness to cooperate from customer*	1,94	2,07	2,39
Lack relevant information	-	2,06	2,17
Lack of reliable information*	1,84	2,00	2,12
Lack of clear regulations	2,09	2,14	2,11
Lack of willingness to cooperate within the sector	1,82	1,94	2,10
No regulations	1,76	1,65	2,06
Cultural heritage demands*	-	1,49	1,75
Internal obstacles			
Too costly*	2,32	2,41	2,81
Lack of educated personnel	2,31	2,36	2,51
Lack of knowledge on available tools	2,10	2,23	2,36
Lack of financial resources	2,11	2,14	2,32
Insufficient organizational structure	-	2,17	2,15
Communication difficulties	-	2,00	2,05
Lack of management support	1,95	2,07	2,01
Counteracting organizational structure	-	1,74	1,89

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[1] NACE is the European statistical classification of economic activities. NACE means 'Nomenclature Generale des Activite's Economiques dans l'Union Europeenne (General Name for Economic Activities in the European Union). The first four digits of the code are the same in all European countries. The following NACE codes are included in the survey: NACE Groups 41.2, 42.1, 42.2, 43.1, 43.2, 43.3, 43.9 representing building contractors / executing construction companies, NACE Group 68.2 and 68.3 representing property owners and managers, NACE Class 71.11 representing companies within architecture, and NACE Class 71.12 representing building engineering and design consultants.

[2] The use of Likert scales with varying number of scale-steps has a historical reason, stemming from how the first questionnaire in 2002 was developed and where it was judged that different some questions were better measured by scales with either fewer or more steps.

[3] Difference significant at $p<.05$ measured on a 5-point scale ranging from 'considerable decrease' to 'considerable increase'.

[4] The result was computed by means of a Chi^2-test and was significant at $p<.001$.

[5] Difference significant at $p<.05$ measured on a 4-point scale ranging from 1='totally disagree' to 4='totally agree'.

[6] a) I have authority to influence strategic decisions so that they meet environmental interests (mean 2006 = 2.9, mean 2010 = 3.06). b) It is every individual's responsibility to improve the companies' environmental performance (mean 2006 = 3.33, mean 2010 = 3.25). c) I have knowledge to influence strategic decisions so that they meet environmental interests (mean 2006 = 3.09, mean 2010 = 3.14). d) I have the power to stop operation/activity that can cause negative environmental impact (mean 2006 = 2.92, mean 2010 = 3.07). e) I have knowledge to influence practice so that it develops in line with environmental interests (mean 2006 = 3.03, mean 2010 = 2.94). f) It is my personal responsibility to improve the environmental performance of the company (mean 2006 = 2.73, mean 2010 = 2.84).