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ORIGINAL PAPER

Legitimacy Strategies in Corporate Environmental Reporting: A Longitudinal Analysis of German DAX Companies' Disclosed Objectives

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Abstract Ecological objectives in environmental reports usually promise a high degree of environmental responsibilities in a company's activities. Several studies have already highlighted that most companies do not keep their promises since stakeholders' expectations and a company's capabilities for internal adjustments do not always match. Thus, a company might use strategic reporting in order not to endanger its legitimacy. However, no study so far has demonstrated how companies use different legitimacy strategies in reporting their environmental objectives over time. To achieve this in our study, we focus primarily on findings from legitimacy theory in combination with the legitimacy strategies suggested by Lindblom (in: Gray, Bebbington, Gray (eds) Social and environmental accounting: developing the field, Sage, Los Angeles, pp 51–63, 2010). To test our theoretical framework empirically, we analyze 260 corporate environmental reports of German DAX companies between the years 2000–2014 by coding all disclosed objectives within these reports. Based on this longitudinal approach, we are able to identify reporting patterns of the different companies that provide insights into those companies' environmental reporting legitimacy strategies. Overall, this study contributes to research on voluntary disclosure by showing that a comprehensive analysis of the reporting pattern of disclosed objectives allows the identification of certain legitimacy strategies.

Keywords Corporate Environmental Reporting · Ecological sustainability · Environmental reports · Legitimacy strategies · Legitimacy theory · Transparency

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Introduction

RWE, a large German electric utilities company, announced in its environmental report of the year 2007 that it would expand the installed power of renewable energies at its disposal by 4.5 gigawatts by 2012. This objective was pursued in the following years' reports; however, without any notification, *RWE* changed the target time for the objective to 2014 and reduced the extent to 4.3 gigawatts. In 2015, the actual installed power of renewable energies was 4.2 gigawatts only (RWE AG 2016). None of the changes made to the original objective nor the non-compliance with that objective was communicated in any reports. Since we consider this reporting style to be not transparent, the question arises whether *RWE* follows a strategic approach in its communication that is intended to mislead stakeholders. Such an approach is often referred to as "greenwashing." Does *RWE* use greenwashing to legitimate its operations in the eyes of stakeholders?

Legitimacy theory assumes that companies' survival depends on whether the society in which they operate recognizes that their activities conform to its value system (Gray et al. 1996). Thus, from a strategic point of view, a company

is able to influence its legitimacy status by communicating its behavior to its environment (Dowling and Pfeffer 1975). Several authors have differentiated these legitimacy strategies in substantive (actions are transformed to conform to social values) and symbolic (no transformation of actions but using symbols to conform to social values) (Ashforth and Gibbs 1990; Deegan 2006; Richardson 1985). Lindblom (2010) builds on this idea by further differentiating and explicitly describing four legitimacy strategies in regard to companies' corporate environmental reporting (CER).[1] While the first legitimacy strategy comprises transparent and thematically relevant communication of the stakeholders' requirements and needs that have been fulfilled by the company (substantive), Lindblom highlights three kinds of legitimacy strategies that try to change stakeholders' perception or expectation of a company without making internal adjustments (symbolic). A company may not apply only one of these strategies in its CER but two or even all three of them. It is also important to clearly differentiate legitimacy strategies from corporate strategies. While corporate strategies relate to the company as a whole and aggregate particular planned behaviors of the company toward its main goals, a legitimacy strategy is applied in corporate communication and aims at presenting the company as legitimate in the view of the stakeholders.

One key element of any CER is the disclosed objectives, which are statements about a future intention that contain a clear subject, extent and time period. As such, companies can use objectives to apply greenwashing on the pretext of informing stakeholders about future actions in regard to the ecological environment, because it is difficult for stakeholders to identify transparent reporting (Delmas and Burbano 2011; Fukukawa et al. 2007; Marquis et al. 2016). Whether companies communicate their objectives in a comprehensible and consistent way and, thus, report them transparently, is not part of any official audit. Although the Global Reporting Initiative (GRI) established certain principles for companies that call on consistency and comparability in reporting (Global Reporting Initiative 2015), it does not evaluate if companies pursue the claimed objectives.

[1] The wide variety of terms and definitions relating to non-financial/voluntary disclosure asks for an exact delimitation. In general, topics concerning corporate social responsibility are disclosed in corporate sustainability reporting, which usually includes the dimensions ecological and social, sometimes complemented by financial issues (for an overview, see Hahn and Kühnen 2013). Since we exclusively focus on the ecological dimension of voluntary disclosure, we use the term corporate environmental reporting (CER) hereafter. Yet, because CER is part of the larger concept corporate sustainability reporting, and to avoid inaccuracy, we use the term CER also when authors were originally referring to both dimensions ecological and social. Likewise, when speaking of environmental reports as our research subject, this includes both pure environmental reports and sustainability reports in which we coded only environmental elements (Stray 2008).

The question as to whether companies communicate transparently in their CER has been examined in a number of studies, but has not yet been comprehensively clarified (for an overview, see Hahn and Kühnen 2013). Researchers have highlighted that companies' CER is often characterized by a self-laudatory tone (Archel et al. 2008; Holder-Webb et al. 2009). Although the voluntary disclosure of negative aspects in environmental reports seems not to have an impact on stock price or investment decision (Reimsbach and Hahn 2015), scholars have shown that companies use impression management strategies to avoid transparency regarding these negative incidents (Criado-Jiménez et al. 2008; Hahn and Lülfs 2014). However, despite the intense research on transparency in CER, no study so far, to our knowledge, has focused on the identification of the strategic approach of demonstrating legitimacy when analyzing transparency in terms of the disclosed objectives over time. This is remarkable because objectives play a decisive role when it comes to stakeholders' expectations. By disclosing objectives companies can show that their planned internal adjustments coincide with stakeholders' expectations (Parsons 1956a, b; Suchman 1995). Furthermore, Ashforth and Gibbs (1990) show—from a theoretical perspective—the option for companies to disclose objectives in line with stakeholders' expectations, while actually pursuing objectives that are less acceptable to stakeholders. A company reporting this way can be clearly identified as not transparent in disclosing its objectives. In line with this, we state there is a high level of transparency when a company discloses and pursues its objectives in a comprehensible and consistent way over time (Nienaber et al. 2015).

Overall, this study focuses on the reporting pattern of companies' disclosed objectives, which we analyze over a time period of 15 years to identify companies' legitimacy strategies. Based on legitimacy theory, we design a theoretical framework that allows us to draw conclusions from the reporting patterns of particular legitimacy strategies suggested by Lindblom (2010) when disclosing objectives.

To conduct this analysis, we use a qualitative content analysis of German DAX companies' environmental reports for the years 2000–2014. We focus on DAX companies because Germany has relatively strict regulation in terms of annual reporting and ecological standards, which allow us to work with a sample of environmental reports that are all governed by the same set of regulatory requirements. Our sample numbers 260 reports. Within these reports, we identify all disclosed objectives and code them according to three indicators: the level of transparency in CER objectives, which indicates how far a company pursues the disclosed objectives in a comprehensible and consistent way over time; the number of objectives, which shows how ambitious a company is in disclosing its objectives; and the thematic focus (topic), which helps the observer to understand

whether or not a company discloses objectives thematically in line with stakeholders' expectations. The collected data are consolidated and assessed over the period of 15 years in order to evaluate each company's reporting pattern. This longitudinal approach is of great importance because stakeholders are not able to assess transparency themselves by reading only a single report, given that the objectives can be evaluated only after a delay of several years and with significant effort. Furthermore, we apply a cluster analysis in order to identify companies showing similar characteristics in their reporting of objectives.

Our results demonstrate that four groups of companies exist in regard to their reporting behavior: the *Signaler*, the *Ambitious*, the *Unconcerned* and the *Careless*. We find evidence that most of the DAX companies apply, to some extent, legitimacy strategies when reporting objectives in their CER. While the *Signaler* report success or failure in achieving disclosed objectives mainly in a comprehensible and consistent way, we can identify a tendency in relation to some companies in the groups *Ambitious, Unconcerned* and *Careless* to apply legitimacy strategies that are intended to mislead stakeholders with regard to the companies' internal adjustments.

In sum, we make two contributions to research on voluntary disclosure. First, we apply the well-known legitimacy strategies of Lindblom (2010) on a particular element of CER, namely the disclosed objectives. This leads to a deeper understanding of the strategies used in CER. Second, we show that a comprehensive analysis of the objectives' reporting pattern allows for further conclusions regarding the applied legitimacy strategies. In this way, we are able to examine the extent to which the four legitimacy strategies apply to our data.

In the following section on the theoretical background, we discuss strategies used in CER to reach the status of legitimacy. Then, we explain our methodological approach to data collection and analysis over the time span of 15 years. Following, we reveal our findings and discuss them, before we highlight managerial implications and provide a short conclusion.

Theoretical Background

Systems-Oriented Theories

In line with Gray et al. (1996), we take into account systems-oriented theories, which allow scholars to study the role of information and disclosure by examining the relation a company has to other companies, the government, individuals or groups. Systems-oriented theories are grounded on the idea that an organization is a part of a larger social system, which influences the organization in its practices and vice versa. Therefore, a company's disclosure practices are best understood when paying attention to an organization's context (Gray et al. 1996). In this study, we focus on the German DAX companies to ensure that all companies have the same context in terms of disclosure requirements, international activity and level of sales and size. Three systems-oriented theories help to understand why CER is of relevance for companies: *Legitimacy theory* reflects how certain disclosure strategies are used by organizations to gain, maintain or repair legitimacy (Deegan and Unerman 2011; Suchman 1995). As such, this paper mainly builds on legitimacy theory. It is supplemented by *stakeholder theory*, which deals with the expectations of an organization's CER by particular stakeholders (Freeman 1984; Mitchell et al. 1997) and *institutional theory*, which focuses on the question of how organizational forms are adopted to bring legitimacy to an organization (DiMaggio & Powell 1983; Meyer & Rowan 1977; Smith et al. 2011). These theories complement each other in the analysis of an organization's disclosure practices with different levels of resolution of perception (Gray et al. 1995). In the following, we will describe these theories in detail.

Legitimacy theory has become one of the most cited theories within the environmental accounting area (Hahn and Kühnen 2013). This theory assumes that companies' survival depends on whether the society in which they operate recognizes that their activities conform to its value system (Gray et al. 1996). The idea behind this assumption is that an organization does not have inherent rights to resources. Thus, the legitimacy granted by society gives an organization the right to use resources. According to legitimacy theory, a social contract exists between an organization and society. This social contract represents the external expectations that propose how an organization has to operate to receive social validation (Deegan and Unerman 2011). If a social contract is not fulfilled, the consequences are legal, economic and social sanctions (Dowling and Pfeffer 1975). For example, since the Japanese nuclear accident in 2011, both electric utilities within the DAX, *REW* and *E.ON* are confronted with expectations that nuclear energy will be eliminated. Because the social contract is currently still not fulfilled, economic and legal sanctions have been implemented in Germany in recent years. CER is a tool an organization can use to legitimate its activities. Researchers, such as Laine (2010), Cho (2009), Tilling and Tilt (2010) and Lindblom (2010), have examined how companies use their CER to manage legitimacy. According to legitimacy theory, a crucial role of corporate disclosure is to legitimate the existence of a company (Dowling and Pfeffer 1975; Lindblom 2010). O'Dwyer (2002) demonstrates that Irish managers' prime motivation behind corporate disclosure is the enhancement of corporate legitimacy. Hopwood (2009) also found that companies use CER in order to increase their legitimacy or to facilitate a new and different image. A distance between stakeholders' expectations and internal adjustments is called

a legitimacy gap (O'Donovan 2002). The gap arises from how stakeholders expect companies to act in comparison with how they perceive that companies do act (O'Donovan 2002; Deegan and Unerman 2011).

As explained above, CER has a strong link to stakeholders' expectations and thus to *stakeholder theory*. Stakeholders' expectations are the reason organizations disclose information in regard to their environmental activities. Following Freeman (1984), we define a stakeholder as any group or individual that can affect, or be affected by, the achievement of a firm's targets. Stakeholders are the reason organizations have to disclose information at all—since they have to demonstrate the basis of their legitimacy. The observed pattern of voluntary disclosure is found to be consistent with the managerial branch of stakeholder theory (Oliveira et al. 2013). Stakeholders control resources a company may need to be successful. The more critical stakeholder resources are, the higher is the level of stakeholders' expectations that have to be addressed by the company (Roberts 1992). If an organization is not able to fulfill stakeholders' expectations, it loses the basis of its legitimacy. Through voluntary disclosure, organizations can improve their reputation (an important resource for them) by negotiating with and influencing stakeholders. In Germany, the general topics that stakeholders expect from a DAX company are made explicit in a list published by the GRI. The GRI mentions 34 topics that have been declared as standard for companies when reporting their ecological activities (Global Reporting Initiative 2015).

Institutional theory has been used primarily in organizational studies and explains how and why environments influence an organization to conform to external expectations. Organizations seek to demonstrate their activities—for example by appropriate communication—in accordance with what is perceived to be appropriate behavior by the society, e.g., stakeholders. Two key aspects of this theory are important for our study. First, Meyer and Rowan (1977) showed that external expectations and internal efficiency do not always conform with each other and thus organizations decouple their formal and informal activities to be perceived as acting in accordance with external expectations without harming internal efficiency. Second, following DiMaggio and Powell (1983), isomorphism mechanisms affect organizations. Coercive isomorphism drives organizations toward the practice of greater homogeneity to deal with pressure from society. Mimetic isomorphism refers to a company's tendency to imitate another company's structure or processes because of the belief that this structure or process is more beneficial than their own. Normative isomorphism describes how companies become similar due to pressure that stems from professionalization, e.g., similar education. Under institutional theory, an organization seeking social validation is expected to act in accordance with external expectations. Social validation is mandatory for an organization's legitimacy and thus for it to achieve stability, access resources and to improve its chances of survival (Larrinaga-González 2007; Moll et al. 2006).

Strategic Disclosure

In our study, we build on these three systems-oriented theories when analyzing how companies disclose objectives in their CER and thus show what kind of legitimacy strategies these companies chose. According to legitimacy theory, this choice depends on a company's disclosure aim—to gain, to maintain or to repair legitimacy (Suchman 1995). In the case of the regular and voluntary disclosure by DAX companies within their CER, companies usually aim at maintaining legitimacy. However, maintaining legitimacy is at risk when stakeholders' expectations cannot be fulfilled through sufficient internal adjustments. In this case, companies may want to mislead stakeholders in relation to companies' environmental practices.

If we look at legitimacy theory from a strategic perspective, companies are able to influence their legitimacy status through certain actions (Dowling and Pfeffer 1975). In CER, these actions are the way a company communicates its behavior in regard to the environment. A company might communicate either reactively or proactively (Lindblom 2010). Reactive communication is applied when a company has to respond to stakeholder complaints to narrow a legitimacy gap. Proactive communication aims at using regular disclosure to prevent a legitimacy gap arising. Companies use CER as the main tool for this regular disclosure.

When companies proactively address stakeholders' expectations, it is very important for them to disclose objectives in their CER. Lindblom points out that "the relevant publics continuously evaluate corporate output, methods, and goals against an ever evolving expectation" (Lindblom 2010, p. 52). Other researchers in the field of organizational legitimacy also highlight the importance of objectives that match stakeholders' expectations for maintaining legitimacy (Parsons 1956a; Parsons 1956b; Suchman 1995). However, taking a strategic perspective, it is important to address how companies use objectives to present themselves as legitimate to the stakeholders.

Lindblom (2010) distinguishes four proactive legitimacy strategies that, when reporting environmental issues, can be utilized by companies to maintain legitimacy. When defining these legitimacy strategies, Lindblom builds on the findings of institutional and stakeholder theory by relating the internal adjustments of a company to the external expectations of the stakeholder. In the following, we explain each of the four legitimacy strategies and show how they can be applied to CER's objectives.

Strategy 1 A company that is able to make internal adjustments and thus fulfill the expectations of its stakeholders

will apply legitimacy strategy one. The company seeks to maintain legitimacy by disclosing objectives that actually entail internal adjustments. An example would be the objective in the year 2005 to reduce the energy consumption of the whole company by 5% by the year 2010, which is declared as fulfilled in the year 2010.

Strategy 2 A company that is not able or willing to make internal adjustments can try to change the stakeholders' perception of its ecological measures. The strategy does not change the expectations of the stakeholders in general, but it affects the way the stakeholders perceive the company's internal adjustments. The company seeks to maintain legitimacy by disclosing objectives that connote a stronger engagement in ecological measures than actually exists. An example would be the objective in the year 2005 to reduce energy consumption of the whole company by 50% by the year 2010, which is reported until the year 2009 and then not mentioned anymore.

Strategy 3 A company that is not able or willing to make internal adjustments can try to manipulate stakeholders by associating itself with symbols having high legitimacy status. The company seeks to maintain legitimacy by disclosing objectives that cover rather non-critical and symbolic topics instead of actual areas of stakeholder concern. An example would be the objective of an oil company to finance an environmental foundation for the next five years, while not disclosing a single objective related to the topic of improving the environmental safety of its oil rigs.

Strategy 4 A company that is not able or willing to make internal adjustments can try to decrease stakeholders' expectations in general. The company seeks to maintain legitimacy by disclosing objectives that do not make the company perceived to be more environmental sound as it actually is, but by lowering stakeholders' expectations about the quantity and quality of environmental measures. The strategy is designed to make it appear that the company has not taken much care about formulating its objectives. However, through a continued low quality in reporting, stakeholders lower their expectations in the long run. An example would be the objective to reduce waste by 1% within the next ten years while the objective is actually cancelled without notification after the first year.

Within their CER, companies may use any of these strategies when reporting their ecological effort. Following Lindblom (2010), it is also possible that companies might use a combination of all four strategies. Especially legitimacy strategies two and three lead to a company's behavior that is referred to as greenwashing. We summarize our theoretical framework in Fig. 1.

Data and Methods

Analytical Approach

In order to gather the relevant data from the environmental reports, we analyzed the reports using qualitative content analysis to extract all disclosed objectives. The predefined procedure of qualitative content analysis ensures a consistent and comprehensive collection of the data (Krippendorff 2004). We sorted the extracted objectives and tracked them through the reports until they are either reached or cancelled. Furthermore, we used a cluster analysis to show a particular pattern in CER of our sample (Aldenderfer and Blashfield 1984) that allowed for further conclusions within our analysis regarding the legitimacy strategies applied.

Sample

Our sample includes all available environmental reports published from the years 2000 to the year 2014 inclusive from all companies that were listed in the German DAX 30 stock index. The cut-off date was August 20, 2015. The DAX comprises the 30 largest German companies in terms of order book volume and market capitalization. The reasons for choosing this sample are described in the following. Management research defines two main internal determinants of companies that influence CER: (1) size and (2) industry (Fifka 2013). (1) Studies have shown a positive correlation between company size and tendency to disclose environmental reports (e.g., Adams et al. 1998; Guthrie and Parker 1989; Hahn and Kühnen 2013; Thorne et al. 2014). Thus, targeting an adequate sample, the 30 biggest companies in Germany constitute an appropriate group. Since German stock companies are subject to certain statutory disclosure requirements, we can assume that these companies are experienced in systematic ecological reporting. Both selection criteria ensure a suitable sample size and a high degree of regularity of reporting, which facilitates the extraction of significant and comparable results. (2) Industry affiliation is the second main factor influencing extent and quality of CER (Beresford and Feldman 1976; Bowman and Haire 1976; Esrock and Leichty 1998). While we strive for a homogenous sample in terms of company size, we deliberately accept a heterogeneous group regarding industry affiliation. This is due to the reason that objectives in CER are still an under-researched area and we therefore want to obtain data from a variety of industries to reach generalizable results (for similar approaches, see Bansal and Roth 2000; Sweeney and Coughlan 2008). Since the DAX companies cover a wide range of industries (Hahn and Lülfs 2014), our findings are broadly applicable.

In August and September 2015, a total of 260 reports were procured from corporate websites, through personal

Systems-oriented Theories

Legitimacy Theory

How certain disclosure strategies are used by an organization to gain, maintain or repair legitimacy.

Stakeholder Theory	Institutional Theory

Legitimacy Strategies by Lindblom (2010)

Strategy	Application in voluntary disclosure (Hahn and Lülfs 2014)	Exemplary application in voluntary disclosure of objectives
1	Make internal adjustments and communicate them.	Disclose objectives that comply with actual internal adjustments.
2	Demonstrate appropriateness of output, measures etc. without making internal adjustments.	Change stakeholder perception by disclosing objectives that connote a stronger engagement in ecological measures than actually exist.
3	No change in business performance nor in societal expectations but manipulating perception by associating with symbols having high legitimacy status.	Change stakeholder perception by disclosing objectives that cover rather noncritical and symbolic topics instead of actual areas of stakeholder concern.
4	Change stakeholders' expectations through education and information.	Influence stakeholders' expectations downward through incomprehensible communication or irrelevant topics in disclosed objectives.

Fig. 1 Theoretical framework

requests or a web search. As not all selected companies disclose in the same form, we applied the following inclusion and exclusion criteria to make sure that the reports were comparable to each other. First, besides common stand-alone environmental reports, we also included integrated reports in our sample. Integrated reports combine annual reports and environmental reports and are an approach to link financial and non-financial figures and topics (Milne and Gray 2013). To be included in our sample, further requirements of a report were that it had to apply to the entire corporate group and that it had to be published in a format that cannot be changed subsequently (e.g., printed booklet or PDF document). In accordance with the latter restriction, website-only versions of environmental reports were not included in the sample as they are not suitable for a longitudinal analysis for two reasons. First, unlike printed reports, the disclosing company can subsequently change data on websites. Second, websites, especially from the beginning of the observation period, are often no longer available.

The final sample consists of 25 companies that disclosed 260 environmental reports (see Appendix 1 for an overview). Five companies in the DAX were not included in the sample, namely *Fresenius Medical Care*, *Fresenius*, *SAP*, *Thyssen-Krupp* and *Deutsche Börse*. The first two companies did not provide any detailed environmental reporting that we were able to analyze. *SAP* and *ThyssenKrupp* report only online on their websites. *Deutsche Börse* disclosed environmental reports that we were able to analyze, but did not issue any objectives.

Data Collection

Due to the large quantity of text, a structured approach to gather the data is required. The method of qualitative content analysis allows large amounts of content to be codified, and, based on certain criteria, themes or patterns to be identified (Krippendorff 2004; Weber 1990). A key criterion for our study is that each coded text passage consists of an actual objective. Based on defined characteristics for objectives (discussed in the following paragraph), qualitative content analysis allows this kind of specific data to be collected in a replicable and valid way (Krippendorff 2004). We conducted

the qualitative content analysis as described by Mayring (2015).

For our coding we used the data analysis software MAXQDA. In order to ensure a high quality in our approach, we applied several coding rules: First, in line with Nienaber et al. (2015) and Schewe et al. (2012), we coded only those statements concerning ecological intentions that can be clearly identified as objectives. This means a company reports (a) which result, (b) on which basis and (c) when it will be achieved. Therefore, the dimensions (a) subject, (b) extent and (c) time period have to be specified in detail. If one of the three dimensions was not available, we classified those kinds of statements as "intention" instead of objective and did not include them in our analysis. An example of a clear target can be seen in the case of *E.ON*, which stated in one of its reports that the company wanted to achieve a decrease of its carbon dioxide emissions (subject) by 50% (extent) between 1990 and 2030 (time period). A second coding rule is that we did not code objectives that refer to a specific division of the company or a particular region. These objectives do not ensure a proper comparison of the companies in our sample. Third, we included only those objectives that applied for a period of more than two years. That means we excluded those targets that applied for a very short period, since we are interested to see whether companies report consistently over several years (longitudinal approach).

The analysis was done by two separate coders (research assistants). The first research assistant coded 20% of the reports. Based on this initial coding, the coding procedure was modified in coordination with the second research assistant (Strauss and Corbin 1990). The first research assistant then coded all reports. A memo containing operational definitions, coding rules and sample report quotes was written. The second research assistant independently coded 20% of the overall data. The percentage agreement between the two coders reached a satisfactory level of 78.1%.

Data Analysis

For the analysis of the data extracted, we used three different indicators: (1) level of transparency, (2) number of objectives disclosed and (3) thematic focus (topic) of the objectives. From these indicators, we were able to identify the overall reporting pattern of a company, which allowed us to derive conclusions in relation to the applied legitimacy strategies. While indicator (2) number of objectives disclosed is rather easy to extract from the data collected, both indicators (1) level of transparency and (3) thematic focus (topic) need intense preparation of the data. We describe the extraction of each indicator in the following.

First, we analyzed the level of transparency, which shows whether the company pursued the disclosed objectives in a comprehensible and consistent way over time. The figure determines the ratio of objectives that were reported transparently instead of not transparently by each company. In order to assess the level of transparency of CER over the 15-year period, we applied a procedure that allowed us to identify inconsistency in reporting objectives over time. This aim prohibits the use of a simple scoring model as applied in previous studies (e.g., Aerts and Cormier 2009; Al-Tuwaijri et al. 2004; Cormier and Magnan 2003; Wiseman 1982). Kolk (2004) showed that a profound assessment of transparency has to go beyond the statements *reported* or *not reported* in respect of certain dimensions regarding sustainability. We therefore proposed a more complex method of analysis that did not assess the objectives per year but rather over a period of time. An objective that was mentioned for the first time in an environmental report was evaluated by its indication in following reports. This means that we classified the reporting of an objective as transparent when the objective was pursued over the next several years until it was attained without a negative change of subject, extent or time period. It is important to note that this approach does not intend that all objectives claimed to be transparent had to be achieved. Changes of subject, extent or time period were allowed as long as this was explained transparently in the relevant report.

Second, to extract the number of objectives for each company, we counted the objectives disclosed in order to see how ambitious a company was in its reporting.

Third, we analyzed the company's objectives in terms of their content by assigning each objective to a particular category. This aggregation of the data is important because objectives are disclosed with regard to all kinds of environmental issues, which makes it difficult to carry out a comparison of the objectives' thematic focus. On an aggregated level, companies' objectives can be compared with regard to the topics covered. In order to reach this aggregation, we developed a categorical system that included all ecological dimensions for all company types. The categories were derived from the *Sustainability Reporting Guidelines Version 4* of the Global Reporting Initiative (2015), as 23 of the 25 companies in our sample use these guidelines to ensure accountability (see Appendix 1). Within the section *Environmental*, the GRI subsumes twelve single categories[2] that companies should report in. All these categories were included in our categorical system to achieve a consistent and contemporary approach. Due to the high number of coded objectives in the categories *Energy*, *Emissions*, *Products and Services* and *Supplier Environmental Assessment*, we further subdivided each of these into several

[2] The GRI labels these twelve categories "aspects," while the aspects are summarized in the "categories" Economic, Environmental and Social. However, to achieve a clearer naming system, in this paper we are always speaking of categories. Each objective is classified in one category. All categories form the category system.

sub-categories (see Appendix 2). Following Nienaber et al. (2015), we added two categories for objectives that are not covered by the GRI: *Strategic Projects* and *Monitoring*. The category *Strategic Projects* contains objectives in which the companies plan to anchor in the organization a certain strategic approach regarding ecological sustainability. The objectives that deal with the control of ecological sustainability are subsumed within the category *Monitoring*.

It is important to note that the companies within the sample belong to different industries and thus—depending on their business operations—stakeholders have different expectations with regard to the companies' environmental disclosure. Lindblom (2010) has highlighted that objectives have to be evaluated against the expectations of the stakeholders. Considering this fact in our analysis, we evaluate the three indicators in relation to these expectations. We therefore categorized stakeholders' expectations in line with the approach by Reverte (2009) and Kilian and Hennigs (2014), who differentiate high-, middle- and low-controversy industries in terms of environmental impact. This means, the more controversial a company is, the higher are the stakeholders' expectations of the company's CER and vice versa.

Based on the combination of the three indicators, the study aims at revealing legitimacy strategies used by the companies in their disclosed objectives. In the following, we explain our identification approach for each strategy. For the first legitimacy strategy, it is necessary that a company's objectives are reported transparently. Additionally, thematically they should be in the focus of stakeholder interest and thus demonstrate the motivation of a company to achieve an environmental benefit. Just like legitimacy strategy one, the second legitimacy strategy is also characterized by disclosed objectives that are in topical areas of high stakeholder concern. However, since this strategy aims at changing the stakeholders' perception of a company's ecological measures due to a lack of internal adjustments, the companies often disclose overambitious objectives that are hardly achievable. Due to this procedure, objectives are cancelled or changed without notification, often close to the due date, which leads to a lower level of transparency in our sample. Additionally, very high numbers of disclosed objectives can be a further characteristic that a company applies within legitimacy strategy two, because many disclosed objectives suggest to stakeholders that a company is particularly environmental active. Overall, we expect the second legitimacy strategy to be applied when a company discloses rather high numbers of objectives in topical areas of stakeholder concern that are reported consistently over several years, but at some point, often shortly before the due date, are not mentioned anymore. The third legitimacy strategy depends primarily on the analysis of the objectives' topics in relationship to stakeholders' expectations. If a company that has to deal with high stakeholders' expectations discloses only a few objectives covering sensitive topics, and at the same time discloses many objectives dealing with non-critical topics, the application of legitimacy strategy three is obvious. Accordingly, this strategy is independent from the transparency level and the total number of disclosed objectives. Finally, the fourth legitimacy strategy is mainly characterized by a low level of transparency, often in combination with irrelevant content and a rather low number of objectives. In the first instance, this reporting pattern appears in a way that companies do not take much care about formulating their objectives. However, the strategy aims at a continued low quality in reporting so that stakeholders lower their general expectations with regard to the environmental reporting in the long run. In our analysis, we identify the strategy by an overall confusing communication of a company's objectives, e.g., in terms of inconsistent reporting (low levels of transparency) or leaving out topical areas of high stakeholder interest. Overall, it is important to note that our evaluation of the reporting pattern of a company and its applied legitimacy strategy is always a relative indication in comparison with the other companies in the sample.

Cluster Analysis

A cluster analysis identifies relatively homogeneous groups based on particular characteristics of the objects (Hair et al. 1998). The clusters show similarities within a group and divergences between the groups (Aldenderfer and Blashfield 1984). For our analysis of disclosed objectives, it was important to establish the commonalities and disparities among and between the companies in our sample. We describe the precise procedure of our cluster analysis in the following.

First, we checked for potential outliers by assessing the levels of (dis)similarities by means of the squared Euclidean distance. We applied Ward's method, one of the most common methods when applying cluster analysis (Dolnicar 2003; Du et al. 2015). The method belongs to the hierarchical approaches group of analysis and aims at minimizing the variance within a cluster (Aldenderfer and Blashfield 1984; Ward 1963). Because both our indicators—level of transparency and number of objectives disclosed—had different scales and means, we standardized to z scores. We identified four clusters by checking typical criteria such as the coefficient of error, sums of squares and the dendrogram. These clusters showed a satisfactory internal homogeneity and good distance values between each other (see Appendix 3). Four groups result from our cluster analysis. Figure 2 shows all companies in line with the total number of objectives disclosed by each company (x-coordinate) and the share of objectives that are reported transparently instead of not transparently (y-coordinate). The thematic focus (topics) of the different objectives is shown separately in each cluster due to the high complexity (284 objectives in 22 different

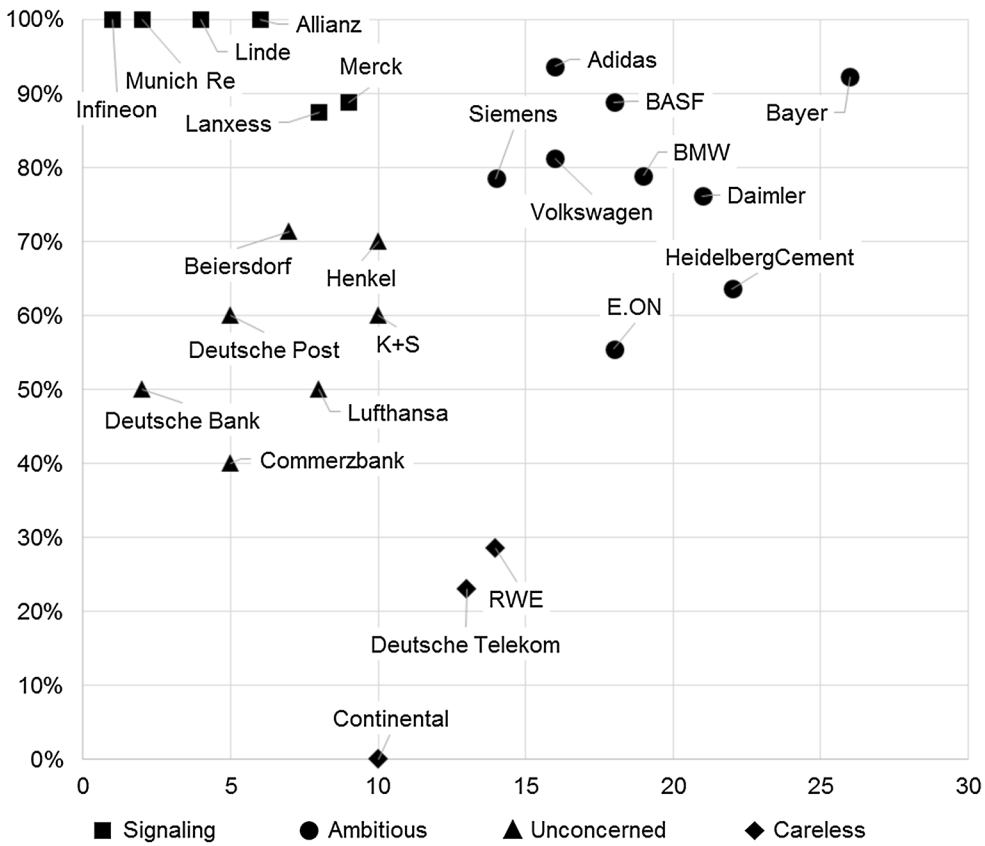

Fig. 2 Grouping of companies based on cluster analysis

categories). For each group, this approach allows for a structured analysis of the particular legitimacy strategies that the companies in the groups apply.

Findings

Cluster 1: Signaling

Overall, the 25 companies in our sample disclose 284 objectives, which is an average of 11.4 objectives per company. Of all objectives, 69.4% are reported transparently. The first group is characterized by a relatively low number of total objectives (fewer than ten) and a high level of transparency of more than 85%. These numbers are steady over the periods of observation. It is the most homogenous group regarding the number of objectives and the level of transparency in regard to their CER. The objectives' topics are focused on those with great relevance for stakeholders nowadays (United Nations 1997), e.g., *Energy* (*Energy Consumption* and *Use of Energy from Renewable Sources*) or *Greenhouse Gas Emissions* (see Table 1). Thus, the objectives disclosed can all be rated as highly relevant. In this group, not only the companies that have to deal with high stakeholder expectations (*Lanxess, Merck*) but also those with middle (*Linde*) and low expectations (*Allianz, Infineon*) focus on these topics. Overall, due to the transparent and focused reporting on those objectives that are of importance to stakeholders, the aim of the companies in this group seems to be a clear signaling of a purposive reporting that fulfills stakeholders' expectations. We thus call this group *Signaler*. It includes six companies: *Allianz*, *Infineon*, *Lanxess*, *Linde*, *Merck* and *Munich Re*.

Based on these reporting patterns, the question is, "What strategy does this group apply in its CER?" Considering the three indicators of our analysis, it seems that these companies want to demonstrate quality rather than quantity. This becomes clear in two ways. First, the companies report about topics that are highly relevant for their stakeholders. Second, the companies disclose rather few objectives but want to follow up on those disclosed objectives. In relation to the first point, we see that each of the six companies discloses at least one objective in the main categories *Energy* and/or *Emissions*. Although the particular level of expectations of the stakeholders for the different companies in cluster one differ (high, middle and low, see Table 1), the analysis shows that the companies in this group disclose objectives in topical areas of significant concern for stakeholders. Topics in the categories *Energy* and *Emissions* are very important in general to all stakeholders and therefore companies should fulfill stakeholders' expectations in these areas. Second, the transparent reporting of disclosed objectives becomes obvious with the example of chemical and pharmaceutical company *Merck*. In the year 2002, *Merck* discloses the objective

Table 1 Overview of companies for cluster *Signaling*

Company	Main sector	Stakeholder expectations (with regard to environmental disclosure)	Indicators				
			1: Level of transparency (%)	2: Number of objectives disclosed	3: Top three topical areas of disclosure based on category system (in brackets: number of objectives in that category)		
Allianz	Insurance industry	Low	100	6	Emissions/greenhouse gas emissions (2)	Energy/use of energy from renewable sources (2)	Energy/energy consumption (1)
Infineon	Semiconductor industry	Low	100	1	Emissions/other significant air emissions (1)	–	–
Lanxess	Chemical industry	High	88	8	Responsibility for products and services/usage (2)	Emissions/greenhouse gas emissions (1)	Energy/energy consumption (1)
Linde	Industrial gases and plant engineering	Middle	100	4	Energy/energy consumption (2)	Energy/use of energy from renewable sources (2)	–
Merck	Chemical and pharmaceutical industry	High	89	9	Responsibility for products and services/usage (2)	Emissions/greenhouse gas emissions (2)	Waste (1)

to *increase the recycling rate of waste to 57% by 2010*. The company pursues this objective transparently and is able to report its success in the year 2010, even overachieving by 5%. That members of this group characteristically use transparent reporting of the kind seen in this example is shown by the group's level of transparency, which is above 85%.

Both points discussed lead to the assumption that the companies in this group predominantly try to apply the first of Lindblom's legitimacy strategies. The companies disclose well-chosen objectives that they are able to achieve through internal adjustment and, thus, fulfill stakeholders' expectations. Hence, based on the idea of stakeholder theory, this group is an example of transparent CER toward stakeholders. The consistency within the objectives demonstrates further that these companies do not want to manipulate their stakeholders but rather to demonstrate their trustworthiness to maintain legitimacy.

Cluster 2: Ambitious

The group *Ambitious* is the largest group in our sample, containing nine companies (36% of the whole sample), namely *Adidas, BASF, Bayer, BMW, Daimler, E.ON, HeidelbergCement*, *Siemens* and *Volkswagen*. These nine companies release a total of 170 objectives (more than 60% of all objectives in our sample). On average, each company in this cluster reports 18.9 objectives (seven more than the sample average). A high number of objectives are published between the years 2005 and 2009 (69 new objectives) and 2010 to 2014 (80 new objectives) (see Appendix 4). Despite the increased number of objectives, the companies are able to enhance their level of transparency in both periods. Between the years 2005 and 2009, 70% of objectives are reported transparently; and 89% between 2010 and 2014. With an overall group transparency level of 79%, the *Ambitious* report on the second-highest level of transparency of all groups. The companies in this group cover the full list of topics in our category system, which shows a broad field of objectives are disclosed. Most objectives are disclosed in the category *Responsibility for products and services (Usage).* A high number of objectives can also be found in the highly topical categories *Emissions* (*Greenhouse Gas Emissions* as well as *Other Significant Air Emissions*) and *Energy Consumption*. All but two companies (*Daimler*, *HeidelbergCement*) in this group also report in the category *Water*, a topic commanding rather little stakeholder attention. All companies except for *Adidas* in the cluster *Ambitious* are confronted with middle or high stakeholder expectations (see Table 2).

Within this group, *BMW* seems to be a good example to demonstrate the group's CER, since *BMW* meets the absolute average. The company discloses 19 objectives, reaches a transparency level of 79% and focuses strongly on topics that cover product responsibility, which is a main expectation of automotive manufacturer's stakeholders. In most cases, *BMW* is transparent in the ways objectives are reported to stakeholders. For example, the objective to *reduce waste water by 30% (based on 2006)* is disclosed in 2008 and fulfilled in 2012. Subsequently, *BMW* publishes a follow-up

objective, this time a *reduction of 45% waste water (based on 2006) by 2020*, which is reported transparently until the cut-off date for this study. In contrast to *BMW*, *Bayer* and *E.ON* occupy, respectively, the upper and lower levels in regard to transparency level in this group (both companies can assume high expectations from their respective stakeholders, see Table 2). Reaching a level of transparency of over 90%, *Bayer* is on the same level as the companies in the group *Transparent*. However, *Bayer* discloses 26 objectives—a considerable number—over the total period under consideration and covers 13 of 22 topical categories, which is by far the largest coverage. The top three categories in which *Bayer* disclosed objectives (*Responsibility for Products and Services/Usage*, *Transport*, *Supplier Management/Control*) seem to be rather extraneous in the first instance, but become very relevant when it is considered that *Bayer*, as a chemical company, has to take great care of its supply chain. *E.ON* discloses 18 objectives, but the transparency level of 56% is rather low (group average 79%). A total of eight objectives are evaluated as not being transparently reported over the time period. The detailed analysis of the individual objectives reveals that each of the eight objectives lacking transparency is directly or indirectly associated with climate protection (objectives in categories *Energy consumption*, *Manufacturing of energy from non-renewable sources*, *Manufacturing of energy from renewable sources*). Climate protection is of special relevance for *E.ON* as an electric utilities company, because the company's power plants emit large amounts of carbon dioxide. As the public's attention to climate change increases over the observation period, the company needs to report carefully. One example demonstrates relatively well *E.ON's* typical reporting pattern. In 2005, the company claims it would *invest five billion euro in renewable energy by 2015*. Although *E.ON* tracks this objective in the following years, the reporting stops in 2009 and 2010 without further explanation. In 2011, the objective is resumed with a due date of 2016 and a total investment of now seven billion euro. The same objective is changed again in 2013 without any comment to a yearly investment sum of 1.3 billion euro in 2014.

An example similar to *E.ON* is *HeidelbergCement*, a producer of construction materials. This company experiences high stakeholder expectations with regard to its environmental disclosure. These high expectations most certainly lead to the disclosure of a total 22 objectives (second-highest number of objectives within the sample), most of which are disclosed in the categories *Other Significant Air Emissions*, *Use of Energy from Renewable Sources* and *Materials*. While these topics in general are of stakeholder interest, the analysis reveals that all objectives with regard to *Energy* (three objectives in the category *Use of Energy from Renewable Sources* and two objectives in the category *Energy Consumption*) are either cancelled or changed without notification. The fact that this happens several times in related categories points to the assumption that the company is not able to fulfill the internal adjustments as targeted. Since objectives in these categories are of highest stakeholder concern, the way the company communicates these objectives has to be evaluated as greenwashing.

Based on these findings, we have to draw a rather complex picture in terms of the legitimacy strategies applied by the companies in the group *Ambitious*. As the group in total is very ambitious concerning the great number of objectives, a high coverage of topics as well as a relatively high level of transparency, for some companies the data show an overambitious reporting of objectives in their CER, which allows the presumption that legitimacy strategy two is applied. For example, *HeidelbergCement* shows a total failure of a transparent communication for all objectives related to the important topic of *Energy*. The overall high number of objectives from this company leads to a situation in which the stakeholder perceives the company as environmentally sound, whereas at least in the field of *Energy* the company does not fulfill internal adjustment as announced in its objectives. Thus, this behavior needs to be described as greenwashing. Another example is *E.ON*, for which we are able to show indications for both legitimacy strategies two and three. Against the background of climate change and the nuclear accident in Japan in 2011, stakeholders' expectations have strongly changed for electric utilities within the period under review. We assume that *E.ON* is, on the one hand, not able to fulfill its stakeholders' expectations (which can be seen by a low transparency level) and thus tries to change stakeholders' perceptions by applying the second legitimacy strategy. On the other hand, *E.ON* discloses a number of objectives that highlight renewable energy projects, whereas no objective is reported regarding nuclear power, although it is one of *E.ON's* key sources of energy. This allows us to assume that the third legitimacy strategy might be applied as well. This kind of strategy uses reporting to manipulate stakeholders' perceptions by talking about non-critical topics.

Overall, the companies within the group *Ambitious* try hard to present themselves as very environmentally sound. This is appropriate since all companies (except for *Adidas*) are faced with middle or high expectations of stakeholders with regard to their environmental disclosure in CER. However, high numbers of objectives can always hide the fact that companies avoid disclosing objectives in critical topical areas or, as in case of *HeidelbergCement*, objectives in important topical areas are not fulfilled. Besides this use of legitimacy strategy two, the example of *E.ON* also shows that companies in this group highlight non-critical topics according to legitimacy strategy three.

Table 2 Overview of companies for cluster *Ambitious*

Company	Main sector	Stakeholder expectations (with regard to environmental disclosure)	Indicators				
			1: Level of transparency (%)	2: Number of objectives disclosed	3: Top three topical areas of disclosure based on category system (in brackets: number of objectives in that category)		
Adidas	Clothing industry	Low	94	16	Materials (5)	Supplier management/plan (4)	Energy/energy consumption (2)
BASF	Chemical industry	High	89	18	Emissions/Greenhouse gas emissions (4)	Responsibility for products and services/analysis and development (3)	Emissions/other significant air emissions (2)
Bayer	Chemical and pharmaceutical industry	High	92	26	Responsibility for products and services/usage (4)	Transport (3)	Supplier management/control (3)
BMW	Automotive manufacturer	Middle	79	19	Responsibility for products and services/usage (5)	Water (2)	Energy/energy consumption (2)
Daimler	Automotive manufacturer	Middle	76	21	Responsibility for products and services/usage (12)	Responsibility for products and services/creation (3)	Emissions/greenhouse gas emissions (2)
E.ON	Electric utility service provider	High	56	18	Energy/manufacturing of energy from renewable sources (7)	Energy/manufacturing of energy from non-renewable sources (3)	Emissions/greenhouse gas emissions (2)
Heidelberg Cement	Construction materials industry	High	64	22	Emissions/other significant air emissions (7)	Materials (3)	Energy/use of energy from renewable sources (2)
Siemens	Electrotechnical industry	Middle	79	14	Responsibility for products and services/usage (3)	Waste (3)	Transport (2)
Volkswagen	Automotive manufacturer	Middle	81	16	Responsibility for products and services/usage (4)	Responsibility for products and services/analysis and development (3)	Emissions/greenhouse gas emissions (2)

Table 3 Overview of companies for cluster *Unconcerned*

Company	Main sector	Stakeholder expectations (with regard to environmental disclosure)	Indicators				
			1: Level of transparency (%)	2: Number of objectives disclosed	3: Top three topical areas of disclosure based on category system (in brackets: number of objectives in that category)		
Beiersdorf	Consumer goods industry	Low	71	7	Responsibility for products and services/ usage (1)	Emissions/ greenhouse gas emissions (1)	Monitoring of ecological aspects (1)
Commerzbank	Banking sector	Low	40	5	Emissions/ greenhouse gas emissions (2)	Energy/use of energy from renewable sources (2)	Materials (1)
Deutsche Bank	Banking sector	Low	50	2	Emissions/ greenhouse gas emissions (1)	Water (1)	–
Deutsche Post	Logistics sector	Middle	60	5	Emissions/ greenhouse gas emissions (2)	Transport (2)	Monitoring of ecological aspects (1)
Henkel	Consumer goods industry	Low	70	10	Materials (3)	Energy/energy consumption (2)	Waste (2)
K + S	Mining industry	High	60	10	Effluents (3)	Monitoring of ecological aspects (2)	Emissions/ greenhouse gas emissions (2)
Lufthansa	Aviation industry	Middle	50	8	Responsibility for products and services/ usage (5)	Emissions/ greenhouse gas emissions (1)	Emissions/other significant air emissions (1)

Cluster 3: Unconcerned

The third group consists of seven companies that are characterized by a relatively low number of objectives (6.7 on average), a below-average level of transparency (60%) and a rather unfocused picture in relation to the topics in CER compared to the rest of the sample. These companies are *Beiersdorf, Commerzbank, Deutsche Bank, Deutsche Post, Henkel, K + S* and *Lufthansa*. Due to the relatively vague picture and lack of any particular tendency in the number of objectives, topic or level or transparency in their disclosed objective, we call this group the *Unconcerned*. However, it is important to point out that the degree of both indicators level of transparency and number of objectives is not uniform over time (see Appendix 4). The group shows a strong increase from a 0% level of transparency between 2000 and 2004 to 73% in the period between 2010 and 2014. Also the number of objectives rises noticeably. Considering the topics this group covers, we see that all companies but one disclose at least one objective regarding *Greenhouse Gas Emissions* (see Table 3). Besides, it is noteworthy that *Lufthansa* discloses five of its eight objectives in the category *Responsibility for Products and Services/Usage*.

Our analysis of the objectives for the group *Unconcerned* reveals a number of examples in which companies in the group frequently fail to pursue clear objectives consistently over time. One example is the chemical company *K + S,* which, in their environmental report of 2008, announces an aspiration to *increase investments in water protection by up to 360 million euro in order to halve the amount of salt water in the production process by 2015* (category *Effluents*). The company reports this objective transparently until 2012. After 2012 the objective is not pursued any more, and without any further explanation. Another example relates to the logistics company *Deutsche Post.* In its 2008 report the company announces it would *replace 90% of its own air fleet with more economical models by 2020* (category *Transport*). However, the objective is not tracked in the following report. In 2010, the company follows up on the objective but with changed numbers. Their new target is to *replace more than 15% (reference year 2009) of the air fleet by 2015.*

The overall evaluation of this cluster regarding its use of legitimacy strategies is rather difficult and shows a fuzzy picture. The companies reveal a below-average level of transparency, with, however, a positive trend. Nevertheless, as our examples show, objectives are often cancelled or changed without notification. This is particularly noteworthy

as the number of objectives is comparatively low. It appears that the industry of which the companies in this cluster are members plays a decisive role. For the two companies in each of the banking (*Deutsche Bank*, *Commerzbank*) and consumer goods (*Beiersdorf*, *Henkel*) industries, we see relatively low stakeholders' expectations due to a rather small environmental impact (see Table 3). However, these companies do not reach a high level of transparency. This is due to two reasons. On the one hand, for some objectives the companies show a negligence in the reporting, e.g., when an objective is pursued over several years and only forgotten ones in a report. On the other hand, for a few objectives we find signs that stakeholders are consciously mislead by these companies (legitimacy strategy two). Stronger indications for this second legitimacy strategy are apparent for the logistics company *Deutsche Post* and the chemical company $K + S$. We can see in these examples that both companies disclose objectives in topic areas that are strongly marked by high stakeholders' expectations. Stakeholders expect *Deutsche Post* to reduce emissions relating to its logistics operation, which the company tries to meet by disclosing the objective described above. The way this objective is communicated (ambitious outcome, cancelled without notification after one year) is a clear indication of the use of legitimacy strategy two, meaning that the company discloses an objective according to stakeholders' expectations without sufficient internal adjustments. $K + S$ is confronted with high stakeholder pressure (see Table 3), which stems mainly from local residents due to the pollution of adjacent rivers. The company disclosed three objectives in the topical area of *Effluents*. While the objective to invest in water pollution control (see above) is cancelled without notification close to the due date, two other objectives are reported transparently in this field. However, due to a discipline-specific wording of both transparent objectives, the evaluation of the objectives' relevance is rather difficult for most stakeholders. This reporting pattern makes it tricky to assess whether $K + S$ aims at making the stakeholder perceive it to be more active in its environmental reporting than it actually is. In sum, the companies in cluster three show a rather fuzzy picture in their reporting. We find indications for negligent reporting of objectives that does not follow any strategy. In addition, we identify some companies that use the second legitimacy strategy to change stakeholders' perception of the company's internal adjustment and thus practice greenwashing.

Cluster 4: Careless

The last group in our sample is characterized by a very low level of transparency (less than 30%) and contains three companies. *RWE*, *Continental* and *Deutsche Telekom* publish ten objectives on average and achieve a group transparency level of only 20%. While topics of high importance are tackled by all three companies (*Greenhouse Gas Emissions*, *Energy Consumption*), *Continental* and *Deutsche Telekom* show most objectives in the less relevant topical area of *Waste* (*Continental*: 4; *Deutsche Telekom*: 3) (see Table 4). Furthermore, we can see that although the companies disclose a considerably lower number of objectives from 2010 to 2014 (six objectives) compared to the period from 2005 to 2009 (17 objectives), the transparency level of reporting decreases from 29% to 17% in the respective periods (see Appendix 4). Due to this very low level of transparency, the group is labeled as *Careless*.

The companies within the *Careless* group produce many examples of insufficiently transparent reporting on different topics. In 2007, *RWE*, the second electric utilities company in our sample, discloses it would *expand the installed power of renewable energies by (1) 4.5 gigawatts by 2012 and (2) up to 10 gigawatts by 2020* (category *Manufacturing of energy from renewable sources)*. The latter objective is tracked only until 2009. Afterward, there was no follow-up at all. For the first objective, in 2010 *RWE* extends the targeted time period to the year 2014 without any comment. In 2013, the objective is adjusted again but this time in relation to its extent: in particular, the level of installed power of renewable energies is changed from 4.5 to 4.3 gigawatts. This kind of reporting allows us to assume that *RWE*, like *E.ON*, has not only to deal with high stakeholder expectations (see Table 4), but is especially faced with changing expectations in recent years due to external challenges that threaten the business model, mainly from climate change and the nuclear phaseout in Germany. Furthermore, we are also able to identify another distinctive feature in *RWE*'s reporting pattern. *RWE* does not disclose a single objective that related to the topic of nuclear energy, whereas renewable energy projects are highlighted several times (three objectives). Additionally, we identify a company that does not pursue a single objective transparently: automotive supplier *Continental*. A first wave of four objectives is disclosed within the annual report of 2007, namely *a 5% reduction of each of energy consumption, water consumption, carbon dioxide emissions and waste volume by 2012.* While *Continental* pursues these objectives in the following report, they pay no attention to them in the years 2009 and 2010. In the reports from 2011 onwards, *Continental* revives these objectives, but repeatedly changes the extent and time period.

The results of the analysis of this group leave room for two interpretations. First, the careless way of communicating objectives in the companies' CER might be due to an inability to report on, or a general dismissive attitude toward this reporting of, objectives. As discussed earlier, all DAX companies have both the necessary resources and decades of experience in reporting so that the abilities generally exist. There might always be the possibility that individual objectives are reported negligently, but the amount

Table 4 Overview of companies for cluster *Careless*

Company	Main sector	Stakeholder expectations (with regard to environmental disclosure)	Indicators				
			1: Level of transparency (%)	2: Number of objectives disclosed	3: Top three topical areas of disclosure based on category system (in brackets: number of objectives in that category)		
Continental	Automotive supplier	Middle	0	10	Waste (4)	Water (2)	Emissions/greenhouse gas emissions (2)
Deutsche Telekom	Telecommunication provider	Low	23	13	Waste (3)	Energy/energy consumption (3)	Transport (2)
RWE	Electric utility service provider	High	29	14	Emissions/greenhouse gas emissions (5)	Energy/manufacturing of energy from renewable sources (2)	Energy/manufacturing of energy from non-renewable sources (2)

of non-transparent reported objectives is rather surprising. Second, there is the possibility that the reporting pattern of the companies in the group *Careless* aims at influencing stakeholders' expectations downward (Lindblom's legitimacy strategy four). Automotive supplier *Continental* discloses the objectives of achieving reductions in four areas by five percent. The fact that these objectives are always of 5%, disclosed in very different topical areas, and that none of the objectives is achieved, is so obviously careless, that the assumption of an application of Lindblom's fourth legitimacy strategy is evident. It is probable that *Continental* tries to lower stakeholder expectations in general by communicating the objectives in a very confusing manner. The assessment for telecommunication company *Deutsche Telekom* is less clear. The company is faced with comparatively low stakeholders' expectations regarding environmental issues (see Table 4). The topics related to the objectives they discuss are able to fulfill these expectations in general; however, they also show a non-transparent way of communicating the disclosed objectives. Thus, for this company, our data do not provide a final clarification of whether legitimacy strategy four is used to lower stakeholder expectations. The same applies for electric utilities company *RWE*. In contrast to *Deutsche Telekom*, *RWE* is confronted with high stakeholder expectations. The company is very aware of the expectations that the stakeholders have, especially with regard to the high carbon dioxide emissions of its power plants. *RWE* fulfills these expectations and reports a number of objectives in this field; however, again in this case because of the non-transparent way of communicating, we cannot rule out that the company aims to lower stakeholders' expectations. In contrast, our results indicate clear tendencies toward the use of the third legitimacy strategy. This becomes obvious because *RWE* discloses a number of objectives regarding renewable energies, but none concerning nuclear power.

Discussion

Legitimacy Strategies

In recent years, several studies have shown that companies nowadays are aware of the importance of transparent reporting (e.g., Scherer et al. 2013; Smith 2003; Waddock et al. 2002). Furthermore, a great number of companies worldwide (e.g., BP in relation to its oil disaster) were seriously affected by the discovery of greenwashing (Cherry and Sneirson 2011). Institutional theory uses the term "decoupling" to describe how a mismatch between the disclosed objectives and the actual internal adjustments that have not been transparently communicated leads to dissatisfied stakeholders (Du et al. 2010). In contrast, following stakeholder theory, companies that are perceived to fulfill stakeholders' expectations benefit, for example, through access to capital at lower costs (Orlitzky 2008) or through an advantage in attracting and retaining employees (Greening and Turban 2000). Thus, in line with legitimacy theory, it is advisable to follow Lindblom's first legitimacy strategy when possible. However, our results suggest that companies seem to have different demands of their own reporting quality in terms of disclosed objectives. Only the companies in the group *Signaling*, and a few companies from the *Ambitious* group, are able to disclose and pursue objectives with relevant topics that reach high transparency levels over time, and thus successfully apply the first legitimacy strategy. These companies seem to be concerned about their CER and invest a great amount of effort to communicate their objectives in critical and, for their stakeholders, relevant topics transparently over a long time. They do not try to pretend to achievements they have not achieved and report honestly about failures—always giving further explanations when

something happened that was not in line with their expectations. Thus, these companies signal honest behavior toward their stakeholders.

Based on our data, we are also able to demonstrate that companies apply the second legitimacy strategy and thus try to ensure that their activities are recognized as conforming to their stakeholders' value system (legitimacy theory). We find companies in the clusters *Ambitious* and *Unconcerned* use this strategy, which we can refer to as greenwashing. For both groups, most companies disclose objectives in topical areas of high relevance for stakeholders (e.g., *Greenhouse Gas Emissions*). However, often we have the impression that objectives are hardly achievable, mainly because the objectives' achievement is highly dependent on external factors, such as the legal situation. We assume that high stakeholder pressure might be a key reason for trying to change the stakeholder's perception in terms of the companies' own internal adjustments. One major indication of this strategy's application can be seen in the fact that companies disclose several objectives that are reported consistently over time, but unexpectedly cancel them without notification. Considering that we identify the second legitimacy strategy frequently within our data, we assume that objectives are a common tool in CER to change stakeholders' perceptions in terms of the internal adjustments that are actually made.

However, it is important to note that the second legitimacy strategy is relatively complicated and thus difficult to identify. On the one hand, a failure in the transparent communication of objectives does not necessarily indicate an intent to mislead stakeholders. Often, we assume a negligent communication of objectives rather than the deployment of a conscious strategy. On the other hand, a company might communicate objectives transparently, but without making actual internal adjustments. However, since we cannot prove in our analysis if a company lies to its stakeholders in such a way, further analyses are necessary to evaluate this issue. Nevertheless, we can clearly show that at least in the group of *Ambitious* and *Unconcerned* the frequency of such failures in CER in regard to the level of transparency is relative high and thus allows our assumption that here companies apply Lindblom's second legitimacy strategy.

Occasionally, we can find hints of the third legitimacy strategy. This strategy highlights non-critical topics instead of subjects from areas of concern. Both electric utilities companies, *E.ON* and *RWE*, disclose above-average numbers of objectives, but not one objective related to nuclear energy, which is a topic of the highest public interest. Instead, both companies report intensively about their renewable energies (*E.ON*: four objectives; *RWE*: three objectives). Without any question, this is also a topic of great interest—but it is also a symbol for clean and future-oriented technology and therefore has a high legitimate status, which makes it a preferred topic for a company to talk about. Overall, companies that apply this strategy can be labeled as greenwashing.

Furthermore, our results show at least one company in the sample that seem to follow legitimacy strategy four. In contrast to legitimacy strategies two and three, a company that applies this strategy aims not at manipulating its stakeholders but rather at lowering stakeholders' expectations of the company's future environmental measures. This legitimacy strategy is characterized by a low transparency level, often in combination with content-related irrelevance and rather low numbers of objectives. Automotive supplier *Continental* (from the group *Careless*) is the most notable example for this strategy. *Continental* reports in such a confusing manner that we have to assume that they expect stakeholders to become aware of their careless reporting of objectives. If a company changes the extent of an objective in every report without notification, even a stakeholder who compares only two or three consecutive reports can identify a non-transparent communication. This reporting pattern suggests that *Continental* changes its objectives on purpose in order to lower the stakeholders' expectations with regard to the environmental measures targeted within the objectives.

The results described raise the question as to why companies have a certain reporting behavior. External pressure can force companies to disclose objectives in a different way than they wish to: this can take the form of more objectives, objectives with higher extents or shorter time periods, or objectives in a thematic area that the company actually wants to avoid. Therefore, companies may be in the situation of having to disclose objectives while knowing well that the required internal adjustments cannot be achieved. If this is the case, a company has two options. First, the company can follow up on the objective until the end of the time period and then report openly that it failed to achieve this objective. Second, companies can either stop reporting information about the objective or change the extent or time period of the objective without further explanation. In our analysis, we identify several cases that take the latter option, whereas the first option could be found only a very few times. Because the costs of a confession (in the literature also called proprietary costs, e.g., Prencipe 2004, Verrecchia 1983) in line with option one can be relatively high, we are not surprised to find this small number of examples. In contrast, the second option is applied far more often, since costs would only arise when the non-transparent reporting is revealed by stakeholders. Obviously, on most occasions stakeholders do not notice this non-transparent reporting, since we are able to show changes in extent and time period regularly for the companies in our sample. This strategy leads to minimum cost for the company, which companies aim at in environmental reporting (Cormier and Magnan 1999; Gamerschlag et al. 2011). Therefore, we wish to encourage stakeholders and researchers to check for consistency when trying to identify

whether a company claims to be an ecologically sustainable company or not.

Managerial Implications

We are able to derive three managerial implications. First, it is important for a manager to have a clear understanding of how to handle objectives in a company's CER. That means it is best to disclose only those objectives that can be realistically achieved. This allows companies to reach a relatively high level of transparency in reporting over time and thus helps to maintain legitimacy (following legitimacy strategy one). In contrast, it is very important to avoid a negligent communication of objectives. Even though a company might actually be able to make sufficient internal adjustments, this kind of communication gives stakeholders the impression that the company does not take its statements about future intentions serious (Du et al. 2010). Although objectives that are very ambitious may pretend—potentially over several years—a relatively high ecological engagement of a company, we do not recommend disclosure of objectives that are too ambitious. This is because a company will probably not achieve these objectives and therefore has to decide between two choices: (a) not communicating the failure transparently or (b) communicating the failure transparently. While (a) is definitively misleading stakeholders, we also think that (b) is ethically not correct because the objective was disclosed knowing that an achievement would be unlikely, and the stakeholders are misled over several reporting periods. In contrast, the failure will be announced in just one report, hoping that a great percentage of stakeholders will be unaware of it. Furthermore, in both cases the costs of (a) an exposure of the non-transparency and (b) an own confession of the failure (especially for a company's legitimacy) are extremely unpredictable. Overall, a high level of transparency in the disclosed objectives becomes even more important since we expect that companies' disclosed objectives in CER will be monitored more closely in the future. Thus, a company is well advised to apply the first legitimacy strategy, and, in case of high stakeholders' expectations, communicate clearly why the circumstances do not allow the disclosure of objectives, e.g., because of unpredictable external factors.

Second, we recommend publishing overview tables for objectives to those managers who have to deal with the design and development of environmental reports. These tables contain all recent objectives, divided into thematic categories, and include extent and end time. Changes in objectives as well as new objectives should be indicated clearly and explained briefly. Measures adopted and status updates on progress are not necessary but add interesting information. These tables make it easy for stakeholders to gain an overview of objectives in reports. As we identified, clearly structured overview tables are a first indication of transparent reporting. *Merck*, which has used overview tables in its reports since 2005, is a positive example of a company taking this approach. Only one of *Merck*'s nine objectives is not reported transparently. Thus, we recommend companies to demonstrate a high level of transparency when disclosing objectives by providing tables that stakeholders can easily follow.

Third, we suggest managers consider the industry their company operates in when disclosing objectives. Our results show the number of objectives disclosed varies greatly between the companies in our four groups, which indicates that no standard exists that recommends how many objectives should be disclosed. Despite the rather small number of companies in our sample, our findings indicate that the number of disclosed objectives might be related to the industry in which a company operates. Research has already shown that different sectors influence the quality and extent of environmental reporting (Hahn and Kühnen 2013). Our results partially correspond to those findings, as the *Ambitious* group (characterized by a rather large number of disclosed objectives and a rather high level of transparency) contains only companies from sectors whose operations have environmental impacts, e.g., the automotive industry (*BMW*, *Daimler*, *Volkswagen*), the chemical industry (*BASF*, *Bayer*) or the operations of an electric utilities company (*E. ON*). Companies from sectors that are less closely related to environmental impacts, such as the financial service sector (in the insurance field, such as *Munich Re* and *Linde*, or the banking field, such as *Commerzbank* and *Deutsche Bank*) disclose fewer objectives. However, exceptions can be found. *Lufthansa* (aviation industry; 8 objectives) and *K + S* (chemical industry; 10 objectives) do have a direct environmental impact but disclose a below-average number of objectives. Based on these results, we suggest companies from sectors with high environmental impact should disclose a higher number of objectives compared to those companies from low-impact industries. This is important to comply with stakeholders' expectations. For the actual number of objectives that are expected, the companies can take account of our study's results.

Theoretical Implications

Our study strongly builds on the legitimacy strategies suggested by Lindblom (2010). In her study, Lindblom shows how these strategies are applied for continuous text in CER. However, as explained above, objectives are a particular element of CER and thus need to be considered with specific attention. From this point of view, our findings help to opening up the debate for two important points. First, our results show that there is need for further research in this field. Second, our methodological approach provides a first suggestion

on how research can analyze objectives considering their use in CER, especially with regard to their strategic application.

While this future research will be done mainly empirical, a particular focus should be given on adapting the conceptualization of legitimation strategies toward the disclosed objectives. In our study, we show this conceptualization for a proactive way of reporting, that is maintaining legitimacy through regular reporting in CER. Besides that this approach needs to be refined in future studies, the role of objectives in a reactive way of reporting needs to be analyzed as well. Reactive communication aims at repairing legitimacy for a company that has to deal with a negative ecological impact caused by company operations. Also in this case objectives might be used strategically to mislead stakeholders. The different conceptualizations of reactive legitimation strategies by Benoit (1997), Cho (2009) and Suchman (1995) can each be a starting point for this analysis.

Limitations and Future Research

Some limitations must be mentioned: First, our findings show tendencies as to the kinds of legitimacy strategies the companies in our sample apply. While the measures used in our analysis allow for an initial assessment of the companies' legitimacy strategies applied when communicating their environmental objectives, the results for each company are not fully resilient. This is mainly due to two reasons: Firstly, the three indicators used are a combination of quantitative and qualitative assessments. While these indicators enable us to handle the large amount of data collected in our sample, the qualitative assessment based on the objectives' topics can give only a basic idea of how far an objective can satisfy the stakeholders' expectations. Future research needs to take this as a starting point and assess how ambitious objectives themselves are, for example by using a scoring model that evaluates an objective holistically. To do so, further indicators need to be measured, e.g., the importance of the objective for particular stakeholders or the difficulty of achieving the objective based on its subject, extent and scheduled time period. Secondly, based on the three indicators used, the deduction of the four legitimacy strategies implies a certain extent of subjectivity by the authors. Since some of these strategies aim at misleading stakeholders (which also includes scientific research), revealing their application is based on an overall impression that we get from the three indicators as well as the whole process of coding and processing the data. As mentioned before, the differentiation of legitimacy strategies one and two in particular are challenging. Future studies that perform in-depth analysis of individual companies (case studies) and use further indicators as described above can help to reduce the subjectivity.

Second, it is important to state that our results are based on environmental reports only and thus do not give any information regarding the actual and concrete ecological activities of a company. Thus, if a company aims at lying to its stakeholders (instead of misleading them), we cannot prove this in our analysis. In fact, our evaluation of a company's transparency is an assessment of its reporting consistency over time as well as a relative indication in comparison with the other companies of the sample.

Third, our study considered the largest stock-listed companies in Germany, which is a rather small sample. However, all of these companies have embedded sustainability management as part of their strategy and therefore have issued environmental reports frequently. Therefore, future research should also try to analyze the reporting strategies of small- and medium-size companies, which may not have embedded sustainability management, and compare our findings with other international samples. Furthermore, in order to reach generalizable results in an under-researched field, we did not focus on a particular industry. Since the industry a company belongs to might affect its reporting pattern, further studies on specific industries can provide valuable insights of the extent to which the legitimacy strategies applied depend on a company's industry. For this approach, a case study methodology promises the best results because it allows an in-depth analysis of a small number of companies.

Fourth, due to the longitudinal design of our analysis, we have to state that the transparency level of reporting objectives in the third period between 2010 and 2014 might, in general, be positively skewed compared to the first (2000–2004) and second (2005–2009) periods. While the first period can be evaluated over a rather long time horizon, objectives first disclosed in the third period are usually not completed within our sample. Further studies are needed to follow up on our analyzed objectives and to compare the results with our results, in particular in time period three (2010–2014).

Fifth, we did not consider environmental reports on websites due to the ability for them to be changed over time. Although it seems likely that website reports will be given increasing attention in the future, and thus, potentially more stakeholders will read them, we believe that the backward modifiability of the data supports non-transparency. Nevertheless, when companies stop publishing reports in PDF format, future research will have to consider the use of online CER. Periodic screenshots of the reporting websites might be a feasible solution for the problems mentioned above.

Lastly, our research design does not consider how companies address different stakeholders when disclosing objectives in their CER. Stakeholder theory suggests a long-term involvement of stakeholders to obtain a competitive advantage (e.g., Fernandez-Feijoo et al. 2014; Morsing and Schultz 2006). Future research in this field should consider

this fact and answer the question as to the extent to which transparency in CER is necessary for the various stakeholder relationships.

Conclusion

This study addresses the different kinds of legitimacy strategies companies apply in their CER. Based primarily on legitimacy theory and the legitimacy strategies suggested by Lindblom (2010), our work contributes to existing research in two respects.

First, we use the established legitimacy strategies to apply them to a particular element of CER, namely the objectives disclosed, which helps the further understanding of strategies in CER. Second, we show that these legitimacy strategies can be identified through a comprehensive analysis of the objectives' reporting pattern. Thus, we are able to examine the extent to which the four legitimacy strategies apply to our data.

Based on our results, we assign each company to one of the groups *Signalers*, *Ambitious*, *Unconcerned* and *Careless*. While the *Signaler* group shows a strategy of actual internal adjustments that follow on the disclosure of objectives, we can see a tendency of certain companies within the groups *Ambitious* and *Unconcerned* to use misleading strategies that are intended to change the stakeholders' perception regarding the companies' internal adjustments. Within the fourth group, *Careless,* we are able to identify the fourth legitimacy strategy which is characterized by a general downgrading of stakeholders' expectations.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interests.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Appendix 1

See Table 5.

Table 5 Sample

Company	GRI	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Adidas	✓	ER	ER	ER	ER	ER	ER		ER	ER	ER	ER	ER	ER	ER	ER
Allianz	✓				←	ER	ER	ER	ER	ER	ER	ER	ER	ER		ER
BASF	✓	ER	ER	ER	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR
Bayer	✓		←			ER	ER	ER	ER	ER	ER	ER	ER	ER	IR	IR
Beiersdorf	✓												IR	ER	ER	ER
BMW	✓		← ER		ER		ER		ER	ER	ER	ER	ER	ER ER	ER	ER
Commerzbank	✓					←	ER	←	ER	←	ER	ER	ER	ER	ER	ER
Continental	✓								IR	IR	IR	IR	ER	ER	ER	IR
Daimler	✓	ER	←	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER
Deutsche Bank	✓			ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER
Deutsche Post	✓		←		ER	←		ER	←	ER	ER	ER	ER	ER	ER	ER
Deutsche Telekom	✓				ER	ER	ER		←	ER	ER	ER	ER ER	ER	ER	ER
E.ON	✓					ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER
HeidelbergCement	✓				←	ER		ER		←	ER	ER	ER		ER	
Henkel	✓	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER
Infineon	✓												IR	IR	IR	IR
K+S	✓		ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER
Lanxess	✓									IR	IR	IR	IR	IR	IR	IR
Linde	✓					←	ER	←	ER	ER	ER	ER	ER	ER	ER	ER
Lufthansa		ER		ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER
Merck	✓				ER	←	ER	←	ER	←	ER	←	ER	ER	ER	ER
Munich Re												ER	ER	ER	ER	ER
RWE	✓	ER	ER	←	ER	←	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER
Siemens	✓	ER	ER	ER	ER		ER	ER	ER	ER	ER	ER	ER	ER	IR	IR
Volkswagen	✓		ER		ER		ER		ER		ER	ER	ER	ER	ER	ER

ER environmental report, *IR* integrated report; The years refer to the publication date of the reports given by the companies. Where a report encompasses longer reporting periods than the year of the publication date, we marked the prior years by an arrow. For example, the *Allianz* environmental report of the year 2004 includes the reporting periods for 2003 and 2004

Appendix 2

See Table 6.

Table 6 Category system

Basis: GRI aspect and indicator of environmental category		Resulting category	Exemplary CSR measure
Materials (EN1, EN2)	Primary and secondary resources used for the production of products and services	Materials	Higher usage of ecological resources
Energy (EN3–EN7)	Energy consumption within and outside of the organization, energy intensity reduction of energy consumption	Energy	
		Energy consumption	Reduction of energy consumption
		Use of energy from renewable sources	Growth of green electricity usage
		Manufacturing of energy from non-renewable sources	Increase in efficiency of coal-fired power plants
		Manufacturing of energy from renewable sources	Increase of energy output of renewable energies
Water (EN8–EN10)	Withdrawal of water, volume of water recycled and reused	Water	Reduction of water consumption
Biodiversity (EN11–EN14)	Impact of products and services on the biodiversity, measures of protection and renaturation, endangered species	Biodiversity	Reduction of noise emission
Emissions (EN15–EN19)	Volume of direct and indirect greenhouse emissions, extent of other air emission, measure of reduction	Emissions	
		Greenhouse gas emissions	Reduction of carbon dioxide emissions
		Other significant air emissions	Reduction of dust emissions
Effluents and waste (EN22–EN26)	Total volume of effluents discharged, total weight of waste, hazardous waste, extent of significant pollution	Effluents	Reduction of effluents produced
		Waste	Reduction of waste
Products and Services (EN27, EN28)	Measures for the reduction of ecological effects of products and services	Responsibility for products and services	
		Analysis and development	Development of products and services with awareness of ecological effects
		Creation	Optimization of conventional products and services
		Usage	Reduction of energy consumption of a product
		Exploitation	Increase in products' exploitation rate
Compliance (EN29)	Monetary and non-monetary penalties for non-compliance with environmental laws and provisions	Compliance	Prevention of violations of environmental laws
Transport (EN30)	Ecological consequences of transportation of products and employees	Transport	Optimization of the truck capacity utilization
Overall (EN31)	Total expenses and investments for environment protection	–	–
Supplier Environmental Assessment (EN32, EN33)	Screening of suppliers using environmental criteria, significant actual and potential negative environmental impacts in the supply chain and actions taken	Supplier management	
		Plan	Integration of ecological standards in contracts
		Control	Enhancement of ecological supplier audits
Environmental Grievance Mechanisms (EN34)	Number of complaints in relation to ecological complaints	Complaints procedure	Prevention of future ecological complaints
Inductive complemented categories		Strategic foundation	Expansion of training for conscious ecological behavior
		Monitoring of ecological aspects	Introduction of an environmental management system

Appendix 3

See Table 7.

Table 7 Distance table

Proximity matrix													
	Squared Euclidean distances												
	1	2	3	4	5	6	7	8	9	10	11	12	
1. Adidas	0.000												
2. BASF	.119	0.000											
3. Bayer	2.135	1.381	0.000										
4. BMW	.502	.161	1.297	0.000									
5. Daimler	.969	.420	.900	.096	0.000								
6. Siemens	.411	.492	3.337	.533	1.053	0.000							
7. Volkswagen	.221	.168	2.305	.199	.569	.095	0.000						
8. E.ON	2.149	1.572	3.275	.795	.794	1.091	1.019	0.000					
9. HeidelbergCement	2.050	1.243	1.504	.524	.244	1.680	1.206	.433	0.000				
10. Lanxess	1.420	2.135	6.940	2.683	3.784	.880	1.420	3.576	4.984	0.000			
11. Merck	1.078	1.727	6.178	2.272	3.298	.684	1.127	3.299	4.505	.024	0.000		
12. Allianz	2.187	3.245	8.611	4.230	5.599	2.014	2.629	5.865	7.328	.306	.367	0.000	
13. Infineon	4.852	6.336	13.408	7.534	9.330	4.253	5.294	8.956	11.272	1.266	1.539	.533	
14. Linde	3.125	4.353	10.402	5.424	6.963	2.782	3.567	6.973	8.778	.562	.708	.085	
15. Munich Re	4.234	5.632	12.363	6.788	8.498	3.720	4.676	8.252	10.398	.989	1.219	.341	
16. Henkel	1.565	1.869	6.162	1.840	2.634	.445	.947	1.660	3.127	.519	.526	1.614	
17. K + S	2.379	2.545	6.934	2.235	2.950	.829	1.406	1.392	3.089	1.155	1.202	2.605	
18. Lufthansa	4.072	4.272	9.440	3.765	4.573	1.922	2.746	2.176	4.442	1.990	2.161	3.622	
19. Beiersdorf	2.432	3.011	8.313	3.150	4.211	1.117	1.863	2.936	4.883	.387	.517	1.176	
20. Commerzbank	6.667	6.984	13.273	6.325	7.311	3.832	4.987	3.945	6.952	3.384	3.723	5.114	
21. Deutsche Bank	6.886	7.597	14.812	7.347	8.667	4.225	5.560	5.501	8.791	2.757	3.184	3.878	
22. Deutsche Post	4.191	4.784	10.878	4.686	5.829	2.215	3.218	3.631	6.180	1.262	1.522	2.285	
23. Continental	13.202	12.543	17.512	10.545	10.792	9.075	10.107	5.731	8.799	10.917	11.200	14.489	
24. Deutsche Telekom	7.258	6.661	10.384	5.184	5.356	4.378	4.980	2.025	4.054	6.405	6.469	9.416	
25. RWE	6.096	5.488	8.817	4.123	4.253	3.537	4.011	1.371	3.104	5.680	5.680	8.583	

Proximity matrix													
	Squared Euclidean distances												
	13	14	15	16	17	18	19	20	21	22	23	24	25
1. Adidas													
2. BASF													
3. Bayer													
4. BMW													
5. Daimler													
6. Siemens													
7. Volkswagen													
8. E.ON													
9. HeidelbergCement													
10. Lanxess													
11. Merck													
12. Allianz													
13. Infineon	0.000												
14. Linde	.192	0.000											

Table 7 (continued)

Proximity matrix													
	Squared Euclidean distances												
	13	14	15	16	17	18	19	20	21	22	23	24	25
15. Munich Re	.021	.085	0.000										
16. Henkel	3.000	2.041	2.638	0.000									
17. K + S	3.990	3.031	3.628	.141	0.000								
18. Lufthansa	4.582	3.878	4.304	.651	.227	0.000							
19. Beiersdorf	1.922	1.347	1.688	.195	.377	.671	0.000						
20. Commerzbank	5.434	5.114	5.285	1.806	1.099	.333	1.483	0.000					
21. Deutsche Bank	3.558	3.622	3.537	1.930	1.506	.767	1.183	.333	0.000				
22. Deutsche Post	2.605	2.285	2.455	.674	.533	.333	.270	.566	.333	0.000			
23. Continental	15.874	14.915	15.512	6.932	5.093	3.622	7.410	2.797	4.901	5.626	0.000		
24. Deutsche Telekom	11.441	10.098	10.951	3.307	2.121	1.558	4.075	1.770	3.605	3.293	.945	0.000	
25. RWE	10.821	9.350	10.288	2.769	1.739	1.417	3.643	1.912	3.720	3.124	1.496	.064	0.000

Appendix 4

See Fig. 3.

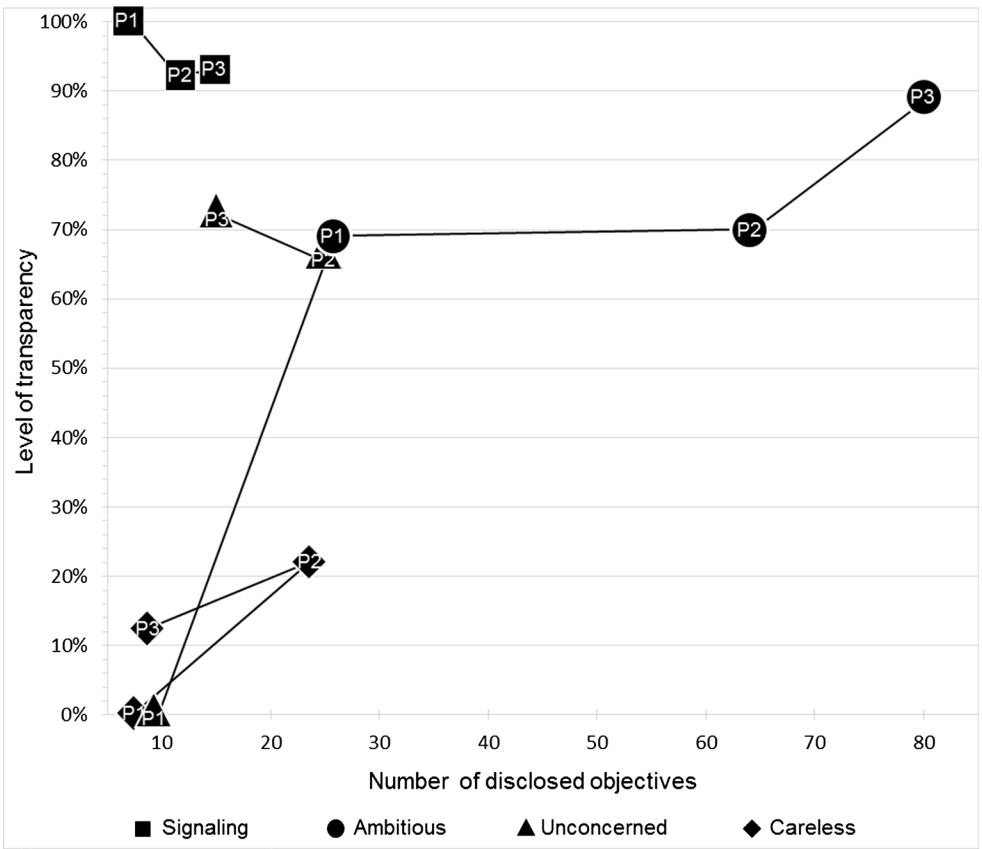

Fig. 3 Longitudinal results

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