

Global Environmental Website Disclosure of Large Production Companies and their CDP Scores

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Abstract: This work contributes to the exposure of the current state of environmental disclosure through an empirical transnational study of 344 websites of large production companies from China, Europe, Japan, and the USA. The focus of the investigation is on four formative indices based on variables covering observation of disclosure extent of environmental management and environmental compliance management. All countries show low levels of disclosure. However, some variation on the extent of disclosure was found. The lowest level of disclosure was found for the Chinese websites. Higher - though not remarkable higher - levels of disclosure extents were observed for the companies from Europe, Japan, and the USA. Also, the correlation between disclosure scores based on these observational data and the CDP carbon disclosure scores of the year 2020 did only reveal insignificant correlations. However, websites having webpages containing a higher number of terms of the corporate environmental management terminology also achieve higher CDP scores.

Keywords: corporate environmental management, corporate environmental compliance management, website disclosure, sustainability ranking, Carbon Disclosure Project, CDP

1 Introduction

In recent years website publishing has evolved to a major component of corporate environmental communication. Up-to-date information about environmental concerns at various levels of granularity can be disclosed to the stakeholders and the greater public with relatively low costs. In addition to market conditions and climate change awareness, the ever-growing global environmental legislation is a main driver for environmental website disclosure.

The evaluation of the business world by rating companies which originally focussed on financial performance has been extended in the last decade. Based on complex scoring methodologies, now the companies are also evaluated in terms of their environmental performance and environmental disclosure. In general, evidence-based scoring methods will only yield high scores for companies that through verifiable facts can demonstrate

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environmental efforts. Hence, regular sustainability rankings such as published by Corporate Knights, Standard and Poor's, and the Carbon Disclosure Project [Di20], [SA11] have to be regarded as a further driver of corporate environmental disclosure.

Environmental website disclosure has been addressed by several scientific disciplines including environmental accounting, environmental communication, and environmental informatics. Of the available studies many focussed on a single country and/or a specific business sector. Because of the dynamics of the above described disclosure drivers as well as the permanently evolving digital world, the findings of these earlier works may not accurately describe the current situation of environmental website disclosure. The primary purpose of the research described in this article is to reveal an up-to-date status of environmental website disclosure in China, countries of the European Union (EU), Japan, and the United States of America (USA). The production sector was chosen for analysis because production is often considered to be a major pillar for the respective economies and production companies are believed to often leave a heavy environmental burden. A large data set for the production companies was obtained by a thorough website inspection identifying specific features and disclosure subjects. Four formative indices were developed in order to explore disclosure extent of corporate environmental management and corporate environmental compliance management (CECM).

Corporate websites play a major role in image building, reputation management, and investor attraction of today's business world. Hence, it can be assumed that companies are intrinsically motivated to publish information about their environmental achievements such as good scores in sustainability rankings. Conversely, they are less motivated to disclose information that may have a negative impact on the environmental reputation of the company such as a bad ecological footprint of a product, hazardous substances of product components, environmental incidents, and violations of environmental legislation. These considerations lead to the following research hypothesis (H1): There is a positive correlation between the level of environmental website disclosure and the company's score in fair and objective sustainability rankings. Test of this hypothesis is using the 'Climate Change' scores of the company from the 2020 CDP Rating [CD21b] and their corresponding disclosure scores obtained from observations at the company website.

The literature overview contained in the next section is followed by a description of the research method in Section 3. The study results are described in Section 4 and Section 5 concludes the article with a summary and an outlook to our future research.

2 Literature Overview

Environmental disclosure at corporate websites has been investigated empirically earlier. Cho and Roberts [CR10] investigated the environmental disclosure of US firms. The researchers found that 'worse environmental performing firms' provide more extensive disclosure. The categorization of companies is formed by official pollution data from the EPA's Toxics Release Inventory. From this inventory the top-100 highest toxic scoring

companies were considered as environmentally worse performing.

Jose and Lee [JL07] presented a global cross-industry study which focused on the website disclosure policies and practices of the 200 largest multinational companies. The article reports that 29% of the study sample disclosed details of their Environmental Management System (EMS) and that approximately one-third of the companies addressed office and site practices. The researchers found that when companies disclose, 31% report compliance information regarding legal standards.

The investigation results of a Canadian research group who looked at oil firms [BCT13] suggest that the larger the firm and the greater its media exposure, the more likely the firm is to include environmental management disclosures on its website. Furthermore, Suttipun and Stanton [SS12] found a relationship between the amount of disclosures and type of industry, ownership status, and audit firm in their study of Thai companies.

A study by Brazilian researchers used website observation data and website sustainability reports for a transnational comparison of environmental website disclosure [PB20]. It was revealed that companies from the USA stood out compared to Brazilian companies concerning environmental disclosure. The researchers concluded from the study results that the country of origin of the company has to be regarded as a variable that explains the environmental disclosure in corporate website.

3 Research Method

The target population of the study is implied by our research focus on production companies. We focus on large companies with more than 10,000 employees registered in China, Europe including Great Britain (in the following referred to as EU), Japan, and the USA. A production company was defined as a company with the particular codes 13 to 16 and 22 to 31 among its primary NACE codes [EU]. The selection of the population was performed in the Global Company Database ORBIS [Bu19] which lead to a random sample of 344 Companies. The distribution of the sample by country and by industry sector is shown in Table 1.

The data collection was performed by about 250 well-trained student research assistants during three periods: 1. EU companies: 10/15/-11/30/2019, 2. USA: 03/15/-04/30/2020, 3. China & Japan: 10/15/-11/30/2020. For each website three steps were completed (see Figure 1) in order to observe features (e.g. environmental menu items, environmental news sections, options to contact the environmental management team) and disclosure subjects (e.g. environmental awards, certificates, audits, compliance violations) at the websites as described in [TR20]. In the first step the start page was inspected. In step two followed an observation of lower-level pages according to a restricted top-down traversal of 'environmental links'. The 'environmental links' can be supplied by menu items or hypertext links in the content area of the start page. A link established a new traversal starting point for a further potential traversal path. As opposed to 'ordinary links' the

Industry Sector using NACE Classification	China N	EU N	Japan N	USA N	All N
13 textiles	3	.	1	.	7
14 wearing apparel	2	2	1	3	8
15 leather and related products	.	1	.	3	4
16 wood and products of wood and	.	.	.	1	1
17 paper and paper products	.	2	.	1	3
22 rubber and plastic products	2	4	5	2	13
23 other non-metallic mineral products	3	3	4	1	11
24 basic metals	12	6	8	1	27
25 fabricated metal products	.	4	8	7	19
26 computer, electronic, optical	16	14	25	34	89
27 electrical equipment	11	8	5	7	31
28 machinery and equipment	10	11	20	11	52
29 motor vehicles, trailers	12	18	22	10	62
30 other transport equipment	1	6	4	9	20
All	72	79	103	90	344

Tab. 1: Distribution of sample by countries and manufacturing sector

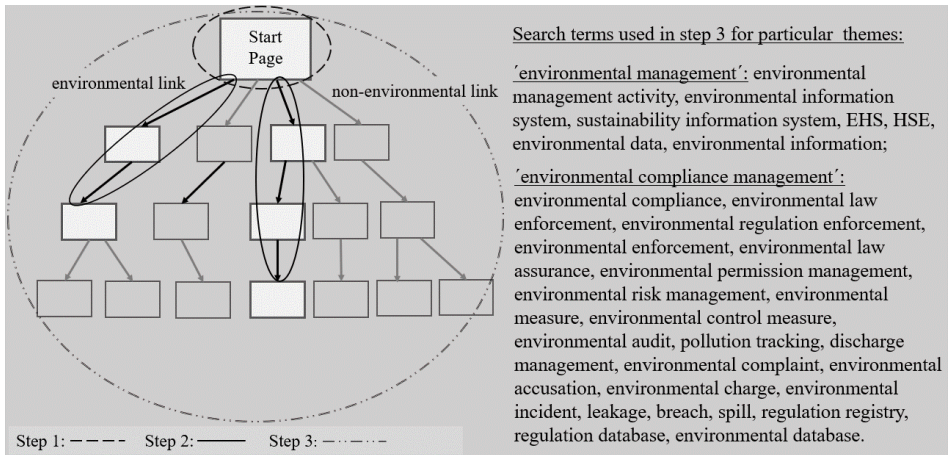


Fig. 1: The three-step website observation approach and the search terms of step three

'environmental links' are defined as links where relevant content is implied by the link name or the context. Consequently, the traversal was terminated when reaching a page without 'environmental links'. Step three used Google Advanced Search full text searches for the 29 particular terms displayed at the right side of Figure 1. The number of hits and the top five urls of the result list that referred to a html page were recorded excluding advertising links.

Drawing on theoretical foundations for the construction of multiscale measures four formative disclosure indices were developed similar to indices used in other disclosure studies [BE02], [CI08]. In general, formative indices are based on formative indicators as described in more detail by Diamantopoulos and Winklhofer [DW01]. Following the guidelines distinctive sets of weighted variables were chosen [TR20] to construct the following formative indices: the *Environmental Management Overview Disclosure Index (EODI)* measures extent of overview information of the company's general environment management engagement; the *Compliance Management Disclosure Index (CMDI)* measures extent of information focused on the company's environmental compliance management efforts; the *Environmental Presentation Features Index (EPFI)* measures extent of dialogical communication capabilities through website features such as contact options and specific information about environmental management; the *Environmental Disclosure and Presentation Index (EDPI)* is a summary index thus measuring websites from all of the perspectives of the three former indices.

The indices were built through a pragmatic scheme to assign weights of value 0.5, 1.0, 1.5, and 2.5 to the indices' variables [TR20]. Features and disclosure subjects at the start page are assigned a higher value than their counterparts at lower-level pages of the website. The higher weight reflects that an environmental news section at the start page is more likely being noticed by ordinary website visitors than when the section is at a lower-level web page. Also, the frequencies of the search terms listed in Figure 1 are reflected in the indices. The frequencies of the terms that are addressing the theme 'environmental management' were used for the EODI index and the other terms were used for the CMDI index. A weigh factor of 0.1 was uniformly used for all frequencies of search terms in order to reflect that the great majority of the obtained hits did not lead to web pages with extensive environmental management disclosure.

For every website the index score for the EODI, the CMDI, and the EPFI was computed by an accumulation of the weighted values of the observation variables associated with the index. The results were used to compute the websites' EDPI scores through the formula $EDPI = EODI + CMDI + EPFI$.

4 Study Results

This section describes the results of investigations of the website data collection. Box-and-whisker plots are used to visualize the results: a box depicts the middle 50% of the observations, the middle line of a box signifies the median, and the calculated mean is depicted by a diamond.

Differences of environmental website disclosure at a regional level can have various reasons such as differences in the environmental legislation (including fines for breaches), differences in the environmental regulatory authorities, differences in general business practices, and cultural differences. However, this work does not address reasons for disclosure variations.

4.1 Disclosure of Environmental Management and CECM

The EDPI index is used to reveal the extent of disclosure in general. From the box plots in the left pane of Figure 2 two major characteristics of the general environmental disclosure practices can be derived. First, the companies fell far short of the maximum possible EDPI value of 49.9, as the mean is 10.1 and the highest EDPI score achieved was 37.4 (by a company of the USA). In fact, the majority of the companies disclose environmental information to a relatively small extent. The Chinese companies are slightly behind the companies of the other three regions with the Japanese companies at the top.

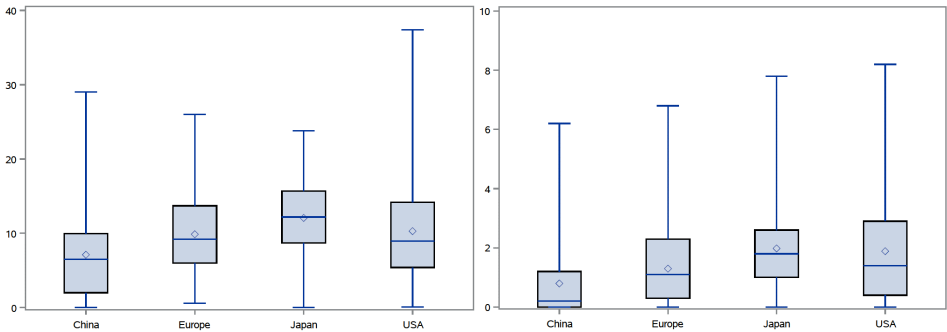


Fig. 2: EDPI (left) and CMDI (right)

As the box plots in the right half of Figure 2 show, only a small amount of CECM information was found at the websites. None of the investigated countries came close to the maximum possible CMDI index value of 14.2. CECM information found at websites often consisted of short general statements about the company's CECM commitment but did not cover details regarding the organizational concept, processes, measures, and use of IT. At some websites, visitors looking for CECM information were referred to corporate sustainability reports. In a small number of cases hyperlinks to online versions of the reports were supplied. A regional comparison shows that Chinese companies are again slightly behind the other three regions that achieve similar CMDI numbers with the USA companies at the top.

Building on the observational data an automated investigation was performed on the recorded webpages of the websites. For the set of company urls recorded during observation it was determined whether an English webpage successfully opens and a registration of the search terms (listed in Figure 1) was recorded. For each observed website the frequency for occurrence of each search term was registered. In the further analysis, only the occurrence or non-occurrence of the search term was registered. The proportion of companies in China, Europe, Japan, and the USA where the search terms occurred is displayed in Figure 3. Each bar displays the occurrence of a particular search term for the corresponding set of companies. For example, the term 'breach' was found at 60 companies of the set of 89 inspected US websites which results a mean of $60/89 = 0.674$. Chinese companies show a lower proportion for the search terms. For example, compare

the proportion for the term ‘carbon disclosure project’ and the corresponding acronym ‘cdp’. Some local differences stand out. For the term ‘environmental measure’ the Chinese companies are no different from the companies of Europe and the USA. For this term only Japan stands out with a higher proportion.

Generally, Europe, Japan, and the USA are quite similar compared to the Chinese companies that have a less frequent occurrence of the search terms.

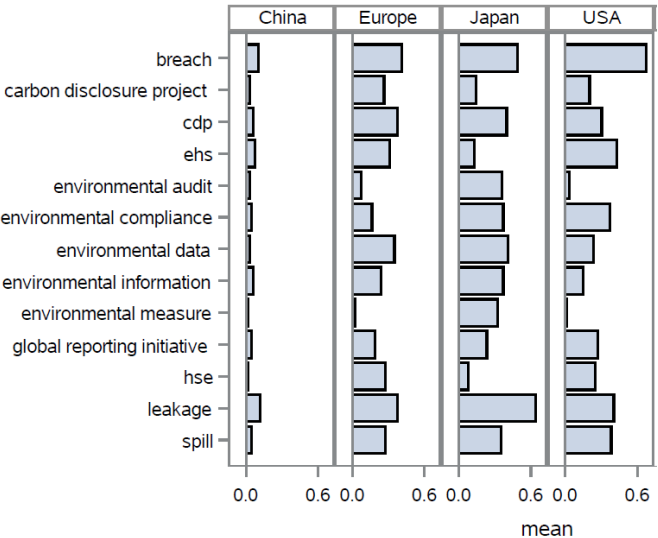


Fig. 3: Proportion of occurrence of selected search terms of companies in countries

4.2 Investigations Considering the CDP Ranking

In this work it is focused on CDP’s climate change sector scores of the sample companies. A description of the general questionnaire-based scoring approach and the method of the 2020 scoring round can be found in an article recently published by the CDP organization [CD21a]. The scores are based on a sector-specific questionnaire and a scoring methodology where responding companies are ‘assessed across four consecutive levels which represent the steps a company moves through as it progresses towards environmental stewardship’ ([CD21a], p. 6). The levels with ‘D’ being the lowest score and ‘A’ the highest scores are in ascending order: Disclosure (D-, D), Awareness (C-, C), Management (B-, B), Leadership (A-, A).

The results of the 2020 scoring have been published on the web as the so-called CDP 2020 ranking [CD21b]. Through a semi-automated procedure, the 2020 Climate Change scores for 180 companies of the sample were obtained from this online data source and are contained in Table 2. Because only 4 Chinese companies with a CDP Climate Change score were found China is excluded from the further investigations. The two leftmost

columns of Table 2 describe the recoding scheme used to transform the CDP scores into numeric scores to enable statistical investigations. From the mean CDP scores and further data of Table 2 it can be obtained that the EU companies achieved the highest CDP climate change scores. The EU companies are followed by the companies of Japan which still outperform the companies of the USA.

CDP Score	Transformed Score	China N	EU N	Japan N	USA N	All N
A	11	1	16	14	10	41
A-	10	1	15	17	10	43
B	9	1	15	14	10	40
B-	8	.	1	9	2	12
C	7	.	5	7	19	31
D	5	1	2	4	4	11
D-	4	.	.	.	2	2
All		4	54	65	57	180
Mean CDP score		8.75	9.52	9.09	8.37	8.98

Tab. 2: CDP 2020 Climate Change Scoring Results of the sample companies

In the following the research hypothesis (H1) described in the introduction is tested through correlation analyses focusing on companies with CDP scores from the EU, Japan, and the USA. Two correlation tests are performed with different proxies for environmental website disclosure. The EDPI scores of the companies serves as first proxy. The amount of different search terms found on the webpages described above serves as second proxy.

Pearson tests revealed highly insignificant correlations between the EDPI scores and the CDP scores of the companies. That is, the observational investigation using the EDPI score as proxy for environmental website disclosure did not lead to any evidence for the research hypothesis H1.

The plot of data points for the number of found search terms (i.e. second proxy for environmental website disclosure) and the CDP scores are displayed in Figure 4. From the left side to the right side the plots show the data points for the complete sample, for Europe, for Japan, and for the USA. Note that some circles in the diagrams are obscured due to overlapping data points. A medium and significant positive correlation was obtained for the USA ($r=0.323$, $p=0.014$) as well as for Japan ($r=0.294$, $p=0.036$). For Europe the result is insignificant. For all companies (Figure 4, most left plot) the result presents some significant correlation ($r=0.202$, $p=0.007$). These results can be viewed as a confirmation of the research hypothesis H1 mostly obtained by the companies of USA and Japan.

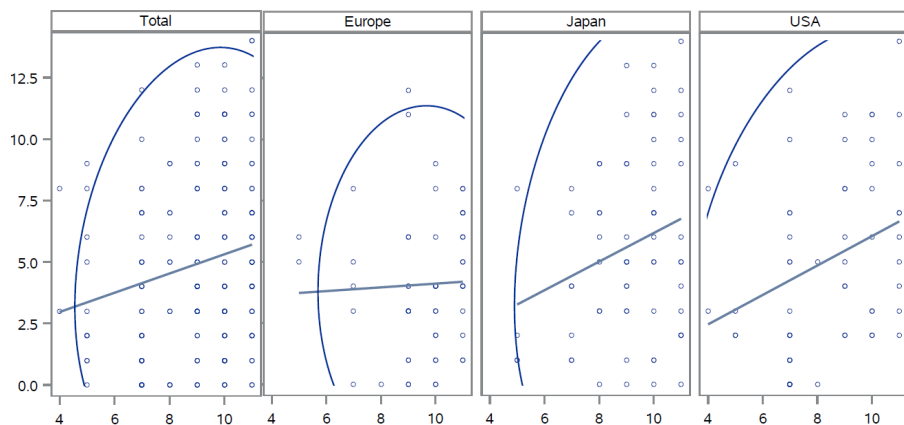


Fig. 4: Scatter plot to explore correlation between number of found search terms (vertical) and CDP scores for complete sample (left) and for countries of sample

5 Conclusions

The study results suggest that large production companies in China, Europe, Japan, and the USA today only to a small extent disclose environmental information on their websites. Many of the potential disclosure capabilities investigated are left unused. For the subtopic of environmental compliance management, the study revealed that the companies disclose information to an even smaller extent. One may argue that companies are assuming the CECM topic to be too narrow for being of large interest for the greater public and thus on purpose disclose only very little CECM information if at all. Another more extreme explanation of the low CECM disclosure is that extensive and detailed CECM information may bring critical attention to the company. Chinese companies are in terms of the two addressed disclosure extents somewhat behind the other countries. For companies of the USA the statistical tests revealed support of the research hypothesis that companies with a good carbon disclosure score disclose environmental information to a larger extent than low scoring companies. However, the proxies for disclosure have to be further investigated and additional sustainability rankings are of interest, too.

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