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A longitudinal and cross-sectional analysis of volume and content of corporate environmental disclosure in Norwegian companies: A research note on innovativeness and adoption

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Abstract

Innovation adoption theory is a fruitful supplement to legitimacy theory to explore voluntary environmental disclosure in annual reports. The present study reveals that disclosure volume is not a sufficient measurement of environmental information, especially when voluntary environmental disclosure is viewed as an innovation. The information content has to be captured since this innovation is divisible and can be adopted on a limited basis. The trialability of voluntary disclosure enables the companies to experiment with this type of information and reveal the degree of adoption.

One of the main findings in the present study is the demonstration of decreased disclosure volume together with increased number of environmental categories reported. Hence, reduced volume does not mean that the information value decreases when the variety of content increases. Maturation combined with experiments of limited adoption will over the years raise the information value of voluntary environmental disclosure.

The attention of environmental issues in society has turned out as a significant predictor of adoption of environmental categories in annual reports. This attention is a proxy for relative advantage and compatibility with social norms in innovation adoption theory and of social pressure in legitimacy theory.

An important result revealed by the present study is the significant support for the hypothesized differences in disclosure volume and disclosure content between businesses having severe environmental impact and their counterparts. The reported environmental disclosure of volume and content is higher for the group of companies with serious environmental impact than those having modest environmental impact. This result is in accordance with innovation adoption theory, and may also follow from legitimacy theory.

Keywords

Disclosure content, disclosure volume, environmental disclosure, voluntary disclosure, innovation, innovation adoption theory, legitimacy theory.

A longitudinal and cross-sectional analysis of volume and content of corporate environmental disclosure in Norwegian companies: A research note on innovativeness and adoption

Introduction

In most western countries social and environmental disclosures in annual reports are voluntary¹. Hence, decisions of whether to disclose, how much to report and what type of content to make are almost entirely those of the company (Campbell *et al.*, 2003). Previous studies indicate that environmental disclosure is not uniform even if companies are likely to face environmental liabilities (e.g. Fallan, 2007; Freedman and Stagliano, 1995). Other empirical event studies reveal that the volume of environmental disclosure responds to increased exposure to criticism experienced after a particular event (Patten, 1992; Deegan *et al.* 2000).

Legitimacy theory is probably the most widely used theory to explain social and environmental disclosures (Adams *et al.*, 1998; Ljungdahl, 1999; Milne and Patten, 2002; O'Donovan, 2002; Wilmhurst and Frost, 2000). Although other theories can be and are used to explore environmental disclosure, Campbell *et al.* (2003) claim that legitimacy theory has become the pre-eminent explanatory theory in this field. However, testing the significance of this theory and others cannot be carried out only by having a few case observations. Campbell *et al.* (2003) capture voluntary social disclosures over a longitudinal period in excess of 20 years, but only six big companies in three different industries were included. Their study has more than 100 observations from annual reports and is probably one of the most thorough empirical examinations so far. Their results indicate that legitimacy theory may be an explanation of disclosure volume in some cases but not in others. Campbell (2004) having more than 250 observations over a period of 26 years concludes that differentials in the perceived need for social legitimacy may be one cause of both longitudinal and cross-sectional variability in disclosure volumes.

No research as far as we know has addressed the question of how theory of adoption of innovations (Rogers, 1995) can be understood as a subsidiary theory of legitimacy explaining both volume and content of environmental disclosure in annual reports and within notes to financial statements. Extensive research on the adoption of innovations shows that

¹ Norway was the first European country requiring all firms to publish a clarification of executed and planned operations for environmental protection from 1989 and also emphasized in the new accounting act of 1998. However, there are no definite rules concerning how much to report and as to form and content of environmental reporting in notes to the financial statement. It is entirely up to the reporting entity.

the adoption rate varies dramatically across innovations, and that potential adopters vary in their ability and willingness to adopt an innovation. Furthermore, research has been conducted to profile and distinguish adopters from non-adopters, as well as groups of adopters, based on when they adopt an innovation. Since environmental disclosure can be viewed as an innovation in annual reports, these results from innovation theory may explain adoption of this information in annual reports. This paper uses elements from these theories (legitimacy and adoption) to predict volume and content of environmental disclosure.

Most studies up to now include only volume of environmental disclosure and do not take content into consideration. This weakness may probably be due to the overwhelming problem in document gathering, especially when it comes to longitudinal data capture. Previous empirical studies of environmental disclosure are mostly cross-sectional and very few are longitudinal (exceptions are e.g, Campbell, 2004; Gray *et al.*, 1995a, 1996; Ljungdahl, 1999). The present study redresses this weakness when we combine longitudinal and cross-sectional perspectives including both volume and content of environmental disclosure in annual reports. This is also an attempt to repair the empirical deficit in environmental disclosures, especially in the Scandinavian countries. We aim to establish hypotheses of expected development in voluntary environmental reporting based on these two theoretical perspectives and to test them on data from Norwegian companies.

This paper proceeds as follows: The theoretical foundations for expected development in environmental disclosure mainly based on an innovativeness perspective are discussed in the next section and the research questions are developed. The phenomenon of environmental disclosure is discussed and the appropriate research method is clarified. Then findings are reported, conclusions are drawn, and some implications are indicated in the last section.

Environmental disclosure as innovation

The concept «environmental» in this context refers to those disclosures where an organizational process or a production process may have impact on the natural environment. Since environmental disclosure is voluntary whether to report, how much to report and what type of content to make, the decisions are entirely those of the company. In Norway there are no common standards for these disclosures. To pursue such reporting, the company must adopt, and make use of, various information categories in environmental reporting to form their information strategy. These information categories are not common knowledge and can be viewed as innovations.

So far environmental disclosure is a new innovation to the innovation literature. However, there is no doubt that environmental disclosure can be viewed as an innovation. According to Rogers (1995: 11): «An innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.» The idea does not need to be objectively new, but if it seems new to the individual, it is an innovation. Newness in an innovation need not just involve new knowledge. Someone may have known about an innovation for some time but has not yet developed a favourable or unfavourable attitude towards it, nor has decided to adopt or reject it. «Newness» in this respect may be expressed in terms of knowledge, persuasion, or decision to adopt. Voluntary environmental disclosures fulfil the requirements.

From a large number of studies in this extensive research field of diffusion of innovations (Rogers, 1995), some strong generalizations have emerged. A closer inspection of these generalizations reveals that they relate to the relationship between the adopter and the way the adopting unit considers the potential innovation. In this respect adoption theory and legitimacy theory interact to some extent. For example, studies of adoption have shown that the higher the perceived relative advantage of an innovation, other things being equal, the more likely and quickly the innovation will be adopted. Other identified dimensions are perceived compatibility (+), complexity (-), trialability (+), observability (+), and interconnectedness in the social system (+), indicating access to information and/or social pressure. Signs in parentheses indicate the direction of relationship (Rogers, 1995). Interconnectedness in the social system is another common dimension between legitimacy theory and theory of diffusion of innovations.

Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social prestige factors, convenience, and satisfaction are important factors too. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea in accordance with the values and norms of a social system will be adopted more rapidly than innovations that are incompatible. Complexity is the degree to which an innovation is perceived as difficult to understand and use. Trialability is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the instalment plan will generally be adopted more quickly than innovations that are not divisible. Observability is the degree to which the results of an innovation are visible to others. The easier it is to see the results of an innovation, the more likely it is to be adopted.

An important point connected to the adoption perspective is that the characteristics of the potential adopters influence whether or not the advantages and interconnectedness are understood, or whether an innovation is perceived complex. The main emphasis on what we have termed research on «innovativeness» is to identify characteristics that enable us to predict who will both see the advantages and adopt the innovation. A voluminous research literature of adopter categories is reviewed by Rogers (2003). From this literature we know that companies being earlier adopters are larger than those who are later adopters. They have more change agent contacts than later adopters. A change agent is an individual who influences client's innovation-decisions in a direction deemed desirable by a change agency. Fallan *et al.* (1995) have identified accountants, auditors, lawyers as change agents when it comes to adoption of tax planning instruments in business organizations. In the area of environmental disclosure such agents could be a wide range of people from auditors to public relation consultants. We also know that the heart of the diffusion process is the possibility to imitate the experiences of close equals who have previously adopted a new idea. When it comes to environmental disclosures such diffusion networks could be members of an industry association or other networks.

The innovation in this study is the degree of environmental disclosure in annual reports with respect to volume and information content.

Hypotheses

Environmental disclosure is relatively new as being a part of an annual report in Norwegian companies. Before the mid-1980s such disclosure was modest, sporadic and situational. To day environmental disclosure is a more common part of the annual reports. According to the theory of diffusion of innovations adoption is more likely when the perceived relative advantage is increasing. The relative advantage is closely related to the awareness of environmental issues. Then such reporting is interconnected with the growing attention within the social system. The attention to environmental questions in the society during the last twenty years will, other things being equal, be a driving force. The society will demand environmental information and companies will supply such information. From this we hypothesize:

H₁: The volume of environmental disclosure in annual reports is positively related to the perceived relative advantage from attention towards environmental issues in the society over years.

H₂: The information content of environmental disclosure in annual reports is positively related to the perceived relative advantage from attention towards environmental issues in the society over years.

These two hypotheses could also have been developed from legitimacy theory. The adopting perspective interacts with the assumption of a social contract between a company and the society which is a central part of legitimacy theory too (Donaldson, 1982). Companies «agree» to operate within certain bounds imposed by society in order to access to product and resource markets. Although much of the emphasis is placed on the company acting legitimately, the nature of the contract is two sided (Campbell *et al.*, 2003). The theory of diffusion of innovations capture this relation not only through relative advantage, but also through perceived compatibility, trialability, observability and interconnectedness in the social system indicating access to information and/or social pressure.

The «innovativeness» research has identified characteristics that enable us to predict who will both see the advantages and adopt the innovation. Since firms vary in the way their operations have environmental impact, emission, pollution, cleaning up (after pollution) and re-landscaping, the adoption of environmental disclosure is supposed to be more likely in companies which run businesses having a serious environmental impact. Those companies will perceive a greater relative advantage of adopting environmental disclosure to satisfy society's demand for such information. These companies have to report directly to the Norwegian Pollution Control Authority (Statens Forurensingstilsyn, SFT) and the County Governor according to the Pollution Act. It is also easier for them using some of this technically required information in annual reports. Hence, the compatibility is higher for these companies than for other companies. Thus we hypothesize according to the diffusion of innovation theory:

H₃: Companies running businesses having serious environmental impact are more likely to report higher volume of environmental disclosure in annual reports than other companies.

H₄: Companies running businesses having serious environmental impact are more likely to report larger information content of environmental disclosure in annual reports than other companies.

Research method

Longitudinal and cross-sectional analysis

Being able to answer the research questions addressed in the above hypotheses, we need longitudinal as well as cross-sectional data. We have to follow the reporting over some years to test the first two hypotheses, but we do need cross-sectional data as well. The last two hypotheses can be tested using cross-sectional data only, but a research design collecting longitudinal data where the hypotheses can be tested each year over a period of time will strengthen our conclusions.

Measurement of concepts

The literature reflects a debate of aspects of data in voluntary disclosure. There are different ways of measuring volume and content of environmental disclosure. Campbell (2004) refers to two main issues, first, the unit of analysis and, second, what medium should be selected.

First, the debate over unit of analysis concerns the most effective way of inferring reporting of volume and content. Most studies have limited the measurement to volume only. Meaning is first coded from phrase or sentence (Milne and Adler, 1999), and if the content is classified as environmental, then the coded disclosure is counted. The most commonly employed counting measures are word count (e.g. Wilmhurst and Frost, 2000), sentence count (e.g. Deegan *et al.*, 2000) and page proportion count (e.g. Gray *et al.*, 1995b).

Of the various methods described: word count, sentence count and page proportion count, all are capable of catching disclosure volume. Page proportion count is selected for the present study.

When it comes to information content of environmental disclosure, this should be based on a qualitative measurement. However, we have decided to convert the content variable into a quantitative measurement. The content is much more interesting than volume alone to describe the development of voluntary environmental disclosure over years. Hence, the measurement of content is very important and a lot of effort is exercised to find an appropriate method gathering these data.

The second area of discussion in the literature is which media to use as a basis for data collection. According to Campbell (2004) the majority of previous studies have used the annual report as the basis of analysis for several reasons. The annual report is produced regularly, a substantial editorial input is used to develop it, and it is widely read (Deegan and Rankin, 1996; Grey *et al.*, 1995b). However, the totality of a company's environmental communications towards the public should include other media used, e.g. environmental supplement to the annual report, separate environmental reports, internet web pages, stock exchange announcements and so on. It is likely that internet web pages have become the medium of choice for voluntary information in recent years and environmental reports have also been widely used since the mid 1990s. As for a considerable part of the longitudinal period studied here neither of these media were a feature of the reporting alternatives. Hence, we have used the annual report and we have also collected data for environmental supplement to the annual report.

The categorization of information content of environmental disclosure is based on two main principles. (1) The list of categories should be complete, i.e. all possible and relevant environmental information should be included in one of the categories. (2) The categories are mutually exclusive, i.e. one type of information could only be included in one separate category and no other.

The categorization is mainly based on United Nations Commission on Transnational Corporations about environmental disclosure in annual reports (UNCTC, 1991) and on a doctoral thesis about environmental disclosure in Swedish companies (Ljungdahl, 1999). We have added two more categories and the present study includes 13 mutual exclusive categories for grouping information content of environmental disclosure (see Table 1). Fallan (2007) has detailed examples of how to classify according to these categories.

The measurement and the gathering of information are closely connected. The grouping of very heterogeneous types of information into 13 categories is a demanding task where grey areas can occur from time to time. Hence, the reliability could be threatened. Therefore we have decided to make the category variables dichotomous. If the environmental disclosure includes one type of information which belongs to a specific category, the value 1 is assigned whether the type of information is one single sentence or a whole page. Naturally, when using a nominal scale much information is lost, but on the other hand the reliability will increase. Hence, the content variable will inform us how many categories are reported by the company. The variable can take on values up to 13. The content variable informs us about the variety of a company's environmental reporting.

Table 1*Environmental disclosure categories. Definitions/description.*

No.:	Category:	Definition/description:
1	Environmental policy	Includes supereminent objectives and strategies. A minimum requirement is that priority of the environmental focus is expressed or an intention to follow an environmental program, e.g. The International Chamber of Commerce (ICC) Environmental Program, the Charter of World Business Council for Sustainable Development or a national environmental responsibility program. A statement saying that the company has an environmental policy is not sufficient to be included in this category.
2	Environmental objectives	To be included here it is required that the company reports specific and measurable goals derived from their environmental policy. For example an objective to decrease a specific discharge level of a substance in a definite period.
3	Environmental impact - process	Includes information about environmental impact from production processes as regards status and environmental improvements. Status includes: e.g. technical environmental accounts of pollution, waste and energy consumption; production methods; waste processing, and environmental risk. Environmental improvements includes: e.g. production process, and pollution.
4	Environmental impact - products	Like the above category 3; includes impact from products only.
5	Environmental organization	Includes information of how the company has organised their environmental work: e.g. responsibility, division of work, emergency preparedness to meet environmental requirements and disasters, development of environmental expertise, implementing of ISO 14001, the implementation of EMAS standards of environmental management and auditing. Specific auditing is excluded. See the below category 6.
6	Environmental auditing	Includes information about planned and completed environmental auditing acts (internal and external), reporting of auditing results and the company's follow-up work.
7	Environmental authorities	Includes information about present and future environmental constraints, green certificates, existing disputes, results of closed disputes, results of applications processing of discharge permits and so on.
8	Environmental events	Includes information about specific events that have caused environmental impacts; e.g. excess of discharge permit, serious environmental disasters.
9	Environmental investments	Includes economic information about completed investments to reduce the company's environmental impacts. Planned investments are excluded and belong to category 11 (environmental liabilities) below.
10	Environmental costs	Includes economic information about the environmental costs of the year. This is the change in environmental liabilities in accordance with accrual accounting. Environmental income and cost reduction are viewed as negative environmental costs. Information about future costs are classified in category 11 below.
11	Environmental liabilities	Includes information about future costs. Best estimate based on all available information should be adopted for contingent liabilities.
12	Definition of	Includes information about definition and clarification of

	environmental concepts/accounting principles	environmental concepts. The category includes: e.g. clarifications, accounting principles, accounting rules, procedures relating to measurement, valuation and disclosure because of lacking accounting standards in this area.
13	No environmental impact (compulsory obligation)	From 1989 Norwegian companies have to report whether the enterprise pollutes the environment in the financial statement There is no standard for this disclosure, but a common statement in the annual report is: «The company does not pollute the external environment.»

Source: Fallan (2007)

Testing the first two hypotheses requires us to capture the concept «attention towards environmental questions in the society». At least two different measurements are possible to use. Memberships of a «basket» of environmental lobby groups can be used as a proxy for attention toward environmental questions in the society (Campbell, 2004; Deegan and Gordon, 1996). Another measurement of this attention in the society can be notices on environmental issues or environmental related articles in newspapers over the years. The present study has selected newspaper's notices and articles on environmental questions as a proxy for this attention. That is because they are easy to find. A data base, Atekst, includes all notices and articles from a group of Norwegian newspapers and periodicals. However, going back to 1987 there is only one newspaper, Aftenposten, and one news agency, NTB, which are included for the whole longitudinal period. The search is restricted to these two media to make results comparable reflecting the development from year to year.

We have searched how many notices and articles that include words and phrases related to environmental issues. The following words and phrases are selected (an asterisk * attached to all words and phrases having this start will be included, and words and phrases put in «quotation marks» include only the exact word or phrase): *preservation**, *environment**, *pollution**, *discharge**, «*sustainable development*», *climate change**, and «*global warming*».

Hypotheses 3 and 4 appear to be reasonable and testable. However, we need to separate which companies are considered to run businesses having «serious environmental impact». The management of the company must have an understanding of how society perceives the company. The Norwegian Pollution Control Authority (Statens Forurensingstilsyn, SFT) and the County Governor rank those companies that have got a discharge permit into four risk groups based on their pollution potential. Risk group 1 includes businesses having the greatest risk of serious environmental impact, and risk group 4 the lowest. The present study considers companies in risk group 1 and risk group 2 to run

businesses having «serious environmental impact». Companies which belong to these groups have to report directly to SFT whilst companies in the other groups have no orders to report. The environmental disclosures of companies in risk group 1 and 2 will be compared to the disclosures of companies in risk group 3 and 4 and also including those companies which do not need any discharge permit at all.

Sample

In order to provide a longitudinal review of environmental disclosure in Norwegian companies, a long period was selected. However, since a cross-sectional sample for each year also is required, the considerable work gathering data of volume and content limited the period to what was practically feasible. This study includes data from a period of 19 years from 1987 to 2005 and 822 annual reports are included.

The companies were selected among those listed on Oslo Stock Exchange (OSE). The public interest in these companies is greater than randomly selected firms among all which are obliged to submit annual accounts, they are bigger and thereby better suited to adopt new trends in disclosure, and all OSE companies have the same requirements for financial statements and annual reports. Unfortunately, neither OSE nor the National Register of Accounts has a common data base of annual reports which also includes notes and environmental supplements over the whole period of 19 years. However, there is a compulsory renunciation for annual reports to The National Library. Lacking reports were collected from the library in hard-copy since no microfilm was available.

Few companies are listed on the stock exchange over the entire period, and, hence, the number of companies can vary from one year to another. A stratified sample is collected because companies running businesses having serious environmental impact have to be included. Almost all companies in SFT's risk groups 1 and 2 at OSE are included in the sample. The other companies included in the sample are randomly selected. The total sample varies from a minimum number of 34 companies in one year and up to 60 companies. Mean number over the period is 46,1 (SD = 8,4).

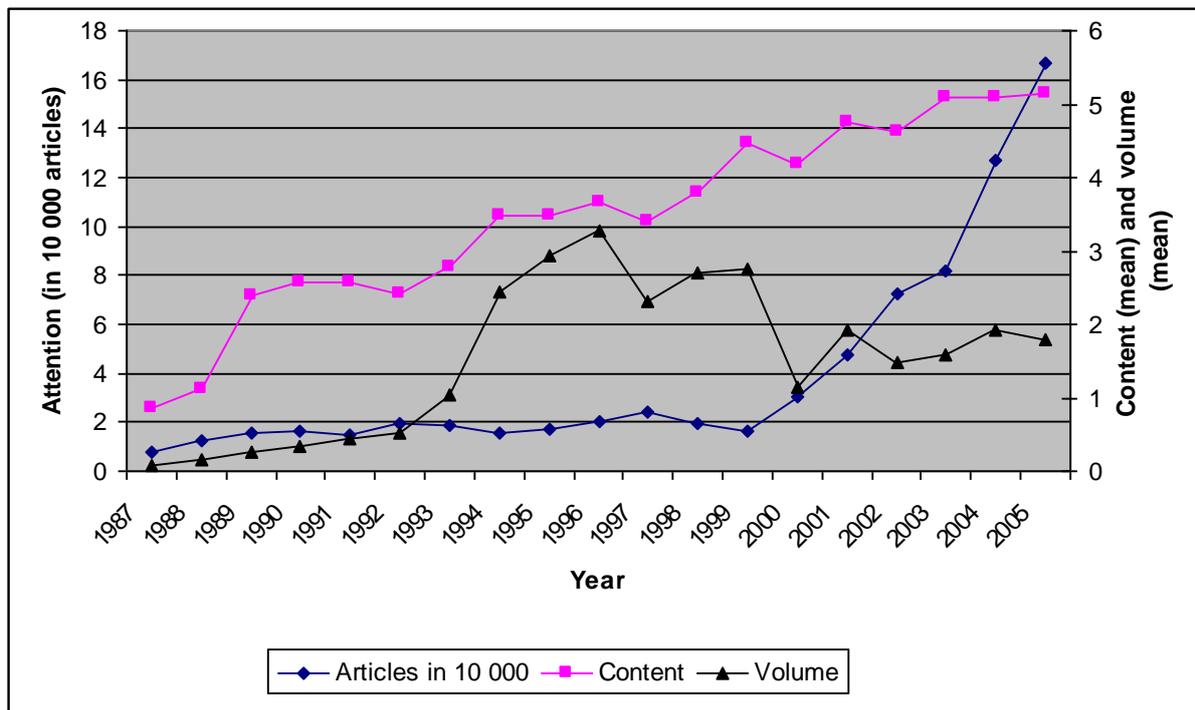
Findings

Over the course of the 19 years of the study, the mean volume of environmental disclosure was low until a considerable increase was observed in the early 1990s. The volume reached a peak having over 3 pages on average in 1996 and decreased more or less until the early 2000s. The last five years of the period the volume has reached stability of slightly under 2 pages on average (Figure 1 and Appendix A).

The content of environmental disclosure has developed from an average of one category reported up to an average over 5 categories in the course of the 19 years period. The information content has increased during the period (Figure 1, Appendix A). Even in the period of decreased volume of environmental disclosure from 1996, the information content has increased. This reveals a development of more concentrated and varying environmental disclosure from the mid 1990s.

Figure 1

Development of attention towards environmental issues (number of environmental related articles in 10 000), content (mean number of categories), and volume (mean page proportion count) of environmental disclosure. 1987 – 2005.



The attention towards environmental issues is related to the relative advantage of adopting environmental disclosure. This attention was measured through number of articles related to environmental issues. The increase has been moderate with a few set-backs up to

2000, but in the 2000s there is a considerable increase in environmentally related articles (Figure 1 and Appendix A).

The first hypothesis (H₁) which predicts that the volume of environmental disclosure in annual reports is positively related to the perceived relative advantage from attention towards environmental issues is not supported. The results from ANOVA are reported in Table 2. However, applying Spearman rank-order correlation test to measure the degree of association between the media articles relating to the environment and the average disclosure volume, we find $\rho = .42$ and the 1-tailed significance $p < .05$.

The second hypothesis (H₂) is strongly supported. The information content of environmental disclosure in annual reports is positively related to the perceived relative advantage from attention towards environmental issues in the society over years (Table 2). Spearman rank-order correlation indicates a strong association ($\rho = .85$, $p < .001$).

Table 2

ANOVA. Dependent variables: volume by year and content by year respectively, and independent variable: attention by year.

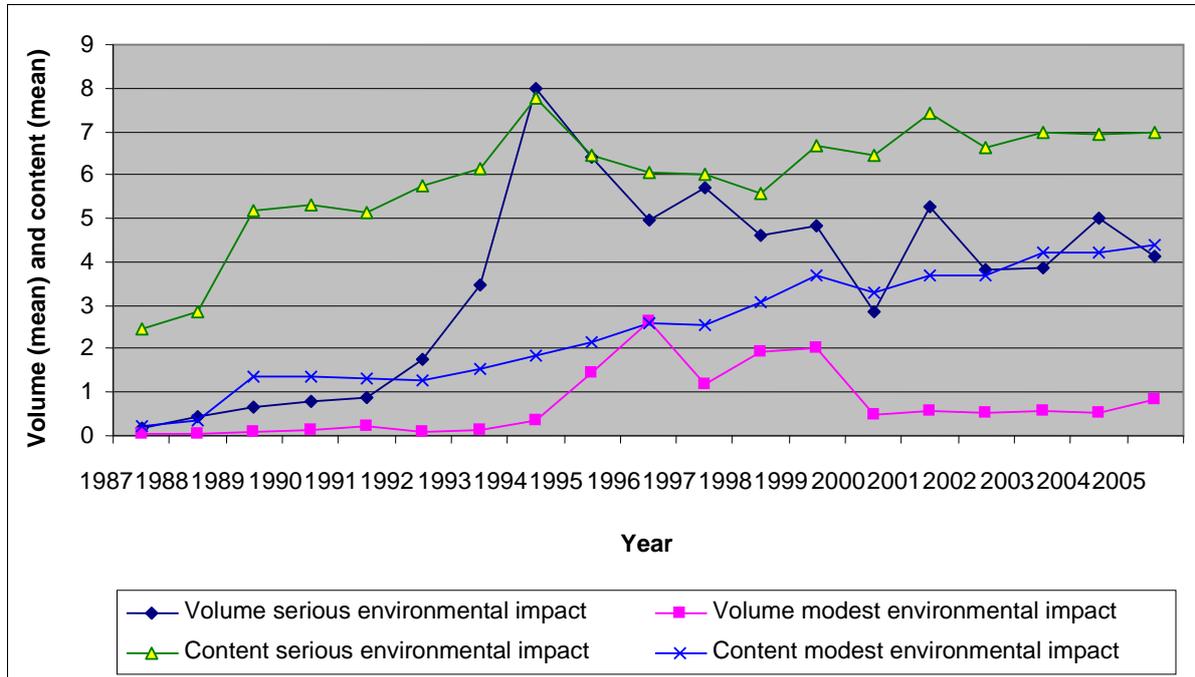
	Volume	Content
F-statistic	.42	15.07**
<i>t</i>	.65	4.26**
R ²	.02	.47
Adjusted R ²	-.03	.44

Significance: * $p < .05$ ** $p < .01$ *** $p < .001$

Figure 2 reveals the development in volume and content of environmental disclosure in businesses having serious and modest environmental impact respectively. The companies with severe environmental impact have higher volume of environmental disclosure than their counterparts for all years studied. The disclosure volume increased until 1994 where these companies published almost 8 pages on average. The rest of the period the disclosure volume were about 4 to 5 pages among those companies having severe environmental impact. The other companies had a modest disclosure volume until 1994. The last half of the 1990s these companies with modest environmental impact had an average disclosure volume of from one to two pages, and this volume decreased to a lower level than one page the last five years of the period.

Figure 2

Development of volume (mean page proportion count) and content (mean number of categories) of environmental disclosure in businesses having (1) serious environmental impact and (2) not serious environmental impact. 1987 – 2005.



The information content of the companies with serious environmental impact has increased during the 19 years from an average of 2,5 information categories up to an average of 7 categories in 2005. These companies published nearly an average of 8 disclosure categories in the top year of 1994. The other group of companies with modest environmental impact had an average information content of 1/5 category in 1987, but the information content has increased during the whole period and has reached an average of almost 4,5 categories.

Table 3

Difference of means in volume and content of environmental disclosure in annual reports between companies having serious and not serious environmental impact. Each year 1987 – 2005. *T-test and F-test.*

Year	Volume			Content		
	Companies having serious environmental impact <i>Mean (SD)</i>	Companies not having serious environmental impact <i>Mean (SD)</i>	<i>t-value F-statistic[†]</i>	Companies having serious environmental impact <i>Mean (SD)</i>	Companies not having serious environmental impact <i>Mean (SD)</i>	<i>t-value F-statistic[‡]</i>
1987	.19 (.23)	.03 (.07)	-3.29** 22.22***	2.45 (2.77)	.22 (.51)	-4.10*** 22.85***
1988	.45 (.51)	.03 (.09)	-4.27*** 28.22***	2.85 (2.64)	.36 (.68)	-4.72*** 31.41***
1989	.68 (.66)	.09 (.21)	-4.41*** 43.82***	5.18 (3.28)	1.34 (1.61)	-4.98*** 13.22***

1990	.81 (1.01)	.11 (.29)	-3.45** 9.40**	5.31 (2.02)	1.34 (1.08)	-8.33*** 12.18***
1991	.88 (.89)	.22 (.70)	-2.55* 1.84	5.15 (2.04)	1.30 (1.10)	-7.81*** 5.06*
1992	1.75 (4.38)	.10 (.22)	-2.30* 12.16**	5.77 (2.42)	1.28 (.91)	-9.54*** 13.11**
1993	3.48 (5.41)	.12 (.20)	-3.85*** 35.92***	6.15 (2.73)	1.54 (1.19)	-8.35*** 13.67**
1994	7.98 (10.34)	.33 (.74)	-4.55*** 56.06***	7.79 (2.58)	1.84 (1.61)	-9.91*** 10.08**
1995	6.40 (10.45)	1.43 (6.71)	-2.08* 7.23*	6.44 (2.92)	2.16 (2.13)	-5.98*** 3.24
1996	4.97 (11.15)	2.62 (9.14)	-.83 1.58	6.06 (2.46)	2.60 (2.73)	-4.51*** .02
1997	5.72 (9.79)	1.17 (3.73)	-2.59* 19.62***	6.00 (3.14)	2.53 (2.44)	-4.39*** 2.32
1998	4.63 (8.01)	1.91 (8.07)	-1.19 2.21	5.56 (3.07)	3.07 (2.48)	-3.29** 1.92
1999	4.81 (7.18)	2.04 (7.01)	-1.30 1.59	6.67 (2.30)	3.70 (2.54)	-3.95*** .05
2000	2.85 (3.97)	.47 (.94)	-3.07** 27.70***	6.45 (2.58)	3.31 (2.24)	-3.81** 1.16
2001	5.25 (9.35)	.58 (1.31)	-2.72* 14.14**	7.42 (2.88)	3.70 (2.09)	-4.67*** 3.44
2002	3.84 (4.97)	.52 (.97)	-3.50** 58.41***	6.92 (3.50)	3.69 (2.07)	-3.68** 7.52**
2003	3.86 (4.83)	.56 (.77)	-3.32** 77.65***	7.00 (3.77)	4.21 (2.34)	-2.69* 7.41*
2004	5.00 (7.16)	.51 (.75)	-3.21** 37.65***	6.92 (3.78)	4.23 (2.27)	-2.73* 8.63**
2005	4.13 (5.58)	.82 (1.39)	-2.77** 22.51***	7.00 (3.53)	4.38 (2.12)	-2.69* 4.37*

Significance: * p < .05 ** p < .01 *** p < .001

† Levene's Test for Equality of Variances

A cross-sectional analysis of volume and content is required to answer the questions of hypotheses 3 and 4. We have tested the differences in volume and content between companies having severe environmental impacts and their counterparts in Table 3. Hypothesis (H₃) states that companies having serious environmental impact are more likely to report higher volume of environmental disclosure in annual reports than their counterparts. This hypothesis is strongly supported for most years. Only three of the nineteen years there was no significant support. When it comes to disclosure content, the fourth hypothesis (H₄) states that companies having serious environmental impact are more likely to report higher levels of environmental information in their annual reports than other counterparts. According to the cross-sectional analysis this hypothesis is strongly supported for all years studied.

Discussion

The present study has revealed some interesting development in Norwegian companies' environmental disclosure. The increase in disclosure volume until the mid 1990s is in accordance with a general trend revealed in other studies at that time (Deegan and Gordon, 1996; Brown and Deegan, 1998). However, the development since the mid 1990s represents a departure from the general trend of increasing disclosure volume in annual reports and environmental supplements over the years. The decrease started in 1996 and from 2001 to 2005 the disclosure volume seems to converge to a steady level of slightly under 2 pages on average. This development in disclosure volume is not in accordance with other studies from other countries (e.g. Campbell, 2004, reporting from UK companies).

The reduced disclosure volume is not expected, given that the relative advantage of publishing such information has dramatically increased during the period 1999 – 2005. The hypothesized positive relation between environmental disclosure volume and relative advantage of such disclosure measured by media attention and thereby community concern about environmental issues, is not supported for the period as a whole. This may be due to several factors. First, we have not considered any time lag effects in the regression model estimating the relationship between media attention and subsequent disclosure volume. However, inspecting the time series in Figure 1, this will probably not have any effect on the relationship. Hence, we can disregard the influence of time lag in this study.

Second, the relative advantage of environmental disclosure is related to the community expectations of the importance of environmental issues. Perhaps the words and phrases related to environmental issues which we have selected in the present study to measure the community attention towards such questions, are not considered by the management of the companies to boost the relative advantage of environmental disclosure.

Third, several studies based on legitimacy theory (e.g. Deegan and Rankin, 1996; Walden and Swartz, 1997) have revealed increased environmental disclosure volume in response to increased attention and public pressure. However, some studies (e.g. Brown and Deegan, 1998; Deegan *et al.*, 2000) have provided evidence that the role media coverage of environmental issues increase public policy pressure, which in turn leads to greater environmental disclosure. On the other hand, Patten (2002) concludes that the public pressure does not have to arise from media coverage alone, but can arise from the dissatisfaction of the public itself, from new or proposed political action, and/or from increased regulatory oversight. The present study is only considering media attention as proxy for relative

advantage of environmental disclosure. This may be a source of failure based on a simplistic assumption and could be subject for further research.

Fourth, the measurement of volume in the present study includes annual reports and environmental supplements. Hence, the measurement of volume is lacking environmental information through web-pages on internet. Probably, web-pages have to some degree substituted hard copy environmental supplements during the late 1990s and the 2000s. Consequently, the mean volume of environmental information will be underestimated.

Fifth, hypothesis (H_1) could be too simple. Disclosure volume may not be the appropriate innovation to be adopted. In fact, the innovation is the environmental information value rather than the volume. Then content of environmental information is more likely to be adoption unit and leads us to the next hypothesis (H_2).

Content of the environmental disclosure is the most interesting part of the present study. The way in which we have classified and measured the information content, makes it possible to observe how the companies try innovation on a limited basis and development in category adoption over the years. According to the time series in Figure 1 the companies reported an average of less than one category in 1987. Increasing adoption during the period has resulted in an average environmental category disclosure of more than 5 in 2005.

In fact, the degree to which environmental categories are adopted in annual reports reveal the trialability of the innovation, the compatibility, and the relative advantage for the company. Voluntary environmental disclosure is definitely an innovation where the attributes of the innovation itself facilitate adoption. The more categories adopted the higher environmental information value. Media attention and thereby community concern about environmental issues creates a need for such information. The compatibility of environmental disclosure meets the need of the management of companies and thereby boost the relative advantage of adoption. In this respect adoption theory and legitimacy theory interact to some extent. The strong support for the hypothesized positive relationship between information content of environmental disclosure in annual reports and attention towards environmental issues in the society is derived from both innovation adoption theory and legitimacy theory.

An interesting finding is the observed decrease in disclosure volume from the mid 1990s and the increase of environmental categories reported. This development reveals probably a maturation process where environmental disclosure has been more exact with a higher information value during the period studied.

The last two hypotheses about differences in environmental disclosure (volume and content) between companies running businesses having either a serious or a modest

environmental impact are strongly supported. According to H₃ companies having serious environmental impact are more likely to report a higher volume of environmental disclosure in annual reports than other companies. Unlike the study of Campbell *et al.* (2003) where no significant difference was found between three groups of companies as to their degree of “sinfulness”, the present study reveals that the mean disclosure volume among companies is significantly higher among companies having serious environmental impact than their counterparts (Figure 2 and Table 3). The reported disclosure volume of the businesses having severe environmental impact is higher for all years included than their counterparts with modest environmental impact. This may be interpreted as support to both the innovation adoption theory and the legitimacy theory.

The grouping of companies in the present study into either serious environmental impact or modest environmental impact is based on Norwegian Pollution Control Authority’s risk groups, while Campbell *et al.* (2003) used a more subjectively based grouping of “sinfulness”. In their study one tobacco company was selected to represent the most “sinful” industry, two brewer companies constituted the middle group, and three retailers represented the least “sinful” group. While Campbell *et al.* (2003) focused on the broader concept of social reporting counting three social categories: natural environment, employee welfare and community, the present study examines environmental disclosure only. We observe the companies over a period of 19 years and 822 annual reports are included, while Campbell *et al.* (2003) follow their 6 companies over a period of 24 year, hence, 144 annual reports are included.

When it comes to H₄ that companies having serious environmental impact are more likely to report larger information content of environmental disclosure in annual reports than other companies, we have not found other studies conducted to reveal the information content between these two groups. Although Ljungdahl (1999) has examined the companies which have reported the highest number of environmental categories and concluded that they probably are among the biggest polluters, the present study reveals higher information content for businesses with severe environmental impact than for other companies for all years studied (Figure 2 and Table 3). The strong support for this hypothesis is in accordance with both theory perspectives: innovation adoption and legitimacy.

Conclusions

It is evident from this study that using innovation adoption theory is a fruitful supplement to legitimacy theory to explore voluntary environmental disclosure in annual reports. The present study reveals that disclosure volume is not a sufficient measurement of environmental information, especially when voluntary environmental disclosure is viewed as an innovation. The information content has to be captured since this innovation is divisible and can be adopted on a limited basis. The trialability of voluntary disclosure enables the companies to experiment with this type of information. The development of environmental disclosure categories reported over the years reveal the degree of adoption.

One of the main findings in the present study is the demonstration of decreased disclosure volume together with increased number of environmental categories reported. Hence, reduced volume does not mean that the information value decreases when the variety of content increases. Maturation combined with experiments of limited adoption will over the years raise the information value of voluntary environmental disclosure.

The attention of environmental issues in society has turned out as a significant predictor of adoption of environmental categories in annual reports. This attention is a proxy for relative advantage and compatibility with social norms in innovation adoption theory and of social pressure in legitimacy theory.

An important result revealed by the present study is the significant support for the hypothesized differences in disclosure volume and disclosure content between businesses having severe environmental impact and their counterparts. The reported environmental disclosure volume and content is higher for the group of companies with serious environmental impact than those having modest environmental impact. This result is in accordance with innovation adoption theory, and may also follow from legitimacy theory.

Further research on environmental disclosure from an innovation adoption perspective is requested. This perspective makes it possible to distinguish between different types of adopters and what types of content are most likely to be adopted in a way that may hopefully provide better understanding of voluntary reporting than the pre-eminent explanatory legitimacy theory does alone.

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Appendix A

Volume (page proportion) and content (number of categories) of environmental disclosure and attention towards environmental (articles) issues in 1987 – 2005.

Year	Volume (SD)	Content (SD)	Attention
1987	.07 (.15)	.85 (1.80)	7 570
1988	.16 (.34)	1.12 (1.93)	12050
1989	.25 (.46)	2.39 (2.73)	15 651
1990	.33 (.67)	2.56 (2.30)	16 114
1991	.44 (.81)	2.56 (2.30)	14 498
1992	.53 (2.29)	2.42 (2.47)	19 110
1993	1.04 (3.05)	2.78 (2.65)	18 788
1994	2.44 (6.27)	3.48 (3.25)	15 737
1995	2.93 (8.17)	3.48 (3.06)	17 275
1996	3.27 (9.66)	3.66 (3.05)	20 159
1997	2.31 (6.10)	3.41 (3.01)	23 810
1998	2.70 (8.01)	3.80 (2.88)	19 334
1999	2.76 (7.04)	4.48 (2.78)	16 024
2000	1.13 (2.42)	4.18 (2.71)	30 603
2001	1.91 (5.41)	4.76 (2.86)	47 311
2002	1.49 (3.13)	4.63 (2.93)	72645
2003	1.59 (3.11)	5.09 (3.10)	81 515
2004	1.93 (4.48)	5.08 (3.05)	126 828
2005	1.79 (3.49)	5.15 (2.83)	166 767