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Environmental Management Systems and The Eco-Lighthouse Program: Stakeholder involvement and environmental effects in Norwegian education and nursing

Lars C. Monkerud and Bjarne Ytterhus
Department of Economics
Norwegian Business School (BI)
lars.monkerud@bi.no, bjarne.ytterhus@bi.no

Abstract

The *Eco-Lighthouse* program is a national program for environmental certification of private firms and public administrations in Norway. Today nearly 3000 certificates are awarded, 72 industry specific criteria are issued and 250 municipalities have joined the program.

The aim of this paper is to present results from a study on stakeholder involvement and environmental effects from *Eco-Lighthouse* certification in important local public service organizations. We consider institutional and resource-based theory to explore the organizations' motives for environmental certification.

In order to assess the impact of certification in local public services we concentrate on two large and important service sectors, i.e. education and nursing homes. Our data consists of responses to a survey going to directors of 391 schools and 87 nursing homes in five large Norwegian cities (Oslo, Bergen, Trondheim, Stavanger and Kristiansand). Importantly, our data allow us to take into account directors' attitudes towards the environment, as well to control for the impact of service sector and city specific confounding effects in multivariate analyses.

Our main findings are: Certified organizations reported reduced sick leave rates and cost savings on purchased materials. On the other hand, waste handling costs were perceived to increase with certification. Stakeholder involvement increased the environmental motivation of workers and parents. Some municipalities have been very active in both promoting and supporting Eco-Lighthouse certification financially. These have reported on collaboration models which may be a driver towards prosperity and sustainability. However, our study did not find much evidence of new alliances between the public organizations in question and the private sector.

Keywords
Environmental certification, stakeholder involvement, environmental effects and the Eco-Lighthouse Program

1. Introduction

The aim of this paper is to summarize the experiences of introducing environmental management systems (*EMS*) and standards like the *Eco-lighthouse* (*ELH*) program in education and nursing in five of the largest cities in Norway.[1] In Norway, local authorities – i.e. municipalities - are important service providers and are responsible for primary schools, kindergartens, primary health care, nursing homes and water-sewage-waste management. Moreover, municipalities support different voluntary activities to heighten climate and environmental awareness in their own organizations and the local community. The *ELH* program is a voluntary certification scheme to help local manufacturing and service producers to change the complex environmental agenda into a manageable processes. The target groups are private and public businesses, especially small and medium sized enterprises. The alternative to an *ELH* certificate in larger and more complex organizations is ISO 14001, EMAS or the SWAN Eco-label.

The *Eco-Lighthouse* (*ELH*) certificate is a Norwegian public certificate.[2] The program has defined more than seventy categories of certification standards. The most relevant standards for local goverments are: Office, kindergarten, youth center, nursing home and library. In total, 3200 private and governmental businesses have been awarded an *ELH* certificate. *ELH* certification numbers for the five cities in our project are: Oslo (675), Trondheim (206), Bergen (177), Kristiansand (142) and Stavanger (101).The municipality of Oslo has been a driving force in implementing *ELH* certification. As early as 2004 the Oslo City Council decided to implement environmental certification for all their service providers.
In addition, in 2009 the central Government put forth a proposal for a new planning part in the Planning and Building Act, aiming to protect important environmental values in a long-term perspective and give the municipalities the authority to draw up local climate and energy plans. Municipalities have taken steps to build up expertise and are searching for tools to develop climate plans and reporting systems on energy, purchasing, transport and waste management. In addition, local authorities have wanted to improve their reputation by building environmental awareness into their activities.

More than half of Norwegian municipalities are taking part in the *ELH* program, appointing local officers and setting up collaborative activities with neighboring municipalities to organize courses for local certifiers and to market efforts of the *ELH*-scheme. These activities contribute to regional cooperation and collaboration between public and private partners. Our paper explores stakeholder involvement and environmental effects from *ELH* certification in important local public service organizations. We consider institutional and resource-based theory to explore organizations' motives for implementing environmental management systems and an *ELH* certified system.

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[1] Our results are based on findings in a project financed by the *Norwegian Association of Local and Regional Authorities* (*KS*) which has a specific program supporting research in large cities (*KS Program for Storbyrettet Forskning*). The authors would like to thank the *KS* for funding our project, "Miljøledelse i bykommuner", under the auspices of this program.
[2] See www.miljofyrtarn.no.

Our data consists of responses to a survey going to top executives in 391 schools and 87 nursing homes in Oslo, Bergen, Trondheim, Stavanger and Kristiansand. Importantly, the data allow us to take into account directors' attitudes towards the environment, as well to control for the impact of service sector and city specific confounding effects in multivariate analyses. The paper is structured as follows: First, a brief literature review summarizes the relevant literature and presents the hypotheses to be tested. Next, we preset the data, the relevant variables and research designs. The main findings are presented in the subsequent section.

2. Literature review and hypotheses

2.1 Institutional theory

Institutional theory challenges the traditional view in economics that firms are exclusively profit-maximizing, and stress the importance of external legitimization (DiMaggio & Powell, 1983). Hoffman (2001) proposed three institutional actors as the most important in influencing voluntary environmental actions in organizations: Regulatory, market and social actors. Adoption of an *ELH* certification and other voluntary tools would in this way create regulatory advantages, market advantages and a reputation for social responsibility. Below we breifly outline the main approaches within institutional theory along these lines. We bear in mind that these have been developed mainly in the context of the private business sector, acknowleding that public service providers are likely influenced and motivated by relevant actors in ways different from that of actors in the private sector.

2.1.1 Regulatory advantages

Regulatory influence theory postulates that businesses are investing in voluntary actions to influence the regulatory system (Maxwell & Decker, 1998). By taking a proactive position in managing their environmental challenges, firms can accrue political capital and credibility with enforcement agencies and pre-empt or slow down future regulations. For instance, the regulatory framework has been adjusted to affect the internal decision-making processes by providing "regulatory reliefs" for firms having an ISO 14001-sertification in some countries (OECD, 2007). However, the behavior of public organizations – under the direct supervision of local authorities - may be different from that of private firms, with consistency with environmental principles and compliance a more immediate motivation (Andrews et al, 2001).

2.1.2 Market advantages

Businesses may adopt environmental certification schemes like the *ELH* for a variety of economic reasons, for instance in order to satisfy market demand and to attract investors in raising new capital. An *ELH* certificate would in this way represent a signal to market participants concerning the firm's commitment to the natural environment and their adherence to accepted environmental standards. Such information would act as a response to increasing consumer demand for green products (Khanna & Damon, 1999). More and more commercial

buyers are requiring their suppliers to adopt an ISO 14001 or an *ELH* certification. Socially concerned investors may favor certified firms to reduce perceived risk, increase future profit from green products or better their reputation among green customers. On the other hand,we would not expect public service institutions to be particularly sensitive to the activities of other comparable institutions in a context which is largely uncompetitive.

2.1.3 Social responsibility

In addition to regulatory and market pressure, organizations both in private and public industries are subject to pressure from environmental and community groups, the media and labour and trade associations to reduce their environmental impact. These constituents in the social system influence the norms and change the public perception about the environment Like market actors, the social actors have increased their environmental awareness due to more public information on environmental issues. Delmas and Toffel (2004) argue that organizations are likely to mimic behaviour of other firms that are tied to them through networks between private and public groups. Public service organizations, in charge of services for broad population groups, would cite media, users and NGOs as quite important influencing factors.

In summary, with institutional theory as a backdrop, we explore the following tentative hypothesis about motivating and influencing factors:

H1: Public service providers stress the importance of external political legitimization and social responsibility and are implementing environmental actions to reduce their environmental impact.

2.2 Resource-based theory

So far our discussion has proposed that adoption of environmental management systems and standards like the *ELH* are driven by external factors. In a dynamic environment, organizations are not always operating at peak efficiency (Andrews et al., 2001). Therefore, implementation of *ELH* and other voluntary environmental activities can help organizations to identify cost-effective opportunities and avoid organizational failures (Gabel and Sinclair-Desgagne,1993). For instance, businesses need constantly to improve their internal competences to transfer expertise to produce a competitive advantage. These views are in line with resource-based theory: Business performance is driven by firms' use of their strategic resources. Related to environmental issues, studies have indicated that an organization's complementary resources may facilitate the adoption of environmental management systems and standards (Darnall et al 2008). In our context, a resource is complementary to *ELH* if it assists and facilitates the process of its implementation. We propose that three categories of complementary internal resources - related to labor, management systems and capital – are particularly important.

2.2.1 Top management commitment

Top management commitment is a critical element when implementing an environmental strategy (Cordano and Frieze, 2000). Top management commitment may increase the consciousness about the environment among line managers and employees and are important to explain why facilities undertake voluntary environmental actions. Implementing the basic elements of an environmental management system, including an environmental review and an environmental policy and objectives, can create new ways of thinking since continuous improvement requires that managers identify environmental aspects in their day-by-day activities. Organizations that appoint an environmental manager, who has the overall responsibility for environmental matters, are all the more likely to establish voluntary environmental activities (i.e. the core elements of an *ELH* system) as a central part of their business.

2.2.2 Budget allocations for environmental activities and research

When a firm undertakes new strategic directions to reduce its environmental impact, internal resources are needed to succeed. By investing in environmental activities and research , the top management demonstrates commitment to environmental innovations (Porter and van der Linde, 1995). In the business sector knowledge-based capital is critical to sustained competitive advantage. Investing in environmental innovations generates knowledge-based capital which is difficult to replicate and firms may get a first-mover advantage. In either case, we would expect that organizations with environmental budgets – be they public or private business entities - are more likely to commit to voluntary environmental initiatives of all kinds, including environmental management systems and standards like the *ELH*.

In light of the above points from a resource-based theoretical viewpoint, we suggest the following hypothesis:

H2: Public service providers with complementary resources to reduce their environmental impact – e.g. budgetary allocations to environmental activities and/or a person in charge of environmental issues – will set up environmental management systems (*EMS*) more easily.

As mentioned above, Andrews et al (2001) explored whether private and public organizations have different motives for adopting voluntary environmental activities. Specifically, they found that important motivating factors for private businesses were better environmental performance, cost reductions and compliance improvement. In contrast, for non-market organizations such as governmental facilities, consistency with environmental principles and compliance were the most important motivations. Darnall et al (2008) studied the adoption of environmental management systems (*EMS*) from the perspective of both institutional and resource–based theory. Their results confirm that both institutional pressure and resources and capabilities encourage businesses to comprehensive *EMS* adoption. However, facilities that are mainly driven by their resources and capabilities, rather than institutional pressure, are more likely to obtain improved business performance.

2.3 Effects of environmental management systems (EMS)?

Zobel (2009) compared environmental performance in ISO 14001-certified and non-certified companies in Sweden. In some cases certifications had positive effects on environmental performance, but improvements were relatively small and limited. In most cases it was not possible to find any effects at all. In another series of studies, conducted by *the Industrial Ecology Program* (*IndEcol*) at the Norwegian University of Science and Technology, there are some indications that organizations with a comprehensive *EMS* are at an advantage. For instance, in the latest available report (NTNU, 2009) aggregated results based on 1012 environmental reports from *ELH* certified organizations in 2008 showed that *ELH* schools tended to perform better on average in terms of energy usage. Further, the total percentage of sick leaves in *ELH* organizations was about half a percentage point below the national average figure. While these results are indeed somewhat limited – both in terms of the methodoligies put to use in the cited studies and substantively - a natural hypothesis is nevertheless the following.

The *Revised Planning Act* recommends that municipalities have greater focus on climate and environmental issues (National Budget, 2011). Specifically, the Ministry of the Environment has launched a network for sustainable and resilient societies ("*Livskraftige kommuner*") in which 192 municipalities are participating. Many of these municipalities are also taking part in the *ELH* program. The aim of these local networks, comprised of local governments and private businesses, is to strengthen environmental competence in both the public and private sectors.

H3: A comprehensive environmetal mangement system (*EMS*) leads to improved environmental performance, both in terms of internal improvements in the institution at hand, and in terms of increased environmental cooperation with important actors in institutions' surrondings.

Ytterhus (2004) explored if the presence of environmental certification was significantly associated with firms` propensities to undertake different voluntary actions to reduce their environmental impact. Based on data from 309 Norwegian manufacturing companies, the study found that certified businesses had undertaken more actions to reduce damages caused to environment than non-certified companies. In line with this, we therefore explore a related hypothesis going ultimately to the assertion that certification can actually aid in impelmenting core elements of a working *EMS*:

H4 : *ELH* organizations undertake more environmental actions to reduce their environmental impact than non-*ELH* organizations.

3. Data and research design

The present study puts to use data from a survey to executives in Norwegian nursing homes and schools in five large Norwegian municiplaities.[3] Institutions within these two service sectors were chosen as units of analysis since they naturally engage in extensive day-to-day contact with their environments (students and their parents, nursing home patients and their relatives). Moreover, these two sectors are by far the largest in terms of local expenditures, with primary education making up 22 per cent and old age care/nursing 27 per cent of total local government spending (Statistics Norway 2009). As such, institutions within these sectors should provide a natural focal point for studying particularly wide stakeholder involvement – from e.g. clients, contractors, unions and local governments themselves – and for analyzing perceived environmental effects of organizational choices within the very core services under Norwegian local government jurisdiction. Survey questionaires were administered to 478 institutions in mid-February 2010 and by mid-March 39 percent had responded.[4] Table 1 gives details on disaggregated populations, samples and response rates, as well as variation in our main variable of interest, *ELH*, namely whether the institution at hand is *Eco-Ligthouse* certified or is in the process of being certified.[5] Descriptive statistics for additional variables used in the ensuing analyses are given in the appendix (Table A1).

As can be seen from Table 1 response rates vary quite much from the one instance to the other, with a low of only 25 per cent for schools in Stavanger and a high of 57 per cent from their counterparts in Trondheim. Also, *ELH* certification seems to vary quite a bit by sector-municipality groups, from no certified institutions in Trondheim and no certified schools in Kristiansand to uniform certification among the five sampled schools in the latter municipality.[6]

[3] The surveyed municipalities are Kristiansand, Stavanger, Trondheim, Bergen and Oslo, with populations ranging from around 80,000 inhabitants in Kristiansand to almost 600,000 in Oslo. The survey was financed by the *Norwegian Association of Local and Regional Authorities* (KS), under the *Program for storbyrettet forskning*, and is documented in KS (2010). Survey questionaires were returned by directors or executives in charge of environmental issues in nursing homes and principals/assistant principlas or executives for environmental issues in schools. Oslo – which is both a municipality and a county – is responsible also for county-tier secondary education (high schools).

[4] Comparable surveys conducted by the Norwegian Business School (BI) have achieved response rates of around 30 per cent, see for instance GRIP (2002).

[5] Respondents were asked whether "their institution has a environmental management system in place", were a response of "yes" or "in the process of establishment" would lead to follow up question on whether the said sytem is certified and wether it is certified in a certain manner (*Eco-Lighthouse* being one of the alternatives). See KS (2010:64, Question 6). Hence the variable *ELH*=1 if the response to the last question is "*Eco-Lighthouse*" and 0 otherwise.

[6] We return to the implications of limitations in the variability of *ELH* and our measre of the comprehensiveness of *EMS*s in the results section.

Table 1. Number of survey responses [n], number of institutions [N], response rate [%] and number of *ELH* certified institutions [*ELH* (=1)] . By sector and municipality.

	Nursing homes				Schools				Total			
Municipality	n	N	%	*ELH* (=1)	n	N	%	*ELH* (=1)	n	N	%	*ELH* (=1)
Trondheim	6	16	(38)	0	31	54	(57)	0	37	70	(53)	0
Oslo	13	27	(48)	4	61	164	(37)	23	74	191	(39)	27
Bergen	15	21	(71)	1	25	93	(27)	2	40	114	(35)	3
Stavanger	3	11	(27)	2	11	44	(25)	1	14	55	(25)	3
Kristiansand	5	12	(42)	5	16	36	(44)	0	21	48	(44)	5
Total	42	87	(48)	12	144	391	(37)	26	186	478	(39)	38

Unfortunately, no publically available records of *ELH* certification exist against which to assess overall or group specific sample rates, and the relatively low response rates may imply that certification sample rates are biased estimates of true population rates. However, in earlier analysis we find no indication that sampled institutions are dissimilar to unsampled institutions with respect to certain important characteristics, and we do not find any evidence of *ELH* certified institutions being under- or overrepresented in our sample.[7] We therefore conclude that our data is not skewed in any obvious direction.

Before we present the results of our analyses we point out some obvious weaknesses of our data and design, but also underline some strengths. First, assertions of general representativeness notwithstanding, ours is a *small N* study. Viewed together with the fact that variables are measured with some imprecision, as one may expect in a self-reported survey, results from multivariate analyses should be interpreted with some caution. Second, our data does not in principle allow us to interpret statistical effects measures as causal relationships. For instance, in analyses of propensities to implement certain elements of an *EMS*, unless we are confident that all relevant variables are accounted for we can only talk about *differences* in propensities between certain organizations (e.g. in terms of their use of internal resources). As such, statistical effects are merely *partial correlations*, although we in some cases may alliviate some endogeneity problems by way of including fixed effects for municipality and sector in multivariate analyses. Third, measures of organizational choices and their effects are *self-reported*. In particular, self-reported effects are likely to be biased in an absolute-positive

[7] Specifically, sample means and standard deviations and their population counterparts for number of employees (in full-time equvalents) and for number of patients (nursing homes) or students (schools) are quite similar (KS 2010:23). Moreover, response time patterns are quite similar for *ELH* institutions and non-*ELH* institutions: Since the former are as (in)hesitantly sampled as the latter, this suggests that both are fairly represented in the sample (*ibid*.:23-24). In addition, as far as reliability goes, respondents seem to be dilligent in their reporting: Reported values for number of employees and number of patients/students are nearly always on-mark or very close to official records (which can easily be checked) (*ibid*.:60).

direction if respondents fall victim to a process of *rationalization*, i.e. if there is a tendency to exaggerate the impact of organizational choices. In its turn one may assume that such a tendency depends upon the importance that respondents attach to outcomes. In the ensuing multivariate analyses of effects of *EMS*s we control for the value each individual respondent attaches to environmental issues (via the "environmental awareness" variable *EA*). Moreover, questions on effects ask of effects from *EMS* measures *specifically*, thereby in principle avoiding problems of confounding influences from other omitted variables – at least in some situations. These two features of our effects analysis design (i.e. control for rationalization tendencies and *EMS* specific effects questions) suggests that we in certain situations may interpret effect results in a causal manner in certain situations.[8]

4. Results

In this section of the paper we will first analyze the driving forces behind the introduction of an environmental management system (*EMS*). Specifically, in order to explore the first hypothesis (H1), we look at reported sources of motivation for establishing an *EMS* and also reported perceptions of who are the important influencing actors (the local political level, local administrations etc.). In addition, in order to asess the second proposed hypothesis (H2), we look into possible effects of external pressure and internal resources on the propensity to implement elements of an environmental management system.

Secondly, we will look into hypotheses H3 and H4, and first analyze perceived effects of introducing an environemental mangement systems (*EMS*) specifically - be it (*ELH*) certified or not. The latter point is important: Since an *EMS* may or may not be certified by some recognized body, our design in principle allows us to disentangle the *value added* of certification in itself (such as the ease with which a management system is coordinated) from the working elements of a management system (such as having an environmental training program). In an extension of this analysis one may also ask whether certification seems to aid in introducing certain elements of an *EMS* (as suggested by hyopothesis H4). Data will also allow us to look into this question tentatively.

Since we (for the most part) will be studying variation in binary variables (e.g. the choice or non-choice of individual *EMS* elements; reports of positive or non-positive effects from *EMS*s), we will employ logistic regressions in multivariate analyses. That is, we model

[8] We return to a discussion of interpretation of effects below. Ideally, one would like more objective measures of effects (changes in energy consumption in *kWh*, say) and relate these to exogenous variations in organizational choices (making use of a natural experiment or a plausible instrument variable for organizational choices). In practice, and at any rate for a survey like the present one, such figures are largely inaccessible. In fact, in the present study only 25 out the total of 186 responding institutions (13 per cent) reported figures for energy consumption. Of course, this may be an indication of general low quality *EMS*s in terms of environemental reporting systems (ref.).

$$\text{Logit} \equiv \text{L} \equiv \log\left(\frac{P}{1-P}\right) = a + b_1 \cdot X_1 + b_2 \cdot X_2 + \cdots + b_n \cdot X_n ,$$

where P is the probability of e.g. a choice of a particular *EMS* element or the probability of a positive effects report and b_1, b_2,…, b_n are coefficients of the impacts of explanatory variables X_1, X_2,…, X_n respectively. In this way we ensure that predicted probabilities will lie in the [0,1] region, and that we may estimate the impacts of explanatory variables (the *b*s) correctly (in terms of statistical significance tests; see e.g. Gujarati and Porter 2009: 553-558). We take a two-sided $p<0.15$ in *t*-tests to indicate a significant relationship.

4.1 The driving forces of environmental managements system implementation

Figure 1 displays responses to each item of a question on motivating factors for introducing an *EMS*. Respondents rated factors to be "not important", "somewhat important" or " very important", recoded to a 1-2-3 numerical scale in the figure.

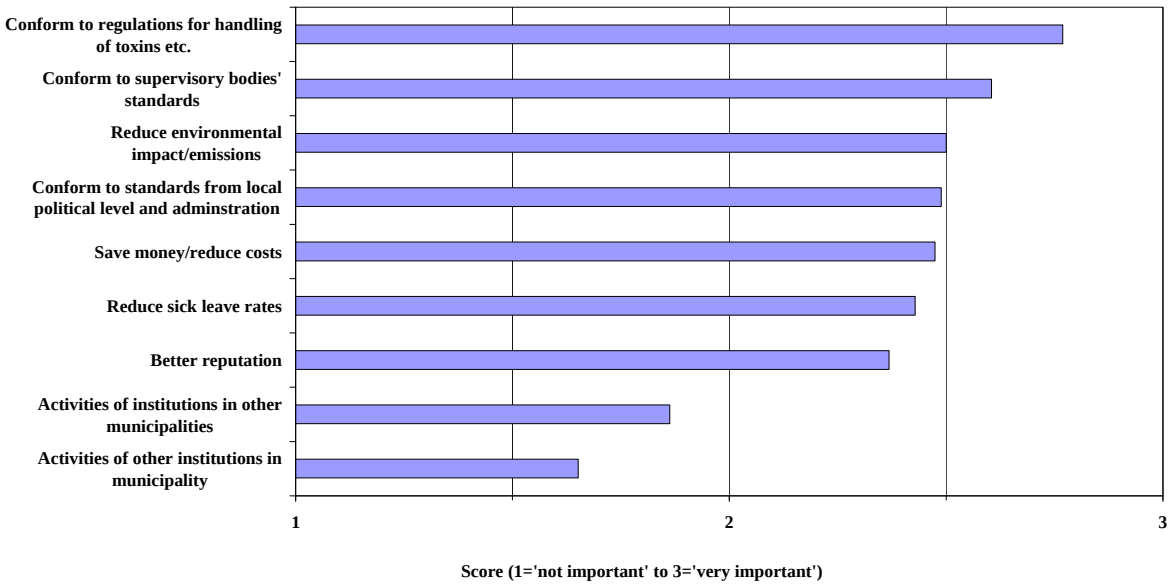

Figure 1. Motivations for implementing environmental management systems (*EMS*).

Compliance with standards and regulations and reducing ones environmental impact (three upper items in figure 1) are viewed as quite important motivating factors (score ≥ 2.5, i.e. leaning towards "very important"), while institutions do not seem to look much to other comparable institutions when contemplating *EMS* implementation (two lower items in figure with score < 2.0, i.e. less than "somewhat important). This lends some creedence to the proposition that environmental impact in itself is a major concern when public institutions

contemplate *EMS* implementation, while any direct comparison with other institutions' choices is of lesser importance where competitive concerns are largely absent (H1).

In Figure 2 we display responses to each item of a question on motivating factors for introducing environmental activities. Respondents rated each actor/group as having "very weak", "weak", "some", "strong" or "very strong" influence, recoded to a 1-2-3-4-5 numerical scale in the figure.

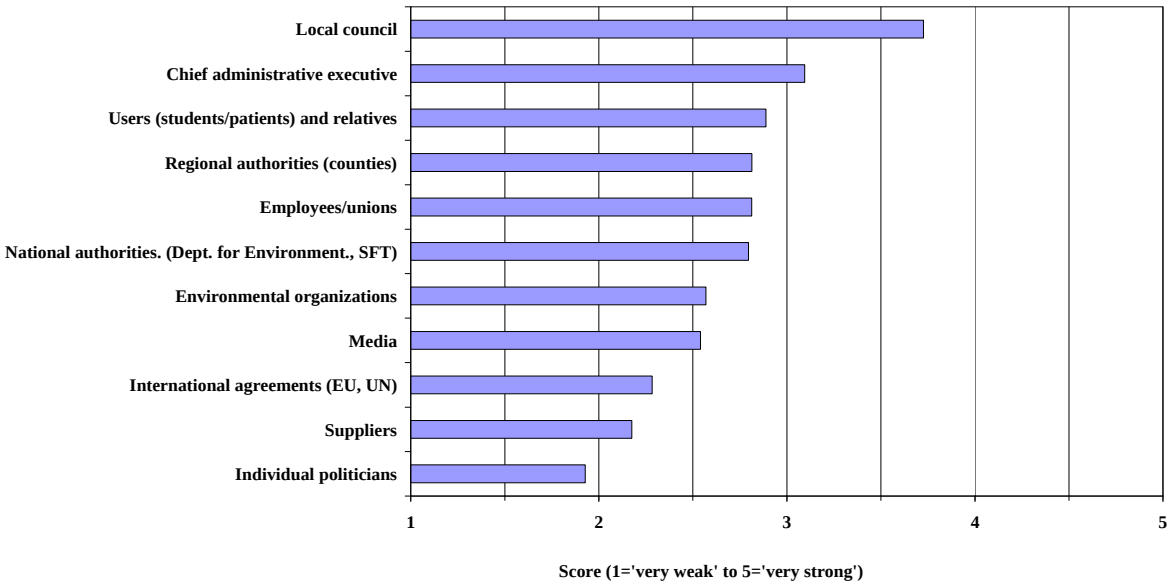

Figure 2. The influence of different actors/groups in implementing environmental activities.

Respondents view the influence of local political and administrative authorities (two upper items in figure 2) as quite important (score > 3, i.e. more than "some" influence), while users, empoyees, environmental organizations, the media and other authorities (national and regional) verge on having at least "some" influence on average (score > 2.5). This is broadly consistent with our expectation (H1) that local service providers are first and foremost at the hands of top level political and administrative direction when contemplating environmental action, although with an eye to the inputs of important societal and cliental groups (as suggested by a "social responsibility" hypothesis).

We next turn to our second hypothesis (H2), concerning whether successful implementation of an *EMS* hinges on the allocation of certain resources. Specifically, one would expect that organizations with budgetary means allocated towards environmental activities would be in a better position to introduce an *EMS*. In addition, implementation of an *EMS* should be easier when "environmental issues" is recognized as a separate field of organizational expertise,

with responsibility laying with specific persons within the organization, preferably someone from the management.

Tables 3a and 3b dsiplay detailed results from logistic regressions of adoption of individual elements (*EMS1-EMS8*) of an *EMS*.[9] In these regressions we control for the possible confounding effect of influence from actors and groups discussed above: It is concievable that the outside influence of certain actors or groups has a direct effect on propensities for introducing different elements of an *EMS* (i.e. independently of formal organizational choices). To simplify the analysis we include controls for the influence of "national authorities", "the media" and "employees/unions" as indicators of influence from "political and administrative authorities", "societal actors" and "internal actors" respectively.[10]

Table 3a. Logistic (logit) regressions of implementation of *EMS* elements (*EMS1-EMS8*).

	"Routines for assessing legal requirements" (=1)	"General assessment of environmental issues" (=1)	"Codified environemntal policy" (=1)	"Measurable environmental goals" (=1)
Employee *outside* management w/ specific environm. responsibilities (=1)	0.58 (0.42)	**2.83** **(0.01)**	0.73 (0.35)	**1.49** **(0.06)**
Employee *in* management w/ specific environm. responsibilities (=1)	**1.09** **(0.08)**	**1.94** **(0.00)**	**1.77** **(0.01)**	**1.63** **(0.01)**
Budget for environmantal activities (=1)	0.71 (0.31)	-0.58 (0.46)	0.53 (0.40)	**1.01** **(0.14)**
Indicator for influence from "political and adminstrative authorities (=1) (a)	**0.47** **(0.08)**	0.23 (0.45)	0.13 (0.64)	-0.16 (0.58)
Indicator for influence from "societal actors" (=1) (b)	-0.33 (0.32)	-0.42 (0.27)	-0.19 (0.57)	0.37 (0.26)
Indicator for influence from "internal actors" (=1) (c)	0.12 (0.65)	0.27 (0.37)	0.37 (0.17)	0.23 (0.41)
N	115	118	115	118
p(Likelihood Ratio)	0.00	0.00	0.00	0.00
Fixed effects for municipality and sector	yes	yes	yes	yes

Coefficients with p<0,15 in *t*-tests in bold. (a) indicated by a positive response to the question on influence from "National authorities" (*A6*); (b) indicated by a positive response to the question on influence from "Media" (*A8*); (c) indicated by a positive response to the question on influence from "Employees/unions" (*A5*)

[9] Respondents simply asked whether they have implemented the said elements (*EMS1-EMS8*). See Table A1 in the Appendix for descriptive statistics.

[10] This seems reasonable since a factor analysis reveals that influences (as measured in Figure 2) can be grouped into these three dimensions or factors. The cited individual indicators are the variables that have the highest loadings on the respective factors. See full factor analysis results in Table A3 in the Appendix.

As can be seen both in tables 3a and 3b, as compared to the reference case (no-one in charge of environmental issues) the presence of a person in charge of environmental issues who is *also* part of the management is nearly always associated with a higher probaility of implementing an individual *EMS* element (*b*>0 in the second row; save for implementation of "Environmental training programs"). On the other hand, simply having a person in charge *outside* management is seldom associated with a higher implementation propensity (*b*s by and large not significant in the first row). Even so, it seems that designation of responsibilities for the environmental area *outside* management is quite sufficient for implementing a "general asseessment of environmental issues" and a "continuous process of evaluation" (*b*s in first row significant and even larger than *b*s in second row, i.e. coefficients for responsibilities *within* management). One interpretation of this particular pattern is that these tasks are at the low and initiating ends of a full fledged *EMS* ("general assessment…") or quite broadly defined as compared to other elements ("continous process…"). Nevertheless, patterns on this point are broadly consistent with the assertion (H3) that designated responsibilities for environmental issues *coupled with* clear commitment on the part of the top management is associated with higher propensities for *EMS* implementation.

The same broad pattern applies to the impact of budgetary allocations for environmental activities: In the analyses of implementation of "measureable environmental goals", a "continuous process of evaluation", "environmental reporting to management" and an "aacounts system… for environmental activities" estimated impacts are all positive and significant (*b*s in the third row). Thus, budgetary allocations for ebnvironmental activities seem by and large to be associated with higher propensities for *EMS* implementation.

Also, indicators for influence from important actors/groups are largely insignificant (*b*s in the lower panel), save for the indicator for influence from "political and administrative authorities" when it comes to implementing "routines for assessing legal requirements". Presumably, such measures would be "routine" indeed for the organizations under study, whether internal resources are geared towards broader environmental policies or not, whereas the impact of influential actors in other areas likely come through implementation of additional elements of an *EMS*.

As noted earlier, we view these patterns as partial correlations, not necessarily as causal relationships: In particular, the modeled relationships may suffer from misspecification due to omitted variables - other resources or assets, say - that are correlated both with internal resource use (budgetary allocations and appointments of environmental managers) and abilities to set up working *EMS*s. Insofar as such resources and assets reflect the type or location of the individual institution such worries should at least be partially allayed.[11]

[11] For instance, certain municipalities are able to offer more support form the central level in setting up *EMS*s due e.g. to the fact that they have more experience from starting work on environmental management earlier (as have Oslo and Trondheim, both starting work in this field in the 2000-2005 period, as opposed to the other municipalities under study, starting after 2005). A plausible problem is the omission of organization size (as measured by the number of employees, students or patients). However, additional analyses reveal this variable to have a negative impact for some items and positive for others, and its impact is never significant.

Table 3b. Logistic (logit) regressions of implementation of *EMS* elements (*EMS1-EMS8*).

	"Environmental training programs" (=1)	"Continuous process of improvement" (=1)	"Environemntal reporting to management" (=1)	"Accounts system for asessing environemntal activities" (=1)
Employee *outside* management w/ specific environm. responsibilities (=1)	0.66 (0.39)	**1.44** **(0.05)**	0.75 (0.30)	0.34 (0.76)
Employee *in* management w/ specific environm. responsibilities (=1)	0.69 (0.28)	**1.32** **(0.03)**	**0.94** **(0.12)**	**1.94** **(0.03)**
Budget for environmantal activities (=1)	0.44 (0.43)	**1.52** **(0.04)**	**1.05** **(0.08)**	**1.79** **(0.01)**
Indicator for influence from "political and adminstrative authorities (=1) (a)	0.25 (0.34)	0.13 (0.63)	0.00 (0.99)	0.00 (0.99)
Indicator for influence from "societal actors" (=1) (b)	0.22 (0.48)	-0.08 (0.81)	0.10 (0.73)	-0.16 (0.64)
Indicator for influence from "internal actors" (=1) (c)	-0.18 (0.49)	0.08 (0.76)	0.18 (0.46)	0.26 (0.39)
N	115	117	117	113
p(Likelihood Ratio)	0.04	0.00	0.01	0.00
Fixed effects for municipality and sector	yes	yes	yes	yes

Coefficients with p<0,15 in *t*-tests in bold. (a) indicated by a positive response to the question on influence from "National authorities" (*A6*); (b) indicated by a positive response to the question on influence from "Media" (*A8*); (c) indicated by a positive response to the question on influence from "Employees/unions" (*A5*)

4.2 Perceived effects from environmental management systems

We move now to the analysis of perceived effects from introducing *EMS*s. To this end we construct a compound index measuring the comprehensiveness of the *EMS*. Specifically, we construct an additive index, *EMS*, comprised of the sum of individual elements analyzed above, i.e. *EMS1* through *EMS8*. In addition, we include indicators for *ELH* and *GF* (*Grønt Flagg*) certification and, as noted earlier, an index, *EA*, measuring "environmental awareness" to control for possible rationalization bias in effect reporting. Specifically, the *EA* variable is an additive index of scores from five questions gauging the value each respondent attaches to environemtal issues. Our dependent variables in these analyses are responses to questions on perceived cost reductions in five different areas (*A1-A5*) and other benefits (*B1-B7*) "from implementation of EMS/environmental activities".[12] We note that these analyses necessarily must use relatively few respondents (around 40 to 60), since respondents who report no *EMS* measures (*EMS1-EMS8*) whatsoever do not answer effects questions (*A1-A5*, *B1-B7*). In the analyses of benefits (*B1-B7*) this has the practical implication that we cannot sensibly analyze equations which include fixed effects for municiplaities or sector, or in some cases even

[12] Details for analysis variables are given in Table A1 in the Appendix.

indicators for certification.[13] Tables 4 and 5 show results from the logistic regression analyses.

As seen in table 4 and 5 a more comprehensive *EMS* (i.e. an increasing number of *EMS* elements) is associated with higher propensities for reporting (*EMS* specific) cost reductions in the "goods consumption", "refuse management" and "sick leaves" areas (*b*s>0 and significant). The *value added* of a an *ELH* certificate is positive for "travel/transport" (although not significant) but negative in some cases, almost significantly so for "refuse management". The last result is presumably due to stricter – and more costly – standards (in infrastructure, supervisison etc.) accompanying an *ELH* certficate in this area.

Table 4. Logistic (logit) regressions of effects of *EMS* implementation (*A1-A5*).

Cost reductions (=1) in:	Energy con-sumption	Goods con-sumption	Travel/ transport	Refuse management	Sick leaves
No. of *EMS* elements, *EMS* (a)	0.29 (0.20)	**0.54 (0.04)**	0.21 (0.23)	**0.50 (0.03)**	**0.89 (0.01)**
ELH certification, *ELH* (=1)	-0.22 (0.84)	-1.21 (0.35)	2.11 (0.42)	-1.56 (0.15)	0.48 (0.71)
Grønt Flagg certification, *GF* (=1)	1.69 (0.31)	0.19 (0.90)	1.08 (0.60)	0.78 (0.59)	**6.99 (0.03)**
"Environemntal awareness" index, *EA* (b)	0.07 (0.63)	0.15 (0.29)	0.21 (0.23)	**0.24 (0.09)**	-0.08 (0.66)
N	61	60	53	60	55
p(Likelihood Ratio)	0.08	0.17	0.00	0.09	0.02
Fixed effects for municipality and sector	yes	yes	yes	yes	yes

Coefficients with p<0,15 i Wald Chi Square tests in bold. (a) indicated by the sum of positive responses in the questions on implemented *EMS* elements (*EMS1 -EMS8*). (b) Indicated by the sum of scores in the questions on personal opinions on environemntal issues (*PO1 -PO5*). All regression include indicators for municipality and sector (schools and nursing homes).

Analogously to Table 4, the effects of a more comprehensive *EMS* dsiplayed in Table 5 are also always positive, and benefits are significantly positive in terms of a "better reputation", "better working conditions", "better mangement systems" and "increased environmental awareness among employees" and among "users/relatives" (*B1-B5*). This, and the patterns

[13] Presumably, a combination of heavily skewed distributions for these variables (see Table A1 in the Appendix; this also producing a number of empty cells for municipality-sector combinations) and considerable measurement error in reporting is the culprit behind problems with converging on a Maximum Likelihood solution for such fixed effects models.

found in Table 4, is broadly consistent with the proposition in the first part of our third hypothesis (H3). Here also, the *value added* of an *ELH* certficate is ambiguous, with a negative coefficients for benefits in the "reputation" and "user awareness" areas and a positive coefficient for the "better management systems" item. However, none of these estimates are significant.

Table 5. Logistic (logit) regressions of effects of *EMS* implementation (*B1*-*B7*).

	"Better reputation" (=1)	"Better working conditions" (=1)	"Better mangement systems" (=1)	"Increased environm. awareness among employees" (=1)	"Increased environm. awareness among users/ relatives" (=1)	"Increased cooper-ataion with local environm. organi-zations" (=1)	"Increased cooper-ation with business sector" (=1)
No. of *EMS* elements, *EMS* (a)	**1.92 (0.02)**	**0.45 (0.02)**	**0.48 (0.03)**	**0.50 (0.03)**	**0.32 (0.13)**	0.23 (0.18)	0.54 (0.28)
ELH certification, *ELH* (=1)	-3.85 (0.50)		0.64 (0.60)		-0.53 (0.70)	12.25 (0.97)	9.65 (0.98)
Grønt Flagg certification, *GF* (=1)	-0.70 (0.90)		-1.22 (0.31)		1.41 (0.35)	12.99 (0.97)	10.55 (0.97)
"Environemntal awareness" index, *EA* (b)	**1.22 (0.01)**	**0.28 (0.04)**	**0.57 (0.00)**	**0.45 (0.00)**	**0.26 (0.06)**	0.09 (0.45)	0.26 (0.45)
N	42	52	52	59	58	61	61
p(Likelihood Ratio)	0.00	0.00	0.00	0.00	0.07	0.23	0.62
Fixed effects for municipality and sector	no	no	no	no	no	no	no

Coefficients with p<0,15 i Wald Chi Square tests in bold. (a) indicated by the sum of positive responses in the questions on implemented *EMS* elements (*EMS1 -EMS8).* (b) Indicated by the sum of scores in the questions on personal opinions on environemntal issues *(PO1 -PO5*).

Surprisngly, though, we find no impact of *EMS* comprehensiveness when it comes to "increased cooperation with local environmental organizations" or with the "business sector". Our simple models do not even fit the data well in the analyses of the said items (*B6*, *B7*; witness large *p*s in Likelihood Ratio tests for overall significance). Even when we try to estimate coefficients for *EMS* or certfication indicators in isolation we fail to find any statistically significant relationships. Since we do find some indication of effects in other areas ("goods consumption", "awereness…" etc.) we believe this says something substantive about the limited impact of implementing *EMS*s in this area. This goes clearly against the second part – dealing with public-private cooperation - of our third hypothesis (H3).

Lastly, we note that the coefficient for the *EA* index, measuring "environmental awareness" is positive in all analyses (save for the "sick leaves" item), and it is also signifcant in most cases.

The implcation is that especially “environmentally aware” respondents view effects as greater for given levels of certification and *EMS*, strongly suggesting that there might be a rationalization effect in reporting on impacts of *EMS* elements.

To get at the substantive implications of estimated coefficients i.e. effects in terms of probabilities - we display predictions curves for the EMS variable in the models in which we find both a reasonable overall fit (a Likelihood Ratio-test probabilty close to zero; i.e. for items *A2*, *A4* and *A5* and items *B1* through *B5*) and significant effect measure for either the *EMS* variable or the *ELH* indicator. We predict probabilities for a typical group of respondents, namely schools in Oslo (the modal values for sector and municipality) having an average value of the *EA* index of 6.71 (see Table A1 in the Appendix). Where possiblke, we display curves both for cases with *ELH* certification and for cases without certification. The curves are dsiplayed in figure 3a and b.

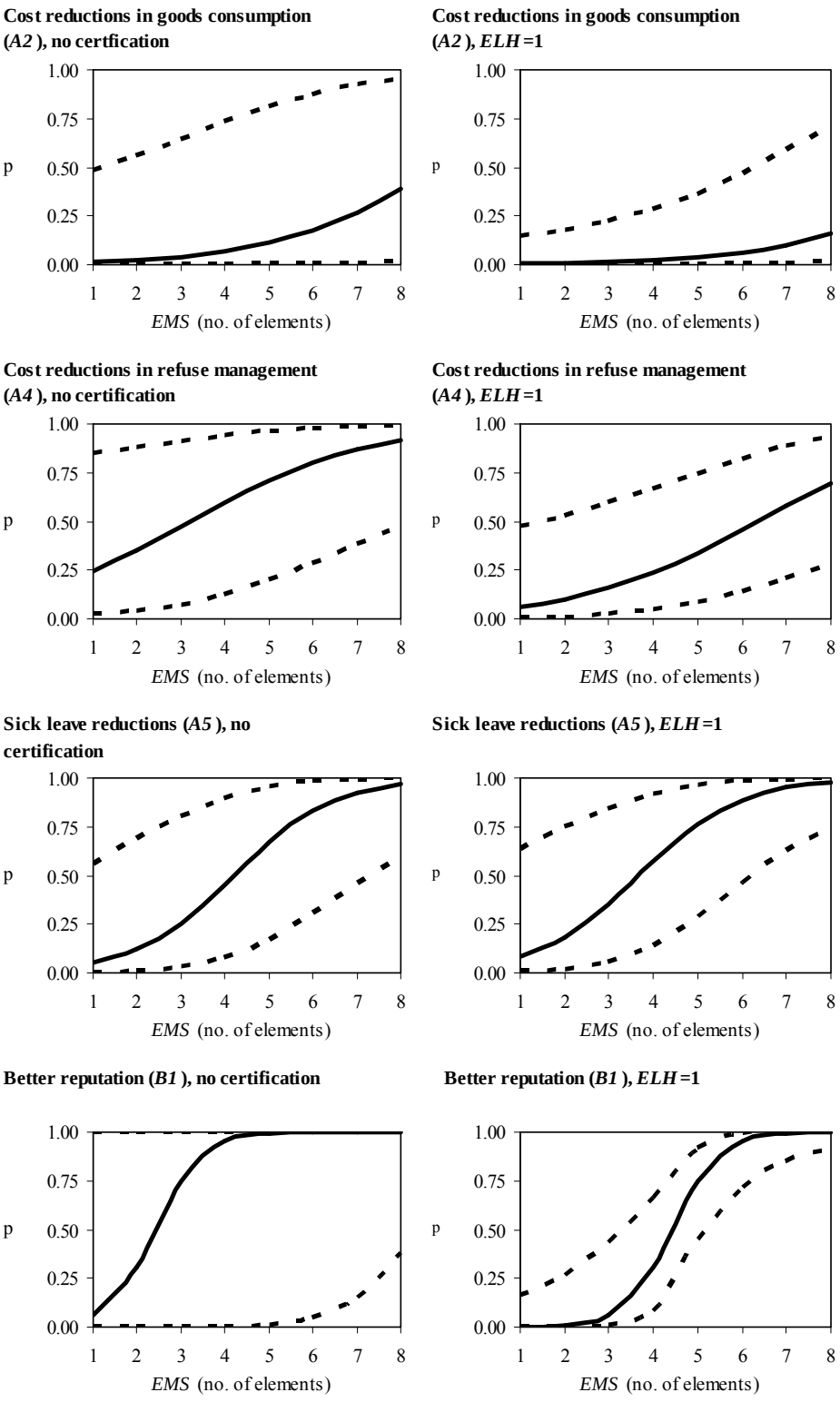

Figure 3a. The influence *EMS* comprehensiveness on the probability of perceived cost reductions and benefits in different areas.

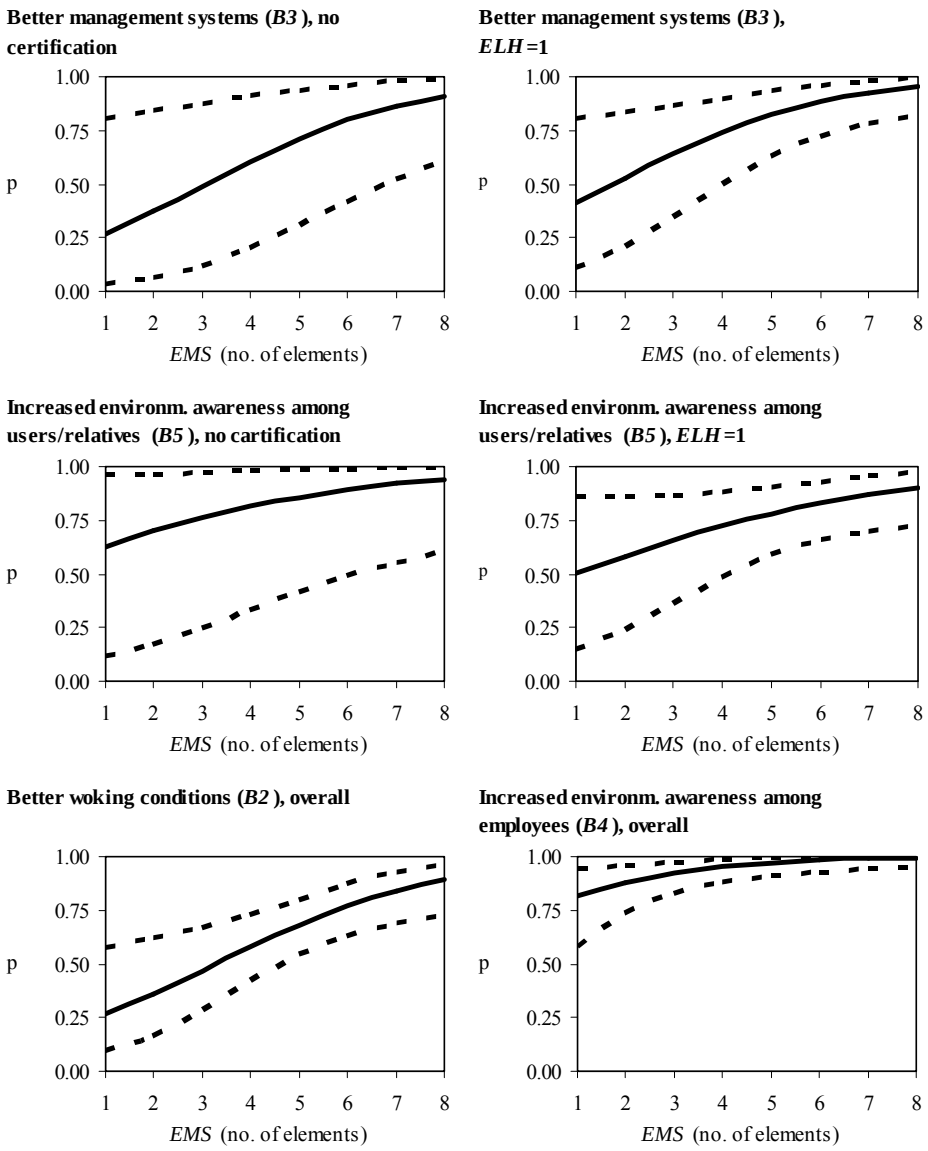

Figure 3b. The influence *EMS* comprehensiveness on the probability of perceived cost reductions and benefits in different areas.

As can be seen from the figures, an increase in *EMS* comprehensiveness from the minimum (one element) to the maximum (eight elements) raises the probabilty of perceived gains in the "goods consumption" and "user awareness areas" somewhat moderately (from p=0 to p=0.30 and from p=0.70 to p=1.00 respectively), while similar effects are considerably larger in e.g. the "refuse management", "sick leaves" and "reputation areas" (increases in the range of 0.60 to 1.00 proportion points). We also note that curves for "sick leaves" and "better management

systems" are poised slightly higher in the case where institutions are *ELH* certified, indicating a *value added* advantage of *ELH* certification (whereas the reverse pattern is found among the other items).

Our last hypothesis (H4) stated the expectation that certified organizations implement more environmantal actions than non-certified organizations. In Table 6 we display results from a regression of EMS on indicators for the different types of certifications that we observe in our data.

Table 6. The relationship between certification and EMS implemenation.

ELH (=1)	**2.94**
	(0.00)
Grønt flagg (=1)	0.54
	(0.31)
Trondheim (=1)	**3.30**
	(0.00)
Oslo (=1)	0.89
	(0.15)
Bergen (=1)	-0.08
	(0.91)
Stavanger (=1)	**2.63**
	(0.00)
Nursing home (=1)	-0.51
	(0.28)
N	132
adjusted R^2	0.41

Coefficient with p<0,15 in *t* -tests in bold.

Results show that *ELH* certified institutions have implemented around three more elements of an *EMS* than non-certified institutions. This is in line with the hypothesized relationship. As expected, *GF* (*Grønt Flagg*) institutions do not implement significantly more elements than non-certifed institutions. However, we do not take these results as an indication of a causal relationship, whereby certfication fosters the adoption of *EMS* elements. For instance, especially resourceful institutions may implement both certain elements of an *EMS and* aquire an *ELH* certificate independently of one another. As such, the observed pattern may be one of effects from certain innate resources or assets, rather than an effect running from *ELH* to EMS.

5. Conclusions

Public service providers in the education and nursing home sector view compliance and consistency with standards and regulations as the most important motivation for Environmental Management System (*EMS*) adoption. Public service providers' EMS adoptions are driven first and foremost by signals from top-level political and administrative authorities. However, they also look to clients (students, patients and their relatives) and societal actors (the media, NGOs, unions) when contemplating *EMS* adoption.

Top-management commitment to environmental issues (e.g. the appointment of an environmental manager) and budgetary allocations to the environmenatl area is associated with higher propensities for *EMS* implementation.

In multivariate controlled analyses we find that managers in public institutions perceive positive *internal* effects from *EMS* adoption (e.g. better performance in terms of cost reductions and environemnetal awareness of user/clients and employees). On the other hand, we find no indication of *external* or indirect effects from *EMS*s, such as increases in cooperation with environmental organizations or the private business sector.

Possibly, Eco-Lighthouse (*ELH*) certfication aids in implementing a more comprehensive *EMS*: *ELH* institutions on average have implemented significantly more *EMS* elements than non-certified institutions.

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Appendix

Table A1. Descriptive statistics for analysis variables.

Question/variable:	min.	mean	max.	std.dev.	n
Motivating factors (Q7): (a)					
Reduce environmental impact/emissions	1.00	2.50	3.00	0.58	134
Conform to regulations for handling of toxins etc.	1.00	2.77	3.00	0.47	134
Conform to suoervisory bodies' standards	1.00	2.60	3.00	0.55	134
Conform to standards from local political level and adminstration	1.00	2.49	3.00	0.57	135
Better reputation	1.00	2.37	3.00	0.57	133
Save money/reduce costs	1.00	2.47	3.00	0.62	135
Reduce sick leav rates	1.00	2.43	3.00	0.68	133
Activities of institutions in other municipalities	1.00	1.86	3.00	0.60	131
Activities of other institutions in municipality	1.00	1.65	3.00	0.61	132
Influential actors (Q4): (b)					
International agreements (EU, UN)	1.00	2.28	5.00	0.96	134
National authorities. (Dept. for Environment., SFT)	1.00	2.80	5.00	1.00	137
Regional authorities (counties)	1.00	2.81	5.00	1.08	134
Local council	1.00	3.73	5.00	0.92	139
Individual politicians	1.00	1.93	5.00	0.95	137
Chief administrative executive	1.00	3.09	5.00	1.30	138
Environmental organizations	1.00	2.57	5.00	1.00	137
Employees/unions	1.00	2.81	5.00	1.07	139
Users (students/patients) and relatives	1.00	2.89	5.00	1.08	135
Suppliers	1.00	2.18	5.00	0.95	137
Media	1.00	2.54	4.00	0.86	137
Internal resources (Q2, Q3):					
Employee *outside* management w/specific environm. responsibilities (=1)	0.00	0.23	1.00	-	152
Employee *in* management w/specific environm. responsibilities (=1)	0.00	0.49	1.00	-	152
Budget for environmantal activities (=1)	0.00	0.24	1.00	-	154
Reported EMS elements and EMS index (Q8):					
EMS1: "Routines for aseesing legal requirements" (=1)	0.00	0.65	1.00	-	125
EMS2: "General assessment of environmental issues" (=1)	0.00	0.72	1.00	-	129
EMS3: "Codified environemntal policy" (=1)	0.00	0.48	1.00	-	122
EMS4: "Measurable environmental goals" (=1)	0.00	0.59	1.00	-	128
EMS5: "Environmental training programs" (=1)	0.00	0.38	1.00	-	124
EMS6: "Contious process of improvement" (=1)	0.00	0.57	1.00	-	127
EMS7: "Environemntal reporting to management" (=1)	0.00	0.46	1.00	-	127
EMS8: "Accounts system for asessing environ. activities" (=1)	0.00	0.28	1.00	-	122
EMS: Index for Environemntal management system comrehensiveness	0.00	3.95	8.00	-	132

(a) Responses on a three point "not important" to "very important" scale were recoded into numerical scores on a 1 (="not important") to 3 (="very important") scale. (b) Responses on a five point "very weak" to "very strong" scale were recoded into scores on a 1 (="very weak") to 5 (="very strong") scale.

Table A1, continued. Descriptive statistics for analysis variables.

Question/variable:	min.	mean	max.	std.dev.	n
Certification (Q6):					
ELH: Eco-Lighthouse certification (=1)	0.00	0.20	1.00	-	186
GF: Grønt Flagg (=1)	0.00	0.19	1.00	-	186
Index for "environmmental awareness" (Q13):					
EA: index for "environmental awareness" (a)	-2.00	6.71	10.00	2.64	129
Area cost reductions from EMS indicators (Q11): (b)					
A1: in energy consumption (=1)	0.00	0.63	1.00	-	64
A2: in goods consumption (=1)	0.00	0.33	1.00	-	63
A3: in travel/transport (=1)	0.00	0.22	1.00	-	55
A4: in refuse management (=1)	0.00	0.44	1.00	-	63
A5: in sick leave rates (=1)	0.00	0.19	1.00	-	58
Benefits from EMS indicators (Q12):					
B1: "Better reputation" (=1)	0.00	0.68	1.00	-	44
B2: Better working conditions (=1)	0.00	0.69	1.00	-	54
B3: "Better mangement systems" (=1)	0.00	0.66	1.00	-	53
B4: "Increased environm. awareness among employees" (=1)	0.00	0.92	1.00	-	61
B5: "Increased environm. awareness among useres/ relatives" (=1)	0.00	0.85	1.00	-	60
B6: "Increased cooperataion with local environm. organi-zations" (=1)	0.00	0.25	1.00	-	63
B7: "Increased cooperation with business sector" (=1)	0.00	0.03	1.00	-	63

(a) Based on the followig five assertions (*EA1 -EA5*): "Environmental and climate problems are quite serious and they are some of the greatest problems society is faced with", "Stricter regulation is required in order to solve environemnetal and climate problems", "Technological development is required in order to solve environemnetal and climate problems", "Voluntary measures, such as EMS, are required in order to solve environemnetal and climate problems" and "I think of environemnetal and climate problems as more important after we have started working with EMS". Responses were given on a four point "disagree" to "agree" scale, recoded to a numerical -2 (="disagree") to 2 (="agree") scale. The resulting *EA* score is the sum of scores for responses given to the individual assertions. (b) Questions (*A1 -A5*) on perceived cost reductions is recoded form an original "cost reductions"- "no change"-"cost increases" scale, since less than nine per cent reprorted "cost increases" for any one item.

Table A2. Factor analysis of influence from actors/groups. *Principal factor* analysis with *Varimax* rotation.

	Factor 1 - political and adm-inistrative authorities	Factor 2 - societal actors	Factor 3 - internal actors
National authorities. (Dept. for Environment., *SFT*)	**0.81**	0.16	0.36
Regional authorities (counties)	**0.70**	0.09	0.30
International agreements (EU, UN)	**0.64**	0.19	0.35
Local council	**0.52**	0.09	-0.06
Local chief executive officer/area executives	**0.49**	0.37	-0.08
Media	0.08	**0.61**	0.22
Environemntal organizations	0.28	**0.56**	0.29
Individual politicians	0.32	**0.56**	0.11
Suppliers	0.03	**0.44**	0.19
Employees/unions	0.09	0.31	**0.66**
Users (students/patients) and relatives	0.23	0.35	**0.62**
Var. explained by factors (total 5.27)	2.30	1.61	1.36